Project Title: MTA Ridership Analysis

Project Description:

This project analyzes ridership data for seven transportation services in New York City, capturing the total number of riders for each mode of transportation per day. The dataset includes pre-pandemic ridership percentage columns, allowing for a clear comparison across different time periods. Using Excel, Power Query, and Power BI, the project aimed to uncover patterns in rider behavior before, during, and after the COVID-19 pandemic.

Objective:

To compare ridership trends across years for each transportation type, focusing on changes before (2019), during (2020–2021), and after (2022–2024) the COVID-19 pandemic. The goal was to understand how rider volumes fluctuated and which services saw faster recovery.

Data Source:

CSV file containing MTA ridership data, including daily rider counts and pre-pandemic comparison percentages.

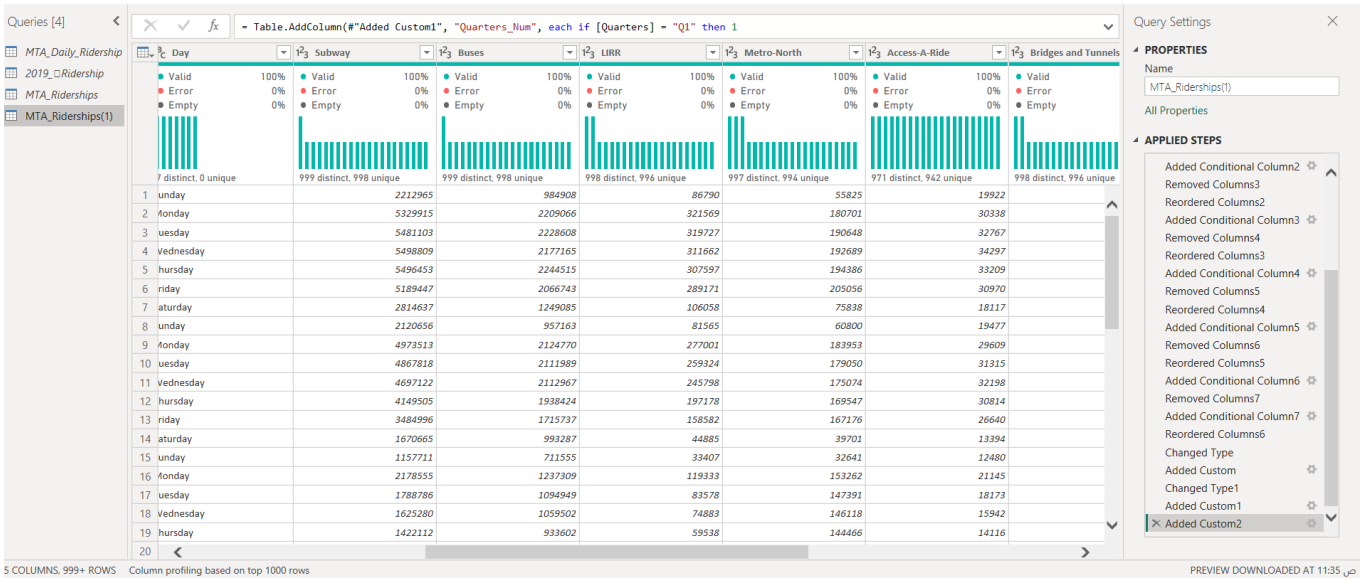
Tools Used:

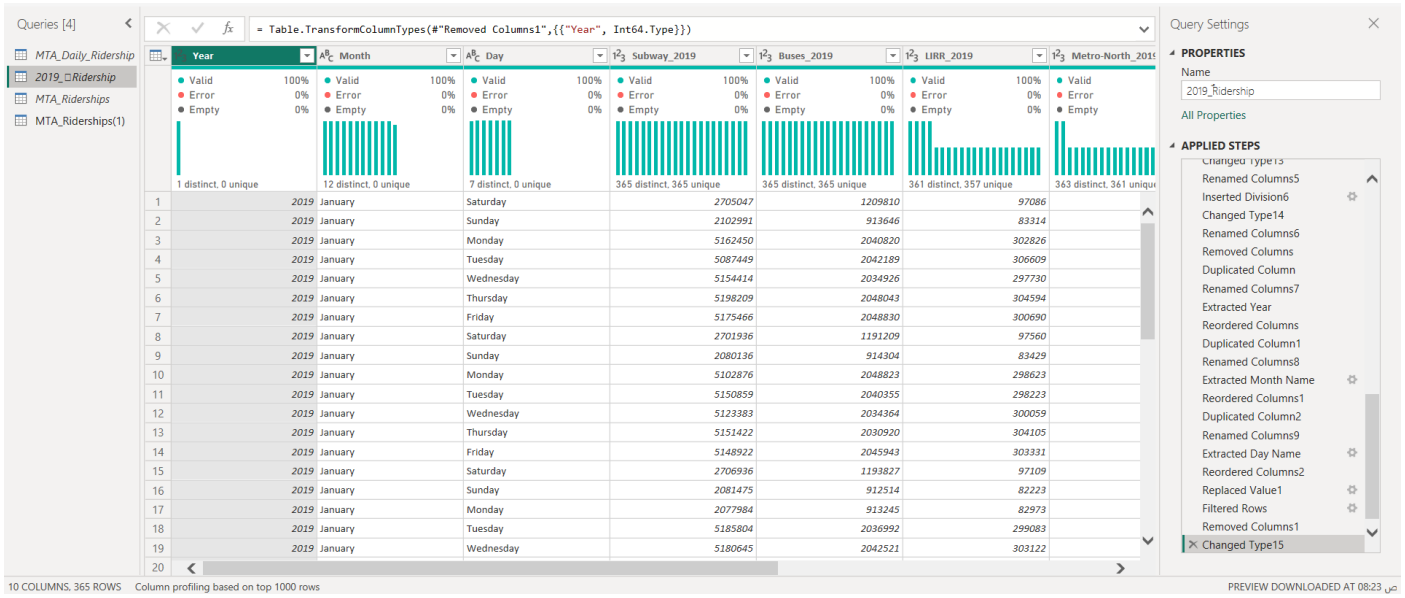
- Power BI
- Excel
- Power Query

Data Cleaning Steps

- The dataset included several columns such as:
  - **Transportation type**
  - **Date**
  - **Ridership percentage compared to pre-pandemic levels (2019)**
- Calculated the **actual number of riders in 2019** by:
  - Dividing the current ridership number by the percentage value (to estimate the original 2019 value).
  - **Special case**: For **Staten Island**, the percentage column was returning `NULL` when dividing, so it was assumed to be **100%** (i.e., ridership remained the same).
- **Duplicated the table** to isolate and extract **2019 ridership data** from the 2022 data using the calculated values.
- Extracted **date components** for time-based analysis:
  - **Year**
  - **Month**
  - **Quarter**
  - **Weekday name** (e.g., Sunday, Monday, etc.) to analyze daily ridership trends.
- Used **DAX measures** to create custom calculations and perform deeper analysis.
- **Merged data from multiple years using `Append` to create a continuous timeline from 2019 to 2024.**
- Calculated key performance metrics:
  - **Recovery %** = Post-pandemic ridership / Pre-pandemic ridership.
  - **Year-over-year change** = (Current year - Previous year) / Previous year.
- Computed general statistics:
  - **Total Ridership**
  - **Total Trips**
  - **Total Traffic**
  - **Average Ridership** (overall and per year)
  - Used slicers to allow filtering by year to view yearly averages.
- Created DAX measures to distinguish between:
  - **Pre-pandemic**
  - **During pandemic**
  - **Post-pandemic** periods — useful for segmenting and comparing performance over time.
- Calculated **maximum**, **average**, and **total** ridership for each transportation type.

Snapshots from the Power Query





Analysis & Insights

1. **Subway Ridership Trends**
    - Subway ridership experienced the **sharpest decline**, dropping by **74% in 2020** compared to 2019 (from **1.686 billion to 370 million**).
    - By 2024, it recovered to **988 million**, which is approximately **59%** of its pre-pandemic level — indicating a **gradual but incomplete recovery**.
    - The weekday ridership remained significantly higher than weekends, especially for **commuter-heavy routes**.
2. **Bus Ridership**
    - Buses showed more **resilience** than subways.
    - Maintained around **50–60%** of ridership in 2020 and reached **90%** recovery by 2024.
    - Their essential role in outer boroughs contributed to a **faster and more consistent recovery**.
3. **Bridges & Tunnels**
    - This was the **fastest-recovering mode**.
    - Car traffic dropped only **27% in 2020** and fully recovered by **2023**, even surpassing pre-pandemic levels at **103% in 2024**.
4. **LIRR (Long Island Rail Road)**
    - Saw a **75% decline in 2020**.
    - Recovered to **73.7 million riders in 2024**, or **81%** of its 2019 level — **slower than buses and bridges**.
    - Strong difference observed between **weekday and weekend ridership**.
5. **Metro-North**
    - Ridership declined by **76% in 2020**.
    - Reached **69.4 million** in 2024 — about **79%** of 2019 levels.
    - Similar to LIRR, it showed **slower recovery trends**.
6. **Staten Island Railway**
    - Had the **lowest pre-pandemic ridership** at **4.6 million in 2019**.
    - Dropped by **76% in 2020**, recovered modestly to **3.1 million in 2024** (approx. **67%** of pre-pandemic levels).
7. **Access-A-Ride**
    - Showed the **most stable demand**.
    - Fell to **81%** in 2020 but quickly rebounded.
    - By 2023 and 2024, it exceeded pre-pandemic levels, operating at **110%**.
8. **Pandemic Impact Timeline**
    - The **steepest drops** occurred in **April 2020** (over **90%** for subway).
    - Recovery began in **mid-2020**, with subway ridership increasing by over **100% from 2020 to 2021** (370M → 760M).
    - **Spikes** were noted during reopening phases and summers; **drops** occurred during holidays, winter storms, and COVID variant waves.
9. **Recovery Patterns**
    - Clear **variation in recovery speed**:
        - **Fastest**: Bridges & Tunnels.
        - **Moderate**: Bus, Access-A-Ride.
        - **Slowest**: Subway, LIRR, Metro-North, Staten Island Railway.
    - **Post-pandemic ridership remains below pre-pandemic levels** in most modes, especially the subway system.

Visualization

To effectively communicate trends and patterns in ridership, we designed a dashboard with carefully selected visuals that provide both detailed insights and high-level overviews.

Cards

We included Cards at the top of the dashboard to provide a **quick snapshot** of the system's overall status:

- Total Ridership
- Total Traffic
- Total Trips
- Average Volume
  These KPIs allow viewers to quickly understand **overall performance at a glance**, without diving into the details.

Line Charts

We used line charts to visualize:

- **Total volume of transportation over time**
- **Percentage change year by year**
- **Recovery percentage compared to 2019**

What we gained:
These charts allowed us to clearly track the **impact of the pandemic**, the sharp decline in 2020, and the **gradual recovery** through 2024. They made it easier to monitor how each year compared to pre-pandemic levels and where major changes occurred.

Donut Charts

Two donut charts were used to break down:

- **Ridership by transportation type** (e.g., Subway, Bus, Bridges & Tunnels)
- **Ridership by COVID phase** (Pre-Pandemic, During, and Post-Pandemic)

What we gained:
These visuals gave us a quick understanding of:

- Which transit modes carried the largest share of passengers (with the subway being the highest).
- How ridership was distributed across different pandemic periods — confirming that most usage occurred **before 2020**, with slower recovery afterwards.

Recommendations:

Based on the findings, here are some suggested recommendations:

1. **Targeted service optimization** during weekdays where rider volume is high, and cost-saving reductions on weekends and holidays.
2. **Invest more in subway infrastructure and service quality**, as it remains the most used mode.
3. **Use traffic data (bridges & tunnels)** as a proxy for shifts to personal car usage during crises, and explore integrating this insight into emergency transportation planning.
4. **Promote safety and public trust** in transportation services to accelerate post-pandemic recovery, especially for modes with slower rebound rates.