A Study of Change and Displacement

Exploring a methodology for predicting neighborhood changes resulting from construction of light rail

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BY

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Acknowledgements

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www.neighborhoodindicators.org/turningthecorner

An advisory group of community stakeholders representing a range of perspectives was formed to provide feedback. That advisory group was called Phoenix Turning the Corner Steering Committee ("Steering Committee") and is referenced in the Acknowledgments section at the beginning of this report. The Steering Committee was led by LISC Phoenix. LISC Phoenix developed a communications plan to share progress with the advisory group as well as the broader community. In addition, Julie Seward of Julie Seward Consulting, helped LISC Phoenix coordinate the various aspects of the study and provided interface with the Urban Institute and other Turning the Corner participants. Participation in cross-site exchange and learning was facilitated by the Urban Institute and The Funders Network's Federal Reserve/Philanthropy Initiative.

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1. Introduction

a. Project Overview

The original purpose of this study was to answer the question: Will extension of light rail south, along Central Avenue into the South Phoenix neighborhoods, cause gentrification to those neighborhoods and if so what changes are likely and when? Various political considerations caused the focus of the study to change and instead the objective became creation of a model to determine an inflection point in neighborhood characteristics signaling the onset of gentrification resulting from construction and operation of light rail. If such a model could be created it would help forecast changes to other neighborhoods not yet impacted by light rail and possibly predict gentrification. Such a model could be used to formulate policy designed to mitigate the negative aspects of gentrification resulting from future extension of light rail.

Since operation of the light rail system in metro Phoenix began, much has changed on the local, State and National levels. Most all those changes affected all neighborhoods including those impacted by that first 20 miles of light rail. This raises several questions: Was light rail the cause of change or were there other local, State and National factors? Did light rail alter the trajectory of change in an adjacent neighborhood? What percentage of change was caused by light rail? The reason for asking this question is to understand the impact of light rail. If the study could identify those changes directly resulting from light rail, then a model to forecast gentrification could be created. It is difficult to predict all changes but knowing what factors are associated with a high likelihood of change resulting from light rail may lead to predicting not only how the neighborhood will change but also when that change may occur which would allow steps to be taken well in advance, to counter or ameliorate, unintended consequences through public policy and investment. Methodologically, there are two main findings. First, we determine that the subject neighborhoods were likely to gentrify and changes actually occur during the study period. Second, it was not possible to state that light rail was the cause and as a result we could not predict when other neighborhoods were likely to change as a result of future light rail extension. More work is needed to determine if a predictive model can be created. If one can, policy makers and planners can determine the effect of proposed policy and capital improvement projects, before they are implemented, thus providing the information necessary to avoid or mitigate impacts that cause significant negative changes, including displacement.

b. Required Project Elements and Critical Research Questions

The following are the goals established for Turning the Corner research:

1. Develop holistic metrics for in-depth and broad understanding of neighborhood dynamics in the post-recession economy, especially in neighborhoods at risk of becoming unaffordable.
2. Facilitate informed community conversations among stakeholders, who can use the data and analysis to develop creative local policies and programs to equitably restore neighborhoods.
3. Advance the field through a cross-site summary of local findings on monitoring neighborhood change and strategies for incorporating analysis into local decision making.
4. Share strategies on local policies and programs from places with varying economic and housing market strength.
5. Produce protocols and methodology to monitor neighborhood revitalization that can be adapted by other cities.

2. Methodology

a. Central Questions and Important Considerations

Was light rail the cause of change or were there other local, State and National factors? Did light rail alter the trajectory of change in an adjacent neighborhood? What percentage of change was caused by light rail? Were Eastlake, Garfield, Camelback and Glendale gentrifiable? Do those neighborhoods served by light rail benefit from the service provided by light rail? Did the advent of light rail cause the neighborhoods to gentrify? The methodology to answer these questions is straightforward. First, identify neighborhoods already impacted by light rail and a neighborhood not yet impacted by light rail, but in the path of light rail expansion (control neighborhood). Then study all neighborhoods to determine if characteristics correlated to light rail could be identified. If specific characteristics could be identified, then create a model to predict how the control neighborhood would change when light rail was constructed. Three already impacted and one not yet impacted were selected. Of the three already impacted, two were adjacent to downtown Phoenix and one outside the downtown area. The two neighborhoods adjacent to downtown are: Eastlake and Garfield and the neighborhood outside the downtown area is Camelback. The neighborhood not yet impacted is Glendale. All four neighborhoods are described in detail below.

b. Methodology

The analysis would attempt to determination the odds a given characteristic of a neighborhood will change because of light rail. This identifies specific neighborhood factors (characteristics) that change but does not identify when they might change. Change can take several different forms including purchase and renovation of existing housing or demolition and redevelopment of housing for investment because the land is more valuable than the existing homes. Neighborhood change can be driven by different combinations of private market forces, public state intervention strategies, and efforts of community organizations.

To determine when change might occur, survival analysis would be used. Survival analysis is a branch of statistics used for analyzing the expected duration of time until one or more events happen. More generally, survival analysis involves the modelling of time to event; in this context, gentrification is considered an "event" in the survival analysis. Often used in biology or medicine it looks at a single event to occur. Survival analysis requires sufficient temporal data to accurately predict with a high degree of confidence when change will occur.

The study horizon was the years 2000 and 2015. This timeframe corresponds with planning, construction and operation of light rail. Data analysis included time periods 2000, 2005, 2010 and 2015 with some data points for the year 2017.

Part of the study would be to establish whether the neighborhoods in question were, in fact, “gentrifiable” before the advent of light rail to determine if they were likely to change regardless of the light rail. This was important consideration when trying to determine what amount of change was directly related to light rail versus other factors. The next question to answer was “What are best indicators of gentrification?” There are several possible indicators, but the most obvious indicator is housing prices and rents. There are also other social indicators but having current, consistently available data that was available in 2000 as it is in 2015 makes those less useful for this purpose. The idea is that the neighborhood needs to have characteristics that can change and change in a significant way to become more like surrounding metro area. To determine if a neighborhood was gentrifiable in 2000, the study would use Median Per Capita Income, Median Rent and Median Sales Price of a home sold and compute the following statistics in 2000:

A = (Median Per capita Income)Neighborhood – (Median Per capita Income)MSA

B = (Median Rent)Neighborhood – (Median Rent)MSA

C = (Median Sale Price)Neighborhood – (Median Sale Price)MSA

The study would compute these statistics for Eastlake, Garfield, Camelback and Glendale neighborhoods. Our priori is that if A < 0 *and* B < 0 *and* C < 0 for a neighborhood, then the neighborhood in questions is "gentrifiable" in 2000. We *expect* that Eastlake, Garfield and Camelback will indeed be "gentrifiable" in 2000 (as defined above).

Next, we would try to determine whether these gentrifiable neighborhoods underwent gentrification between 2000 and 2015 by recomputing variables A, B, and C using 2015, and check whether:

> $(A_{2015} - A_{2000}) > 0$, $(B_{2015} - B_{2000}) > 0$, and/or $(C_{2015} - C_{2000}) > 0$ than the neighborhood did gentrify [i.e. whether the difference between neighborhood average and MSA average has decreased between 2000 and 2015]

This, effectively, tests whether the change in the neighborhoods was greater than the change in MSA. Additional variables may be added to compute using 2015 Data to determine the onset of gentrification, such as:

> D = (Median fraction of people in professional occupations)Neighborhoods – (Median…)MSA
>
> E = (Median fraction of owner occupied dwellings)Neighborhoods – (Median…)MSA

To understand more clearly how the advent of light rail in mid 2000s affected the onset of gentrification in the neighborhoods, a survival analysis technique would be used. Under this approach, the outcome variable is time until an event occurs, which, for the purposes of this study, would be the onset of gentrification (inflection point). The purpose of survival analysis is to make statistical inferences about how given independent variable affects the probability of the event occurring at a given time. The extended Cox model for the survival analysis could be used. The Cox model is a semi-parametric model that allows the hazard function and survival time more flexibility. Specifically, the Hazard Ratio can change overtime. This model also allows for a separate analysis of time-dependent variables:

$$h(t, X(t)) = h_0(t)\exp\left[\sum \beta_i X_i + \sum \delta_j X_j(t)\right]$$

For the purposes of this research, this independent (treatment) variable is proximity to light rail stations. The reason for using proximity to light rail stations is to determine the utility benefit of light rail - if you cannot access the service, it has diminished or no value. Direct, easy access nearby, has more value. If there is no station or if one is more than a walkable distance (.25 mile), then light rail provides little benefit, or which is the same utility benefit as a neighborhood not proximate to light rail.

Different methods could be employed to measure proximity to light rail stations. One way is to simply measure the distance of the affected neighborhood's centroid from the nearest railway station. Another way to measure proximity to light rail stations could be using some variant of the following gravity model:

$$expo = [\![cdist]\!] \text{ ^}\alpha.\ e\text{^}(\beta.cdist)$$

> Where, cdist = distance between neighborhood centroid and nearest light rail station
>
> expo = exposure
>
> One could assume $\alpha = 1$ and $\beta < 0$, where the specific value of β would depend on maximization of the log-likelihood function.

For this study the distance from a neighborhood centroid to light rail stations were measured and the percent of residents within .25 miles of a station was estimated by analyzing land use maps.

c. <u>Data Sources</u>

As summary of the data collected is listed below. The data used for this study is from various sources that include:

Maricopa Association of Governments Data 2000, 2005, 2010, 2015

Cities of Phoenix and Glendale General Plan 2000, 2005, 2010, 2015

Cities of Phoenix and Glendale Land Use 1999, 2004, 2010, 2016

Google Street View 2010, 2015

U. S. Census Data 2000, 2015 (see specific list of data in Appendix "A")

Maricopa County Tax Assessor Parcel Data 2000, 2005, 2010, 2015

Multiple Listing Service Data 2000 – 2015

d. Critical Limiting Conditions

There are several issues associated with use of the available data that made application of the methodology difficult. There are many factors other than light rail that can cause change ("outside factors"). These outside factors may skew, influence or effect the interpretation of the data. The following are important considerations and limiting conditions:

Access to Data – Not all data was readily available or available for all time periods. For some characteristics either the data was not available, not available for all time periods, not available for all neighborhoods (Glendale versus City of Phoenix), was not consistently reported over time, did not reflect change (single time period or only time periods after start of operations) or was not available in a form that could be manipulated for analytic purposes.

Consistency, quality and availability of data – This study is about change and to identify factors that can be used to predict change within the study neighborhoods. Therefore, it was important to select data that is available for other areas, has been consistently collected, is readily available and is reliable. Occasionally data is redefined, and as stated above, not available for all time or neighborhoods or is not reliable. An example is employment data. Maricopa Association of Governments collects data on employers through the annual Maricopa County Trip Reduction Program. This survey collects information on employers with 5 or more employees. This leaves out many small businesses and businesses operated by families where family members contribute to the success of the business. Many times, it is these small businesses most impacted. To understand impact on small, minority owned business, it was necessary to find other methods. The method used was not reliable data and was for a single time-period which was insufficient for use in the model.

Public Policy – Because the focus of the study was determining the impact of light rail, it was important to consider the Outside Factors that could or did impact change in the neighborhoods. The study attempted to isolate changes related to the light rail but recognized that there were other factors that would have caused displacement or similar impacts as light rail. These Outside Factors include the State law titled "Support Our Law Enforcement and Safe Neighborhoods Act" more commonly known as Proposition 1070, enacted in 2010 ("Prop 1070"). Prop 1070 was adopted shortly after full operation of light rail. Prop 1070, was the broadest and strictest anti-illegal immigration measure passed in Arizona, required that state law enforcement officers attempt to determine an individual's immigration status during a "lawful stop, detention or arrest", when there is reasonable suspicion that the individual is an illegal immigrant and barred state or local officials or agencies from restricting enforcement of federal immigration laws and imposed penalties on those sheltering, hiring and transporting unregistered aliens. The purpose of Prop 1070 was to employ the "attrition through enforcement" doctrine to reduce the number of illegal immigrants in Arizona most of whom were Hispanic. As a result, many Hispanic illegal immigrants moved, and many fled the State. Therefore, when looking at the change in ethnic make-up of the neighborhoods, a reduction in the number of Hispanic persons may be a result of Prop 1070, and not because of displacement by light rail.

Another public policy that could contribute to change in neighborhoods is a change in the City's General Plan and/or zoning. The adoption of policy that allows, encourages or incentivizes redevelopment adjacent to light rail can, and often does, accelerate change and displacement by creating economic incentives for new development. These policies encourage development as private parties seek a change in zoning to uses and intensities that allow feasible development. For example, the adoption of a Transit Oriented Development ("TOD") zoning ordinance and designation of areas where TOD development can occur will change land values, increase land sales, cause new higher density development and result in replacement of existing lower intensity uses. These new developments add new residents to a neighborhood. In these cases, it is not the light rail that causes changes, it is related public policy supporting light rail that causes the changes.

Major outside influences - There are often significant public or private development in adjacent areas that can influence, or effect change in adjacent areas – spillover effect. This might be a significant public or private project. In the case of Garfield and Eastlake neighborhoods, the creation of the Arizona State University (ASU) downtown campus had the potential to effect development of not only downtown, but the surrounding areas. The ASU downtown campus began classes in August 2006 and is located approximately, 1 mile west of the western boundary of the neighborhoods in an area bound by Van Buren Street, Fillmore Street, 1st Avenue, and 7th Street. Coupled with the biotech campus on 7th Street, downtown began redeveloping. One effect of that redevelopment was on adjacent areas which were made valuable and desirably by proximity.

Systemic Economic shocks – There are certain economic events (shocks) that are systemic, unrelated to any one metropolitan area and affect broad swaths of an economy. No event has influenced the Metro Phoenix Area more in the past 25 years than the global economic downturn that began in December 2007, commonly known as the Great Recession. Millions of people lost their jobs and homes when the housing market crashed. Nationally, from the mid-1990s to the mid-2000s the average price of housing spiked 124%, according to University of North Carolina (UNC) research. The reasons were numerous and resulted in the supply of homes greatly surpassing demand, and finally in 2007 the market corrected. This resulted in numerous foreclosures and defaults greatly depreciating the value of all homes. A study from Arizona State University showed home prices declining 40% in a year. The crises in the Metro Phoenix was so bad that President Obama chose the area to unveil his housing policy in 2010. This economic condition impacted how growth and development has occurred. Since that time the Metro Phoenix Area has recovered and become one of the fastest growing areas in the Nation, but its development pattern changed from growth on the periphery to a focus on denser, infill development. This change, along with technologic advances and demographic shifts that occurred simultaneously, has caused a resurgence in living in downtown Phoenix. Therefore, changes in neighborhood characteristics may be related to the recession and recently a focus on infill development rather than light rail.

Change Relative to Broader Metropolitan Area and Surrounding Neighborhoods – Another consideration is change in a neighborhood relative to the broader metropolitan area. In the case of Phoenix, it is a relatively young, rapidly growing metropolitan area. This means overall development policies and patterns will influence individual neighborhoods. Change that is out of context may be an indicator of succession and possible impending displacement. But some change may simply be part of the overall change occurring in the metropolitan area as it matures and evolves.

3. Context

a. History of Metro Phoenix

In the case of this analysis, history and context is important in explaining how and why the Metro Phoenix are evolved and how the subject neighborhoods relate to the region. The United States Office of Management and Budget designates the Phoenix metropolitan area as the Phoenix-Mesa-Scottsdale

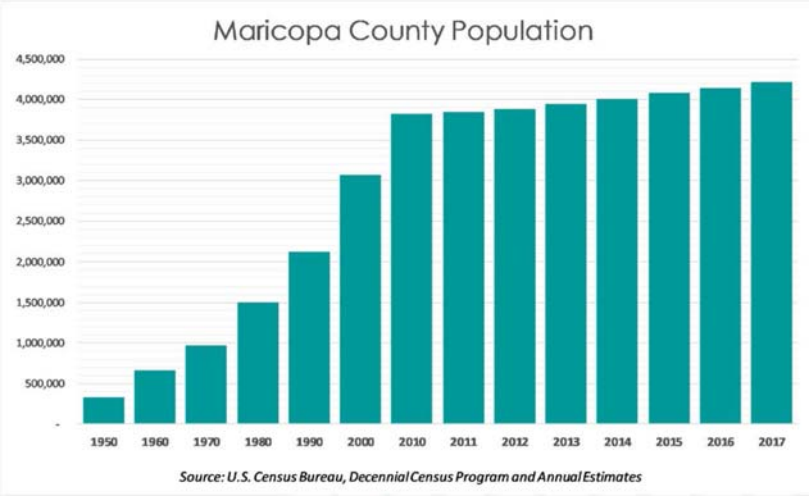
Metropolitan Statistical Area which is essentially all of Maricopa County and recently has been expanded to include adjacent parts of Pinal County (“Phoenix Metro Area”).

The Phoenix Metro Area, as stated previously, is a relatively young metropolitan area. This fact means that development patterns and economic make-up, is very different than most other major metropolitan areas. The Phoenix Metro Area has historically been the center of the state's economy. The Phoenix Metro Area, as with the state of Arizona, had historically relied on what is commonly known as “the 5 C's” for its economic growth and expansion - referring to copper, cattle, climate, citrus, and cotton. Growth of Phoenix Metro Area was relatively slow during the first 50 years of the Century. However, after World War II, the area began to see expansion due to the manufacturing industry, which spurred the growth of what would eventually be one of the largest urban areas in the nation. The Phoenix Metro Area is now one of the most economically diverse areas of the country.

The post-World War II years saw the city beginning to grow more rapidly, as many men who had trained in the military installations in the valley (primarily Luke and Williams Air Force bases), returned, bringing their families. The growth of Phoenix Metro Area was driven by several factors including the GI Bill that provided mortgages for Vets, the advent of production housing, cheap and plentiful easy to develop land and the automobile. These factors supported the expansion of the suburban, low density development pattern that dominated the United States in the 1950’s through the early 2000’s. The population growth was further stimulated in the 1950s, in part because of the availability of air conditioning, which made the very hot dry summer heat tolerable, as well as an influx of industry, led by high tech companies. The population growth rate of the Phoenix Metro Area has averaged nearly 4% per year for the past 40 years although much slower in the recession and during the recovery. Although the growth rate slowed during the Great Recession, the U.S. Census Bureau predicted it would resume as the nation's economy recovered, and it already has begun to do so. While currently ranked 5th largest city in the United States by population, it is predicted that Phoenix will rank 4th by 2020.

The Phoenix Metro Area’s rapid growth began with the birth of the Baby Boomer generation after World War II. In 1950 the US Census found the county had a population of just 331,770, which was smaller than most large and mid-sized cities that year, including Louisville, Kentucky and Rochester, New York. However, over the course of the next decade, Metro Phoenix Area would grow at more than five times the national rate, doubling its population by 1960 to 663,510. Annual growth rates for the remainder of the twentieth century remained robust, staying between 4% and 5.5%, matching or exceeding the growth rates of the State of Arizona, and far exceeding the national growth rates. Since the 2008 recession, growth rates in Metro Phoenix Area have slowed to between 1% and 2% each year, which still exceeds the national growth rate. As of 2017, Maricopa County had a population of 4,221,684, trailing only Los Angeles County, California, Cook County, Illinois (Chicago), and Harris County, Texas (Houston). The following chart shows population growth between 1950 and 2017 and the reduction in rate of growth is obvious beginning in 2011.

Phoenix Metro Area Population 1950 to 2017



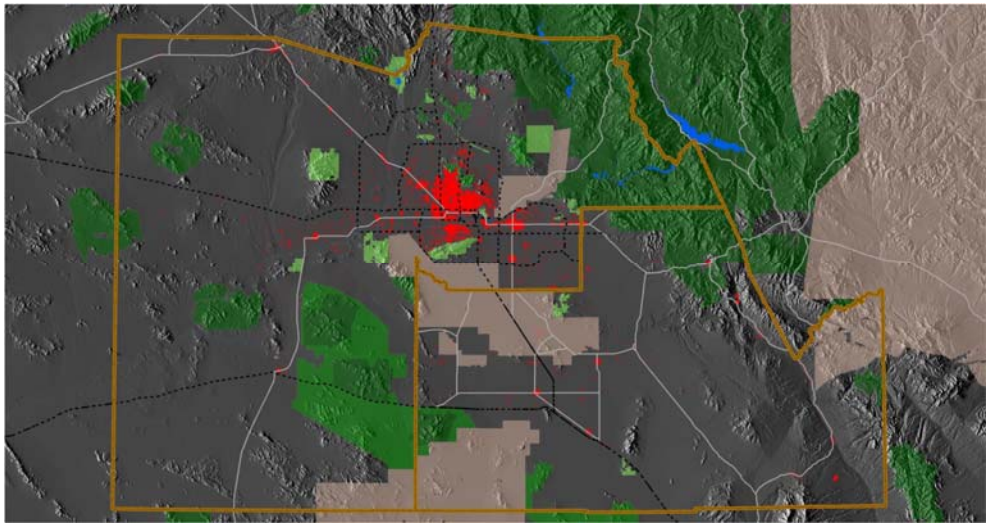
The following two graphics depict the growth pattern of Phoenix Metro Area. The first graphic illustrates the developed areas in 1955 as red dots superimposed on a map that shows the current freeway system as a reference. The second graphic shows the developed areas in 2015 illustrated on the same map. In the 1950's through 1990's there was little constraint to development. Recently development has been directed by Native Communities, National Forest, preserved open space and Trust Lands. These constraints (all of these constraints, except Trust Lands, are illustrated on the two graphics) have directed development patterns and created increased expense. Much of this growth was directly related to expansion of the freeway system. An aggressive freeway expansion program provided access to land on the urban fringe making its development feasible. Small farming communities that made up the Phoenix Metro Area began to convert to suburban bedroom communities and expansion continued outward.

Phoenix's growth has not occurred evenly. The rapid growth from 1950's through 2006 largely took place on the city's edges with constant suburbanization of the surrounding areas. In the 1950's and 60's much of the new development took place north and east of downtown and was nearly all white in its population make-up. At a US Commission on Civil Rights hearing in 1962 it was uncovered that no homes sold in the area of rapid expansion was to an African-American. Phoenix Metro Area African-American and Mexican-American communities were relegated to the south side. It was noted that the color lines were so rigidly drawn such that people of color could not rent or own property north of Van Buren Street. This fact was an important consideration when selecting the specific neighborhoods to analyze for this study.

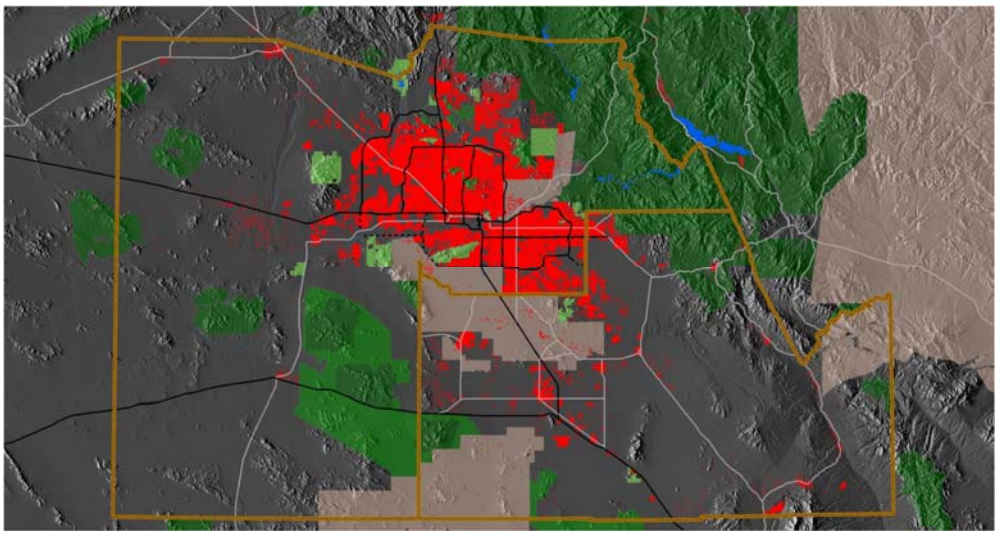
Since the Great Recession, and resulting collapse of the housing market, the development pattern of Phoenix Metro Area has been somewhat altered. From 2006 to 2013 most all development that has occurred was infill. There are several factors that drove this change in development pattern – collapse of the housing market, constrained mortgage/credit market, shifts in demographics, increasing education debt, impact of technology on socializing and change in attitudes and behavior of both younger and older consumers. Two important public investments also helped shape the recent development pattern – construction of light rail and the expansion of Arizona State University, especially the development of a new campus in downtown Phoenix. The combination of all of these factors has resulted in the redevelopment of neighborhoods within the center of the Phoenix Metro Area putting stress on residents and business that occupied these places. Infill development pattern is likely to continue even as growth on the periphery becomes feasible again.

Currently, Phoenix Metro Area is once again growing at rates similar to, but slightly less than, previous decades. The current population is approximately 4.65 million people with a growth rate of 2.2% resulting in approximately 100,000 persons being added to annually. Assuming a typical household of 3.5 persons, this equates to a demand for almost 30,000 new housing units. The Phoenix Metro Area is a young and

rapidly growing community with the majority of its growth occurring after 1945. The maps below illustrate the growth that has occurred and outward development patter of the metro area between



Population Distribution of Phoenix 1950



Population Distribution of Phoenix 2015

b. History of Light Rail in Metro Phoenix

After a previous failed attempt to construct light rail in metro Phoenix in the mid 1980's voters finally approved a system in 1996 and operation began in 2008. The timeline for approving, designing, funding, constructing and operating light rail is listed below.

September 1996 - Tempe voters pass Proposition 200, a half-cent sales tax initiative to support public transportation.

September 1999 - The Preliminary Map for Light Rail is unveiled

March 2000 - Phoenix voters pass a 4/10 cent sales tax for public transportation.

Fall 2000 - Phoenix and Tempe City Councils approved a 20-mile light rail transit alignment from Christown Mall in Phoenix to Dobson/Main in Mesa and final light rail alignment approved.

September 2001 - Footprint meetings begin with property owners immediately adjacent to proposed stations. City of Phoenix purchases first property for the light rail system at Camelback Road and Third Avenue.

November 2001 - Glendale voters pass a transit referendum, which includes constructing a light rail line from downtown Glendale to link with the 20-mile starter segment through Phoenix, Tempe and Mesa.

December 2001 - City of Phoenix approves three park-and-ride locations: 19th Avenue and Camelback Road, Central Avenue and Camelback Road and 40th Street and Washington.

October 2002 - The agency formed to design, build and operate the Valley's light rail system is formed. Valley Metro Rail Inc.— doing business as METRO— is an Arizona nonprofit corporation formed by the cities of Phoenix, Tempe, Mesa and Glendale, and operates under a Joint Powers Agreement pursuant to ARS 11-952.

February 2004 - The METRO initial line is included in President Bush's federal FY 2005 budget, with a recommendation for a Full Funding Grant Agreement and a $75 million appropriation.

November 2004 - Maricopa County voters pass Proposition 400, which provides funding for additional transportation improvements Valleywide, including 27.7 miles of light rail extensions to the planned system.

January 2005 - Full Funding Grant Agreement signed, providing METRO with $587 million in federal funding for the 20-mile starter segment.

March 2006 – Construction begins

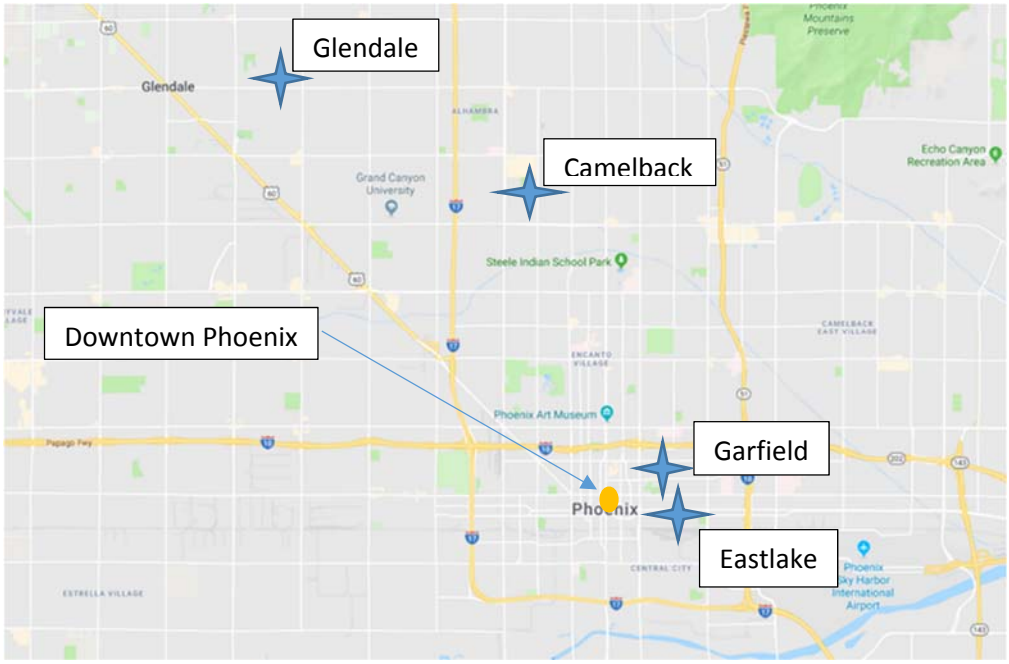
December 2008 - The 20-mile METRO starter line opens for service on Dec. 27. More than 200,000 people ride the system during the two-day grand opening Dec. 27 – 28.

c. Description of Subject Neighborhoods

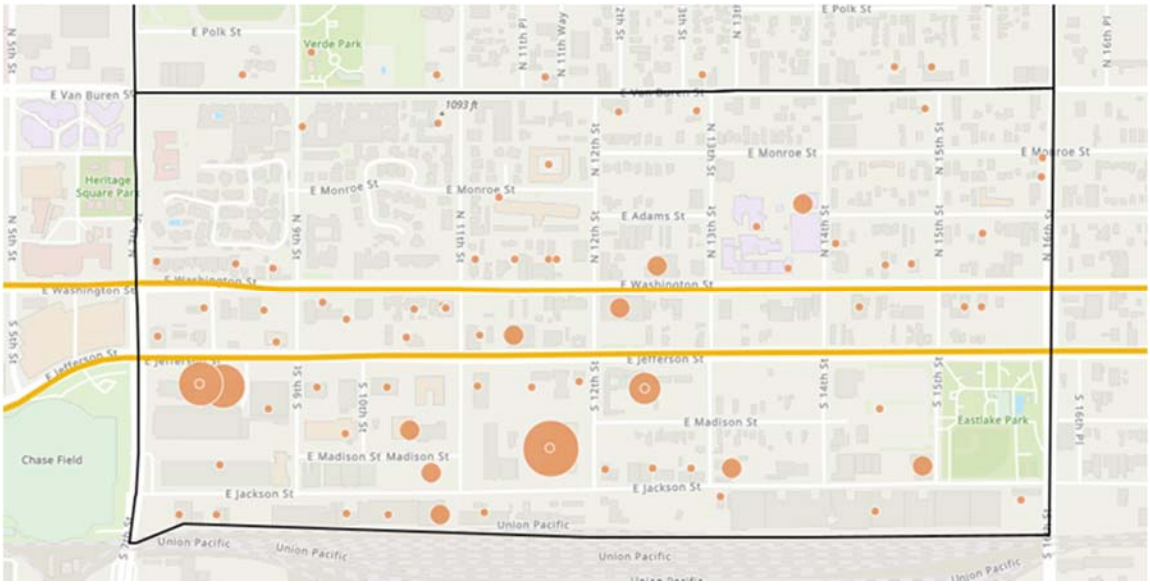
Of the four subject neighborhoods selected for study – three (3) are in Phoenix already and already impacted by operation of light rail and one (1) located in Glendale in an area previously planned for light rail service but not yet impacted. Of the three (3) already impacted, two (2) are defined neighborhoods – Eastlake and Garfield. East Lake is south of Van Buren Street and Garfield is north directly adjacent to East lake. The third is an area bisected by light rail which is referred to in this study as "Camelback" because Camelback Road is the primary regional roadway servicing the area. All three areas are within the City of Phoenix.

The fourth area selected is in the City of Glendale and is referred to in this study as simply "Glendale". Like Camelback, Glendale is not a defined neighborhood but rather an area where residential and commercial growth occurred many years ago and has since declined. Each area/neighborhood is described below. The following map illustrates the general location of the four neighborhoods.

Location of Study Neighborhoods



Eastlake

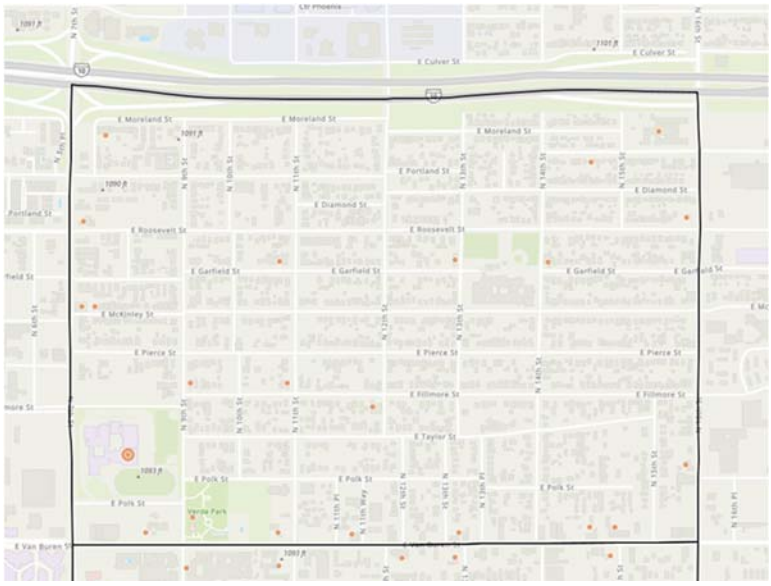


Eastlake is close-knit, historically Afro-American Phoenix neighborhood located adjacent to downtown Phoenix that boasts the oldest park in the city. Eastlake Park was comprised almost entirely of black-owned businesses, churches, and schools such as Tanner Chapel A.M.E. Church and the Booker T. Washington School Eastlake which shares a common border, Van Buren Street, with the Garfield neighborhood to the north. As was the case with Garfield neighborhood, once Van Buren Street diminished as a regional commercial corridor, the community became poorer and over time, local businesses struggled to survive. In addition, a Latino community has populated the Booker T. Washington portion of Eastlake. In recent years City redevelopment projects - like an arena complex - eroded neighborhood fabric. Recently the City identified Eastlake as a Choice Neighborhood and invested in significant neighborhood planning and

redevelopment of a large park and recreation green space. The community also developed a strong and well-organized neighborhood association that works closely with the City and nonprofit developers. Like Garfield, Eastlake is changing as Phoenix residents return to center city.

2000 Total Population	1,839
Percent Hispanic	56%
Median Year HH Moved in	1997
Median PerCap Income	$12,687
Median Residential Rent	$248/mo
2015 Total Population	1,604
Percent Hispanic	24%
Median Year HH Moved in	2011
Median PerCap Income	$22,218
Median Residential Rent	$682/mo

Garfield



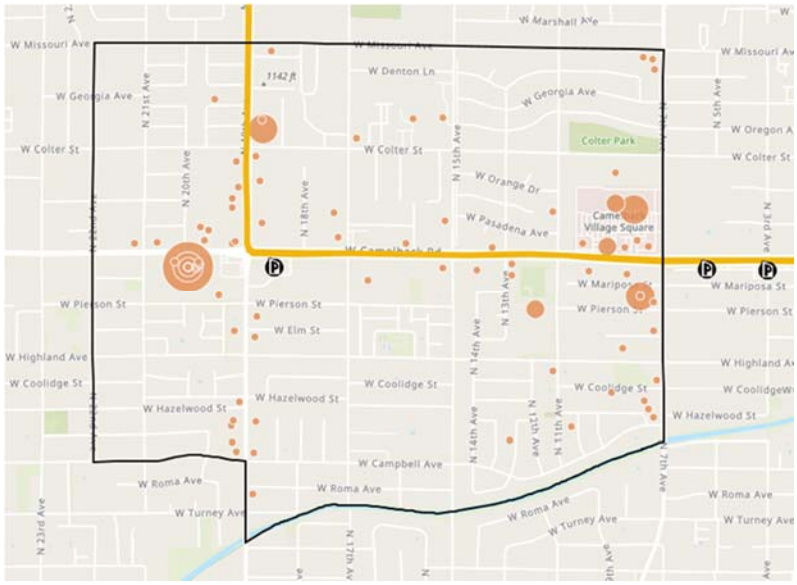
The Garfield neighborhood is one of the oldest downtown Phoenix neighborhoods developed from 1883–1955, with parts of it platted as early as 1883. The Garfield Historic District contains nearly 11,000 persons and the housing stock is made up of mostly bungalows, Period Revival homes and the city's largest concentration of "pyramid cottages." The area has experienced significant change and some revitalization over the last decade. There are two historic districts within its borders. Residents combine new, diverse voices with "old-timers" who appreciate its wide planned streets and green sidewalks. The Garfield Neighborhood Organization promotes a swath of activities and supports connective information to residents within its roughly one mile footprint. Garfield also includes several major retail corridors and a number of new small businesses in addition to its proximity to the growing ASU campus.

Garfield's south border is Van Buren Street, a regional east/west arterial connecting downtown to eastern Arizona. Van Buren Street was the northern border of the original 320 acre Phoenix town settlement and is the historic U.S. 60, 70, 80 and 89. Initially built in the 1880s, the street eventually connected to Apache Blvd in Tempe and became an important commercial corridor. As Phoenix expanded northwards, it became increasingly popular as people began to use it to travel between areas to the east such as Tempe, Mesa and

Globe. Van Buren Street became the major commercial east/west arterial out of downtown and included Arizona's first drive-in movie theater and many motel owners. The area also became known for auto dealerships and auto related services. When other Interstate highways were built to the south, Van Buren lost its commercial importance and the area no longer could support those businesses although remained a regional arterial. Eventually urban decay began to impact the areas adjacent which led to the shuttering of many businesses and an increase in crime and prostitution, some of which continues to this day. Salient characteristics of the Garfield neighborhood are:

2000 Total Population	9,149
Percent Hispanic	87%
Median Year HH Moved in	1998
Median PerCap Income	$7,059
Median Residential Rent	$451/mo
2015 Total Population	6,820
Percent Hispanic	78%
Median Year HH Moved in	2010
Median PerCap Income	$10,563
Median Residential Rent	$566/mo

Camelback Neighborhood

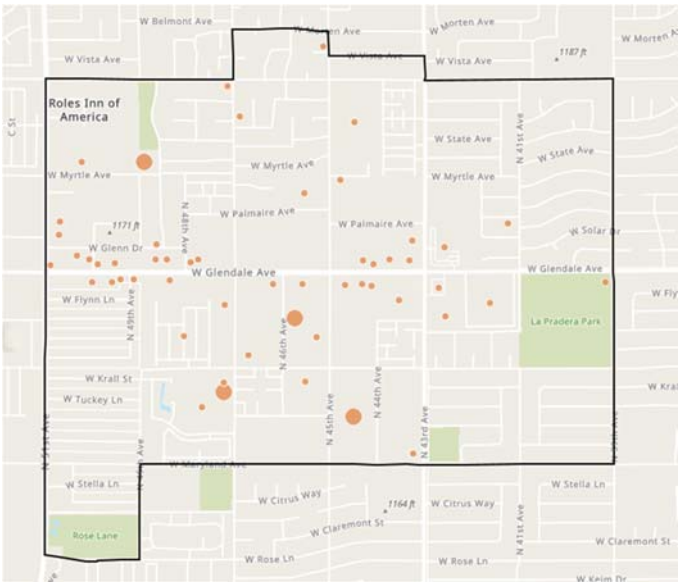


The neighborhood labeled “Camelback” is the area north and south of Camelback Road, a prominent east west arterial that extends across the Phoenix metropolitan area. The street is approximately 33 miles in length extending from the Salt River Pima Maricopa Indian Community on the east through Scottsdale, Phoenix, and Glendale to Litchfield Park in the west. The area of Camelback Road from Scottsdale to Central Avenue has been a prominent commercial and employment corridor with Scottsdale Fashion Square, Colonnade, Town and Country and Biltmore Fashion Park Malls all located along the road. In addition, it is a location for class “A” office and a variety of employment types past the Phoenician Resort. In Litchfield Park, Camelback Road passes the historic Wigwam Resort. The portion of the road that was part of this study was not a high-end area. The area studied was developed as a predominantly single-family area in the 1950’s and 60’s. It is located south of the Christown Mall on 19th Ave. Christown Mall was the third mall built in metro Phoenix and the first indoor mall built in metro Phoenix in 1961. Originally developed by Del Webb the mall lost its prominence in the late 1970’s and the areas adjacent began to also see a decline.

Significant suburbanization during the 1950's-1990's resulted in expansive retail, commercial and housing development in the area including residential communities and shopping centers. Over time, portions of Camelback declined.

2000 Total Population	17,236
Percent Hispanic	35%
Median Year HH Moved in	1997
Median PerCap Income	$14,738
Median Residential Rent	$485/mo
2015 Total Population	12,038
Percent Hispanic	36%
Median Year HH Moved in	2008
Median PerCap Income	$18,370
Median Residential Rent	$686/mo

Glendale Neighborhood



The Glendale neighborhood studied is located about 1 mile east of downtown Glendale and near some of the oldest parts of Glendale and the fast-growing new areas. Historic ranch-style and new urban-style homes can all be found here. Glendale Avenue is a major regional arterial extending from Scottsdale on the east (its name changes in Paradise Valley and Scottsdale to Lincoln Blvd) through downtown Glendale west to Luke Airforce Base at Litchfield Road. Like Garfield, Eastlake and Camelback, the Glendale neighborhood is accessed by commercial corridor. Like Garfield, Glendale Avenue housed many different retail facilities and auto dealerships, some of which still exist.

2000 Total Population	12,338
Percent Hispanic	32%
Median Year HH Moved in	1997
Median PerCap Income	$16,168
Median Residential Rent	$514/mo
2015 Total Population	10,909
Percent Hispanic	52%
Median Year HH Moved in	2008
Median PerCap Income	$15,982
Median Residential Rent	$635/mo

Summary of Neighborhood Population Characteristics

Year 2000	Eastlake	% Change	Garfield	% Change	Camelback	% Change	Glendale	% Change
Total Population	1,839		9,149		17,236		12,338	
Percent Hispanic	56%		87%		35%		32%	
Median Year HH Moved in	1997		1998		1997		1997	
Median PerCap Income	$12,687		$7,059		$14,738		$16,168	
Median Residential Rent/month	$248		$451		$485		$514	
Tenure	3		2		3		3	
Year 2015								
Total Population	1,604	-13%	6,820	-25%	12,038	-30%	10,909	-12%
Percent Hispanic	24%	-57%	78%	-10%	36%	3%	52%	63%
Median Year HH Moved in	2011		2010		2008		2008	
Median PerCap Income	$22,218	75%	$10,563	50%	$18,370	25%	$15,982	-1%
Median Residential Rent/month	$682	175%	$566	25%	$686	41%	$635	24%
Tenure	4	33%	5	150%	7	133%	7	133%

4. Results and Observation

a. Summary of Subject Neighborhood Analysis

Employment

Maricopa Association of Governments ("MAG") collects information on business annually by way of its annual Travel Reduction Program survey of employers and schools. However, MAG only surveys businesses with 5 or more employees. After observing the neighborhoods and comparing what was seen to MAG's data it because obvious that there was far more small business (fewer than 5 employees) in each neighborhood. For example, in one neighborhood MAG survey data indicated 25 businesses were in the neighborhood in 2015. Using Google Street View and Maps (referred to here as "Street View") 68 businesses were identified as being in the neighborhood. In the Glendale neighborhood MAG data showed 55 businesses while Street View Data analysis showed 143. Equally important was the type of business captured in the Crowd Source Data, but not captured in MAG data. In Glendale for example MAG data showed only 2 (3.6%) of all businesses to be Personal and Laundry Services. Using Street View Data counted 19 business fitting this category (13.3%). The same was found in all 4 neighborhoods. These are businesses more likely to be locally owned with very few employees so missed by using conventional means of counting. Knowing what small businesses exist and monitoring them is important to predicting impacts of policy decisions. Garfield was the only neighborhood that had an increase in number of business, whereas Eastlake stayed about the same and Camelback and Glendale both lost employers.

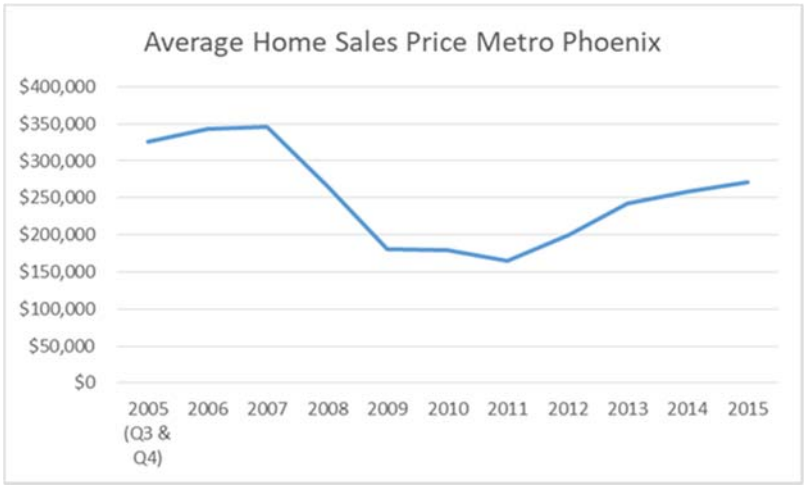
Employment MAG Employee Data and 2015 Google Street View Buiness Count

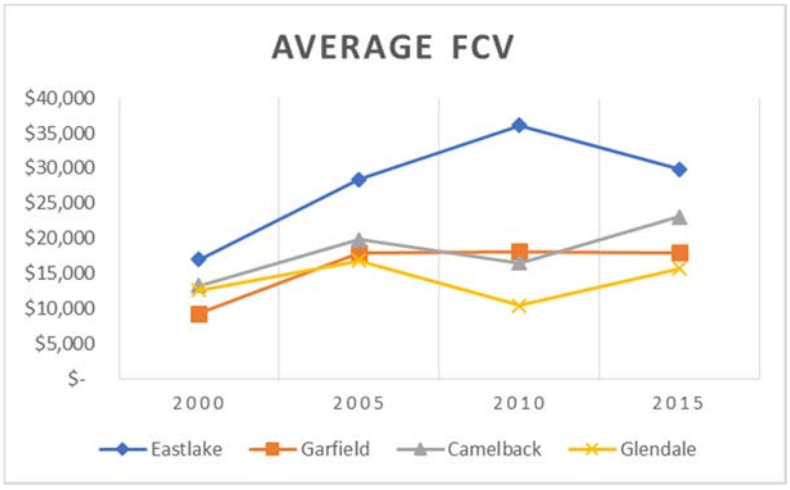
	Eastlake			Garfield			Camelback			Glendale		
	2000	**2015**	**Street View**	**2000**	**2015**	**Street View**	**2000**	**2015**	**Street View**	**2000**	**2015**	**Street View**
Number of Business	84	83	120	18	25	68	155	102	209	84	55	143
Min Num Employees	5	5		5	5		5	5		5	5	
Maximum Num Employees	523	1,575		100	100		190	589		140	93	
Avg Num Employees	51.8	48.4		21.0	21.7		19.9	25.5		24.8	18.6	

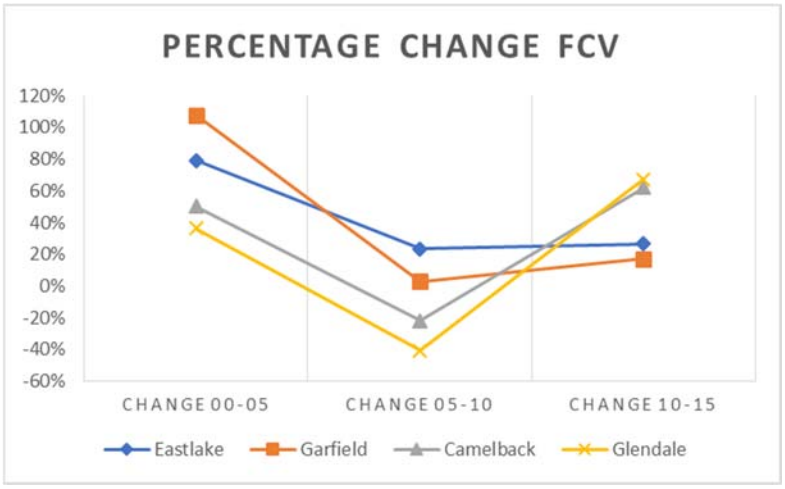
Housing and Property Values

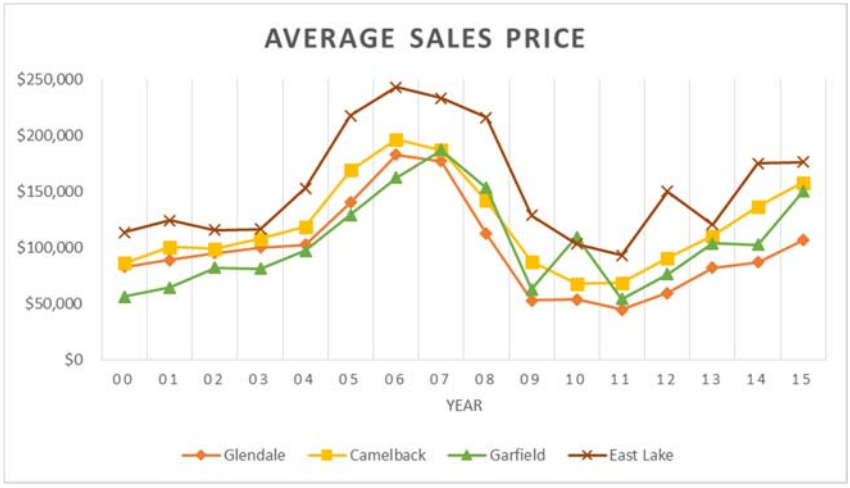
House and property values in all neighborhoods had similar trends in sales prices of homes and full cash value of all property as Maricopa County as a whole (Average Home Sales Price Metro Phoenix). The various chants below show the changes in Full Cash Value ("FCV"), Average FCV, % Change in FCV, Average sales Price and Number of Closing Transactions as illustrated in the graphs below.

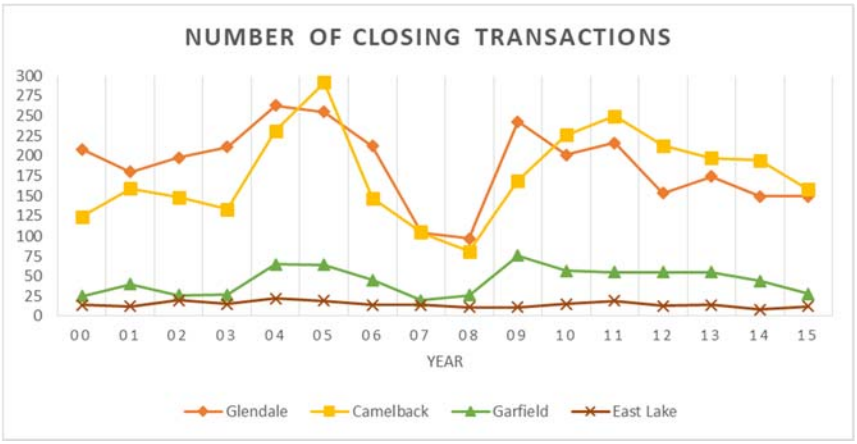
Maricopa County Historical Closings (Average Stats)				
Type	$	Homes sold	Homes on Market	$% Change
2005 (Q3 & Q4)	$326,200	45,894	52,702	N/A
2006	$342,750	68,007	178,958	5%
2007	$345,600	49,151	209,991	1%
2008	$265,125	57,757	216,029	-23%
2009	$180,150	79,536	175,395	-32%
2010	$180,075	76,233	173,171	0%
2011	$165,464	88,347	119,702	-8%
2012	$199,993	79,845	70,919	21%
2013	$242,478	75,753	73,764	21%
2014	$258,617	68,565	91,409	7%
2015	$271,716	74,938	79,021	5%
Change 2000-2015	-20.1%	38.8%	33.3%	











One observation is that Garfield and Eastlake neighborhoods were considerably less volatile in terms of number of closing transactions that occurred during the study period. This is the opposite of what would be expected if a neighborhood was experiencing gentrification. A gentrifying neighborhood would have considerably more sales/transfers of property as investors and speculators purchased property and pushed real estate prices upward. Also, the number of transactions in Garfield and Eastlake were considerably lower than either Camelback or Glendale, each of which showed trends that matched all of metro Phoenix. Average sales price has been the highest in Eastlake during the study period although the percent change in FCV was lowest over time in Garfield and Eastlake, again opposite of what would be occurring if those neighborhoods were rapidly changing. Eastlake did have the greatest change in Average of Median Rent Payment with a 175% increase during the study period and it had the lowest percent change in Average of

Median Value of Owner occupied Homes although the change in FVC was less than Glendale and Camelback and only slightly higher than Garfield. Eastlake had a 477% increase in housing projects with 20 to 49 units, an indication of new development occurring in the neighborhood which may explain the 175% increase in Rent Payment. New for rent construction replacing older units would likely command higher rents. The Glendale neighborhood performed the worst of all neighborhoods in almost every measure as shown below. This was expected given its location in the urban area and the lack of significant public investment in the area.

In all neighborhoods rent increased more than Per Capital Income. Eastlake had the most striking disparity with Per Capita Income rising 75% and Average House Hold Income rising 18.67% but Median Residential Rent increasing by 175%. Garfield had Per Capita Income rise 50% but Average of Median House Hold Income fell -1.94% and Average of Median Rent increased 46.78%. Glendale had income, value of owner occupied homes, number of housing units all go down, number of vacant units increase substantially but rent payment went up by 27%. Glendale also so median household income go down by 1% and Average of Median House Hold Income go down (-15.21%).

Housing (Change from 2000 to 2015)

	Camelback	Eastlake	Garfield	Glendale
Average of Median Household Income	11.26%	18.67%	-1.94%	-15.21%
Average of Median Rent Payment	41.29%	175.00%	46.48%	27.15%
Average of Median Value Owner Occupied Homes	39.23%	29.27%	70.09%	-1.27%
Sum of Housing Units	-10.64%	4.89%	7.14%	-3.27%
Sum of Housing Units Vacant	224.93%	-65.75%	125.00%	248.09%

Housing Stock

The makeup of housing stock changed in each neighborhood. Sum of Housing Units for Rent increased substantially in Glendale (137%), Camelback (98%) and Garfield (95%). Only Eastlake saw a decline in Housing Units for Rent -64%) and an almost 7% reduction in single family detached housing stock and a -40.35% reduction in duplex units. The data suggests Garfield, Camelback and Glendale all became more renter neighborhoods while Eastlake more owner occupied which seems contrary to the significant increase in projects that suggest it is densifying unless the new units added are owner occupied condominiums which correlates with a 64% decrease in Housing Units Renter Occupied but that conflicts with a 43% decrease in House Holds with Mortgages, an almost 50% reduction in the number of Housing Units Owner Occupied.

Hosuing Type (Change from 2000 to 2015)

	Camelback	Eastlake	Garfield	Glendale
Sum of Detached Single Family Homes	8.19%	-6.94%	19.38%	3.64%
Sum of Housing Units 2	5.80%	-40.35%	-2.96%	-24.14%
Sum of Housing Units 3-4	-16.14%	33.67%	44.72%	-60.70%
Sum of Housing Units 5-9	138.67%	1.98%	-10.87%	23.03%
Sum of Housing Units 10-19 units	70.78%	14.71%	-21.74%	17.24%
Sum of Housing Units 20-49	-35.42%	477.27%	-16.67%	76.44%
Sum of Housing Units 50 PLUS	-78.64%	-5.81%	-26.09%	-54.35%
Sum of Housing Units Own Occupied	-30.60%	-49.17%	1.44%	-27.91%
Sum of Housing Units Renter Occupied	-19.69%	78.42%	-8.69%	-10.52%
Sum of For Housing Units for Rent	98.10%	-64.07%	94.90%	136.76%
Sum of Households with a Mortgage	-26.49%	-42.96%	27.20%	-32.85%

Population

All four neighborhoods lost population during the study period. This is contrary what would be found if an area were gentrifying. Only Garfield and Eastlake had an increase in Total Housing Units. What is interesting is that Garfield had a drop of 25% in population but had the highest percent change in Total Housing Units (5.11%). This suggests either a decrease in density or a decrease in number of persons per household. Again, opposite what would occur if gentrification was occurring.

All neighborhoods saw significant change in population makeup. Camelback both saw the substantial change in each category of Spanish speaking population while Garfield, Eastlake and Camelback all saw increases in both Spanish and English Speakers and English Only Speakers population and lost significant numbers of people speaking Spanish with Limited English. This is a trend that would be expected because of gentrification but may well be the result other policy changes (SB 1070). Of note is the change in Education Attainment. Garfield and Eastlake saw very significant increase in those with Bachelor (235% and 282.22%) and Associate degrees (130% and 106%). This suggests a trend found in gentrifying neighborhoods.

Population (Change 2000 to 2015)

	Camelback	Eastlake	Garfield	Glendale
Sum of Total Population	-30.16%	-12.78%	-25.46%	-11.58%
Sum of Total Housing Units	-10.04%	3.96%	5.11%	-3.46%

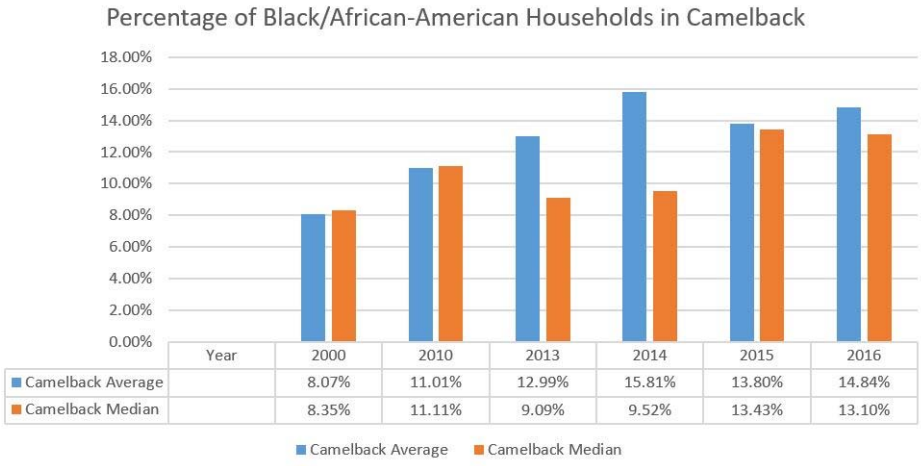
Language Spoken (Change 2000 to 2015)

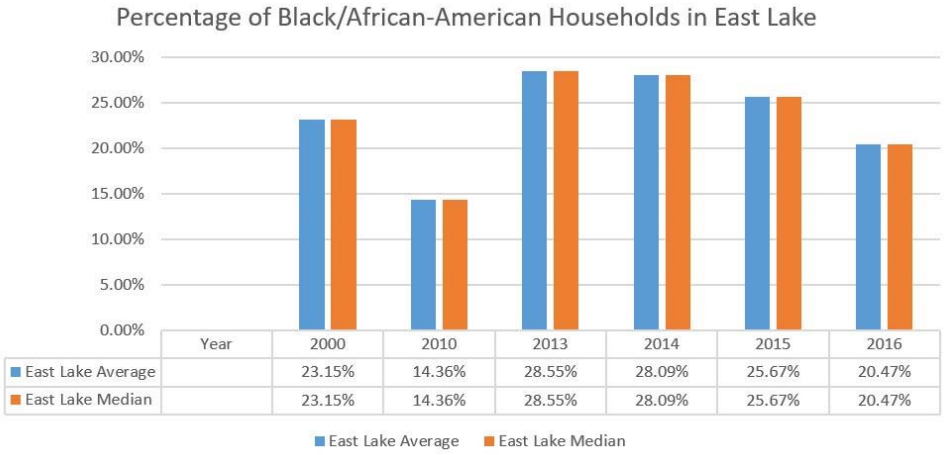
	Camelback	Eastlake	Garfield	Glendale
Sum of Spanish and English Speakers	-19.60%	41.86%	13.32%	32.78%
Sum of Spanish with Limited English Speakers	-60.88%	-34.58%	-56.54%	23.81%
Sum of Speak English Only	-15.96%	58.04%	97.36%	-33.86%

Education Attainment (Change 2000 to 2015)

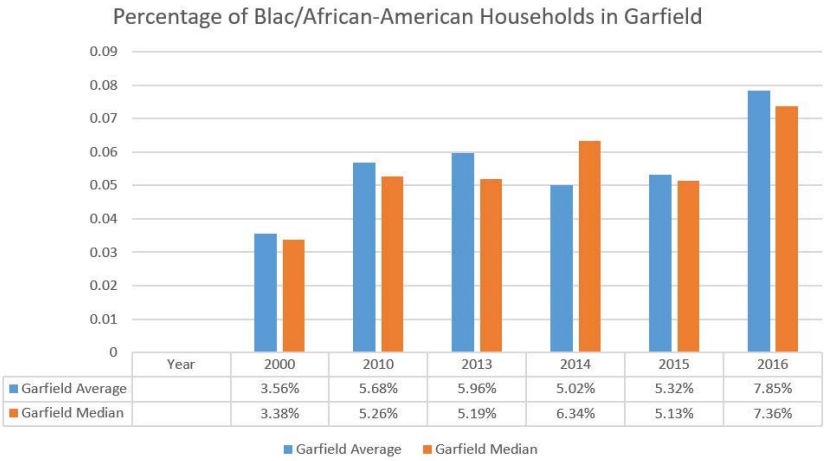
	Camelback	Eastlake	Garfield	Glendale
Sum of Bacherlor Degrees	10.76%	282.22%	235.05%	4.27%
Sum of Associate Degrees	14.86%	106.45%	130.30%	-5.66%

When Black/African American racial makeup is considered Eastlake has on average lost population which is surprising given it was historically African American neighborhood. This is a Signiant indication of change especially considering the average and median have change at the same rate. Garfield has increased its population of those who are Black/African American. Since one indication of gentrification is a reduction in Black/African-American households from a neighborhood, no real signs of any reduction in the percentage of Black/African-American households in Garfield, Camelback or Glendale, only Eastlake.





Year	2000	2010	2013	2014	2015	2016
East Lake Average	23.15%	14.36%	28.55%	28.09%	25.67%	20.47%
East Lake Median	23.15%	14.36%	28.55%	28.09%	25.67%	20.47%



Year	2000	2010	2013	2014	2015	2016
Garfield Average	3.56%	5.68%	5.96%	5.02%	5.32%	7.85%
Garfield Median	3.38%	5.26%	5.19%	6.34%	5.13%	7.36%

b. <u>Neighborhood Meetings</u>

There were several meetings held with neighborhood groups in the Camelback, Garfield and Eastlake neighborhoods. No meetings were held in the Glendale neighborhoods. The purpose of these was to get direct feedback from the residents compare comments with statistical analysis. The idea was people know it when we see it and those living and working in the impacted neighborhoods see it first so they are the front line of predicting change. Although the number of respondents and the method of selecting them means the results cannot be considered a statistically significant representation of the neighborhood, there are some interesting observations. The results related to displacement and change include Eastlake had the highest tenure with 66% of respondents saying they were lifelong residents of the neighborhood while Camelback (29%) and Garfield (22%) had much lower percent of respondents who stated they were lifelong residents of their neighborhood. Most respondents (66%) from the Eastlake neighborhood stated they did not work in the neighborhood. When asked if they use light rail 100% of Eastlake respondents stated never or rarely. When asked the same question respondents from Camelback and Garfield answered similarly with 85% and 75% responding rarely or never with the majority stating never. This suggests that proximity to light rail alone is not a motivation to use it. When asked "Do you observe that your neighbors are moving from the neighborhood" 60% of Camelback and Garfield respondents and 100% of respondents from Eastlake stated, "no change" so although changes are occurring, residents are not seeing significant pressure to move. When asked "Is there more or less crime in the past 10 years?" Camelback (60%), Garfield (86%) and Eastlake respondents answered, "Less or About the Same".

The use of Public Transit – specifically the light rail, it does not appear that residents of the neighborhoods impacted by construction and operation use the service. When asked how often they use the train [light rail], 75% of Garfield respondents indicated "Rarely" or "Never"; 71% of Camelback respondents indicated "Rarely" and 100% of Eastlake indicated "Rarely" or "Never". Respondents were more likely to use the bus. This correlates with Census data that showed Camelback (32.25%), Eastlake (62.86%) and Glendale (58.97%) all increased use of Public Transportation but Garfield showed a 46.61% decline in use.

5. Conclusions

a. Main Findings

This study presents a methodological issue of major significance – the use of the proposed Survival analysis to determine when change occurs as a result of light rail requires temporal data not available for this study to accurately predict with a high degree of confidence when change will occur. There is clear evidence that change has occurred in all three Phoenix neighborhoods and that Glendale neighborhood has not changed to the same degree. But change that is related specifically to light rail is not identified.

Were Eastlake, Garfield and Camelback "Gentrifiable"? – The first step in the analysis was to determine if the subject neighborhoods had characteristics that would make them likely to be gentrified. To determine if a neighborhood was gentrifiable in 2000, the study used Median Per Capita Income, Median Rent and Median Sales Price of a home sold. Table 7 below, shows the following statistics for each factor and for each neighborhood in the years 2000 and 2015:

	2000					2015				
Factor	Eastlake	Garfield	Camelback	Glendale	MSA	Eastlake	Garfield	Camelback	Glendale	MSA
Median Per Capita Income	$ 12,687	$ 7,059	$ 14,738	$ 16,168	$ 45,167	$ 22,218	$ 10,563	$ 18,370	$ 10,909	$ 42,812
Median Rent	$ 248	$ 451	$ 485	$ 514	$ 666	$ 682	$ 566	$ 686	$ 635	$ 986
Median Sales Price	$ 107,500	$ 56,450	$ 79,900	$ 83,086	$ 129,200	$ 167,450	$ 133,000	$ 144,000	$ 106,760	$ 271,716

The study than assessed the ability to gentrify buy applying the following formulas. The priori was that if A < 0 *and* B < 0 *and* C < 0 for a neighborhood, then the neighborhoods in question would be considered "gentrifiable" in 2000.

A = (Median Per capita Income)Neighborhood – (Median Per capita Income)MSA

B = (Median Rent)Neighborhood – (Median Rent)MSA

C = (Median Sale Price)Neighborhood – (Median Sale Price)MSA

We expected Eastlake, Garfield and Camelback all to be "gentrifiable" in 2000 and in fact the analysis supported this. For each neighborhood, each factor was less than the MSA Median and therefore each neighborhood was considered gentrifable. The table 8 shows the results of this analysis:

	Change Relative to MSA*		
	Factors	2000	
A	Median Per Capita Income Eastlake	$ (32,480)	< 0
	Median Per Capita Income Garfield	$ (38,108)	< 0
	Median Per Capita Income Camelback	$ (30,429)	< 0
	Median Per Capita Income Glendale	$ (28,999)	< 0
B	Median Rent Eastlake	$ (418)	< 0
	Median Rent Garfield	$ (215)	< 0
	Median Rent Camelback	$ (181)	< 0
	Median Rent Glendale	$ (152)	< 0
C	Median Sales Price Eastlake	$ (21,700)	< 0
	Median Sale Price Garfield	$ (72,750)	< 0
	Median Sales Price Camelback	$ (49,300)	< 0
	Median Sales Price Glendale	$ (46,114)	< 0

Did the neighborhoods gentrify? - Next, study tried to determine if the neighborhoods underwent gentrification between 2000 and 2015 by recomputing variables A, B, and C for 2015 and comparing to 2000 using the following formula and if difference decreased by 2015 for all factors, then the neighborhood did experience some degree of gentrification:

If $(A_{2015} - A_{2000}) > 0$, $(B_{2015} - B_{2000}) > 0$, and/or $(C_{2015} - C_{2000}) > 0$ than the neighborhood did gentrify

The results Eastlake, Garfield and Camelback all experienced some degree of gentrification. Glendale did not and, as shown in this study, all three factors showed decline indicating the neighborhood has not begun

to transition and fell further behind the MSA. The results show that Eastlake has improved, relative to the MSA more so than the Garfield and Camelback.

Did the neighborhood gentrify?

	Eastlake	Garfield	Camelback	Glendale
($A_{2015} - A_{2000}$)	$ 11,886	$ 5,859	$ 5,987	$ (2,904)
($B_{2015} - B_{2000}$)	$ 114	$ (205)	$ (119)	$ (199)
($C_{2015} - C_{2000}$)	$ (82,566)	$ (65,966)	$ (78,416)	$ (118,842)
Aggregate Change	$ (70,566)	$ (60,312)	$ (72,548)	$ (121,945)

Determining the utility benefit of light rail - Do those neighborhoods served by light rail benefit from the service provided by light rail? To benefit from light rail, a user must have access, so the utility benefit of light rail is accessibility to a station where a rider can get on or off a train, not proximity to the light rail system. Accessible means walkable distance and a walkable distance is considered .25 miles (1,320 feet). The utility benefit declines with distance from a station and a walkable threshold is considered .5 miles.

All three neighborhoods, Eastlake, Garfield and Camelback, have different access to light rail stations. Eastlake has 1 east bound and 1 west bound station separated by 560 feet. The average distance to the stations from the neighborhood centroid is 295 feet or .05 miles making the utility benefit high however only approximately 40% of all housing in the neighborhood is within ¼ mile of the station. Garfield has no station within its boundary. The light rail is not in the Garfield neighborhood and the closest station to the Garfield neighborhood is those located in Eastlake which is approximately .66 miles from Garfield's centroid. Only approximately 5% of all housing within the Garfield neighborhood is .25 miles from a station. Therefor the utility benefit of light rail to each neighborhood is very low. The Camelback neighborhood has 2 stations within its boundary and 1 located just north of its northwestern boundary. The 2 located within the neighborhood are approximately .90 miles apart. The average distance to the centroid from these 3 stations is .59 miles. Neither station within the Camelback neighborhood is .25 mile of the centroid only approximately 30% of all housing is within ¼ mile of one or both stations. Therefor the utility benefit of light rail to each neighborhood is very low.

Distance to Station from Neighborhood Centroid

Neighborhood	Distance to Centroid*	Utility Benefit
Eastlake	0.06	High
Garfield	0.66	Low
Camelback	0.59	Low

* miles

Note: Eastlake and Camelback are average distances

Did the advent of light rail cause the neighborhoods to gentrify? – Knowing that each neighborhood was gentrifiable and determining that Eastlake, Garfield and Camelback each had experienced some degree of gentrification and that the utility function of light rail the next step in the analysis was to understand more clearly if the advent of light rail caused the gentrification or was a catalyst for the onset of gentrification in the neighborhoods. To do this, a Survival Analysis technique was proposed with the outcome variable being time until gentrification occurred. The extended Cox model for the survival analysis was proposed. However, the data available proved to be insufficient to run the model. There were too few data points and some data were inconsistent between time periods to yield a statistically significant and reliable result.

All neighborhoods were found to be gentrifiable in the year 2000, prior to construction and operation of light rail. There is little doubt that significant changes have occurred in each neighborhood. Garfield showed the greatest positive change in almost all factors while Eastlake showed similar improvements as did Camelback but not to the same degree. Can these changes be attributed to light rail? Given the fact access to light rail station was lowest in Garfield, which had the most change and its likelihood of gentrification was highest, it is difficult to attribute the changes to light rail due to its low utility function. Camelback has the greatest access to light rail but showed moderate change. However, given that Glendale made no

improvement during the same time period is it possible that light rail was an influence on Eastlake, Garfield and Camelback but not a cause?

b. Strengths and Limitations of Findings

The data is insufficient to run the survival model and yield a reliable result to determine time to change related to light rail and prove this conclusively. Certain changes in neighborhood characteristics are better indicators than others but they may also be correlated with other factors or conditions occurring in the metro area. There are many factors that are changing around the same time, and it is important to control for their effect before we attribute those changes to light rail alone. One the one hand, light rail may have been the cause. On the other hand, the establishment of ASU's downtown campus and the change in growth patterns in the metro area resulting from the recession may have had a significant role. It's obvious Garfield changed in significant ways and could be considered as gentrifying, but it is not directly impacted by light rail so did light rail impact the Garfield neighborhood?

c. Observations

However, the changes in the neighborhoods already impacted (Eastlake, Garfield and Camelback) were significant when compared to Glendale which has not seen any positive change since 2000. The inference is that light rail has made the difference in how the neighborhoods recovered from the recession and have changed. What cannot be said conclusively is that absent light rail, these neighborhoods would not have experienced the same changes or the same degree of change. Other observations and conclusions are:

- Neighborhood change is a normal part of community evolution and may occur in correlation with overall community change. The neighborhood's studied declined in line with the overall National and local economy due to the national recession. Those neighborhoods located in the City of Phoenix that were impacted by construction and operation of light rail, recovered in line with the overall Phoenix economy while the Glendale neighborhood, not yet impacted by light rail has lagged significantly in its recovery. Is this disparity a result of light rail? If light rail had been constructed through the Glendale neighborhood would it have recovered in similar ways to the Phoenix neighborhoods?

- Changes are seen retrospectively – we are studying the effect, not the cause and cause can be many things. All the data reflects the past. Can the past be used to predict the future? The recovery and positive change can be the result of factors exogenous to the neighborhood and relate to economic stimulants other than light rail. In the case of this study, change to the neighborhoods located in the City of Phoenix, could be attributed, to some degree, to the establishment of the Arizona State University Downtown Campus ("ASU Campus") and its rapid expansion. How much may be attributable to the ASU Campus is not determined but logic and observation suggest some significant amount of change was related to the ASU Campus. Change can also relate to other broader public policy decisions too. For example, the change in percent of population listed as Hispanic dropped in all three neighborhoods but rose in the Glendale neighborhood. These changes occurred at the same time Arizona instituted Senate Bill 1070 which specifically targeted illegal immigrants, many of whom are Hispanic. Might some of the change relate to the passage of Senate Bill 1070? So, when considering the past as a predictor, knowing all the possible reasons for change is critical to confidently predicting the future.

- The Garfield neighborhood seems to have had characteristics in the year 2000 that match those of the Glendale neighborhood in 2015 and therefore reflects the changes most likely to occur in the Glendale neighborhood if it were impacted by construction and operation of the light rail. However, because Glendale is not influenced by the either ASU Campus or emerging downtown core would it change as much and to the same degree as Garfield?

- Public policy and improvements can, and many times do, increase the rate of change. Might the neighborhoods impacted by construction and operation of light rail have changed regardless of light rail? It is possible and even highly likely, but the probability is not determined. However, other

public policies directly related to construction and operation of light rail also had impacts and likely accelerated the rate of change. The location of a station, change in zoning codes, targeted financing or incentives for transit-oriented development along with other public policy decisions can, and often do, impact the type and rate of change. How much change is a result of construction and operation of light rail and how much is attributable to other related public policy and investment? The Glendale neighborhood has not been impacted by any of these factors and has seen little or no positive change since recovery from the recession has occurred.

- Rents grew considerably more than income. In all three Phoenix neighborhoods, rents increased substantially faster than household or per capita incomes. For example, in Eastlake average rents rose 178% but income only increased 75%. In both Garfield and Camelback rents rose at twice the rate as income. Glendale however saw a worse change – income dropped by 1% but rents increased by 27%. Were rent increases directly and solely related to construction and operation of light rail? The answer is no. Was the change accelerated and made greater due to light rail? Possibly. This situation is found across the US and represents other larger factors. But, there does appear to be a direct correlation in terms of rent increase and income of residents living in a neighborhood adjacent to light rail.

- Every neighborhood saw a significant loss of total population between 2000 and 2015 with Garfield (-25%) and Camelback (-30%) having the greatest percentage drop and Eastlake (-12) and Glendale (-13) had almost the same decrease in population. The reason for these losses is not clear but may correlate with a significant reduction in Hispanic population, change in land uses or a combination of factors.

- There was a very significant reduction in Hispanic population in all but one (Camelback) of the study neighborhoods. In the neighborhoods located in the City of Phoenix there was a decrease in percentage of population that is Hispanic but in the Glendale neighborhood there was a significant increase (32% up to 52%). In Eastlake the percentage of the population identified as Hispanic dropped in half from 56% to 24%. Was this related to construction and operation of light rail? No definitive conclusion as to why was reached. Could it be a symptom of change? Yes. An unfortunate reality may be that increase in rents is causing existing residents to be economically displaced and they are relocating to other neighborhoods where rents are more affordable possibly moving from Phoenix to Glendale but that statement cannot be made with confidence.

- There appears to be a significant impact on small business. One of the most striking changes was to small business – both the number and types. More reliable, consistent longitudinal data is required to better study the impact on small business. Very good data, collected regularly over long period of time is available for business with 5 or more employees. But for small, locally owned business, data is not readily available. It is small, locally owned business that are most likely impacted by economic stimulants causing changes to the neighborhood. A significant discrepancy in information about small business was found. For example, Maricopa Association of Governments ("MAG") collects information on business annually by way of its annual Travel Reduction Program survey of employers and schools. However, MAG only surveys businesses with 5 or more employees. For example, in one neighborhood MAG survey data indicated 25 businesses were in the neighborhood in 2015. Using Google Street View and Maps (referred to here as "Crowd Sourced Data") 68 businesses were identified as being in the neighborhood. In the Glendale neighborhood MAG data showed 55 businesses while Crowd Source Data analysis showed 143. Equally important was the type of business captured in the Crowd Source Data, but not captured in MAG data. In Glendale for example MAG data showed only 2 (3.6%) of all businesses to be Personal and Laundry Services. Using Crowd Source Data counted 19 business fitting this category (13.3%). These are businesses more likely to be locally owned with very few employees so missed by using conventional means of counting. Knowing what small businesses exist and monitoring them is important to predicting impacts of policy decisions.

- We know it when we see it and those living and working in the impacted neighborhoods see it first, so they are the front line of predicting change. There were several meetings held with neighborhood

groups in the Camelback, Garfield and Eastlake neighborhoods. No meetings were held in the Glendale neighborhoods. Although the number of respondents and the method of selecting them means the results cannot be considered a statistically significant representation of the neighborhood, there are some interesting observations. The results related to displacement and change include Eastlake had the highest tenure with 66% of respondents saying they were lifelong residents of the neighborhood while Camelback (29%) and Garfield (22%) had much lower percent of respondents who stated they were lifelong residents of their neighborhood. Most respondents (66%) from the Eastlake neighborhood stated they did not work in the neighborhood. When asked if they use light rail 100% of Eastlake respondents stated never or rarely which is interesting given Eastlake has the highest utility function related to light rail (best access to light rail). When asked the same question respondents from Camelback and Garfield answered similarly with 85% and 75% responding rarely or never with the majority stating never. This suggests that proximity to light rail alone is not a motivation to use it. The use of Public Transit – specifically the light rail, it does not appear that residents of the neighborhoods impacted by construction and operation use the service. When asked how often they use the train [light rail], 75% of Garfield respondents indicated "Rarely" or "Never"; 71% of Camelback respondents indicated "Rarely" and 100% of Eastlake indicated "Rarely" or "Never". Respondents were more likely to use the bus. This correlates with Census data that showed Camelback (32.25%), Eastlake (62.86%) and Glendale (58.97%) all increased use of Public Transportation but Garfield showed a 46.61% decline in use.

- When asked "Do you observe that your neighbors are moving from the neighborhood" 60% of Camelback and Garfield respondents and 100% of respondents from Eastlake stated, "no change" so although changes are occurring, residents are not seeing significant pressure to move. When asked "Is there more or less crime in the past 10 years?" Camelback (60%), Garfield (86%) and Eastlake respondents answered, "Less or About the Same".

- The obvious impacts to a neighborhood are on property value. Are the changes the result of construction and operation of light rail? The answer is likely, but how much is attributable to light rail is not determined. The average full cash value of all property in all study neighborhoods increased between 2000 and 2015. Camelback (89%), Garfield (113%) and Eastlake (114%) all impacted by light rail and all rose substantially while Glendale, not yet impacted by light rail rose by only 22%.

- When sales price is considered, all neighborhoods saw an increase in average sales price between 2000 and 2015 while overall metro Phoenix (Maricopa County) saw a 16.7% decrease. Camelback (82.7%), Garfield (165.7%) and Eastlake (55.2%) saw substantial increases but Glendale saw only a 28.5% increase, considerably lower than those neighborhoods already impacted by light rail, but still higher than the County average for the same time period.

- When sales price per square foot is considered, the trend is similar but not as pronounced Camelback (73.4%), Garfield (126.8%) and Glendale (22.1%) saw increases at similar rates but Eastlake saw a 60.7% increase. This also reflects the fact the average unit size has increased (average price goes up but cost/square foot goes up slower) except in Glendale average sales price and average sales price/square foot have gone up at exactly the rate. This is reflected in the average unit size for Glendale (4.3%), Camelback (3.0%), Garfield (14.7%) all saw an increase but East Lake (-3.4%) saw a decline. There are several possibilities for this, one being that there were more new units built in Eastlake and those are smaller in size.

- The School of Geographical Sciences & Urban Planning – Geospatial Research and Solutions created an online interactive map showing changes in each neighborhood from 2000 to 2015. The maps can be found by going to the following website:

  https://asu.maps.arcgis.com/apps/MapJournal/index.html?appid=42bbaab9b4f94bdc91763fdb9dd55ffb

d. Recommended Additional Research and Work

Use of the survival analysis technique requires data available on a yearly or better, monthly basis. Using census data is not sufficient and American Community Survey data has limitations. It may also be useful to use the model to study other cities that have had light rail operating for longer time. Because the operation of light rail in metro Phoenix corresponds with the national recession, state wide policy that impacted underserved populations and the development of significant projects that impacted development patterns in downtown Phoenix, other cities may provide a better context. One of the areas of study that is of great interest, but insufficient data was available, is impact on small, locally owned business. Knowing how light rail impacts small business over a long period of time would help understand how those business are effected and could be helped.

One of the best sources for highly reliable is the neighborhoods merchants and residents. Collecting data at that level, consistently over time, would provide better and more reliable data. Establishing a tool to help residents collect information about critical factors is one approach. No good data source for small business is readily, consistently available and regularly updated. Also, there is no easy way to know what rents merchants and residents pay so no way to accurately measure those changes. Many of the buildings are small and owned by small investors who do not report the rents they change so no source exists for this information. Using technology, for example, to create an app designed to be used by neighborhood groups and residents to record and store data that can be uploaded and fed into a model to show changes and predict an inflection point in a neighborhood. If neighborhood groups could be employed to identify and collect data along with their observations about changes it would not only provided needed data but engage the neighborhoods, empower them and provide them facts needed to address policy makers about changes. This would also create better neighborhood connectivity and communication, so residents and merchants can better advocate for protections against change that could cause displacement. Applying this method would also foster community engagement and help empower neighborhoods with facts that allow informed interaction with policy makers and elected officials.

Appendix 1 List of 40 Factors from Census Data Used

Percent Change between 2000 and 2015	**Camelback**	**Eastlake**	**Garfield**	**Glendale**
Average of MedHInc201	11.26%	18.67%	-1.94%	-15.21%
Average of MedRnt_Pay	41.29%	175.00%	46.48%	27.15%
Average of MedValOwnO	39.23%	29.27%	70.09%	-1.27%
Average of PrCapIn	24.64%	75.12%	49.64%	-1.15%
Median of HUMedYrBlt	-0.05%	0.91%	-0.28%	-0.10%
Median of MedYrHHMov	0.60%	0.70%	0.68%	0.63%
Sum of AmInd_Alas	-51.47%	150.98%	-39.50%	-39.58%
Sum of Asian_Only	-1.14%	14.29%	-76.92%	92.50%
Sum of AssocDeg	14.86%	106.45%	130.30%	-5.66%
Sum of Attached_1	-41.19%	-63.27%	-76.99%	-16.61%
Sum of BachDeg	10.76%	282.22%	235.05%	4.27%
Sum of CarTruckVa	-42.52%	24.52%	-12.58%	-24.45%
Sum of Detached_1	8.19%	-6.94%	19.38%	3.64%
Sum of ForRent	98.10%	-64.07%	94.90%	136.76%
Sum of Hisp_Lat	-28.40%	-61.72%	-33.21%	42.76%
Sum of HU	-10.64%	4.89%	7.14%	-3.27%
Sum of HU_Occ	-23.38%	42.84%	-5.47%	-19.69%
Sum of HU_Vacant	224.93%	-65.75%	125.00%	248.09%
Sum of HU10_19	70.78%	14.71%	-21.74%	17.24%
Sum of HU2	5.80%	-40.35%	-2.96%	-24.14%
Sum of HU20_49	-35.42%	477.27%	-16.67%	76.44%
Sum of HU3_4	-16.14%	33.67%	44.72%	-60.70%
Sum of HU5_9	138.67%	1.98%	-10.87%	23.03%
Sum of HU50_PLUS	-78.64%	-5.81%	-26.09%	-54.35%
Sum of Mdeg	76.76%	8.51%	626.67%	7.19%
Sum of Mortgage	-26.49%	-42.96%	27.20%	-32.85%
Sum of NoMortgage	4.05%	0.00%	-14.86%	72.50%
Sum of OccHU	-23.38%	42.84%	-5.47%	-19.69%
Sum of PublicTran	**32.75%**	**62.86%**	**-46.61%**	**58.97%**
Sum of ResHUOwnOc	**-30.60%**	**-49.17%**	**1.44%**	**-27.91%**
Sum of ResHURntOc	**-19.69%**	**78.42%**	**-8.69%**	**-10.52%**
Sum of SpanAndEng	-19.60%	41.86%	13.32%	32.78%
Sum of SpanLimEng	-60.88%	-34.58%	-56.54%	**23.81%**
Sum of SpkEngOnly	**-15.96%**	**58.04%**	**97.36%**	**-33.86%**
Sum of SqMiles	-17.41%	1.89%	-17.12%	-0.19%
Sum of TotalPop	-30.16%	-12.78%	-25.46%	-11.58%
Sum of TotHU	-10.04%	3.96%	5.11%	-3.46%
Sum of Walked	-8.96%	-76.32%	-31.82%	-94.68%
Sum of White_Only	-17.04%	1.00%	-24.51%	-15.59%
Sum of WorkHome	-77.52%	566.67%	332.35%	53.85%

Turning the Corner required exploration of various types of displacement, such as physical, cultural and commercial. This necessitated study of various neighborhood characteristics and analysis of quantitative neighborhood indicators. One important aspect of Turning the Corner is identifying data sources, local and national, that are timely and available, released more frequently, have finer levels of geographic detail, or tap new data sources. The objective is the practical application of a methodology that can, on a regular basis, be applied to any study area to predict changes, the data sources must be at the appropriate spatial unit, readily available, reliable and consistently collected over the appropriate time periods. It is possible to collect data that describes current conditions, some of which shows changes that have occurred, but not be readily available, collected for only a short time period or not in a form that can be incorporated into a predictive model.