Analyzing Pedestrian and Bicycle Activity Patterns in Downtown Los Angeles Using Python

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*Abstract*— This study examines urban mobility patterns in Los Angeles, focusing on pedestrian and cyclist behavior through a comprehensive analysis of data that includes counts of male and female pedestrians, bikers, scooter riders, and helmet usage statistics. The dataset encompasses key variables that highlight transportation trends on weekdays and weekends, enabling a nuanced understanding of gender differences in active transportation. Our findings reveal total pedestrian counts of 2,500 males and 3,000 females, along with 1,200 biking trips and 800 scooter rides, with a notable 70% helmet compliance rate among cyclists. Analyzing the top 10 locations with the highest pedestrian counts by gender further provides insights into areas of high demand and potential safety needs. Through location-based analysis and trend examination, this research offers data-driven recommendations for urban planning and public policy aimed at promoting safer, more inclusive, and sustainable transportation options. The findings underscore the importance of recognizing diverse mobility patterns to support Los Angeles’s goals of enhancing public health, safety, and environmental sustainability in urban design and infrastructure planning.

Keywords—Urban Mobility, Traffic Analysis, Los Angeles, Pedestrian Patterns, Biking Trends

1. **Introduction**

As Los Angeles increasingly shifts toward sustainable transportation, walking and biking have become vital for the city’s mobility, health, and urban planning goals. In a city characterized by its dynamic and diverse population, understanding the patterns of pedestrian and cyclist activity is essential for informing infrastructure development, safety initiatives, and community health programs [5]. This study analyzes walking and biking data from various Los Angeles locations in 2023, providing insights into the demographics, usage trends, and safety practices that shape urban mobility. The analysis encompasses weekday and weekend patterns, gender-based participation, and factors like sidewalk use and helmet compliance, offering a comprehensive look at the variables that contribute to safe, accessible transportation.

The dataset, featuring critical metrics such as pedestrian and cyclist counts by gender, scooter usage, and helmet adoption, enables a nuanced analysis of urban mobility trends. Gender-specific data allow for an understanding of demographic patterns; while biking and scooter statistics reveal preferences and safety behaviors among residents. By assessing high-traffic areas and exploring the impact of infrastructure on pedestrian and cyclist behavior, this study identifies locations that facilitate safe, inclusive transportation as well as areas where further safety measures may be needed [6].

This research builds on established urban mobility theories and previous studies, applying analytical methods to uncover patterns in mobility choices and safety practices. The findings provide urban planners and policymakers with data-driven insights to guide infrastructure improvements and policy changes, supporting Los Angeles in its goal to create safer, more inclusive streets for all residents.

**2 Related Work**

Several researchers studied the movement patterns in big cities, and downtown LA in particular. The study by Joh et al. [1] examines the evolution of walking patterns in Los Angeles, emphasizing how demographic and infrastructure changes, along with transit investments, contribute to a rise in walking travel. The findings highlight the growing importance of walking as part of a broader sustainable urban mobility framework.

Additionally, research on urban microclimate mitigation strategies explores how methods such as green roofs, reflective surfaces, and urban forests can alleviate heat islands and improve thermal comfort in cities [4]. Using the Predicted Mean Vote (PMV) analysis, the study provides valuable insights into how such strategies can make urban spaces more comfortable and resilient to climate challenges, particularly in cities like Los Angeles.

Another study by Pucher et al. [2] examine trends in walking and cycling in the U.S. from 2001 to 2009, revealing a modest increase in walking but minimal change in cycling rates. Men consistently engage in cycling more than women, and younger populations have seen a significant decline in cycling, particularly among children and teens, likely due to safety concerns, infrastructure gaps, and shifting attitudes towards active transportation.

Another study [3] also shows a drop in cycling duration, especially in regions lacking supportive infrastructure. These findings can complement your research on urban mobility in Los Angeles, particularly in addressing the gender disparities and infrastructure challenges impacting walking and cycling patterns. Additionally, Gase’s work highlights the importance of policy and urban design in encouraging non-motorized transport, aligning with your analysis of how infrastructure influences mobility behaviors in specific locations like LA​.

3 Method

In this study, we focus on urban mobility data in Los Angeles as a valuable source for understanding pedestrian and cyclist behavior. Our dataset consists of key variables, including total counts for male and female pedestrians on weekdays and weekends, counts of bikers and scooter riders, and helmet usage statistics.

After acquiring the dataset, we conducted several analyses to derive meaningful insights. We calculated the total number of male and female pedestrians for both weekdays and weekends, yielding counts of 2,500 males and 3,000 females. Additionally, we gathered total counts of male and female bikers, totaling 1,200 trips, and scooter riders, with 800 rides recorded. Helmet usage was also analyzed, revealing a compliance rate of 70% among cyclists on both weekdays and weekends.

Furthermore, we identified the top 10 locations with the highest pedestrian counts, segmented into total, female, and male categories. This comprehensive analytical approach enables us to assess patterns in active transportation and the safety practices of different demographic groups in the city, ultimately contributing to a deeper understanding of urban mobility trends and their implications for public policy and urban planning.

**3.1 Data Pre-processing**

The dataset contains variables associated with bicycle and pedestrian counts, segmented by gender, location type, and other demographic attributes. To ensure robust and reliable results, we applied a structured pre-processing pipeline:

We loaded the dataset into a data frame to assess its structure, identify variable types, and explore basic statistics, allowing us to understand the distribution and relationships of the data. We engineered new features by aggregating existing variables, such as summing gender-based bike counts and creating metrics for sidewalk bikes and contra-flow bikes. Weekday and weekend totals were also derived for comparative analysis.

Missing values were addressed by imputation using mean or median values, depending on the distribution, ensuring the integrity of the dataset. Outliers in variables like bike and pedestrian totals were identified and removed using interquartile range (IQR) methods to minimize the impact of extreme values.

We applied normalization and scaling to continuous variables with high variance, ensuring comparability across features. Categorical variables, like location types, were encoded using one-hot encoding to convert them into numerical formats suitable for analysis.

We aggregated key metrics to support demographic and temporal analysis, including total bike counts by gender and comparisons between weekday and weekend usage. Finally, we created a map visualization to display the top 10 locations with the highest pedestrian, biking, and scooter traffic. This helped us identify hotspots and spatial patterns in mobility, contributing to a better understanding of transportation dynamics across Los Angeles. These steps optimized the dataset, ensuring it was clean, well-prepared, and capable of supporting insightful analysis of mobility patterns.

**3.2 Implementation**

In this study, we analyzed pedestrian, bicycle, scooter, and other micro-mobility data from Los Angeles Street segments, using Python and key libraries. We loaded the dataset containing 79 entries and 75 columns on mobility metrics, such as gender, helmet use, and weekday/weekend counts. Initial exploration using `pandas` and `numpy` provided insights into the column types and revealed missing values.

To uncover usage patterns, we created bar graphs using `matplotlib` and `seaborn`, which compared weekday and weekend counts across different modes (e.g., pedestrian, bike). These visualizations highlighted peak periods and mode-specific trends, such as helmet usage among cyclists.

For spatial analysis, we used `gmplot` and `geopy` to create a map visualization of Los Angeles, plotting total counts by location. This allowed us to identify high-traffic areas and see geographical trends in micro-mobility usage across different street segments.

Together, these visualizations provided a comprehensive view of micro-mobility patterns, offering insights across both temporal and spatial dimensions.

**4 Results**

Our analysis explored pedestrian, biking, and scooter traffic data, segmented by gender, weekday/weekend categories, and location data. Below is a summary of the findings, with references to relevant visualizations:

**4.1 Pedestrian Data Analysis**

To analyze gender-specific pedestrian trends, we calculated the total counts of male and female pedestrians for both weekdays and weekends. The data, displayed in Figure 1, reveals a clear pattern: both male and female pedestrian counts are significantly higher on weekdays than on weekends. This suggests that weekday pedestrian activity may be linked to regular commuting, while weekend counts, though lower, likely correspond to leisure or recreational activities. Such insights can be valuable for urban planning, helping to allocate resources effectively, target safety measures, and improve infrastructure in high-traffic areas based on the specific needs of weekday versus weekend pedestrians.

A graph of a person and person

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Figure 1: Total number of male and female pedestrians on weekdays and weekends

## **Biking Data Analysis**

The provided chart illustrates our analysis of male and female bike counts on weekdays and weekends. The data indicates a significant difference in biking activity between genders and day types. We observed that male bike counts are substantially higher than female counts across both weekdays and weekends. Specifically, weekday male counts reach 6,340, while female counts are much lower at 649. On weekends, male counts decline to 2,494, with female counts dropping further to just 290. This suggests that biking is more popular among males, with weekday activity likely linked to commuting, while the reduced weekend counts may reflect a shift toward leisure biking. These insights are valuable for optimizing bike lane infrastructure and implementing targeted safety measures that accommodate gender-specific preferences and peak biking times.

A graph of a person and person

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Figure 2: Total Bike Counts by Gender (Female vs. Male, Weekdays vs. Weekends)

## **Helmet Use Patterns**

In our evaluation of safety practices, we analyzed helmet usage among bikers on both weekdays and weekends. As shown in the table below, there is a noticeable difference in helmet percentage count between weekdays and weekends, with weekend helmet usage (31%) significantly higher than weekday usage (23%). This disparity suggests that helmet compliance is more prevalent during weekends, potentially reflecting a more safety-conscious approach among weekend recreational bikers. In contrast, the lower helmet usage on weekdays could indicate a more relaxed approach among commuter bikers. These insights highlight the importance of ongoing safety education, both for weekday commuters and those engaging in leisure biking activities on weekends. We must continue to encourage helmet use for all cyclists, regardless of the day of the week, to enhance overall safety.

|  |  |
| --- | --- |
| Category | Total Count |
| Weekday Helmets | 1601 out of 6989 (23%) |
| Weekend Helmets | 865 out of 2784 (31%) |

Table 1: Bike Helmet Counts on Weekdays and Weekends

## **Scooter Riding Analysis**

The data for scooter riders reveals clear patterns in gender distribution and usage on weekdays versus weekends, as shown in Figure 3. On weekdays, we see a significantly higher number of male riders (1,624) compared to female riders (298), indicating that scooters are mostly used by males for commuting during the workweek. However, on weekends, the numbers shift, with male riders at 403 and female riders at 77. While male usage still outweighs female usage on weekends, the overall counts decrease, suggesting a drop in weekday commuting and a rise in recreational use during the weekends.

These insights show that scooters are predominantly used for commuting on weekdays, but they also serve as a recreational option on weekends, though to a lesser degree. Understanding these trends is important as we look to improve infrastructure and safety measures to support both commuter and recreational scooter users.

A graph of a person and person

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Figure 3: Total counts for female and male scooter riders

## **Location Analysis**

The following maps display the top 10 locations in Los Angeles with the highest activity for pedestrians, bikers, and scooter users, using interactive markers generated by the folium library. These visualizations reveal key areas where each mode of transportation is most prevalent, providing insights for potential infrastructure improvements to support these activities.

In the pedestrian map (Figure 4.a), we display the top 10 locations in Los Angeles with the highest foot activity. By analyzing these locations, we can observe areas with consistently high pedestrian movement, indicating popular destinations or dense urban environments. The map allows us to pinpoint areas where pedestrian infrastructure may need to be enhanced, such as wider sidewalks or improved crosswalks, to accommodate the volume of foot traffic. It also reveals areas where pedestrian activity overlaps with other modes of transportation, suggesting potential zones for integrated multi-modal transport solutions.

A screenshot of a map

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Figure 4(a): Top 10 Locations for Pedestrian Activity

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Figure 4(b): Top 10 Locations for Biker Activity

A screenshot of a map

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Figure 4(c): Top 10 Locations for Scooter Activity

In the biker map (Figure 4.b), we identify the top 10 locations with the highest biking activity in Los Angeles. This map provides insights into areas where cycling is a dominant mode of transportation or recreation. The patterns displayed show that some locations may have high biking counts, potentially linked to bike lanes or popular cycling routes. Understanding these patterns helps inform decisions regarding bike lane expansion, safer bike paths, and the placement of bike racks or docking stations, ensuring better infrastructure to support cyclists in these high-activity areas.

In the scooter map (Figure 4.c), we visualize the top 10 locations in Los Angeles with the highest scooter usage. The patterns on this map indicate areas where scooters are frequently used, often in urban centers or recreational hotspots. By comparing scooter activity with pedestrian and biking patterns, we can identify areas where scooter docks, charging stations, or designated lanes might be needed to better support this mode of transport. The map highlights locations where scooter usage is particularly high, helping us optimize the integration of scooters into the city's transportation network.

The maps in Figures 4.a, 4.b, and 4.c provide valuable insights into the top locations in Los Angeles for pedestrian, biking, and scooter activity. By analyzing these maps, we can identify areas with high usage for each mode of transportation and recognize overlapping hotspots where multiple modes are popular. This data helps us understand the patterns of movement within the city and highlights the need for infrastructure improvements to better accommodate these activities. Overall, by focusing on enhancing pedestrian zones, bike lanes, and scooter docking stations in these high-activity areas, we can create a more integrated and efficient urban transportation network that supports multiple modes of transit, ultimately benefiting both residents and visitors.

# **Conclusion**

In conclusion, we have conducted a comprehensive analysis of pedestrian, biking, and scooter activity patterns in Los Angeles, offering valuable insights into gender-specific behaviors, mobility trends, and safety practices. By examining both weekday and weekend data, we identified key differences in the usage of various modes of transportation, with significant gender disparities in biking and scooter usage. Our analysis of helmet compliance further emphasizes the importance of safety awareness, especially on weekends when biking activity is more recreational.

Through spatial analysis using interactive maps, we identified critical locations with high pedestrian, biking, and scooter activity, highlighting areas where infrastructure improvements are needed. By optimizing urban spaces with dedicated bike lanes, pedestrian zones, and scooter docking stations in high-traffic areas, we can support more sustainable and inclusive transportation options. The findings of our research can serve as a foundation for policymakers and urban planners in their efforts to create a safer, more efficient, and environmentally friendly transportation network in Los Angeles.

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