VAMPIRE ANALYSIS OF HILLSBOROUGH COUNTY:
A SPATIAL REPRESENTATION OF OIL AND MORTGAGE VULNERABILITY

By

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To Megan and the Cat, for keeping me sane

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To my beautiful fiancée for leaving everything behind so I could pursue this degree. To my parents, if anything was ever good enough I wouldn't have kept striving.

TABLE OF CONTENTS

page

LIST OF FIGURES

LIST OF ABBREVIATIONS

CNT	Center for Neighborhood Technology
DEPTP	Demand elasticities for public transport relative to fuel prices.
SEIFA	Socioeconomic index for the area.
USGAO	US Government Accountability Office
VAMPIRE	Vulnerability assessment for mortgage, petroleum and interest rate expenditure.
VIPER	Vulnerability index for petrol expense rises.
VMT	Vehicle miles travelled.

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Oil Vulnerability refers to the degree in which an urban area, analyzed in this thesis at the level of the census tract, is vulnerable to negative economic impacts from rising oil and gas prices. An existing model has been applied to many different Australian cities, and is applied to Hillsborough County/Tampa Bay, FL in this thesis. This model is called the VAMPIRE, or vulnerability assessment for mortgage, petroleum, and inflation risks and expenditure.

The results of the model show Tampa Bay to have an overall high level of vulnerability, without a clear “core” area of low vulnerability that can aid in a region-wide effort to mitigate the problem by expansion of services or spreading favorable development patterns outward. While this is the policy solution put forward for Australian cities, an analysis of Tampa Bay reveals the city center, and not the periphery, to have the strongest need for action. The discussion at the end of the thesis argues for improved transit in the jobs rich 275 corridor north of downtown Tampa as the most expedient way to address Hillsborough County’s oil vulnerability.

CHAPTER 1
INTRODUCTION

Problem Statement

Oil dependence is a ubiquitous problem throughout much of the industrialized world. Many different predictions exist about when global oil production will peak, ranging from now to around 2050. What is clearly documented is that oil is getting harder to find, and harder to produce. “One thing is clear: the era of easy oil is over” (Chevron Oil Ltd advertisement, The Economist, 2005 as quoted in Dodson and Sipe, 2008).

Many factors affect the global market of oil. First, global demand is rapidly increasing. China and India have a rapidly expanding middle class, and are adding millions of new vehicles to their fleets each year. “Global oil seems to be at or close to its full capacity… China and India have entered the global oil market in a big way- China is now the world’s second largest consumer of oil” (Newman, 2007). Furthermore, China is now the largest consumer of energy in the world. “China's ascent marks "a new age in the history of energy," IEA chief economist Fatih Birol said in an interview with the Wall Street Journal. “The country's surging appetite has transformed global energy markets and propped up prices of oil and coal in recent years, and its continued growth stands to have long-term implications for U.S. energy security” (Wall Street Journal, 2010). What this all means is that oil demand is increasing against a flattening supply that is going to inevitably decrease. Indeed many major fields are already decreasing, “North Sea oil production has been in decline since 1999 while Mexican oil production is also declining sharply” (Dodson and Sipe, 2008). While major fields are in decline, there is a large new discovery off the shore of Brazil, as well as modest increases in the

United States. “Unfortunately, at their best, the Brazilian fields will not offset the production declines elsewhere in the world” (Deffeyes, 2010). Furthermore, the increases in US production are not sufficient to displace the US’s reliance on imported oil.

Oil prices are increasing and show no signs of falling to levels seen before the price spike of 2008. The market is unable to respond as predicted, however, “tripling the price [between 2005 and 2008] brought out only a trivial amount of oil [.2 percent]” (Deffeyes, 2010). Indeed the era of $1-$2 gallons of gasoline appears to be over in the United States.

Increasing oil prices are typically thought of in a macro-economic manner in which they drive inflation and slow economic growth. The OPEC crisis of the late 70s/early 80s produced a global recession, and many argue that the recent/current “great recession” was caused by the spike in oil prices that peaked in 2008, topping $140 right before the collapse of Bear Stearns in March 2008 (Deffeyes, 2010). “Oil costs exceeded 4% of GDP in 1982 and again in 2008. Both of those price spikes caused extensive damage to the U.S. economy (Deffeyes, 2010).

The “oil intensity” of the economy has been the subject of much deliberation during oil price spikes and their associated recessions. Oil intensity refers to the amount of oil needed to produce one unit of GDP. It has improved much since the 1980s, driven by technological advances, specifically by using oil more efficiently. What has not improved, however, is our overall dependence on oil. We are more dependent on oil now than during the OPEC crisis. This study seeks to address this dependence at the household level. “The burden of rising fuel transport and fuel costs is shared unevenly

between household income segments" (Dodson and Sipe, 2008).This thesis aims to further the fledgling field of studying oil impacts at the household level.

Hypothesis

The hypothesis of this thesis is that the overall pattern established by previous oil vulnerability studies in Australia will hold for Tampa Bay. This pattern sees higher oil vulnerability on the periphery of the urban area, with moderate vulnerability in the inner-ring suburbs, and low vulnerability in the city center.

Due to the large urbanized area in the Tampa Bay region, and relatively small 'dense' city-center area, It is expected to see a disproportionately large high vulnerability area surrounding a small core of relatively low vulnerability. Another expectation is to see relatively low vulnerabilities following the streetcar system in place, due to its mitigating influence on auto dependence.

Finally, due to the extremes of auto dependence in the Southern United States, of which Tampa Bay is no exception, it is expected that oil vulnerability is generally higher than what has been established in the study of Australian cities.

CHAPTER 2
REVIEW OF LITERATURE

Transportation

When it comes to auto-dependence, the United States outdoes other countries, even those commonly regarded as auto dependent such as Australia and Canada. “U.S. cities in general are out-consuming oil in similar Western cities by a factor of between four and ten” (Newman et al., 2009). There are many reasons for this, primarily lack of public transportation infrastructure. “Suburbanization and the failure to extend public transport infrastructure has created vast tracts of urban car dependence” (Dodson and Sipe, 2008). Like many cities across the world, US city’s historic centers have relatively strong public transportation options. However, suburbanization has largely disregarded any mode of travel other than the automobile.

A second reason for our unmatched auto-dependence is another product of suburbanization. As the suburbs have opened up inexpensive land and provided affordable housing, many of the working poor in the US have been locked into extremes of auto-dependence not seen elsewhere. “What is different about North America from most other place is that even the poor drive” (Rubin, 2009). This fact is particularly troubling when addressing auto-dependence from an oil vulnerability perspective. While the suburbs have brought affordable housing to the less affluent, the method of providing that affordable housing has left those least able to afford oil price increases poised to bear the largest burden when prices do rise.

The issue of high oil dependence, in the context of stagnant global oil production and rapidly increasing oil consumption (due to increases in China and India), would seem to create a pressing need that demands grave respect and consideration. It is not

widely treated as such, however, perhaps because as Newman states, “acknowledging and responding to the problems related to our automobile dependency challenges every aspect of life” (Newman et al.. 2009).

Rubin puts it a different way, he states that either our spatial arrangements or our transportation options will have to change in the future. “Are commuters going to be living or working where they are today when oil prices inevitably soar again? And if they are, will they still be driving cars? Either our living arrangements or our transportation options are going to have to change” (Rubin, 2009). The issue with both of those methods of addressing auto-dependence is that they are long-term processes that cannot adapt overnight. This means that all the time not spent preparing for the inevitable future of post-peak oil makes the impact all the more dangerous. Today’s land use and transportation infrastructure decisions will have strong consequences long into the future.

Our current land use patterns are increasing, rather than decreasing, our auto dependence. Suburbs are ringing other suburbs in ever-widening circles of development away from historical centers. Each new suburb on the outskirts of a city is more auto-dependent than its predecessors, all things being equal. “Average outer suburban journey lengths are almost double those of middle and inner suburban residents, and average daily distances travelled by those in outer regions are nearly triple those of the denizens of the middle and inner zones” (Dodson and Sipe, 2008). Therefore, those who are least able to afford oil price increases (those seeking the affordability of exurban locations) are those with the least ability to switch modes if needed due to lack of transport options. They are those who are driving the farthest distances. As oil prices

have begun to rise, we can see the beginning of the ramifications of this spatial mismatch between socio-economic needs and realities. Speaking about the oil price spike of 2008, Newman writes, “in the United States, [it was] found that most people opted to stay at home and took fewer trips instead of shifting their mode of transport from the single-occupancy vehicle to walking, mass transit, biking, or car-pooling. In many places the infrastructure was not in place for these alternative modes of travel” (Newman et al., 2009). This exurban reality is in contrast to a significant increase in mass transit ridership where those services are offered. “This urban transport gulf is growing: inner-city residents are shunning their cars and their trips are shrinking, while those in the outer suburbs wade further into the depths of car reliance” (Dodson and Sipe, 2008). Regardless of quality, public transportation access is a big issue that needs addressing. Rubin provides the figures: “75 percent of all Americans living in cities have access to some form of public transit; only 50 percent of American households living in the suburbs have similar access. In rural areas, access to some form of public transit plummets to about 25 percent” (Rubin, 2009).

The figures of the American poor and transit are worth exploring, if only because they are exceptional in the fact that they are the both the cause of our unmatched auto-dependence and the primary concern in studies of oil vulnerability. Rubin, in his book *Why Your World is about to get a Whole Lot Smaller* conducts an analysis of the driving rates of the country’s poor. “Some 24 million American households with annual family income of less than $25,000 own at least one vehicle. There are more than 10 million such households that own and drive more than one car. Soon they won’t be driving any” (Rubin, 2009). Rubin arrives at his 10 million figure based on an analysis in which he

uses European driving habits as a way to gauge how our driving will be affected once prices approach the high levels paid in Europe today because of taxes. His theory is that affluence (or just economics) determines driving habits; that people will drive if they can afford to. His main point to support this theory is that throughout Europe and areas with very high gas prices, the wealthy drive at the same rate as the wealthy in the United States. He concludes that “what speaks the loudest about the importance of the car in American culture and life is not the driving habits of the rich but rather the driving habits of the country’s poor” (Rubin, 2009).

It is clear that the working poor, subjected to the need to “drive to qualify”, where their only housing options are the farthest-flung suburbs or substandard inner-city, are going to need new transit options in a post-peak oil world. However, as Dodson explains, when transit is expanded, it is most often to middle-class areas that by virtue of their wealth are less likely to be impacted by rising oil prices. He has coined this term “middle class capture”. It is a reflection of the market at work. The places with more money get to have nicer things, or another explanation, inner suburbs are more likely to be denser and wealthier, making them more attractive for transit. In planning for a new future, socio-economic realities should be taken into account when designing new transit access. “Those on the lowest incomes in the most car-dependent outer suburbs will face the greatest burden in this new world” (Dodson, 2008).

The end result of the impacts of rising oil prices are what is termed “transit stress”. “Soaring transport costs and the subsequent collapse of commuter traffic will depopulate the suburbs. The farther they are from where people work, the emptier they will get” (Rubin, 2009). The stress refers to negative economic impacts on an area. It is

the logical aftermath of a situation where there is a need for a resource for the survival of an area, but that resource drains more money than can be financially sustained. Theoretically there is a price threshold for gas, based on how much driving an area does, that would tip the area into a negative financial situation, i.e.: the oil consumption that is driving economic activity is pricier than the economic activity can justify; this situation is “transit stress”. “We will soon be driving less [because] we won’t be able to afford to drive the way we have been accustomed to” (Rubin, 2009).

In the oil vulnerability literature there is a divergence in proscribed ways to address the issue. One view is that urban consolidation is the best way, promoting smarter, infill development in areas that already have transportation infrastructure to serve it. This argument is supported by the exponential cut to vehicle miles travelled (VMT) as transit increases. “There is an exponential relationship between increasing transit use and declining car use in the global cities database developed by Jeff Kenworthy. This helps explain why use of cars by inner-city residents in Melbourne is ten times lower than that of fringe residents, though transit use by inner-city residents is only three times greater” (Newman et al., 2009). It would suggest that either the areas that are good for transit are also good for promoting all modes of travel, the trips are shorter, or both. No matter the reason, a decrease in VMT is an increase in resiliency to oil prices.

Another side claims that the market prevents urban infill development from helping those who are the most oil vulnerable, the people that have already been priced out of adequate housing in the inner suburbs and city center. “Newman has been quoted as warning that much higher oil prices will mean a new residential abandonment

in car-dependent suburbs… only new rail lines (rather than higher densities) will save the suburbs" (Dodson, 2008). This premise is based on the fact that it is more expensive to develop infill areas, so the developments have to be targeted at the high end of the spectrum to cover the increased costs. Affordable housing is built on the affordable land, and it is argued that there are not adequate ways to mitigate this to allow "consolidation" to be the primary method of addressing oil vulnerability.

No matter where development efforts should take place, public transit is the key way to build economically sustainable communities in the post-peak era. "We now face the choice between propping up a collapsing way of life based on car-dependent suburbs and designing and building systems better scaled to the future we face. Development always follows the transportation routes, just as water follows the path of least resistance. Build the transportation you want, and you won't have to wait long to get the kind of town suited to the future" (Rubin, 2009). The key to being suited to the future is public transportation. "Suburbs were founded on cheap mobility providing access to the cheap land that provided affordable housing. With this model now quivering in the face of higher fuel prices, we need to start planning for a public transport system that provides a level of mobility that can sustain our suburbs and their capacity to afford cheap housing for those on modest incomes" (Dodson, 2008).

Getting the kind of public transportation that is called for to address oil vulnerability has historically required high densities, the scale of which is unattractive to people living auto-dependent lifestyles. "Transit needs densities over thirty-five people and jobs per hectare (fourteen per acre) of urban land and for walking/cycling to be dominant requires densities over one hundred people and jobs per hectare (forty per

acre). Most new suburbs are rarely more than six or seven people and jobs per acre" (Newman, et al., 2009). The areas that most need increased public transit options (those that are the most "oil vulnerable") are least suited to expansion of their infrastructure. However there is a trend that will help with the provision of transit to vulnerable areas. "Four dollar gas meant our public transportation systems saw 300 million more trips in 2008 than in 2007" (Steiner, 2009). This suggests that the densities needed to sustain transit will be different based on the price of gas.

In addition to adding transit riders, each dollar level of gas has produced lower VMTs. "Bureau of Transportation statistics show that vehicle miles travelled peaked and leveled off at the onset of $3 gasoline in 2005. $4 gasoline in July 2008 caused them to markedly drop" (Ruppert, 2009). This drop of VMT came at a time where the trajectory was to continue to increase. Rubin explains, "not only are there more cars on the roads, we are driving them more. In 1970, the average American car was driven only 9,500 miles per year. By the time of the new millennium, it was driven over 12,000 miles" (Rubin, 2009). The fact that gas prices have been able to dramatically reverse the trend of increasing travel, as demonstrated by Ruppert, proves the power that they will have over our communities in a post peak-oil world. Ruppert claims that simple fact of decreasing VMTs means there should be no expansion of roads. "Traffic and air travel are not going to expand as oil runs out. They are already decreasing. There is no point in destroying arable land, paving it with petroleum products and maintaining it for traffic that isn't going to be there" (Ruppert, 2009). While this viewpoint is extreme, the key point is that there should be an understanding of a future world with higher gas prices in any developments that are undertaken today.

Oil prices are a complete game-changer for the economics of everything they involve. They have the power to completely redefine what is sustainable economically in a spatial and functional manner. They also have the power to ruin communities. There are many communities that are not at all prepared to cope with a post-peak oil paradigm. This issue is especially relevant in the Southeast United States, which is one of the most car dependent regions in the most car dependent country in the world. It will be interesting to see how our cities adapt, but it will not be pleasant to live in a city that has not adapted well. It is not hyperbole to suggest collapse on the scale seen in inner city Detroit for much of our communities, coupled with a strengthening of the competitiveness of many urban areas that have seen recent disinvestment. The end result may well be better cities that function better for society as a whole, but the two choices to get there seem to be planning, especially transportation planning, or chaos that will see many suffer.

Economics of Rising Oil

The impact of rising oil prices on our communities is a key issue to this research. Some are set to be more resilient to the ill effects of rising prices than others. Many factors go into the economic impact of oil prices. There is a need for oil vulnerability analyses because our cities are set up to let oil price increases have a regressive impact. Transit provision has a clear financial benefit to residents that use it. Also, as demonstrated earlier, when oil prices rise, people switch modes to public transportation. This ability to cope with cost increase is not there for many of the most vulnerable communities. There is a small but growing body of literature that seeks to calculate what people are spending on their transportation, and what this means for their communities.

Transportation and Housing Costs Combined

Transportation is a major expense in our society, and it is one that is going to increase as fuel prices rise due to the increasing cost of oil. “Combined, the costs of transportation and housing account for 52 percent of the average family’s budget... health care and food when combined, are less than transportation. It is an obligatory expense to get to and from work, home, school, and shopping, but is not categorized as a basic necessity, even though it is the second highest expenditure and it continues to rise in price” (CNT, 2005). This means that there is no official policy to keep transportation affordable. This is problematic because not all areas have equal transportation costs. The ‘drive to qualify’ is seen on in many US cities, where those who seek homeownership and cannot afford adequate housing closer to the job centers are forced to search for housing farther and farther away. Increased transportation costs are incurred to access housing that is affordable. The drive to qualify sees people stretching their budgets to the maximum amount possible because only by undertaking extensive commutes is housing affordable, which implies that these are households of modest means that are undertaking the drive to qualify.

“On average working class families spend about 57 percent of their incomes on the combined costs of housing and transportation. While the share of income devoted to housing or transportation varies from area to area, the combined costs of the two expenses are surprisingly constant. However, in all the metropolitan areas there are neighborhoods where working families are saddled with both high housing and high transportation cost burdens” (Lipman, 2006). These working class families that are extended on their mortgages are incurring extremely long commutes, indeed “for many [working] families, their transportation costs exceed their housing costs” (Lipman, 2006).

Our sprawling land use patterns is necessary, because the drive to qualify has existed dominant for so long that land farther and farther away from the center has to be developed. There are just too many people needing peripheral affordable housing to accommodate everyone in a reasonable space. Once the commute becomes too long, though, the cost savings from housing start to disappear. "At some distance, generally 12 to 15 miles, the increase in transportation costs outweighs the savings on housing, and the share of household income required to meet these combined expenditures rises" (Lipman, 2006). This upsets basic land-rent balances that show housing cost to be a decreasing function of distance from the city center, and instead, overall affordability decreases at the same time housing costs decrease (Tanguay and Gingras, 2011). Therefore only looking at housing costs to measure affordability is inadequate and transportation must be accounted for. The primary method of providing working class homeownership opportunities, peripheral development, will see diminishing benefits the more it is exploited as a development strategy.

Transportation Costs Analyzed Alone

The cost of transportation is dramatic when analyzed on a regional scale. For example, the Baltimore area averages a household income expenditure rate on transportation of 14%. At the national average transportation rate, 19.1% Baltimore households would have spent an additional $2 Billion in 2003. Likewise, if Houston households would reduce their spending to national averages, it would save the region $1.2 Billion (CNT, 2005). These figures are extremely large despite the fact that transportation infrastructure is rarely analyzed in terms of costs to households. Baltimore's transit system is much easier to justify subsidizing when it is seen as a key contributor to a savings of $2 billion, money that would most likely leave the region as

oil imports. This says nothing about the exposure to increasing costs, which will see these margins widen. According to the American Petroleum Institute, “every penny increase in the cost of gasoline means more than $1.4 billion in higher costs” (CNT, 2005).

The US economy is extremely vulnerable to oil prices. Despite lowering the oil requirement per unit of GDP since the OPEC embargo, Rubin states “the US economy is almost twice as depend on *imported* oil as it was during the first OPEC oil shock”. Rubin states that oil prices will drive recessions, and the main reason for this is that “$4 per gallon… left your average American paying more to fill up than to cover the weekly grocery bill… America may be the land of the car, but when faced with the choice of feeding your stomach or filling your gas tank, your stomach is usually going to win” (Rubin 2009). The fact that our economy and communities are so dependent on people continuing to fill up their gas tanks means that serious economic ramifications are in order when gas continues to rise in a post peak-oil world. Even writing before $4 gas (2005), the Center for Neighborhood Technology claims that “While there isn’t a guideline for total transportation expenditures as a percent of income, it seems that the current spending levels [of] 14-13% of income and 19.1% of expenditures, is too high.” There is a need to address the cost of transportation at the household level. The key way to do this is through provision of quality public transportation.

Financial Benefits of Public Transportation

Public transportation has a strong impact on the amount spent on transportation at the household level. In fact, transportation expenditures can range from “less than 10 percent of the average household’s expenditures in transit-rich areas to nearly 25 percent in many other areas” (CNT, 2005). This household savings is capturing money

that would be otherwise lost to the locality as oil imports and investing them into the transit system itself as well as other household needs. This is a critical feature in a world of increasing gas prices. Put simply, “regions with public transit are losing less per household from the increase in gas prices than those without” (CNT, 2005).

This household-level analysis done by the Center for Neighborhood Technology has shown that among groups that own the same number of cars, “after subtracting total transportation expenditures from income, heavy transit users have a greater portion of their incomes left over, $41,567, than the non-transit users, $38,322” (CNT, 2005). Transit use saves money, plain and simple.

If transit use saves money that can then be recycled into a locality instead of lost to pay for oil imports, then it makes sense to address transit use from an economic perspective. In other words, our urban form has an effect on our economic health. Places that are isolated, in the sense that transit options do not exist, will suffer, especially in an era of increasing oil prices. “The outer suburbs are likely to suffer most in the coming energy and credit barrage” (Dodson and Sipe, 2008).

Public Transportation Demand Elasticity

Historically, at low oil prices, public transportation use has been shown to be dependent on the density of an area. “Transit needs densities over 14 people and jobs per acre, and for walking and bicycling to be dominant requires densities over 100 people and jobs per acre. Most new suburbs are rarely more than six or seven people and jobs per acre” (Newman, 2009).

However, the increase in oil prices that was seen in the 2000s suggests that density is not the sole determinant of public transit support. “The Industry Commission suggested that the demand elasticities for public transport relative to fuel prices

(DEPTP) was 0.07, suggesting that a 1.0 per cent fuel price increase will produce a 0.07 per cent increase in public transport use. De Jong et al. suggest the long run DEPTP is 0.26. [However] historic demand elasticity figures may not be valid bases for assessments in circumstances where a long term expectation of sustained fuel cost increases is apparent." (Dodson and Sipe, 2005) The paper goes on to cite figures of 14 percent transport increases during over a period that saw a 20 percent increase in the price of gasoline. (July and August 2005 vs 2004). This is a faster rate of increase by an order of magnitude of 10. Indeed common sense would dictate that the DEPTP would not follow a linear growth pattern, as cost increases that households are able to absorb will not affect change in a way that costs that cannot be afforded will. Put differently by Dodson and Sipe (2008) "We're now entering an era when fuel cost will be a far more important factor in travel choices [than density]."

Local Disadvantage and the Regressive City

In addressing the impacts of rising transportation costs on the poor, it may seem obvious but it bears pointing out that, as according to the Center for Neighborhood Technology report *Driven to Spend* "lower income households are particularly burdened by higher transportation costs since these expenditures claim a higher percentage of their budgets even if they are spending less." While people are able to adapt their housing choices to their budgets, transportation is a more obligatory cost. According to the presentation "Building Sustainable Communities" by Beth Osborne, Deputy Assistant Secretary for transportation policy at the US Dept. of Transportation, households in transit rich neighborhoods spend 9% of their budgets on transport costs, while the average American family spends 19%, and those in "auto-dependent exurbs" spend 25% of their household budgets on transportation. Their same figures cite all

households in the three zones spending an average of 32% of their budgets on housing costs. This suggests that people are willing to spend equal proportions of their incomes on housing, and those that are priced into exurban markets are bearing the highest transportation costs (Osborne, 2011). This is borne out in the fact that low income households spent 4% of their total budgets on gasoline (at 2002 gas prices) while a median-income family spent only 2.3% according to Bureau of Labor Statistics data, as cited by the Center for Neighborhood Technology. These figures are despite the fact that low-income households spend less in aggregate than medium and high earning households. However, this difference is small. “The difference between expenditures of a household earning $40,000 and a household earning twice that much is only about $500 [with the average $40,000 household spending $1,500]” (CNT, 2005). Therefore, an increase in the cost of gas (with current prices near double 2002 levels) will adversely affect low income groups.

While housing has a threshold of unaffordability (30% of household budget), transportation has no such measure. What is documented is that when the proportion of a household’s budget spent on transportation becomes too high, mode shifts to save money will happen, if the infrastructure is there. A major issue with our current cities that prevents this from happening is the ‘locational disadvantage’ of “outer suburban households who are forced to make trade-offs between affordability and access to infrastructure and services” (Dodson and Sipe, 2008). This means that the people who undertake the drive to qualify in order to gain housing affordability are those that will most need to save money through mode shifts once oil prices rise. Locational disadvantage refers to the fact that working class people are moving outside of the

service provision they need. Wealthier communities tend to be closer to the city center and therefore receive better transportation services. “Households who move to outer suburban areas to attain home ownership become more car dependent as a result of their shift… this means that the costs of higher fuel prices will be borne most heavily by those with the least capacity to pay” (Dodson and Sipe, 2008). Because of this reality, any effort to address oil vulnerability must address service provision to isolated working class communities, through affecting land use decisions to bring more working-class affordable housing closer to the center and bringing transport options to those that are isolated in car dependent exurbs.

It is troubling, therefore, to note that the processes underlying the regressive city are increasing rather than decreasing. “Growth in social polarization and the spatial segregation of various socio-economic groups [are] key dimensions of recent urban change” (Dodson, Gleeson, and Sipe, 2004). Dodson, Gleeson and Sipe also note that the US experiences the ‘most extreme’ socio-spatial polarization and spatial exclusion in the world. Addressing our economic segregation would lend itself to increasing resilience to oil vulnerability. Social exclusion can be defined as economic factors preventing households from accessing social services or adequate housing. It is our housing market, and the aforementioned ‘drive to qualify’ (among other factors not to be discussed here) that is driving this polarization. Put in other words, “if the future is left to short-term market interests it will lead rapidly to the divided city” (Newman et al.. 2009).

Another way to measure this polarization and its effect on oil vulnerability is to look at the transportation costs of each income quintile. Dodson and Sipe (2008), have shown that the middle fifth quintile and the next income bracket down spend the largest

proportion of their incomes on transportation. “These are the working families who traverse vast distances to work.” This shows that the lower-middle class stands to be most affected by an increase in oil prices. The rise in the price of oil will not be fairly distributed under our current urban form.

United States Outlook for Oil Resilience

In a study prepared by the US Government Accountability Office (2007), designed to assess the US Government and US economy’s preparedness for peak oil, no suitable alternatives were identified. Furthermore, the ability to track oil’s production peak was found to be lacking.

The main issue in adapting to an alternative technology as identified in the GAO report was the time necessary to get supporting infrastructure in place. No alternative technology has the infrastructure necessary to supply more than a trivial amount of the overall demand in the United States.

While government investment in alternative infrastructure has not been nonexistent, it has been piecemeal. Ethanol, biodiesel, electric, hydrogen, syngas (biomass), coal gasification, and natural gas vehicles were all evaluated by the report, and despite sizeable investments in more than one of the technologies, none would be able to fill demand in the absence of oil. Furthermore, none would be able to “ramp up” quickly enough to fill in necessary supply in a peak-oil scenario in which production is expected to decrease at an increasing rate each year.

“DOE projects that alternative technologies… have the potential to displace up to the equivalent of 34 percent of annual U.S. consumption of petroleum products in the 2025 through 2030 time frame. However, DOE also considers these projections optimistic—it assumes that sufficient time and effort are dedicated to the development

of these technologies to overcome the challenges they face." This fact is troubling when viewed in light of the report's admission that oil may very well peak within that timeframe.

The report also assessed the preparation of the US government to respond to a crisis of peak oil. It found that efforts to address peak oil are dispersed throughout different agencies without proper coordination between efforts. The main recommendation of the report is to have the Secretary of Energy work with all other government agencies and prioritize goals with those agencies. Of key concern are efforts to assess the timing of a peak in oil production. The reports subtitle, "Uncertainty about Future Oil Supply Makes It Important to Develop a Strategy for Addressing a Peak and Decline in Oil Production" highlights a pragmatic attitude in which oil is not needed to be replaced wholesale, but rather alternatives (in all their forms, including demand reduction) only need to keep pace with decreases of production.

It is acknowledged that the transition period in which alternatives are expected to replace oil production will have undesirable consequences, "A number of studies we reviewed indicate that most of the U.S. recessions in the post-World War II era were preceded by oil supply shocks and the associated sudden rise in oil prices" (US GAO, 2011). However, the study stops short of calling for a major effort to prevent a harsh transition, which would entail reduction of oil dependence before the peak. Rather, the report puts emphasis on having the necessary preparations for alternatives to step in post-peak. Regardless, the report acknowledges the consequences of inaction to be "severe economic damage. While these consequences would be felt globally, the United States, as the largest consumer of oil and one of the nations most heavily dependent on

oil for transportation, may be especially vulnerable among the industrialized nations of the world" (US GAO, p. 40).

Oil Vulnerability Models

The work of Jago Dodson and Neil Sipe has been instrumental in establishing oil vulnerability as an area of study. They have had success around their native Australia in bringing outside interest to the topic, most notably with the Queensland Government's 2007 "Oil Vulnerability Taskforce Report". However, their work has been confined to Australian cities. Throughout their body of work they have created and revised oil vulnerability assessments for Brisbane, Sydney, Melbourne, Adelaide, and Perth.

While this thesis will run a VAMPIRE model, Dodson and Sipe began their work with the VIPER model. VIPER stands for vulnerability index for petrol expense rises. In their words, it aims to "assess the potential exposure of households to adverse socioeconomic outcomes arising from increased fuel costs, [and serve as] a basic locational measure of oil vulnerability" (2007).

One point that Dodson and Sipe repeatedly stress in their papers is that they expect their rudimentary models will be expanded upon and refined. There has not been any efforts to date to do so but there exists many opportunities to achieve a more precise measurement of oil vulnerability. How this can be done will be more apparent after detailing the individual components of the model.

The VIPER model is composed of three variables that are readily available in the Australian census. They are mapped at the Census Collection District, the Australian equivalent of the census block. The variables are socioeconomic index for the area (SEIFA), the percent of households with 2 or more cars, and car use for the journey to work. This model then gives an average for the entire census block.

SEIFA scores take into account many different socioeconomic variables that aren't particularly useful to the measurement of oil vulnerability, such as age. However, the fundamental fact is that "higher socioeconomic households are more financially capable of absorbing increasing transport costs than lower socioeconomic status households and are therefore less vulnerable to petrol price rises" (Dodson and Sipe, 2007).

In addition to socioeconomic status, the VIPER's remaining two variables take into account car dependence. The household motor vehicle ownership levels are assumed to be tied to the overall demand for car travel. It is assumed that increased exposure to motor vehicle need indicates greater exposure to oil usage.

The journey to work mode is a good indicator of auto-dependence, as the rate of auto use is characteristically less for commutes than overall mode choice. Therefore, people are more likely to take an alternate mode for their commute than on other trips. The auto usage for journey to work therefore reflects dependence better.

The VIPER model then weights the variables into a composite index. Each variable is first assigned a percentile rank, between 5 and 0, based on which percentile (10,25,50,75,90) range the values fall in for each city/study area. The socioeconomic indicator (SEIFA), however, is given equal weight with the two automobile dependence variables, and its 0-5 value is doubled (Dodson and SIpe, 2007).

The results of the VIPER analysis on various Australian cities indicate that "each city displays clear spatial patterns that indicate a highly uneven distribution of potential vulnerability to oil price pressures" (Dodson and Sipe, 2005).

The VIPER model was the first model used to measure oil dependence. It has since been refined by the same authors, Dodson and Sipe, who now use the VAMPIRE

(vulnerability assessment for mortgage, pertroleum, and inflation risks and expenditure) index, an updated version of the VIPER, and the index used in this thesis.

The VAMPIRE index modifies the variables found in the VIPER, keeping the two measures of car dependence, but changing the composite socioeconomic indicator (SEIFA) to a simple median household income. The simple measure of household income is sufficient to gain an understanding of a household's ability to "absorb fuel and general price increases" (Dodson and Sipe, 2008).

Finally, the VAMPIRE adds in the proportion of households with a mortgage. By using mortgage prevalence, household exposure to interest rate rises is taken into account. This is important to consider because of the "association between higher fuel prices and inflation". Rising inflation puts pressure on interest rates, and "interest rate increases have resulted in higher mortgage interest rates" (Dodson and Sipe, 2008).

Outer ring suburbs have, on average, higher rates of mortgage prevalence. This combines with moderate incomes and greater transportation/oil costs to heighten disproportionate impacts of oil vulnerability

The VAMPIRE provides a "basic, but comprehensive, spatial representation of household mortgage and oil vulnerability" (Dodson and Sipe, 2008). It is important to note, however, that it is a "relative, not absolute, oil vulnerability, meaning it can be used for comparative assessments of localities within, but not between cities" (Dodson and Sipe, 2005). This analysis will show what the most impacted areas within each city will be, but does not address the general state of resiliency for each urban area. For example, the least resilient American city, Atlanta, is likely to not show any areas of even moderate resilience if it were compared to a place like New York City, but will still

show a wide range if its districts are compared solely within the region. This switch from relative to absolute measurements of oil vulnerability are doubtless what Jago Dodson and Neil Sipe had in mind when they expressed a desire to see their models elaborated upon, as they have talked about such a shortcoming in the “limitations to study” section of all of their papers. To develop the model beyond a “relative” assessment is beyond the scope of a thesis and therefore their established method will be used.

Conclusion of Literature Review

The analysis of the oil vulnerability and resilience literature has shown that housing and transportation policy need to be addressed together. The financial impact of poor transport options are too large, at household, regional, and even national scales, to ignore. To address transport cost as a percentage of income, the housing market must play a role, along with the expansion of transportation options. Diversity must be achieved where there is economic segregation; diversity must be achieved where there are fewest transportation options. Rising oil prices will target these weaknesses in our society and magnify their impacts. Without bringing transportation into the equation of housing affordability, transportation policy will serve to strengthen these structural weaknesses.

CHAPTER 3
METHODOLOGY

The 4 statistics used in the VAMPIRE model are percent of households with 2 or more cars, percent of commutes to work by auto, median area income, and percent of households with a mortgage. These statistics were collected at the census tract level from the US Census Bureau at the website dataferrett.census.gov. The statistics were taken from the aggregate level American Community Survey 5 year summary file, from the period 2006-2010.

Each of the 4 statistics were given a score on a scale from 0 to 5, with 0 being the best performance and 5 the worst. The score ranges used were:

0-9 % - 0

10-24% - 1

25-49% - 2

50-74% - 3

75-89% - 4

90-100%- 5

This range was used for all statistics except income, where the highest incomes were given the lowest scores. The highest income in the county was set to 100%, and all incomes were calculated as a percent of that amount.

The remaining variables are calculated as a simple percentage, the percentage amount of households with the desired characteristic in an area is simply converted straight to a VAMPIRE score.

Each of the scores is then added to give an overall VAMPIRE score, with a possible range of 0 to 30. The variables are divided into 3 categories; each assigned an

equal weight, 1/3 of the total. The 3 categories are income, mortgage tenure, and car dependence. Car dependence is composed of two variables, each contributing half of the weight of the category. Therefore mortgage and income each contribute a possible 10 points each to the total, and journey to work and car ownership each contribute a possible 5 points each to the total.

CHAPTER 4
TAMPA BAY AND HILLSBOROUGH COUNTY CONTEXT AND BACKGROUND

Figure 4-1 is a map of the Tampa Bay area, showing the different employment clusters. What stands out is the dispersion of the employment clusters. While the traditional downtowns of both Tampa and St. Petersburg are employment clusters themselves, the rest of the activity is dispersed throughout the region with clusters of employment in North Saint Petersburg/Clearwater and West Tampa. What Figure 4-1 shows, among other things, is a disconnect between employment clusters and transportation infrastructure. With the exception of the city centers of Tampa and St. Petersburg (themselves not strong clusters), the employment clusters are not served by transit and are somewhat removed from the interstate system. This results in the high transportation costs shown throughout much of the central Tampa area.

According to the US Census "Quickfacts" the demographic information for Hillsborough County is:

- Population, 2010 1,229,226
- Population, percent change, 2000 to 2010 23.1%
- Median household income, 2009 $47,129
- Homeownership rate, 2005-2009 63.5%
- High school graduates, percent of persons age 25+, 2005-2009 85.4%
- Bachelor's degree or higher, pct of persons age 25+, 2005-2009 28.7%
- Mean travel time to work (minutes), workers age 16+, 2005-2009 25.7

The Tampa Bay region of Florida is an unusual metropolitan area. It has high tech and highly skilled manufacturing clusters, but it doesn't have a very educated population. Also, despite a non-exceptional median income, housing and transportation costs combined are the highest in the nation (Lipman, 2006). Transportation infrastructure does not serve the population well:

> This is one of the few metropolitan areas (Miami being the other) where increases in the local concentration of affordable housing are associated with increased transportation costs. This metropolitan area is also rather unique in that housing costs are negatively associated with job density (CNT, 2005).

The profile in Figure 4-2, done by the Center for Neighborhood Technology, shows there to be a large burden of transportation costs, 31% of households are classed in the “severe” burden category (highest transportation/housing cost combination). In addition, it shows that very few of the population lives near where they work (14%), this is reflected in the relatively high commute times.

Tampa Bay and Hillsborough County were selected for this analysis because the Tampa region is a unique area with a broad mix of economic activity, and a chaotic transportation and land use pattern that has created extremes of unaffordability. In a table listing the most expensive regions by combined housing and transportation costs, the report *Driven to Spend* states that “Tampa and Miami are the least affordable MSAs”. Granted that this ranking is for a share of incomes, so that higher incomes will make a region more “affordable”, it is still a good indicator of how the region works for its own economic situation. Transportation costs in the form of oil payments have no local multiplier effect. In an era where it is necessary to plan for transportation costs to increase due to tightening global oil markets, this lack of affordability needs to be addressed in an overarching plan that takes into account the location of jobs, people, and how they are linked.

> In areas where driving is the only way to get around, cutting back on driving can also be doubly costly to the economy, since it means households are… not spending money on local entertainment or restaurants. In times [of increasing transportation costs], areas where people can walk or take transit to places of commerce may be better off. Higher density places with better transit options are losing less per household than those with higher car ownership and lower transit use (CNT, 2005).

Tampa Bay has a chaotic transportation and land use pattern that has resulted in it being the least affordable metropolitan area in the nation for its citizens to live and get around in. People do not live near where they work, and worse yet, do not have good access to their centers of employment. However, these employment centers are widely dispersed throughout the region. There is a small, expanding light rail system that could be used in a program to address linkages between centers of residence and job clusters.

The map in Figure 4-3 shows the first VAMPIRE statistic, median household income in Hillsborough County. What this map shows is higher incomes in the north of the county and south through the center of the county. There are pockets of high incomes along the water near Tampa Bay's downtown. Moderate incomes extend outward into the suburban Eastern part of the county. There are low income areas in the center of the city of Tampa Bay and in the Southern part of the county. The more "far-flung" low income areas are prime targets for high oil vulnerability.

The next VAMPIRE statistic to be used is the percent of households with a mortgage. The map in Figure 4-4 shows an overall high rate of mortgages throughout

the area, with low rates of mortgages roughly corresponding with low income areas. This map differs from the Australian cities analyzed by Jago and Dodson in that the outer areas in the Eastern part of the county have moderate levels of mortgages, while Australian cities all have higher rates in the periphery. The same general pattern of high mortgages follows the high income pattern, with high rates in the north, and extending south in the center of the county. Parts of central Tampa Bay and the South of the county have low rates of mortgages.

By and large, the combinations of higher incomes with increased rates of mortgages will have a moderating effect on oil vulnerability ratings. It will be the exceptions to this trend that will stick out either positively or negatively, but based on these two statistics, (2/3rds of the weight of the model) most census tracts will score in the mid-range of vulnerability. This is due to the aforementioned atypical spatial distribution of jobs and housing in which there is no dominant center, and furthermore there is no evidence of a strong historical center, in which concentric patterns of development would take place radiating out from the center. This concentric model is common throughout the world, showing itself strongly in Jago and Dodson's work in Australia, but not in the United States, where Tampa Bay has a typically "polycentric" development.

The next statistics used by the VAMPIRE address car-dependence. Percent of houses with 2 or more cars is shown in Figure 4-5, percent of houses with 3 cars in Figure 4-6, and percent of houses with 4 or more cars in Figure 4-7. These three statistics were combined to produce one "2 or more" metric.

In these maps, Tampa Bay is finally conforming to what would be expected of it. The areas near the center of the city have lower rates of high auto ownership, while those areas least served by transit, in the Eastern part of the county, have the highest rates of auto-ownership. This is consistent with the expectations and results of Jago and Dodson in Australia. However, the results may be skewed by the widespread ownership of 2 cars per household. While 2 or more cars was sufficient to achieve a stark spatial segregation in Australia, the same general pattern does not emerge for Tampa Bay until 3 and 4 or more cars is taken into account. Therefore the VAMPIRE model may be distorted by the cultural difference of car ownership generally being higher in the United States.

This statistic once again shows an overall moderate amount of vulnerability, by looking into the data further, we can see separation, but the VAMPIRE model only cares about 2 or more cars per household. A household with 2 cars is counted the same as one with 4 or more cars in the model. However, the amount of households with 2 or more cars may be adequate in that the amount of households with only 2 cars closer to the center of Tampa Bay may be constrained by other factors such as space and parking availability, and it is possible that their auto-dependence is high despite showing less extreme rates of auto ownership. In this light, the 2 or more statistic would be adequate. Regardless to change, the model would require further research. It is quite possible, especially given Tampa Bay's awful public transportation system for a city of its size (even by US standards), that the widespread oil vulnerability shown in this statistic is accurate, and any desire for spatial differentiation is arbitrary.

The final statistic used in the VAMPIRE model is the percent of commutes done by auto. It is shown in Figure 4-8. The census statistic used includes car, truck, or van.

Overall, Tampa Bay has a very high rate of auto-dependent commuting, as would be expected given its poor public transportation system. What is not to be expected (but again in line with its spatial mish-mash development shown in the other statistics) is that proximity to the center of Tampa Bay does not lower the rate of commuting by auto. It is expected that this statistic would buck Tampa Bay's trend of being unorganized, due to the existence of the small light rail system near the center of the city. While the area with light rail is on the lower side of auto commuting, it does not stand out in any pattern. Instead it fits into an oddly distributed patch work of pockets of lower auto commuting throughout the region.

What does stand out with this statistic is the pattern of high auto-commute rates in the higher-income areas. While the northern part of the county has mixed rates of high auto commuting, the high-income area extending south through the center of the county has the highest rates. It would seem that income drives rates of commuting by auto, but there are many exceptions. The northern, high income area has exceptions of lower auto-commuting, and the moderate income south eastern area has high rates of auto commuting. While the center of Tampa Bay does not look as one would expect, the south east does behave like the car-dependent suburban area that would be expected.

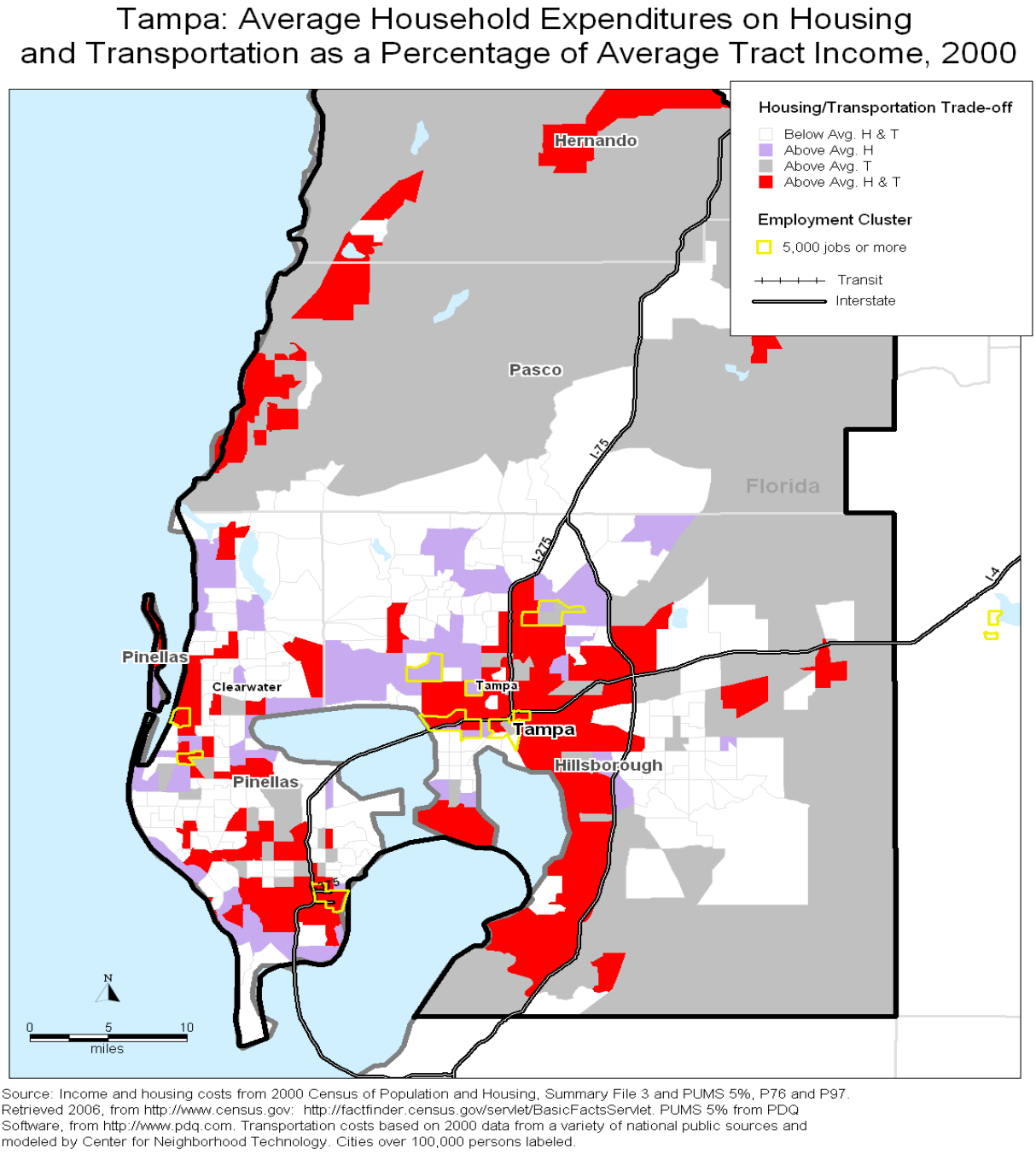

Figure 4-1. Tampa: average household expenditures on housing and transportation as a percentage of average tract income, 2000. Center for Neighborhood Technology. (CNT) "Driven to Spend: Pumping Dollars out of Our Households and Communities." *Surface Transportation Policy Project.* (2005)

Profile: Tampa, FL MSA	
Combined Housing and Transportation Category:	Low H, High T
Housing Market:	Hot Single Family Market
Households earning 30-50% HAMFI with Severe Burden:	31%
Affordable Housing Shortage:	Medium
Transportation: % Non-Auto Commute, Rail Transit System Size, 2003 Congestion:	4%, Small Expanding Rail System
Jobs-Housing: % of Pop. living near an Employment Center (EC), % of Jobs in ECs:	14%, 18%

Figure 4-2. Tampa, FL profile. Center for Neighborhood Technology. (CNT) “Driven to Spend: Pumping Dollars out of Our Households and Communities.” *Surface Transportation Policy Project. (*2005)

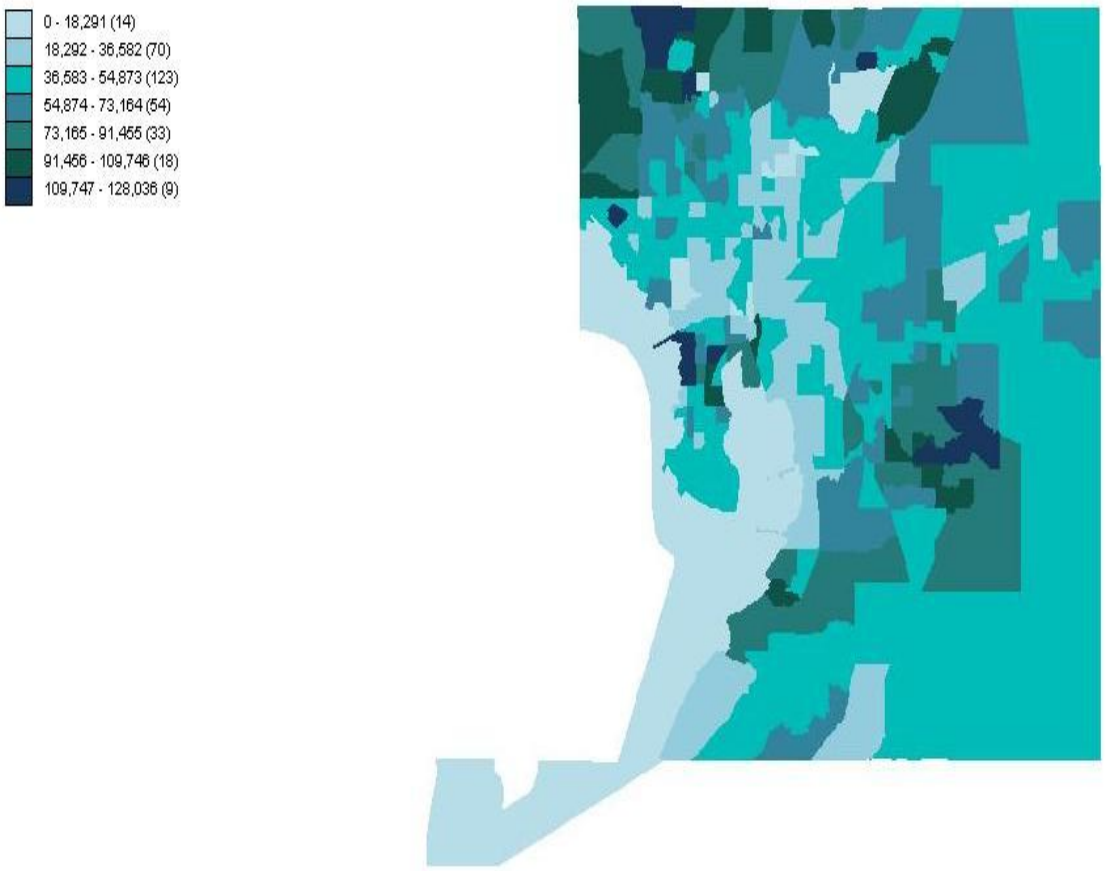

Figure 4-3 Median household income for Hillsborough County by census tract. Prepared with data from the US Census.

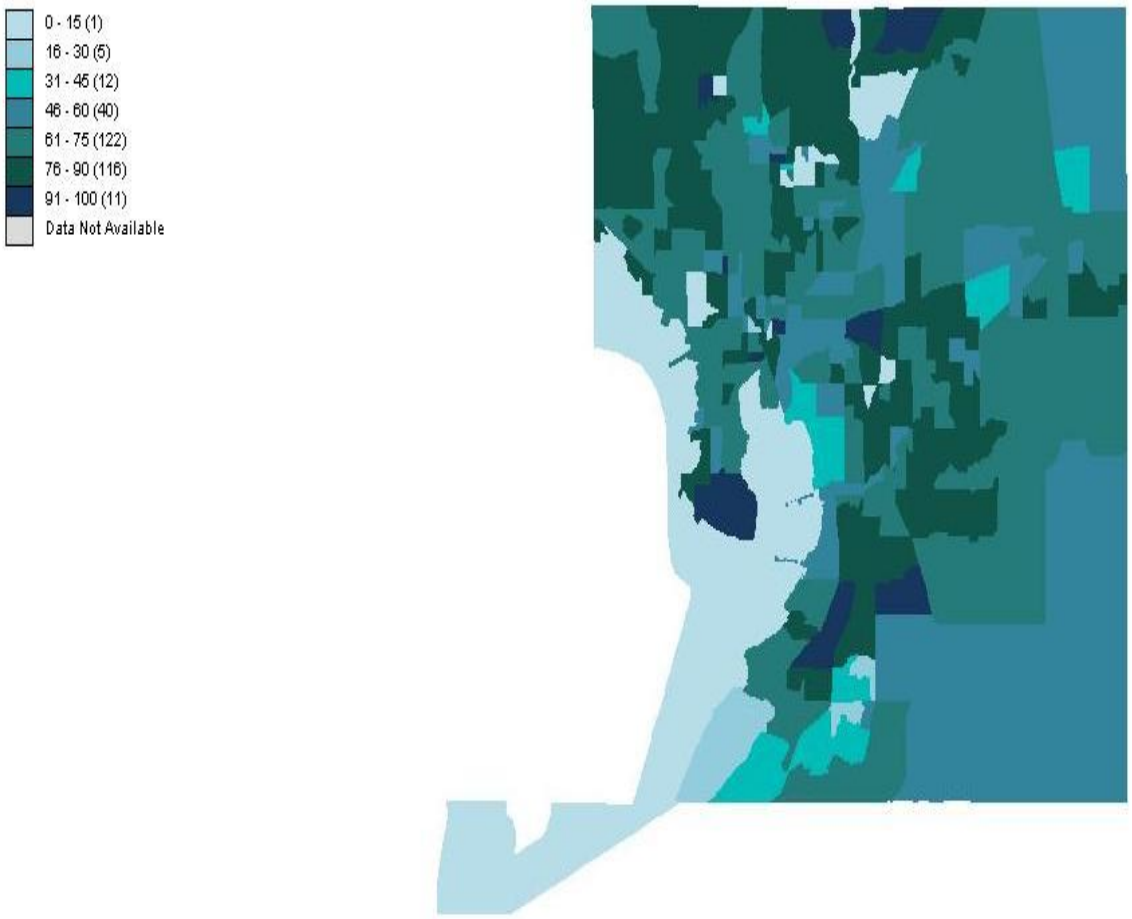

Figure 4-4 Percent of households with a mortgage for Hillsborough County by census tract. Prepared with data from the US Census.

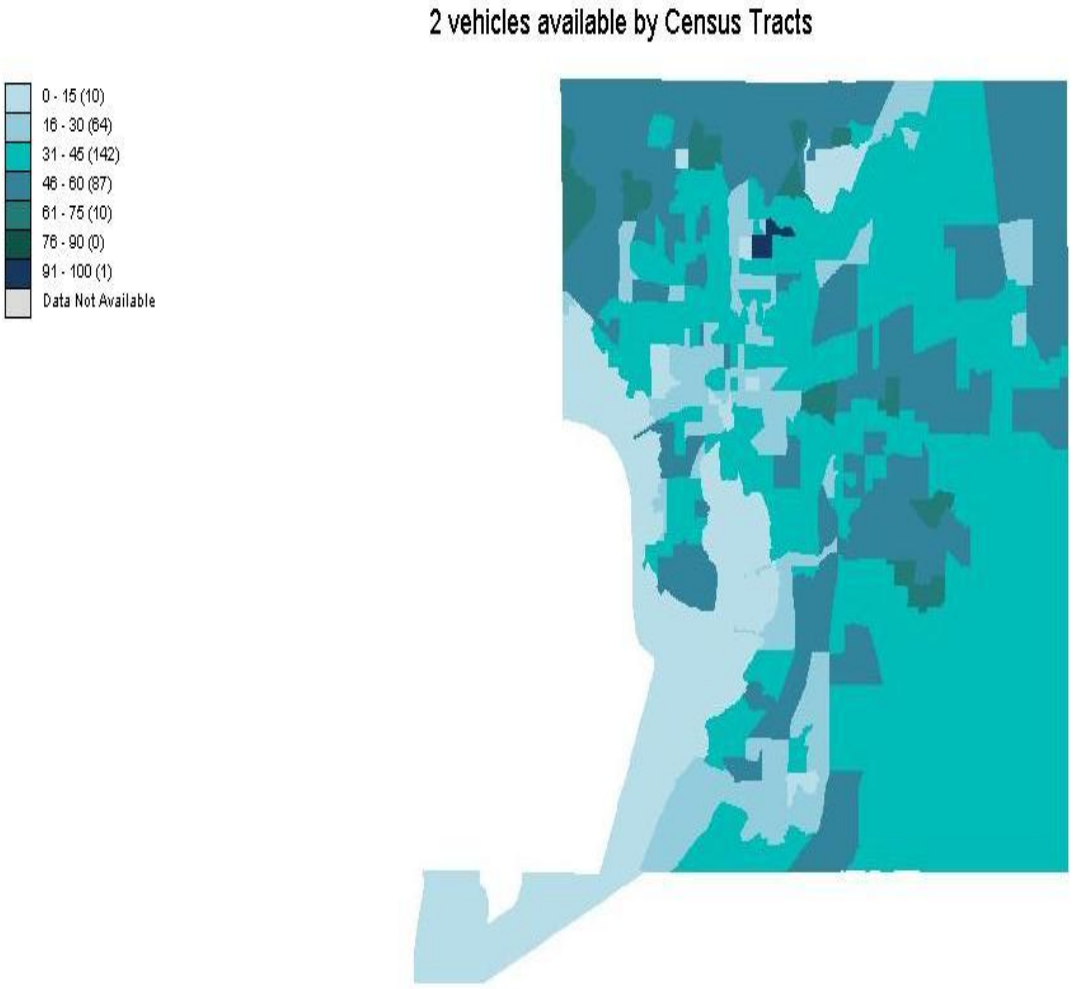

Figure 4-5 Percent of households with 2 vehicles for Hillsborough County by census tract. Prepared with data from the US Census.

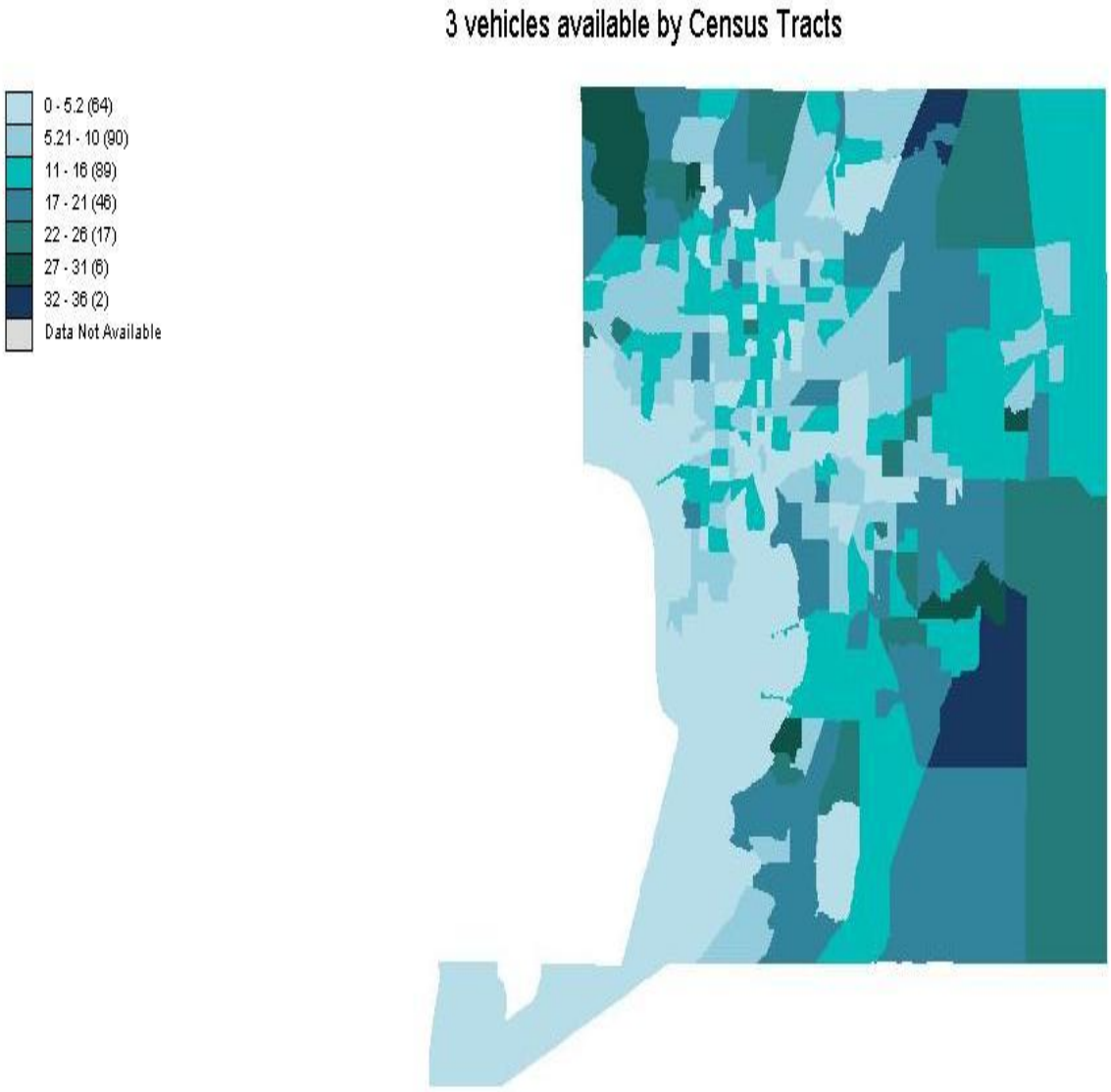

Figure 4-6 Percent of households with 3 vehicles for Hillsborough County by census tract. Prepared with data from the US Census.

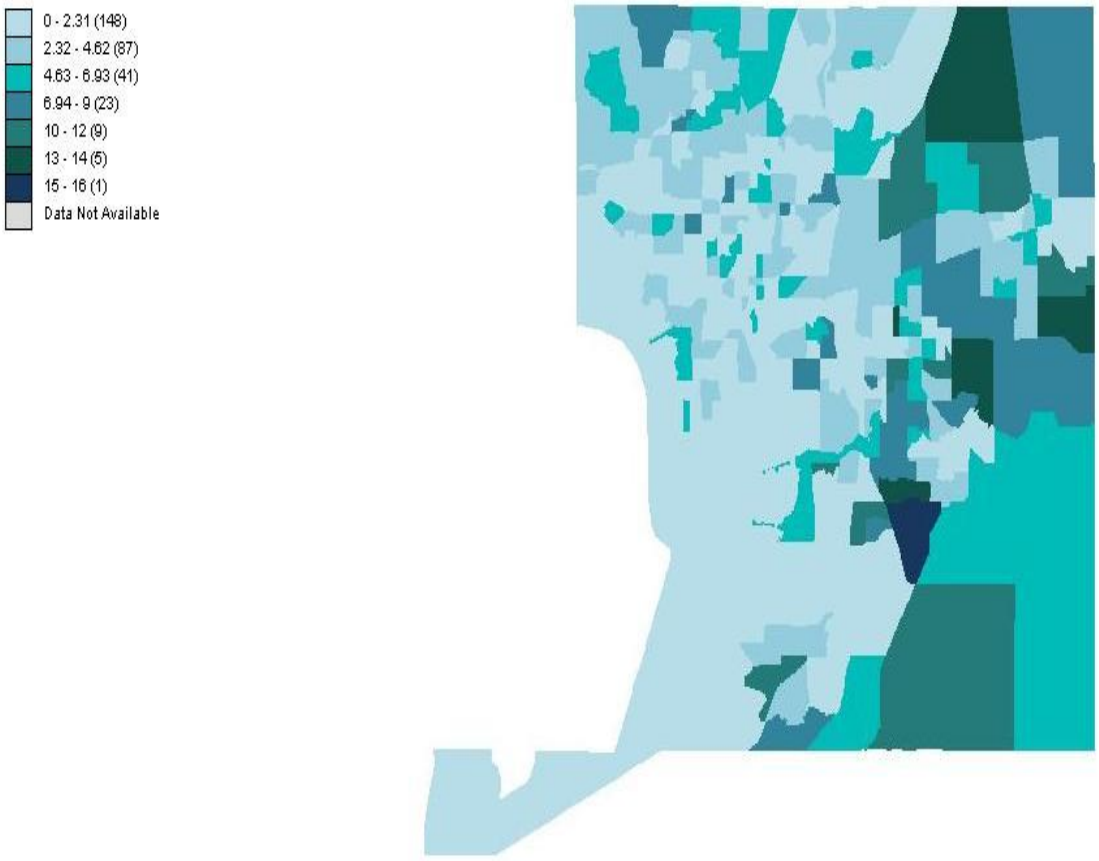

Figure 4-7 Percent of households with 4 or more vehicles for Hillsborough County by census tract. Prepared with data from the US Census.

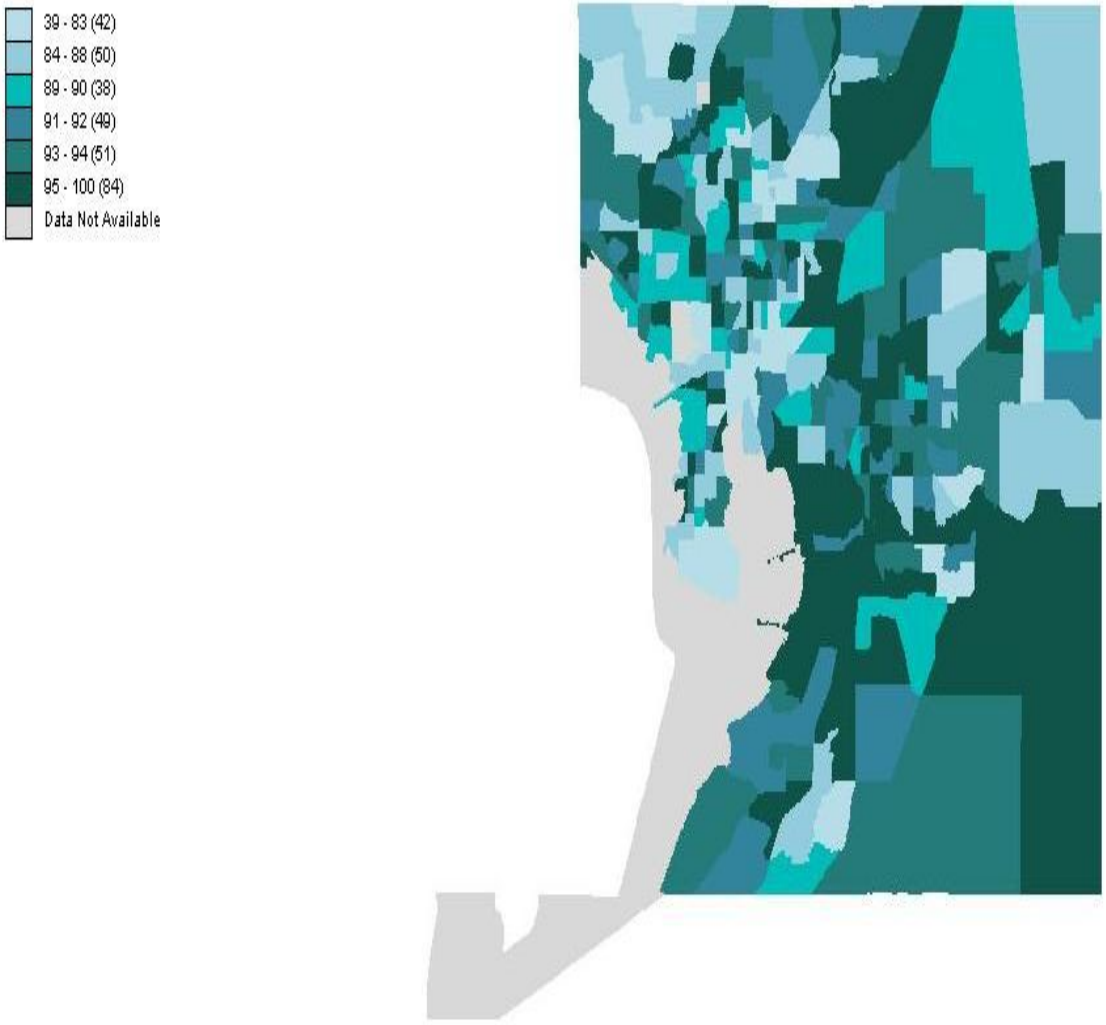

Figure 4-8 Percent of commutes by car, truck, or van for Hillsborough County by census tract. Prepared with data from the US Census.

CHAPTER 5
DISCUSSION OF RESULTS

Results of Hillsborough VAMPIRE and Comparison to Melbourne VAMPIRE

The Melbourne VAMPIRE (shown in Figure 5-1), mimics what the hypothesis expected of the Tampa Bay VAMPIRE (shown in Figure 5-2). There is low vulnerability close to the city center, as more renters, more transit options, and a mix of incomes keep vulnerability very low. The range of vulnerability for Melbourne is very wide, however, from one to 22. The high end of the range is again in the expected areas, the outer suburban areas. While there are pockets of low-vulnerability exceptions, there are no areas of high vulnerability within the city center, and the majority of the first concentric circle surrounding the center is of a moderate vulnerability. This gives a very clear policy direction, as Jago and Dodson (2008) have argued that extending services to the outer suburbs is of paramount importance.

The results of mapping oil and mortgage vulnerability show the hypothesis to be wrong on two key points. First is the expectation for there to be a circular pattern to the data in which rings of vulnerability radiate from the city center. The opposite is in fact true; there are more moderate vulnerabilities in the outer periphery of the city center both to the north and to the south.

Because of the lack of this organizational pattern, the second hypothesized point, that there would be a larger outer ‘high vulnerability’ ring and a smaller ‘low vulnerability’ core than those shown in the Australian cities, is also wrong.

A final hypothesized point, that there would be a greater overall oil vulnerability is by all standards of measurement correct. The range of vulnerability on the VAMPIRE score for Tampa Bay extends from 12 to 24, while the Melbourne VAMPIRE has a

range from 1 to 22. In addition, there are less tracts that score in the low range end of the range in Tampa Bay, while the majority of Melbourne's data points are in the bottom two vulnerability classes.

Discussion

The Hillsborough VAMPIRE analysis shows a largely unorganized dispersal of oil vulnerability, especially when compared to the Melbourne or other Australian analyses. There are pockets of low vulnerability in the high-income northern areas, and somewhat extending south into the high income swath through the center of the county. Perhaps most surprising is the relatively low vulnerabilities in the southernmost part of the county, south of the Brandon area. What can be considered the center of Tampa Bay has pockets of low vulnerability, especially the area due west of downtown. Finally, the area between Brandon and Tampa shows high vulnerability.

The vulnerabilities shown in the index are a composite of the different variables used, but it is possible to analyze the data based on what different variables are contributing to the score. For example the low income areas with high vulnerabilities are north and east of downtown Tampa. The more car dependent vulnerabilities are in the east of the county, and the more mortgage related vulnerabilities are in the higher income northern part of the county.

A stark contrast between the Tampa Bay and the Australian cities is the lack of a pattern in which vulnerability increases as the city extends farther from the center. The outline census tracts show a moderate level of vulnerability, and overall fit into the seemingly random manner in which vulnerability is dispersed throughout the county.

Another way in which the results run counter to expectations is the dispersal of very-high vulnerability areas. Again, in Australian cities these are almost exclusively in

the periphery of the urban area, however in Tampa they are evenly distributed throughout the region. Perhaps most surprisingly of all is the existence of very high vulnerabilities near the center of Tampa Bay.

Overall, the main takeaway from the mapping of Tampa Bay's oil vulnerability is a general dispersal of moderate-to-high vulnerabilities, with the better performing clusters in the North-West, the South-West and areas to the West of the city center. Beyond these weak clusters, there is no clear pattern to the results.

This general, random distribution makes more sense when viewed in a context of the bewildering distribution of transit affordability and jobs clusters. There is no real center to Tampa Bay in more than a symbolic sense. There is no transit system that exerts a significant control over the statistics used in the VAMPIRE model. Tampa Bay and Hillsborough County are part of a larger region that the data suggest has many dispersed "edge cities" exerting their own influences on the region.

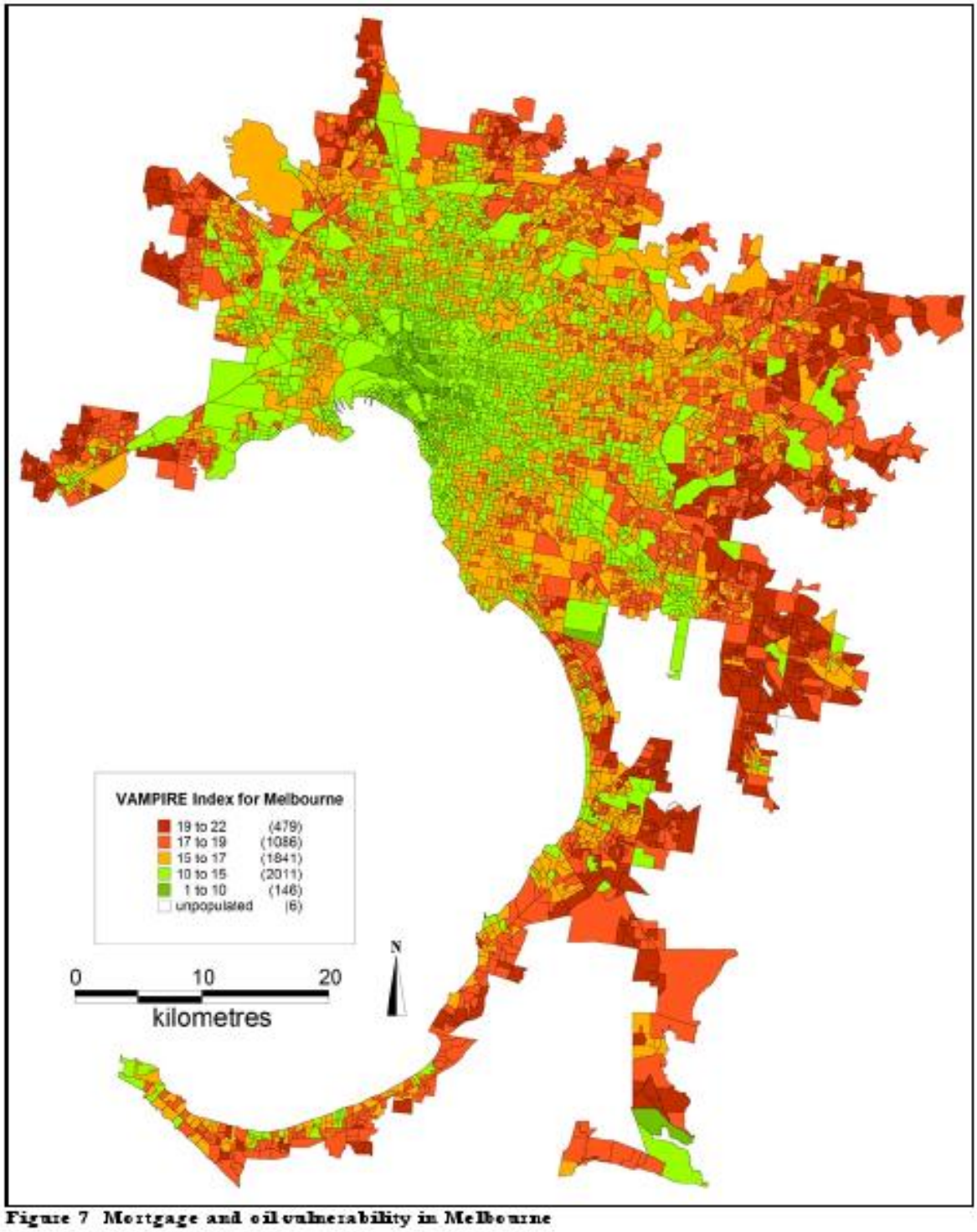

Figure 7 Mortgage and oil vulnerability in Melbourne

Figure 5-1 Melbourne VAMPIRE. Dodson, J. and Sipe, N. “Shocking the Suburbs: Oil vulnerability in the Australian city”. Sydney: UNSW

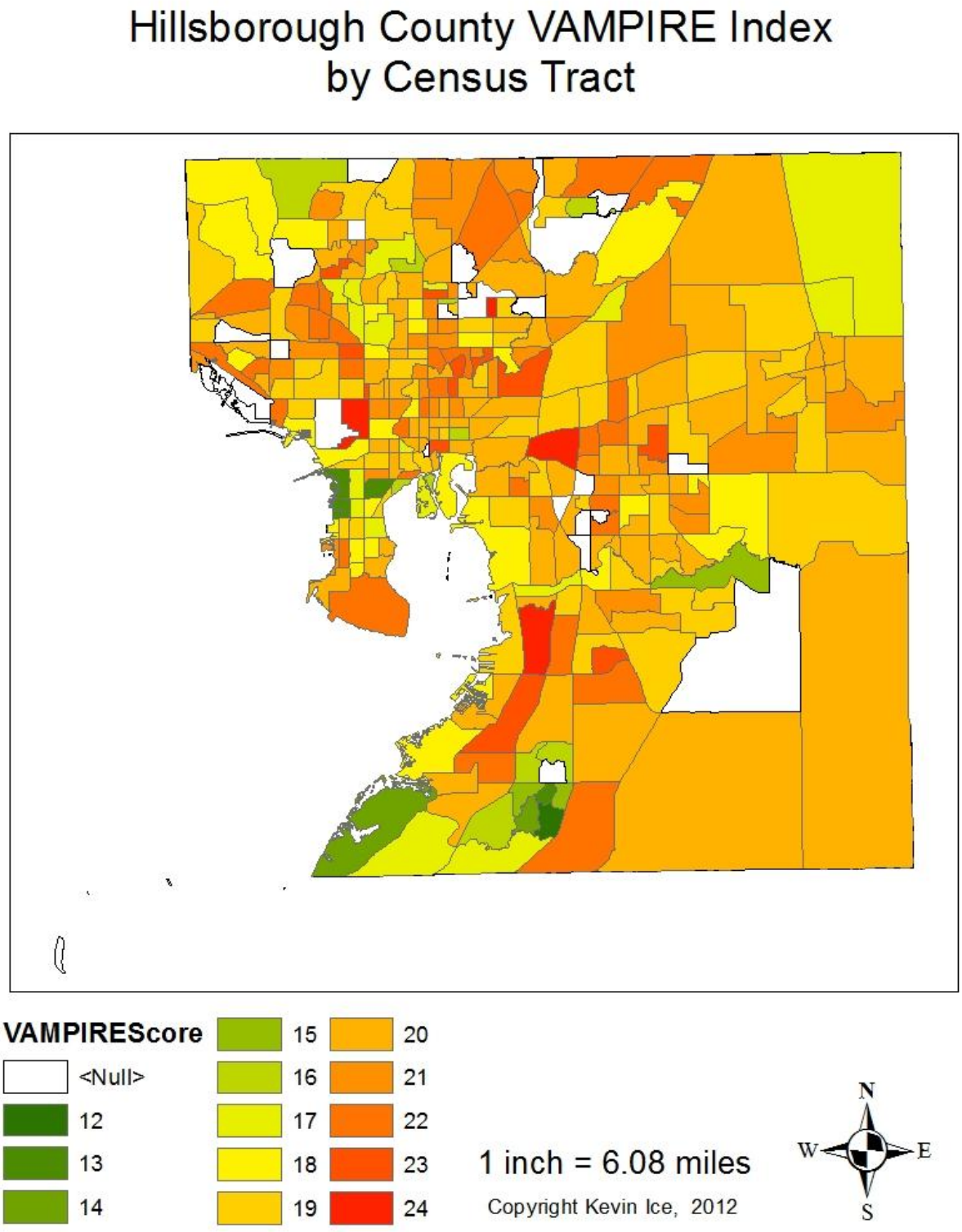

Figure 5-2 Hillsborough VAMPIRE. Prepared with data from the US Census.

CHAPTER 6
POLICY DISCUSSION

In examining this data for policy implications, it is first helpful to frame how to look at the data. The measurement of oil vulnerability is not an exact process, and it has no correlation to expected quantities of damages. Instead, what it does is compare the different tracts within the region against the rest of the region. This is useful in determining what the most impacted areas are likely to be, as well as where negative effects are likely to first be seen.

Because of these reasons, the middle-range vulnerability data are less useful from a policy formation standpoint than the two extremes. The low vulnerability areas warrant a closer look as to what they've "done right", and the high extreme highlights the areas most in need of intervention.

From a policy perspective, however, not all the vulnerabilities are of the most pressing need. The income based vulnerabilities to the north and east of downtown are of more concern than the mortgage=based vulnerabilities in the northern parts of the county.

Tampa Bay has a general oil vulnerability problem. There is a distinct lack of transit options. Jobs are dispersed in a way that sees the majority of commuters, even those living in the city, travelling a relatively large distance to get to work. Housing is not attractive close to the job centers. In effect the disparate job centers of Hillsborough County have all experienced a decentralization process of their own that has resulted in substandard housing options.

To address this, Tampa Bay needs to have an accurate accounting of jobs and transit, and make a concerted effort to link the two. An analysis of the Tampa Bay

transportation system shows the existing rail system to be linked to cultural amenities, and historic city attractions. The main job clusters, however, are along the 275 corridor extending north. The streetcar and transit infrastructure serving downtown starts South of 275 and continues South to the Canal District, with connections to the Ybor streetcar. Furthermore, Figure 4-1 shows the 275 corridor and North of the 275 corridor to suffer from both above average housing and transportation costs, and the VAMPIRE analysis has shown the area to fit into the greater Tampa area's high oil vulnerability pattern.

The center of the region's jobs clusters should not suffer from high transportation costs. The area has a large amount of built-in demand, and it presents itself as the best possible way to address the Tampa Bay area's oil vulnerability. The 275 is over capacity and does not adequately serve the area's transportation needs, further improving the viability of extending high-quality transit north. The area's plans involve more auto-dependence, and inadequacy, "Plans have been drawn to widen Interstate 275 in the Northeast Corridor (North of Downtown) to a cross-section that is 10-12 lanes wide. Even with these added lanes, by 2035 this section of roadway would still be 28% over capacity; in order to make this roadway fit capacity it would have to be expanded to 16 lanes wide" (Hillsborough MPO, 2009). This inadequate transportation infrastructure has resulted in high oil vulnerability and transportation costs precisely in the place where those qualities should be the best in the region.

To use this study for policy formation, it is important to understand why the model has given the results that it has. High rates of auto dependence in the poorer areas would present the most pressing areas of high oil vulnerability. These areas are concentrated north and east of downtown Tampa. As it turns out, the areas that would

most be served by the connection of jobs to housing are precisely the areas that are vulnerable due to higher car dependence coupled with low incomes. These are the areas of highest priority to address oil dependence in.

CHAPTER 7
LIMITATIONS OF THE STUDY AND RECOMMENDATIONS FOR FURTHER RESEARCH

A major limitation of the study stems from the nature of predictions. “The uncertainty over the future cost of fuel is matched by uncertainty about the nature of household response” (Dodson and Sipe, 2005).

Another major limitation of the study is in the statistics used in the model. Dodson and Sipe (2007), say that “if a better data set were available that could reveal information about household socio-economic status, vehicle and travel costs, and the access to and use of different travel modes… a more sophisticated analysis could [be done].”

The model could be refined by an attempt to measure more accurately the household level constraints. Such a study would likely take into account housing/travel budgets as a percentage of income, (“housing stress”, with travel costs integrated) as well as transit accessibility and capacity. It could be assumed that given accessible transit service and sufficient capacity, individuals under severe transportation cost stress would make a modal change. In addition, measuring the VMT at a household level, perhaps though a length of commute analysis, would give more detail about not just the need for auto travel, but the need for how much auto travel. This could then be weighted against incomes to give a clearer assessment, than a basic median household income, of the amount of stress a household would experience if gas prices increased substantially. The phenomenon of being “house poor”, in which incomes are high, but disposable income is sacrificed to housing costs, underlines this concept, though it stretches the concept of “house poor” to include transportation costs.

The other statistics used have limitations worth noting. The mortgage variable has the most pressing limitation, given the adaptation of the model from Australia to the United States. The theory behind using the mortgage variable is based on the exposure of areas dependent on homeownership to interest rate increases.

As oil prices increase, inflation is fuelled. The typical response of a central bank is to combat inflation by increasing interest rates. This for example is what happened in the mid-2000s oil price spike in Australia. The United States, however, responded atypically. The Fed decided to actually lower interest rates, in an effort to boost Wall Street and stimulate consumer demand. When oil price spikes result in lowered interest rates, the mortgage statistic loses its relevance to the model. The lowered interest rates result in increased inflation, which affects equally across society, magnifying the importance of the income variable in the model. Housing tenure in such a situation does not describe the necessary process.

The mortgage statistic highlights the issues in adapting an Australian study to the United States. The nature of how their cities operate is different. They have not experienced “white flight” and the accompanying disinvestment from the central city. This disinvestment associated with the suburbanization of our nation has given our cities a unique development pattern that would demand a tailor-made approach to their study in order to get the best idea of the true nature of oil vulnerability.

A good example of how the different realities found in the different countries can affect the study of oil vulnerability is found in the measurement of car dependence. The first of the two statistics used was the percent of households with 2 or more cars. In Australian cities this generally results in higher rates in the periphery and lower rates

closer to the central city. In Hillsborough county, however, this statistic produced overall high rates throughout the county. By breaking down the statistic into households with 3 cars, and households with 4 or more cars, the patterns start to emulate the Australian results, with higher levels outside of the city center. Perhaps the relative increase in cars per household outside the city center does indeed reflect an increased need for auto-based travel in those areas, but the threshold being set at 2 or more cars misses this nuance. 2 cars per household appears to be a cultural norm, and lower amounts appear to be found in the lower-income areas, which does not appear to reflect a decreased "dependence" on auto-travel, just an ability to pay for it. It is unlikely that central city areas with lower rates of households with 2 or more vehicles are that way because of a significant difference in transit provision, because the Tampa area's transit is largely unused throughout the region. In impoverished areas where transit ridership is higher and car ownership is lower, there is no basis to declare that transit provision is inherently better, or that car dependence is structurally different.

This could reflect factors other than "car dependence" per se. For example, the American "car culture" may play a larger role than transportation need in determining cars per household. Household size and income may play just as large a role as

A limitation of this thesis study is that of scope. By looking at only Hillsborough County, there is the potential that greater patterns could exist. However, expanded scope is unnecessary to determine that what is shown is valid. Both city center and fringe areas were studied, and the lack of any true "center", as far as improved performance is concerned, speaks loudly for how the greater area is expected to behave.

CHAPTER 8
CONCLUSION

This thesis ran a VAMPIRE model in Hillsborough County, FL. The results were not entirely consistent with the assumptions made based on previous studies with the model. The fact that the results are contrary to the assumptions that can be taken from the results of the Australian VAMPIRE studies adds to the validity of the model, however, when the different contexts are taken into account. Given the scale of Tampa Bay's oil vulnerability problem, results that shadowed those of the Australian cities, with strong centers and weak peripheries, would be called into question given the drastically different nature of Tampa Bay. What is seen in the Hillsborough County results is explained in the assessment made of Tampa Bay.

The model has shown there to be a strong need to shore up transit service in the city of Tampa Bay, along the 275 corridor. This would begin to address the poor linkages of jobs to housing in the region, as well as target the most distressed high vulnerability areas.

It is possible to differentiate between the different high vulnerability areas with differing levels of "priority" in requiring a policy response. The areas with vulnerability due to low incomes are deemed to be of greater need than the areas of high mortgage prevalence. It is not a coincidence that these areas are also the jobs clusters for the region, because of the negative correlation to affordability and job density in the region.

While there is room for improvement of the model, the results are clear enough to suggest that Tampa Bay begin to address its weakness, given that the core of the city is underperforming in energy resilience.

There are issues in adapting the model to the United States, however, and the model could be refined to better take account of the United States context more appropriately. The following are the lessons gleaned from this analysis that could be used to tailor further study into the topic of oil vulnerability in the United States.

A more accurate of public transportation accessibility, and a more accurate representation of VMTs at the household level would provide an improved understanding of car dependence in the American city.

Due to differences in handling the interest rate response to inflationary pressure between the United States and Australia, the use of mortgage prevalence is not an effective measure of oil vulnerability in the United States.

Finally, while the use of median area income is a quality measure of capacity to absorb price increases at the household level, the topic could be clarified with the use of a housing and transportation combined affordability assessment. This would more accurately reflect the ability of households to adjust their budgets due to rising oil costs.

In conclusion, the adaptation of the Australian-based VAMPIRE model has shown the potential for a more targeted United States-based study of the topic of oil vulnerability. It has given the basis to give future recommendations on what a model should attempt to do given the unique differences of the typical American city when compared to the rest of the industrialized world.

Given the fact that long-term oil costs are going to rise, absent a major technological breakthrough that does not appear to be on the horizon, addressing the oil resilience of Tampa Bay is a realistic goal for policy formation. Global supplies of oil production are flat, and global demand is rising. It is the responsibility of the planner to

foresee the consequences of our development decisions and work to alleviate their impacts. By not addressing our oil consumption patterns, and our ability to change those patters, we truly are, as Kunstler said, “sleepwalking into the future.”

APPENDIX A
HILLSBOROUGH VAMPIRE DATA

Census Tract	Total Households	2 Vehicles	3 Vehicles	4 + Vehicles	2 + Vehicles	JTW Auto	Median Income	Mortgage
1.01	1115	366	96	34	1450	1354	34693	209
1.02	2379	596	288	57	2572	2290	32721	589
2.01	1401	256	70	0	1618	1363	27745	308
2.02	1631	622	191	80	2408	1929	37361	649
3	2533	769	306	164	3186	3048	34557	1103
4.01	930	298	111	33	918	788	32100	329
4.02	1049	355	47	6	1003	912	31733	467
5	1595	521	176	136	1865	1755	51127	1073
6.01	1770	622	257	25	2392	2200	37021	538
6.02	753	238	180	0	1104	947	48984	331
7	2109	512	243	32	1941	1734	25999	601
8	1149	439	141	48	1602	1486	41291	710
9.01	896	311	41	64	1184	1131	31907	211
9.02	2015	546	42	0	1840	1721	27168	344
10.01	1220	266	42	0	1185	1071	30365	159
10.02	1880	434	152	56	1626	1364	26675	807
11	1010	394	147	14	1180	1138	55992	546
12	1009	316	22	0	1050	992	26565	344
13	2386	813	302	69	2849	2596	37474	1187
14	1809	529	179	16	1924	1654	23812	708
15	1155	454	111	64	1687	1403	52128	655
16	975	326	110	14	1163	1079	48640	637
17	1726	647	228	26	1927	1773	35797	924
18	1295	434	119	35	1428	1273	27417	554
19	1080	402	90	50	1089	885	24960	520
20	837	166	113	41	944	833	32824	397
21	999	429	49	23	1156	991	34943	563
22	658	363	75	14	1061	1007	45821	391
23	1290	340	151	5	1522	1278	37840	522
24	1814	452	63	100	1885	1748	31844	505
25	2700	681	109	114	3034	2874	30000	467
26	562	159	39	0	717	557	27245	93
27	2554	656	268	27	2602	2319	35222	1022
28	1433	549	146	38	1703	1554	47159	946

29	689	289	65	15	830	772	39563	265
30	981	211	23	13	739	620	16750	273
31	829	248	55	36	774	618	22621	238
32	877	271	109	0	1057	878	29018	227
33	626	160	6	34	636	447	25000	197
34	919	206	64	0	705	575	20506	292
35	843	85	104	0	742	466	22219	157
36	1350	331	140	86	1959	1568	31991	546
37	472	114	8	7	296	245	31932	109
38	437	133	56	0	437	353	26750	91
39	1093	225	0	0	923	714	31169	131
40	224	0	0	0	108	57	7924	0
41	726	150	19	32	393	320	13487	99
42	453	113	64	0	443	360	44107	228
43	1343	27	27	0	531	324	8544	14
44	768	184	22	5	567	503	22374	230
45	1477	429	119	25	1254	1095	31430	632
46	1308	327	29	35	1532	1303	34387	404
47	1274	413	91	41	1414	1326	42958	387
48	1718	562	185	39	1973	1788	51121	809
49	2122	606	173	0	2642	2122	55139	770
50	921	244	36	0	1439	970	19928	149
51.01	580	89	0	0	403	308	34750	139
51.02	1914	720	99	10	2225	1817	103659	854
53.01	568	246	31	38	808	753	95746	97
53.02	686	216	35	14	911	817	43767	214
54.01	2443	1051	271	93	2967	2528	84608	1104
55	1095	309	50	29	1150	935	54974	467
57	2007	598	38	0	1655	1556	46188	735
58	2017	788	288	92	2461	2196	69239	1079
59	2162	1077	270	132	2511	2220	120615	1414
60	1957	1026	230	83	2630	2113	128036	1032
61.01	1523	526	166	32	1718	1407	76691	658
61.03	2236	677	127	0	2028	1920	51005	901
62	1528	809	159	19	2135	1943	101554	979
63	1465	717	166	30	1681	1494	77716	998
64	1451	717	273	78	1926	1689	117066	874
65.01	1676	656	144	6	1892	1783	40370	431

65.02	1357	315	26	0	1265	1069	31042	245
66	1848	653	49	29	1810	1650	49008	818
67	2377	1019	347	93	3040	2529	93255	1307
68.01	2092	729	211	82	2241	1927	47571	765
68.02	1504	693	96	21	1512	1391	63456	770
69	2222	878	222	32	2546	2372	50192	1040
70.01	1492	513	133	26	1686	1415	47564	505
70.02	1136	481	38	0	1417	1247	32055	152
71.02	1211	341	22	0	1389	1312	49457	41
71.03	1473	574	125	99	1877	1719	63688	910
72	1337	468	124	19	1689	1404	44181	709
73	398	227	0	0	745	504	51346	24
101.03	1532	659	335	196	2316	2051	59597	960
101.05	1560	690	272	101	2257	2102	49944	842
101.06	1623	799	225	179	2145	1904	52321	992
101.07	1608	479	150	55	1284	1211	42500	499
101.08	770	377	97	60	902	778	54400	346
102.03	705	213	97	25	559	504	21125	218
102.04	1784	611	181	134	2389	2169	49026	744
102.05	2487	1404	259	96	3469	3165	84639	1537
102.09	2939	1651	305	128	4141	3727	71797	1804
102.1	1213	533	89	39	1572	1444	53495	352
102.11	1947	939	256	84	2566	2152	68818	1143
102.12	1751	1237	221	95	2418	2026	119476	1319
102.13	791	345	129	49	994	971	44107	290
102.14	107	30	39	0	137	137	46806	87
103.03	1117	321	102	26	910	830	32146	310
103.04	1237	561	246	130	1788	1663	58616	693
103.05	1320	609	109	33	1546	1382	42652	492
104.01	2136	662	311	54	2883	2762	43039	801
104.02	2049	673	160	45	2316	2183	31004	574
105.01	2292	808	85	20	2321	2112	32194	928
105.02	880	368	62	16	1174	969	42500	427
106	1334	452	115	53	1459	1231	50086	492
107.01	2431	858	325	57	3171	2949	51426	1008
107.02	1111	533	80	26	1558	1386	44989	447
108.05	1597	310	64	9	1462	1155	22539	203
108.08	1096	227	24	17	1116	940	21000	46

108.09	1005	328	165	11	1227	1111		31427	182
108.1	1766	625	233	27	2384	2243		45667	134
108.11	2760	972	228	7	3361	3073		40780	661
108.12	2368	634	135	62	2745	2217		24367	200
108.13	2105	648	200	7	2543	2169		27461	0
108.14	1198	146	0	68	772	666		21799	117
108.15	799	89	0	13	888	592		31599	13
108.16	1540	146	84	17	1044	851		12906	0
108.17	1357	238	47	20	1435	1265		21775	193
108.18	1985	388	54	0	2283	1792		19415	10
109	10	10	0	0	1485	580	null		0
110.03	2158	549	244	73	2185	1880		28598	514
110.05	1011	513	240	27	1227	1123		92083	739
110.06	1855	884	430	115	2800	2540		74174	1381
110.07	1293	627	237	68	1671	1534		74732	825
110.08	2628	1380	269	24	3261	2943		62692	1173
110.1	1921	692	107	91	2629	2490		43112	839
110.12	1696	1026	214	47	2409	2207		101557	1291
110.13	1232	751	125	12	1853	1701		62270	564
110.14	288	174	55	0	466	451		59583	0
110.15	2683	929	265	116	3598	2961		40860	567
110.16	1215	785	53	17	1641	1397		58920	454
111.03	1213	711	201	76	1844	1705		82225	807
111.06	961	302	48	1	1031	968		32620	285
111.07	2555	1017	509	160	3758	3306		73114	1266
111.08	806	286	36	22	671	546		37639	265
111.09	1028	623	163	39	1591	1507		88611	653
112.03	1334	679	74	34	1616	1397		57385	609
112.04	2681	1000	299	114	2818	2618		42601	1053
112.05	1229	550	253	18	1518	1432		48229	609
112.06	1130	385	78	9	1176	1044		36675	438
113.01	1235	503	188	39	1501	1421		63464	582
113.03	1347	519	85	0	1386	1209		53153	483
113.04	2081	946	320	35	2509	2214		66104	1149
114.07	1098	577	33	36	1175	1022		79537	538
114.08	1001	512	117	37	1552	1434		75531	723
114.09	1365	573	194	37	1463	1278		67266	708
114-1	2031	1249	348	79	2848	2346		70740	1607

114-11	604	329	102	8	847	807	66591	419
114-12	1260	311	103	15	1392	1318	55395	399
114-13	2169	1107	333	82	3074	2775	63819	1382
114-14	2227	798	223	40	3062	2919	46155	1306
114-15	2154	859	166	98	3052	2854	55278	1301
114-16	2570	1087	362	71	3597	3300	49194	1595
114-17	2038	856	141	34	2631	2402	46269	1104
114-18	1781	868	217	16	1997	1772	67225	977
115.04	828	387	226	37	1009	878	87400	511
115.06	2873	1643	328	106	4142	3810	86880	1902
115.07	2611	1323	265	29	3247	3009	74037	1436
115.09	2216	1131	461	186	3304	2720	115913	1829
115-1	1013	575	149	59	1415	1230	104426	748
115-12	1304	693	301	38	2010	1736	96216	1042
115-14	2147	1020	472	94	3340	3053	73237	1593
115-15	1352	799	205	94	2173	2053	63625	1039
115-16	1298	458	138	82	1632	1477	64259	493
115-17	2388	1487	375	65	3374	3097	99873	1963
115-18	1307	597	395	80	1777	1463	97708	950
115-19	786	458	122	31	1060	968	104643	638
115-2	1768	1035	134	41	2350	1940	108889	1002
115-21	2070	719	131	15	2244	2127	39565	293
115-22	1363	815	105	55	1818	1541	93365	903
115-23	554	293	145	25	923	786	115000	542
115-24	2276	851	119	11	2672	2501	44097	638
116.03	1508	581	189	71	2018	1671	55842	885
116.05	1968	790	171	82	2774	2463	42544	845
116.06	2774	1349	169	12	3654	3378	51240	1201
116.07	2930	1466	298	68	3868	3635	52587	1692
116.08	392	204	100	22	612	549	110323	270
116.1	2019	593	197	18	2161	1841	31997	822
116.11	1581	826	104	29	2118	1892	46685	1026
116.12	2344	904	356	75	3136	2800	47850	1326
116.13	2086	702	320	37	2654	2355	44153	1028
116.14	2243	929	273	68	3054	2940	36664	1350
116.15	1738	915	101	24	2450	2218	35568	464
117.06	2997	950	227	60	3957	3719	41883	666
117.08	1847	766	45	69	2405	2145	62125	375

117.09	341	75	74	0	404	404	45089	68
117.1	3053	1086	197	0	3729	3305	51730	1138
117.12	2180	946	294	44	2638	2433	54254	947
118.02	2267	863	381	49	2828	2486	34436	874
118.03	2918	858	174	12	3289	3190	31590	794
118.04	1846	731	298	155	2618	2464	39335	936
119.01	2023	682	53	72	2601	2275	38652	306
11902	2699	1196	248	62	3199	2911	39675	1023
11904	949	249	29	0	1176	1095	33079	12
11905	493	227	28	0	642	585	38646	144
11906	1726	657	154	82	2092	1959	40762	625
12001	887	302	168	12	1078	1022	37578	381
12002	1264	467	157	47	1458	1278	38048	564
12103	2174	802	76	87	2860	2674	47426	582
12104	2491	858	223	66	3010	2809	37226	776
12106	1525	740	278	119	2225	2010	68514	1030
12107	1751	799	125	50	2271	2096	43442	773
12108	1125	380	128	45	1436	1362	50586	717
12206	2005	1030	288	79	2782	2629	59276	1508
12207	2497	1159	545	148	3591	3473	71513	1789
12208	2109	1355	195	50	2769	2607	62468	1541
12209	1519	772	203	117	2141	1852	74609	1030
12210	1658	684	124	0	1507	1361	43081	669
12211	100	67	0	0	152	152	46481	53
12212	1843	634	36	54	2048	1928	37559	475
12213	1681	866	217	69	2579	2358	57304	1097
12301	2209	737	465	51	2783	2604	55956	984
12303	1138	509	96	135	1777	1628	55735	467
12304	1675	730	154	79	2188	1921	54047	823
12401	1597	634	209	55	2061	1647	38955	462
12402	769	429	102	56	1252	1055	30958	204
12403	1418	793	177	102	1838	1688	44949	802
12501	1528	644	234	69	2005	1890	49100	655
12503	1820	827	125	64	2083	1845	55111	761
12504	1080	539	299	57	1649	1544	67012	750
12600	1739	630	207	102	2234	2071	47609	615
12701	2034	794	150	38	2709	2514	33500	749
12702	1232	514	81	38	1411	1273	41000	504

12800	1304	549	190	81	1670	1576	48293	714
12900	944	227	92	12	1080	964	27979	328
13001	1218	611	163	14	1672	1550	55285	521
13002	1363	443	151	130	2158	1901	46685	719
13003	1049	432	171	41	1543	1162	40450	374
13004	1011	547	137	132	1525	1365	55284	578
13100	884	333	222	71	1498	1290	41859	373
13203	1153	453	187	68	1533	1399	87063	790
13204	1378	508	70	14	1119	945	44025	680
13205	2627	1346	415	248	3980	3684	79692	2030
13206	1960	1121	372	77	2782	2519	84480	1651
13207	1204	500	189	142	1746	1598	64828	630
13208	1645	1011	282	124	2577	2127	114274	1306
13305	1416	788	269	77	2114	1973	89143	967
13307	1566	526	70	0	1838	1713	41364	383
13310	1038	471	217	92	2123	1994	87667	638
13311	1205	620	47	26	1576	1432	54740	511
13312	1491	645	270	54	2183	2079	65236	981
13313	1750	762	314	176	2382	2183	73194	1088
13314	1025	530	147	79	1445	1375	65354	728
13315	965	327	70	4	1352	1216	52307	116
13316	1053	363	35	9	1300	1248	36857	0
13317	780	245	0	0	1026	957	51071	0
13318	1712	722	92	0	2206	1986	51709	71
13319	1758	521	129	33	2436	2135	56281	633
13320	1539	676	165	12	2027	1948	54936	558
13321	2678	1333	279	77	3278	3118	50131	1583
13322	2686	1244	197	43	3444	3143	43879	1244
13406	365	187	46	0	456	414	42446	206
13407	2213	1200	500	174	3409	2950	75313	1555
13409	1558	928	237	53	2049	1764	80873	1134
13410	1762	601	173	34	2384	2194	45437	819
13411	813	293	150	27	847	841	48615	339
13412	1282	628	237	71	1826	1812	67065	771
13413	1153	682	149	90	1772	1714	98831	841
13414	2131	1105	348	193	3335	2992	86975	1537
13415	1139	646	203	55	1870	1749	98724	932
13501	1170	343	107	43	1213	1068	31778	350

13503	1229	406	160	61	1695	1560	35220	501
13504	1316	696	231	28	2173	2019	43333	846
13505	1060	383	65	75	1318	1188	32353	611
13602	673	362	52	49	820	711	41801	266
13604	392	146	69	9	426	426	34778	68
13702	2215	1000	186	66	2614	2570	44714	1061
13703	1707	740	49	36	1866	1700	33867	689
13704	2537	1432	274	72	3644	3540	78894	1607
13801	744	180	104	40	1018	964	28929	230
13802	893	254	100	52	1180	1068	41348	235
13803	563	204	66	54	726	726	32073	238
13804	2137	1118	250	50	2763	2666	55151	1436
13806	494	292	78	13	691	691	65926	272
13807	1932	945	292	27	2672	2535	62430	1281
13903	1080	468	256	61	1535	1453	52500	576
13907	746	296	128	75	1016	934	46019	371
13908	2837	1259	328	14	3366	3197	53942	1384
13912	1068	448	169	172	1560	1374	48387	687
13913	1137	416	162	22	1342	1214	36659	433
13914	882	401	135	46	1145	1068	29670	461
13915	1907	763	298	179	2711	2399	64511	1410
13916	2050	1028	248	13	2851	2807	75152	1536
13917	1889	949	361	132	2466	2312	63653	1423
13918	607	216	104	82	820	784	69572	442
13919	2100	952	481	174	3211	2944	85338	1610
13920	1218	503	412	77	1762	1698	86615	733
13921	598	284	166	0	1014	953	117025	392
13922	1562	924	230	15	2364	2115	89583	1205
13923	1253	945	140	57	1847	1522	105531	996
14002	1116	372	92	14	880	795	42727	329
14003	580	197	104	44	699	617	66990	362
14007	489	138	114	11	633	624	79063	300
14008	2057	344	16	0	363	340	44665	503
14009	686	269	0	31	423	357	46786	215
14010	1528	429	27	0	416	402	37875	473
14011	2306	278	12	0	343	297	38765	627
14012	1579	246	11	0	220	146	48717	519
14013	452	118	71	19	517	443	48125	121

14014	1437	162	14	0	160	121	37219	169
14015	733	188	13	0	264	195	50673	325
14016	484	112	0	0	105	55	70192	166
14104	1055	230	0	9	444	410	32639	178
14106	1396	624	128	16	1544	1464	42297	665
14108	1820	876	129	79	1922	1757	39136	813
14109	1186	327	205	114	1606	1566	43651	675
14117	1244	475	331	0	1521	1438	80526	747
14118	1166	592	250	20	1378	1276	93750	771
14119	1407	836	245	11	2367	2146	75912	1031
14121	944	391	152	13	1063	967	87798	577
14122	825	244	147	34	1368	1267	47571	380
980100	0	0	0	0	0	0	null	0
980200	0	0	0	0	0	0	null	0
980300	43	0	0	0	43	43	null	0
980400	46	19	9	0	66	66	93333	27
980500	0	0	0	0	0	0	null	0
980600	0	0	0	0	0	0	null	0
980700	0	0	0	0	0	0	null	0
990000	0	0	0	0	0	0	null	0
990100	0	0	0	0	0	0	null	0

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BIOGRAPHICAL SKETCH

Kevin Ice holds a Master of Arts in urban and regional planning from the University of Florida, and a Bachelor of Science in community and regional development from the University of California Davis. He was born in Hawaii and grew up in Nevada. After high school, Kevin has preferred a nomadic lifestyle, never staying put for long. He has lived, worked, studied, and procrastinated in Boston, Reno, Honolulu, Sacramento, and San Francisco before moving to Gainesville. Kevin decided to pursue a career in urban planning due to health concerns related to his previous career, asbestos consulting, and a lifelong love of cities.