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MTA Daily Ridership

Strategic Insights & Dashboards with Power BI & Tableau

Advisor/Dr. Ahmed Abdellatif

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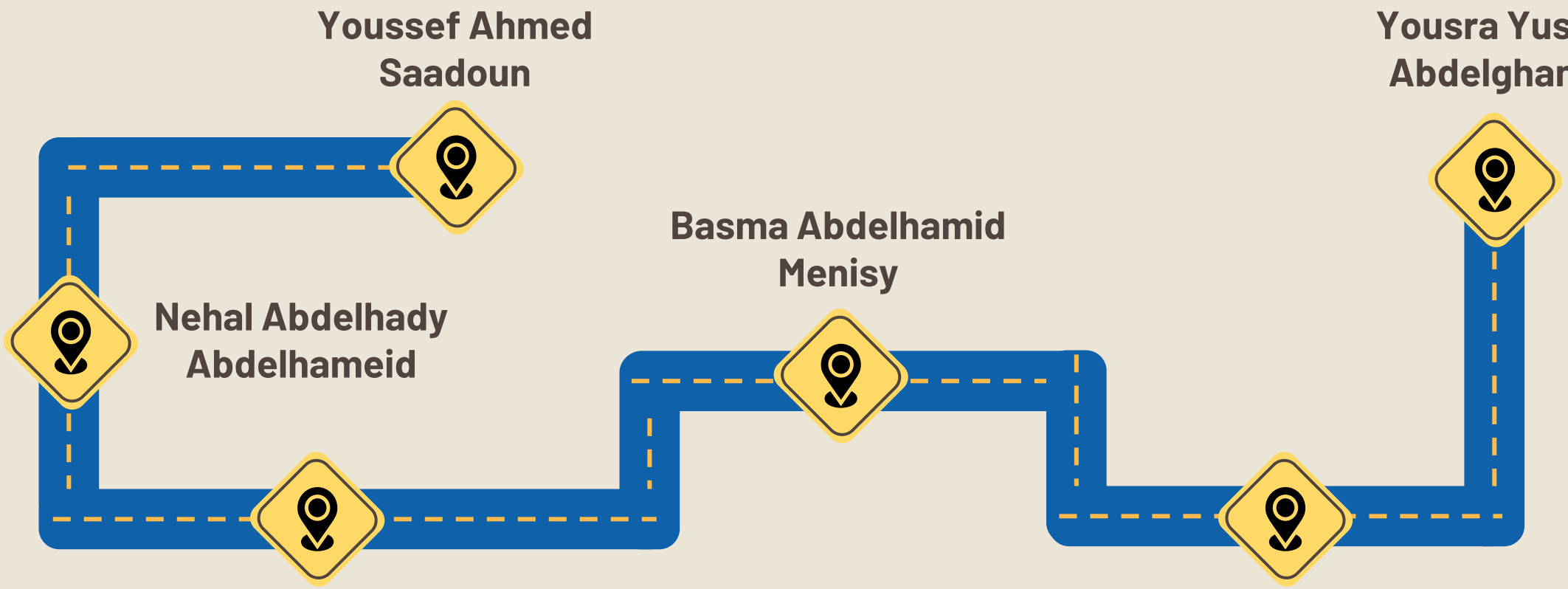
Pioneers Team Members



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01

Intoduction & Data Overview

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Introduction

The Metropolitan Transportation Authority (MTA) is the largest public transit agency in the U.S., operating subways, buses, and regional rail in New York City. The COVID-19 pandemic caused ridership to drop to below 10% of pre-pandemic levels, and even by 2022–2023, recovery reached only about 65–75%.

This decline created significant financial and operational challenges for the MTA.

Data Overview

The datasets are official ridership and performance statistics (from MTA Open Data): -

1- Subway Hourly Ridership: Entries by hour, station, and payment method; includes ridership counts and transfers.

2- Daily Ridership & Traffic Data: Systemwide totals for subways, buses, LIRR, Metro-North, Staten Island Railway, Access-A-Ride, and bridges & tunnels traffic counts.

3- Subway Terminal On-Time Performance (OTP): % of trains arriving on time at terminals, reported by line, division, and day type.

02

Objectives & Analysis Questions

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Objectives

- Assess ridership recovery since 2020.
- Compare weekday vs weekend shifts.
- Evaluate subway reliability (OTP).
- Track OMNY vs MetroCard adoption.
- Deliver insights & recommendations.

Analysis Questions

- What are the busiest & least busy stations?
- How does OMNY vs MetroCard usage vary?
- What are peak hours/days/months?
- How do transport modes differ in recovery?
- How did ridership differ pre- vs post-pandemic?
- Is there correlation between subway ridership & bridges/tunnels traffic?

03

Methodology: Data Preparation & Modeling

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Data Preparation & Modeling

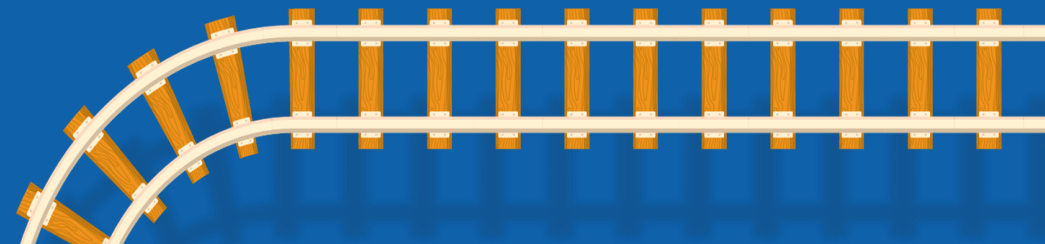
Tools: Power BI and Tableau were used for data loading, transformation, and visualization.

Data Cleaning:

- Separated date and time into distinct columns.

- Corrected station complex ID data type from number to text to fix a data format error.

- Added a Day Name column and a Day Type conditional column (Weekday vs. Weekend).

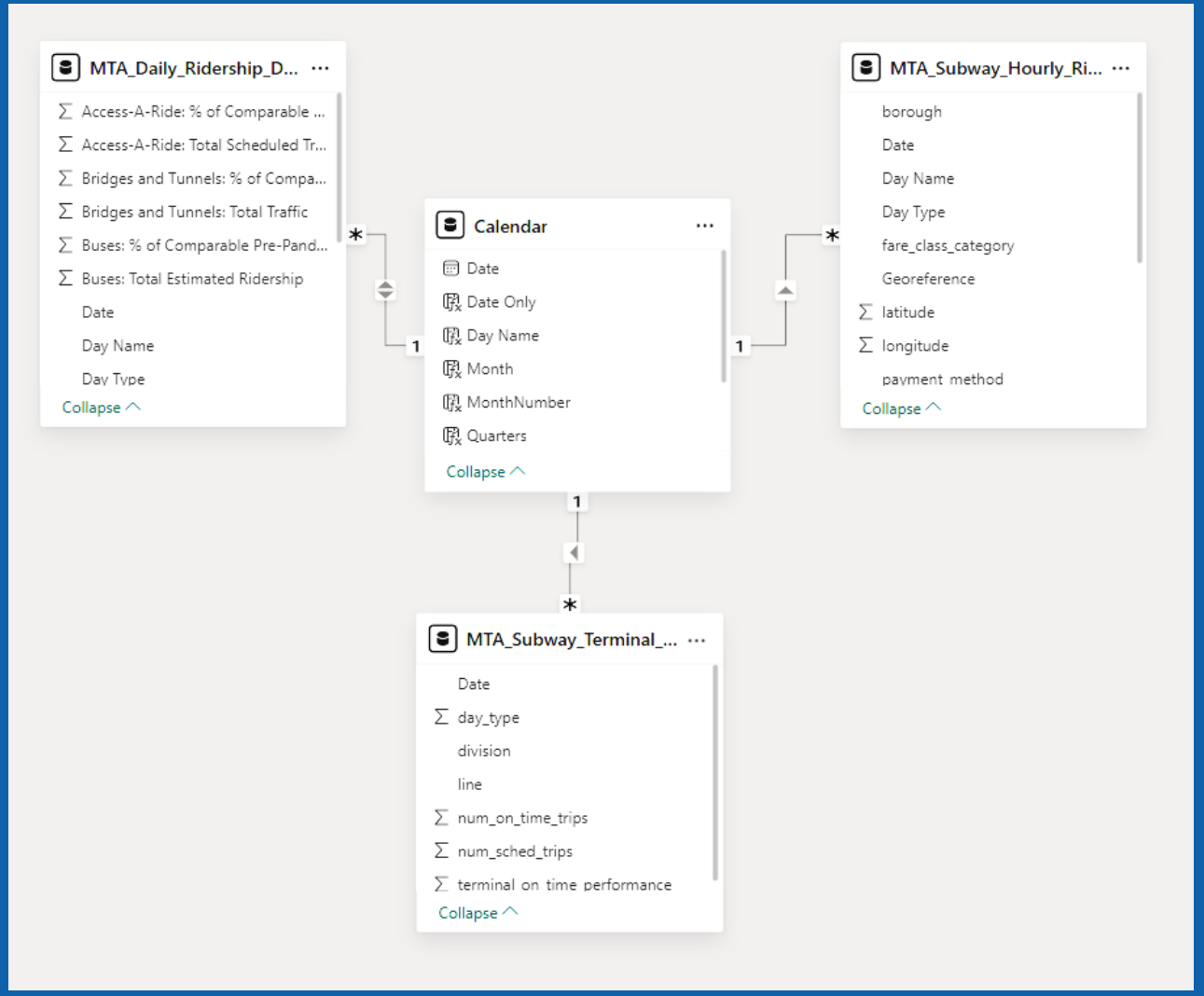


Data Preparation & Modeling

Data Modeling (Star Schema):

- Created a central Calendar Table to enable time-based analysis and link all datasets.

- Connected Daily Ridership, Subway Hourly Ridership, and Terminal On-Time Performance fact tables to the Calendar dimension.



04

DAX Measures & KPIs

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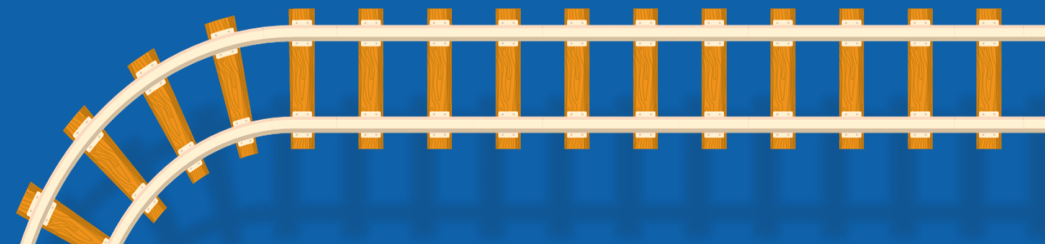
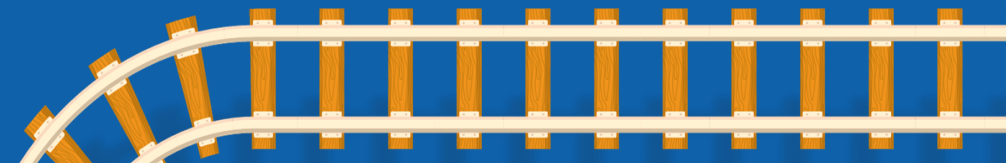
KPIs

- **Core Ridership KPIs:** Total ridership, transfers, average/max/min daily usage.
- **Time Intelligence:** MTD, YTD, last 7 days, last month, YoY growth.
- **Peak vs Off-Peak:** Rush-hour ridership, off-peak demand, % share of peak.
- **Station-Level:** Ridership and transfers by station, busiest stations, top 5.
- **On-Time Performance (OTP):** On-time rate, weekday vs weekend, correlation with ridership.
- **Pandemic Recovery:** % of pre-pandemic baseline, recovery index, dip days.
- **Payment Methods:** OMNY vs MetroCard, adoption trend, usage share



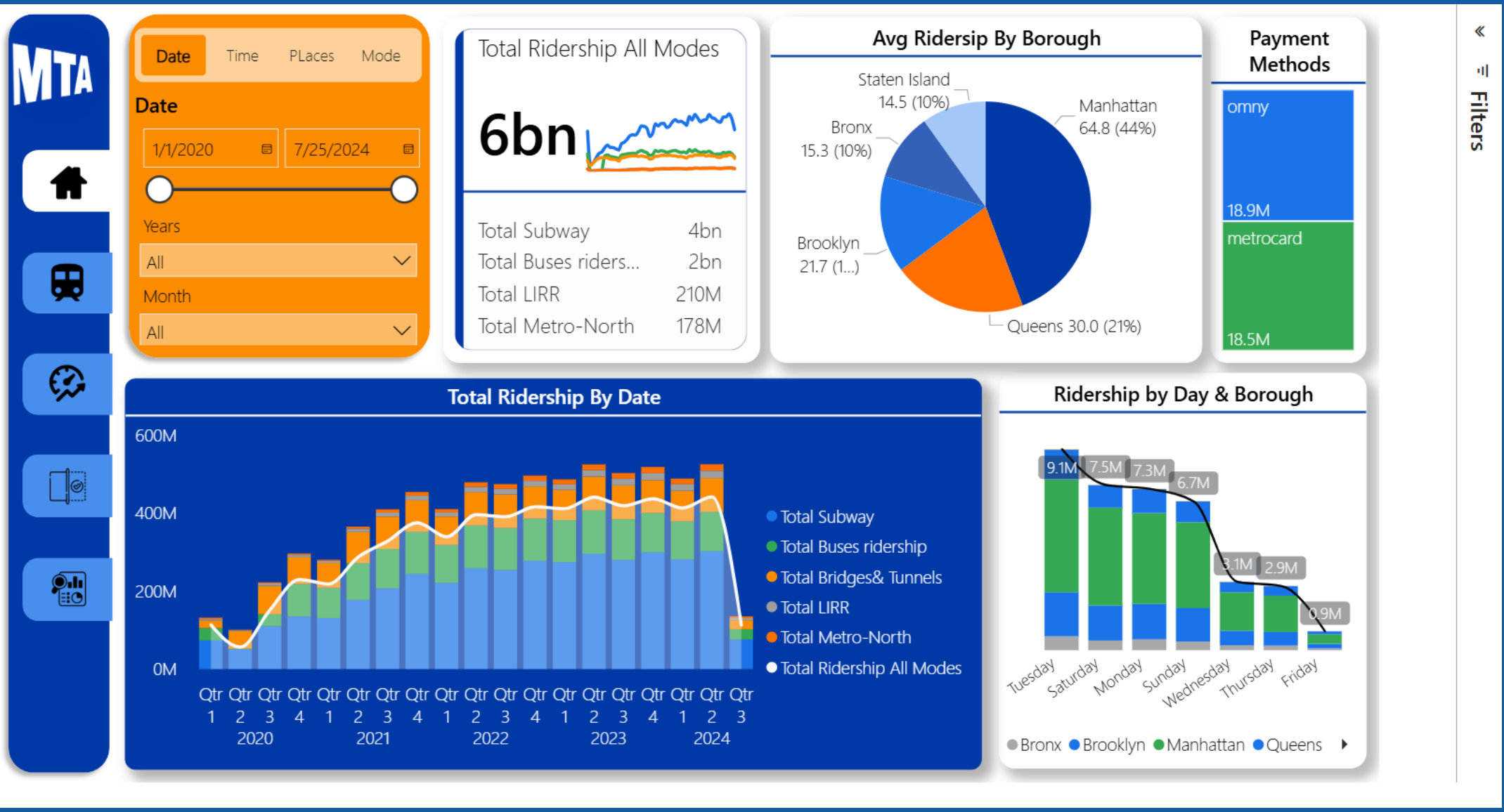
DAX Measures

Category	KPI	Formula (Short)
Core Ridership KPIs	Total Ridership	(SUM)
	Total Transfers	(SUM)
	Average Daily Ridership	(AVERAGEX)
Time Intelligence	Ridership YTD	(CALCULATE)
	Ridership YoY %	(VAR curr / VAR prev)
Peak vs Off-Peak	Peak Hour Ridership	(CALCULATE)
	Peak % of Total	(DIVIDE)
Station-Level	Top 5 Stations	(TOPN)
	Busiest Station % Share	(DIVIDE)
On-Time Performance	On-Time Rate	(DIVIDE)
	OTP Weekday vs Weekend	-
Pandemic Recovery	% of Pre-Pandemic	(AVERAGE)
	Ridership Recovery Index	(DIVIDE)
Payment Methods	OMNY Ridership	(CALCULATE)
	MetroCard Ridership	(CALCULATE)
	OMNY Share %	)DIVIDE.(

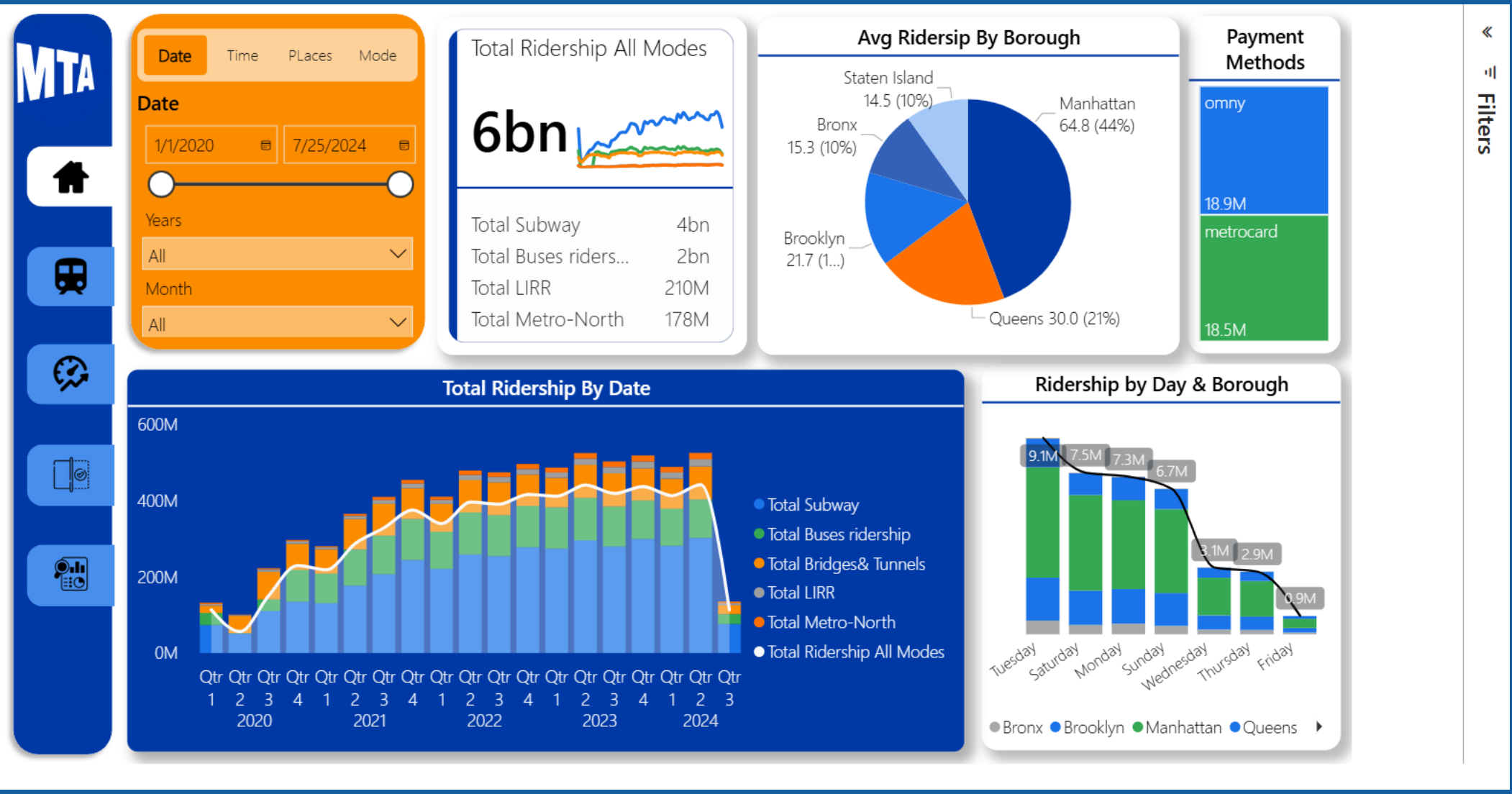


05

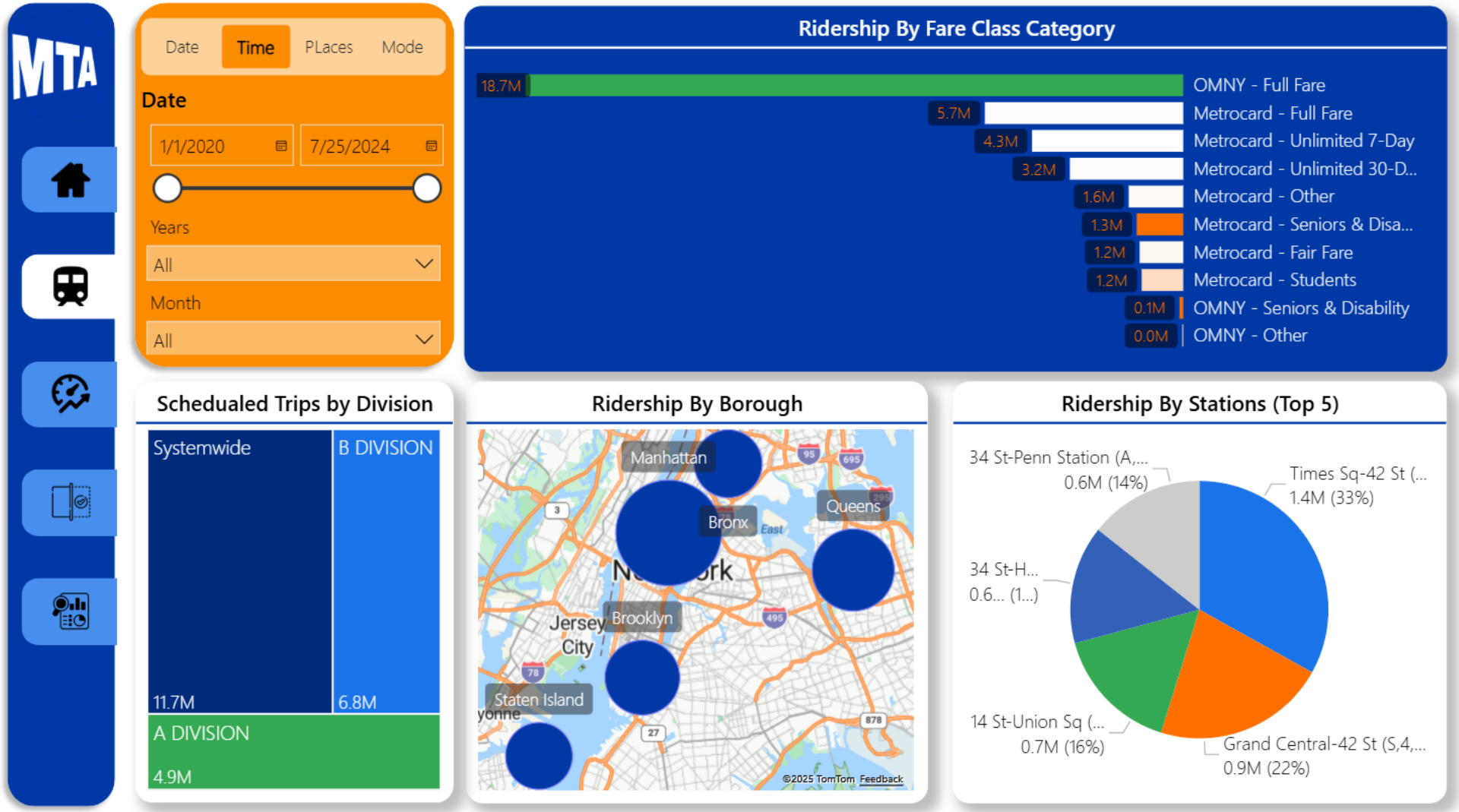
Key Insights & Visualizations



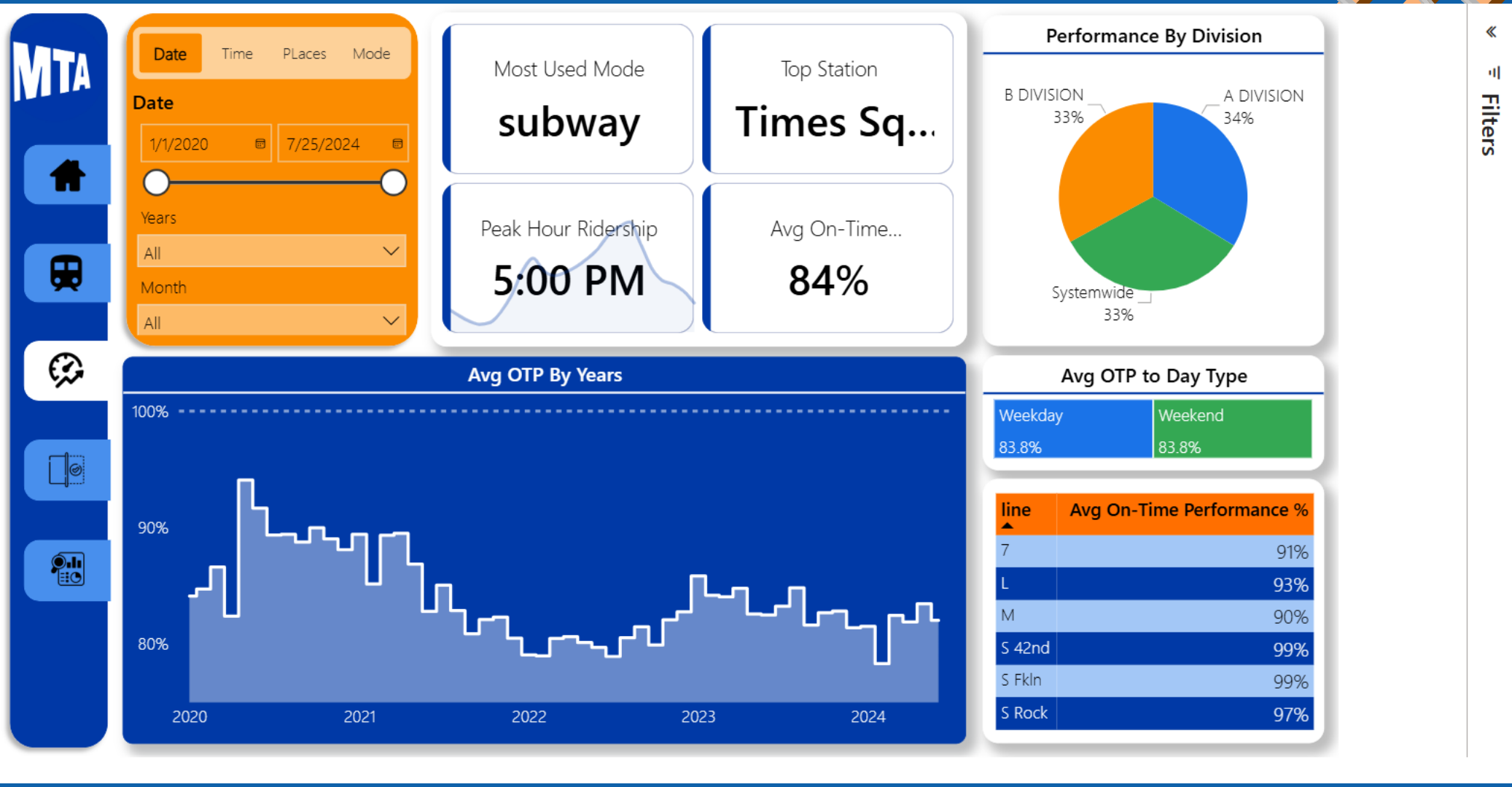
- Ridership: 6B riders across all modes → Subway & Buses account for majority.
- Ridership by Borough:
  Manhattan = 44% (largest share) , Queens = 20.5% , Brooklyn = 14.74%
- Payment Methods: OMNY (18.9M) ≈ MetroCard (18.5M) → strong OMNY adoption.



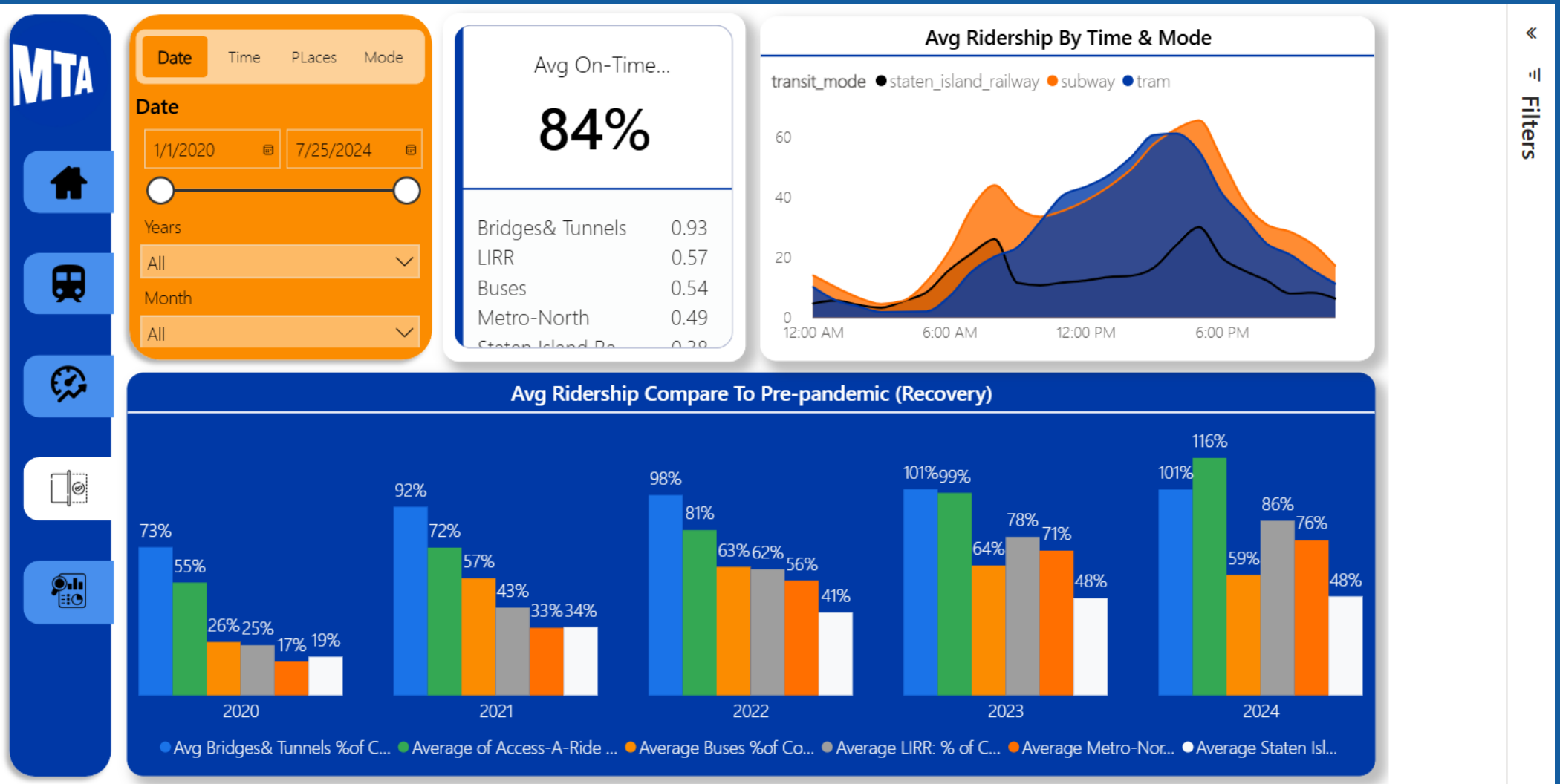
- Ridership by Date (2020–2024): Sharp drop in 2020 → gradual recovery, but still below pre-pandemic levels.
- Ridership by Day & Borough:
  Tuesday = highest ridership.
  Gradual decline through the week.
  Borough contributions vary (Manhattan leads).



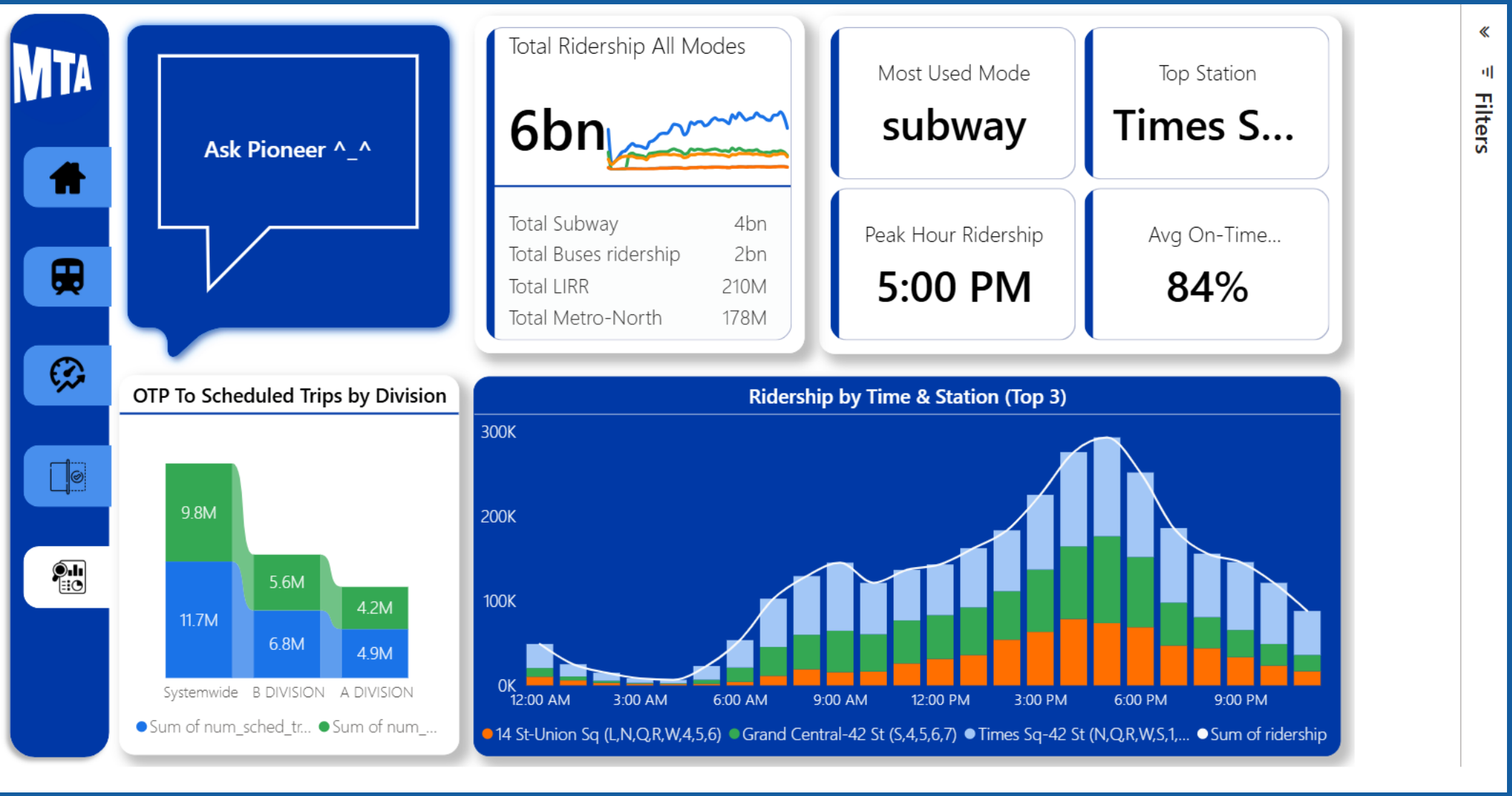
- Top categories: OMNY – Full Fare, MetroCard – Full Fare, MetroCard – Unlimited 7-Day.
- Scheduled Trips by Division: Systemwide = 11.7M scheduled trips , B Division second, followed by A Division.
- Map view: Highest concentration in Manhattan.
- Top 5 Stations (pie chart): Times Square = 33% (busiest hub).



- Most Used Mode = Subway
- Pear hour ridership = 5 PM / Top station = Times square.
- Overall Performance: Average OTP = 84%
- OTP by Year (2020–2024): Performance fluctuated but stayed in the 80–90% range.
- OTP by Day Type: Weekday vs Weekend = 83.8% each → reliability is consistent across the week.
- OTP by Line: Line 7 = strong at 91%.



- Bridges & Tunnels, LIRR, and Buses record the highest reliability.
- Ridership Recovery by Mode (2020–2024):Steady increase across all modes.
- LIRR & Bridges & Tunnels exceeded pre-pandemic levels by 2022–2023.
- Hourly Ridership by Mode: Subway = clear AM & PM peaks (commuter-driven).
- Tram & Staten Island Railway = flatter curves, less peak variation.

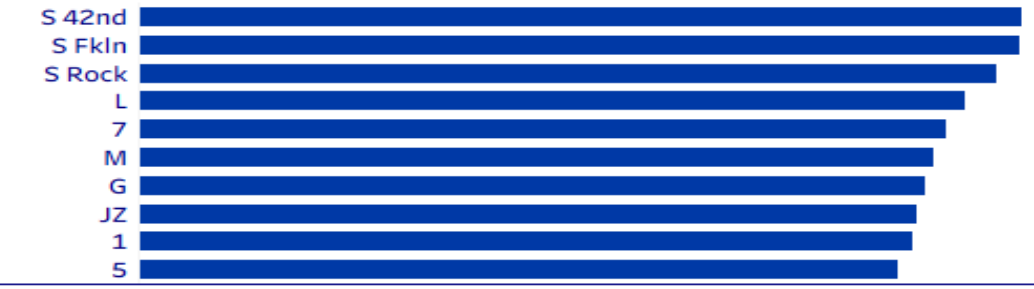


- Total Ridership: 6Bn riders across all modes → Subway = 4Bn (largest share).
- Most Used Mode & Top Station: Subway dominates usage; Times Square is the busiest station.
- Peak Hour: 5:00 PM → aligns with end-of-workday commute.
- On-Time Performance (OTP): Average punctuality = 84% → key reliability measure.
- Ridership by Time & Station: Clear late afternoon peaks, driven by Times Square & Grand Central.

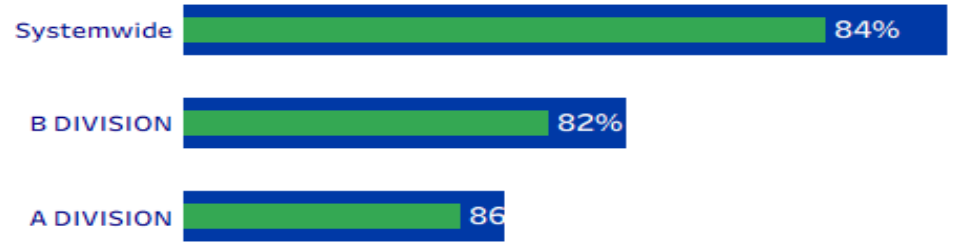
MTA Lines Dashboard

Total Lines	Top line OTP	Worst line OTP	Top Division OTP
24	S 42nd	2	A DIVISION

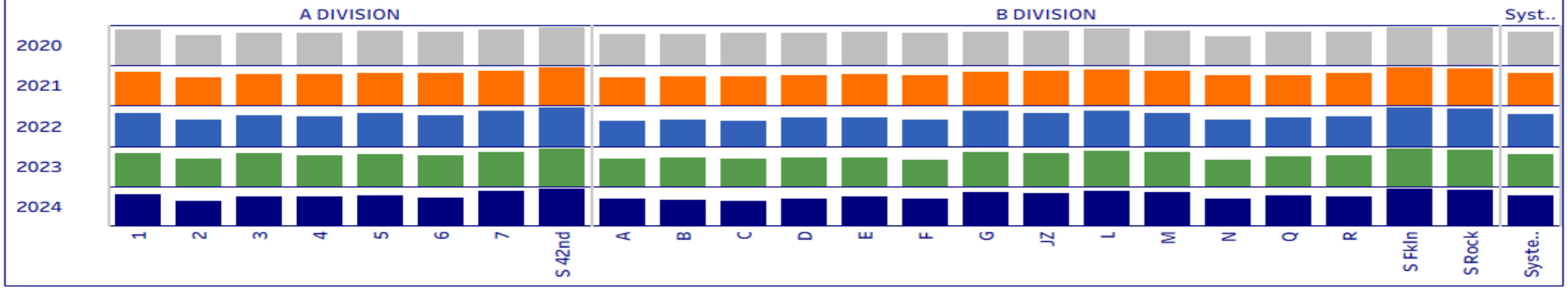
Top 10 lines performance



Divisions Performance



Division & Lines YOY

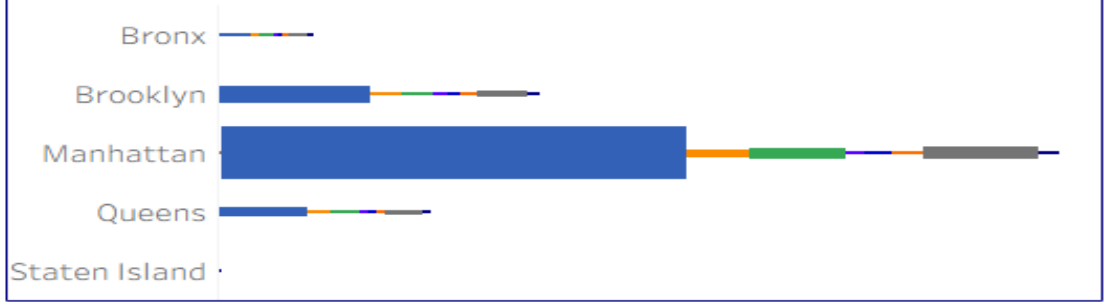


- Total Lines: 24
- Best Line: S 42nd Street Shuttle; Worst Line: OTP = 2% (check for data issue)
- Top Division: A Division (86% OTP); B Division = 82%; Systemwide = 84%
- Top Lines Driving OTP: S 42nd, S Franklin
- YOY Trend: Decline in 2020–2021; stabilization/improvement 2022–2024; system-wide pattern

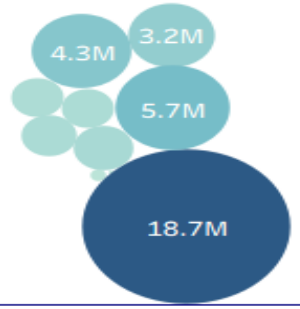
MTA Payment Dashboard

Most payment method	Most familiar fare category	Least used fare category
omny	OMNY - Full Fare	OMNY - Other

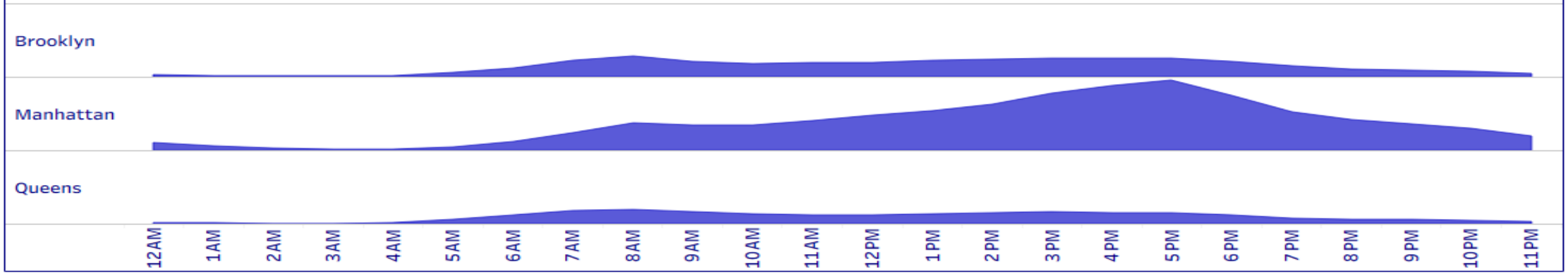
Fare class by borough



Fare class category riderships



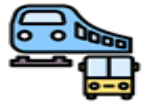
Subway riderships (Top 3 boroughs)



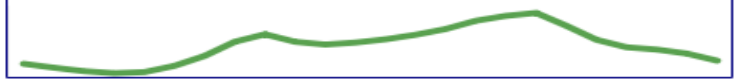
- Most Used Payment Method: OMNY
- Most Used Fare Category: OMNY – Full Fare; Least Used: OMNY – Other
- Ridership Concentration: Manhattan highest, then Brooklyn, Queens; Bronx & Staten Island lowest
- Ridership Peaks: Morning 7–9 AM (all boroughs), Evening 4–7 PM (Manhattan highest)Key
- Takeaway: OMNY dominates, ridership concentrated in Manhattan, evening peak strongest there

MTA Trips Dashboard



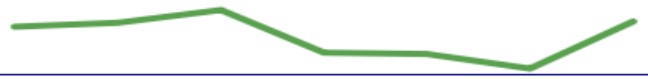



Peak hour(5 pm)

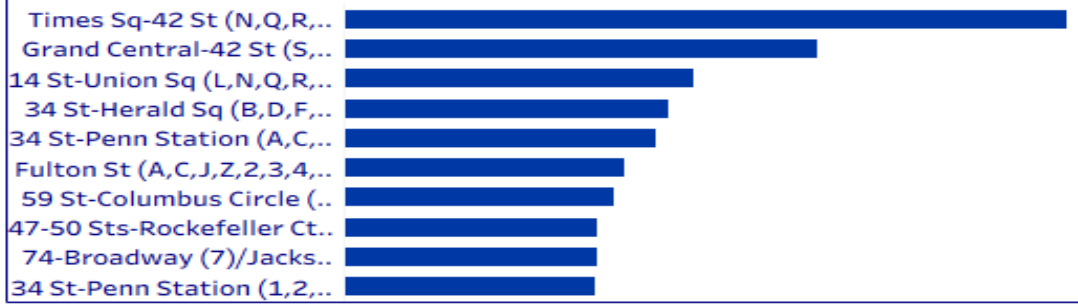


Total Riderships (6B)

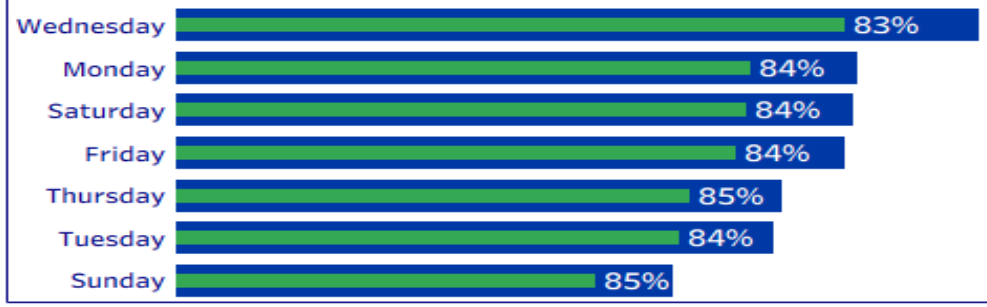
Peak Day(Tuesday)



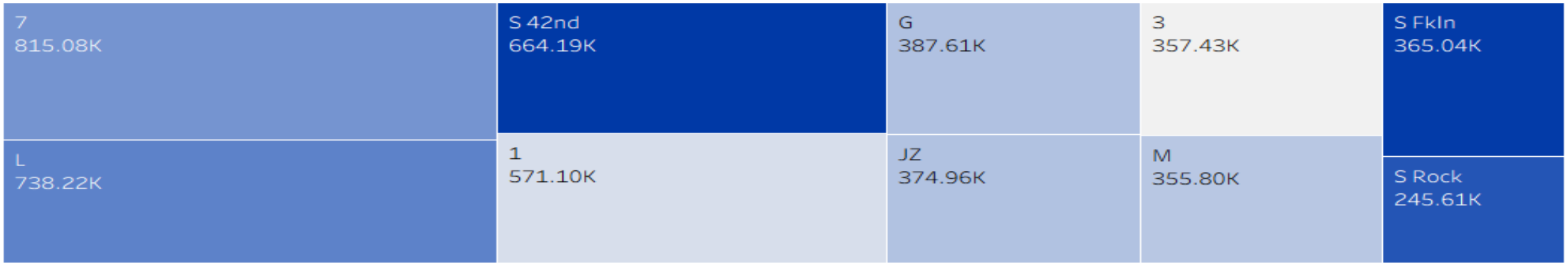
Top 10 station ridership



Days performance



Top 10 lines by trips



- Total Ridership: 6B trips → very high passenger volume
- Peak Activity: 5 PM, Peak Day: Tuesday → focus resources on this time/day
- Top Lines: S 42nd Shuttle (OTP), 7 Train (815.08K trips) → monitor performance vs. high volume
- Top Stations: Times Sq-42 St, Grand Central-42 St → key transfer hubs

06

SWOT Analysis, RCA & Recommendations

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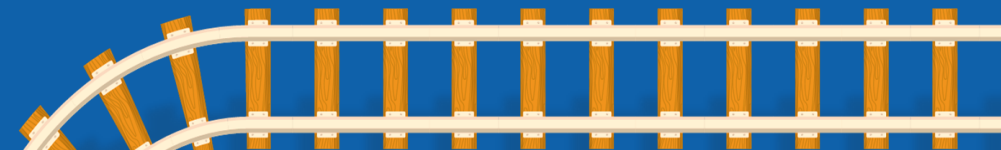
SWOT Analysis

SWOT Category	Points
Strengths	- High On-Time Performance (84%) → operational reliability - Subway as backbone: 4bn riders (65% in Manhattan) - Digital payment adoption (OMNY & MetroCard) → user convenience
Weaknesses	- Regional imbalance: Manhattan dominates; Staten Island & Bronx lag - LIRR & Metro-North low utilization despite high costs - Service variability: Buses & Staten Island OTP low (0.38–0.54 vs Bridges & Tunnels 0.93) - Peak-hour congestion stressing central infrastructure
Opportunities	- Target growth in outer boroughs (Brooklyn, Queens, Bronx, Staten Island) - Leverage data analytics for demand forecasting & resource optimization - Expand OMNY adoption; phase out MetroCard - Better integration of buses & rail with subway → grow multimodal ridership
Threats	- Economic downturns or fare hikes → lower ridership - Competition from ride-sharing services - Infrastructure strain from central Manhattan congestion - Service disruptions (maintenance, weather) → impact trust & usage - Post-COVID commuter shifts (remote work) → lower long-term demand

Root Cause Analysis (RCA)

Category	Problem	Root Causes	Key Recommendations
Uneven Recovery (Residential vs Manhattan)	Residential stations recovered faster (80–95%) than Manhattan (50–60%)	1. Essential trips resumed earlier 2. Outer borough jobs cannot be remote 3. Schools reopened4. Manhattan tourism collapse5. Socioeconomic differences	1. Reallocate service frequency 2. Enhance residential service 3. Restore Manhattan ridership 4. Real-time dashboards5. Long-term network redesign
Weekly Pattern Shift (Tue–Thu Peak, Fri Collapse)	Weekly ridership shifted: Pre-COVID Monday peak → Post-COVID Tue–Thu peak, Friday lowest	1. Hybrid work adoption 2. Corporate schedule changes 3. Lifestyle shifts 4. Structural employment change	1. Optimize Tue–Thu frequency 2. Reduce Friday off-peak 3. Enhance weekend service 4. Corporate incentives5. Public awareness campaigns



Recommendations

Operational

- Improve OTP for weaker modes (Staten Island Railway, Buses).
- Introduce dynamic scheduling to reduce peak-hour congestion.
- Promote LIRR & Metro-North through discounts and bundled tickets.

Strategic

- Invest in underserved boroughs with equity-focused planning.
- Apply data-driven planning to optimize seasonal and daily resources.
- Expand OMNY adoption

Customer Experience

- Enhance real-time updates through unified mobile app.
- Strengthen customer feedback channels to improve service quality.

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Questions & Answers

Thank YOU

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