TRANSFORMING THE 21ST CENTURY BUILT ENVIRONMENT: SELECTED STUDENT PAPERS IN DOMICOLOGY

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INTRODUCTION

Dear Readers,

For several decades, many U.S. cities have experienced significant economic and population decline that has resulted in large amounts of structural abandonment. This abandonment has pervasive social, environmental, and economic consequences that disproportionately affect already struggling communities. In response to this problem, scholars at Michigan State University have focused their efforts on understanding the complex circumstances that have led to blight in order to create potential solutions. One such research area has focused on altering our perceptions of the built environment from the traditional linear model to a cyclical system. Domicology examines the continuum from the planning, design, and construction stages through to their end of use, abandonment, deconstruction and reuse.

The following primer was developed during a Spring 2020 as a part of a the nation's first regular course on Domicology offered in the MSU School of Planning, Design & Construction at MSU entitled "Transforming the 21st Century Built Environment: Advancing the Science of Domicology." The course was co-taught by Dr. Rex LaMore, faculty in the
Urban and Regional Planning Program and Director of the MSU Center for Community and Economic Development as well as Dr. George Berghorn, faculty in the Construction Management Program. The primer seeks to expand on the existing knowledge surrounding structural abandonment, explore various implications of "design for deconstruction" principles, as well as assess the social, environmental, and political factors involved in adopting domicological practices. This primer and the primers developed in 2017, 2018, and 2019 can serve as introductory readings for those seeking to explore the various concepts of sustainable development and the life cycle of structures. The research contained in this primer is by no means a complete work; as the built environment is a multifaceted area of study, so too are its implications.

Contributors to the primer include selected students of the course and represent several disciplines in the built environment including planning, construction, environmental sustainability, and other disciplines. Special thanks to our editor, Jhovonne Fernandez. For more information on the study of Domicology, we invite you to visit https://domicology.msu.edu/ . We also welcome external research on the subject of the life cycle of structures, which can be submitted via the website.

We hope that you find these selected writings stimulating and informative as we seek to transform our understanding of the built environment.

Yours for stronger communities,

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The statements, findings, conclusions, and recommendations expressed herein are solely those of the respective authors, and do not necessarily reflect the views of Michigan State University.

Domicology Through a Social Lens

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Introduction

Throughout history, residential housing patterns have illustrated that groups of people surround themselves among other individuals similar to themselves (Fulwood, 2016). While migration is an option for people who have the financial capital to purchase extravagant homes in upscale neighborhoods, it inherently provides them with unchecked power to carelessly leave all others in less desirable regions- vulnerable to other forms of discrimination. Poverty is entrapping and persistent through generations and can be exacerbated by the identity of individuals such as race or gender. Poverty's crippling and stagnant effects result in restrictive lifestyles for subjects, inherently limiting opportunities for social or economic mobility. Social injustice in the housing industry has previously been encouraged by law, and despite Supreme Court rulings against its institutionalized practice, the core structure has evolved into a de facto, binding social standard of residential segregation (Fulwood, 2016). In order for Domicology to present the most beneficial social justice impacts, it must permeate into other sectors of the development industry, making it feasible on a larger scale.

Historical Trends of Residential Segregation

There is social injustice rooted in the front end of the real estate field through unfair housing distribution, injustices in redevelopment, and demolition inevitable. Higher rates of vacancy disproportionately affect working class neighborhoods, increasing the severity of social stratification and creating more apparent barriers between social groups. Describing the initial neighborhood demographic distribution transformation in Detroit:

> As white movement increased the housing options available to black city dwellers, blacks began the process of sifting and subdividing, replicating within Detroit's center city the

> divisions of class that characterized the twentieth-century metropolis as a whole. (Sugrue, 2014, pp. 188)

Once a change in demographics begins in a city, the trend is likely to pick up among wealthier homeowners who have the option to uproot and move, leaving the economically vulnerable population stuck in the remains of what a city used to be. When wealthy people flee from cities, the remaining people are less able to participate in the economy and therefore sets the city on track for a social and economic downward spiral.

Due to the history of residential segregation, the current neighborhoods and cities remain separated in a more discreet manner. There is more diversity in housing, however groupings of homogenous types of people is no coincidence. Prior to the Civil Rights Movement, "the Federal Housing Administration underwriting manuals encouraged developers to put racial restrictions on their properties to protect the 'character' of a neighborhood and to maintain high housing values" (Sugrue, 2014, pp. 182). The "exodus of the black middle class from central cities, left the black poor more isolated and concentrated than ever before in urban history" (Wilson, 1992, pp. 189). In the case of housing in Detroit during a time of demographic change as whites began fleeing the city, more houses became available to blacks on the market which resulted in additional socioeconomic divisions. Following trends of "white flight" in Detroit during the 1960's, not only did a majority of the wealthy, white population leave, but with them went a bulk of the population in general. This left the geographically expansive city (nearly 139 mi^2) with only 713,777 local residents compared to its previous peak of 1.86 million people in the early 1950's (A Declining Population in A Widespread City, n.d.; U.S. Census, 2010). This inevitably left thousands of houses vacant, which for the most part remain abandoned to this day because the wave of abandonment set off a downward spiral of social and economic decline standing as a barrier

against incentivizing new residents to move in (Graham, 2017). Until Domicologists can build relationships and spread the consciousness of deconstruction and material salvation to other sectors of the constriction field as a preventative measure, it will not operate at a large enough level to feasibly manage largely abandoned cities.

Domicology as an Environmentally Sustainable Alternative to Demolition

Deconstruction is more environmentally sustainable than is demolition, where all potentially salvageable material is blindly sent to a landfill (USDN, n.d.). A tangent of social justice is environmental justice, and Domicology works to implement these practices when deconstructing structures. First, deconstruction diverts less waste to landfills and instead works to salvage and recycle those materials for other projects. This is relevant in the discussion of environmental justice because landfills are disproportionately placed in lower income regions: "minorities are more likely to live near a hazardous waste treatment, storage, or disposal factory. Likewise, low-income neighborhoods tend to have more landfills and waste transfer stations" (Daniels, 2014, pp. 44). The excess waste produced through the process of demolition in poorer neighborhoods will essentially stay in *them*, if not the specific neighborhood, then another neighborhood with the same financial and environmental struggles; essentially the impacts would remain the same. Researchers and professors Paul Mohai and Robin Saha found in their longitudinal study "a consistent pattern over a 30-year period of placing hazardous waste facilities in neighborhoods where poor people and people of color live" (Erickson, 2016). Executive director of Re:Purpose, Savannah, an organization rooted in the lessons of Domicology through repurposing salvaged materials from deconstruction projects, Mae Bowley (2020)explained, "there are additional hazardous materials than what [preliminary] reports say, half of buildings [she deconstructed] had extra hazardous materials that weren't found" (Bowley, 2020). All of the

negative environmental externalities surrounding demolition are disproportionately increased for people in poverty because there is more abandonment in working class neighborhoods and by default more demolition. Furthermore, if demolition doesn't happen at all which would benefit the environment, buildings would remain standing and abandoned. Domicology has the potential to perpetuate preexisting social injustices through disproportionately impacting wealthier neighborhoods which have the budget to implement environmentally beneficial deconstruction techniques but disregarding the across the board need of implementation in all types of neighborhoods.

Benefits of Domicology on Neighborhoods

Neighborhoods in dire need of large-scale demolition are likely the most financially impaired, and therefore the least likely to have the means for deconstruction. These same neighborhoods also are in need of increased environmental awareness because demolition produces more waste which is likely to end up closer to them. Demolition, the most common weapon used to fight against abandonment in lower income neighborhoods invokes more hazardous health risks to the community than does deconstruction (USDN, n.d.). It is more expensive to deconstruct houses than to demolish them, it is more likely for Domicology to occur on a greater scope in wealthier neighborhoods, where municipalities can afford the extra cost and a house is more likely to be redeveloped and generate future wealth. Currently, poor municipalities cannot afford to deconstruct houses, more alarmingly, they cannot even afford to demolish them, explaining why there remains a large amount of abandoned lots in these communities. In the *Demolition Policy and Procedures* manual, there are four different categorizations of 'neighborhood needs': healthy neighborhoods, tipping point neighborhoods, revitalization neighborhoods, and redevelopment neighborhoods. Most significant is the

comparison of demolition feasibility between the second most intact neighborhood which “in most cases, properties will be selected on a scattered site basis for rehabilitation and demolition, hoping that taking care of the worst properties will stimulate the private market to take over and recover tipping point neighborhoods” as compared to redevelopment areas characterized by “abandoned, blighted houses are everywhere, with over 70% of the properties blighted… In this strategy, much, or all of a neighborhood will be demolished, and the neighborhood will be redeveloped” (United States Congress, n.d.).

However, according to Elemental Green (n.d.), a company focused on environmental building and development, “not only is reuse much more eco-friendly, it's also incredibly budget-friendly: reclaimed materials can be 50 percent to 75 percent cheaper than their new counterparts” (Elemental Green, n.d.). This side of Domicology’s environmental benefits caters toward people with lower socioeconomic backgrounds by providing them with an alternative source of building materials. While this is beneficial, it does not make as significant of a difference because the amount of poor people seeking affordable building materials does not compare to the amount of poor people negatively affected by the short reach and selectivity of Domicology implementation.

What happens when a neighborhood is in need of large-scale demolition? There is less focus on utilizing an environmentally friendly strategy for taking down houses, and a greater emphasis on traditional demolition which creates excess garbage and ignites unaccounted for hazardous waste. Even with the projected profits of Domicology through selling the recycled material, “a comprehensive deconstruction project will generally cost more than the value of the recycled material… and the deconstruction process slows down the removal of blight” (Demolition Requirements, n.d., pp. 19). This is one of the most prominent social justice impacts

of Domicology: the inequity regarding *which neighborhoods* and on what *scale* deconstructing buildings provides a feasible economical and timely option.

In a capitalist economy, one of the predominant forms of increasing profits requires maximizing efficiency, however, in order for Domicology to make economic sense, it must be ingrained in the ethics of the development field so as to take preventative actions during the beginning stages of a development plan for and accommodate the Domicological strategy. The study and implementation of Domicology can currently be deemed a luxury service; it is not a necessary component in reaching the same outcome as demolition, but for communities that can afford the extra costs, there are bonuses including environmental and social benefits. Domicology caters predominantly to the purpose of ethics: the end result of redevelopment *could* occur at a financially cheaper cost, but deconstruction would help to "internalize [developers'] externalities" (Daniels, 2014, pp. 56). Requiring redevelopers to pay a higher cost in turn for less invasive environmental impacts assigns financial accountability to the violator of environmental wrongdoings. In other words, "the value of these [environmentally conscious] services generally do not appear in the market." (Daniels, 2014, p. 56). The positive externalities of environmental consciousness does not necessarily translate directly to economic profits, despite its important benefits. This idea begs the question, "what price is the public willing to pay for environmental amenities?" (Daniels, 2014, p. 61). Domicology is primarily a change for the environment and sending less demolition waste to landfills will primarily benefit residents of lower income neighborhoods, knowing that landfills are disproportionately located in lower income regions. There is no way to perform Domicology on a larger scale aside from expanding the physical size of operations, but nothing exponential. In its current form, for Domicology to be worthy, a city

must be willing to increase government spending with predominant intentions of decreasing negative environmental and social impacts without a surpassing benefit to the economy.

The practice of Domicology requires a larger and relatively higher skilled workforce compared to other strategies of demolition. While this may not seem initially beneficial for the developer or contractor in charge of taking the building down, it provides a new sector for the working-class population with a new field to offer a plethora of job opportunities. Large scale employment and training will both directly and indirectly affect workers: there will be laboring jobs available providing a salary and experience, but also after completing a training program, workers will gain a new set of knowledge that can be used as a tool for the common denominator of construction for future jobs and opportunities. Once Domicology becomes systemically ingrained in the construction field, and a larger skilled workforce becomes a normalized expectation for taking down buildings, there will be visible positives.

Not only are there concerns regarding access to Domicology on a local scale, but also potentially on a regional level throughout the country. Previously mentioned executive director of Re:Purpose Savannah- Mae Bowley (2020), discussed the role that historical preservation played in a historically rich city such as Savannah. During her speech, she confirmed that, “historically preserved sites are sometimes more valuable when allowed to remain broken down and deteriorated in their original location than if they were repurposed, even for upcycling” (Bowley, 2020). This is significant because although it does not directly relate to the social justice aspect of Domicology, it does connect to the relationship between geography and access to widespread Domicology.

In conclusion, there is unequal access to Domicology: it is only eligible for admissible neighborhoods, not for those which are more vulnerable. The most harmful social justice

implication regarding Domicology is the disproportionate opportunities it offers different neighborhoods that have minor needs than others severely struggling. The neighborhood more likely to adopt Domicology and spend more funds on deconstruction is therefore more likely to guarantee that something profitable will replace the abandoned structure. The only way to make the practice of Domicology socially just is to perform it on a large scale. There will need to be a systemic shift of priorities and a large-scale reassessment of sustainability within the industry. If the construction and development field reformed their sourcing strategies for tools and resources and heavily prioritized utilizing recycled materials from previously vacant buildings, the Domicological cycle would then have the potential to be widely implemented and successful. If that were the case, there would be the critical market demand that is currently missing. With consumer demand for Domicological resources, the context that currently frames deconstruction as a predominantly ethical practice without practical economical compensation will switch to an environmentally sound practice of deconstruction that also works to strengthen the economy and is available to all people despite differences in race, gender, or socioeconomic backgrounds.

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Workforce Training Recommendations

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Introduction

As the world continually promotes an environment that supports the increase of recycling, reusability, and sustainability, an emerging industry has risen to push the boundaries of reusability. Deconstruction is an alternative to the demolition of a structure that recovers and reuses materials to build new structures (Guy, 2007). Deconstruction is an industry rising in popularity that requires hand labor to complete jobs. This has created job opportunities for unskilled and unemployed workers ("Why Deconstruct?", n.d.). Along with the social benefits associated with deconstruction, such as low-skilled employability, deconstruction also removes blighted structures. The removal of blighted and abandoned structures can decrease crime and raise property values in neighborhoods (HUD, 2001). Just as important, deconstruction is an environmentally friendly option that diverts materials from landfills and has the ability to reduce airborne toxins associated with demolition (Maurer, 2019). There are numerous certifications available specifically for deconstruction professionals, including Build Reuse's training completion certificate, and even more organizations that offer courses. In addition to deconstruction specific certifications, there are general certifications that are recommended for all trade-oriented professions including deconstruction. Still, in an industry that is growing, there is a lack of properly trained professionals. The question arises, what kind of workforce training is recommended for deconstruction?

The Case for Deconstruction

Deconstruction training is important because it creates employable professionals, increases social equity, and leads to an increase in the popularity of the trade. Being certified in any profession adds values to any job candidate's resume and makes them more desirable by employers. Certifications that prove specific competency hold the most value (Indeed, 2019). For those seeking a

career in deconstruction, a proper certification shows that an individual can properly dismantle a structure, is effective in their work, and has knowledge that encourages a safe work environment. Simon (2019) created a distinct definition of skills. He concludes that “skills are work proficiencies and knowledge obtained from past occupations, education, training, or other life experiences (e.g., hobbies) that require more than a brief period (i.e., greater than about 30 days) to fully learn and apply to a job.” This is important because Simon (2019) explains how this cannot be a brief experience. Only through proper deconstruction training can individuals come into a career with the necessary skills. Proper training is important for developing the employability and effectiveness of workers in the deconstruction industry.

Increased employability can be extremely valuable to people who fall under the United Way’s ALICE Designation. The ALICE designation "[is] an acronym for Asset Limited, Income Constrained, Employed, [and] is a new way of defining and understanding the struggles of households that earn above the Federal Poverty Level, but not enough to afford a bare-bones household budget” ("Do You Know ALICE?", 2020). Those who are included in ALICE are low-income workers who often are low-skilled. Deconstruction training is seen as an avenue for current low-skilled workers to gain training and work in a career that offers more earnings. Deconstruction requires knowledge and skills, but this trade enables unskilled or low-skilled workers because of on-the-job training and the ease of learning the basics (Frisman, 2004).

Training creates competent laborers which can result in an easier time operating a deconstruction business. Effective and efficient laborers who have been trained should lead to an increase in the overall practice, barring that supervisors/project managers are also trained in deconstruction (Frisman, 2004). Frisman (2004) noted that deconstruction leads to job creation considering these are manual labor-intensive jobs rather than equipment-intensive, and that they

should cultivate community-oriented enterprises, such as deconstruction firms, resale and salvage warehouses, and more. Not only does deconstruction training give unskilled/low-skilled and underpaid workers the skills and certifications need to find a skilled opportunity and an increase in income, but it contributes greatly to the overall growth of the industry.

There is environmental importance to deconstruction that is aided through training. Deconstruction training can both aid and improve the local environment while contributing to an environmentally friendly ideal that is becoming more common. Build Reuse, previously known as the Building Material Reuse Association (BMRA), is one of the most reputable private organizations offering deconstruction training (Building Material Reuse Association, n.d.). Their curriculum has been duplicated by numerous other organizations throughout the U.S. One of the key parts of their training is the actual deconstruction of a structure where students gain hands-on experiences (BMRA, n.d.). Abandoned and blighted structures "can foster crime and strain social cohesion" (de Leon & Schilling, 2017, p. 29) so their removal as part of their training would directly contribute to maintaining neighborhoods' integrity. This coupled with the fact deconstruction training can provide residents who are more likely to live in abandoned blighted neighborhoods an opportunity for a better career, proper deconstruction training can improve the lives of those in the neighborhood and the neighborhood itself (Stebbins, 2019). This can increase the overall social equity in a neighborhood.

Along with the environment of affected neighborhoods, there is a large-scale environmental impact. The United States Department of Housing and Urban Development (HUD) stated in a report that "there are real environmental benefits to building disassembly and material salvage" (2000). It saves landfill space, reduces the pollution and energy consumption associated with manufacturing and production of new materials, and it can reduce site impacts in terms of dust, soil compaction, and loss of vegetation or ground cover. Reduced unemployment strengthens the local economy directly as well

as indirectly in areas such as retail sales and housing" (HUD, 2000). In 2017, demolition material accounted for 90% of the 569 million tons of construction and deconstruction debris generated in US landfills (EPA, 2020). Increasing deconstruction training can increase the amount of salvaged construction materials that are reused and recycled rather than put in landfills. In order to see the benefits of deconstruction come to fruition, the training involved must be effective, efficient, and thorough. With numerous courses on the market, there fails to be a comprehensive list of the training recommendations given by practicing deconstruction firms.

Skills and Certifications

The overarching importance of deconstruction and the proper skills and certifications gained from deconstruction training has been established, but still different organizations have different recommendations on what skills and certifications potential employees should have. The skills recommended for deconstruction professionals vary from skills related to the management of deconstruction crews and job sites to skills needed to properly operate a company that intends to operate in the deconstruction industry and finally the skills that laborers should be versed in.

Skills for Deconstruction

The Detroit Training Center (DTC) includes skills in their training that prepare managers and supervisors for the process of running a deconstruction crew. They intend on providing skills that can allow for an expedited deconstruction process. DTC also trains deconstruction firms in human resources skills, safety procedures, and proper record keeping ("Employers"). Some may think of the necessary skills only being related to the actual process of dismantling a structure, but the Detroit Training Center's recommendations bring to light that lack of training lies not only with the laborers but also with supervisors. If a site has an unprepared and disorganized project manager, it may not

matter how well trained the crew is, work may still be asked to be done in an unorganized and dysfunctional manner. Management skills often go overlooked, but many organizations have recommendations for proper management skills that are extremely relevant to deconstruction training. The U.S. Green Building Council's (USGBC) deconstruction training recommendations were heavily focused on deconstruction project management. The USGBC recommends training provide the necessary skills to "create, develop, manage, monitor, document and promote a successful deconstruction project from beginning to end" (U.S. Green Building Council, 2014). Similarly, a necessary skill recommended by the city of San Antonio's Office of Historic Preservation is that their trainees be well versed in proper site preparation (2019). There are key differences between the day-to-day operations that make deconstruction different than construction. For instance, deconstruction is labor-intensive and often has minimal heavy equipment use. It is important for a deconstruction project manager to be able to effectively manage their crew for effective results but also for safety reasons. Deconstruction often places workers in dilapidated structures that may pose risks including collapsing, fire, and exposure to toxins (Huang, 2014). Project managers who operate deconstruction sites must be well-versed in safety features considering the constant possibility of unknown risks associated with blighted structures (ASW, n.d.)

Multiple organizations offer deconstruction training recommendations on how to properly train individuals who hope to operate a business in the deconstruction sector. For example, the ReUse Institute helps individuals gain information they need to "launch and operate a retail operation dedicated to selling and distributing reusable building materials" (The ReUse People of America, n.d.). Likewise, the Building Deconstruction Institute offers training in the sale of salvaged materials during their deconstruction training ("Building Deconstruction Institute"). Both organizations realize the importance of preparing business owners for a competitive and emerging industry. If business

owners lack the skills at selling, distributing, and marketing their materials and services then their business stands a slim chance at succeeding. The deconstruction industry suffers when opportune and eager business owners who are excited about deconstruction fail to gain traction because of a lack of skills or knowledge about the industry. The only way to make sure that the industry continues to grow is by fostering an environment where those involved have the skills and knowledge needed to succeed. Business owner success is also important because thriving businesses have the ability to hire more deconstruction laborers and participate in more projects, furthering the popularity of the industry.

With the recommended skills for deconstruction project managers and business owners, it is important to look at the skills recommended for those who will participate in the physical deconstruction. The city of San Antonio's Office of Historic Preservation offered recommendations for the training of deconstruction laborers. These recommendations include skills related to the assessment of materials and the removal of "siding, framing, flooring, windows and doors, porch elements, and fixtures" (City of San Antonio, 2019). While the skills needed for deconstruction may seem similar, individuals must realize that these skills differ from those of construction. Construction involves lots of precise measurements and building from plans, where the elements of the project are known beforehand. In deconstruction, there may be unknown factors that are only discovered once the deconstruction has begun. Having competent laborers who are well versed in frequently handling unexpected obstacles, while remaining safe, creates a safe and efficient job site. It is also important for deconstruction workers to have effective skills in removing home features because the industry relies on material salvage and resale (North West Economic Research Center 2016). A worker who is not well trained and cannot effectively remove and dismantle a structure may damage materials reducing their resale values, negatively affecting the bottom line. One of the best ways to effectively

train deconstruction laborers in deconstruction practices that salvage the most materials in the actual deconstruction of a house (Office of Sustainability County of San Mateo, n.d.). Being on an actual job site while training allows for hands-on learning that is seen as integral for all trades. It has been found that hands-on learning translates to a greater development of on-the-job problem solving, familiarity with how to handle different materials, and increased information retention (IECGC, n.d.). With this being said, it is no surprise that most deconstruction courses include a hands-on portion where trainees actually deconstruct a structure.

One organization, Build Reuse, specifically has offered a list of ten competencies that they recommend all deconstruction professionals familiarize themselves with. Build Reuse's competencies aim to create a well-rounded deconstruction professional. Their immersive list was separated from the previous sections because of their in-depth analysis of what is needed for successful deconstruction business and successful deconstruction workers. Their list goes as follows:

- Competency 1: Demonstrate Knowledge of Buildings, Building Materials, Salvage & Deconstruction Practices;
- Competency 2: Demonstrate an Understanding of the Process in Evaluating a Building Deconstruction Site;
- Competency 3: Demonstrate Knowledge of Safety Measures Applicable to Building Deconstruction and Building Material Salvage Activities;
- Competency 4: Demonstrate Knowledge of the Environmental Hazards Associated with Deconstruction and Building Material Salvage Activities;
- Competency 5: Demonstrate Knowledge of the Types and Use of Tools Applicable to Deconstruction and Building Material Salvage Activities;

- Competency 6: Demonstrate Ability to Develop a Site Plan & Schedule for Building Deconstruction;
- Competency 7: Demonstrate Knowledge of the Steps and Processes Involved in Nonstructural Salvage (soft Stripping);
- Competency 8: Demonstrate Knowledge of the Steps and Processes Involved in Full Deconstruction;
- Competency 9: Demonstrate Knowledge of Materials Management Applicable to Deconstruction and Building Material Salvage Activities;
- Competency 10: Identify Steps in Closing Out a Building Deconstruction Project (Building Material Reuse Association)

There is a common theme throughout Build Reuse's competencies, they are applicable to project managers, laborers, and important for business owners to know. The skills they teach and recommend deconstruction trainees to gain help to create project managers who understand the complex processes of planning a site, managing the site and workers, and closing out the site. The competencies ensure that business owners have proper salvaged material management techniques along with the ability to properly bid sites and manage project managers. For laborers, Build Reuse's competencies ensure that they can effectively salvage materials, properly assess what is salvageable, and how to do so safely.

Certifications for Deconstruction

In addition to the numerous skills that have been recommended, an important type of recommendation was seen across the industry was for deconstruction professionals to hold certain certifications. Some of these certifications are not specific to deconstruction, but the knowledge and skills that these certifications exhibit hold value, nonetheless. There were three main types of

certifications that were recommended: overall safety, the removal of toxic materials, and competency in operating heavy equipment.

Safety is a very important concept to be familiarized with while working on a deconstruction job site. Safety certifications show employers that employees have gone through the necessary steps to prove their competency. The Detroit Training Center (DTC) offered the recommendation that deconstruction trainees have a First Aid/CPR certification (DTC, n.d.). The American CPR Association provided a list of benefits associated with having employees certified in CPR and first aid. The main take away is that a CPR certification gives individuals the ability to act fast and give lifesaving help with confidence, making the job site safer (American CPR Care Association, 2017). A common certification recommended for deconstruction specialists is Occupational Safety and Health Administration (OSHA) 10 or 30-hour training (The ReUse People of America, n.d.;" DTC, n.d.; Institute for Local Self-Reliance, 2012; Detroit Training Center, n.d.). OSHA's 10-hour training is intended to inform workers, not limited to deconstruction, with an "awareness of common job-related safety and health hazards", while 30-hour training is more appropriate for those who have more responsibility, such as supervisors or project managers (U.S. Department of Labor, n.d.). The recommended certifications covered so far have the intention of creating a workforce that is able to safely operate a project and have the knowledge on how to avoid and correctly handle dangerous and possibly life-threatening situations.

Certifications related to worker safety do not stop at the threat of bodily harm to workers. There are dangers that linger in the air and in the materials that are being deconstructed. Most organizations recommend a certification related to the removal of possibly toxic materials, and many recommend more than just one. The Detroit Training Center (DTC) recommends HAZWOPER 40 Certification (DTC, n.d.). This is an OSHA training that prepares workers for situations that call for

the proper removal of hazardous chemicals while maintaining environmental and safety standards (OSHA, n.d.). The deconstruction of industrial structures may leave workers at risk of coming into contact with potentially toxic materials and substances. Having this training alleviates some of the risks associated with this.

The most commonly recommended certifications demonstrating knowledge of properly removing toxic materials involve familiarity in properly handling lead and asbestos. Certifications that prove lead safety are extremely common in the deconstruction industry (The ReUse People of America, n.d.;" DTC, n.d.; Institute for Local Self-Reliance, 2012). Lead can be commonly found in buildings built before 1978, meaning that deconstruction workers are at risk for first-hand exposure (U.S. Environmental Protection Agency, 2014). Improper disposal of lead materials while deconstructing a structure can contaminate the soil for years, putting future people at risk, and constant exposure can be very harmful to individuals (Mayo Clinic, 2019). Receiving a certification from the United States Environmental Protection Agency (EPA) in lead safety allows employers to know their deconstruction workers can mitigate lead-related issues for themselves, their coworkers, and the community surrounding the job site.

The second, but equally as important, common certification related to toxic material removal is an Asbestos Contractor/Supervisor certification or license (DTC, n.d.; Institute for Local Self-Reliance, 2012). Asbestos was not entirely banned by the EPA until July 1989, meaning that deconstruction workers who are often working on older homes are especially at risk (Lahav & Pacheco, 2020). Asbestos is dangerous because once disturbed, the particles can remain in the air for days. Once inhaled, the particles can damage an individual's lungs. Extended exposure to asbestos can result in illnesses such as lung cancer, asbestosis, and mesothelioma (Minnesota Department of Health, n.d.). Like lead, receiving a certification in asbestos safety allows employers to know their

deconstruction workers can mitigate asbestos-related issues for themselves, their coworkers, and the community surrounding the job site.

The final type of certification recommendation for deconstruction training programs is heavy equipment training. Numerous types of heavy machinery could be used at the job site or in a salvage warehouse during the deconstruction process. These include but are not limited to Bobcat/Skid Steer Operator Certification, Aerial Lift Operator Certification, Excavator Operator Certification, and Forklift Operator Certification (DTC, n.d.; The ReUse People of America, n.d.). Heavy equipment may be used to increase job efficiency since they have the power to move materials quicker than manual labor, yet they pose great danger risks to those who are not confident or skilled in operating them (HEC, 2018). Being certified demonstrates that an individual has expertise in operating heavy machinery decreasing the risks of bodily injury. All of the recommended certifications mentioned above have one goal in common, to create a workforce that can safely and effectively participate in the emerging industry that is deconstruction.

Implications of Inadequate Learning

Knowing what skills and certifications are recommended, along with why it is important, but it also is important to know the implications of poor or a lack of deconstruction training. Individual job sites, the industry as a whole, and the environment suffer when there is a lack of training available. Lack of training not only includes a lack of training opportunities, but training opportunities that lack the recommendations talked about above.

On the jobsite, a lack of training can lead to decreased safety, lower salvage rates, and worse site management. It is very important to educate and train those who will be constructing in practices that best salvage material and maintain safety (Kibert, Chini, & Languell, 2001). Failing to complete

a training recommendation, for example, the training given through an OSHA 10 or 30-hour certification, can result in increases in on-site incidents (Detroit Training Center, n.d.). One of the most important recommendations for deconstruction training was that supervisors and project managers are aware of proper deconstruction management techniques. It has been found that ineffective management can negatively impact the company and its employees and that it is a major factor in business failure (Deeb, 2019). Incompetent managers can also be a leading cause of high turnover rates which decreased company productivity (McGurgan, 2017). In order for a deconstruction business to remain open and productive, it is imperative they have leaders who are well trained in deconstruction site management.

The industry of deconstruction suffers when there is a lack of comprehensive training. For example, in Portland, Oregon, an ordinance was initiated requiring the deconstruction of certain structures in which only certified deconstruction contractors could be hired. Portland State University (2017) conducted a series of interviews of Portland area contractors to gauge how their businesses were impacted initially. They found that contractors wanted to hire workers who were already trained in deconstruction in order to increase their efficiencies, but a high percentage of these vacancies were considered difficult to fill (Willingham, Hulseman, Paruszkiewicz, 2017). This study reported that a lack of employable deconstruction professionals was an issue for the industry as a whole (Willingham, Hulseman, Paruszkiewicz, 2017). Other sources have indicated similarly, that one of the biggest barriers to implementing a successful deconstruction industry is the transfer of knowledge, which can be understood as proper training. (Kibert, Chini, & Languell, 2001). If the lack of workers creates inefficiencies in the job, then it is possible that the industry is limited not by the demand, but the supply of workers. This can contribute to a slower deconstruction process and thus less completed deconstruction projects.

If deconstruction projects could not keep up with demand, many of the projects that are slated for deconstruction would end up demolished, adding to the 300,000 homes already demolished annually (LaMore, Berghorn, & Syal, 2018). Having proper deconstruction training in place allows for efficient work which allows for more projects to be completed in the same amount of time. This could allow for a greater diversion rate of construction materials from landfills. The environmental impact of reducing the number of homes demolished and in landfills can be greatly influenced by deconstruction training.

Conclusion

The field of Domicology is emerging as are the industries in which it studies. Deconstruction, or the reuse of building materials, has existed as a concept for hundreds of years, but standardized training goals, let alone training courses, cease to exist. This report's goal was to help create a comprehensive list of deconstruction training recommendations in terms of skills and certifications as stated by deconstruction businesses themselves. The importance of every recommendation was noted along with the importance of the industry and the implications of a lack of training. Like every industry, deconstruction is easier when those who participate are knowledgeable, effective, and efficient. Future research on the topic could include a comprehensive guide to who offers deconstruction training, differences between public and privatized training, and how to grow this trade to be featured in places where other trades are taught (Career Centers, Tech Centers, etc).

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Issues of Historic Preservation with Regards to Blight and Structural Abandonment

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Introduction

Historic Preservation is a relatively new term; the word was coined in the 1960s and is specific to the United States, though other countries have similar terms, such as "heritage conservation" and "built environment/heritage conservation" (Britney, 2020). However, the act of preserving buildings and man-made structures with a history worthy of preservation has been in practice since the mid-17th century (Britney, 2020). The act of historic preservation emerged through the desire to protect national monuments; in 1853 Ann Pamela Cunningham acquired and sought to preserve Mount Vernon, George Washington's home (Rypkema, Cheong, 2013). In the United States, the first preservation group, the Association for the Preservation of Virginia Antiquities, was founded in 1889 (Britney, 2020). Many architectural firms and cities followed suit in the following years. Historic Preservation became a part of urban planning and many University curriculums in the 1960s due to the increase in preservation and the 1966 National Historic Preservation Act. The Act detailed that, the historical and cultural foundations of the Nation should be preserved as a living part of our community life and development in order to give a sense of orientation to the American people; and further that: …the preservation of this irreplaceable heritage is in the public interest so that its vital legacy of cultural, educational, aesthetic, inspirational, economic, and energy benefits will be maintained and enriched for future generations of Americans (Rypkema, Cheong, 2013)

Historic Preservation continues today to be an important aspect of both architecture design, construction, and deconstruction (Britney, 2020). However, historic preservation is often overlooked in favor of the demolition of old buildings to build newer, more modern designs and functions. There are multiple forces at work, both pushing the use of historic preservation, and

keeping other construction companies from using its methods, though the market is changing in favor of preserving historic buildings. These forces are both cultural and economic, as well as in the focus on sustainability as a benefit of preservation. Patrice Frey (2019), historic preservationist and president of the National Main Street Center, writing on Historic Preservation, says, " we've seen a surge in interest in revitalizing historic downtowns, thanks to the market's new enthusiasm for flexible and character-rich space, as well as social and demographic forces that favor these types of districts" (2019). The "surge in interest" for downtown- and largely commercial- areas rather than in more residential neighborhoods is due to the nature of commercial buildings and the economic benefit of commercial investing. Commercial buildings are often areas where local culture and history, such as churches, museums, manufacturing warehouses, and retail spaces, are found and shaped by the character of the city. They are also good market investments; the Wisconsin Historical Society states that historic commercial buildings are generally well-built, energy efficient, and offer great flexibility in the reuse of space rehabilitation work. The revived buildings provide jobs and economic opportunity to locals, and in addition, the buildings can qualify for federal and state tax credits as part of a historical district (Wisconsin Historical Society, 2014). Residential buildings in current states of blight and abandonment, on the other hand, are not as financially equitable as commercial ventures. Historic preservation is expensive and has intensive regulations and buildings codes ensuring the historic aspect of the house is properly preserved. Another reason that residential buildings have poor chances in historic preservations is the unknown effects of historic preservation on property values; some argue that historic districts raise property values while others- including those looking to develop or renovate- argue that adhering to strict historic regulations lower property values (Adair, 2015).

Market trends play a big role in the limitations of historic preservation; Frey (2019) states that rapid investments in "hot" markets creates conditions for demolition because of claims that density is only supported through modern structures. But that claim is false according to Frey. Little Havana, a growing neighborhood outside Miami, was the subject of a study conducted by the National Trust's Research and Policy Lab that found, "the district could easily accommodate 10,000 new residential units and accommodate 550 new businesses by building out vacant lots and utilizing vacant buildings to a height and scale compatible with existing structures." (Frey, 2019). This it demonstrates that we can accommodate modern functions and population levels, particularly in cities, where populations are often continuously growing, with some of our current buildings. This isn't to say that historic preservation can and should take the place of new construction. Besides not being realistic due to the disruptions in the construction industry, relying solely on historic preservation also takes away from progress in the sustainability of new designs and the ability to create buildings and places that reflect the community and need of that city. In this paper, we will take a look at what aspects of historic preservation should be adopted more widely, the pros and cons for doing so, and how historic preservation looks on a global scale.

Historic preservation is composed of two aspects; recycling and stories. We preserve buildings that have significant cultural meaning in communities and tell a story about a time that has passed. Already used materials- such as wood or brick- have a way of reminding people of the history that occurred when those pieces were being used in their original, intended purpose. This makes the pieces unique and adds value for those who want to keep a piece of history alive; humans have always been interested in stories and it's no surprise that we have included those stories into our houses, businesses, and other buildings. Our reverence for stories and the pieces that hold them has grown in recent years. Frey (2019) wrote that, "research from the National

Trust for Historic Preservation shows that over 90 percent of Millennials express support for preservation." This is important because if more people are interested in preservation, more companies will follow those trends to include preservation in their work. As it turns out, our desire for interesting pieces and the environmental movement has sparked an industry that is both centuries old and just starting out. The recycling industry brings the two- the process of recycling and the story aspect of building materials- together and brings a significance to historic preservation. The act of historic preservation is recycling the function and certain amenities of a house while keeping the background and decorative or structural foundations. Taken to generalities, there is a story in every house or building, particularly those older than 50 years. Additionally, in buildings that cannot be wholly preserved, pieces of the structure may be salvaged and used in new construction instead of virgin materials. Recycling materials from houses and using them in new construction offers homeowners a way to bypass the stricter regulations of preserving entire buildings while maintaining the historic preservation aspect of material history and stories. The act of historic preservation, and specifically the preservation of whole buildings, brings into question what buildings stories have been deemed "worthy" of remembering and why those stories and places are chosen over others. When do we choose to preserve structures? What qualifications define the historic aspect of these places? Historic preservation will have biases in what structures are preserved due to a number of confounding variables including the money required to restore these sites, the original shape, leaders in the construction industry, nonprofits, and governments which are all involved in historic preservation.

The process of preservation requires five steps:

how communities decide what buildings have historic value. For a structure to be considered for historic preservation it must have,

Historic, architectural, and community value... All designating agencies use qualifications that emphasize age (usually 50 years old and older), historic significance, architectural and engineering merit, and integrity of design, character, workmanship and materials (WBDG, 2019)

Cities with significant amounts of blighted or vacant structures have a correlation with economically impoverished areas and tend to be older communities with an industrial background. Cities like Detroit, Cleveland, and Youngstown are some of the hardest hit with blight- and they were all once industrial centers that, through recessions, faced economic declines and population loss. One plan of action of blight reduction is a process of population growth, redeveloping properties, and economic growth; historic preservation is a way to involve the history of the community, and the people themselves, in revitalizing their cities to encourage new growth. Critical to this process is the current trends amongst younger generations; they want unique places with stories and architecture, preferably in cities (Frey, 2019). Historic preservation is the way that the community can reach these needs and combat blight.

There are several benefits to historic preservation that support using historic preservation as a tool to combat blight in communities. Economic benefits are brought to communities from the act of historic preservation. The National Trust for Historic Preservation is pushing for historic preservation as a redevelopment tool by promoting the idea that cities should build on the assets they have; by doing so they keep the identity of a community and shape the real estate market for new growth. Historic preservation has proven to raise home values and people are more willing to pay for homes in historic districts (University of Delaware, n.d). An analysis done by economist Donovan D. Rypkema in Connecticut in 2011, found that, “property

values in every local historic district saw average increases in value, ranging from 4% to over 19% per year." (Cole, 2018). Increasing property values may excite business and property owners in the area, but there are negative consequences to the increase in the form of limits on potential buyers and higher taxes, both factors in gentrification.

Part of the economy supported by historic preservation is heritage tourism. The term is defined by the National Trust for Historic Preservation as, "traveling to experience the places, artifacts, and activities that authentically represent the stories and people of the past and present. It includes visitation to cultural, historic, and natural resources," (Gibson, 2015). National Heritage Areas (NHA), places designated by Congress as places where natural, cultural, and historic resources combine to form a cohesive, nationally important landscape, bring in $12.9 billion dollars a year to the United States economy (NPS, 2015). One specific NHA, the Motor Cities National Heritage Area around Detroit, "generates $410.4 million in economic impact, supports 4,560 jobs, and generates $35.4 million in tax revenue." a year in federal money (NPS, 2015). That impact is from tourism ($408.6 million), operations ($1.7 million), grants, ($53, 678), and capital projects ($88, 423) as direct, indirect and induced costs; the economic impact includes the expenses paid by the NHA as an impact to the economy. Direct costs is defined in the study as, "items such as operational spending, spending by visitors to the NHA, and grantmaking/capital expenditures," while indirect costs is referred to as, "also known as the multiplier effect, includes the re-spending of dollars within the local economy by vendors and suppliers. Induced costs, as determined by the study are, "measure the effects of the changes in household income." (NPS, 2015). Across the country, NHAs are responsible for an annual economic impact of $12.9 billion, provides 148,000 jobs and, "generates $1.2 billion in Federal taxes from sources such as employee compensation, proprietor income, indirect business tax, households, and corporations." (NPS,

2015). Compared to the demolition and wrecking industry in the United States, which has a market size of $7 billion dollars (IBISWorld, 2019), the tax benefits and economic revenue are too significant to rely wholly on demolition as a response to blight and abandonment. Locally, heritage tourism brings jobs back into the community and generates State tax revenue. This helps revitalize cities by encouraging tourists to spend money and visit those areas that were once abandoned, as well as, supports the residents through jobs and the influx of money spent in the local area. Tourism is a driving factor in the economy of many countries. Max Roser with Our World in Data shows how influential tourism has become; since 1950, international tourism has risen from 25 million yearly arrivals to 1.4 billion yearly tourists in 2017 (Roser, 2017). Tourism in 2016 generated $7.6 trillion, 10.8% of the global GDP (Destinations International, 2017). The data from the National Park Service (2015) shows that Heritage Tourism is no exception and as the tourism industry continues to expand, the potential of heritage tourism grows as well.

An important aspect of historical preservation and why many cities are adopting the practice to fight blight instead of demolition are the environmental and sustainability impacts from the act preservation. According to the Environmental Protection Agency (EPA, 2020), the construction industry is responsible for the generation of 569 million tons of waste in 2017. Out of that demolition represents more than 90 percent of total waste generation (EPA, 2020). Globally, construction and demolition waste are projected to rise; Adam Redling (2018) writes that worldwide waste is set to double by 2025, with building material making up half of all solid waste (. Our production of waste has severe effects on the natural environment. Some of the effects that directly affect humans alongside the ecosystems in areas near landfills include air pollution, groundwater pollution, and adverse effects on soil fertility. Research on the effects on the environment from the construction industry show that that the sector,

contributes to 23% of air pollution, 50% of the climatic change, 40% of drinking water pollution, and 50% of landfill wastes. In separate research by the U.S. Green Building Council (USGBC), the construction industry accounts for 40% of worldwide energy usage, with estimations that by 2030 emissions from commercial buildings will grow by 1.8% (Snook, 2017)

This data raises question, how can the construction industry change to reduce emissions? There is a strong connection between environmental planning and historic preservation in which the latter helps mitigate adverse effects on the environment through the reuse of materials and protection of natural and cultural resources. Choosing historic preservation during environmental planning for structures that meet the historic requirements can directly impact the surrounding environment; the way we built structures in the past has changed since the present way we construct buildings due to greater technological affordances and different architectural needs. However, old buildings have attractive qualities that some newer structures do not. For example, many older buildings have wooden frameworks that are of better quality than newer materials found today because the wood is old growth rather than harvested from younger trees. Preserving important qualities of historic buildings includes preservation of the surrounding landscape, mitigating runoff by planting trees and shrubs, diverting demolition waste to nearby landfills, and putting less strain on natural resources extraction for new construction.

Historic Preservation & Social Justice

Historic preservation has several benefits aside from revitalizing the economy and supporting the sustainability of built structures. However, there are downsides to historic preservation and biases that must be taken into account before communities decide to fund the preservation of blighted buildings. To fully understand the approaches used in historic preservation and the issues inherent within the practice, the benefits and consequences can give

insight into how the practice is perceived versus how it is implemented. Historic preservation is by no means a cure-all for blight and abandonment and the next two arguments against historic preservation illuminates the importance of considering all aspects of historic preservation and its impact on a community before its implementation.

In recent years, there has been a trend following historic preservation and revitalization of blighted, declining communities. Namely, as communities' economies grow and people move back into those areas, the housing market prices rise, as do the cost of goods and commodities from businesses in the area. This rise in cost of housing directly affects residents that lived in the area during its economic decline and, in particular, impoverished minority groups that typically cannot move to other areas when a community faces blight and abandonment. The term gentrification is defined as, “a process of changing the character of a neighborhood through the influx of more affluent residents and businesses,” as well as, “the process of renovating and improving a house or district so that it conforms to middle-class taste” (Collins English Dictionary, 2012). Historic preservation may play a role in the gentrification of a neighborhood because redevelopment encourages the movement of people to these areas and raises the desirability of a community. Studies show that younger generations are moving out of the suburbs and into cities, with special consideration for cities that display unique heritages and cultures. Historic preservation requires property owners to maintain their property in compliance with the city’s historic district codes. While this is an asset to both the structures and value of homes, the attraction of affluent residents brings new ideas of what a neighborhood should look like and may hurt renters who cannot afford higher rental prices (Succinct Bill, 2017). Historic preservation may not intend for the displacement of poor residents, historic preservation depends on gentrification to showcase the benefits of the practice. San Francisco is a good example of

gentrification. In the 1960s, the city relied mostly on blue-collar work- fishermen, global trade, and local businesses- that was done by people of many different ethnic identities. Stephanie Meek, author of The Past and Future City, writes about the role of historic preservation in America's cities. According to Meeks, commercial rents in San Francisco have risen 250 percent since 1999 (McElwee III, 2017). Meeks writes that, "saving places is about "defin[ing] a community so that future generations can know their past, feel a connection to those who came before, and build a foundation for the future" (2017). Historic preservation is complex because there needs to be a balance between restoring historic structures, preserving the unique character of a city, growing the economy, and ensuring that minority and lower-income groups are not pushed aside. However, there may be parts of gentrification that are beneficial to communities. Mostly in the form of monetary resources, a decrease in crime rates, and declines in buildings becoming blighted. McElewee states that, arguably, it's through gentrification that preservation prevails in city neighborhoods. An investor is more inclined to restore an aging corner store into a microbrewery if the neighborhood sheds its unpleasant past. In American cities lucky enough to experience gentrification, the survival of historic buildings often depends on a neighborhood's transformation (McElwee III, 2017)

Historic preservation and gentrification may have a high correlation, but there are efforts to encourage the resource and monetary benefits of gentrification while negating the displacement of minority groups.

Barriers to Historic Preservation

Those who are against historic preservation argue that focusing on the preservation of old buildings to promote redevelopment rather than supporting new builds and encouraging a modernization of city architecture halts progressive technological and building advancements in the construction industry. The rehabilitation of blighted historic buildings is expensive, so while historic preservation can save cities and taxpayers money in the long run, it can seem just as or more expensive than new construction. Emily Washington brings an important argument for preservation regulators, "at the local level, regulators should likewise be required to look at the opportunity costs of historic preservation—which normally include preventing the construction of newer and larger buildings that could house more neighborhood residents." (Washington, 2012). Preserving already built structures limits the ability of those in the construction industry to make changes to the way it designs buildings; it is not possible to redesign a historic building for deconstruction because doing so may obstruct the historic architecture and pieces in the structure preservationists are trying to conserve. Historic preservation may also hinder the economic growth and development value of the community it is said to promote. That is, strict regulations on how a historic district may be rehabilitated and maintained can cause investors- and people looking for more lenient building codes- to move elsewhere. The disadvantage of cost and strict regulations is detrimental to the promotion of the practice of historic preservation. There is a balance between new construction and historical preservation, particularly in urban settings, that is needed to effectively fight blight and abandonment through the redevelopment of the community and revitalization of the local economy. The combined benefits ensure that the negative aspects of each are diminished to support the community as much as possible. Cities with a mix of historic

districts and new construction areas are better equipped to handle population density, supply housing to meet demand and offset price inflation, and maintain a sense of community identity.

The biggest issue presented in the practice of historic preservation is the lack of research to show how historic preservation affects local communities. Despite the idea of preservation being hundreds of years old, the field is relatively small, especially in the concept of historic preservation as a tool to combat a community's structural blight and abandonment. Studies like the report *Measuring Economic Impacts of Historic Preservation* by the Advisory Council on Historic Preservation and PlaceEconomics, used several quantitative methods to measure the impact of historical preservation. Those include, the value of the affected properties, the rate of value change of the properties, or the contributory value of being within a local historic district (Rypkema, Cheong, 2013). Rypkema and the coauthors of the report go on to say, "the most sophisticated analysis that has been used in heritage property value studies is known as hedonic pricing. This method tries to identify the individual components of a property and each component's contribution to the overall property value." (2013). The variables used in hedonic pricing studies include number of bedrooms, number of bathrooms, square feet of living area, square feet of lot, number of garage spaces, availability of a swimming pool, and age of the property. These studies lend to the quantitative side of historic preservation research because they are able to collect data on monetary values and compute numerical trends on the effects of using historical preservation. However, there is a qualitative side to the practice that is little explored due in part to the lack of standard methodology to do so and a lack of knowledge on the exact variables that should be measured to give an accurate portrayal of historic preservation. Through interviews and surveys, as well as case studies and observations, researchers can collect data on the impacts of historic preservation that are less easily defined by quantitative data. These impacts

are social impacts; how the practice encourages a community identity, the improvements or detriments to quality of life for residents, and changes in the perception of the city from both a local standpoint and a nonlocal one. The way to measure such outcomes is hard to define because there are many other factors that can influence study participants. But if we look at historical preservation as a program being implemented by a community, we can use methods of program evaluation to determine immediate and long-term outcomes. Conducting a pre-test, middle test, and post-test assessing people's answers on all variables present allows researchers to find patterns and changes specific to the variable of historic preservation because there will be a baseline for the variable that we can deduct the new answers from. In addition, asking a mix of open ended and closed ended questions may reveal other impacts and variables that are not previously considered. Qualitative analysis is as important as quantitative economic and environmental figures because man-made structures should exist to serve the needs of the community, so why not have buildings that improve the happiness and behaviors of those residents?

Another issue in historic and cultural preservation is the question of whose story society is preserving. An example that illustrates this is of a 19th century warehouse in Detroit. The mayor, Mike Duggan, and other city officials had the warehouse demolished in the city's attempts at combating blight- and it was done on the owners of the warehouse's expense. While this might look to the government of Detroit as a step in the right direction for fixing the city's extensive vacant and blighted building problem, many local members of the community mourned what they thought of as a piece of the city's history (Michigan Historic Preservation Network, 2014). The community saw the potential for preservation that the city officials did not. There may not be a correct answer on if the building should have been preserved but it showcases that the

desires of the community and what they feel as part of their history might not align with those who make decisions on the historic value of structures. What parts of history will vary from town to town and from country to country? Regulations and procedures for determining the historical value should be flexible enough to accommodate a wide variety of historical perspectives. Even so, it must be taken into account that current architecture is the result of certain groups retaining power.

There is an inherent bias in historical preservation because the people in charge, including govern

significant and where funding should go. A strategy to combat this is by involving the community in the preservation community; the formation of community preservation boards and putting preservation proposals on local voting ballots can be ways to include more members of the community. Including a larger range of histories in the preservation of buildings is also a way to keep that history alive; some preserved structures become museums and the most well-known historic preservation sites are UNESCO World Heritage sites. Similar to the different terms for the practice, historic preservation looks different globally. The regulations and ideas about what is historic also shifts, though most heritage sites are presented as tourist opportunities for economic value rather than uniquely for the daily functions of the local community. UNESCO works in cultural preservation in most countries, collaborating with governments to preserve the country and its people's history. Cultural preservation is a way to conserve the traditions, beliefs, and way of life of the past. Australia's indigenous peoples have religious landmarks designated by the government that have become popular tourist spots even though the indigenous population has petitioned to keep heritage tourism away from those sites because people still practice the religion that considers those spaces sacred. Adeshola Ore journaled some of the petitions of the Anangu

people where, “the Uluru, the iconic sandstone rock that juts from Australia’s “’Red Center’, is a holy area, holding the stories of their ancestors” (2019). The protests towards heritage tourism illustrates the bias in historic preservation and heritage tourism is global and it details how a heritage site can be preserved but the culture of the people it represents is not respected in a way that outside of its preservation, highlighting the lack of community input from the indigenous peoples’ perspective of how the site should be preserved. In contrast, places like the Vatican- which, similar to the Uluru of Australia, is an important tourism landmark- are able to keep portions of their archives completely out of the public eye at the request of the Pope. Both sites have current practitioners of the religion and both sites are considered top tourist attractions in their countries, so why do the indigenous people of Australia face obstacles in their preservation from the government and tourists that the Vatican does not? It is easy to see that the definitions and structures that make up historic preservation are vastly different from culture to culture, but the adverse effects and drawbacks of the practice remains consistent.

Conclusion

Historic preservation as a practice has come from the preservation of national monuments in the United States to a mainstream movement that has become an integral tool to combat blight and revitalizing declining former industrial cities. Studies have proven that preserving the history of a place has economic value and brings jobs to communities as well as supports the heritage tourism sector. Despite potential drawbacks of gentrification and the cost of saving a blighted structure to its former ability, the shifting focus of sustainability in buildings and adjusting the lifecycle of built structures to include end of life plans brings to light how the benefits of historical preservation can outweigh the cons. There are several issues with historic preservation that need to be taken into account when deciding if historic preservation is the best option for a community.

While groups are taking precautions to address bias and include the historical structures of minority groups, the practice is still evolving and working on efforts to make historic preservation a part of a community rather than tourism-focused museums or large buildings with less direct involvement with the residents of the community. Historic preservation needs to be able to grow and evolve across different cultures in the same way that each building has a unique story that builds the framework of a larger history. The issues of historic preservation are still being researched and there is still much to learn about the direct impacts of historic preservation on the social aspects but with more attention being placed on Domicology and the sustainability of built structures, the prevalence of preserving the story of buildings and the people that live in them will continue to grow.

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Cooperative Land Banking (CLB): Transitioning the Detroit Land Bank Authority (DLBA) to Smaller Neighborhood CLBs to Greater Serve Marginalized Communities

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Introduction

Domicologists examine the life cycle continuum of the built environment, with Domicology referring to the study of the built environment's life cycle from the planning, design, and construction stages through to their end of use, abandonment, deconstruction and reuse (LaMore, 2017). While a relatively new approach to development and design, if widely adopted and understood, Domicological models of use and re-use offer new opportunities for social justice. For example, by leveraging cooperative land banks as a mechanism for reusing and repurposing abandoned land and properties in historically marginalized communities.

Cooperative land banks, as opposed to traditional land banks, function through membership investment who mutually benefit from the services provided through a cooperative land bank. In this analysis, it is proposed that the transition of land banks from a traditional model to neighborhood-centric cooperative land bank model will benefit and drive investments in communities that have been marginalized and affected by blight and abandonment. This research paper argues in favor of community-focused cooperative land banks in Detroit, as opposed to a single organization serving an entire city of over 670,000 people, such as the DLBA (United States Census Bureau, 2020). Considering the scope and depth of marginalization created by "white flight" from urban centers to surrounding suburbs, and the impact of dilapidated, crumbling, and often toxic built structures characteristic of many urban landscapes, the spirit of Domicology as an economic equalizer offers some promise for communities historically left behind.

Detroit and Social Justice

It is imperative that marginalized communities affected by the current built environment are fairly represented to reduce the cycle of structural abandonment that the City of Detroit has experienced. The deterioration of Detroit is very much a social justice issue, rooted in a history of

corrupt and centralized power across the auto industry and local government (Baldas, 2013). At its peak, the population of the city of Detroit was 1.838 million people in 1950 (U.S Department of Commerce, 1950; p. 6). More recently, however, the landscape of the city has changed dramatically from the jewel of automotive industry in first half of the 20th Century to a city largely abandoned as a result of suburbanization and deindustrialization, segregated by wealth, leaving Detroit's historical neighborhoods with a dwarfed population of 713,777 (United States Census Bureau, 2010). Some of the more infamous abandoned structures in Detroit include, the Packard Automotive Plant, Fisher Body Plant and Michigan Central Station. Structures like these loom over the city like a visible ghost, serving as a reminder of a once thriving destination and economic hub held together by the automotive industry. The crumbling homes, and drastic contrast of Detroit's neighborhoods, as compared to their immediate neighbors, has not received the type of attention that Detroit residents deserve. However, a current shift in residential migration patterns is now drawing people from the suburbs back to urban centers, such as Detroit (Weidenaar, 2018). This renewed interest provides opportunity to address what is often characterized as urban decay by focusing redevelopment and re-investment efforts on neighborhood blight and abandoned properties throughout the city.

Theoretical Background: Cooperative Business Structures, Land Banks, & CLBs

Cooperatives are an organization or business "owned and operated for the benefit of its members... earnings and profits are distributed among its members" (Petersen, 2016, p.13). Cooperative systems function as businesses in which members are owners who benefit from decreased prices in goods and services that occur as a result of the system. To be a successful cooperative system, the organization must apply seven principles. These are: 1) voluntary & open membership, 2) democratic member control, 3) members' economic participation, 4) autonomy & independence, 5) education, training and information, 6) cooperation between cooperatives, 7) and

concern for community (NCBA, n.d.). Such principles serve as the foundation for other equitable development initiatives across the United States, such as the Dudley Street Neighborhood Initiative in Boston, Massachusetts, and Evergreen Cooperative in Cleveland, Ohio (Nembhard, 2006; p.44; Weidenaar, 2018). Land banks are defined as:

> A land management technique used by local governments to purchase tax-delinquent, tax-reverted, foreclosed, or abandoned properties. By transferring vacant and abandoned properties to responsible landowners through a land bank program, local government benefit because they avoid the significant cost burden of property maintenance. These foreclosed properties are then "banked" for future use or resale (Tappendorf & Denzin, 2011, p. 801)

The concept of CLBs has been heavily pioneered by Dr. Shann Turnbull, principal at the International Institute for Self-Governance and a founding member of the New Garden City Alliance (Turnbull, 1997.). Turnbull claims that CLBs create a system that both rewards private investment local residents through the use of dynamic leases that divert ownership back to the cooperative and through residential shares which distribute wealth to local residents (Lewis, 2015). Under these conditions it is believed that "affordable housing and many other social and economic benefits can be achieved without recourse to cash-strapped governments" (p. 1). In order to rehabilitate and uplift communities plagued with blight and abandonment CLBs present themselves as a source of community and business development created.

The Detroit Land Bank Authority

The Detroit Land Bank Authority was incorporated in 2014 via the Land Bank Fast Track Legislation, Public Act (PA) 258 enacted in 2004 by Governor Jennifer Granholm (Brooks et al., 2004). Alongside PA 258, former Michigan Governor Granholm signed four other Public Acts: (1) PA 259 which amends the Michigan Brownfield Redevelopment Act to allow land banks to receive

tax increment financing (TIF) on Brownfield sites owned by the Land Bank (LB); (2) PA 261 which created the Property Tax Exemption Act and exempts titles held by LBs from taxes and titles sold by LBs property taxes for five years; (3) PA 260 which created the Tax Reverted Clean Title Act, to impose a specific tax, which would have the same rate of general property taxes for five years, on property sold by a LB fast track authority, and; PA 263 which amended the General Property Tax Act to permit a foreclosing governmental unit to request a title product other than an unreliable title search to identify the owners of tax delinquent properties at the time of foreclosure and describe a reasonable process for identifying these owners and providing public notice to them (De Wit, n.d.). The combination of these Public Acts allows for the DLBA to form and function as a corporation in the state of Michigan.

Private Ownership & Abandonment

Issues of abandonment are not unique to Detroit. In the 1970s the City of New York was faced with an abandonment crisis led in part by a move for disinvestment by landlords leaving nearly 20,300 buildings by the end of 1978 (Leavitt & Saegert, 2007). New York City subsequently transferred ownership to tenants, non-profit community-based organizations, and screened landlords rather than redistributing the structures back to landlords and continuing a cycle of future abandonment. During this time, case study research using interviews and surveys showed that "tenant turnover was relatively low, vacancies were easily filled, service and maintenance problems were minor in most buildings, and resident satisfaction was high, particularly when residents compared their situation to that of living in a landlord-owned building" (Leavitt & Saegert, 2007, p. 492). Serving as a model that empowers residents through cooperatives, New York City served as an example of resident empowerment through cooperatives. Private ownership encourages abandonment, especially by investors who are protected by Limited Liability Corporations (LLC), because outside

stakeholders do not experience the cycle of abandonment that residents and tenants do. On the other hand, those living in the impacted community are also those who make community thrive and should therefore be entitled to the benefits they create.

Similar to New York City, Detroit also owns thousands of parcels of land under the Detroit Land Bank Authority throughout the city. Although none of the DLBA's structures currently house tenants, a transition of the organization into a number of smaller neighborhoods CLBs could reduce cost barriers for private investment, current, and incoming residents through tax breaks provided under the classification as a cooperative non-profit.

Ownership & CLBs

The backbone of a CLB is the homeowners and tenants residing within structures. In the establishment of a CLB, residents' area are given shares equal to the area covered by their parcel (i.e. 150m^2 dwelling would receive 150 shares with each share equal to 1m^2 of land). While ownership is maintained by the residents who own shares of the CLB, the structure is transferable through a lease, thereby allowing the CLB to collect gains from investment in the community. Furthermore, CLBs collect structures from investors through the transfer of equity at the same rate that investment costs are reduced through lower taxes under the CLB. The CLB then transfers those shares to residents. This process incentivizes residents to stay in their structure longer because those who stay longer receive greater compensation in windfall gains. See *Fig. 1*.

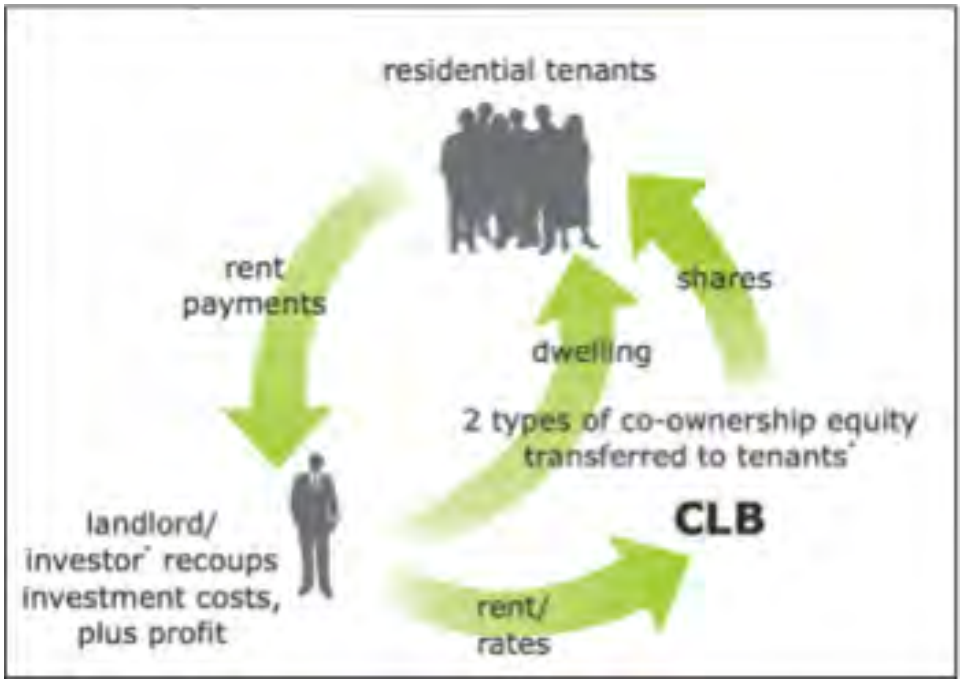

Fig. 1 Cycle of Ownership (Lewis, 2015)

Benefit Transfer Analysis of CLB Rehabilitation

In order to quantify the economic gains provided by a hypothetical CLB, this paper conducted benefit transfer analysis modeled after that used by the Michigan Association of Land Banks (2018) in case studies of LBs in Benzie, Calhoun and Kalamazoo Counties. The first part of the organizations analysis was "used to estimate the impact of residential demolition and rehabilitation on neighboring residential property values" (p. 50) applied as follows:

1. Use literature to identify the distance of impact (500 feet for demolition and rehabilitation) from the given property intervention;

2. Use literature to identify the percent impact on nearby residential property values from each residential intervention type;

3. Calculate nearby housing counts, occupancy rates and value of homes that were impacted by each property intervention.

The calculated estimate of impact in part one is then used for "estimating the economic and jobs impact of case study land bank expenditures applied as follows:

4. Total expenditures of land bank on all property related activity (i.e. non staff expenditures) were captures;

5. Job multiplier;

6. Economic impact multiplier;

7. Multiply total relevant expenditures of case study land banks with the jobs and economic impact multipliers of the adaptable literature to estimate the impact of case study land bank expenditures.

Using the Michigan Land Banks methodology this study analyzes the hypothetical impact of a CLB structure rehabilitation on Bedford Street in Detroit. As a result of the available data, steps 5 & 6 use the full-time equivalent (FTE) and economic impact multipliers of Lansing in this study because it has the closest alignment to economic demographics of Detroit that was used in the Michigan Land Banks study.

Data used in this study includes parcel data from Motor City Mapping, a complete survey of every parcel in the City of Detroit commissioned by the Detroit Blight Removal Task Force in addition to Data Driven Detroit's 2014 aggregated vacancy index (Data Driven Detroit, 2015; Data Driven Detroit, 2014). This benefit transfer analysis is being used to demonstrate the windfall gains believed to be created through a CLB rehabilitation of 9264 Bedford Street on surround parcels. In this neighborhood there are a total of 37 parcels and covers 1.69 acres2. The distribution of ownership on Bedford street is 49% private investment; 27% DLBA; 24% owner-occupied respectively (See *Fig. 2*). The average price per home in the area is $24,000 (See *Fig. 3*).

Findings

The findings of my case study suggest an average increase of $3,360 per neighboring residential parcel within a 500ft radius of 9264 Bedford Street after rehabilitation. According to the estimated minimum cost of repairs for 9264 Bedford Street is $51,579 during its inspection date on March 9th, 2020 (DLBA, 2020). Under the aforementioned theoretical framework of a CLB this would create a windfall gain of $43,563 for Bedford Street alone (See Fig. 3), almost fully covering the minimum cost of repair. As opposed to a traditional LB where windfall gains would be experienced mostly by private investors from outside the community, the CLB increases the equity of shares from which residents can benefit from as illustrated in Fig 3. Under a traditional LB more than half of predicted windfall gains are experienced by private investors who in areas like Bedford Street own more than 50% of parcels owning nearly five times as many parcels compared to owner-occupied and more than twice that owned currently by the DLBA.

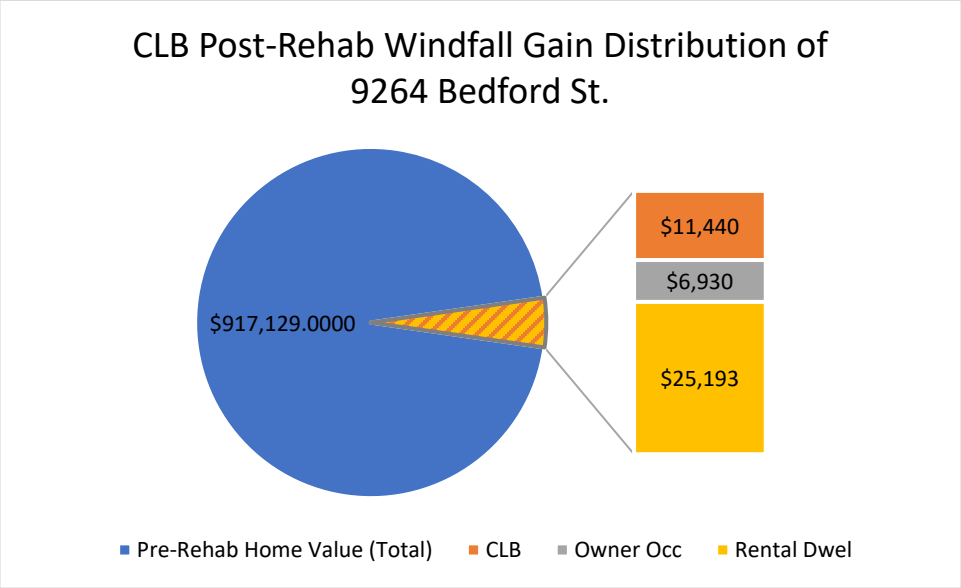

Fig. 4 Windfall Gain Distribution of Equity Post-CLB Rehab of 9264 Bedford Street

Areas of Future Research

Despite the perceived incentives and gains possible through the institution of a CLB, outcomes are not guaranteed or known, however, they can be estimated. As a result of the limited research in the field of cooperative land banking and a lack of established CLB case studies, outcomes are generated by the theoretical framework examined above. Impediments to establishing neighborhood CLBs in Detroit will most likely come from a lack of initial capital to incentivizes investment which according to Turnbull seems to be the first source of income for the organization. Without the resources to establish a CLB the organization will struggle to maintain itself or serve the community. Additionally, any move away from resident control of the CLB holds the potential to drastically change the dynamics and goals of the organization and revert back to a system that marginalizes residents of communities.

Conclusion

Under the current system of land and structure ownership in Detroit and across the U.S. those who benefit and profit not residents of the areas being uplifted but rather private investors who often are not even members of the community from whom they profit. Domicology aims to reduce the negative impacts of the built environment, and with the current status quo of the transfer of equity leaving communities marginalizes and segregates minority populations such as those experienced by many residents in the City of Detroit. The theoretical background of CLB's pioneered by Dr. Shann Turnbull have presented themselves as a possible form of remediation to counteract the negative social impact of private land ownership and abandonment.

Appendix

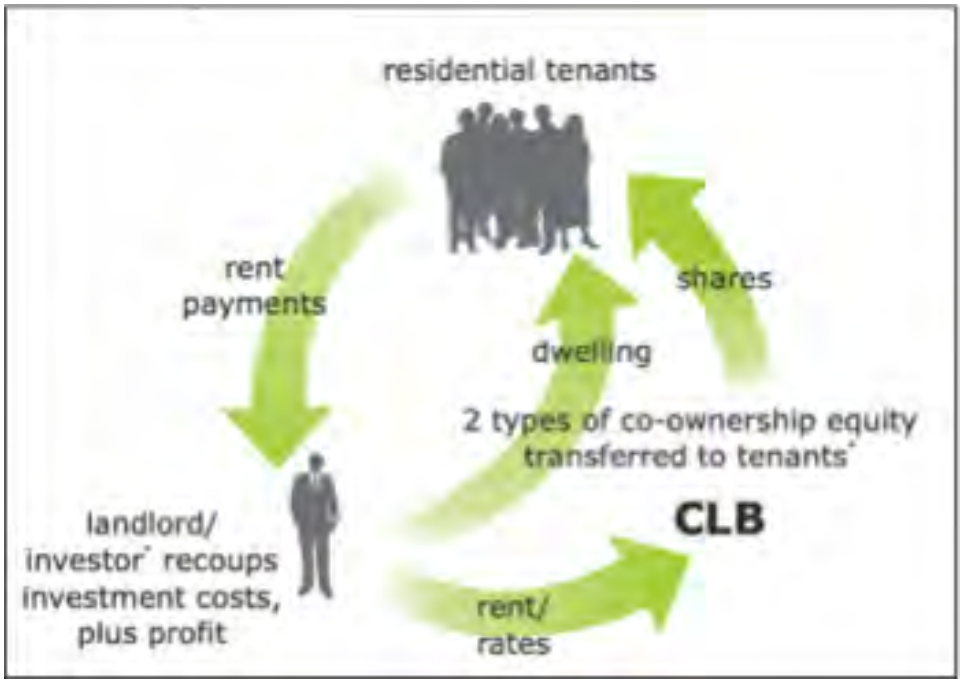

Fig. 1 Cycle of Ownership (Lewis, 2015)

Fig. 2 Land Distribution of Parcels on Bedford Street, Detroit

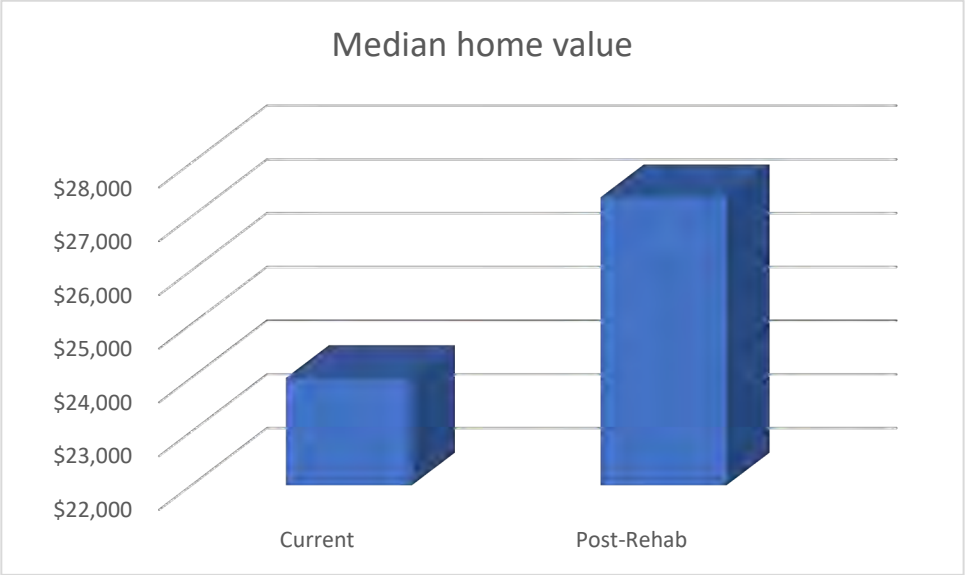

Fig. 3 Median home values of parcels on Bedford Street

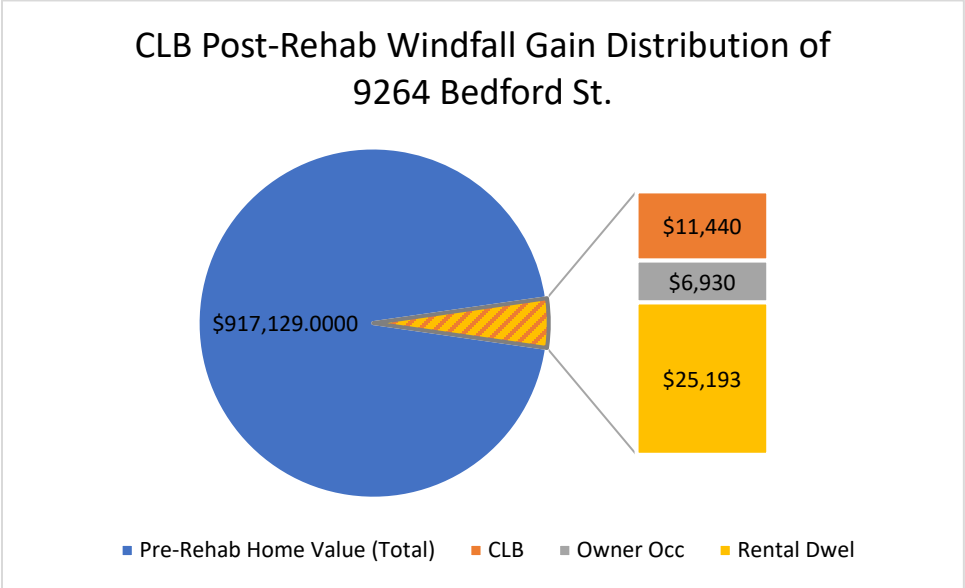

Fig. 4 Windfall Gain Distribution of Equity Post-CLB Rehab of 9264 Bedford Street

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Analysis of Vacant Lot Redevelopment

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Introduction

The current Domicological framework focuses on reducing the negative social, economic, and environmental impacts associated with structural abandonment. However, this paradigm neglects the final steps of a site's remediation; its redevelopment. The deconstruction and material reclamation of a blighted property is a significant first step in increasing a site's redevelopment viability but does not guarantee the lot will return to a useful space. When a deconstruction team walks away from a project without plans for further redevelopment, a vacant lot is left. These lots may be absent of blighted structures but still negatively impact neighborhoods by disrupting their sense of community, becoming illegal dumping sites, and a maintenance expense for local governments. Therefore, redeveloping vacant lots is an important aspect of a domicologist mission that should be further explored by the field.

Vacant Lots & the Opportunity for Redevelopment

There are a multitude of incentives for the redevelopment of land rather than clearing of a greenfield. Environmental preservation, the deceleration of urban sprawl, and reinvestment in blighted communities are often claimed as benefits of lot redevelopment. Additionally, properties with blight are generally sold at a lower price than undeveloped land. For example, the City of Muskegon, MI sells buildable abandoned lots for 75% of the "true cash value" as assessed by the County Equalization Office and has a $1 policy for transferring vacant lots to adjacent property owners ("City Owned Vacant Lots for Sale," 2017). Many municipalities are eager to see the land transformed and absolve themselves of maintenance responsibilities. Abandoned and blighted properties have no or negative monetary value and thus the land's owner is often willing to part with these parcels for a negligible fee. Blighted properties are thus attractive sites for redevelopment because of their environmental and economic benefits.

However, not all abandoned lots are equally eligible for redevelopment. Structural abatement can deter developers from pursuing projects on blighted properties. The demolition and landfilling of abandoned structures is expensive and environmentally destructive (Berghorn et al. 2018). Deconstruction is more economically and environmentally beneficial than demolition, however, it can be time intensive (Berghorn et al. 2018). For this reason, vacant lots are notably attractive for new construction. These parcels no longer have structures that must be removed. This advances redevelopment temporally and can save the new owner the cost of abatement. Vacant lots thus hold superior redevelopment feasibility as structural nuisances have already been removed.

Vacant Lot Redevelopment Builds Community Resilience

Vacant lots are neglected parcels of property with no buildings on them. When unmaintained and abandoned, vacant lots pose serious social and environmental risk and are a lost economic opportunity ("Vacant and Abandoned Properties: Turning Liabilities Into Assets," 2014). Though these lots do not have structures to house criminal activity, they still endanger communities. Unmonitored spaces are prime for illegal dumping of both household and hazardous waste. Unkempt lots can also deter community engagement and are linked to increased crime rates (Kondo, n.d.). Lot vacancy is also an environmental justice concern, as these sites are disproportionately prevalent in low income neighborhoods ("What are Vacant Lots?" 2017), meaning these ailments are affecting communities that are already marginalized.

Remediation efforts can ease the effects of lot vacancy and build community resilience. The U.S. EPA estimates that the average cost to "clean and green" a vacant lot, which includes trash removal and basic lawn care, is between $1,000-$1,300 with annual maintenance costs around $150 (Grosshans, n.d.). According to findings published by the Proceedings of the National Academy of Sciences, "neighborhoods where vacant lots were cleaned up experienced a

29 percent reduction in gun violence, 22 percent decrease in burglaries, and 30 percent drop in nuisances like noise complaints and illegal dumping" as compared to neighborhoods with blighted vacant lots (Berger, 2018). When lot vacancy is addressed in a strategic block-by-block approach, neighborhoods can be strengthened through a common cause and a collaborative initiative. Community members reported that the clean-up of vacant lots "significantly increased use of their outside spaces for relaxing and socializing" (Berger, 2018). Economic benefits of lot vacancy remediation has shown that every dollar spent on vacant lot remediation generates an additional $224 in housing wealth for the surrounding community (Grosshans, n.d.). Investing in communities through vacant lot redevelopment aligns with the Domicological vision of mitigating the negative social, economic, and environmental effects of blight and is an opportunity to build community resilience.

Analysis of Lot Vacancy in Muskegon, MI

In 2017, the City of Muskegon identified and acquired more than 350 orphaned vacant lots in 11 different neighborhoods. In the interest of characterizing these lots, a simple random sample of properties was analyzed using the Muskegon County Property Viewer GIS application which offers information about parcels including size, owner, and estimated value. For each of the parcels, the City of Muskegon is listed as the legal owner and each lot is assessed to have a $0 taxable value (Muskegon County GIS, 2020). It was found that the average area of the vacant lots was 0.46 acres and the median parcel size was 0.2 acres. Of the sample, all but three properties were less than one acre. The maximum size was 9.58 acres and the smallest parcel was 0.01 acres as shown in *Figure 1*.

Min	Q1	Median	Q3	Max
0.01	0.12	0.2	0.27	9.58

Figure 1. Statistical summary of random sample (n=50) of the City of Muskegon's Adopt a Lot parcel inventory.

The City of Muskegon monitors and maintains these site's through the City of Muskegon Adopt a Lot program. As they sit, vacant lots are an economic burden on communities. Each lot annually costs the city's department of Community and Neighborhood Services an average of $750 to maintain (Pulos, 2020). However, these expenses can be offset by partnering with residents and local businesses. The city's department of Community and Neighborhood Services has a Neighborhood Empowerment Program (NEP) grant that awards $250 to groups seeking to maintain or remediate a vacant parcel from the Adopt a Lot inventory. An "adopted" lot's maintenance costs the city $500 less each year, a clear incentive for the local government to prioritize these partnerships (Pulos, 2020).

The social impacts of vacant lot redevelopment are abundant in Muskegon, MI. The teamed efforts of Muskegon's Adopt a Lot and NEP programs have bolstered both informal and formal community organizing. Not only has this program fed into the organization of 15 neighborhood associations, one for each ward of the city, but lot remediation has also spurred community engagement and mutual aid efforts ("Neighborhoods," n.d.). The McLaughlin Community Park is a highlight of the city's work to redevelop their orphaned lots. In 2008, the city of Muskegon agreed to lease the lots to the McLaughlin Neighborhood Association for a period of 30 years for $1 if the group maintained the property (Solis, 2019). Since then, the lot has transformed from an overgrown nuisance to a vibrant community center. For over a decade, this project has engaged community members in restoration efforts. Each summer, the park hosts a

free summer camp for children to receive supervision, meals, and education (Hart, 2011). The McLaughlin Community Park has become a highlight of the neighborhood and serves to perpetuate equity and social justice, providing an encouraging example of the community resilience that can be built around vacant lot redevelopment.

Figure 2: McLaughlin Community Park. Reprinting from Mlive by K. Renie, 2019, https://www.mlive.com/galleries/Q2GRMXP5SBCJZKSV5L6J26XXJI/.

The orphaned lot maintenance and redevelopment initiatives in Muskegon, MI shows the effects vacant land redevelopment can have on the economic, social, and environmental health of a region. Economically, vacant lot remediation projects have benefited Muskegon's poorest areas (Alhmoudi et al, 2015). The local government has saved on the parcel's maintenance expense, giving them capacity to support other local programs. Socially, these spaces have evolved from a blighted eyesores into thriving community centers. Residents are encouraged and enthused to get outdoors and build relationships with their neighbors. Environmentally, the redevelopment of vacant lots not only discourages illegal dumping and littering, but also serve as learning centers for residents to engage in environmental studies and ponder sustainable practices. Vacant lot

redevelopment in Muskegon has harnessed the spirit of Domicology by transforming blighted properties into accessible and productive spaces.

Analysis of Vacant Lots in Dalton Township, MI

The small community of Dalton Township, Michigan offers another interesting area for the study of blight. The town's total area is 23,360 acres (36.5 mi2), and a population of less than 9,500 as of 2010 ("U.S. Census Bureau QuickFacts: Dalton Township," n.d.). Observing just half a mile of this town's main road, Whitehall Road, reveals a diverse sample of blighted property. The stretch has examples of structural abandonment and lot vacancy and sites with private and municipal ownership.

Figure 4: Aerial Map of Dalton Township Blight. Originally produced for use in this report by author, 2020.

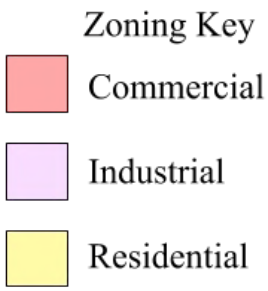

Figure 5: Aerial Map of Dalton Township Zoning. Originally produced for use in this report by author, 2020.

Illustrated by the red circle in Figure 4 is a 0.88 acre privately owned parcel that has two blighted buildings (Muskegon County GIS, 2020). Also on the West side of Whitehall Road, is a privately-owned vacant lot, illustrated by the green circle on Figure 4. Though the structure on this site has been removed, the ground of this 1.41 acre parcel is more nearly 60% covered in concrete (Muskegon County GIS, 2020. As Dalton Township is a zoned community, these parcels lay within the regional commercial zoning district (Muskegon County GIS, 2019). Although the Northern site has already taken the first steps towards redevelopment; this serves as a clear example that structural abatement does not guarantee the site will return to productivity. Removing the abandoned structures on this site has not spurred any interest. In addition, redevelopment of these sites is not only obstructed by zoning limitations but by their private ownership status. This example of commercial blight highlights the difficulty of making meaningful abatement efforts when parcels are privately owned and the struggle to find redevelopment options in strictly zoned regions.

This is not the only zoning district in Dalton Township plagued by abandonment. On the east side of Whitehall Road is the industrial district, the Muskegon County Business Parkway North, which houses over 110 acres of shovel ready industrial land (Lukens, n.d.). Although the parkway is located minutes from a major highway, Muskegon's airport, and the deepest port on Lake Michigan, the site has no occupancy (Lukens, n.d.). On the south end of the industrial zone is a 40.67-acre parcel, noted with a black box in Figure 4, that was clear cut over two decades ago to stimulate the development of Dalton Townships's industrial zone. This site, now owned by a local church, has only attracted the attention of dirt bikers and urban explorers. A notable deterrent for businesses seeking property in this parkway is the proximity of the Ott/Story/Cordova Superfund Site, circled in blue on Figure 4, which has contaminated the groundwater and soil of the area ("Remediation System Evaluation," 2002). Redevelopment in Dalton's industrial district would be contingent on the remediation of this superfund site. The vacancy of this zoning district shows the radiating effects of

blight, in this case from a brownfield, and how it can greatly reduce a lot's viability for new construction. The need for an integrated development plan is also evident in this space, as the preparation of this land was not fruitful in efforts to attract business partners.

Although most of the abandoned sites are privately owned, Dalton Township has acquired one of the orphaned properties in the area of interest. Outlined with a black rectangle in Figure 4 is a 15.38-acre lot zoned as "medium density residential" (Muskegon County GIS, 2019). This lot was once Wayside Mobile Court, a park of just under 100 single family housing units ("U.S. Census Bureau QuickFacts: Dalton Township," n.d.). The property was abandoned by the landowner when they were unable to pay for a sewer and water system assessment for the trailer park. The lot was then reverted to the township because of delinquent taxes. The site was blighted with structural abandonment until 2012, when volunteers organized the removal of the abandoned trailers (Means, 2016). These proto-domicologist were able to abate the site of hazardous substances, including asbestos, and discourage criminal activity through structure removal, but with no plan for redevelopment the site remains vacant. The site still attracts illegal dumping and perpetuates the normalization of abandonment which disrupts the community, as the site is not regularly maintained. This example of residential abandonment suggests the need for a holistic approach to redevelopment. Though many hands make light work, this project could have benefited from a clear direction spearheaded by the municipality. The blight of Dalton Township offers unique insight into the multitude of factors that can affect redevelopment and the success of domicological efforts.

Comparison of Domicological Efforts in Muskegon and Dalton Township, MI

Unlike Muskegon, Dalton Township has seen minimal success in their efforts to mitigate the negative social, economic, and environmental impacts associated with abandonment. Downtown Muskegon has seen a resurgence in community resilience, partly thanks to blight abatement. Some of Muskegon's most impactful domicological efforts have been in the redevelopment of vacant lots like

McLaughlin Community Park. Dalton Township, on the other hand, has yet to tackle blight in a meaningful manner.

The characteristics of blight abatement efforts in Muskegon differ from those in Dalton Township. The City of Muskegon has taken a strategic and centralized approach to tackling blight in their region. Mapping and inventorying vacant lots and then developing programs to support their upkeep has proven to be extremely advantageous for the community. Not only has the city taken measures to acquire the rights to blighted parcels, but their department of Community and Neighborhood Services drives many Domicological efforts. The advancement of abatement efforts is greatly affected by how effective bureaucratic measures can be taken. By consolidating responsibility into the municipality, the City of Muskegon has been able to take assertive action toward lot redevelopment. Dalton Township, on the other hand, does not have a centralized system for tracking blight and does not own the majority of the abandoned lots in the township. This put the township at a logistical disadvantage.

The features of abatement projects in each region also differ. The City of Muskegon strategically targets vacant lots, usually in residential areas, as the first place to make redevelopment efforts. Vacant lots are more attractive options for redevelopment than sites with structural abandonment. The acreage of these parcels are generally less than the lots identified in Dalton. Smaller lot sizes imply that maintenance and development efforts may be less labor and budget intensive, increasing feasibility. Tackling blight in residential areas also offers an opportunity to engage the public, rectifying abandonment and building community.

The efforts of the City of Muskegon appear to be increasingly fruitful compared to Dalton Township whose actions appear to be stagnant. Although these two areas of study differ in demographics, including population count and diversity, they are both afflicted with blight. As one

chooses to tackle the problem head on and strategically, the other appears to be unable to take on any sustainable abatement initiative.

Conclusion

Vacant lot redevelopment is an effective and meaningful way to address the negative social, economic, and environmental impacts associated with blight. Municipalities can tackle lot vacancies by inventorying blighted parcels and centralizing initiatives. Addressing small, residential lots appears to be an effective starting point for community engagement around blight abatement. Lot upkeep can build community resilience by engaging residents, discouraging violence and illegal dumping, and returning the land to productivity. Domicologist should integrate redevelopment into their post-deconstruction plans to ensure the impacts of blight are fully addressed.

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Recycling of Asphalt Shingles

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Abstract

In recent years, the practice of using recycled asphalt shingles (RAS) has gained momentum. There are both environmental and economic benefits of recycling RAS. Recycling of asphalt shingles saves landfill space and natural resources. However, there are environmental concerns related to the use of RAS which limit its applications. The major concern is the leaching of polycyclic aromatic hydrocarbons (PAHs) from RAS. A detailed study on minimizing leaching of asphalt shingles needs to be carried out to expand the uses of RAS. This literature summarizes the relevant information pertaining to possible environmental issues associated with the recycling of discarded asphalt shingles.

Keywords: Recycled asphalt shingles, polycyclic aromatic hydrocarbons (PAHs)

Introduction

Asphalt shingles are used in approximately 80% of structures as roofing materials in the United States (NAHB, 1998; Krivit, 2007). These roofs are generally replaced after 12 to 20 years. “The removal of old asphalt shingles during structural renovations is called ‘tear[ing]-off shingles’ which generates asphalt shingle waste” (Hongmei, 2009). Waste from shingles accounts for 3% of municipal solid waste with only 5% being diverted from landfills (Ddamba 2011). Recycled asphalt shingles are used as components in hot mix asphalt (HMA), cold patch in paved roads, cement kiln fuel, and highway constructions. Since highway construction usually requires large volumes of material, the potential for using the asphalt shingle in other highway applications such as a fill is an is a possible option for reusing this material. However, because of environmental concerns related to the presence of asbestos in asphalt shingles and leaching of PAHs in adjacent soil and ground water, the reuse of asphalt shingles is limited.

Composition of Asphalt Shingles

Asphalt Shingles are made up of different materials including asphalt, a granular/aggregate surface, an asphalt impregnated mat, and a fine mineral base. The base material of the asphalt serves as the matrix to support other components. Asphalt provides weather resistance and increases waterproofing and stability of shingles under extreme conditions. The aggregate/granular surfaces are on the top layer of asphalt shingles and consists of granular ceramic, adds desired color to the products, and protects asphalt from damaged caused by sun. Organic felt consists of cellulose fibers and the fiberglass mat is generally made by chopping fine glass filaments and mixing it with water to form a pulp, which is the formed into sheet (Blachford and Gale 2002). The bottom surface of shingles is coated with sand, talc, or fine particles of mica

(Blachford and Gale 2002; Grodinsky et al. 2002; USGS 2004.) Table 1 and *Figure 1* presents the typical composition of asphalt shingles.

Asphalt cement	30-36	19-22
Felt	2-15	2-15
Mineral granules/aggregate	20-38	20-38
Mineral filler/stabilizer	8-40	8-40

Table 1. Typical Composition of Asphalt Shingles (CIWMB, 2007; NAHB, 1998)

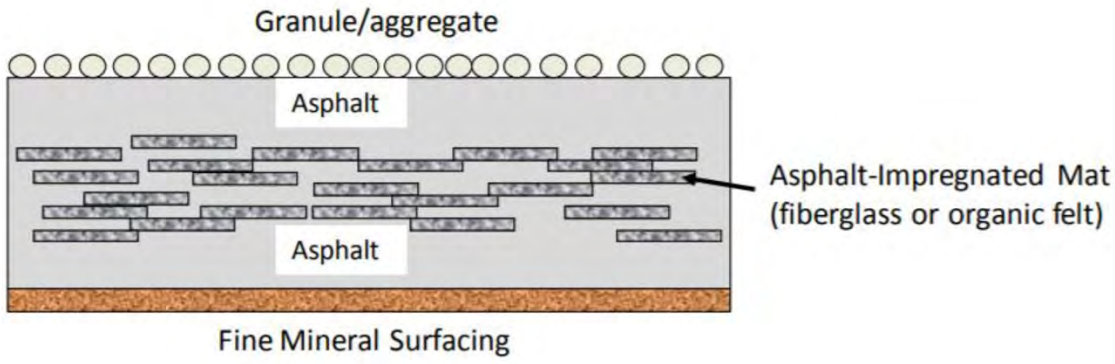

Figure 1. Asphalt shingles composition (Townsend, 2007)

Economic Benefits of Using RAS in HMA

Using RAS's has many economic and environmental benefits. According to the Environmental Protection Agency (EPA), eleven million tons of asphalt shingles are planned in landfills in US every year (EPA, 2016). Furthermore, the recycling of asphalt shingles can save significant amounts of money and solve the problem of disposing used shingles into landfills.

Recent studies have shown that the use of RAS results in increased stiffness and strength of HMA due to the presence of fibers and polymers (C&D world, 2011).

Uses of Recycled Asphalt Shingles in Highway Construction

Previous research has shown that RAS stabilizes when in contact with fly ash (FA) or when mixed with granular materials such as bottom ash (BA) which have suitable geotechnical properties for use as structural fill in highway embankments (Soleimanbeigi 2012). Asphalt shingle have many properties that make it suitable for use in both HMA mix and as a filling material in highway construction. Asphalt shingles can be used as fill material in highway subgrades which could result in the consumption of large volumes of asphalt shingles which otherwise would have ended in landfill. Use of only 5% of asphalt shingle alone can save $1 to $3 per ton of HMA and improve the quality of HMA (Construction pros.com 2011). Asphalt shingles hold a number of properties which makes it suitable for use for reuse in construction of road related works. RAS have excellent drainage and have enough strength to be used as structural fill in highway subgrades. In order to enhance the strength and draining capacity of asphalt shingles a less compressible materials can be added. Despite having many good properties asphalt shingles have not been widely accepted because of environmental concerns resulting in a majority of asphalt shingles ending up in landfills.

Effects of Freezing and Thawing Action on Elasticity of Asphalt Pavement

Climate is a major factor considered while designing asphalt pavements. Design of asphalt pavement mainly focuses on low temperature cracking and fatigue cracking (Ksaibati, 1998). Design of pavements should be such that pavements will have enough resistant to various weather changes. Especially in colder regions asphalt pavements are subjected to freezing and thawing actions. Mie et al. (2010) in an experiment on asphalt pavement found out that freezing and

thawing (FT) actions have a correlation with fatigue damages of asphalt pavements. Additionally, after 14 cycles of FT the strength and elasticity modulus are decreased by 14% and 20% respectively. Chen & Huang (2008) found that asphalt pavement undergoes many freezing and thawing cycles and because of these multiple FT cycles indirect tensile strength (IDT) of pavements is reduced after each cycle. Currently, there is a lack of work that has been carried out to study the effects of FT cycle on fatigue life and stiffness of asphalt pavements. Few studies explain that the maximum damage to asphalt pavement occurs during the first stage of FT cycle and that these effects gradually decreases with every subsequent FT cycle. Using this knowledge, we can develop a hypothesis that in the coming days when more experiments are carried out on the effects of FT cycles we will be able to predict the loss in strength which will occur after every FT cycle, if initial strength of asphalt pavement is known.

There are limited number of studies on FT on asphalt pavements. Many experiments have also concluded that as the number of FT cycles increases, the splitting strength of the asphalt pavement decreases. Feng et al. (2010) discovered that FT cycles damages the asphalt pavements in two phases. In the first phase, due to volumetric expansion of water the indirect tensile strength of asphalt pavement is decreased. The second phase occurs between the inner faces of asphalt and aggregates or sometimes between cracks of asphalt motor which finally results in loss of weight. During this study on FT cycles Feng et al. (2010) studied the impact of distilled water versus salt on the elasticity of asphalt. The group found that the elasticity of asphalt decreases rapidly if salt content is greater than 3% in the mix. Ozgan and Serin (2012) found that the impacts of FT cycles on the fatigue life of asphalt and discovered that there are many negative impacts of FT on engineering characteristics of asphalt which were exposed to FT conditioning. Ozgan and Serin (2012) used HMA samples for this study where they subjected specimens to FT cycles for 6, 8,

12, 18 and 24 days. The group found that the voids between asphalt specimen were filled with asphalt. Void ratio between aggregates were calculated by using the martial stability and ultrasonic velocity methods. These methods were used to calculate the acoustic velocity in order to calculate mechanical properties of the tested specimens. Another research Shu et al. (2012) used a moisture sensitivity stress tester (MIST), a moisture inducing method as well as FT conditioning method for testing the moisture susceptibility of warm asphalt mixtures with a high percentage of reclaimed asphalt pavement. Results concluded that, MIST had a greater impact on the dynamic modulus and the indirect tensile test induced greater damage to IDT strength. From these results, it can be concluded that FT conditioning method was more reliable test then MIST as FT method induced greater damage to asphalt pavements in order to determine fatigue life. Gou and You (2012) studied effects of FT cycles on stripping of fine and coarse aggregates on the top surface of the asphalt mixture using FT conditioning method. Eight FT cycles per day were introduced to each sample for a period of 38 days. Results concluded that with every FT cycle, distressing of cracks and stripping of fine and coarse aggregates on top surface of asphalt mixture increases. But further research is required to confirm these results.

Factors Affecting Leaching of Asphalt Components

Asphalt is used as binders in various applications like roads, pipes and lining of water basins (Hongmei, 2009). There is a potential contact of water in all these applications leading to leaching of asphalt component into environment. Asphalt contains polycyclic aromatic hydrocarbons (PAHs), ester, quinoline, phenol and acidamide (Hongmei, 2009). These substances prove to be harmful to humans and the environment as they are likely for accumulating in living systems (Hongmei, 2009). Leaching of asphalt is influenced by four main factors. These are leaching time, chloride content, leaching temperature, and leachate PH (Hongmei, 2009). From

the experiments conducted it can conclude that with increase in leaching time and increase in temperature the COD of leachate increases. However, the effects of temperature on leachability was less on lower penetration grade asphalt compared to higher penetration grade asphalt. Different crude oils have different effects of chloride on leaching of asphalt binders. Oxidized asphalt and SBS modified asphalt had more leaching components compared to neat asphalt. When PH of leachate was tested on its COD it was found that acidic conditions had a major influence on the leachability of asphalt components (Cai et al.2009).

Environmental Concerns

Presence of asbestos and leaching of PAHs are two of the main environmental concerns related to the recycling of asphalt. Asbestos is a naturally occurring fibrous mineral which has good thermal resistivity and strength (ATSDR 1995). Asbestos was used in the manufacturing of roof shingles until the 1980s (ATSDR 1995). Hence recycling of asphalt shingles which was salvaged from abandoned houses which were constructed before 1980s have asbestos and are of major environmental concern. One of the major environmental concerns is PAHs from asphalt shingles. Leaching off these carcinogenic PAHs in groundwater and adjacent soil restricts the use of the asphalt shingles in HMA payments and use of asphalt shingles in the sub-grade of highway pavements as a structural fill.

Asbestos

In the 1970s, researchers discovered the harmful effects of asbestos on workers respiratory system leading to ban of asbestos. In the early 1980s the use of asphalt was completely stopped when Department of Health and Human Services identified asbestos as a carcinogenic substance (ATSDR 1995). Exposure to asbestos for longer duration resulted in many respiratory diseases such as lung cancer, mesothelioma, and asbestosis (EPA 1990). Particles are released in the air

during grinding process of asphalt recycling and as asbestos fibers are light and small, they stay in the air for longer (EPA 1990). These small and light asbestos particles are a major cause of respiratory diseases.

Polycyclic Aromatic Hydrocarbons (PAHs)

Asphalt shingles are manufactured using petroleum-based products therefore they naturally contain PAHs (Wess et al. 2004). PAHs are a group of chemicals composed of carbon and hydrogen (ATSDR 1995). PAHs are generally formed because of incomplete burning of fuels or organic substances (ARMA 1998). These PAHs are released into the air and are stored in the kidneys and liver of the human body. Although many PAHs are harmless; some PAHs are carcinogenic and do have detrimental effects on human health. Result of laboratory testings on the effects of PAHs on animals found that PAHs can cause tumors and cancer, causing kidney and liver damages in animals (Wess et al. 2004). PAHs have also become a major environmental concern when asphalt shingles are used in HMA production and in structural filling for sub grades of highways. PAHs from asphalt shingles leaches out in adjacent soils and in groundwater making it dangerous for drinking. There is minimal data available about the research related to leaching of PAHs in groundwater. Even in production of HMA it is mandatory to obtain permits that limits the amount of emissions of PAH content carried out a laboratory experiment on four virgin asphalt shingles to study the concentration of PAHs in leachate water using toxic characteristics leaching procedure (TCLP) (Kriech et al., 2002). The total PAH concentration was found to be between 4.0 - 23.0 Mg/Kg. The results of the leaching test concluded that leaching of PAH from virgin roof asphalt shingles was below that which is detectable (0.1 Mg/L). In another experiment on the effects of running asphalt pavement, results indicated that PAH concentration in the runoff samples was below the level of (0.5 μg/L) (Wess et al., 2004). Reclaimed asphalt pavement (RAP)

was tested for PAH leaching using six samples of RAP in Florida, the samples were tested by leaching the samples using deionized water, TCLP and synthetic precipitation leaching procedure (SPLP). Results indicated that all RAP samples containing PAH were below detection limit (Brantley and Townsend 1999). However, there is no strong evidence that indicates that there is no leaching of PAH occurring from RAS. Therefore, further research is necessary to study leaching properties and effects of on adjacent soil and groundwater.

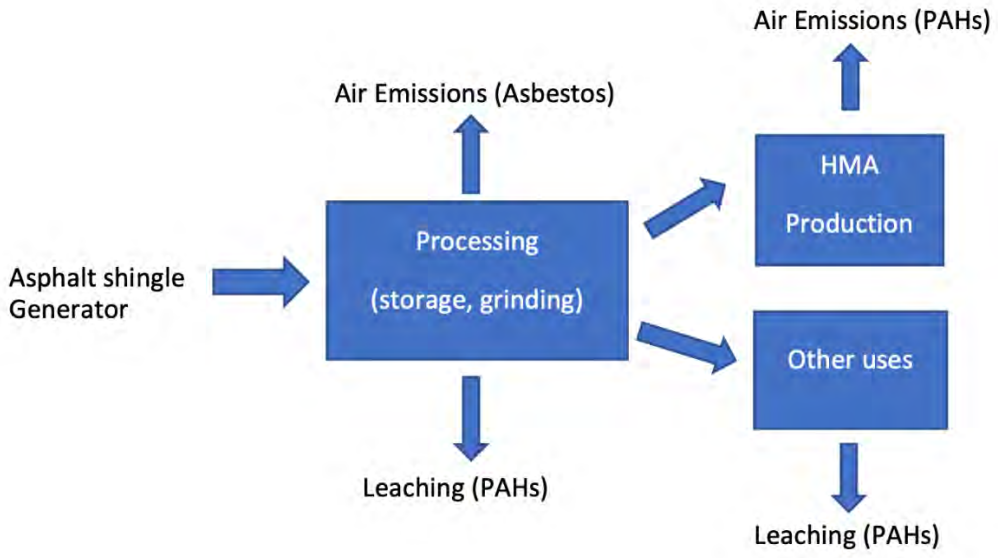

Figure 2. Potential Exposure Pathways of Asbestos and PAHs during Asphalt Shingle Recycling (Townsend, 2007)

Environmental and Health Concerns of PAHs

One of the major environmental concern of asphalt shingles is PAHs. Leaching off carcinogens, PAHs in groundwater adjacent to soil restricts the use of the asphalt shingles in HMA, payments, and the use of asphalt shingles in sub-grade of highway pavements as a structural fill. Asphalt shingles are manufactured using petroleum-based products therefore they naturally contain PAHs (Wess et al. 2004). These PAHs are released from asphalt shingles and are

then stored in the kidneys and livers. PAHs have also become an environmental concern when asphalt shingles are used in HMA production and in the structural fill of sub grades for highways. PAHs from asphalt shingles leeches out into adjacent soils and groundwater making it dangerous for drinking. There is minimal data available about the research related to leaching off PAHs in groundwater. However, related studies on virgin asphalt shingles and RAS have reported the leaching of heavy metals and PAHs at a very low level often below drinking water standards (Legret, 2005).

Eco-toxic Effects of PAHs

Ultraviolet light makes PAHs more toxic to aquatic organisms. If soil is highly contaminated with PAHs then terrestrial invertebrates are likely to be affected (Hussein, 2016). These invertebrates can be adversely affected by PAHs. They can affect development, reproduction, and immunity of invertebrates (Hussein, 2016).There are various sources through which mammals can absorb PAHs (e.g. ingestion, direct skin contact, and inhalation) (Dong et al.,2012; Beyer et al. 2010). Plants too can be affected by PAHs as plants can absorb PAHs from soils through their roots and transfer them to other parts of the plant. The effect of these PAHs is generally governed by physicochemical state, water solubility, and its concentration. Some plants are capable of synthesizing PAHs that act as hormones and some plants have substances that can protect themselves from the bad effects of PAHs (Beyer et al., 2010). Generally, biomagnification leads to higher concentration of PAHs in aquatic animals and invertebrates than those environment from which they have acquired the PAHs.

Effects of PAHs on Humans

A group of 17 PAHs have been identified as a concern for adverse health effects on humans. Widespread diffusion of compounds and their toxicological relevance makes biological monitoring of PAHs very crucial, however, two different PAHs have been found to not affect humans in this manner. The International Agency for Research on Cancer (IARC) classifies some known PAHs as "probably carcinogenic to humans. Among these are benz[a] anthracene, chrysene, and naphthalene" (IARC, 2010). The main reason that these PAHs pose a major threat to humans is that some PAHs are teratogens, mutagens, and carcinogens. Lung cancer is the most significant health effect which can be caused by inhalation of PAHs from air. (Kim et al., 2013).

General Barriers for Using RAS

1. Comparing end products manufactured using RAS and traditional materials, demonstrating that end products of RAS are better than end products of traditional materials.
2. Advancement in the collection and processing of tear-off shingles.
3. Increasing use of RAS in both public and private sector.
4. To develop lab testing and field sampling protocol to provide sufficient data to suggest safety and environmental protections standards.
5. Creating awareness among product buyers through providing them with a clear picture about RAS to develop cooperation between pavement industries and waste management.
6. Explaining the advantages of using RAS both in terms of economic benefits and environmental benefit.

CASE STUDY: Roofing Shingle Scrap in Hot Mix Asphalt, TxDOT Dallas District

Project overview

The selected project for this study is located at westbound SH 31 in Corsicana, Navarro County in the Dallas District. This project was a two-lane highway with each lane measuring 12 feet in width. The Texas Department of transportation (TxDOT) tested two 1000-foot sections of highway using type C asphalt mix with the roofing shingles (TxDOT, 1997). Five percent of post-industrial waste was used in one section and five percent of post-consumer scrap was used for the other. Construction was carried out for four days, from 1st May 1997 to 4th May 1997. Each 1000-foot test section used 600 tons of recycled shingles with 18 tons of manufactured waste from one section and 18 tons of tear of shingles waste from other sections.

Process requirements of roofing shingles

Scrap shingles were reduced in size to about 50mm. The contaminants such as paper and other lightweight materials were removed from the mix by using suction device. Magnetic contaminants such as nails are removed using magnets. These shredded shingles were then passed through vibrating screens, particles which are greater than 50mm are filtered and then fed back to a primary crusher. Fifty millimeters or smaller particles are sent to horizontal shaft impactor, which further reduces the size of particle to 12.5 MM. These shredded particles are then mixed with sand and are stockpiled (NAPA 1997). The stockpiled roofing shingles were then fed into hot mix plant and temperature was raised by 25 Fahrenheit higher than the conventional temperature (Kosse, 1998).

Test Data

Post-consumer singles contained stiffer asphalt cement. In post-consumer shingles, gradation of the aggregate filler was slightly coarser, but both (post-consumer and post- industrial)

gradations were within the fine aggregate gradation band. There was a marginal increase in the strength of the shingle mix indicated by Hveem stability. Tests on post- consumer, post-industrial and control, produced no stripping in Boil test when anti-stripping dosage was used (Tex-530-c, n.d.).

Results

After the rollers first pass on road the roofing felt lifted from the mixed surface but after cooling, roofing mix appeared identical to regular mix. Roofing shingles did not clump in stockpile. Transportation cost of these roof shingles could be of concern due to their heavy weight (1800 LBS/CY). Post-industrial shingles were easier to handle than post-consumer shingles. Higher mixing temperature is recorded for post-consumer shingles. The post-consumer shingle mix seemed to roll creating a hole in the mix. Cost of recycled asphalt shingles roofing shingles is $10 per cubic yard. Disposal cost of roofing shingles is $3250 per time. 1 cubic yard is equal to 2.025 ton stop they made some it.

Conclusion

Comprehensive research on PAH leaching from RAS and methods to minimize its harmful effects on adjacent sites, construction of highways and landfills is currently lacking and needed. A detailed study needs to be carried out on the various pathways of leaching and its effects (example. effect of UV rays on leaching of RAS pavements) and ways to minimize leaching.

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