Introduction

Community investment in the city of Los Angeles has been shaped by historic policy decisions. From the 1930s to 1970s, the city participated in redlining, a mortgage lending practice that segregated the city. Segregation upheld under redlining created historic disinvestment in minority communities that are still evident in the racial demographics, educational attainment, and wealth of our neighborhoods today. This paper will focus on the research question: are fatal car collisions more likely to occur in historically redlined neighborhoods in Los Angeles? The analysis applied the clipping technique in GIS to determine the number of fatal car collisions in redlined Los Angeles. The results of the analysis show that by land area, the most fatal car collisions do in fact occur within formerly redlined areas. Maps designed for the analysis are provided in text, accompanied by full-page versions provided in the appendix for closer inspection.

Background

Redlining

In 1918, the Department of Labor launched the “Own Your Own Home” campaign believing that encouraging property ownership would give citizens a stake in economic stability and civic engagement after WWI (American Architect, 1919). Homeownership began to be advertised as an anti-communist patriotic duty for American families in this era (Lands, 2008). However, mortgages were highly limited at the time, making property ownership unattainable for many families. The Great Depression further exacerbated this problem, prompting the creation of the Federal Housing Administration (FHA) as part of the New Deal programs in 1934 (HUD, 2019). The FHA provides insurance for housing lenders, allowing banks to take on more risk and
expand mortgages (HUD, 2019). Homeownership increased from 40% at the FHA’s inception to nearly 70% by the turn of the century (HUD, 2019).

However, FHA insurance was not available for all Americans. The Home Owners’ Loan Corporation (HOLC) was also created under the New Deal to refinance mortgages during the Great Depression (Roosevelt Institute, 2012). The HOLC developed maps of American cities designed to assess the risk of investment for various neighborhoods (Kazmi, 2017). Areas deemed best for investment were colored green on the maps, areas not strong enough to be green but still desirable were shown as blue, while declining areas were yellow, and areas seen as “hazardous” were red. The HOLC assigned letter grades of A, B, C, and D to these areas with A being the areas best for future real estate investment and D the worst.

The HOLC system relied heavily on the racial make-up of a neighborhood to determine its grade. Neighborhoods that were primarily Black, immigrant, or working-class were seen as “hazardous” investments from the point of view of the banks, lenders, and real estate developers that created the system. Once the HOLC grading system was established, the FHA would only guarantee loans to white people living in green and blue coded areas. Black families that would have been able to afford the same mortgages as white families were shut out of the lending process and forced

Figure 1: Home Owner’s Loan Corporation (HOLC) historic Redlining map of Los Angeles
into red graded areas. The FHA lending process created and upheld racial segregation in American cities. Decreased property ownership in red graded neighborhoods lead to decades of public and private disinvestment and decreased property tax revenue to support education and infrastructure. This phenomenon of downward spiraling disinvestment has come to be known as redlining (Doan, 2017). Redlining maps for the city of Los Angeles are shown in Figure 1.

While Congress passed civil rights protections throughout the 1960s, bringing an end to housing segregation proved more challenging. Even though the practice of redlining was challenged many times in court, it was not federally outlawed until the passage of the Home Mortgage Disclosure Act of 1975 (Canner et al., 1991). The Act required lenders to publicly report the amount and dollar value of loans across neighborhoods (Canner et al., 1991). However, the impacts of redlining were not reversed by the practice being made illegal. Redlining guaranteed that Black families in America would not have access to the intergenerational wealth and upward mobility white families were able to obtain through property ownership. Lack of investment left the inner cities of America in disrepair, with residents facing decreased educational, health, and monetary outcomes that persist today (Rothstein, 2017).

Traffic Collisions in Los Angeles

Over 200 people die in Los Angeles every year as a result of traffic collisions (LADOT, 2019). Collisions are the leading cause of death for children in the city, and collisions have increased 32% since 2015 (Nelson, 2019). Mayor Eric Garcetti committed to Vision Zero in 2015, an international campaign for cities to enhance investment in infrastructure.
and policy changes to bring deaths from car collisions to zero. Since then, the city has identified a High Injury Network to recognize that 70% of the city’s collisions occur on only 6% of the city’s streets (LADOT, 2019). This network overlaps heavily with areas of the city that have faced historic disinvestment due to the racial segregation created by redlining, demonstrated in Figures 2 and 3.

Less than 19% of trips in the city are made by walking or biking, but 44% of people killed or seriously injured in traffic collisions from 2003 to 2015 were pedestrians or cyclists (LA GeoHub, 2016). Cycling rates have been increasing more rapidly among minority communities than white communities since 2000, but streets in minority communities have fewer bike lanes, higher speed limits, and fewer safety measures like crosswalks and street lamps (National Household Transportation Survey, 2017; Houston et al., 2004).

Urban blight caused by redlining spurred the development of major roadways through minority communities without the same safety requirements observed in communities with white property owners (Houston et al., 2004). To determine if there is a lasting overlap between formerly redlined areas and street safety, GIS analysis will be applied to find if there is a difference between the amount of fatal traffic collisions across HOLC graded areas.
Data

The analysis relies on collision data provided by the City of Los Angeles GeoHub, collected from the Statewide Integrated Traffic Records System (SWITRS) from 2009-2013. The High Injury Network shapefile was sourced from the City of Los Angeles GeoHub as well. Redlining shapefiles were collected from the University of Richmond’s Digital Scholarship Lab Mapping Inequality project led by Robert K. Nelson. Finally, demographic data was sourced from the 2014 American Communities Survey (ACS).

Methodology

The first step of analysis consisted of clipping the redlining shapefile so that each grade (A, B, C, D) could be analyzed separately. Fatal collisions data was then clipped to determine how many fatal collisions occurred in each graded area. The city of Los Angeles’s GeoHub provides data for all fatal car collisions in the city from 2009-2013. While the data set includes all fatal and non-fatal accidents, the analysis was restricted to fatal accidents to reduce the total number of data points.

The total and fatal collisions could be calculated at this point, but the total land area was not consistent across grades. Yellow graded areas reported the most accidents, but it was clear upon visual inspection that more land area was coded yellow than the other grades. Therefore, land area was added to the attribute tables of each graded area and summary statistics were calculated to determine the total area of each grade. The same process was applied to determine contemporary demographic measures of interest such as median income, poverty rate, and educational attainment.
Results

The primary analysis results are shown in Figure 4. The summary statistics in Table 1 show that 83% of fatal collisions within former HOLC graded areas of Los Angeles occur in formerly red and yellow graded HOLC areas. In fact, the majority of fatal collisions occur in former yellow areas before controlling for total land area. After controlling for area, both total and fatal collisions increase moving from green to red grades. In total, 1.63 fatal collisions occurred per square mile in formerly redlined areas compared to 0.33 in green areas.

Table 1: Collisions Results Summary

<table>
<thead>
<tr>
<th>HOLC Grade</th>
<th>Total Collisions</th>
<th>Fatal Collisions</th>
<th>Total Area (mi²)</th>
<th>Total Collisions/mi²</th>
<th>Fatal Collisions/mi²</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2,599</td>
<td>13</td>
<td>39.19</td>
<td>66.32</td>
<td>0.33</td>
</tr>
<tr>
<td>B</td>
<td>12,306</td>
<td>55</td>
<td>64.25</td>
<td>191.53</td>
<td>0.86</td>
</tr>
<tr>
<td>C</td>
<td>44,430</td>
<td>216</td>
<td>151.13</td>
<td>293.99</td>
<td>1.43</td>
</tr>
<tr>
<td>D</td>
<td>24,991</td>
<td>118</td>
<td>72.33</td>
<td>345.51</td>
<td>1.63</td>
</tr>
</tbody>
</table>

Figure 4: Fatal collisions overlaid with historic HOLC grades
Figure 5: Fatal collisions overlaid with historically “A” and “B” HOLC graded areas

Figure 6: Fatal collisions overlaid with historically “C” and “D” HOLC graded areas
Additional analysis of demographic data revealed that redlined neighborhoods also have lower median income, higher poverty rates, and lower educational attainment. Table 2 shows that median income is highest in formerly green graded areas, while the average poverty rate is highest in formerly redlined areas. Green areas also have the highest percent white population, nearly fifteen percentage points higher than redlined areas. Interestingly, the average percent Black population is nearly consistent across the city. Mapping analysis shows that this is because the highest concentrated Black population in the city today is around the Baldwin Hills area, which was formerly green and blue graded. Demographic maps are presented below with full page versions in the appendix.

Table 2: Demographic Results Summary

<table>
<thead>
<tr>
<th>HOLC Grade</th>
<th>Median Income</th>
<th>Average Poverty Rate</th>
<th>% White</th>
<th>% Black</th>
<th>Population Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>$85,966.55</td>
<td>9.03%</td>
<td>62.58%</td>
<td>9.05%</td>
<td>17,958</td>
</tr>
<tr>
<td>B</td>
<td>$59,149.12</td>
<td>14.96%</td>
<td>57.80%</td>
<td>9.26%</td>
<td>29,678</td>
</tr>
<tr>
<td>C</td>
<td>$44,055.55</td>
<td>20.91%</td>
<td>50.39%</td>
<td>8.95%</td>
<td>29,903</td>
</tr>
<tr>
<td>D</td>
<td>$41,760.56</td>
<td>24.54%</td>
<td>47.67%</td>
<td>8.64%</td>
<td>34,047</td>
</tr>
</tbody>
</table>
Figure 7: Current day demographics across formerly A, B, C, and D HOLC Graded areas.
Educational attainment is also consistent with previous results. Table 3 shows that the percentage of residents surveyed over 25 that have less than a 9th grade education is highest in formerly redlined areas and is nearly 35 percentage points higher than former green graded areas. Conversely, green areas have the highest percent population with graduate or professional degrees. Mapping results are presented on the following page, with full page maps included in the appendix.

**Table 3: Educational Attainment Results Summary**

<table>
<thead>
<tr>
<th>HOLC Grade</th>
<th>&lt; 9th Grade Only</th>
<th>High School Diploma</th>
<th>Bachelor's Degree</th>
<th>Graduate Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5.48%</td>
<td>16.19%</td>
<td>38.18%</td>
<td>25.32%</td>
</tr>
<tr>
<td>B</td>
<td>17.62%</td>
<td>23.78%</td>
<td>35.97%</td>
<td>20.41%</td>
</tr>
<tr>
<td>C</td>
<td>29.87%</td>
<td>29.61%</td>
<td>27.71%</td>
<td>12.41%</td>
</tr>
<tr>
<td>D</td>
<td>37.01%</td>
<td>29.12%</td>
<td>22.77%</td>
<td>10.35%</td>
</tr>
</tbody>
</table>

**Limitations**

There are many additional measures of the impacts of disinvestment to consider, but the analysis was limited to available data. Additional measures that would be of interest for future analysis include measures such as investment in street repair, heat maps for trees and street lights, and education or public health outcomes. The years of analysis were also limited by data availability. Vision Zero has reported that car collisions have increased in 2015, but collision data was only available up to 2013. Collision data was only available for the city of Los Angeles boundaries, while the redlining shapefile encompasses a larger area. Finally, while the mapping analysis demonstrates more fatal collisions occur in redlined areas, the results should not be interpreted as indicating causality between redlining and fatal collisions. The analysis does not sufficiently address other variables that may have impacted outcomes historically, and a more sophisticated statistical analysis would be required to indicate a correlation or association between the variables of interest.
Figure 8: Current day education outcomes across formerly A, B, C, and D HOLC Graded areas.
Conclusion

Redlining has had a measurable effect on the fate of American cities. The presented analysis shows that controlling for land area, fatal collisions in Los Angeles from 2009-2013 increased with the severity of HOLC grade. Therefore, the effects of redlining are still observable in our cities today despite the practice being made illegal in the 1970s. Even though housing discrimination has been made illegal, there must be further action to counteract the lasting impacts of historical disinvestment.

The practice of reverse-redlining is a potential policy solution to this problem, where policymakers may create incentives for developers and individuals to invest in historically redlined areas (Rothstein, 2017). However, these initiatives are under-utilized and may lead to gentrification. The city of Los Angeles now allocates funds for infrastructure improvements equally across council districts. However, the city should move forward by investing more heavily in formerly redlined areas in order to establish a more equitable environment for city residents. Overall, governments must recognize the lasting impacts of redlining on the lived experience of our cities and develop city plans and budgets accordingly.
References


Figure 1: Home Owner’s Loan Corporation (HOLC) Historic Grade Map of Los Angeles
Figure 2: Vision Zero High Injury Network Overlaid on Historic Redlining Maps
Figure 3: Vision Zero High Injury Network, Expanded Map
Figure 4: Fatal Collisions overlaid on all HOLC Graded Areas
Figure 5: Fatal Collisions overlaid on Historic “A” and “B” HOLC Graded areas.
**Figure 6:** Fatal Collisions overlaid on Historic “C” and “D” HOLC Graded areas.
Figure 7: Median Household Income by Census Tract, ACS 2016
Figure 8: Poverty Rate by Census Tract, ACS 2016
Figure 9: Percent of the population identifying as White/Caucasian by Census Tract, ACS 2016
Figure 10: Percent of the population identifying as Black/African American by Census Tract, ACS 2016
Figure 11: Percent of the population age 25+ with less than 9th Grade Education, ACS 2016
Figure 12: Percent of the population age 25+ with a High School Diploma or equivalent, ACS 2016
Figure 13: Percent of the population age 25+ with a Bachelor’s Degree, ACS 2016
Figure 14: Percent of the population age 25+ with a Graduate or Professional Degree, ACS 2016