Executive Summary:

This report analyzes Cyclistic's 2024 bike usage trends, using data from January to December, with a focus on June through September—the months when casual riders accounted for nearly 50% of total rides, the highest balance observed throughout the year.

Key findings indicate that casual riders take longer trips on average, though with greater variation in ride duration, whereas Cyclistic members maintain more consistent trip lengths. Peak usage patterns also differ: casual ridership peaks at 5 PM, likely driven by leisure activities, while members show peak usage at both 8 AM and 5 PM, aligning with commuting trends. Additionally, ride durations increase on weekends, suggesting higher recreational use, and electric bikes are the preferred choice over classic bikes during these months.

To increase annual memberships, Cyclistic should target strategies based on 2024 ride trends. Offering limited-time discounts or trial memberships from June to September, when casual ridership peaks at nearly 50%, can drive conversions. Marketing should emphasize cost savings for frequent riders and promote commuter benefits (e.g., "Skip Traffic, Save Time") for potential members, while appealing to casual riders with leisure-oriented messaging (e.g., "Ride More, Pay Less") as they tend to take longer trips in the evenings and weekends. Additionally, offering perks like discounts on electric bikes, extended ride times, and weekend ride credits will attract casual riders and help convert them into long-term members. Strategies like these can improve retention, maximize revenue, and promote conversion from casual riders to Cyclistic members.

Introduction:

1.1 Context

Cyclistic is a fictional bike-sharing company created for this capstone project. While the analysis is based on real-world bike share data, the company itself does not exist. The project aims to examine usage trends among casual riders and Cyclistic members to derive insights that could inform business decisions in a real-world setting.

Since its launch in 2016, Cyclistic has grown into a leading bike-share provider in Chicago, operating a fleet of over 5,000 geotracked bicycles across 600+ stations. The system allows riders to unlock bikes from one station and return them to another, offering convenience and flexibility. Cyclistic's marketing strategy has traditionally focused on broad consumer awareness and attracting diverse user segments through flexible pricing plans, including single-ride passes, full-day passes, and annual memberships.

Financial analysis indicates that annual members generate significantly more revenue than casual riders, making membership growth a key priority for the company's long-term success. Casual riders, who already use the service for their mobility needs, present a strong conversion opportunity for Cyclistic's membership program.

1.2 Rider Classification

Cyclistic categorizes its customers into two primary groups based on their purchase behavior:

Casual Riders: Customers who purchase single-ride or full-day passes.

Cyclistic Members: Customers who purchase annual memberships.

Understanding the behavioral differences between these two groups is essential for developing effective strategies to increase membership conversions.

1.3 Data Usage and Compliance

The data used in this analysis originates from the City of Chicago's Divvy bicycle-sharing service, which is operated by Lyft Bikes and Scooters, LLC. The data is publicly available under a license agreement that permits analysis and reporting for non-commercial purposes. This report complies with the terms of use, ensuring that all data is used lawfully and ethically without attempts to identify individual users or correlate data with personal information.

1.4 The "Big Question"

This report examines how annual members and casual riders differ in their usage patterns, with the goal of identifying trends that can inform targeted marketing strategies to encourage casual riders to become long-term members.

1.5 Outline

The following sections present an overview of the 2024 Divvy bike-share dataset used in this analysis. This dataset contains key variables such as membership type, ride type, ride start and end times, and ride duration—each of which plays a central role in evaluating rider behavior.

To evaluate its suitability for the project, the dataset is assessed using the ROCCC framework, which considers Relevance, Objectivity, Currency, Coverage, and Consistency.

Beyond structural evaluation, these sections also address critical data quality and privacy considerations, including the treatment of incomplete records and the exclusion of personally identifiable information (PII) to ensure ethical data handling. Collectively, these attributes support a robust exploration of ride durations, usage patterns, and user segmentation, all of which inform the final strategic recommendations.

Body:

2. Data Overview

2.1 Data Source and Licensing

The dataset used in this analysis was sourced from Divvy's public bike-sharing trip data, hosted on Amazon Web Services (AWS) by Motivate International Inc. and operated under the City of Chicago's Divvy program. It is made publicly available by **Motivate International Inc.** in partnership with **Lyft Bikes and Scooters, LLC**. The dataset is owned by the **City of Chicago** and permits public use of this data under a non-exclusive, royalty-free, perpetual license, provided it is used for lawful, non-commercial purposes (Divvy, n.d.).

2.2 Data Structure

The dataset is structured as monthly CSV files, each packaged within a ZIP folder. Our focus is on a complete 12-month span throughout the year 2024. Each spreadsheet includes the following 13 key fields:

- ride_id, rideable_type, started_at, ended_at
- start_station_name, start_station_id, end_station_name, end_station_id
- start_lat, start_lng, end_lat, end_lng
- member_casual

These variables allow for detailed analysis of trip duration, time of day, location, and user type (casual or member).

2.3 Data Validity and Reliability (ROCCC Framework)

- **Reliable**: The data is collected and maintained by Bikeshare LLC and the City of Chicago, ensuring a reliable and consistent source.

- **Original**: Although it's uncertain if the dataset underwent any transformations before being publicly available, it is assumed that only minimal adjustments were made to safeguard user privacy.

- **Comprehensive**: The dataset offers comprehensive trip-level data—including usage times, customer types, and bike types—which encompasses the variables relevant to our question of interest.

- **Current**: The analysis is based on the most recent full year of data, covering January through December 2024.

- **Cited**: All data sources and license information are properly cited as required by the data license agreement.

2.4 Privacy

This analysis has been conducted in alignment with the data usage policies provided by the Bikeshare program. PII were removed during the data processing phase to ensure user anonymity, and this analysis does not attempt to associate the dataset with names, addresses, or other identifying information.

2.5 Data Quality and Integrity

While formatting was largely uniform across all files, several quality issues were observed. Some fields, such as start_station_name, start_station_id, end_station_name, and end_station_id, had missing values. In rare cases, there were invalid or impossible timestamps in the started_at and ended_at columns. Despite these limitations, the dataset contains a sufficient volume of valid entries for reliable trend analysis. Most of the data integrity issues are associated with information linked to personally identifiable information (PII), which falls outside the scope of this analysis."

2.6 Relevance to the Business Objective

This dataset is integral to the primary analytical objective: to analyze and compare the behaviors of casual riders (those who purchase single-ride or day passes) and Cyclistic members (those with annual memberships). It facilitates the exploration of:

- Temporal ridership patterns

- Trip duration variations by rider type and day of the week

- Preferences for bike types

- Potential indicators for membership conversion opportunities

These findings will directly inform strategic recommendations aimed at boosting Cyclistic's annual memberships and enhancing its marketing strategies.

3. Method

3.1 Tools and Rationale

Microsoft Excel was selected as the primary tool for data processing, analysis, and visualization. The objective was to evaluate Excel's performance under heavy data loads, improve efficiency through optimization techniques, and gain deeper familiarity with handling time and date formats. Excel's Power Query feature was used to streamline data transformation. Additionally, this project will serve as a benchmark for comparing Excel's visualization capabilities to those of more advanced tools such as Power BI and Tableau in future work.

3.2 Data Integrity and Cleaning Process

To ensure data integrity, each of the 12 monthly .csv files from the year 2024 was inspected for consistent formatting and structure. Fields unrelated to the business task or potentially containing personally identifiable information (PII) were removed, including station names, station IDs, and geolocation data. Columns were renamed for clarity (e.g., member_casual was renamed to MembershipType, rideable_type to RideType, and time columns were reformatted for consistency using a 24-hour timestamp format).

Missing values were identified and assessed for relevance. Null values in location-related fields were excluded due to privacy concerns and limited analytical utility. Records with implausible or negative timestamps—indicating data entry errors—were removed. These included:

- 43 instances in November 2024
- 76 in May 2024
- 58 in April 2024
- 25 in March 2024
- 5 in February 2024
- 20 in January 2024

The data was further enhanced by extracting and generating new time-based fields, including StartDate, ReturnDate, StartTime, ReturnTime, StartDay, ReturnDay, StartMonth, and ReturnMonth, allowing for time-series and trend analyses. A RideLength column was calculated by subtracting start timestamps from return timestamps and was formatted to display durations

exceeding 24 hours. A second metric, RideLengthSeconds, was created to convert duration into seconds for quantitative analysis.

3.3 Verification and Documentation

Data quality was confirmed by running summary statistics and conducting random sample checks to validate transformations. Duplicate records were assessed using Excel's unique function, and none were found. All modifications and processing steps were logged in a documentation file titled Cyclistic Capstone Project (Log). A project folder titled CapstoneProject_Cyclistic_Data was structured with subfolders (zip_files, csv_files, xls_files) to maintain data organization throughout the workflow.

This structured approach to data preparation ensures that the dataset is clean, reliable, and aligned with the business objectives, enabling accurate analysis of Cyclistic's customer behavior.

4. Analysis

4.1 Variable and Terminology Overview

This section outlines the key variables analyzed and defines important terms used in interpreting both visual and statistical results. Understanding these elements ensures clarity and consistency in how the data and outcomes are presented.

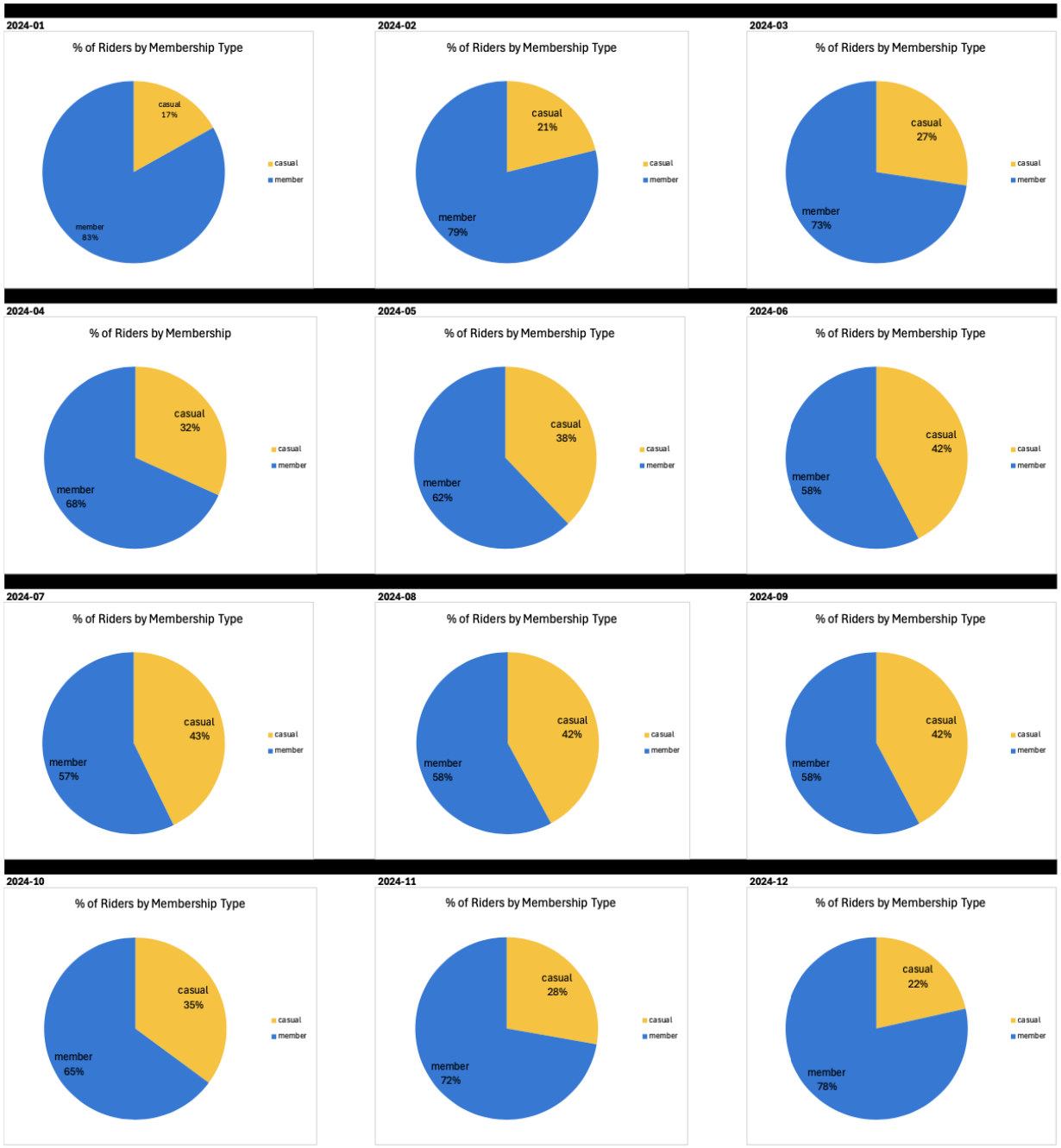
Variables

- **MembershipType** *(categorical)*:
  Indicates the user's subscription status. Possible values:
    - casual: Non-subscribed or one-time users
    - member: Subscribed or regular users
- **RideType** *(categorical)*:
  Specifies the type of vehicle used:
    - classic_bike
    - electric_bike
    - electric_scooter

- **Start Variables** *(datetime/categorical)*:
  These represent the starting point of a ride:
    - StartTimeStamp *(datetime)*: Full timestamp when ride began (mm/dd/yy hh:mm:ss)
    - StartTime *(datetime)*: Time only (hh:mm:ss)
    - StartDate *(datetime)*: Date only (mm/dd/yy)
    - StartDay *(categorical)*: Day of the week (e.g., Monday, Tuesday)
    - StartMonth *(categorical)*: Month of the year (e.g., January, February)
- **Return Variables** *(datetime/categorical)*:
  These represent the end point of a ride:
    - ReturnTimeStamp *(datetime)*: Full timestamp when ride ended (mm/dd/yy hh:mm:ss)
    - ReturnTime *(datetime)*: Time only (hh:mm:ss)
    - ReturnDate *(datetime)*: Date only (mm/dd/yy)
    - ReturnDay *(categorical)*: Day of the week (e.g., Monday, Tuesday)
    - ReturnMonth *(categorical)*: Month of the year (e.g., January, February)
- **RideLength** *(datetime)*:
  Duration of the ride in time format ([hh]:mm:ss)
- **RideLengthSeconds** *(numeric)*:
  Duration of the ride in total seconds, used for numerical analysis.

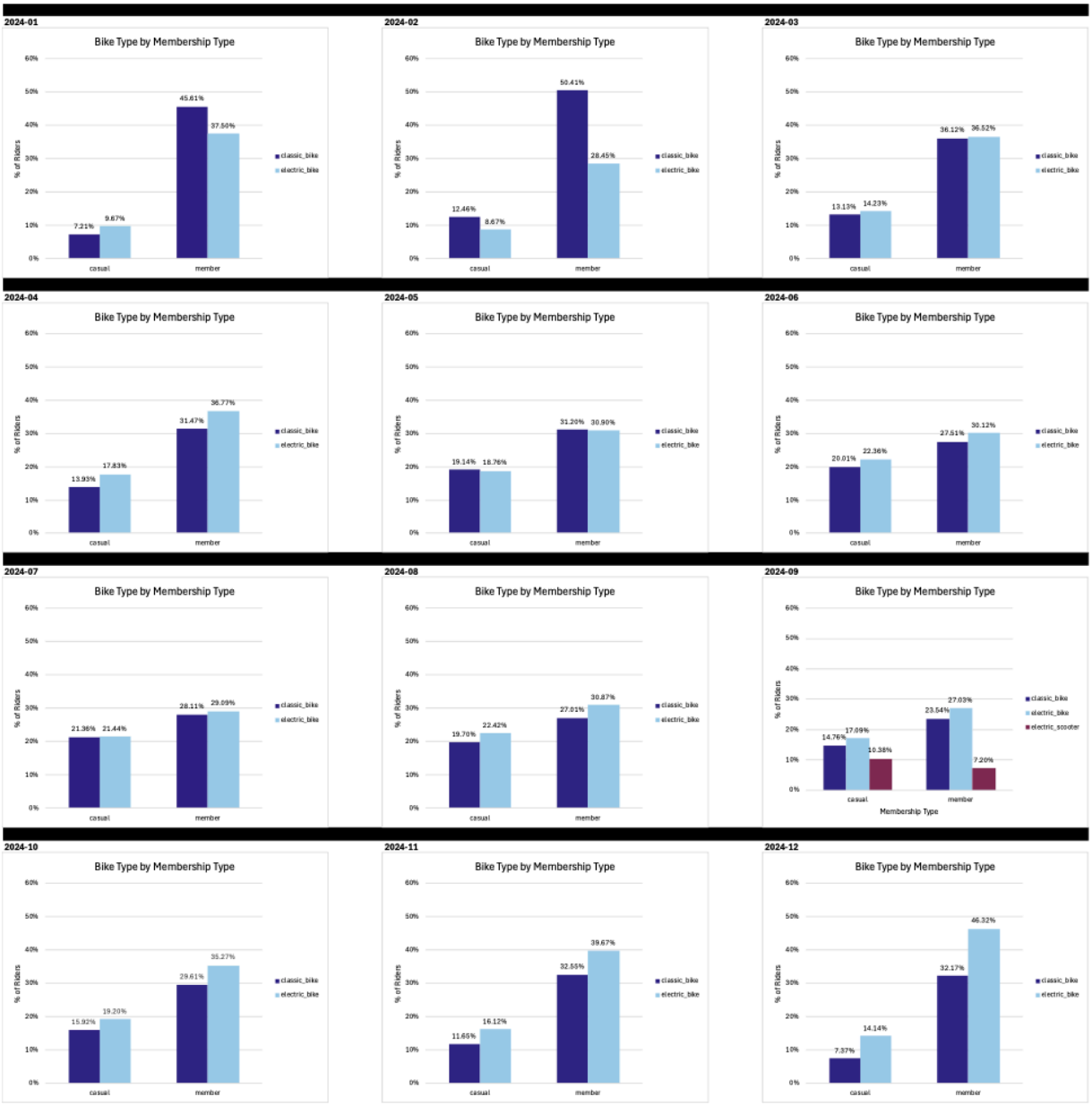
4.2 Data Visualization

Pie charts depicting the distribution of total rides by Casual Riders and Cyclistic Members throughout 2024.
Figure 1: Percentage of Riders by Membership Type



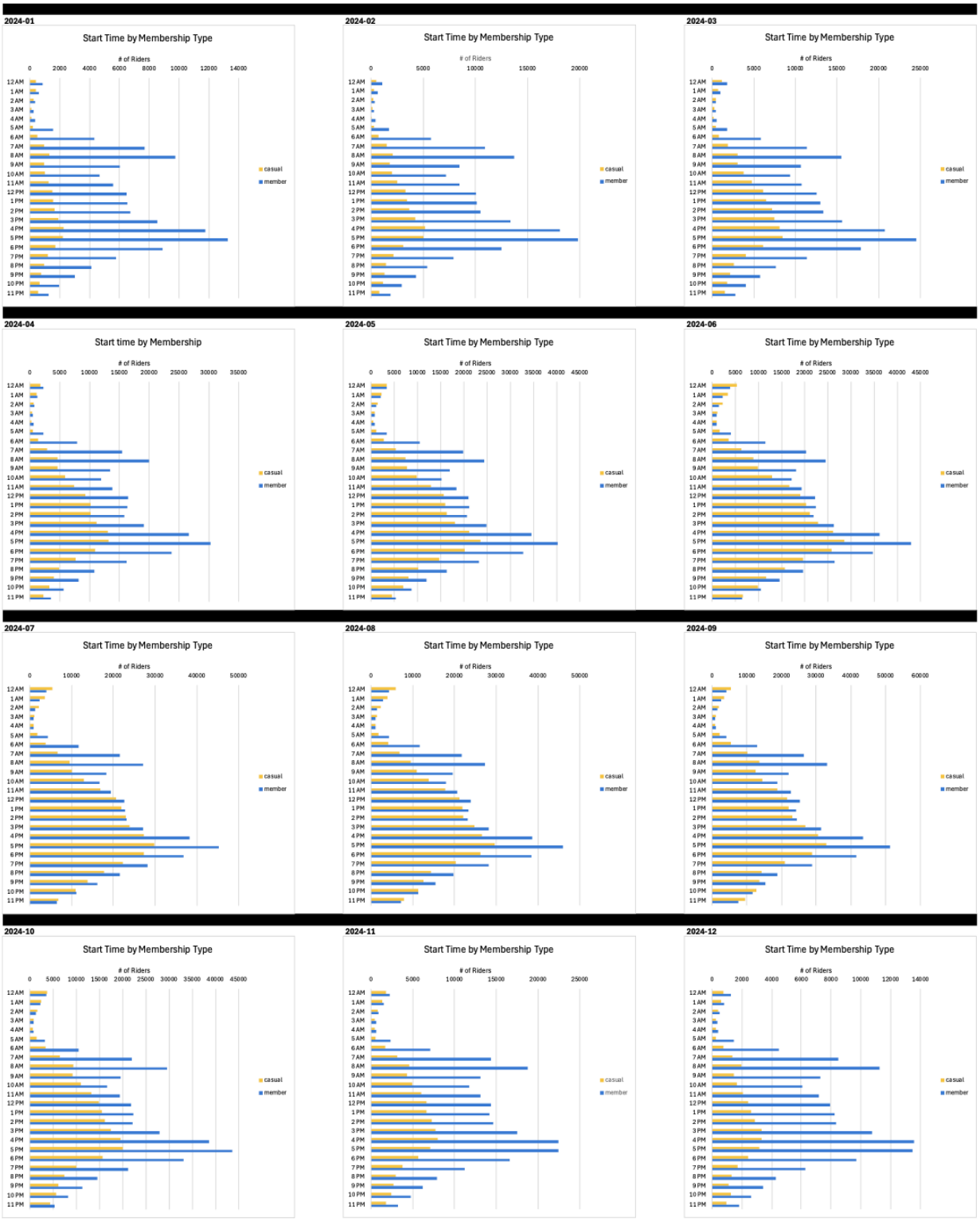
"The proportion of rides between Casual Riders and Cyclistic Members varies across the year. Notably, from June through September, the distribution between the two groups approaches equal. These months represent the most promising period for targeting Casual Riders to convert to membership, as their engagement peaks during this time."

Bar chart illustrating the distribution of Classic and Electric Bike usage by membership type.
Figure 2: Bike Type Usage by Membership Type



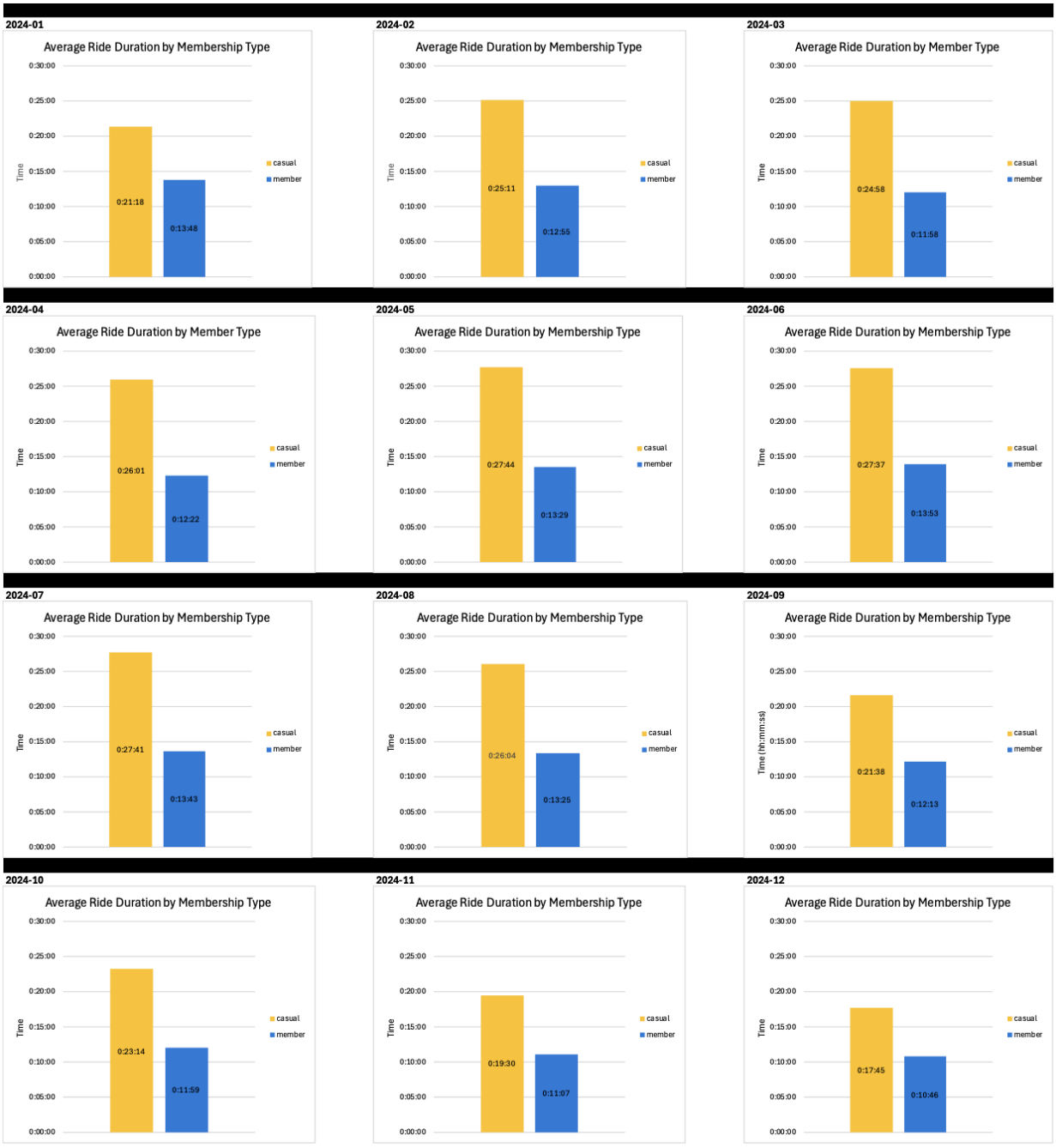
“Across most months—particularly during the summer—Electric Bikes were favored by both rider groups, suggesting a seasonal preference likely tied to convenience and accessibility.“

Bar chart showing ride start time distributions by membership type.
Figure 3: Start Time by Membership Type



“Cyclistic Members exhibit distinct peaks at 8:00 AM and 5:00 PM, aligning with typical commuting hours. In contrast, Casual Riders show a primary peak at 5:00 PM, indicating a preference for leisure-oriented evening rides. These patterns highlight the functional, commute-driven usage among Members and the recreational focus of Casual Riders.”

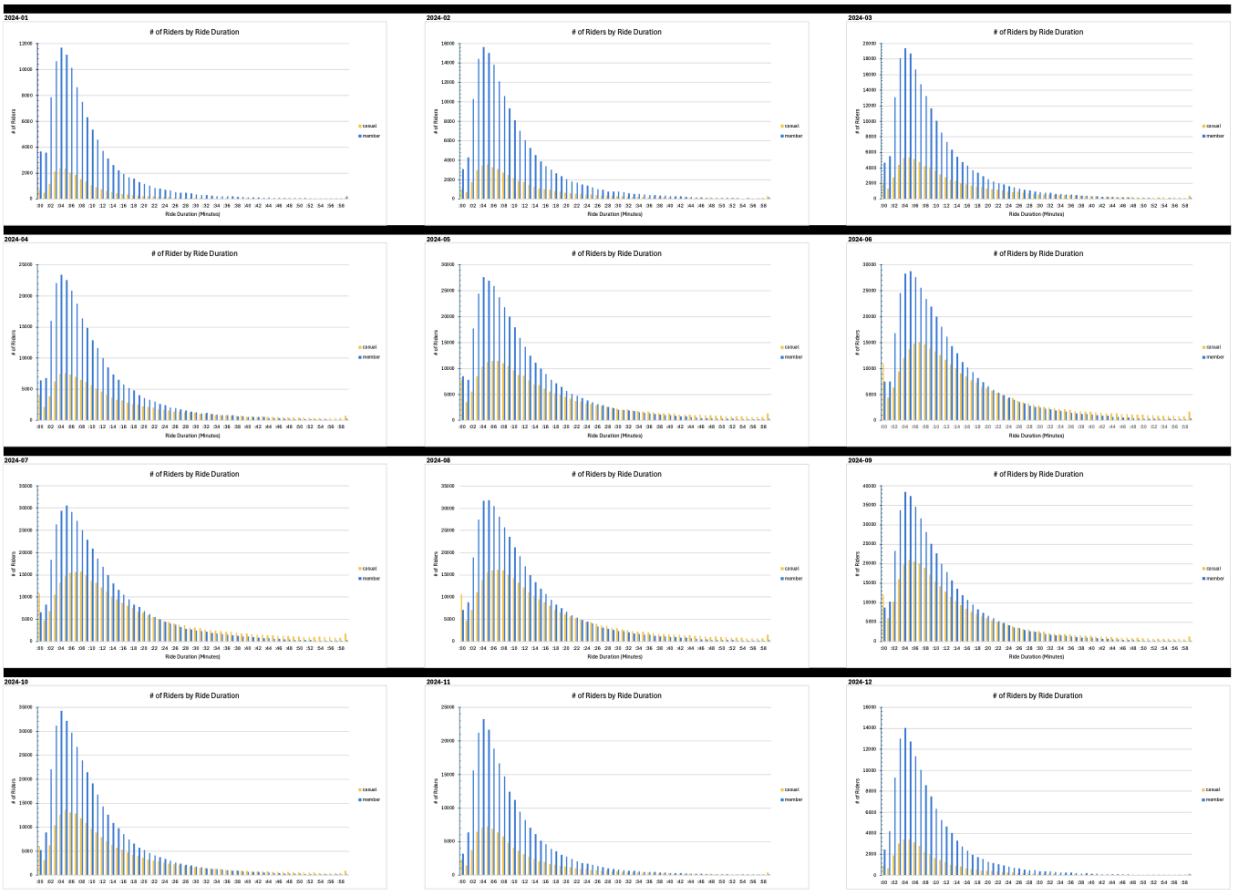
Bar chart comparing average ride durations between casual and Cyclistic members.
Figure 4: Average Ride Duration by Membership Type



“Casual Riders consistently exhibit longer average ride durations than Members. However, the presence of outliers in ride duration data for Casual Riders may inflate these averages, or represent two use cases.”

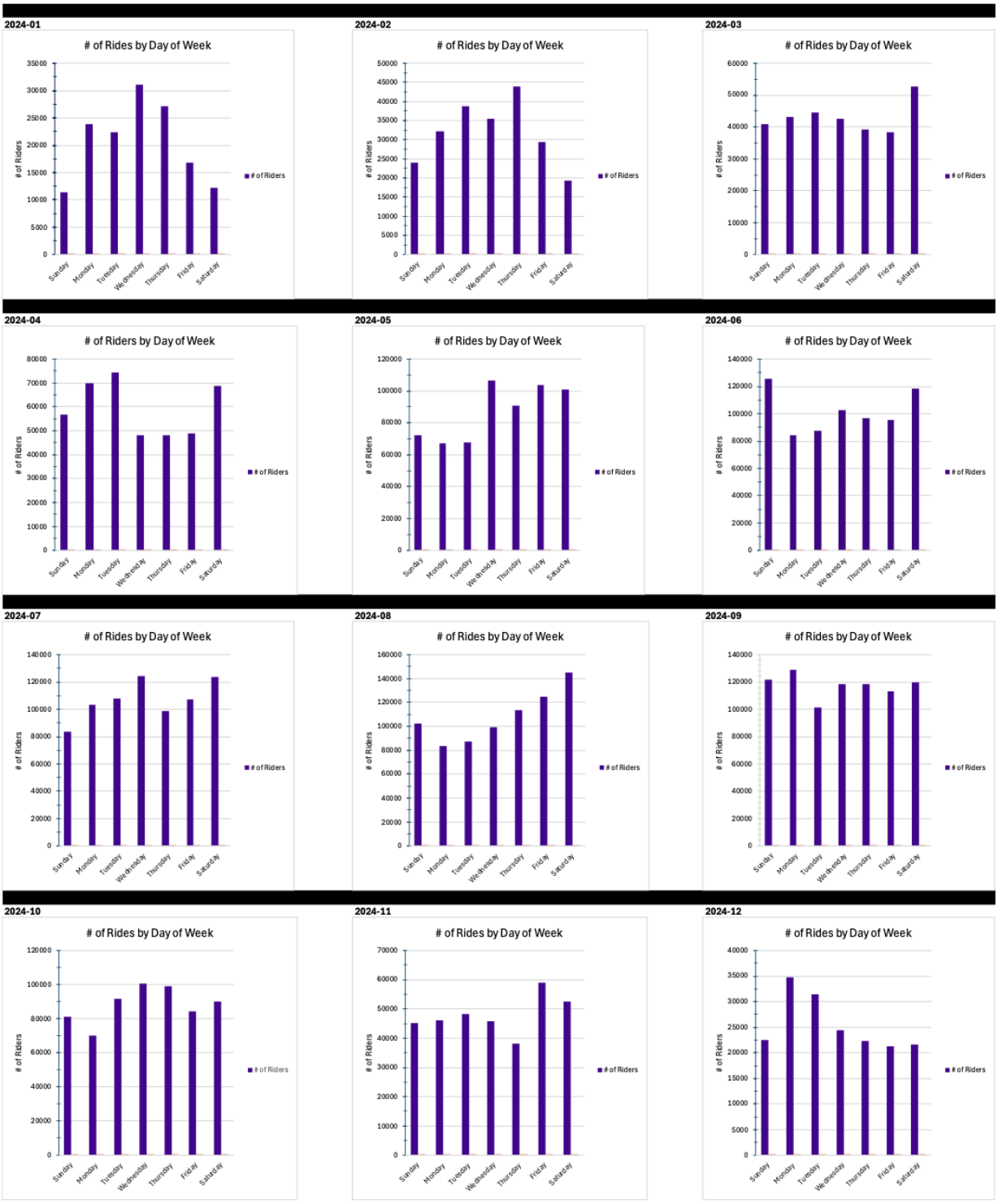
Bar charts illustrate the frequency of rides across various duration intervals for both membership types.

Figure 5: Number of Riders by Ride Duration



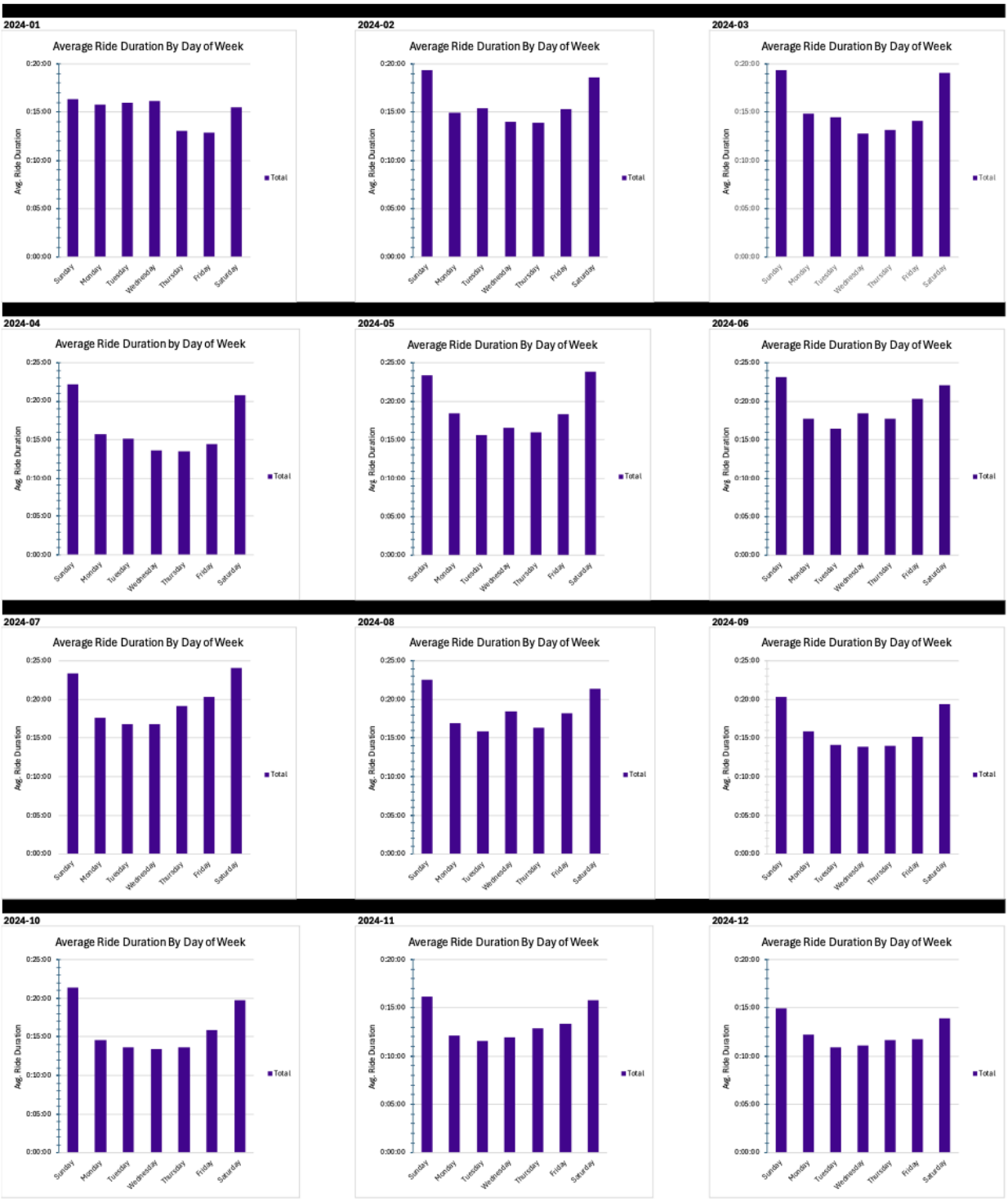
“Casual Riders show a higher prevalence of outlier durations (e.g., extremely long rides), which likely skew their average ride time upward. This suggests that their longer rides may reflect exploratory or recreational usage rather than consistent patterns.”

Bar chart showing ride frequency across weekdays.
Figure 6: Number of Rides by Day of the Week



“Ride frequency peaks vary across months, rendering this metric less conclusive for targeting specific days.”

Bar charts show variations in average ride duration by day of the week.
Figure 7: Average Ride Duration by Day of the Week

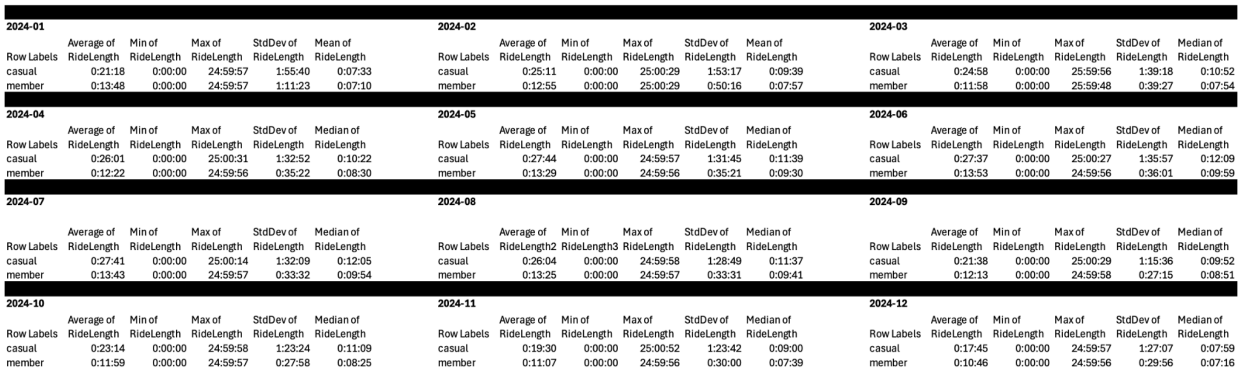


"Riders exhibit longer ride durations on weekends, likely reflecting recreational or leisurely riding behavior during non-working days."

4.3 Statistical Analysis

This figure presents summary statistics for ride durations of Casual Riders and Cyclistic Members throughout 2024.

Figure 8: Descriptive Statistics – Ride Length by Membership Type



2024-01

Row Labels	Average of RideLength	Min of RideLength	Max of RideLength	StdDev of RideLength	Mean of RideLength
casual	0:21:18	0:00:00	24:59:57	1:55:40	0:07:33
member	0:13:48	0:00:00	24:59:57	1:11:23	0:07:10

2024-02

Row Labels	Average of RideLength	Min of RideLength	Max of RideLength	StdDev of RideLength	Mean of RideLength
casual	0:25:11	0:00:00	25:00:29	1:53:17	0:09:39
member	0:12:55	0:00:00	25:00:29	0:50:16	0:07:57

2024-03

Row Labels	Average of RideLength	Min of RideLength	Max of RideLength	StdDev of RideLength	Median of RideLength
casual	0:24:58	0:00:00	25:59:56	1:39:18	0:10:52
member	0:11:58	0:00:00	25:59:48	0:39:27	0:07:54

2024-04

Row Labels	Average of RideLength	Min of RideLength	Max of RideLength	StdDev of RideLength	Median of RideLength
casual	0:26:01	0:00:00	25:00:31	1:32:52	0:10:22
member	0:12:22	0:00:00	24:59:56	0:35:22	0:08:30

2024-05

Row Labels	Average of RideLength	Min of RideLength	Max of RideLength	StdDev of RideLength	Median of RideLength
casual	0:27:44	0:00:00	24:59:57	1:31:45	0:11:39
member	0:13:29	0:00:00	24:59:56	0:35:21	0:09:30

2024-06

Row Labels	Average of RideLength	Min of RideLength	Max of RideLength	StdDev of RideLength	Median of RideLength
casual	0:27:37	0:00:00	25:00:27	1:35:57	0:12:09
member	0:13:53	0:00:00	24:59:56	0:36:01	0:09:59

2024-07

Row Labels	Average of RideLength	Min of RideLength	Max of RideLength	StdDev of RideLength	Median of RideLength
casual	0:27:41	0:00:00	25:00:14	1:32:09	0:12:05
member	0:13:43	0:00:00	24:59:57	0:33:32	0:09:54

2024-08

Row Labels	Average of RideLength2	Min of RideLength3	Max of RideLength	StdDev of RideLength	Median of RideLength
casual	0:26:04	0:00:00	24:59:58	1:28:49	0:11:37
member	0:13:25	0:00:00	24:59:57	0:33:31	0:09:41

2024-09

Row Labels	Average of RideLength	Min of RideLength	Max of RideLength	StdDev of RideLength	Median of RideLength
casual	0:21:38	0:00:00	25:00:29	1:15:36	0:09:52
member	0:12:13	0:00:00	24:59:58	0:27:15	0:08:51

2024-10

Row Labels	Average of RideLength	Min of RideLength	Max of RideLength	StdDev of RideLength	Median of RideLength
casual	0:23:14	0:00:00	24:59:58	1:23:24	0:11:09
member	0:11:59	0:00:00	24:59:57	0:27:58	0:08:25

2024-11

Row Labels	Average of RideLength	Min of RideLength	Max of RideLength	StdDev of RideLength	Median of RideLength
casual	0:19:30	0:00:00	25:00:52	1:23:42	0:09:00
member	0:11:07	0:00:00	24:59:56	0:30:00	0:07:39

2024-12

Row Labels	Average of RideLength	Min of RideLength	Max of RideLength	StdDev of RideLength	Median of RideLength
casual	0:17:45	0:00:00	24:59:57	1:27:07	0:07:59
member	0:10:46	0:00:00	24:59:56	0:29:56	0:07:16

“Casual Riders exhibit longer average ride durations and greater variability, suggesting a broader spectrum of ride purposes—such as leisure, sightseeing, or exploration—that result in more diverse usage patterns.

In contrast, Cyclistic Members demonstrate more consistent and shorter ride durations, aligning with routine or commuter-focused behavior.

Although the mean ride duration is higher for Casual Riders, the median duration remains relatively short and comparable between the two groups, indicating that the average is skewed by a subset of unusually long rides among Casual users.”

Statistical test comparing expected vs. observed ride counts by membership type across months.

Figure 9: Chi-square Goodness of Fit – Membership Type by Month

H_0: Proportion of MembershipType is equal to 50%
H_1: Proportion of MembershipType is not equal to 50%

2024-01
Chi-square GOF (MembershipType):

Row Labels	# of Riders	% of Riders
casual	24458	0.16884704
member	120395	0.83115296
Grand Total	144853	1

Row Labels	# of Riders	expected	O-E	((O-E)^2)/E
casual	24458	72426.5	-47968.5	31769.8217
member	120395	72426.5	47968.5	31769.8217
Grand Total	144853		X2	63539.6434
			df	1
			p-value	0
				statistically significant

2024-02
Chi-square GOF (MembershipType)

Row Labels	# of Riders	% of Riders
casual	47161	0.21133362
member	175998	0.78866638
Grand Total	223159	1

Row Labels	# of Riders	expected	O-E	((O-E)^2)/E
casual	47161	111579.5	-64418.5	37190.91
member	175998	111579.5	64418.5	37190.91
Grand Total	223159		X2	74381.82
			df	1
			p-value	0
				statistically significant

2024-03
Chi-square GOF (MembershipType)

Row Labels	# of Riders	% of Riders
casual	82533	0.27359429
member	219129	0.72640571
Grand Total	301662	1

Row Labels	# of Riders	expected	O-E	((O-E)^2)/E
casual	82533	150831	-68298	30926.1147
member	219129	150831	68298	30926.1147
Grand Total	301662		X2	61852.2294
			df	1
			p-value	0
				statistically significant

2024-04
Chi-square GOF (MembershipType)

Row Labels	# of Riders	% of Riders
casual	131789	0.31758911
member	283178	0.68241089
Grand Total	414967	1

Row Labels	# of Riders	expected	O-E	((O-E)^2)/E
casual	131789	207483.5	-75694.5	27615.0023
member	283178	207483.5	75694.5	27615.0023
Grand Total	414967		X2	55230.0046
			df	1
			p-value	0
				statistically significant

2024-05
Chi-square GOF (MembershipType)

Row Labels	# of Riders	% of Riders
casual	231018	0.37903307
member	378475	0.62096693
Grand Total	609493	1

Row Labels	# of Riders	expected	O-E	((O-E)^2)/E
casual	231018	304746.5	-73728.5	17837.4213
member	378475	304746.5	73728.5	17837.4213
Grand Total	609493		X2	35674.8426
			df	1
			p-value	0
				statistically significant

2024-06
Chi-square GOF (MembershipType)

Row Labels	# of Riders	% of Riders
casual	301127	0.42369228
member	409594	0.57630772
Grand Total	710721	1

Row Labels	# of Riders	expected	O-E	((O-E)^2)/E
casual	301127	355360.5	-54233.5	8276.86961
member	409594	355360.5	54233.5	8276.86961
Grand Total	710721		X2	16553.7392
			df	1
			p-value	0
				statistically significant

2024-07
Chi-square GOF (MembershipType)

Row Labels	# of Riders	% of Riders
casual	320546	0.427987
member	428416	0.572013
Grand Total	748962	1

Row Labels	# of Riders	expected	O-E	((O-E)^2)/E
casual	320546	374481	-53935	7768.04224
member	428416	374481	53935	7768.04224
Grand Total	748962		X2	15536.0845
			df	1
			p-value	0
				statistically significant

2024-08
Chi-square GOF (MembershipType)

Row Labels	# of Riders	% of Riders
casual	318280	0.42120642
member	437359	0.57879358
Grand Total	755639	1

Row Labels	# of Riders	expected	O-E	((O-E)^2)/E
casual	318280	377819.5	-59539.5	9382.6604
member	437359	377819.5	59539.5	9382.6604
Grand Total	755639		X2	18765.3208
			df	1
			p-value	0
				statistically significant

2024-09
Chi-square GOF (MembershipType)

Riders by Me	# of Riders	% of Riders
casual	346804	0.42227461
member	474472	0.57772539
Grand Total	821276	1

Riders by Me	# of Riders	expected	O-E	((O-E)^2)/E
casual	346804	410638	-63834	9923.0455
member	474472	410638	63834	9923.0455
Grand Total	821276		X2	19846.091
			df	1
			p-value	0
				statistically significant

2024-10
Chi-square GOF (MembershipType)

Row Labels	# of Riders	expected	O-E	((O-E)^2)/E
casual	216446	308140.5	-91694.5	27285.869
member	399835	308140.5	91694.5	27285.869
Grand Total	616281		X2	54571.7381
			df	1
			p-value	0
				statistically significant

2024-11
Chi-square GOF (MembershipType)

Row Labels	# of Riders	expected	O-E	((O-E)^2)/E
casual	93055	167516	-74461	33097.9758
member	241977	167516	74461	33097.9758
Grand Total	335032		X2	66195.9517
			df	1
			p-value	0
				statistically significant

2024-12
Chi-square GOF (MembershipType)

Row Labels	# of Riders	expected	O-E	((O-E)^2)/E
casual	38376	89186	-50810	28946.8762
member	139996	89186	50810	28946.8762
Grand Total	178372		X2	57893.7524
			df	1
			p-value	0
				statistically significant

“A Chi-Square Goodness-of-Fit test was conducted monthly in 2024 to determine whether the proportion of ride activity between Casual and Member riders followed an equal (50/50) distribution. In each month, the test yielded a statistically significant result ($p < 0.05$), indicating that the actual proportions differ significantly from the hypothesized equal split.

These results suggest that rider behavior is not evenly distributed between the two membership types in any given month.”

Statistical test assessing ride type usage proportions across months.
Figure 10: Chi-square Goodness of Fit – Ride Type by Month

H_0: Proportion of RideType is equal to 50%
H_1: Proportion of RideType is not equal to 50%

2024-01
Chi-square GOF (RideType) [indicate they are not the same frequency (is a difference)]

Row Labels	# of Riders	% of Riders
classic_bike	76524	0.5282873
electric_bike	68329	0.4717127
Grand Total	144853	1

Row Labels	# of Riders	expected	O-E	((O-E)^2)/E
classic_bike	76524	72426.5	4097.5	231.814408
electric_bike	68329	72426.5	-4097.5	231.814408
Grand Total	144853		X2	463.628817
			df	1
			p-value	7.802E-103
				statistically significant

2024-02
Chi-square GOF (RideType) [indicate they are not the same frequency (is a difference)]

Row Labels	# of Riders	% of Riders
classic_bike	140314	0.62876245
electric_bike	82845	0.37123755
Grand Total	223159	1

Row Labels	# of Riders	expected	O-E	((O-E)^2)/E
classic_bike	140314	111579.5	28734.5	7399.84935
electric_bike	82845	111579.5	-28734.5	7399.84935
Grand Total	223159		X2	14799.6987
			df	1
			p-value	0
				statistically significant

2024-03
Chi-square GOF (RideType) [indicate they are not the same frequency (is a difference)]

Row Labels	# of Riders	% of Riders
classic_bike	148584	0.49255127
electric_bike	153078	0.50744873
Grand Total	301662	1

Row Labels	# of Riders	expected	O-E	((O-E)^2)/E
classic_bike	148584	150831	-2247	33.4746107
electric_bike	153078	150831	2247	33.4746107
Grand Total	301662		X2	66.9492213
			df	1
			p-value	2.7859E-16
				statistically significant

2024-04
Chi-square GOF (RideType) [indicate they are not the same frequency (is a difference)]

Row Labels	# of Riders	% of Riders
classic_bike	188402	0.45401683
electric_bike	226565	0.54598317
Grand Total	414967	1

Row Labels	# of Riders	expected	O-E	((O-E)^2)/E
classic_bike	188402	207483.5	-19081.5	1754.85589
electric_bike	226565	207483.5	19081.5	1754.85589
Grand Total	414967		X2	3509.71178
			df	1
			p-value	0
				statistically significant

2024-05
Chi-square GOF (RideType) [indicate they are not the same frequency (is a difference)]

Row Labels	# of Riders	% of Riders
classic_bike	306789	0.50341392
electric_bike	302628	0.49658608
Grand Total	609417	1

Row Labels	# of Riders	expected	O-E	((O-E)^2)/E
classic_bike	306789	304708.5	2080.5	14.2053151
electric_bike	302628	304708.5	-2080.5	14.2053151
Grand Total	609417		X2	28.4106302
			df	1
			p-value	9.8125E-08
				statistically significant

2024-06
Chi-square GOF (RideType) [indicate they are not the same frequency (is a difference)]

Row Labels	# of Riders	% of Riders
classic_bike	337712	0.47516817
electric_bike	373009	0.52483183
Grand Total	710721	1

Row Labels	# of Riders	expected	O-E	((O-E)^2)/E
classic_bike	337712	355360.5	-17648.5	876.488952
electric_bike	373009	355360.5	17648.5	876.488952
Grand Total	710721		X2	1752.9779
			df	1
			p-value	0
				statistically significant

2024-07
Chi-square GOF (RideType) [indicate they are not the same frequency (is a difference)]

Row Labels	Count of Mer	Count of MembershipType2
classic_bike	370496	0.4946793
electric_bike	378466	0.5053207
Grand Total	748962	1

Row Labels	Count of MembershipType	expected	O-E	((O-E)^2)/E
classic_bike	370496	374481	-3985	42.4059565
electric_bike	378466	374481	3985	42.4059565
Grand Total	748962		X2	84.811913
			df	1
			p-value	3.2814E-20
				statistically significant

2024-08
Chi-square GOF (RideType) [indicate they are not the same frequency (is a difference)]

Row Labels	Count of Mer	Count of MembershipType2
classic_bike	352989	0.4671373
electric_bike	402650	0.53286027
Grand Total	755639	1

Row Labels	Count of MembershipType	expected	O-E	((O-E)^2)/E
classic_bike	352989	377819.5	-24830.5	1631.87377
electric_bike	402650	377819.5	24830.5	1631.87377
Grand Total	755639		X2	3263.74753
			df	1
			p-value	0
				statistically significant

2024-09
Chi-square GOF (RideType) [indicate they are not the same frequency (is a difference)]

Row Labels	Count of Mer	Count of MembershipType2
classic_bike	314562	0.38301618
electric_bike	362377	0.44123656
electric_sco	144337	0.17574725
Grand Total	821276	1

Row Labels	Count of MembershipType	expected	O-E	((O-E)^2)/E
classic_bike	314562	338469.5	-23907.5	1688.68556
electric_bike	362377	338469.5	23907.5	1688.68556
Grand Total	676939		X^2	3377.37111
			df	1
			p-value	0
				statistically significant

2024-10
Chi-square GOF (RideType) [indicate they are not the same frequency (is a difference)]

Row Labels	Count of Mer	Count of MembershipType2
classic_bike	280610	280610
electric_bike	335671	335671
Grand Total	616281	616281

Row Labels	Count of MembershipType	expected	O-E	((O-E)^2)/E
classic_bike	280610	308140.5	-27530.5	2459.68456
electric_bike	335671	308140.5	27530.5	2459.68456
Grand Total	616281		X2	4919.36912
			df	1
			p-value	0
				statistically significant

2024-11
Chi-square GOF (RideType) [indicate they are not the same frequency (is a difference)]

Row Labels	Count of Mer	Count of MembershipType2
classic_bike	148110	148110
electric_bike	186922	186922
Grand Total	335032	335032

Row Labels	Count of MembershipType	expected	O-E	((O-E)^2)/E
classic_bike	148110	167516	-19406	2248.10069
electric_bike	186922	167516	19406	2248.10069
Grand Total	335032		X2	4496.20139
			df	1
			p-value	0
				statistically significant

2024-12
Chi-square GOF (RideType) [indicate they are not the same frequency (is a difference)]

Row Labels	Count of Mer	Count of MembershipType2
classic_bike	70528	70528
electric_bike	107844	107844
Grand Total	178372	178372

Row Labels	Count of MembershipType	expected	O-E	((O-E)^2)/E
classic_bike	70528	89186	-18658	3903.31402
electric_bike	107844	89186	18658	3903.31402
Grand Total	178372		X2	7806.62804
			df	1
			p-value	0
				statistically significant

“A Chi-Square Goodness-of-Fit test was conducted monthly throughout 2024 to assess whether ride type usage (Classic vs. Electric) followed an even 50/50 distribution.

The results revealed statistically significant deviations ($p < 0.05$) in every month of the year, indicating that actual usage patterns consistently differ from the hypothesized equal distribution.

These findings suggest a persistent user preference for one ride type over the other, and this trend holds across seasons.”

Statistical test assessing the relationship between membership type and ride type.
Figure 11: Chi-square Test of Independence – Membership Type vs. Ride Type

H_0: RideType is independent of MembershipType

H_1: RideType is related to MembershipType

2024-01

Chi-square of Independence (MembershipType & RideType):

Count of Mer Column Labels

Row Labels	classic_bike	electric_bike	Grand Total
casual	10451	14007	24458
member	66073	54322	120395
Grand Total	76524	68329	144853

expected

	classic_bike	electric_bike
casual	12920.8507	11537.1493
member	63603.1493	56791.8507

p-value 7.527E-264

statistically significant

adjusted residuals:

	classic_bike	electric_bike
casual	-34.701312	34.7013116
member	34.7013116	-34.701312

2024-02

Chi-square of Independence (MembershipType & RideType):

Count of Mer Column Labels

Row Labels	classic_bike	electric_bike	Grand Total
casual	27811	19350	47161
member	112503	63495	175998
Grand Total	140314	82845	223159

expected

	classic_bike	electric_bike
casual	29653.066	17507.934
member	110660.934	65337.066

p-value 5.4411E-87

statistically signficant

adjusted residuals:

	classic_bike	electric_bike
casual	-19.769595	19.769595
member	19.769595	-19.769595

2024-03

Chi-square of Independence (MembershipType & RideType):

Count of Mer Column Labels

Row Labels	classic_bike	electric_bike	Grand Total
casual	39614	42919	82533
member	108970	110159	219129
Grand Total	148584	153078	301662

expected

	classic_bike	electric_bike
casual	40651.7336	41881.2664
member	107932.266	111196.734

p-value 2.3036E-17

statisticallly significant

adjusted residual

	classic_bike	electric_bike
casual	-8.4773604	8.47736038
member	8.47736038	-8.4773604

2024-04

Chi-square of Independence (MembershipType & RideType):

Count of Mer Column Labels

Row Labels	classic_bike	electric_bike	Grand Total
casual	57819	73970	131789
member	130583	152595	283178
Grand Total	188402	226565	414967

expected

	classic_bike	electric_bike
casual	59834.4234	71954.5766
member	128567.577	154610.423

p-value 1.6009E-41

statistically significant

adjusted residuals:

	classic_bike	electric_bike
casual	-13.498271	13.4982709
member	13.4982709	-13.498271

2024-05

Chi-square of Independence (MembershipType & RideType):

Count of Mer Column Labels

Row Labels	classic_bike	electric_bike	Grand Total
casual	116645	114343	230988
member	190144	188285	378429
Grand Total	306789	302628	609417

expected

	classic_bike	electric_bike
casual	116282.574	114705.426
member	190506.426	187922.574

p-value 0.05562712

not statistically significant

2024-06

Chi-square of Independence (MembershipType & RideType):

Count of Mer Column Labels

Row Labels	classic_bike	electric_bike	Grand Total
casual	142215	158912	301127
member	195497	214097	409594
Grand Total	337712	373009	710721

Expected

	classic_bike	electric_bike
casual	143085.967	158041.033
member	194626.033	214967.967

p-value 2.8311E-05

statistically significant

adjusted residuals:

	classic_bike	electric_bike
casual	-4.1866416	4.18664164
member	4.18664164	-4.1866416

2024-07

Chi-square of Independence (MembershipType & RideType):

Count of Mer Column Labels

Row Labels	classic_bike	electric_bike	Grand Total
casual	159986	160560	320546
member	210510	217906	428416
Grand Total	370496	378466	748962

Expected

	classic_bike	electric_bike
casual	158567.472	161978.528
member	211928.528	216487.472

p-value 3.4515E-11

statistically significant.

adjusted residuals:

	classic_bike	electric_bike
casual	6.62589317	-6.6258932
member	-6.6258932	6.62589317

2024-08

Chi-square of Independence (MembershipType & BikeType):

Count of Mer Column Labels

Row Labels	classic_bike	electric_bike	Grand Total
casual	148876	169404	318280
member	204113	233246	437359
Grand Total	352989	402650	755639

Expected:

	classic_bike	electric_bike
casual	148681.234	169598.766
member	204307.766	233051.234

p-value 0.36307077

not statistically significant

2024-09

Chi-square of Independence (MembershipType & BikeType):

Count of Mer Column Labels

Row Labels	classic_bike	electric_bike	Grand Total
casual	121208	140381	261589
member	193354	221996	415350
Grand Total	314562	362377	676939

expected

	weekday	weekend
casual	121555.944	140033.056
member	193006.056	222343.944

p-value 0.08162435

not statistically significant

2024-10

Chi-square of Independence (MembershipType & RideType):

Count of Mer Column Labels

Row Labels	classic_bike	electric_bike	Grand Total
casual	98137	118309	216446
member	182473	217362	399835
Grand Total	280610	335671	616281

expected

	classic_bike	electric_bike
casual	98553.926	117892.074
member	182056.074	217778.926

p-value 0.02547621

statistically significant

adjusted residuals:

	classic_bike	electric_bike
casual	-2.2341044	2.23410439
member	2.23410439	-2.2341044

2024-11

Chi-square of Independence (MembershipType & RideType):

Count of Mer Column Labels

Row Labels	classic_bike	electric_bike	Grand Total
casual	39047	54008	93055
member	109063	132914	241977
Grand Total	148110	186922	335032

expected

	classic_bike	electric_bike
casual	41137.4915	51917.5085
member	106972.509	135004.491

p-value 2.7732E-59

statistically significant

adjusted residuals:

	classic_bike	electric_bike
casual	-16.236729	16.2367289
member	16.2367289	-16.236729

2024-12

Chi-square of Independence (MembershipType & RideType):

Count of Mer Column Labels

Row Labels	classic_bike	electric_bike	Grand Total
casual	13148	25228	38376
member	57380	82616	139996
Grand Total	70528	107844	178372

expected

	classic_bike	electric_bike
casual	15173.8083	23202.1917
member	55354.1917	84641.8083

p-value 5.73E-126

statistically significant

adjusted residuals:

	classic_bike	electric_bike
casual	-23.87382	23.8738201
member	23.8738201	-23.87382

“Significant associations ($p < 0.05$) were found in most months (January, February, March, April, June, July, October, November, December), with adjusted residuals indicating that Casual Riders use classic bikes less frequently than expected, while Members prefer classic bikes more than expected. In July, this pattern reverses, with Casual Riders favoring classic bikes and Members preferring electric bikes. Non-significant results in May, August, and September suggest more balanced preferences during these months. These findings highlight the influence of membership type on bike choice, with implications for targeted promotions.”

Statistical test examining whether ride frequency by day varies by membership type.

Figure 12: Chi-square Test of Independence – Membership Type vs. Day of the Week

H_0: MembershipType is independent of Weekly Use
H_1: MembershipType is related to Weekly Use

2024-01
Chi-square of independence (MembershipType |to| frequency of weekday & weekend uses):

Count of Mer Column Labels

Row Labels	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Grand Total
casual	2372	4053	3418	4584	4401	3107	2523	24458
member	9033	19780	18926	26510	22683	13759	9704	120395
Grand Total	11405	23833	22344	31094	27084	16866	12227	144853

Count of Mer Column Labels

Row Labels	weekday	weekend	Grand Total
casual	19563	4895	24458
member	101658	18737	120395
Grand Total	121221	23632	144853

expected

	weekday	weekend
casual	20467.8068	3990.1932
member	100753.193	19641.8068

p-value 4.0963E-66
statistically significant

adjusted residuals:

	weekday	weekend
casual	-17.174861	17.174861
member	17.174861	-17.174861

2024-02
Chi-square of independence (MembershipType |to| frequency of weekday & weekend uses)

Count of Mer Column Labels

Row Labels	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Grand Total
casual	7108	6389	7592	6448	8070	6447	5107	47161
member	17003	25739	31280	29050	35763	22842	14321	175998
Grand Total	24111	32128	38872	35498	43833	29289	19428	223159

Count of Mer Column Labels

Row Labels	weekday	weekend	Grand Total
casual	34946	12215	47161
member	144674	31324	175998
Grand Total	179620	43539	223159

expected

	weekday	weekend
casual	37959.7454	9201.25462
member	141660.255	34337.7454

p-value 0
statistically significant

adjusted residuals:

	weekday	weekend
casual	-39.433582	39.433582
member	39.433582	-39.433582

2024-03
Chi-square of independence (MembershipType |to| frequency of weekday & weekend uses)

Count of Mer Column Labels

Row Labels	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Grand Total
casual	14846	10335	9693	9011	8722	9722	20004	82533
member	26144	32850	34739	33710	30520	28529	32637	219129
Grand Total	40990	43185	44432	42721	39242	38251	52641	301662

Count of Mer Column Labels

Row Labels	weekday	weekend	Grand Total
casual	47683	34850	82533
member	160348	58781	219129
Grand Total	208031	93631	301662

expected

	weekday	weekend
casual	56916.0933	25616.9067
member	151114.907	68014.0933

p-value 0
statistically significant

adjusted residual

	weekday	weekend
casual	-81.506178	81.506178
member	81.506178	-81.506178

2024-04
Chi-square of independence (MembershipType |to| frequency of weekday & weekend uses)

Count of Mer Column Labels

Row Labels	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Grand Total
casual	25314	19927	19143	11234	11007	14245	30919	131789
member	31308	49928	55215	36989	37191	34539	38008	283178
Grand Total	56622	69855	74358	48223	48198	48784	68927	414967

Row Labels	weekday	weekend	grand total
casual	75556	56233	131789
member	213862	69316	283178
grand total	289418	125549	414967

expected

	weekday	weekend
casual	91916.0049	39872.9951
member	197501.995	85676.0049

p-value 0
statistically significant

adjusted residuals:

	weekday	weekend
casual	-118.75859	118.758591
member	118.758591	-118.75859

2024-05
Chi-square of independence (MembershipType |to| frequency of weekday & weekend uses)

Count of Mer Column Labels

Row Labels	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Grand Total
casual	34494	24309	19780	33568	28825	39523	50489	230988
member	37892	43120	47893	73258	61970	64063	50233	378429
Grand Total	72386	67429	67673	106826	90795	103586	100722	609417

Row Labels	weekday	weekend	Grand Total
casual	146055	84983	230988
member	290304	88125	378429
Grand Total	436309	173108	609417

expected

	weekday	weekend
casual	165374.683	65613.3168
member	270934.317	107494.683

p-value 0
statistically significant

adjusted residuals:

	weekday	weekend
casual	-113.41012	113.410116
member	113.410116	-113.41012

2024-06
Chi-square of independence (MembershipType |to| frequency of weekday & weekend uses)

Count of Mer Column Labels

Row Labels	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Grand Total
casual	64684	30521	30216	39269	35501	40065	60871	301127
member	60795	53893	57373	63271	61355	55227	57680	409594
Grand Total	125479	84414	87589	102540	96856	95292	118551	710721

	weekday	weekend	Grand Total
casual	175572	125555	301127
member	291119	118475	409594
Grand Total	466691	244030	710721

Expected

	classic_bike	electric_bike
casual	197733.373	103393.627
member	268957.627	140636.373

p-value 0
statistically significant

adjusted residuals:

	weekday	weekend
casual	-112.03596	112.035956
member	112.035956	-112.03596

2024-07
Chi-square of independence (MembershipType |to| frequency of weekday & weekend uses)

Count of Mer Column Labels

Row Labels	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Grand Total
casual	41869	37600	36924	46226	40804	49278	67845	320546
member	41732	65977	71282	78041	57782	57760	55842	428416
Grand Total	83601	103577	108206	124267	98586	107038	123687	748962

Row Labels	weekday	weekend	Grand Total
casual	210832	109714	320546
member	330842	97574	428416
Grand Total	541674	207288	748962

Expected

	weekday	weekend
casual	231829.431	88716.5694
member	309844.569	118571.431

p-value 0
statistically significant.

adjusted residuals:

	weekday	weekend
casual	-109.60282	109.602821
member	109.602821	-109.60282

2024-08
Chi-square of independence (MembershipType |to| frequency of weekday & weekend uses)

Count of Mer Column Labels

Row Labels	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Grand Total
casual	52343	29918	29254	34783	41138	53515	77329	318280
member	49883	53695	57866	64279	72363	71540	67733	437359
Grand Total	102226	83613	87120	99062	113501	125055	145062	755639

Row Labels	weekday	weekend	Grand Total
casual	188608	129672	318280
member	319743	117616	437359
Grand Total	508351	247288	755639

expected

	weekday	weekend
casual	214120.706	104159.294
member	294230.294	143128.706

p-value 0
statistically significant

adjusted residual

	weekday	weekend
casual	-126.68378	126.683777
member	126.683777	-126.68378

2024-09
Chi-square of independence (MembershipType |to| frequency of weekday & weekend uses)

Count of Mer Column Labels

Row Labels	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Grand Total
casual	64333	51534	35238	42280	43950	47447	62022	346804
member	57246	77475	65845	76350	74427	65379	57750	474472
Grand Total	121579	129009	101083	118630	118377	112826	119772	821276

Row Labels	weekday	weekend	Grand Total
casual	220449	126355	346804
member	359476	114996	474472
Grand Total	579925	241351	821276

expected

	weekday	weekend
casual	244887.601	101916.399
member	335037.399	139434.601

p-value 0
statistically significant

adjusted residual

	weekday	weekend
casual	-119.85392	119.853918
member	119.853918	-119.85392

2024-10
Chi-square of independence (MembershipType |to| frequency of weekday & weekend uses)

Count of Mer Column Labels

Row Labels	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Grand Total
casual	39404	21185	24705	27566	29360	31532	42692	216446
member	41629	46884	66736	73022	69483	52916	47165	399835
Grand Total	81033	70069	91441	100590	98843	84448	89857	616281

	weekday	weekend	Grand Total
casual	134350	82096	216446
member	311041	88794	399835
Grand Total	445391	170890	616281

expected

	weekday	weekend
casual	156427.182	60018.8176
member	288963.818	110871.182

p-value 0
statistically significant

adjusted residuals:

	weekday	weekend
casual	-131.60354	131.603544
member	131.603544	-131.60354

2024-11
Chi-square of independence (MembershipType |to| frequency of weekday & weekend uses)

Count of Mer Column Labels

Row Labels	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Grand Total
casual	17007	10722	10481	9986	8883	16636	19340	93055
member	28154	35595	37775	35768	29195	42311	33269	241977
Grand Total	45161	46227	48256	45754	38078	58947	52609	335032

	weekday	weekend	Grand Total
casual	56708	36347	93055
member	180554	61423	241977
Grand Total	237262	97770	335032

expected

	weekday	weekend
casual	65899.4228	27155.5772
member	171362.577	70614.4228

p-value 0
statistically significant

adjusted residuals:

	weekday	weekend
casual	-77.989902	77.9899022
member	77.9899022	-77.989902

2024-12
Chi-square of independence (MembershipType |to| frequency of weekday & weekend uses)

Count of Mer Column Labels

Row Labels	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Grand Total
casual	6135	7094	5741	4386	4426	4342	6252	38376
member	16406	27731	25740	19999	17645	16945	15330	139996
Grand Total	22541	34825	31481	24385	22271	21287	21582	178372

	weekday	weekend	Grand Total
casual	25989	12387	38376
member	108260	31736	139996
Grand Total	134249	44123	178372

expected

	weekday	weekend
casual	28883.1186	9492.88144
member	105365.881	34630.1186

p-value 0
statistically significant

adjusted residuals:

	weekday	weekend
casual	-38.648321	38.6483208
member	38.6483208	-38.648321

“Adjusted residuals show that Casual Riders disproportionately ride on weekends, while Cyclistic Members favor weekdays. This reinforces the interpretation that Casual Riders primarily use bikes for leisure, while Members rely on them for commuting or routine purposes.”

Statistical test evaluating ride type preferences by weekday.

Figure 13: Chi-square Test of Independence – Ride Type vs. Day of the Week

H_0: RideType is independent of Weekly Use
H_1: RideType is related to Weekly Use

2024-01
Chi-square of independence (RideType | to | frequency of weekday & weekend uses):

Count of Mer Column Labels

Row Labels	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Grand Total
classic_bike	6210	12653	12415	17009	13589	8344	6304	76524
electric_bike	5195	11180	9929	14085	13495	8522	5923	68329
Grand Total	11405	23833	22344	31094	27084	16866	12227	144853

Row Labels	weekday	weekend	Grand Total
classic_bike	64010	12514	76524
electric_bike	57211	11118	68329
Grand Total	121221	23632	144853

expected

	weekday	weekend
classic_bike	64039.5146	12484.4854
electric_bike	57181.4854	11147.5146

p-value 0.67417597
not statistically significant

2024-02
Chi-square of independence (RideType | to | frequency of weekday & weekend uses)

Count of Mer Column Labels

Row Labels	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Grand Total
classic_bike	15653	20204	23775	21085	27433	19438	12726	140314
electric_bike	8458	11924	15097	14413	16400	9851	6702	82845
Grand Total	24111	32128	38872	35498	43833	29289	19428	223159

Row Labels	weekday	weekend	Grand Total
classic_bike	111935	28379	140314
electric_bike	67685	15160	82845
Grand Total	179620	43539	223159

expected

	weekday	weekend
classic_bike	112938.312	27375.6884
electric_bike	66681.6884	16163.3116

p-value 1.3534E-28
statistically significant

adjusted residuals:

	weekday	weekend
classic_bike	-11.09321	11.0932097
electric_bike	11.0932097	-11.09321

2024-03
Chi-square of independence (RideType | to | frequency of weekday & weekend uses)

Count of Mer Column Labels

Row Labels	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Grand Total
classic_bike	21646	22145	21846	20318	18149	17977	26503	148584
electric_bike	19344	21040	22786	22403	21093	20274	26138	153078
Grand Total	40990	43185	44632	42721	39242	38251	52641	301662

Row Labels	weekday	weekend	Grand Total
classic_bike	100435	48149	148584
electric_bike	107596	45482	153078
Grand Total	208031	93631	301662

expected

	weekday	weekend
classic_bike	102465.932	46118.0676
electric_bike	105565.068	47512.9324

p-value 1.5807E-57
statistically significant

adjusted residuals:

	weekday	weekend
classic_bike	-15.986747	15.9867472
electric_bike	15.9867472	-15.986747

2024-04
Chi-square of independence (RideType | to | frequency of weekday & weekend uses)

Count of Mer Column Labels

Row Labels	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Grand Total
classic_bike	28187	32700	33636	20283	20275	20689	32632	188402
electric_bike	28435	37155	40722	27940	27923	28095	36295	226565
Grand Total	56622	69855	74358	48223	48198	48784	68927	414967

Row Labels	weekday	weekend	grand total
classic_bike	127583	60819	188402
electric_bike	161835	64730	226565
Grand Total	289418	125549	414967

expected

	weekday	weekend
classic_bike	131400.642	57001.3584
electric_bike	158017.358	68547.6416

p-value 4.833E-148
statistically significant

adjusted residuals:

	weekday	weekend
classic_bike	-25.912358	25.9123578
electric_bike	25.912357	-25.912358

2024-05
Chi-square of independence (RideType | to | frequency of weekday & weekend uses)

Count of Mer Column Labels

Row Labels	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Grand Total
classic_bike	39404	34981	33073	52290	43009	49797	54235	306789
electric_bike	32962	32448	34600	54536	47786	53789	46487	302628
Grand Total	72366	67429	67673	106826	90795	103586	100722	609417

Row Labels	weekday	weekend	Grand Total
classic_bike	213150	93639	306789
electric_bike	223159	79469	302628
Grand Total	436309	173108	609417

expected

	weekday	weekend
classic_bike	219644.023	87144.9766
electric_bike	216664.977	85963.0234

p-value 5.77E-298
statistically significant

adjusted residuals:

	weekday	weekend
classic_bike	-36.893987	36.8939874
electric_bike	36.8939874	-36.893987

2024-06
Chi-square of independence (RideType | to | frequency of weekday & weekend uses)

Count of Mer Column Labels

Row Labels	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Grand Total
classic_bike	62008	40255	41076	48364	45255	44331	56423	337712
electric_bike	63471	44159	46513	54176	51601	50961	62128	373009
Grand Total	125479	84414	87589	102540	96856	95292	118551	710721

Row Labels	weekday	weekend	Grand Total
classic_bike	219281	118431	337712
electric_bike	247410	125599	373009
Grand Total	466691	244030	710721

expected

	classic_bike	electric_bike
classic_bike	221756.71	115955.29
electric_bike	244934.29	128074.71

p-value 3.1696E-35
statistically significant

adjusted residuals:

	weekday	weekend
classic_bike	-12.384525	12.3845247
electric_bike	12.3845247	-12.384525

2024-07
Chi-square of independence (RideType | to | frequency of weekday & weekend uses)

Count of Mer Column Labels

Row Labels	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Grand Total
classic_bike	42339	51289	52962	60477	48253	52404	62772	370496
electric_bike	41262	52288	55244	63790	50333	54634	60915	378466
Grand Total	83601	103577	108206	124267	98586	107038	123687	748962

Row Labels	weekday	weekend	Grand Total
classic_bike	265385	105111	370496
electric_bike	276289	102177	378466
Grand Total	541674	207288	748962

expected

	weekday	weekend
classic_bike	267954.917	102541.083
electric_bike	273719.083	104746.917

p-value 3.2157E-40
statistically significant

adjusted residuals:

	classic_bike	electric_bike
classic_bike	-13.275366	13.2753948
electric_bike	13.2753948	-13.275395

2024-08
Chi-square of independence (RideType | to | frequency of weekday & weekend uses)

Count of Mer Column Labels

Row Labels	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Grand Total
classic_bike	50064	39168	40240	46700	51546	55638	69033	352989
electric_bike	52162	44445	46880	52362	61955	69417	75429	402650
Grand Total	102226	83613	87120	99062	113501	125055	145062	755639

Row Labels	weekday	weekend	Grand Total
classic_bike	233292	119697	352989
electric_bike	275059	127591	402650
Grand Total	508351	247288	755639

expected

	weekday	weekend
classic_bike	237470.95	115518.05
electric_bike	270880.05	131769.95

p-value 1.0317E-93
statistically significant

adjusted residuals:

	weekday	weekend
classic_bike	-20.535764	20.5357664
electric_bike	20.5357664	-20.535766

2024-09
Chi-square of independence (RideType | to | frequency of weekday & weekend uses)

Count of Mer Column Labels

Row Labels	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Grand Total
classic_bike	49283	51740	38614	44431	43628	40116	46750	314562
electric_bike	52578	55710	43305	52810	52835	52380	52759	362377
electric_sco	19718	21559	19164	21389	21914	20330	20263	144337
Grand Total	121579	129009	101083	118630	118377	112826	119772	821276

Row Labels	weekday	weekend	Grand Total
classic_bike	218529	96033	314562
electric_bike	257040	105337	362377
Grand Total	475569	201370	676939

expected

	weekday	weekend
classic_bike	220988.798	93573.2022
electric_bike	254580.202	107796.798

p-value 2.7917E-39
statistically significant

adjusted residuals:

	weekday	weekend
classic_bike	-13.112518	13.1125185
electric_bike	13.1125185	-13.112518

2024-10
Chi-square of independence (RideType | to | frequency of weekday & weekend uses)

Count of Mer Column Labels

Row Labels	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Grand Total
classic_bike	38048	32720	41507	45263	42847	37840	42385	280610
electric_bike	42985	37349	49934	55327	55996	46608	47472	335671
Grand Total	81033	70069	91441	100590	98843	84448	89857	616281

Row Labels	weekday	weekend	Grand Total
classic_bike	200177	80433	280610
electric_bike	245214	90457	335671
Grand Total	445391	170890	616281

expected

	weekday	weekend
classic_bike	202798.997	77811.0033
electric_bike	242592.003	93078.9967

p-value 9.6626E-51
statistically significant

adjusted residuals:

	weekday	weekend
classic_bike	-14.981758	14.9817584
electric_bike	14.9817584	-14.981758

2024-11
Chi-square of independence (RideType | to | frequency of weekday & weekend uses)

Count of Mer Column Labels

Row Labels	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Grand Total
classic_bike	20789	20235	21222	19821	16604	25652	23787	148110
electric_bike	24372	25992	27034	25933	21474	33295	28822	186922
Grand Total	45161	46227	48256	45754	38078	58947	52609	335032

Row Labels	weekday	weekend	Grand Total
classic_bike	103534	44576	148110
electric_bike	133728	53194	186922
Grand Total	237262	97770	335032

expected

	weekday	weekend
classic_bike	104888.115	43221.8854
electric_bike	132373.885	54548.1146

p-value 3.6898E-25
statistically significant

adjusted residuals:

	weekday	weekend
classic_bike	-10.362047	10.3620471
electric_bike	10.3620471	-10.362047

2024-12
Chi-square of independence (RideType | to | frequency of weekday & weekend uses)

Count of Mer Column Labels

Row Labels	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Grand Total
classic_bike	9361	14393	12419	9610	8443	7739	8563	70528
electric_bike	13180	20432	19062	14775	13828	13548	13019	107844
Grand Total	22541	34825	31481	24385	22271	21287	21582	178372

Row Labels	weekday	weekend	Grand Total
classic_bike	52604	17924	70528
electric_bike	81645	26199	107844
Grand Total	134249	44123	178372

expected

	weekday	weekend
classic_bike	53081.8372	17446.1628
electric_bike	81167.1628	26676.8372

p-value 8.1877E-08
statistically significant

adjusted residuals:

	weekday	weekend
classic_bike	-5.3629431	5.36294312
electric_bike	5.36294312	-5.3629431

“Significant associations ($p < 0.05$) were observed in all months except January, with adjusted residuals indicating that electric bikes are used more frequently on weekdays, while classic bikes dominate on weekends. This suggests that electric bikes cater to functional, time-sensitive weekday needs (e.g., commuting), while classic bikes are preferred for recreational weekend rides. The non-significant result in January may reflect seasonal factors, such as reduced ridership or less variation in usage patterns.”

Statistical test evaluating main and interaction effects of membership type and ride type on ride behavior.

Figure 14: Two-Way ANOVA with Replication – Membership Type × Ride Type

H_0A: There is no difference in the group means across levels of MembershipType (casual vs. member), regardless of RideType.
H_1A: There is a difference in the group means across levels of MembershipType.

H_0B: There is no difference in the group means across levels of RideType (electric_bike, classic_bike, [electric_scooter]), regardless of MembershipType.
H_1B: There is a difference in the group means across levels of RideType.

H_0AB: There is no interaction between MembershipType and RideType—the effect of one factor does not depend on the other.
H_1AB: There is an interaction between MembershipType and RideType—the effect of one factor depends on the level of the other.

2024-01

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Sample	1733713884	1	1733713884	257.766587	7.9863E-58	3.84169133
Columns	405011600	1	405011600	60.2166591	8.6981E-15	3.84169133
Interaction	586104732	1	586104732	87.1413778	1.0605E-20	3.84169133
Within	2.6901E+11	39996	6725906.18			
Total	2.7173E+11	39999				

Tukey's HSD test

group 1	casual classic_bike			
group 2	casual electric_bike			
group 3	member classic_bike			
group 4	member electric_bike	Q	3.633	
# of comparis	6	Critical Rang	94.2195012	

comparison	abs. differenc	critical value	result	difference
casual classic_bike to casual electric_bi	658.4749	94.2195012	statistically significant	658.4749
casual classic_bike to member classic_t	443.345	94.2195012	statistically significant	443.345
casual classic_bike to member electric_	617.6279	94.2195012	statistically significant	617.6279
member classic_bike to casual electric_	215.1299	94.2195012	statistically significant	215.1299
member classic_bike to member electric	174.2829	94.2195012	statistically significant	174.2829
casual electric_bike to member electric	40.847	94.2195012	not statistically significant	-40.847

2024-02

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Sample	1383778993	1	1383778993	264.257357	3.1384E-59	3.84169133
Columns	1495299295	1	1495299295	285.554154	7.7115E-64	3.84169133
Interaction	969012151	1	969012151	185.050208	4.748E-42	3.84169133
Within	2.0944E+11	39996	5236482.38			
Total	2.1329E+11	39999				

Tukey's HSD test

group 1	casual classic_bike			
group 2	casual electric_bike			
group 3	member classic_bike			
group 4	member electric_bike	Q	3.633	
# of comparis	6	Critical Rang	83.1352527	

comparison	abs. differenc	critical value	result	difference
casual classic_bike to casual electric_bi	683.2814	83.1352527	statistically significant	683.2814
casual classic_bike to member classic_t	697.9806	83.1352527	statistically significant	697.9806
casual classic_bike to member electric_	758.6828	83.1352527	statistically significant	758.6828
member classic_bike to casual electric_	14.6992	83.1352527	not statistically significant	-14.6992
member classic_bike to member electric	60.7022	83.1352527	not statistically significant	60.7022
casual electric_bike to member electric	75.4014	83.1352527	not statistically significant	75.4014

2024-03

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Sample	437302125	1	437302125	257.342622	9.8667E-58	3.84169133
Columns	178231578	1	178231578	104.885339	1.3879E-24	3.84169133
Interaction	71924138.3	1	71924138.3	42.3257636	7.8178E-11	3.84169133
Within	6.7965E+10	39996	1699299.25			
Total	6.8653E+10	39999				

Tukey's HSD test

group 1	casual classic_bike			
group 2	casual electric_bike			
group 3	member classic_bike			
group 4	member electric_bike	Q	3.633	
# of comparis	6	Critical Rang	47.3587608	

comparison	abs. differenc	critical value	result	difference
casual classic_bike to casual electric_bi	293.9258	47.3587608	statistically significant	293.9258
casual classic_bike to member classic_t	218.3115	47.3587608	statistically significant	218.3115
casual classic_bike to member electric_	342.6211	47.3587608	statistically significant	342.6211
member classic_bike to casual electric_	75.6143	47.3587608	statistically significant	75.6143
member classic_bike to member electric	124.3096	47.3587608	statistically significant	124.3096
casual electric_bike to member electric	48.6953	47.3587608	statistically significant	48.6953

2024-04

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Sample	3272295900	1	3272295900	918.01946	2.152E-199	3.84169133
Columns	4041664284	1	4041664284	1133.86032	3.901E-245	3.84169133
Interaction	1629577442	1	1629577442	457.16642	7.313E-101	3.84169133
Within	1.4257E+11	39996	3564516.92			
Total	1.5151E+11	39999				

Tukey's HSD test

group 1	casual classic_bike			
group 2	casual electric_bike			
group 3	member classic_bike			
group 4	member electric_bike	Q	3.633	
# of comparis	6	Critical Rang	68.5907795	

comparison	abs. differenc	critical value	result	difference
casual classic_bike to casual electric_bi	975.7201	68.5907795	statistically significant	975.7201
casual classic_bike to member classic_t	1039.4211	68.5907795	statistically significant	1039.4211
casual classic_bike to member electric_	1207.7807	68.5907795	statistically significant	1207.7807
member classic_bike to casual electric_	63.701	68.5907795	not statistically significant	-63.701
member classic_bike to member electric	168.3596	68.5907795	statistically significant	168.3596
casual electric_bike to member electric	232.0606	68.5907795	statistically significant	232.0606

2024-05

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Sample	2811205233	1	2811205233	709.465161	5.912E-155	3.84169133
Columns	3878257828	1	3878257828	978.757717	2.727E-212	3.84169133
Interaction	1505530017	1	1505530017	379.951305	3.1408E-84	3.84169133
Within	1.5848E+11	39996	3962428.86			
Total	1.6668E+11	39999				

Tukey's HSD test

group 1	casual classic_bike			
group 2	casual electric_bike			
group 3	member classic_bike			
group 4	member electric_bike	Q	3.633	
# of comparis	6	Critical Rang	72.3179551	

comparison	abs. differenc	critical value	result	difference
casual classic_bike to casual electric_bi	918.2196	72.3179551	statistically significant	918.2196
casual classic_bike to member classic_t	1010.7682	72.3179551	statistically significant	1010.7682
casual classic_bike to member electric_	1152.9646	72.3179551	statistically significant	1152.9646
member classic_bike to casual electric_	92.5486	72.3179551	statistically significant	-92.5486
member classic_bike to member electric	142.1964	72.3179551	statistically significant	142.1964
casual electric_bike to member electric	234.745	72.3179551	statistically significant	234.745

2024-06

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Sample	2939223937	1	2939223937	660.70938	1.569E-144	3.84169133
Columns	4110247248	1	4110247248	923.9442	1.186E-200	3.84169133
Interaction	1573585925	1	1573585925	353.727039	1.4293E-78	3.84169133
Within	1.7793E+11	39996	4448588.18			
Total	1.8655E+11	39999				

Tukey's HSD test

group 1	casual classic_bike			
group 2	casual electric_bike			
group 3	member classic_bike			
group 4	member electric_bike	Q	3.633	
# of comparis	6	Critical Rang	76.6260608	

comparison	abs. differenc	critical value	result	difference
casual classic_bike to casual electric_bi	938.8306	76.6260608	statistically significant	938.8306
casual classic_bike to member classic_t	1037.7966	76.6260608	statistically significant	1037.7966
casual classic_bike to member electric_	1183.2582	76.6260608	statistically significant	1183.2582
member classic_bike to casual electric_	98.966	76.6260608	statistically significant	-98.966
member classic_bike to member electric	145.4616	76.6260608	statistically significant	145.4616
casual electric_bike to member electric	244.4276	76.6260608	statistically significant	244.4276

2024-07

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Sample	2575194068	1	2575194068	662.161771	7.674E-145	3.84169133
Columns	3463963995	1	3463963995	890.691914	1.387E-193	3.84169133
Interaction	1410539616	1	1410539616	362.693187	1.6598E-80	3.84169133
Within	1.5555E+11	39996	3889070.89			
Total	1.63E+11	39999				

Tukey's HSD test

group 1	casual classic_bike			
group 2	casual electric_bike			
group 3	member classic_bike			
group 4	member electric_bike	Q	3.633	
# of comparis	6	Critical Rang	71.6454026	

comparison	abs. differenc	critical value	result	difference
casual classic_bike to casual electric_bi	883.0352	71.6454026	statistically significant	883.0352
casual classic_bike to member classic_t	964.126	71.6454026	statistically significant	964.126
casual classic_bike to member electric_	1096.0182	71.6454026	statistically significant	1096.0182
member classic_bike to casual electric_	81.0908	71.6454026	statistically significant	-81.0908
member classic_bike to member electric	131.8922	71.6454026	statistically significant	131.8922
casual electric_bike to member electric	212.983	71.6454026	statistically significant	212.983

2024-08

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Sample	2314918505	1	2314918505	575.935608	2.255E-126	3.84169133
Columns	3195874938	1	3195874938	795.111435	3.112E-173	3.84169133
Interaction	1410302165	1	1410302165	350.87336	5.9035E-78	3.84169133
Within	1.6076E+11	39996	4019405.08			
Total	1.6768E+11	39999				

Tukey's HSD test

group 1	casual classic_bike			
group 2	casual electric_bike			
group 3	member classic_bike			
group 4	member electric_bike	Q	3.633	
# of comparis	6	Critical Rang	72.8360334	

comparison	abs. differenc	critical value	result	difference
casual classic_bike to casual electric_bi	856.6759	72.8360334	statistically significant	856.6759
casual classic_bike to member classic_t	940.8606	72.8360334	statistically significant	940.8606
casual classic_bike to member electric_	1046.4567	72.8360334	statistically significant	1046.4567
member classic_bike to casual electric_	84.1847	72.8360334	statistically significant	-84.1847
member classic_bike to member electric	105.5961	72.8360334	statistically significant	105.5961
casual electric_bike to member electric	189.7808	72.8360334	statistically significant	189.7808

2024-09

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Sample	4200826496	1	2100413248	826.603339	0	2.99588187
Columns	2756912256	1	2756912256	1084.96406	7.866E-236	3.84161383
Interaction	1660671793	2	830335896	326.773041	0	2.99588187
Within	1.5245E+11	59994	2541017.13			
Total	1.6106E+11	59999				

Tukey's HSD test

group 1	casual classic_bike			
group 2	casual electric_bike			
group 3	member classic_bike			
group 4	member electric_bike			
group 5	casual electric_scooter			
group 6	member electric_scooter	Q	4.03	
# of comparis	15	Critical Rang	64.2404897	

comparison	abs. differenc	critical value	result	difference
casual classic_bike to casual electric_bi	820.8138	64.2404897	statistically significant	820.8138
casual classic_bike to casual electric_sc	964.8505	64.2404897	statistically significant	964.8505
casual classic_bike to member classic_t	898.0421	64.2404897	statistically significant	898.0421
casual classic_bike to member electric_	985.4627	64.2404897	statistically significant	985.4627
casual classic_bike to member electric_	1188.2961	64.2404897	statistically significant	1188.2961
casual electric_bike to casual electric_s	144.0367	64.2404897	statistically significant	144.0367
casual electric_bike to member classic_	77.2283	64.2404897	statistically significant	77.2283
casual electric_bike to member electric_	164.6489	64.2404897	statistically significant	164.6489
casual electric_bike to member electric_	367.4823	64.2404897	statistically significant	367.4823
casual electric_scooter to member class	66.8084	64.2404897	statistically significant	-66.8084
casual electric_scooter to member elec	20.6122	64.2404897	not statistically significant	20.6122
casual electric_scooter to member elec	223.4456	64.2404897	statistically significant	223.4456
member classic_bike to member electric	87.4206	64.2404897	statistically significant	87.4206
member classic_bike to member electric	290.254	64.2404897	statistically significant	290.254
member electric_bike to member electri	202.8334	64.2404897	statistically significant	202.8334

2024-10

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Sample	2472968468	1	2472968468	550.39863	6.778E-121	3.84169133
Columns	2693083760	1	2693083760	599.388804	2.116E-131	3.84169133
Interaction	1272812652	1	1272812652	283.284785	2.3887E-63	3.84169133
Within	1.797E+11	39996	4493049.82			
Total	1.8614E+11	39999				

Tukey's HSD test

group 1	casual classic_bike			
group 2	casual electric_bike			
group 3	member classic_bike			
group 4	member electric_bike	Q	3.633	
# of comparis	6	Critical Rang	77.0080303	

comparison	abs. differenc	critical value	result	difference
casual classic_bike to casual electric_bi	854.0545	77.0080303	statistically significant	854.0545
casual classic_bike to member classic_t	875.7143	77.0080303	statistically significant	875.7143
casual classic_bike to member electric_	1016.2388	77.0080303	statistically significant	1016.2388
member classic_bike to casual electric_	21.6598	77.0080303	not statistically significant	-21.6598
member classic_bike to member electric	140.5245	77.0080303	statistically significant	140.5245
casual electric_bike to member electric	162.1843	77.0080303	statistically significant	162.1843

2024-11

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Sample	1528619980	1	1528619980	375.806393	2.4605E-83	3.84169133
Columns	1088153385	1	1088153385	267.519072	6.1728E-60	3.84169133
Interaction	812046523	1	812046523	199.639073	3.2174E-45	3.84169133
Within	1.6269E+11	39996	4067573.11			
Total	1.6612E+11	39999				

Tukey's HSD test

group 1	casual classic_bike			
group 2	casual electric_bike			
group 3	member classic_bike			
group 4	member electric_bike	Q	3.633	
# of comparis	6	Critical Rang	73.2711624	

comparison	abs. differenc	critical value	result	difference
casual classic_bike to casual electric_bi	675.94	73.2711624	statistically significant	675.94
casual classic_bike to member classic_t	614.836	73.2711624	statistically significant	614.836
casual classic_bike to member electric_	720.8474	73.2711624	statistically significant	720.8474
member classic_bike to casual electric_	61.104	73.2711624	not statistically significant	61.104
member classic_bike to member electric	106.0114	73.2711624	statistically significant	106.0114
casual electric_bike to member electric	44.9074	73.2711624	not statistically significant	44.9074

2024-12

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Sample	1217503654	1	1217503654	333.106389	4.0511E-74	3.84169133
Columns	748886736	1	748886736	204.893805	2.3262E-46	3.84169133
Interaction	727078058	1	727078058	198.926998	4.5934E-45	3.84169133
Within	1.4619E+11	39996	3654999.4			
Total	1.4888E+11	39999				

Tukey's HSD test

group 1	casual classic_bike			
group 2	casual electric_bike			
group 3	member classic_bike			
group 4	member electric_bike	Q	3.633	
# of comparis	6	Critical Rang	69.4558855	

comparison	abs. differenc	critical value	result	difference
casual classic_bike to casual electric_bi	618.5713	69.4558855	statistically significant	618.5713
casual classic_bike to member classic_t	543.3018	69.4558855	statistically significant	543.3018
casual classic_bike to member electric_	622.5854	69.4558855	statistically significant	622.5854
member classic_bike to casual electric_	75.2695	69.4558855	statistically significant	75.2695
member classic_bike to member electric	79.2836	69.4558855	statistically significant	79.2836
casual electric_bike to member electric	4.0141	69.4558855	not statistically significant	4.0141

"A two-way ANOVA with replication examined the main and interaction effects of membership type (Casual vs. Member) and ride type (classic bike, electric bike, and electric scooter in September) on ride behavior. Significant interaction effects ($p < 0.05$) were observed across all months, indicating that ride behavior is shaped by the combined influence of membership and ride type. Tukey's HSD post hoc tests revealed that Casual Riders use both classic and electric bikes more frequently than Members, particularly in warmer months.

Additionally, Members show a growing preference for electric scooters in September, a trend not observed among Casual Riders.”

Conclusion:

5. Key Findings

5.1 Ride Duration

Casual riders exhibit a longer average ride duration compared to Cyclistic members.

However, ride duration within the casual rider group shows greater variability, indicating a wider range of trip lengths.

Most riders, regardless of membership type, tend to ride for around 5 minutes on average.

5.2 Bike Type Preference

During the target months, electric bikes are favored over classic bikes. This suggests that e-bikes may be a preferred option due to their convenience, efficiency, and suitability for summer and early fall conditions.

5.3 Peak Riding Times

Casual riders show a distinct peak usage at 5 PM, likely influenced by post-work or leisure activities.

Cyclistic members exhibit two peak times: 8 AM and 5 PM, which align with traditional commuting hours.

5.4 Weekend vs. Weekday Usage

Average ride duration tends to be greater on weekends (Saturday and Sunday), suggesting that riders use the service for leisure, longer recreational trips, or social activities rather than short commuting purposes.

6. Final Remarks

Based on the 2024 Cyclistic bike usage trends, particularly during the peak months of June through September, the following strategies are recommended to optimize membership conversions and improve service utilization:

1. Develop Targeted Promotions for Casual Riders During Peak Seasons:
   Since casual ridership nears 50% during summer months, Cyclistic should implement seasonal membership promotions to capture this audience. Offering limited-time discounts, bundled ride packages, or trial memberships during June through September could encourage casual riders to commit to annual plans, especially as they engage in more frequent recreational trips.

2. Tailor Marketing Strategies to Different Rider Behaviors:
   The analysis reveals distinct usage patterns: casual riders take longer, more varied trips, often in the evenings and on weekends, while members display structured commuting habits. Cyclistic should target leisure-oriented messaging (e.g., “Ride More, Pay Less”) toward casual riders and highlight commuter benefits (e.g., “Skip Traffic, Save Time”) for potential members who use bikes for work travel. Additionally, promoting the advantages of membership, such as cost savings on frequent rides, could help bridge the gap between occasional and committed riders.

3. Enhance Membership Perks Aligned with Rider Preferences:
   Given that casual riders favor electric bikes and take longer weekend trips, Cyclistic could introduce membership benefits that appeal directly to these preferences. This could include exclusive discounts on electric bike rides, extended ride times for members, or weekend ride credits. Providing these incentives could make annual memberships more attractive to casual riders who already engage with the service regularly.

By implementing these recommendations, Cyclistic can better align its marketing and service offerings with user behavior, ultimately increasing membership conversion rates and long-term customer retention.

Appendix:

Divvy. (n.d.). Data license agreement. https://divvybikes.com/data-license-agreement

Divvy. (n.d.). Divvy trip data. https://divvy-tripdata.s3.amazonaws.com/index.html