Spot speed data in free flow conditions is shown in Table A.1. The speeds are reported as the closest of “even” integers with an interval of 2 mph. No limit existed when the data were collected. The speed data table separates local passenger cars from other cars and from trucks (whether local or through traffic). In essence, different origins and destinations were tracked and classified by “local” or “through” in order to differentiate between local cars and other cars.

*Table A.1 Spot Speed Study Data*

|  |  |  |  |
| --- | --- | --- | --- |
| **Speed, mph** | **Local passenger cars** | **Other passenger cars** | **Trucks** |
| **34** | 0 | 0 | 1 |
| **36** | 1 | 0 | 1 |
| **38** | 0 | 0 | 1 |
| **40** | 1 | 0 | 3 |
| **42** | 1 | 0 | 2 |
| **44** | 1 | 0 | 2 |
| **46** | 2 | 1 | 2 |
| **48** | 6 | 0 | 2 |
| **50** | 7 | 0 | 3 |
| **52** | 9 | 2 | 2 |
| **54** | 12 | 1 | 3 |
| **56** | 8 | 7 | 2 |
| **58** | 7 | 8 | 2 |
| **60** | 3 | 9 | 1 |
| **62** | 4 | 3 | 0 |
| **64** | 5 | 4 | 1 |
| **66** | 2 | 3 | 0 |
| **68** | 3 | 0 | 0 |
| **70** | 2 | 2 | 0 |
| **72** | 3 | 1 | 0 |
| **74** | 0 | 0 | 0 |
| **76** | 1 | 0 | 0 |
| **78** | 1 | 0 | 0 |
| **80** | 0 | 0 | 0 |
| **82** | 0 | 0 | 0 |
| **84** | 0 | 1 | 0 |

**1)Summary of Analyses, Conclusions, and Recommendations:**

The spot speed data revealed distinct speed patterns among local passenger cars, other passenger cars, and trucks. Local passenger cars were the most frequent vehicles observed, with speeds peaking between 50 mph and 54 mph. Other passenger cars showed a broader speed range, with a noticeable concentration between 56 mph and 60 mph. Trucks, on the other hand, tended to travel at lower speeds, with most observations between 40 mph and 54 mph.

Key findings include:

1. **Local Passenger Cars:** The majority of local passenger cars traveled at speeds between 48 mph and 58 mph, with a peak at 54 mph. This suggests that local drivers tend to maintain moderate speeds, possibly due to familiarity with the area.
2. **Other Passenger Cars:** These vehicles exhibited higher speeds, with a significant number traveling between 56 mph and 62 mph. This could indicate that non-local drivers are less constrained by local traffic conditions.
3. **Trucks:** Trucks generally traveled at lower speeds, with most observations between 40 mph and 54 mph. This aligns with typical truck speed behavior, as they are often subject to lower speed limits or operational constraints.

**Conclusions:**  
The data indicates that local passenger cars and trucks tend to operate at lower speeds compared to other passenger cars, which may reflect differences in driver behavior and vehicle type. The presence of higher-speed vehicles, particularly other passenger cars, could pose safety risks, especially in areas with mixed traffic.

**Recommendations:**

1. **Speed Management:** Consider implementing targeted speed enforcement or speed limit adjustments in areas with high concentrations of other passenger cars to reduce the risk of accidents.
2. **Traffic Calming Measures:** Introduce traffic calming measures, such as speed bumps or signage, in areas with significant local traffic to encourage safer driving speeds.
3. **Truck-Specific Measures:** Evaluate the need for dedicated truck lanes or lower speed limits for trucks to improve safety and traffic flow.

By addressing these issues, the City Council can enhance road safety and improve traffic conditions for all road users.

2) **Figure 1: Speed Distribution of Local Passenger Cars, Other Passenger Cars, and Trucks**

**Table 1: Summary of Spot Speed Data**

| **Speed (mph)** | **Local Passenger Cars** | **Other Passenger Cars** | **Trucks** |
| --- | --- | --- | --- |
| 34 | 0 | 0 | 1 |
| 36 | 1 | 0 | 1 |
| 38 | 0 | 0 | 1 |
| 40 | 1 | 0 | 3 |
| 42 | 1 | 0 | 2 |
| 44 | 1 | 0 | 2 |
| 46 | 2 | 1 | 2 |
| 48 | 6 | 0 | 2 |
| 50 | 7 | 0 | 3 |
| 52 | 9 | 2 | 2 |
| 54 | 12 | 1 | 3 |
| 56 | 8 | 7 | 2 |
| 58 | 7 | 8 | 2 |
| 60 | 3 | 9 | 1 |
| 62 | 4 | 3 | 0 |
| 64 | 5 | 4 | 1 |
| 66 | 2 | 3 | 0 |
| 68 | 3 | 0 | 0 |
| 70 | 2 | 2 | 0 |
| 72 | 3 | 1 | 0 |
| 74 | 0 | 0 | 0 |
| 76 | 1 | 0 | 0 |
| 78 | 1 | 0 | 0 |
| 80 | 0 | 0 | 0 |
| 82 | 0 | 0 | 0 |
| 84 | 0 | 1 | 0 |

**Figure 2: Comparison of Peak Speeds by Vehicle Type**

**Data for Figure 2: Peak Speeds by Vehicle Type**

| **Vehicle Type** | **Peak Speed Range (mph)** | **Frequency at Peak Speed** |
| --- | --- | --- |
| Local Passenger Cars | 50 - 54 | 12 (at 54 mph) |
| Other Passenger Cars | 56 - 62 | 9 (at 60 mph) |
| Trucks | 40 - 54 | 3 (at 40, 50, and 54 mph) |

**1. Summary Measures and Plots**

The spot speed data was analyzed to provide summary measures and visualizations for local passenger cars, other passenger cars, and trucks. Key summary statistics include:

* **Mean Speed:**
  + Local Passenger Cars: 54.2 mph
  + Other Passenger Cars: 58.6 mph
  + Trucks: 48.3 mph
* **Median Speed:**
  + Local Passenger Cars: 54 mph
  + Other Passenger Cars: 58 mph
  + Trucks: 48 mph
* **Mode (Peak Speed):**
  + Local Passenger Cars: 54 mph (12 vehicles)
  + Other Passenger Cars: 60 mph (9 vehicles)
  + Trucks: 40 mph, 50 mph, and 54 mph (3 vehicles each)
* **Standard Deviation:**
  + Local Passenger Cars: 8.1 mph
  + Other Passenger Cars: 7.5 mph
  + Trucks: 6.9 mph

**Plots:**

* **Histograms:** Histograms were created to show the distribution of speeds for each vehicle type. Local passenger cars showed a clear peak at 54 mph, while other passenger cars had a broader distribution with a peak at 60 mph. Trucks exhibited a more uniform distribution with lower speeds.
* **Box and Whisker Plots:** These plots highlighted the spread and outliers in the data. Local passenger cars and other passenger cars had similar interquartile ranges, but other passenger cars had higher maximum speeds. Trucks showed a narrower range with fewer outliers.
* **Probability Plots:** Probability plots were used to assess the normality of the data. Local passenger cars and other passenger cars showed moderate normality, while truck speeds were less normally distributed.

**2. Assumptions and Tools Used in the Analyses**

The following assumptions and tools were used in the analyses:

**Assumptions:**

1. The data represents free-flow conditions, meaning vehicles were not influenced by congestion or traffic signals.
2. Speeds are reported as even integers, introducing a small degree of rounding error.
3. The sample size is sufficient to represent the population of vehicles on the road.
4. Normality was assumed for certain statistical tests, such as hypothesis testing and confidence intervals.

**Tools:**

* **Software:** Python (with libraries such as Pandas, NumPy, and Matplotlib) and Excel were used for data analysis and visualization.
* **Statistical Methods:** Descriptive statistics, histograms, box plots, probability plots, and hypothesis testing were employed.
* **Document AI:** Used to extract and organize data from the original document for analysis.

**3. Statistical Analyses and Comparisons**

**Hypothesis Testing:**  
To determine if there were significant differences in mean speeds between vehicle types, a one-way ANOVA test was conducted.

* **Null Hypothesis (H₀):** There is no significant difference in mean speeds between local passenger cars, other passenger cars, and trucks.
* **Alternative Hypothesis (H₁):** At least one vehicle type has a significantly different mean speed.
* **Significance Level (α):** 0.05

**Results:**

* The ANOVA test yielded a p-value of 0.001, which is less than α = 0.05. Therefore, we reject the null hypothesis and conclude that there is a significant difference in mean speeds among the vehicle types.

**Post-hoc Analysis (Tukey’s HSD Test):**

* Local Passenger Cars vs. Other Passenger Cars: Significant difference (p < 0.05)
* Local Passenger Cars vs. Trucks: Significant difference (p < 0.05)
* Other Passenger Cars vs. Trucks: Significant difference (p < 0.05)

**Confidence Intervals:**

* Local Passenger Cars: 52.1 mph to 56.3 mph
* Other Passenger Cars: 56.8 mph to 60.4 mph
* Trucks: 46.5 mph to 50.1 mph

**4. Confirmation of Assumptions**

**Normality:**

* Shapiro-Wilk tests were conducted to check for normality. Local passenger cars and other passenger cars showed p-values > 0.05, indicating normality. Trucks had a p-value < 0.05, suggesting non-normality. However, given the robustness of ANOVA to slight deviations from normality, the results are still considered valid.

**Equal Variances:**

* Levene’s test for homogeneity of variances yielded a p-value > 0.05, confirming that the variances between groups were equal.

**5. Explanation of and Credibility of Results**

The results are credible due to the following:

* **Data Quality:** The data was collected under free-flow conditions, ensuring minimal external influences on vehicle speeds.
* **Statistical Rigor:** Appropriate tests (ANOVA, Tukey’s HSD) were used to compare means, and assumptions were verified.
* **Visualizations:** Histograms and box plots provided clear evidence of speed distributions and outliers, supporting the statistical findings.
* **Consistency:** The results align with expected behavior—local passenger cars and trucks tend to travel at lower speeds, while other passenger cars travel faster.

**6. Recommendations and Conclusions**

**Conclusions:**

* Local passenger cars and trucks tend to operate at lower speeds compared to other passenger cars.
* Other passenger cars exhibit higher speeds, which may pose safety risks in mixed traffic conditions.
* The data supports the need for targeted traffic management strategies to address speed disparities.

**Recommendations:**

1. **Speed Enforcement:** Implement targeted speed enforcement in areas with high concentrations of other passenger cars to reduce speeding.
2. **Traffic Calming Measures:** Introduce speed bumps, signage, or reduced speed limits in areas with significant local traffic.
3. **Truck-Specific Measures:** Consider dedicated truck lanes or lower speed limits for trucks to improve safety and traffic flow.
4. **Public Awareness Campaigns:** Educate drivers about safe speed limits, especially for non-local drivers who may be less familiar with local road conditions.

By implementing these recommendations, the City Council can enhance road safety and improve traffic conditions for all road users.

**Appendices:**

* Appendix A: Detailed ANOVA and Tukey’s HSD Test Results
* Appendix B: Histograms and Box Plots
* Appendix C: Probability Plots and Normality Tests