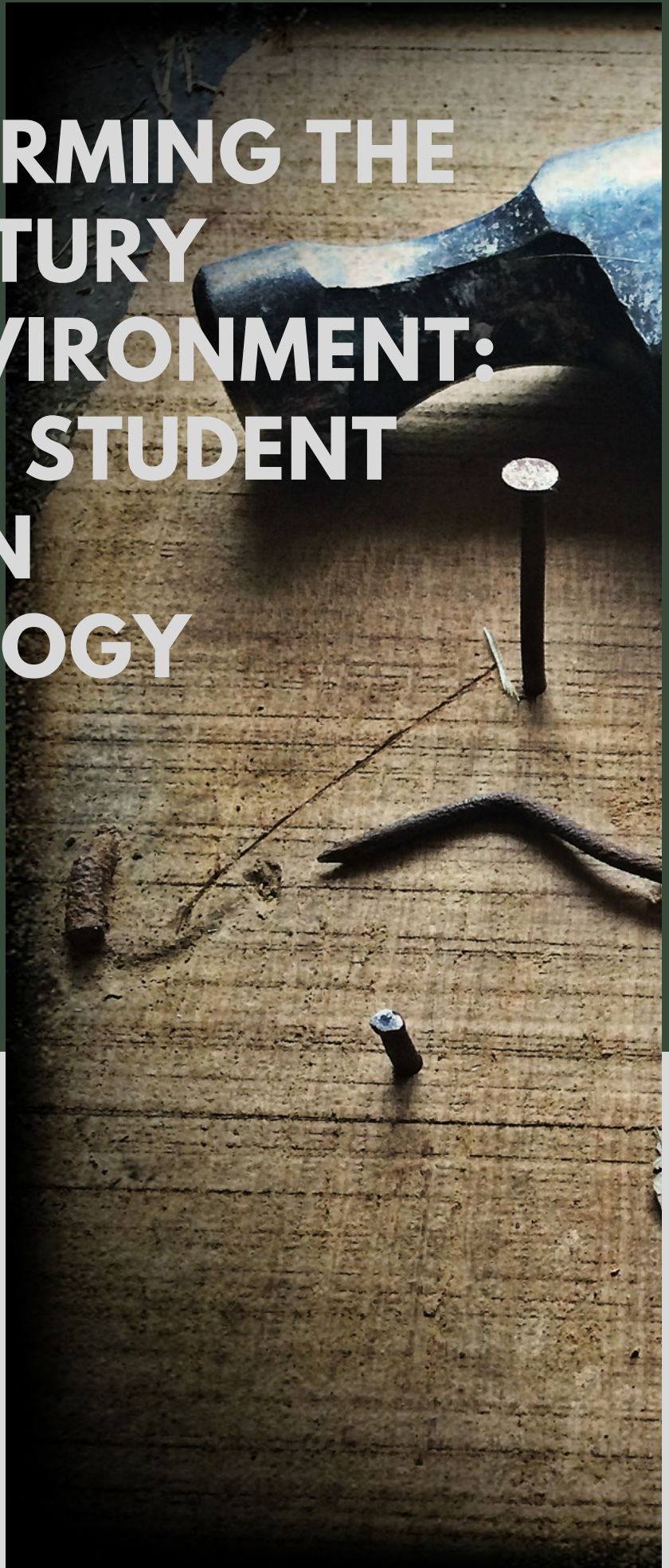


# TRANSFORMING THE 21ST CENTURY BUILT ENVIRONMENT: SELECTED STUDENT PAPERS IN DOMICOLOGY

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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 2019 special topics course in the 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 and 2018 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 special topics course and represent several disciplines in the built environment including planning, construction, environmental sustainability, and other disciplines. Special thanks to our editing team: Madison Nacker, Jonathan Walkotten, and Heather Mahoney. 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,

Rex L. LaMore, Ph.D. & George Berghorn, Ph.D.  
Faculty, MSU School of Planning, Design & Construction

**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.**

**Exploring the Social Causes and Consequences of  
Abandonment in Postindustrial St. Louis, Missouri**

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## **Abstract**

This study examines the social factors that have affected St. Louis, Missouri following the city's population apex in the middle of the 20<sup>th</sup> Century. The Rust Belt, made prominent by cities such as Chicago, Cleveland, Milwaukee, Detroit, and St. Louis, is characterized by population, economic, and industrial decline due to socioeconomic strife and division. This study takes a holistic look at the population and economic changes of St. Louis' condition, and pays particular attention to the social causes of abandonment. Socioeconomic profiling of the city indicates the presence of an ethnic division across Delmar Boulevard. Nicknamed the "Delmar Divide" (Harlan, 2014), reputedly akin to Detroit's Eight Mile Road, Delmar splits St. Louis between the majority black "North City" and the majority white "South City." As of the 2015 parcel survey (City of St. Louis, 2017), North City's vacancy level is more than three times that of South City's. Vacancy in the two areas has slowly risen and slowly fallen, respectively, since 2000. The exacerbation of these changes could also be attributed to St. Louis's substantial population decline since 1950, as well as the Great Recession of 2008. Over time, ultimately, depopulation has been understood to lead to abandonment. The City of St. Louis has sought to remedy this challenge through demolition, which it has increased its budget for, and also through adaptive reuse and development.

*Keywords:* St. Louis, Rust Belt, Vacancy, Socioeconomic

## **Introduction and Review of Literature**

St. Louis bears a legacy. When Pierre Laclede Liguist (City of St. Louis, n.d.) selected modern-day St. Louis's site to be a fur trading post, it eventually led to the development of a small village under Spanish and French jurisdiction until purchased by the United States in 1803. As the City documents, St. Louis has expanded and blossomed, even during the American Civil War, and by 1900 was an established manufacturing center in the United States (City of St. Louis, n.d.). The area once rife with production and industry, however, took a turn for the worse. The change was not exclusive to Saint Louis and occurred in other Northern U.S. cities in what is known as the "Rust Belt," which ultimately was defined by disproportionate wages, low productivity, and union conflict between 1950 and 1980 (Alder, Lagakos, Ohanian, 2018, p. 1). Many of the American Heartland's industrial dynamos—Detroit, Cleveland, Chicago, Milwaukee, and St. Louis, among others—experienced decades of social and economic decline.

Colin Gordon of the University of Iowa (2009) utilized spatiality to conceptualize this decline, showing just how the Gateway City was exposed to this deterioration. Gordon's map shows a substantial case of white flight between the 1970 and 1980 census tracts, as he reports an exodus of nearly 170,000 mostly-white residents from St. Louis proper to suburbs west and south of the city. The United States Census Bureau (2010) estimated that St. Louis's housing stock was approximately 20.7 percent vacant. Minneapolis (Census Reporter, n.d.), a slightly larger city, had a 6 percent vacancy under the 2017 ACS, indicating that some similarly-sized industrial cities faced additional challenges outside of economic decline. Of St. Louis' abandoned properties (Krewson, n.d.), 71 percent are vacant lots, while the other 29 percent are buildings. Because of the steady decline initiated in the 1950s, St. Louis has continuously suffered blight and abandonment, with the effects at times causing substantial community detriment.

The City (Krewson, n.d.) has made a conscious effort to fight this problem. As Mayor Krewson discusses, St. Louis has been forward on this issue, going as far as establishing the first land bank in the United States—The Land Reutilization Authority—in 1971. The LRA has since been a vanguard in conducting demolition operations, acquiring funding, and promoting code enforcement in order to fight vacancy and blight in St. Louis. Despite efforts, there is scrutable evidence that abandonment and race are not mutually exclusive. Gordon’s maps enable the visualization of St. Louis’s white flight, and a 2018 article in the *International Journal of Urban and Regional Research* (Hackworth, p.55) demonstrates evidence of how “white racism against black people has been a far more impactful force in the abandonment process.”

Hackworth’s report (p. 62) shows stark levels of abandonment in the St. Louis area where the city proper has the aforementioned 19-20 percent level, whereas neighboring East St. Louis’s property is nearly 65 percent abandoned (2018). The report’s data analyses also show that between the 1970 and 2010 censuses neighborhoods with extreme cases of abandonment have seen the white population decrease by 24.3 percent, while the black population has increased by 14.7 percent (Hackworth, 2018, p. 64). Cases like these cannot be viewed as coincidental, especially when considering historically-prejudiced mechanisms in mortgages and retail, such as redlining. Redlining is defined as “the practice of denying a creditworthy applicant a loan for housing in a certain neighborhood even though the applicant may otherwise be eligible for the loan” (Federal Reserve Board, 2006, p.1). The Federal Housing Act, under Section VIII of the Civil Rights Act of 1968, expressly forbids redlining as a method for mortgage lenders to force people away from areas on the basis of race. However, the ultimate consequence of this injustice was still felt, and St. Louis as well as other Rust Belt cities still took tolls from predatory schemes and white flight.

Similar to Detroit's 8 Mile Road, St. Louis (BBC, 2012) possesses a similar, infamous boundary across Delmar Boulevard, nicknamed the "Delmar Divide." The Divide has historically presented itself as a barrier between the predominately-white "South City," and the predominately-black "North City." This particular study examines the changes in vacancy over the past 15-20 years to track significant changes since the documentation during census years 1950 and 1980. These reports tell a story of deterioration and blight as consequences of racial injustice. This paper aims to take the knowledge of the city's challenges, extrapolated from raw data, and implement spatiality in order to view how these challenges have arisen geographically. Specifically, property abandonment is a challenge that is best handled when it can be geospatially identified. By understanding where these vacancies are concentrated, and what the demographic profile of those areas are, the foundation is laid for the effort towards a more equitable city.

To best understand this, it requires delving into the data and history of the city in order to understand where, when, and why such abandonment occurred. How deeply ingrained are the tendrils of St. Louis' past with respect to the future? To look at it more holistically, the main research questions are tied to space. How have social injustices, such as racism and classism, contributed to blight in St. Louis? What have the effects of that abandonment been? And where are these high levels of abandonment concentrated? The focus on St. Louis in particular draws from its similarities to other cities that have had similar fates such as Detroit, Cleveland, and Milwaukee.

### **Methodology**

One of the primary linkages between this study and others is the source of the data which provides the foundation of analysis. Due to issues with data availability, as is the case with



current research on the matter, the maps will derive from the 2010 US Census. While this information could be considered outdated encroaching upon the new census year, this census currently provides the most comprehensive information possible relative to the information on St. Louis's census blocks and parcel data. The mapping, created with ArcGIS 10.5.1, is used to give a spatial understanding of where the Delmar Divide exists, and where the demographic split sits on either side of it. The parcel data was collected through St. Louis's Open Data Portal and provides information on parcels relative to the 2000 and 2010 censuses, as well as the most recent usable data from 2015. A graph was then generated to compare the changes in vacancy and occupation between the two recent census years as well as St. Louis's published parcel data as of 2015. The result allows for a side-by-side examination of vacancies relative to either side of Delmar. However, an important consideration is the fact that segregation and racial conflict—historic and current—are not the sole cause of abandonment and vacancies in St. Louis. For this reason, other factors accounted for over time between the 1980 and 2010 census years were incorporated and viewed at a citywide level. Such factors in understanding include rental- versus owner-occupied and rate of change of population. This is given as an overview complement to the focus on social inequity.

## **Results**

A spatial analysis of St. Louis, Missouri (Figure 1) from the 2010 Census shows that, while the area south of Delmar Boulevard is relatively mixed between census blocks of majority white and majority black, the area north of Delmar is disproportionately majority black.

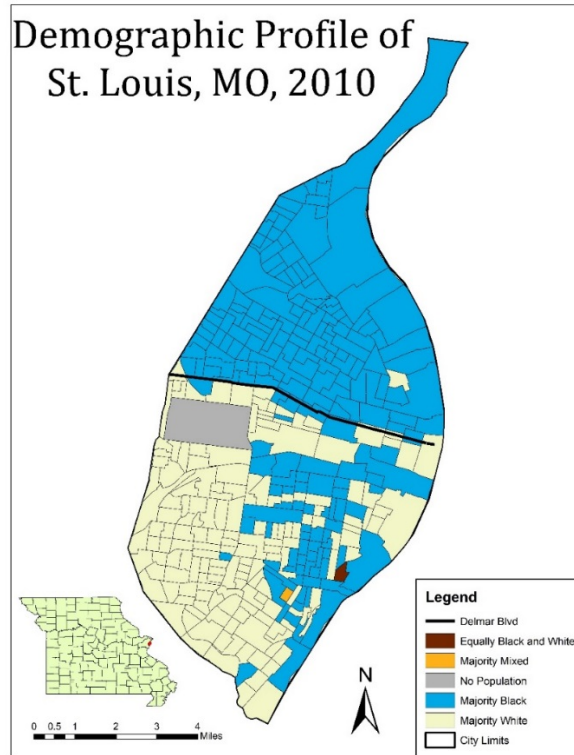


Figure 1: Demographic Profile of St. Louis across Delmar Boulevard.

A matter further compounded by these values is the disparity in property vacancy across Delmar. In 2000, the ratio was 26.2 percent vacant in North St. Louis, and 7.6 percent vacant in South St. Louis. Figure 2 shows that, in 2010, 16,187 of the 53,191 properties (30.4 percent) in North St. Louis are vacant. South of Delmar, however, only 5,582 of 76,323 properties (7.3 percent) are vacant. Vacancy increased in North St. Louis as of 2015 to 32.1 percent, and in South St. Louis, vacancy decreased to 7.1 percent. The general trend from the data shows a marginal decrease in vacancy south of Delmar Boulevard, while vacancy has shown to steadily

increase North of Delmar.

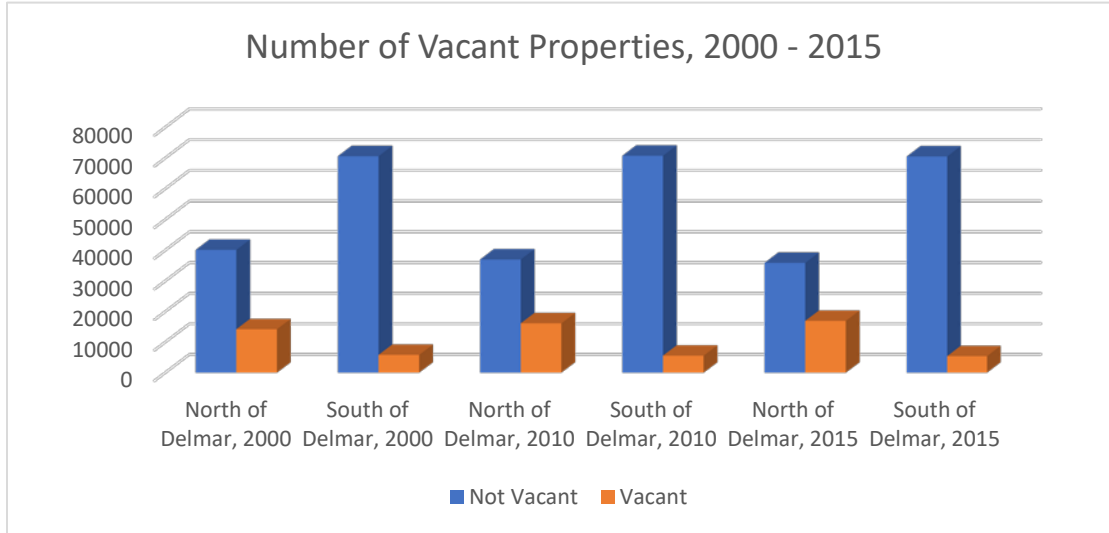


Figure 2: Number of vacant properties in the years 2000, 2010, and 2015.

	North of Delmar, 2000	South of Delmar, 2000	North of Delmar, 2010	South of Delmar, 2010	North of Delmar, 2015	South of Delmar, 2015
<b>Not Vacant</b>	40119	70604	37004	70741	35902	70517
<b>Vacant</b>	14242	5844	16187	5582	16972	5423

Table 1: Figures representing numbers of vacant properties in 2000, 2010, and 2015

Conversely, the City of St. Louis’s (2011) agglomeration of the data shows that between 2000 and 2010, vacancy was worse broadly, showing more than 21,000 total vacant buildings in the central and south corridors below Delmar. To reiterate, it is important to consider that race and segregation are major, but not *sole* indicators for higher vacancy and abandonment in St. Louis. The city’s decline can be mapped out in these same turbulent census years. As shown in Figure 3 and Table 2, the city has experienced a substantial population decline. This is especially evident between 1950 and 1980, where the city lost nearly half of its population in that 30-year period. Much of this decline can be attributed to white flight, as 170,00 mostly white residents

(Gordon, year) had fled between the 1970 and 1980 census years alone. This was a challenge that was further compounded by the decline in manufacturing that had taken hold of the country in the 1970s.

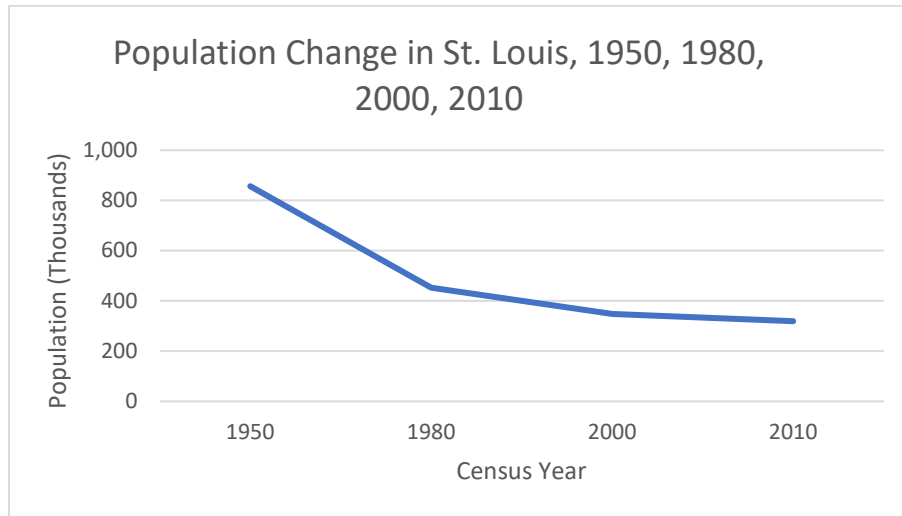


Figure 3: Population change in St. Louis between the 1950, 1980, 2000, and 2010 census years.

	1950	1980	2000	2010
Population	856,796	453,085	348,189	319,294
Percent Change from Previous Report	---	-47.12%	-23.00%	-8.00%

Table 2: Population changes in St. Louis between the 1950, 1980, 2000, and 2010 census years.

Parlaying the population decline and increase in abandonment, there were also slight changes in the differences in renter and owner occupation. While not severe, properties have consistently remained predominantly renter-occupied. While this has slightly improved between 1980 and 2000 (Figure 4, Table 3), owner occupation decreased, and vice versa. This also is likely attributed to the Great Recession, where homeownership had become significantly more expensive.

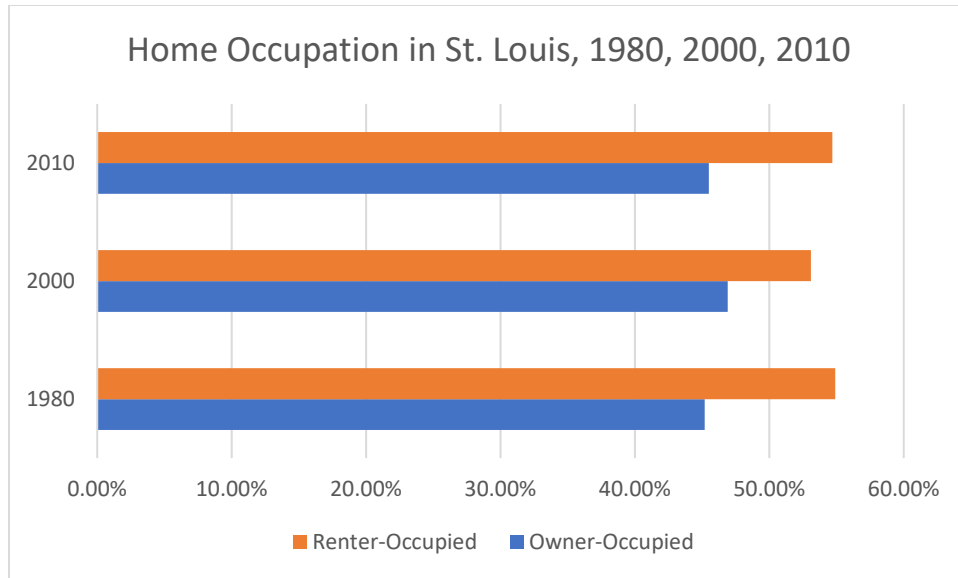


Figure 4: Percentage of renter-occupied versus owner-occupied homes in St. Louis in 1980, 2000, and 2010.

	1980	2000	2010
Owner-Occupied	45.20%	46.90%	45.50%
Renter-Occupied	54.90%	53.10%	54.70%

Table 3: Percentage of renter-occupied versus owner-occupied homes in St. Louis in 1980, 2000, and 2010.

### Discussion

An analysis of the census blocks and an examination of vacancy between 2000 and 2015 shows that the problem of vacancy has only worsened north of the Delmar Divide, attuned to a prior history of segregation. A possible explanation for the high increase in vacancies between 2000 and 2010 can be attributed to the 2008 Recession. However, even when considering general socioeconomic setbacks that afflicted St. Louis because of the Great Recession, the map of the 2010 data and the vacancy rates depict that a majority of troubles stem from White Flight of the 1950s and 1960s. St. Louis, like Detroit, has moved beyond the racist housing policies and predatory loaning practices from around this time, but a point of de facto

segregation across Delmar Boulevard can be seen. This is comparable to 8 Mile Road in Detroit, where the road's cultural notion as an ethnic divide is supplemented by demographic data showing a stark majority of African-American residents on one end (North of Delmar in St. Louis, and 8 Mile moving toward Downtown Detroit), and a disproportionately white population on the other. Because of the higher vacancy levels, this puts North St. Louis at higher risk of urban blight. However, while it is important to explore the causes, it is equally important to explore the possible solutions to fighting blight. Mayor Krewson's plan to address the vacant and condemned building concern has mainly culminated in demolition. As she states, "The Building Division has a current estimate of nearly 4,000 vacant buildings across the City that are condemned and require demolition. An average building demolition costs the City \$10,000" (Krewson, n.d.). Krewson later goes on to say that the City allocated \$1.5 million for its 2017-2018 demolition budget, which can account for approximately 150 buildings to be demolished in that year. This number, the mayor also reports, will be increased to \$3.6 million for the 2018-2019 budget and more than double the amount of property able to be demolished. The result of such expansive demolitions, however, culminates in an excess of vacant lots. In one aspect, this can be beneficial, as it removes derelict buildings that present safety and environmental hazards, which also attracts illicit activity. On the other hand, , this creates an environment of patchy, empty lots between buildings. While there are certain methods of remedying this, a demolition-focused direction can lead to numerous empty spaces across the city hardscape. This plan is a bold first step in fighting blight and abandonment, but will require more perpetual effort than others.

## Conclusion

St. Louis is similar to many cities along the Rust Belt from the Mississippi to the Atlantic. These are cities that boomed and burgeoned at their mid-century zeniths, only to face steady depopulation that lead to decline. This study, however, is relatively small in scope, and necessitates a larger follow-up study to further and more accurately map out trends in growth and decline around the city. This would include a demographic map for every census year dating back to the 1950 Census, the year that saw the apex and later decline in St. Louis's urban population. The study could then better document the changes in racial diversity, housing stock, owner and renter occupation, median income, and where blocks are growing or shrinking in population. The main limitation facing this study was time and resources, as it would take a much longer period of data collection to fully map out every census block for those attributes. This is due in part to the digitization of the most recent censuses, where most detailed data from earlier censuses are on paper or are in scanned archives.

Future studies could examine other cities, too, and look beyond the scope of St. Louis. Perhaps research bodies could collaborate with the goal of finding the commonalities and trends among these Rust-Belt cities. Furthermore, this could include considerations of redevelopment, reuse, and demolition. The city of St. Louis is acquiring a progressively increased budget for demolitions, but other studies of similar cities and their applications of reuse and remediation can be applied as the city seeks out additional grants and funding to fight abandonment. Understanding this can give means for the city not only to address the blighted buildings and lots, but to bring vitality back to them and work to restore the neighborhoods of a lively and historical city.

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**Natural Disaster Recovery: A Domicological Perspective**

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## **Abstract**

The disaster recovery process is complicated, expensive, and poorly defined. The majority of recovery efforts are top down and focused on large scale endeavors; little attention is paid to structures themselves. Major disasters are typically handled by various government agencies at the federal level. This paper attempts to analyze the recovery process from a domicological perspective with a special focus on the impact of policy. Waste streams, structural resilience, flood insurance, and grants are all analyzed within this paper. A general overview of current recovery guidelines is examined, focusing largely on the recovery from Hurricane Sandy. Finally, recommendations are then made regarding future recovery efforts.

## **Introduction**

Natural disasters have always posed a threat to humanity, and because of climate change, some disasters, particularly hurricanes and tropical storms, are likely to become increasingly common, or increasingly intense. Models that take into account climatic trends predict a 2-11% increase in storm intensity, and 20% increase in overall precipitation within the coming years (Knutson et al, 2010, p. 47). Moreover, because roughly 40% of all people on Earth live within 100 kilometers of the coast, hurricanes may be one of the greatest threats to human lives (UN Ocean Conference, 2017, p. 1). In 2017, 356 Americans were killed as a result of a hurricane or tropical storm, and insurance claims for that year reached over \$49 billion (Insurance Information Institute, 2017). Recovery efforts are often grandiose, and backed by a considerable amount of funding; the federal government spent nearly \$4 billion on the recovery process for Hurricane Sandy alone (Hurricane Sandy Rebuilding Task Force, 2013, p. 13). Yet the vast majority of said efforts are top down, wide scaled, and few pay attention to structures themselves. A sociological review of disaster recovery and prevention efforts includes examining: how recovery efforts currently handle structures; how we can make structures more resilient; how recovery efforts on the whole could focus more thoroughly on structures; what kind of inequalities exist within the recovery process; and finally, how policy can affect all of those inquiries.

## **Current Recovery Efforts**

The U.S. Department of Housing and Urban Development (HUD) released their Hurricane Sandy Rebuilding Strategy-- a wide reaching and optimistic template for both the recovery from Hurricane Sandy and the recovery from future hurricanes – in 2013 (Hurricane

Sandy Rebuilding Task Force, 2013). Of the small portion of the document dedicated to structures, there were five goals that coincide well with Domicological efforts:

- Facilitate immediate and temporary repairs.
- Increase the affordable housing stock.
- Increase structural resilience.
- Promote recovery through Community Development Block Grants (CDBG).
- Provide an avenue for mold removal. (Hurricane Sandy Rebuilding Task Force, 2013, pp. 85-98).

However, HUD's execution of these goals was largely inadequate.

#### *Repairs & Structural Resilience*

Disaster-affected areas begin structural repairs almost immediately after a natural disaster strikes, and even temporary repairs are critical. The Federal Emergency Management Agency (FEMA) offers up to \$10 thousand dollars in aid or loans to facilitate emergency repairs, and after Hurricane Sandy New York City (NYC) developed their own "Rapid Repair" program as well, which aimed to accomplish the same goals (Hurricane Sandy Rebuilding Task Force, 2013, p. 86; ). FEMA intends to examine the viability of these programs nationwide (Hurricane Sandy Rebuilding Task Force, 2013, p. 86).

Like structural damage, mold is another serious issue associated with hurricanes. After Hurricane Katrina hit New Orleans, roughly 44% of homes experienced increased mold growth and 19% experienced "heavy" mold growth; extrapolated to the entire city, an estimated 194,000 homes experienced increased mold growth, and 70,000 homes experienced heavy mold growth as a direct result of Hurricane Katrina (Barbeau et al, 2010, pp. 167-168). Mold growth was not limited to severely-flooded structures; leaking roofs were also associated with increased mold

(Barbeau et al, 2010 p. 168). For Hurricane Sandy recovery efforts, HUD has set forth parameters for mold remediation and defers further action to other government agencies. Relative to Hurricane Sandy, no specific amount of money has been set aside to deal with mold. (Hurricane Sandy Rebuilding Task Force, 2013, p. 97)

HUD currently lacks adequate guidelines for increasing structural resistance. The guidelines suggest that recovery efforts take into consideration green building standards and make it a requirement for some CDBGs (Hurricane Sandy Rebuilding Task Force, 2013, p. 87). However, the same requirement is not always present for individuals making their own repairs. Furthermore, recovery guidelines promote using the Insurance Institute for Business and Home Safety (IBHS), a privately funded group owned and operated by insurance companies, FORTIFIED home program, as a guideline for resilient repairs (Hurricane Sandy Rebuilding Task Force, 2013, p. 93).

The National Flood Insurance Program (NFIP) relies on the IBHS insurance companies to process claims. Insurance companies keep roughly one-third of all premiums and typically set the other two-thirds aside for claims; however, when claims exceed the two-thirds set aside, the federal government pays the remainder (Oliver et al, 2017). Insurance companies also garner a hefty fee for processing the claims, also paid for by the federal government (Taddonio, 2016; Oliver et al, 2017). Therefore, there exists a clear incentive for insurance companies to promote substandard resilient building techniques as they profit from the destruction of said structure. The NFIP and insurance companies in general are subjects of much greater scrutiny, discussed further along in this paper.

*Housing, Insurance, and Community Development Block Grants*

Housing, especially affordable housing, after a hurricane is a serious issue. Emergency Rooms within NYC saw a dramatic increase in homelessness as the primary or secondary diagnosis for patients after Hurricane Sandy; many of whom were elderly or people with low to moderate income (Doran et al, 2016, pp. 337-340). As far as HUD's recovery handbook goes:

HUD should explore ways to assist State and local government to develop model affordable housing programs that leverage funding from the public, private, and philanthropic sectors for affordable housing development and preservation in Sandy-affected areas, as well as in other regions that could potentially be affected by future disasters (Hurricane Sandy Rebuilding Task Force, 2013, p. 92).

HUD dedicated no money specifically to this objective, but HUD does make available special CDBGs, which are supposed to be used exclusively for the creation of multi-family housing units, in response to a disaster (Hurricane Sandy Rebuilding Task Force, 2013, p. 87).

However, states often misuse CDBGs. Even though the law stipulates that disaster recovery CDBGs be spent to further three specific goals --“benefiting low- and moderate-income (LMI) persons, aiding in the prevention or elimination of slums or blight, and meeting a need having a particular urgency”--, HUD allows states and municipalities to apply for waivers which reduce the portion required to be spent furthering said goals (Gotham, 2014, pp. 193-194). Oftentimes, states redirect these funds to commercial ventures or economic development. After Hurricane Katrina, Mississippi petitioned to move over \$570 million of grant money away from housing and use it to expand a port instead (Gotham, 2014, p. 201).

There is also an observable racial component to how states spend CDBG money. Typically, money is first spent restoring higher income neighborhoods, which are often predominantly white. The city of New Orleans also used Hurricane Katrina as an excuse to

demolish low income, predominantly African American neighborhoods under the guise of debris removal while at the same time failing to build sufficient housing for these displaced people (Henkel, Dovidio, and Gaertner, 2006, pp. 113-117; Peacock et al, 2014, p. 367; Gotham, 2014, p. 204). Issues like the redirection of funds away from LMI peoples and people of color often contribute to the cycle of blight and abandonment.

Evidence suggests that disasters can dramatically exacerbate abandonment, particularly in low income areas, which are more likely to have previously damaged structures. Models show that a 1% increase in structural damage leads to a 1.2% increase in abandonment after a hurricane (Yang, 2012, p. 1095). Abandonment is a precursor to blight, and blight leads to higher crime which can depress property values, leading to even further abandonment, service cuts, etc. (NVPC, 2005. Curtis and Mills, 2011, pp. 504-505). Models also show how higher income neighborhoods often recover dramatically faster than low income neighborhoods. Moreover, some high income neighborhoods actually increase in property value after a hurricane because recovery efforts have made the area more attractive. Low income neighborhoods are not so fortunate. In fact, in rare instances, recovery efforts can sometimes lead to gentrification in low income neighborhoods, which can force people out of their homes (Lee, 2017, p. 246).

### **Future Efforts**

Recovery efforts going forward could potentially benefit from applying domicological principles. Natural disasters are extremely relevant in structural discussions and provide an opportunity to create structural and environmental improvements for both people and communities. Identified below are aspects of Domicology that could be incorporated into the disaster recovery process:

- Debris management and recycling.



- Build more resilient and green structures.
- Provide funding to upgrade said structures.
- Reducing the likelihood of abandonment.
- Acknowledge environmental justice issues and inequalities associated with recovery.
- Strengthen CDBG policy and enforcement.
- Strengthen building codes and enforcement.
- Reorganize flood insurance in a way more focused on structures.

These are extremely lofty goals, but all are still within the realm of possibility.

#### *Debris Management and Recycling.*

The sheer scale of debris as a result of a natural disaster is staggering. After Hurricane Sandy, 5.25 million cubic yards of debris were removed from NYC alone (FEMA, 2013). The debris itself was far more varied than the typical waste stream, including not just construction and demolition materials or generic household trash, but entire automobiles, trees, and a host of other hazardous materials. The vast majority of this waste is sent, expectedly, to landfills. Typically, counties and municipalities are responsible for debris removal, and FEMA generally reimburses their costs (Luther, 2006, p. 6).

There have been efforts in the past to recycle some of this material, organic material, especially downed vegetation, is sometimes composted; electronics, and other scrap metals are even more likely to be recycled, though the scale of the issue often renders these recycling efforts inefficient (FEMA, 2007, p. 83, Luther, 2006, pp. 18-21). Moreover, much of the recycled waste comes from demolished buildings long after the initial wave of debris (the rubble seen in the commonly published photographs of recovering communities). There are few policies that incentivize the recycling of hurricane debris. One of the few programs comes from FEMA; they offer grants that assist municipalities with debris management, and on rare occasions these can be profitable for a municipality; After Hurricane Sandy, NYC struck a deal with a waste management company to have 22% of any revenue from debris recycling/clearing donated back to the city (Luther, 2006, p. 15).

One potential solution to post-natural disaster debris and waste removal is the creation of temporary debris management sites (TDMS) (Figure 1).

Typically, these are only created when a municipality lacks the

ability to control their waste stream, such as in the event of a disaster (FEMA, 2007). If municipalities were to plan in advance for the creation of a TDMS, they could potentially divert a significant amount of waste from landfills (Kim, Deshmukh, and Makarand Hastak, 2014, p.

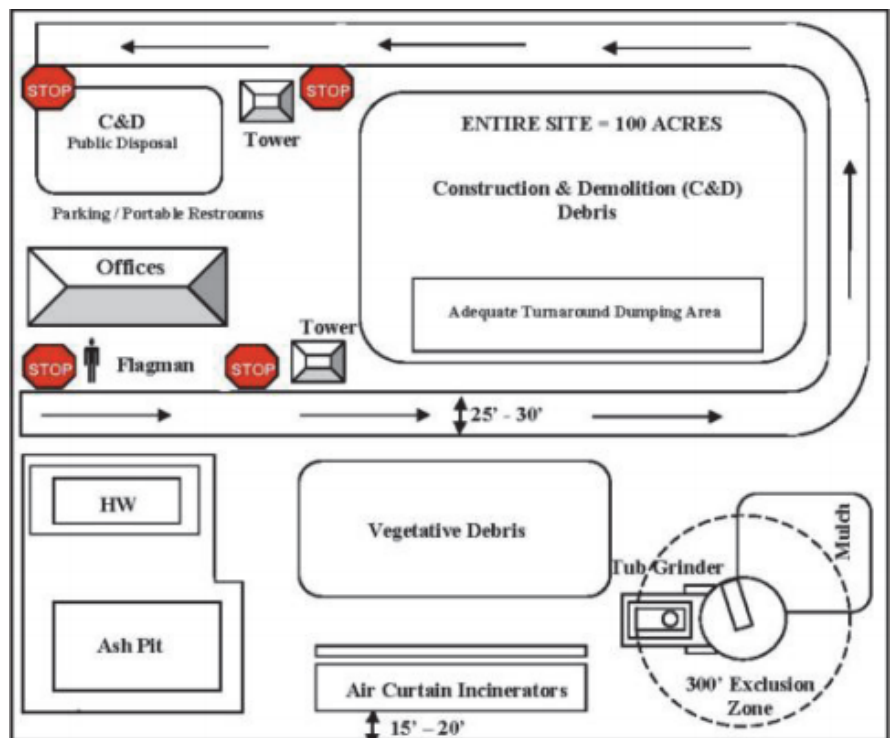


Figure 1: Typical TDMS site layout (FEMA, 2007)

214). Furthermore, by incorporating elements of a materials recycling facility (MRF), a TDMS could provide additional building materials and other useful goods to a community that desperately needs them. Other policy initiatives at the state and federal level, which encourage municipalities to recycle disaster debris, would undoubtedly benefit communities. Any amount of financial assistance at all would likely go a long way.

### *Resilient Structures and Building Codes*

A tremendous amount of work needs to be done in reference to structural resilience, and a significant part of that has to do with building codes. As described above, the vast majority of recovery efforts are top-down, and only a small amount of effort is focused specifically on structures. The federal government does provide a small amount of helpful information about what exactly structural resilience is, and what homeowners can do to prepare their homes for a disaster, however, much of this information is unspecific (**Table 1**) (FEMA, 2017). For example, not everyone can “Consult a professional engineer,” particularly those with low to moderate income.

First and foremost, what the government can do to improve this area is create incentive programs that allow people to reinforce their own homes against disasters. One issue is that often home upgrades increase home value, which can lead to higher property taxes. In California, the state offers tax exemptions for seismic upgrades; some cities within the state go further. Berkeley has instituted a transfer tax rebate program which further reduces the long term costs of resilient upgrades (Kunreuther, Michel-Kerjan, and Mark Pauly, 2013, p. 18). Similar programs do exist on the East Coast, but they are not ubiquitous, and have significant room for improvement. Moreover, these types of programs, particularly tax rebates, do little to help LMI peoples. If a person cannot afford the upfront cost of upgrades, then a rebate is useless to them.

Building codes are another important aspect of structural resilience. In 1992, Hurricane Andrew wrought havoc upon the State of Florida, and caused nearly \$20 billion in damages (Ryland, 2006, p. 185). Shortly after, new building codes came into place which mandated

<b>Structural Risks</b>	<b>Ready.gov Solution</b>
Elevation	Consult a professional engineer to evaluate elevating your structure so the lowest floor is at or above the BFE or DFE, whichever is higher.
Wet Floodproofing	Consult a professional engineer to evaluate options for wet floodproofing the structure.
Dry Floodproofing	Consult a professional engineer to evaluate options for dry floodproofing the structure.
Safe Room or Shelter	Install a safe room or shelter that meets FEMA Guidelines.
Canopies, Awnings, and Carports	Ensure these items are designed to meet hurricane wind loads and uplift.
Openings	Install pressure-rated, impact resistant exterior doors, windows, and garage/rolling doors. Install storm shutters or other tested and approved protection.
Wall Systems	Consult a professional engineer and design the wall system to withstand the expected wind loads, pressure, and water intrusion.
Gutters and Downspouts	Install systems that are noncombustible and designed for wind speed and uplift resistance.

**Table 1:** government provides structural resilience guidelines (FEMA, 2017)

hurricane straps; many structures built since have withstood a number of hurricanes (Ryland, 2006, p. 228).

The NFIP mandates that insured structures are built to a minimum code, however “minimum” is the operative word. Some municipalities and states go far above said code. In NYC, elevation and building setbacks are important, and the city has rigorous codes for different types of structures, dependent upon geography (Aerts and Botzen, 2011, pp. 5-6). Structures closer to the coastline are required to build in a more resilient way than are more inland parts of

the city. Other municipalities around the country, particularly coastal communities, would do well to emulate NYC.

Incentive programs that help LMI people upgrade their homes as well as more rigorous and detailed building codes (including their enforcement) both could go a long way to ensuring safer communities. However, education and psychology do have a role to play. Perceived risk is important, if a person feels that it is unlikely that their home will ever flood, they are far less likely to pay for structural upgrades, the same can be said for whether or not a person chooses to purchase flood insurance (Kunreuther, Michel-Kerjan, and Mark Pauly, 2013, pp. 6-7). It is of the utmost importance that people living in disaster prone areas are made aware of the risks they face, and what steps they can take to fortify their homes.

#### *Flood Insurance and Community Development Block Grants*

In the wake of Hurricane Sandy (and most all other hurricanes) the federal government allocated billions of dollars for both the NFIP and CDGBs; these make up the vast majority of funds dedicated to disaster recovery (Hurricane Sandy Rebuilding Task Force, 2013, p. 13). The efficacy of such a “hands off” approach can be called into question. As mentioned above, CDBGs are often misused, commonly for economic purposes, and the NFIP also suffers from multiple weaknesses (Gotham, 2014, p. 201).

Because flood insurance is typically only mandated by a mortgage, and LMI peoples often cannot afford flood insurance, the NFIP faces a lack of enrollment (Georgic and Klaiber, 2018, p. 9). Moreover, in the past, flood insurance premiums have gone up as a result of increased climatic hazards; this further reduces enrollment, especially for people who cannot afford the increased rates (Thomas and Leichenko, 2011, p. 258). Even further, as mentioned above, psychology has a role to play. If a person does not perceive a hurricane to be a legitimate

risk, they often do little to prepare for it. Not surprisingly, people who have experienced hurricane damage in the past are much more likely to participate in flood insurance programs (Peacock et. al., 2005, p. 4). Increasing enrollment in the NFIP is important. One possible method for this would be to require yearlong flood insurance contracts, mandated for every individual living within a flood zone, attached directly to the property (Michel-Kerjan, Lemoyne de Forges, and Kunreuther, 2012, pp. 17-18). However, this solution does not take into account low income peoples, yearly insurance premiums can total more than \$700 for minimum coverage, an expense not easy to justify when living in abject poverty (Lankford, 2015). Therefore, the NFIP is broken and in need of serious repairs.

The CDBGs that HUD dispenses have a special designation attached, CDBG-DR (disaster recovery). This implies that HUD spends these funds exclusively on disaster recovery. This is not always the case, as described above; in addition, the term “recovery” is nebulous at best (Gotham, 2014, p. 201). Though HUD does maintain final approval over how funds are spent, there is precedence of them being exceedingly flexible. CDBG money can be spent on a plethora of endeavors. Money can be given directly to homeowners, but this is rarely the case, Hurricane Katrina being the only notable exception (Kousky, 2017, p. 4). Often, funds are spent on beachfront replenishment under the guise of recovery when in reality, these efforts are almost exclusively geared towards tourism, economic development, and are often only done to placate a municipality’s more wealthy residents. The U.S has spent over \$9 billion on beachfront replenishment since 1923, and because beaches will continue to erode, largely due to rising sea levels, replenishment will continue to take place at the expense of taxpayers (Song and Shaw, 2019).

Both the NFIP and CDBG are faulty systems and in desperate need of a rework. They are perhaps the best tools available for disaster recovery, and should be treated as such. Stricter guidelines for CDBGs would further their intended goal and limit their more inequitable attributes. The NFIP would benefit from anything that increases enrollment and lowers the burden on taxpayers.

### **Discussion**

Disaster recovery in general is full of domicological niches. HUDs recovery manual essentially ignores structures or passes the burden onto other apathetic agencies (Hurricane Sandy Rebuilding Task Force, 2013, p. 7). The amount of money spent on recovery efforts is staggering, and the amount spent on structures is disappointing. Going forward, recovery efforts would do well to pay attention to smaller scales. It makes sense that recovery is top down. Disasters affect a large amount of people throughout a massive area. Still, improvements can be made.

As mentioned above, the waste streams associated with disasters are tremendous, and the materials underutilized. In a perfect world MRFs would exist throughout the country, and when a disaster strikes, waste could be diverted to the least full facility. Obviously this is unrealistic, but TDMSs can partially fulfil that role. Planning in advance for a disaster, and using GIS software to determine beforehand the best location for a TDMS, could dramatically reduce waste sent to landfills (Kim, Deshmukh, & Hastak, 2014, p. 214). Moreover, TDMS operations could be expanded to specifically focus on identifying recyclable materials. Especially usable building materials, which could quickly be reused by people repairing their homes or businesses.

Current structural resilient recommendations are inadequate. Often the guidelines are simply “consult a professional engineer,” leaving LMI peoples to fend for themselves. First,

efforts need to be made to clearly articulate to people what they can do to protect their homes at all levels. These efforts could either be top down, handled by the state or federal governments, or, municipalities themselves could work to educate people. There needs to be recommendations that take income into account and provide people with an avenue to attain funding, even for things as simple as upgrading their windows. Municipalities should accept some of this responsibility. If it is known that certain structures within a community are more at risk than others, efforts must be made to identify why they are more at risk and assist the property owner in their upgrades. CDBG-DR money specifically can be used for this purpose.

Both CDBGs and the NFIP are broken. CDBGs, especially CDBG-DRs, need to have significantly higher levels of oversight. Not all economic development is bad, in fact, restoring a local economy is paramount to the recovery process, but in some cases it is taken too far. Focusing on beachfront replenishment while there are still vulnerable structures within a community is simply unacceptable. The NFIP needs to change dramatically. The program was created with the thought that if people knew they were living in flood prone areas, they would move (Taddonio, 2016; Oliver, 2017). This has not been the case. Some people simply lack the financial means to move and find themselves trapped within a cycle; their home is destroyed and they receive a payout, but the only property they can afford to move to is also within a flood zone. Wealthy people often use the NFIP as a way to divert their risk onto the taxpayers and will build in flood zones irrespective of the risk of flooding. Truthfully, the NFIP needs to function more like a land bank. When people are bought out, their land should become government property, and no future development should be allowed to take place. However, this plan has unrealistic attributes and would certainly have implications on affordable housing.



## **Conclusion**

Disasters have always, and will always be a part of our existence. Apart from human nature, they may genuinely be the greatest threat to our species survival. However, in 2019, in the wealthiest nation on Earth, our efforts to both protect ourselves from disasters, and recover from them, are woefully inadequate. Recovery efforts are flashy; they promise grand schemes and a brighter future, but they often fail to deliver either. By focusing only on larger scales, they are blind to serious issues at the structural level.

For domicologists, disasters provide a wealth of research potential and opportunities to change systems for the better. There is a tremendous amount of waste associated with disasters, much of which is prime for reuse. Current government systems are broken, and in need of review. Structural resilience is poorly understood, even by “experts”. Big ideas are often passed over because they are too complicated, or difficult to implement. Further research is necessary in all of these fields, but most of all, attention needs to be paid to homes. In the end, it is all about protecting human lives.

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**Implementing a Training Program to Create a Workforce in Deconstruction**

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## **Abstract**

This research was conducted to inform readers of a possible direction to proceed in order to build a workforce in deconstruction. Currently, deconstruction is not utilized at a large scale due to the costs associated with labor, making demolition the preferred method of removing a structure.

The methodology of this research is to identify a possible avenue of approach by implementing training in order to expand the deconstruction workforce. The outcomes of this research are to establish a workforce development plan for deconstruction using military members soon to be exiting the service. Neither the United States Government nor the Department of Labor have been presented with a workforce development plan such as this document suggests at the time this research was conducted.

*Keywords:* Deconstruction, Workforce, Training, Military, Veterans.

## **Implementing a Training Program to Create a Workforce in Deconstruction**

Cities such as Detroit, Indianapolis, Tampa, Cleveland, and many others are experiencing severe blight and abandonment of homes and businesses. Most of these structures are too far gone for repair and end up being demolished, with this debris being thrown into landfills. A better solution to the demolition and landfilling of structural waste, however, would be the deconstruction of abandoned structures to salvage reusable materials to be repurposed in other applications. This method of deconstruction, however, is not sought after by professionals because it tends to be more costly for a company to deconstruct a structure than to simply demolish it. The excess costs of deconstruction are largely a result of a lack of trained workers who can safely deconstruct a structure, and the cost of training a workforce to do this. To counter the cost of training, the United States Government should create a program to train military members who are soon to be exiting active duty, as well as veterans already separated from the military; this workforce training program could prove to be a viable option to creating a skilled workforce in deconstruction.

### **A Lack in the Deconstruction Workforce**

Throughout the United States there is a fast-growing number of blighted and abandoned buildings – including residential, commercial, and industrial structures – which either need to be demolished or deconstructed. In addition to the existing problem of structural blight and abandonment are the costs associated with deconstruction as opposed to demolition; with good reason, deconstruction is more expensive than demolition. According to McKellar (2009), there are three main accelerators of costs in deconstruction: “labor costs, disposal costs, and the resale or donation value of the salvaged materials.” The main accelerator of the three is the cost of labor, as “labor costs are higher for deconstruction than for demolition because of the manual

work required to un-install materials and then process them” (Guy, 2017). The manual work required to deconstruct a structure is time consuming and tedious, and requires a certain level of skill in order to extract the most value out of a project. Since deconstruction is a skilled labor initiative, requiring training to carefully deconstruct a structure without damage, there is not a large workforce in the deconstruction field.

To build a workforce in deconstruction, training would have to occur at a relatively large scale but could be accomplished incrementally over time, although some businesses have expressed concerns about the cost of training programming. According to NAHB Research Center, Inc. (2001), companies “[do] not see training as feasible due to cost effectiveness,” and that they would only “perform deconstruction training if the program was made to be cost effective” (p. F-32). NAHB (2001) also comments on training through an On the Job Training (OJT) contract, saying a trainee “has to be employed during training (assumed job readiness) with a minimum wage” (p. F-27). There is at least one possible solution to implementing a training program for deconstruction. The United States Government already employs a large work force of employees being paid with government dollars, and this employment could be expanded to training a workforce in deconstruction. This would make the cost of training primarily a question of feasibility for the Government, allowing deconstruction contractors to avoid the cost of training a workforce in deconstruction.

### **Benefits of Creating a Deconstruction Workforce through Training**

Until a solid workforce training plan is executed, building a workforce in deconstruction will neither be feasible nor desired by demolition companies due to the costs of training laborers in the skills necessary to perform deconstruction. There are organizations, however, who conduct training and award certifications for completing the training program. One particular



organization based in Oakland, California, The ReUse People (TRP), conducts sessions around the United States which train workers to be certified in the deconstruction skills necessary to safely deconstruct structures. Additionally, TRP has a TRP-Certified Deconstruction Contractor Training, which certifies a contractor to train employees interested in earning their deconstruction worker certifications. These trainings can take place at the contractor's office or on the job site, and contractors and their employees are provided with training manuals (The ReUse People n.d.).

The training programming created by The ReUse People has the potential for use in training active duty military members who are exiting the service, and already separated veterans who have an interest in the construction industry. Offering this type of training program to military members would be less costly because the training contractors would be contracted through the U.S. Department of Labor. This training would take place at military bases to provide training sessions to military members who are already being paid full time while they are on active duty status, avoiding the excess costs of paying deconstruction workers during training. Similarly, the Veteran Affairs Agency (VA) could offer free training to veterans which would be covered under VA programming, and could be accomplished without the necessity of paying veterans for training. This is essential as most deconstruction contractors won't pay for employee to be trained, as referenced in the NAHB's (2001) report on the feasibility of deconstruction: "Wilmot & Associates does not see training as feasible due to cost effectiveness" (p. F-32). Promoting this training in the military, however, would allow mass numbers of individuals to be trained and certified weekly on a military base or at a VA facility. Upon veterans' exit from service, this training and certification would ensure they will be ready to move to their desired location and find employment quickly, allowing them financial stability after separating from the

military and giving veterans new job opportunities. Additionally, this opens up the door for current and soon to be veterans to further advance in the construction industry sector once they have become experienced in the trade of deconstruction.

### **Military Members Exiting Active Duty Service**

The military is a complex organization with a great deal of moving parts, members constantly entering and exiting service each day. According to The Congressional Research Service (2018), “approximately 200,000 transition annually” (p. 2) out of active duty military service, which is about 16,666 members per month or roughly 3,846 members each week. Before exiting, these members must attend a Transition Assistance Program (TAP) which “provides information, tools, and training to ensure Service members and their spouses are prepared for the next step in civilian life whether pursuing additional education, finding a job in the public or private sector, or starting their own business” (Military.com, n.d.). During this program Service members are required to research a desired major and profession they would like to enter if they plan to attend college, find a job, or come up with a plan upon their exit. At this time, there aren’t any clear statistics which show how many of these service members enter into a college program, trade school, or occupation immediately upon exiting their service. Rolan (2017), however, estimated that in 2016 roughly “22.8 percent had some college with no degree, 12.5 percent earned an associate’s degree, and 18.6 percent earned a bachelor’s degree.” Additionally, she found that “in 2016, the overall unemployment rate for veterans was 4.3 percent” (Rolan, 2017). The percentage of veterans attending college is relatively low while the percentage of unemployed veterans is somewhat high, meaning a training opportunity like this could prove to be beneficial to military members exiting the service who are not planning on pursuing higher education or have trouble finding job opportunities. Furthermore, veterans would make good

candidates for this type of work because they have strong work ethics, show respect for others and the work at hand, encompass integrity, and the majority are physically capable of performing such demanding work. By offering military members a training program for deconstruction while they attend TAP, this could provide a new option for Service members who do not wish to attend an educational institution or find a job immediately, and additionally would provide veterans with a new occupational opportunity.

### **Implementation of a Workforce Training Program**

Building a workforce for deconstruction with the use of military members and veterans requires a solid plan be created. This training program could be based upon existing programs available like the one presented by The ReUse People, which effectively trains workers to deconstruct buildings safely and efficiently. As previously mentioned, this training plan also specializes in training future educators for the program. For this plan to come to fruition, however, the United States Government will need to get on board. This would require the federal government hire contractors to attend the TRP-Certified Deconstruction Contractor Training conducted by The ReUse People, and also determine whether they would like to make any changes or adaptations to the training program itself. The federal government has already made investments in employment, education, and training opportunities for veterans, and this training program would align with existing Department of Labor initiatives. According to U.S. Department of Labor (n.d.) “The Veterans Opportunity to Work (VOW) Act required the U.S. Department of Labor to redesign its employment workshop to be more applicable to the realities of today’s job market. Veterans’ Employment & Training Service (VETS) fulfills this requirement for the Department of Labor and manages the implementation of the employment workshop at hundreds of military installations worldwide.” These initiatives would allow for the

creation of a new training program, such as the one provided by The ReUse People, to develop a workforce for deconstruction. Additionally, a training program such as this could be implemented in all major cities, using Veteran Affairs facilities to allow veterans who have already separated to have an opportunity to be certified if they wish to enter into the construction industry.

### **Sewing Everything Together**

Implementing a training program to build a deconstruction workforce composed of highly skilled, professional military members exiting the service will create jobs for veterans and give them financial stability. It will also provide them potential advancement opportunities, a sense of purpose after returning from the service, and help attack the growing blight and abandonment epidemic in cities across the United States by reducing and removing blighted structures, all at an attainable and feasible cost. By training veterans for this type of work this could help attack the blight problem at hand. An increase in the number of trained individuals in this area will speed up the process of ridding blight from our communities. Additionally, after these individuals have had some years' experience in this line of work, this workforce development programming could create new ideas and concepts on how to more efficiently deconstruct blighted areas. This not only helps veterans, but also helps revitalize communities that have succumbed to economic downfall. This training programming will create new jobs in these cities, clean the streets, and potentially reduce upkeep. To conclude, a program such as this will potentially bring new people to areas facing blight and abandonment, boost a city's economy, and make it a better environment for all occupants.

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**Perceived Barriers to the Materials Salvage Resale Market in Residential Structures**

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## **Introduction**

Buildings and structures are said to account for 38 percent (Yüksek 2015, p.45) of our resources globally. Americans constantly build and demolish buildings, but this constant cycling of materials could be an excellent opportunity for reuse. There are still a multitude of impediments before a fully functioning reclaimed building materials market and supply chain can manifest; currently, and in the United States, 53 percent of our buildings were constructed before 1980 (Barry 2017, p.1) as opposed to 74 percent in the United Kingdom (U.K. DCLG 2015, p.14). Many of these buildings end up demolished as we make way for more efficient construction designs, which provides an excellent opportunity to use old buildings as material banks for new construction. This research seeks to ask the question: What are the real & perceived barriers to the reclaimed building materials market? Perceived barriers by stakeholders have the same effect as real, institutional barriers. To examine these barriers, this paper will use two distinct methods- a literature review examining what information already exists on the topic, and conducting a preliminary survey regarding consumer attitudes towards reclaimed building materials.

## **Background & Literature Review**

The existing literature identifies several key barriers to the resale of salvaged building materials, the largest barrier being that there are not enough local facilities due in part to the lack of established materials salvage markets. Those markets are held back because of an industry reluctance to use uncertified materials, and poor information availability, data, and tracking of salvaged material history.

Lumber is the most common building material for residential structures, and currently faces certification barriers in the realm of reuse. A study by Robert Fulk identified inconsistent

rules regarding the re-grading of salvaged lumber. No rules for lumber grading explicitly include salvaged lumber, meaning there are no standards or definitions in place. This lack of explicit definition causes inconsistency in the application of the grading process. An informal phone interview conducted by Fulk's team identified that only two of the seven softwood grading agencies operating in North America would grade and stamp salvaged lumber. Several of the agencies said that if standards and rules existed regarding salvaged lumber, they would consider certifying the lumber's integrity (Falk et al 2013, p.495). Without certification, salvaged lumber feeds into perceived fears about the safety of the materials by builders and the general public. Home builders are not likely to purchase slightly cheaper materials without a guarantee of safety. Builders are not likely to build with materials that may make them liable for damages. Falk's study concluded that reclaimed lumber had weaker properties than their virgin counterparts, but found that salvaged Douglas Fir boards had more structural integrity than virgin Pine wood used in most modern construction, meaning that there is still potential for structural-load applications (Falk et al 2013, p.497).

In many areas of the country, there are other barriers to the market as well; namely, that of supply and demand of reclaimed building materials. As the materials reuse industry currently stands, the reprocessing of materials is labor intensive and costly (Hobbs & Adams 2017, p.110). The success and feasibility of the reclaimed building material market hinges on demand from consumers and potential homeowners. Architects and builders have claimed they would be interested in using those materials if the consumers demanded it. Holding back demand currently is the issue of supply; consumers cannot demand a resource that they are not aware of. Better education about where to find salvaged materials and their economic and environmental benefits are necessary to curb this issue. (Park & Tucker 2016, p.15). Currently there are very few



building material salvage yards, and most consumers are unaware of the possibility of using reclaimed materials (EPA 2012, p. 5).

Nationwide, there is a lack of local facilities that prohibits development of the market. Salvaged materials, especially lumber, are barely cost competitive with their virgin counterparts. (Kernan 2012, p.62). By shipping heavy salvaged materials in the high volume necessary to construct a building, the cost competitiveness of reclaimed materials is eaten away. This poses real challenges for the economic feasibility of the salvaged construction industry, especially combined with consumer perceptions about the risk of reused materials (Hobbs & Adams 2017, p.112). Without local facilities in place, buyers will be unlikely to consider salvaged materials due to the cost of shipping long distances.

The salvaged material industry as a whole suffers from lack of data (EPA 2012, p.1). Without data regarding how long a material has been in use, or where the material may have come from, customers may be hesitant to purchase reclaimed materials (Hobbs & Adams 2017, p.110). That same EPA study identified a lack of centralized information about the existence and scope of the material reuse industry. By their estimation between 1,000 and 1,500 reuse centers are active, and some of those have a wider scope than just the resale of material (i.e., C&D waste recyclers or haulers).The lack of available information worsens the market issues that salvaged goods face. Without consistent & knowledgeable suppliers, building material reuse is unlikely to take hold in the broader industry.

### **Survey Questions & Findings**

The survey was distributed primarily through social media channels and emails and sought to identify consumer attitudes about purchasing homes made with reclaimed materials, determine comfortability with various reused building materials, and identify the perceived

barriers from the viewpoint of the public. The preliminary survey discussed further in the paper is not statistically significant, nor is it a representative sample of the wider population. This study acts as a preliminary introduction into this otherwise untapped subject area, and will require more scholarship in the future. The survey data will be presented in order of the questions on the survey.

### **Demographics**

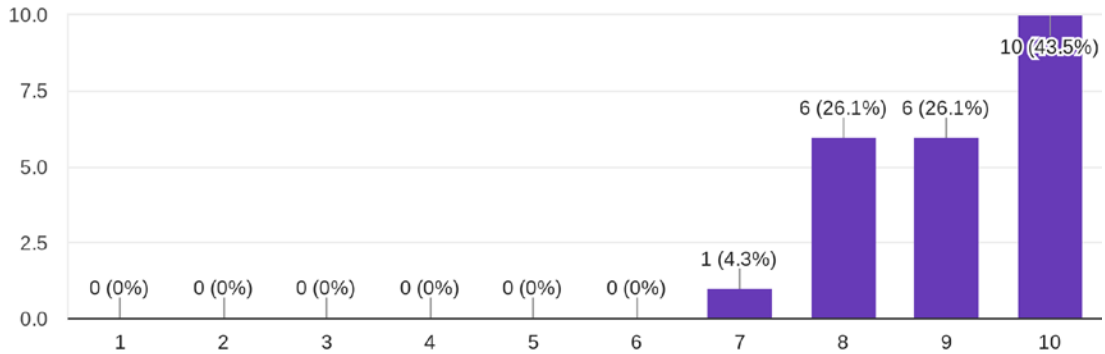
The survey consisted of 23 total respondents, a majority of which were from Michigan; only 3 total participants identified as living outside of Michigan. The occupations of the survey population are as follows:

- |  |                                |
|--|--------------------------------|
| 1. Environmental Science                             | 11. Apparel and Textile Design |
| 2. Environmental Economics and Management            | 12. Lab Tech                   |
| 3. Law   | 13. Occupational Therapy       |
| 4. Communications                                    | 14. Material Handler           |
| 5. Environment Studies, Sustainability, and Business | 15. Teacher                    |
| 6. Accounting  | 16. Political Science Degree   |
| 7. Psychology  | 17. Environmental Studies      |
| 8. Sustainable Parks, Recreation, and Tourism        | 18. Public Policy              |
| 9. International Relations                           | 19. Healthcare                 |
| 10. Sustainability                                   | 20. Dietetics                  |
|  | 21. Student                    |
|  | 22. Nursing                    |
|  | 23. Industrial Design          |

Figure 1

How comfortable would you be living in a house made of re-used and reclaimed building materials?

23 responses

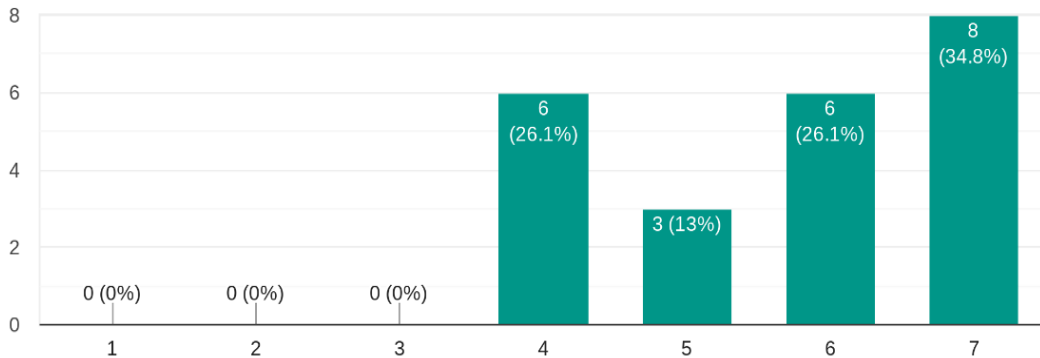


Respondents were asked to rate their comfortability about living in a house made of reclaimed materials on a scale of 1-10. As shown here, the vast majority of consumers would feel very comfortable in a home made out of reclaimed materials. This shows that consumers don't perceive reclaimed materials to be untrustworthy or poorly suited for this type of application.

Figure 2

When purchasing a home, would it be more or less desirable to find it was made with reclaimed materials compar...tional home? (4 being no difference)

23 responses

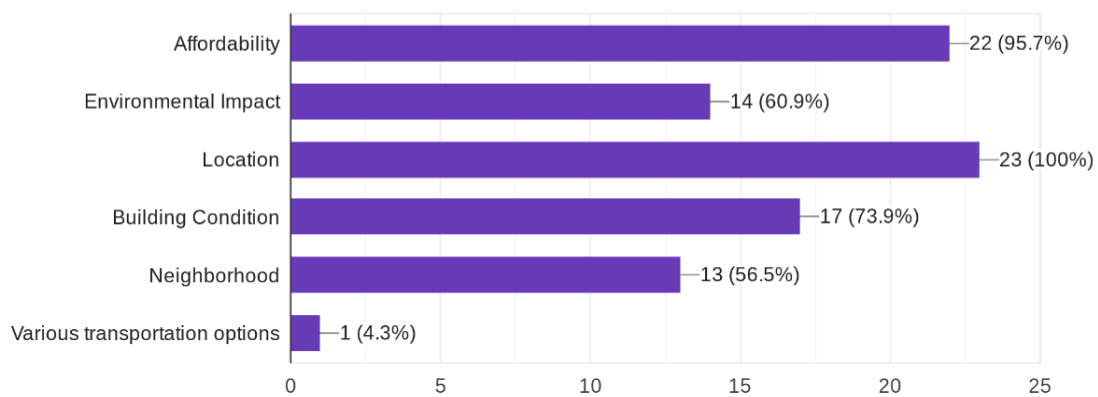


Survey respondents were asked to compare the desirability of a home built with salvaged materials compared to a traditional home. The preliminary survey results here show that consumer desirability is not a factor that is holding back the industry. These results indicate that salvaged homes are just as or more desirable than traditional homes.

Figure 3

### What factors do you consider to be important when purchasing a home?

23 responses

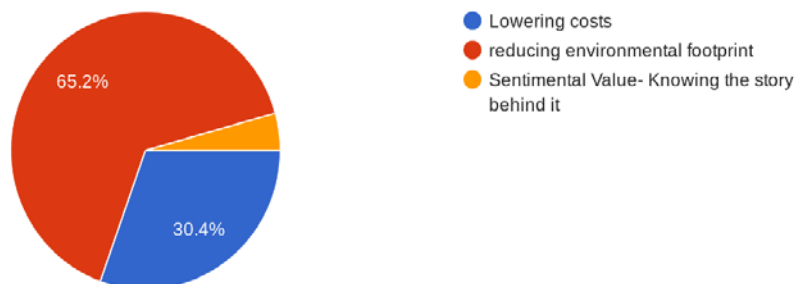


The driving factors in purchasing a home are location and affordability. The other factors appear to be less important by a significant margin, meaning that an affordable salvaged home in an ideal location and in good condition should hold value to the consumer.

Figure 4

### The best argument for using reclaimed building materials is

23 responses

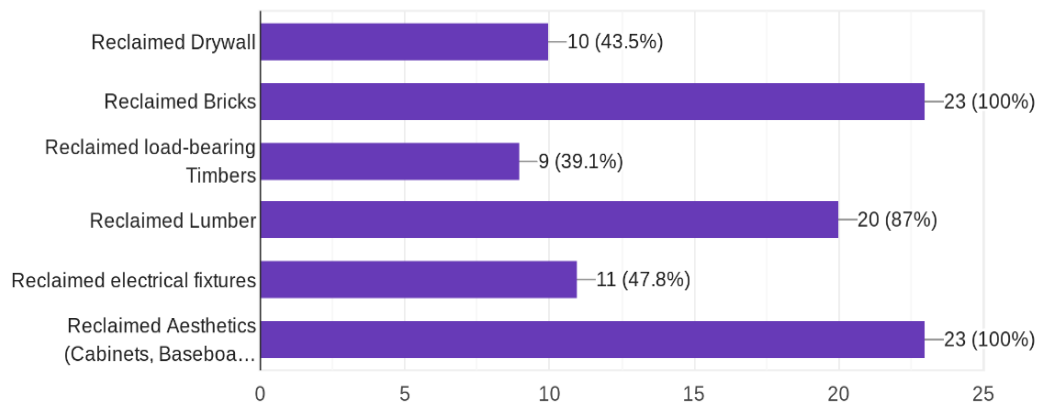


The findings from this question are intriguing within the context of the last research question. The majority of consumers see reusing building materials as having primarily environmental benefits, and a weak majority of 60 percent of respondents identified that they consider the environmental impact when purchasing a home. From this we can conclude that the sustainability of structures is important to consumers, and salvaged materials reuse can play a role in perception of the environmental impact.

Figure 5

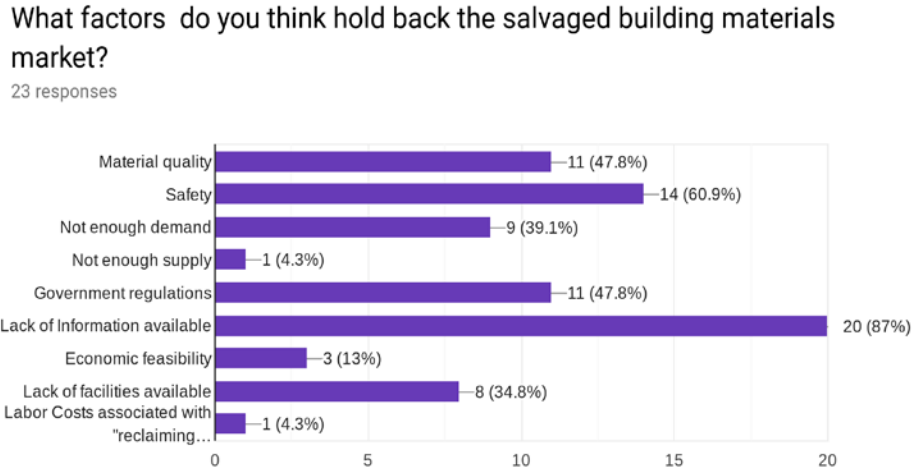
### Which reclaimed materials would you be comfortable with in your home?

23 responses



All respondents surveyed said they would be comfortable with reclaimed bricks and aesthetic elements (such as cabinets, baseboards, trim, etc.). This information is supported by the literature about reclaimed materials that easily go to market (NAHB Riverdale Case Study 1997). The vast majority of respondents would be comfortable with reclaimed lumber, and around 39 percent would be comfortable with load-bearing timbers. Further research is warranted, but it is logical to assume that consumer confidence would increase with explicit timber grading rules or certification.

Figure 6



Respondents were asked to identify all factors they believe to be holding back the building materials reuse industry. By a 26 percent margin, most respondents believe that lack of available information is holding back the reclaimed resale market. Safety concerns came second with about 61 percent selection. Overall, the consumers require more information to help bridge the gap between the perception and reality of the safety and quality of reclaimed materials.

Figure 7

A final research question asked consumers to respond in their own words to the question “What do you think is the largest barrier to the salvaged building material industry?”

The answers vary broadly, but can be condensed into the following categories of response:

Consumer Perceptions	3
Material quality/safety	9
Lack of information or material tracking	10
Affordability/cost	3
Supply	1
Demand	1

Significant points raised here are that some consumers felt uneasy about not knowing the age or past use of certain materials. These results fall in line with the previous figure, and maintain the idea that lack of information about the subject and concerns about the safety of reclaimed materials are the largest barrier to the salvaged buildings market.

### **Discussion**

There are several key barriers currently holding back the resale of salvaged building materials. Knowledge about the benefits of salvaged materials is ill-distributed among consumers, which limits the market demand. The re-certification of building materials is a key barrier that must be overcome to address the other issues holding back the market. With re-certification, salvage facilities will be more likely to hold on to building materials, and consumers will have greater confidence in their safety. When consumers can be confident in the value and integrity of materials, demand will increase which should incentivize the creation of local facilities. The creation of established markets will aid in the collection of data around reuse stores, and ultimately lead to further information dissemination. Consumers are a driving stakeholder of the housing markets, so by informing them and changing behavior, we can change the market.

The sample population identified that 26 percent of the respondents were involved in some form with the environmental industry, meaning there may be inherent bias in this population towards green practices and attitudes. That said, even by removing those samples there seems to be positive perceptions of the comfortability and desirability of living in a home made of reused construction materials.

## **Recommendations**

In order to advance the science of Domicology, three key barriers need to be overcome. Firstly, the National Hardwood Lumber agencies need to establish explicit language regarding the grading of salvaged lumber & timber. This would clear up the confusion that construction companies have about the safety and certification of using salvaged materials. Secondly, there needs to be an education campaign about the availability and feasibility of building with reclaimed materials. Educating stakeholders about the relative benefits of salvaged materials over virgin materials will help to develop the market infrastructure necessary to support the enterprise. Thirdly, a nation-wide materials tracking system should be developed to inform stakeholders about the history and past application of specific materials. This would help ease consumer thoughts about the safety of the materials, and provide a common, uniform method for analyzing the materials.

## **Further Scholarship**

There are several scholarship areas that should be pursued to advance Domicology and give us a more holistic view about consumer perceptions. Firstly, this research should be replicated to a wider, more representative and statistically significant population, in order to identify barriers and gain access to more accurate information. Secondly, A follow up study should be conducted to survey consumers about their willingness to pay for various reclaimed building materials, and whether their positive perceptions about salvaged goods translates into pro-environmental behavior in the housing market. Finally, research should be conducted to identify methods of information relation that actually change consumer opinions about salvaged materials in the marketplace.



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