

**PPD 631**

**Geographic Information Systems for Public Policy,  
Planning & Development**

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GIS Research Project

A Demographic Study on Los Angeles Metro Rail Purple  
Line Extension Corridor

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## **Introduction**

Los Angeles Metro Rail is the rail rapid transit system that serves Los Angeles County, and it's operated by Los Angeles County Metropolitan Transportation Authority (LACMTA). Currently, LA Metro Rail system includes six lines: two of them are heavy rail lines (Red and Purple Lines), and four of them are light rail lines (Blue, Green, Gold, and Expo Lines). The system had expanded many times since its opening. As of 2018, the system has 93 stations, a total service length of 105 miles, and an average weekday ridership of 342,841.

As the population in Los Angeles area keeps increasing, traffic congestion issues become more and more severe. Public transit has begun to gather more attention from local citizens, many of which have begun to commute utilizing public transit rather than driving a car. With many expansion projects underway, LACMTA hopes that such actions would benefit more people due to the convenience of public transit, and will hopefully encourage the entire county to use these more environmentally friendly travel alternatives.

This research project will be focused on LA Metro Rail Purple Line Extension, which is one of the major transit expansion projects in progress, with the utilization of geographical information systems (GIS). GIS has been proven to be a vital decision supporting tool. By visualizing the spatial or geographical data, GIS facilitates more in-depth analysis, and leads to better decision making. Additionally, GIS fosters a bigger spatial awareness of our communities and environment. With the GIS's assistance, the projections of future ridership following Purple Line extension would be more accurate. Consequently, the results from this research could be taken into consideration for future public transit developments.

## **Background**

As one of Los Angeles Metro's priority projects, the Purple Line Extension project will extend the current Purple Line westward for about nine miles from the current Wilshire/Western terminus, and add additional seven stations on the line. This extension project will provide a fast and reliable alternative for commuters to travel between downtown Los Angeles, the Miracle Mile, Beverly Hills, Century City and Westwood, which includes UCLA and the VA Hospital. Figure 1 presents the map of the Purple Line Extension from the LA Metro website.

Purple Line Extension project is being constructed in three sections. Section 1 is 3.92 miles long, and contains three stations: Wilshire/La Brea, Wilshire/Fairfax, and Wilshire/La Cienega. Construction of section 1 began in 2015, and it's expected to be completed in 2023. Section 2 has a length of 2.59 miles, and includes two stations: Wilshire/Rodeo and Century City/Constellation. Section 2 began its construction in 2018, and it's expected to be done in 2025. Section 3 is 2.56 miles long, and has two

stations: Westwood/UCLA and Westwood/VA Hospital. Section 3 is still in the middle of pre-construction activities, and the estimated year of completion is 2026.

When the entire extension project is finished, the travel between downtown Los Angeles and Westwood will be approximately 25 minutes. The estimated daily ridership at the seven new Purple Line stations will be 49,300. The whole Metro Rail system is projected to experience 78,000 additional trips per day due to the Purple Line extension.



Figure 1. Purple Line Extension Map from LA Metro

## Methodology

This section will first discuss what criteria are selected for this project. Next, the types of data retrieved for this project will be mentioned. Then, there will be a subsection about how data are processed for the presentation. Finally, there will be a brief discussion on some data limitations that restrain the analysis.

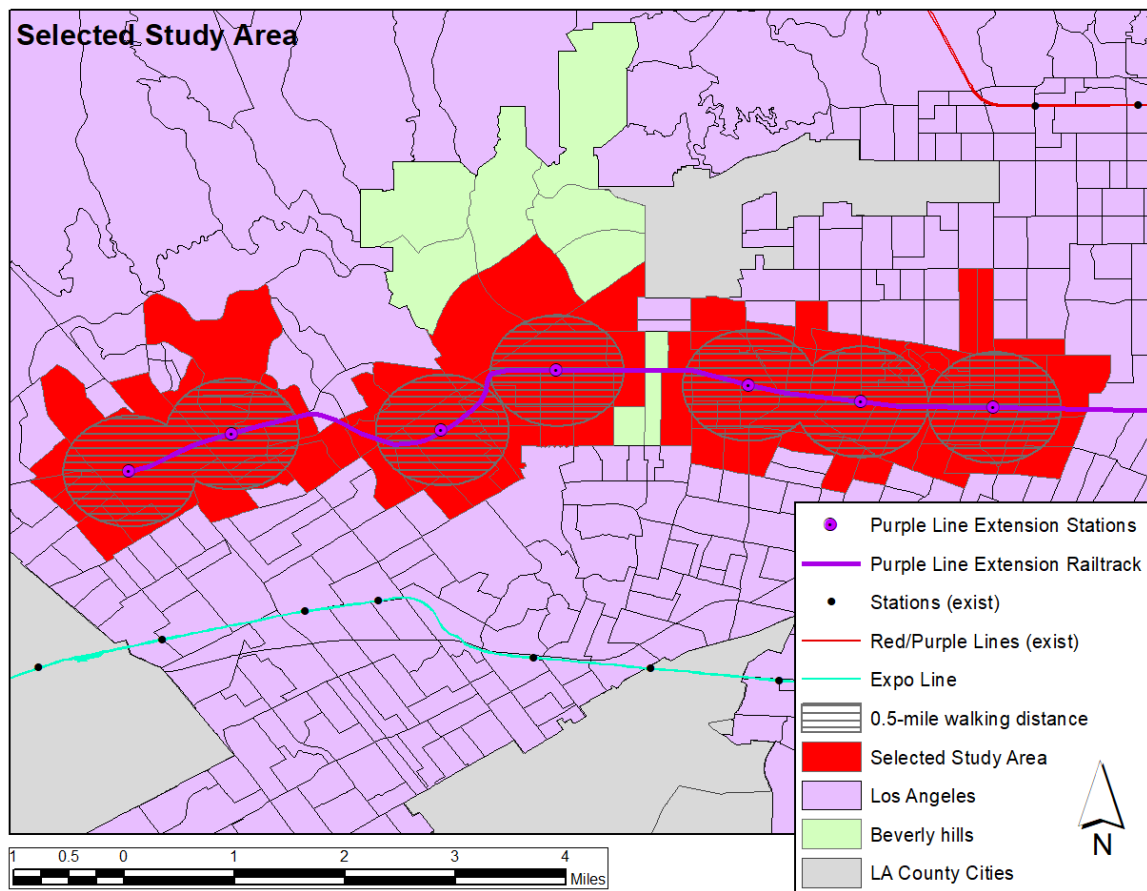
## Criteria Selection

In order to conduct an effective analysis and make a reasonable estimation on ridership, it's necessary to select appropriate criteria. For this project, there are five criteria chosen:

- Population
- Average Household Income
- Percentage of Renter-Owned Housing
- Percentage of people without vehicles
- Percentage of worker using public transportation

Population is the most fundamental factor that affect the ridership, as a rapid transit line is always built in an area with very dense population in order to obtain sufficient ridership. The average household income doesn't only reflect an area's level of affluence, but it also indicates people's choice on a travel mode that they feel most comfortable and affordable. The percentage of renter-owned housing implies an area's housing affordability, as well as the susceptibility of an area's population. Percentages of people without vehicles and worker using public transportation are also considered as the criteria, since both of them are correlated on reflecting the public transit usage of an area.

### Data Retrieving



**Figure 2. Selected Study Area**

The data used for the project come from numerous sources. The base map is made of data of Los Angeles County's cities, which is obtained from Los Angeles County GIS Data Portal. The data of existing Metro Rail Lines and their stations is obtained from LA Metro Developer website, but the website doesn't include the data of rail lines that are still under construction. Therefore, the Purple Line Extension's data is retrieved from a different website called GitHub. The data needed for the five criteria is obtained from the SimplyAnalytics website. All of the criteria data is originally from the Bureau of

Census, which is all estimated. The data is downloaded as shapefile along with the geographical data of cities of Los Angeles and Beverly Hills, which are split into block groups.

### **Data Processing**

When Purple Line Extension data is downloaded, the data format is GEOJSON instead of shapefile. Therefore, the data was converted into the shapefile file before being added to the map. After all of the data is added to the map, buffers were created around the Purple Line Extension stations. Each buffer has a radius of 0.5 miles, which is the acceptable distance for most people to walk to a rapid transit station. Walking is also most direct way to reach the rapid transit station, since it doesn't require additional actions before or after a trip, though walking is not as fast as other travel modes. Once the buffers are created, the areas that intersects with the buffers are selected for the study. Figure 2 illustrates the map of selected study area, which is the corridor composed of 95 tracts and highlighted in red color.

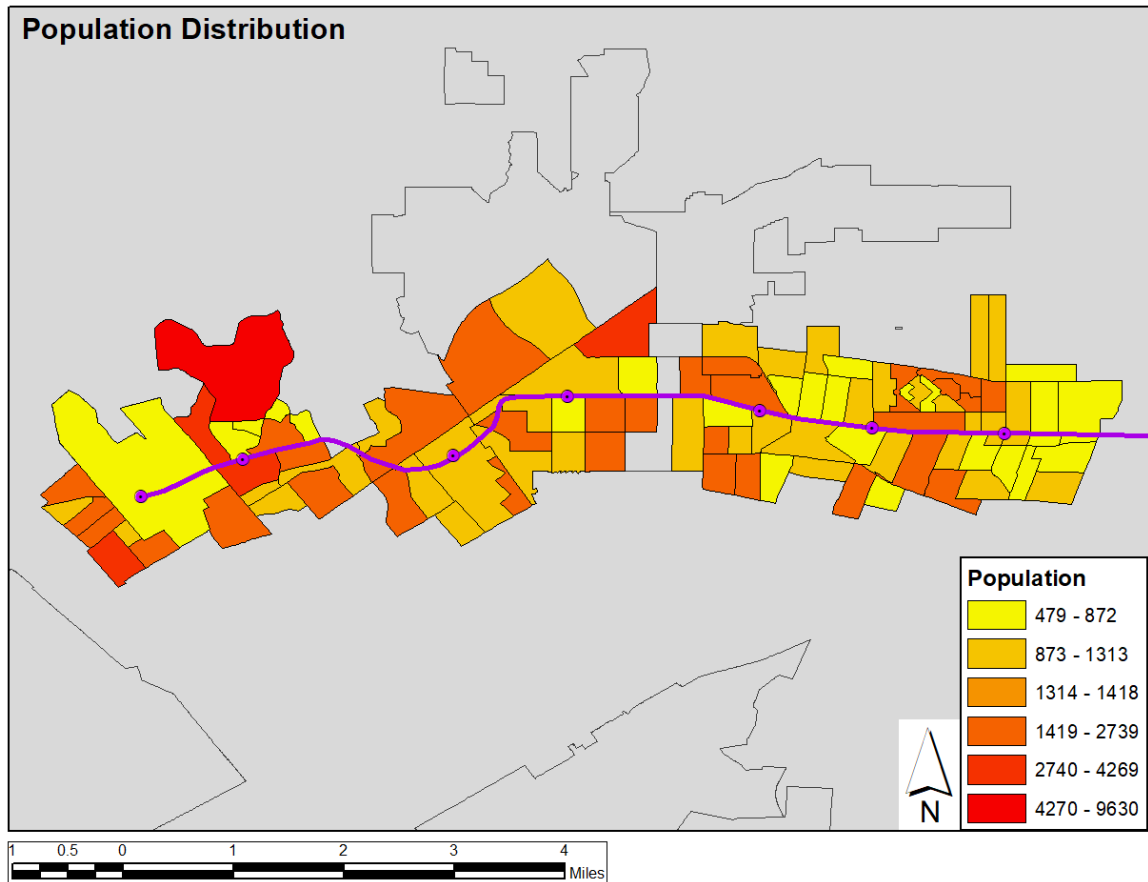
### **Data Limitations**

The criteria data obtained from SimplyAnalytics uses only the estimation. Therefore, data may not be entirely correct, and so it limits the accuracy of the results of analysis. The other data limitation is the station and rail track data of the Purple Line Extension. Since the dataset is not created by LA Metro, the position of rail track and stations are not totally correct. Therefore, such inaccuracy has some impacts on the buffer creation, as well as the corridor selection.

### **Results of Analysis**

This section will present the results of analysis based on the five criteria. Each criterion has its own map created for analysis. Each map has six classifications that are split by natural breaks, but they are adjusted by the mean numbers of each criterion's data.

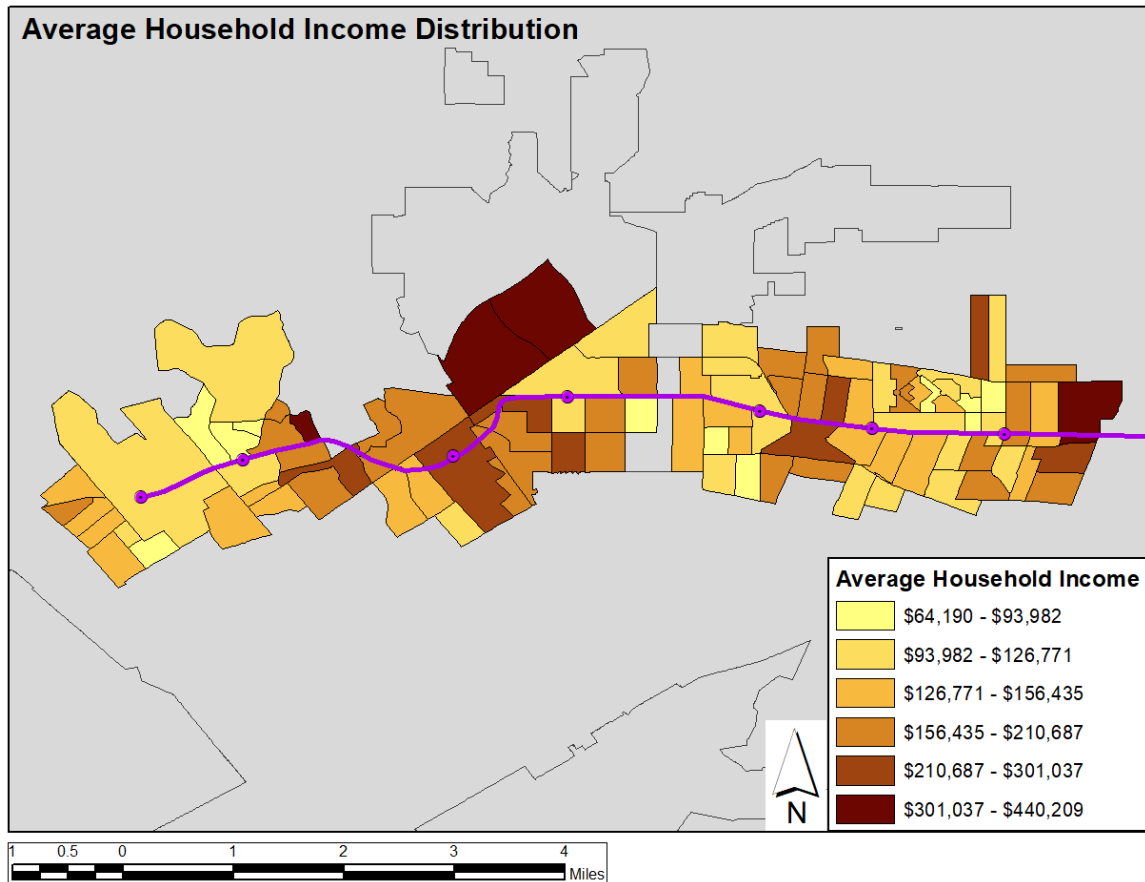
## Population



**Figure 3. Population Distribution**

Figure 3 illustrates a distribution of the population of the corridor. The total population of the corridor is 134,745, and it's only about 3.4% of the combined population of Los Angeles and Beverly Hill, which is 3,976,523. The tracts which have the highest population are around the Westwood/UCLA station, and the one that represents the UCLA area has the highest population of 9,630. But for the areas around the other stations, their population is relatively low. The average population of the 95 tracts within the corridor is 1,418 and only 36 of them have a population above the average. If the ridership is solely depended on the residents who live in the corridor, the Purple Line Extension may not be able to reach the predicted ridership number.

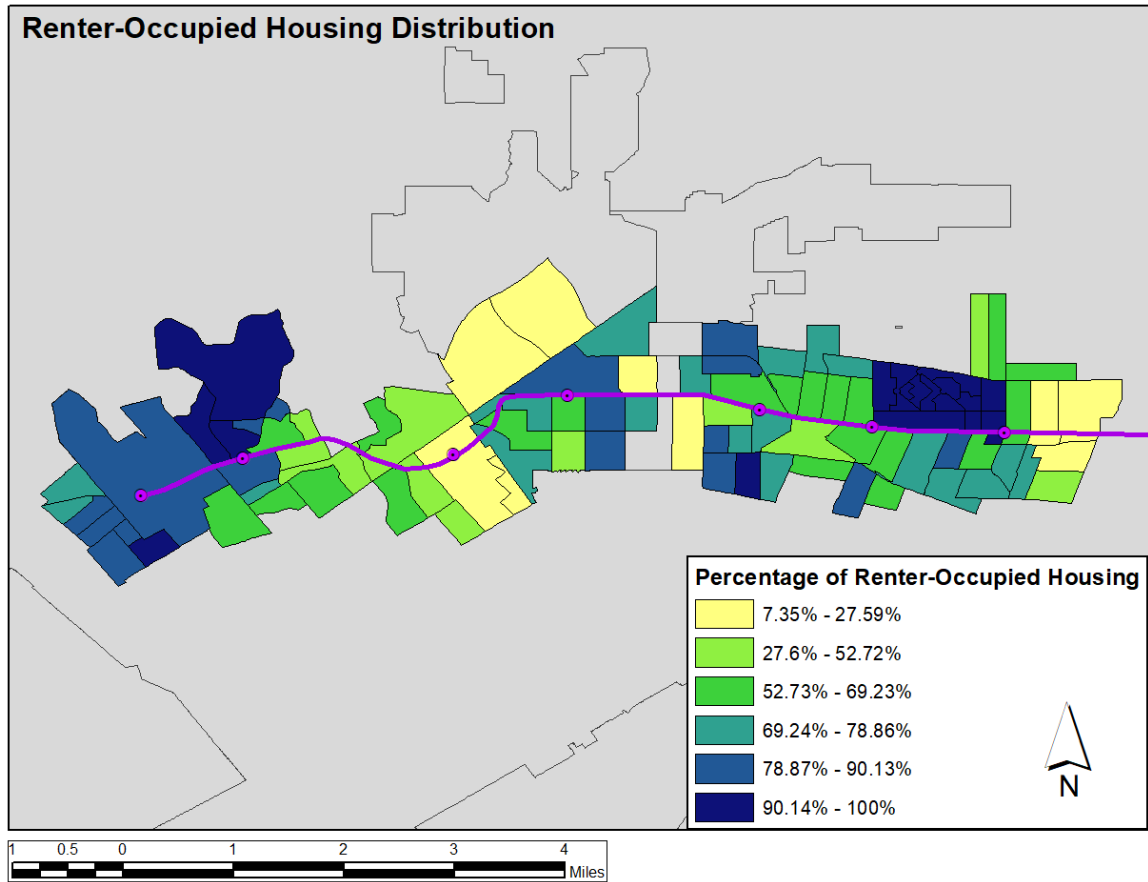
## Average Household Income



**Figure 4.** Average Household Income Distribution

Figure 4 presents a distribution map of the average household income of the corridor. Overall, the corridor has an average household income of \$156,434.81, which is considered as upper-class level. Many of the tracts with high average income are located around the two section 2 stations (Wilshire/Rodeo and Century City/Constellation), including the one with the highest average income. Tracts around the three section 1 stations (Wilshire/La Brea, Wilshire/Fairfax, and Wilshire/La Cienega) are mixed with high and low income households, and the two section 3 (Westwood/UCLA and Westwood/VA Hospital) stations are surrounded by the households with lower average income. Based on the results, it's assumed that the residents who live around the section 3 stations have the highest likelihood to use the Purple Line for a more affordable method of commute.

## Renter-Owned Housing

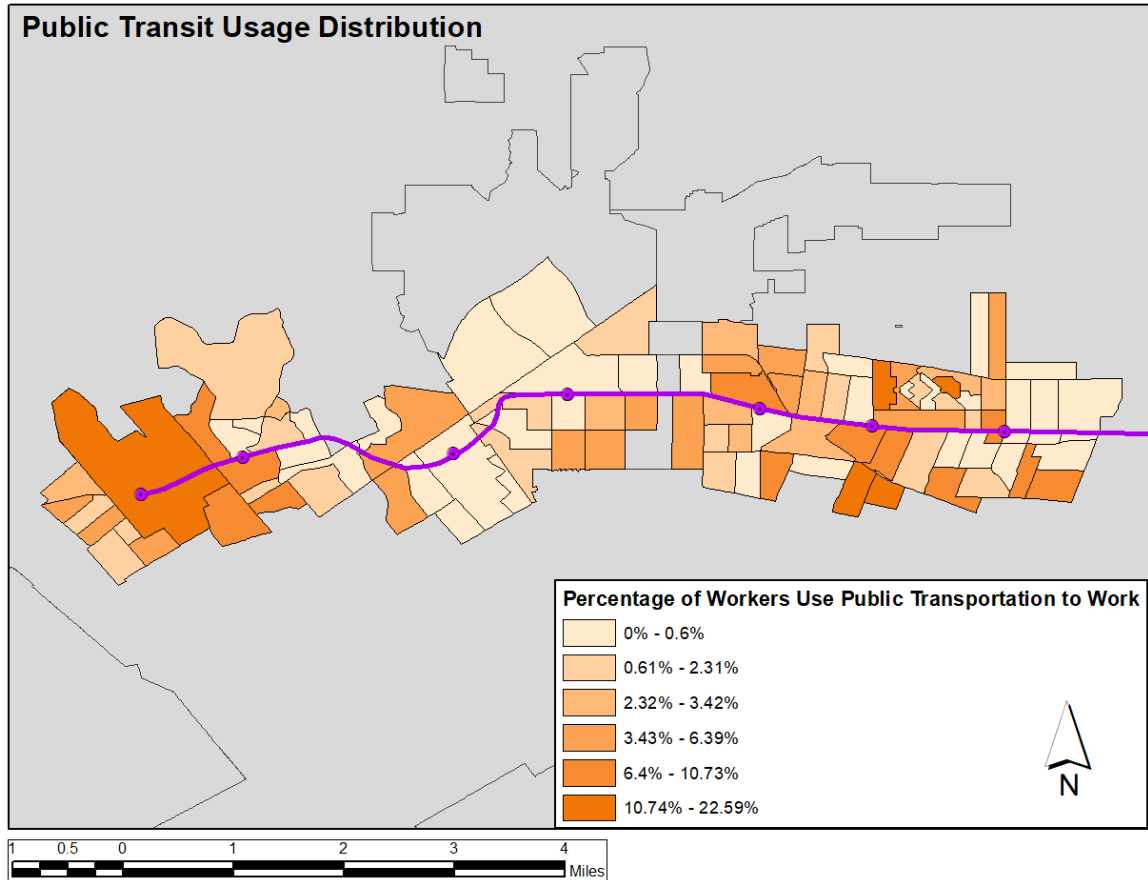


**Figure 5. Renter-Occupied Housing Distribution in Percentage**

Figure 5 shows a percentage distribution of the renter-occupied houses of the corridor. Although the average household income is relatively high, many of the houses in the corridor are being rented by the residents rather than being owned. The average percentage of the renter-occupied houses is about 69.23%, and 54 of the 95 tracts in the corridor exceed that number. Excluding the houses around Century/Constellation station, houses near the other stations are mainly renter-occupied. This implies that as housing affordability of the Purple Line Extension corridor is low, the residents have to be more economic on their daily spending on different items, including transportation. It's possible for the residents to switch their travel mode to public transit if it becomes more convenient.



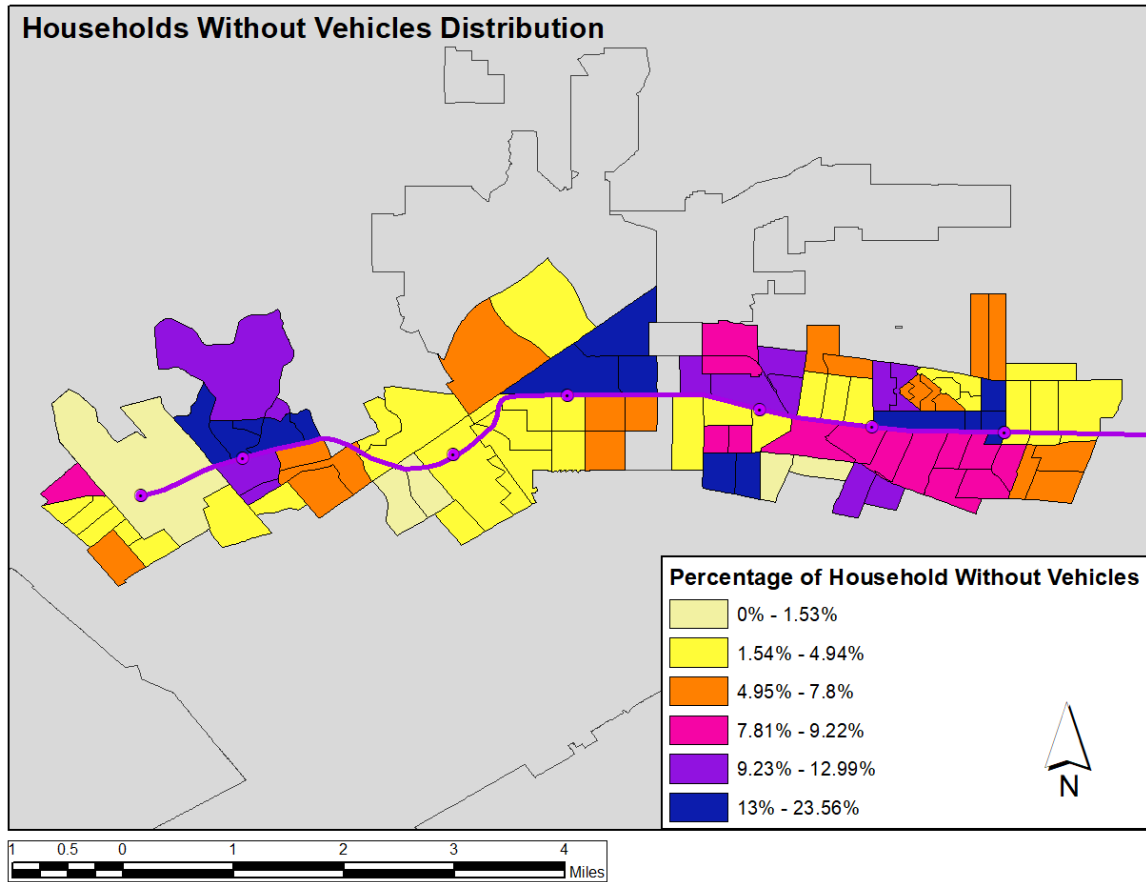
## Public Transportation Usage



**Figure 6. Public Transit Usage Distribution in Percentage**

Figure 6 shows a percentage distribution of the workers who reported using public transportation to work, and the travel modes includes bus, taxi, and subway. Overall, the corridor has a very low usage of public transit, with an average percentage of 3.42%. Workers in 29 of 95 tracts in the corridor doesn't even use public transportation to go to work at all, and those tracts are mainly located around the section 2 stations (Wilshire/Rodeo and Century City/Constellation). Such low usage of public transportation indicates that many workers feel that they don't have a convenient alternative to travel to work other than driving. Another reason could be that some workers could be walking or cycling to work, because they live close to their workplaces.

## Household without Vehicles



**Figure 7. Household without Vehicles Distribution in Percentage**

Figure 7 shows a percentage distribution of the households with no vehicles. In average, only about 7.8% of the corridor's households doesn't have vehicles, which proves that the corridor's residents have a very high dependency on private vehicles. However, in 26 of 95 tracts, more than 10% of households in each parcel don't have vehicles. The tracts surrounding the planned Westwood/UCLA station has the majority of these. Some of the tracts with no workers who use public transportation to go to work are included in those 26 tracts. This proves that some residents in the corridor use walking, cycling, or other modes as the primary travel methods for work or leisure.

## **Conclusion**

The Purple Line Extension Corridor is composed of areas with relatively low population, and the households are mainly in upper class level. Besides, the majority of the households have their own vehicles, and very few residents use public transportation to go to work. But most of the residents occupied the houses as renters, since they are financially struggling to buy their desired houses. If the Purple Line Extension project is completed, it could change many people's way of commuting from cars to public transit.

With the results of the analysis using the aforementioned five criteria, it's assumed that the section 3 stations (Westwood/UCLA and Westwood/VA Hospital) will experience higher ridership than the other five stations. The two section 3 stations mainly serves the students from UCLA and the patients from VA Hospital, and almost all of the people from these two groups don't own houses or cars, and have very little income. But in order to further boost the overall ridership, it's necessary for LACMTA to take many measures so that people feel more convenient to travel by Purple Line. Such measures can be improving the infrastructures of walking and cycling around the stations, having more bus connections between the Purple Line stations and numerous communities, and running trains more frequently.

This study could be further advanced if the study area is more expanded. There will be many people who live outside the corridor to use the Purple Line Extension, since the corridor contains the second-largest job center of the LA region, as well as many commercial and entertainment attractions. Furthermore, if this demographic study relates the Purple Line Extension to the rest of LA Metro system, there would be more detailed or even different results generated from the analysis.

## Reference

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