BIKE STANDS ANALYSIS

1. Project Overview

- The **Bike Stands Analysis Project** focuses on monitoring and analyzing bike stand availability, utilization, and distribution across multiple countries, cities, and stations. The dashboard provides a **real-time and historical view** of bike infrastructure usage to support data-driven decisions for urban mobility planning, operational efficiency, and customer satisfaction.
- This project transforms raw bike-sharing data into **interactive insights** using Power BI, enabling stakeholders to identify demand patterns, capacity gaps, and performance variations across regions.

2. Project Objectives

- Analyze bike stand utilization vs availability
- Track bike availability trends over months
- Compare bike stands across countries and cities
- Identify top-performing and underperforming stations
- Support operational and infrastructure optimization
- Enable quick decision-making using interactive filters

3. Problem Statement

- Urban bike-sharing systems often face challenges such as:
- Uneven bike availability across stations
- Overutilized or underutilized bike stands
- Seasonal and monthly demand fluctuations
- Lack of visibility into station-wise performance
- **Business_Problem:**

  How can city planners and bike-sharing operators efficiently monitor bike stand usage and availability to reduce shortages, improve service reliability, and optimize bike redistribution?

4. Attribute (Column /Features) Details:

Attribute Name	Data Type	Description
Number	Numeric (Integer)	The station number
Country Code	String (Text)	The Code values of Country
Country	String (Text)	Name of the Country
Status Code	String (Text)	Code values of status
Status	String (Text)	Status condition of stands
Bike Stands	Numeric (Integer)	No of Bike Stands
Available Bike Stands	Numeric (Integer)	No of Available Bike Stands
Bike Available	Numeric (Integer)	No of Bikes Available in Stands.
Meridian Indicator	String (Text)	Describe the lines of the Earth
Position	String (Text)	It is used to find the salesperson comes under which team.
Name	String (Text)	It is used to find the Stationss name.

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5. Tools & Technologies

- **Power BI:** Data cleaning, transformation
- **Power BI:** Data modelling, DAX calculations, visualization, and interactive dashboard creation.

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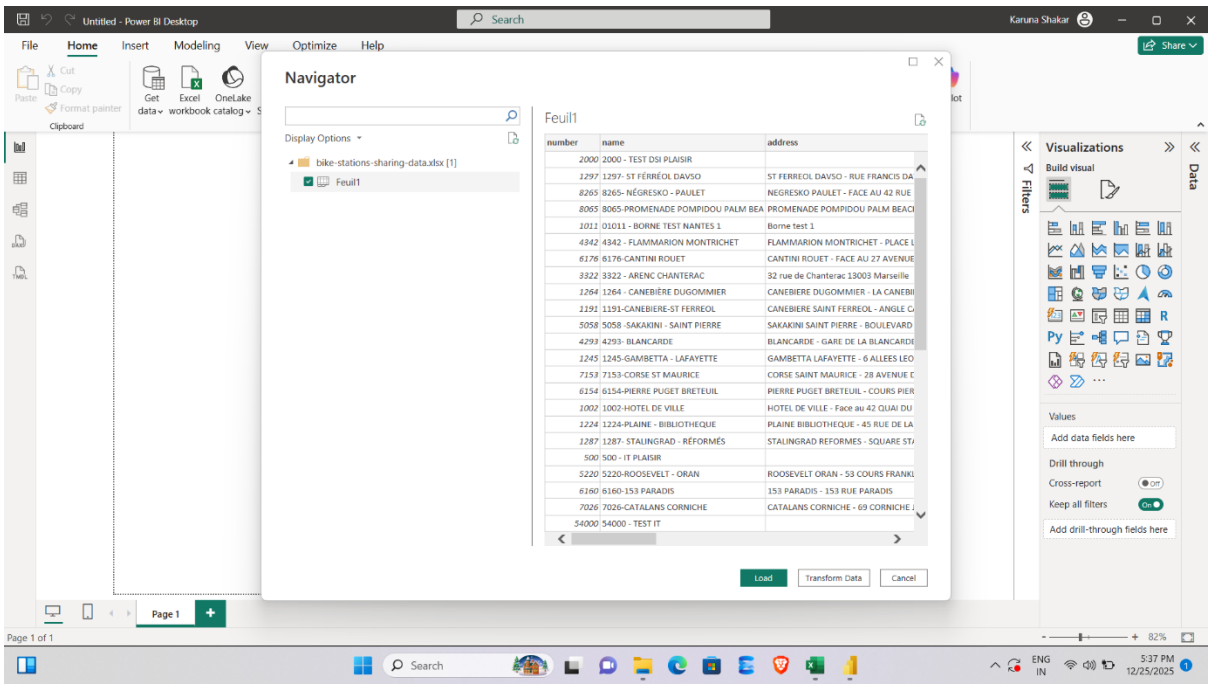
6. Data Pre-Processing & Understanding the data (Power BI / Power Query)

Tasks Performed:

- **Data Cleaning & Transformation:** Removed duplicates, handled missing values, standardized formats, and created calculated fields.
- **Filtering & Sorting:** Organized data to focus on relevant records.
- Convert the data into Fact and Dimension Table.

Power BI Environment

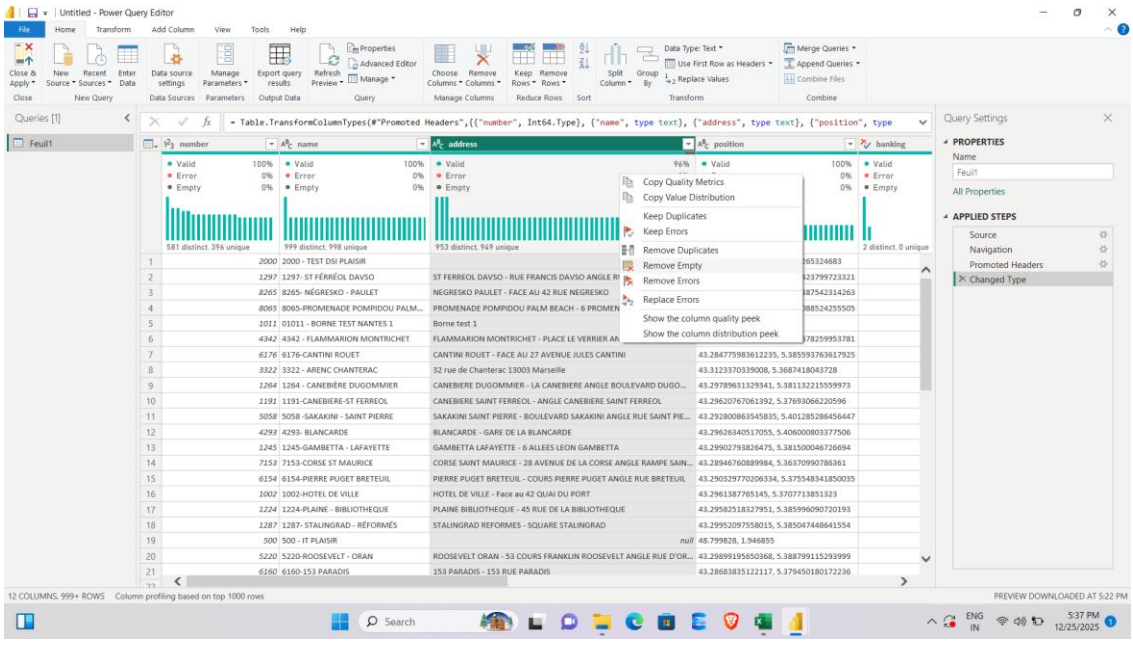
- Data Connection, Import, Interface Exploration In power BI



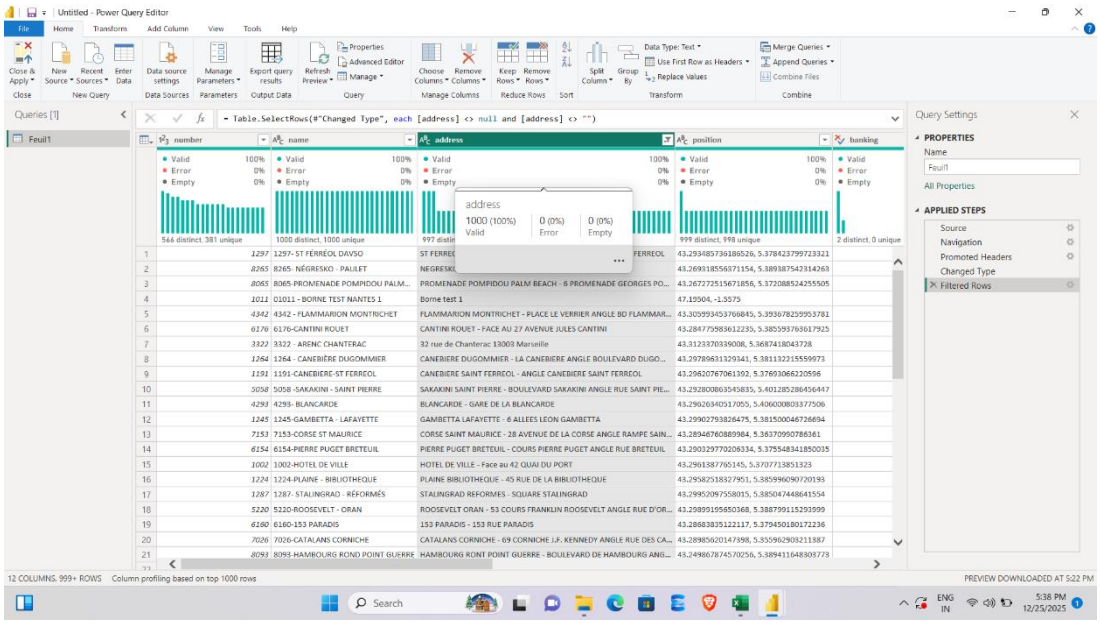
Data Cleaning & Transformation

Remove Duplicates, Handle Missing Data, Format & Transform Columns in Power Query

Removing Empty from the Column

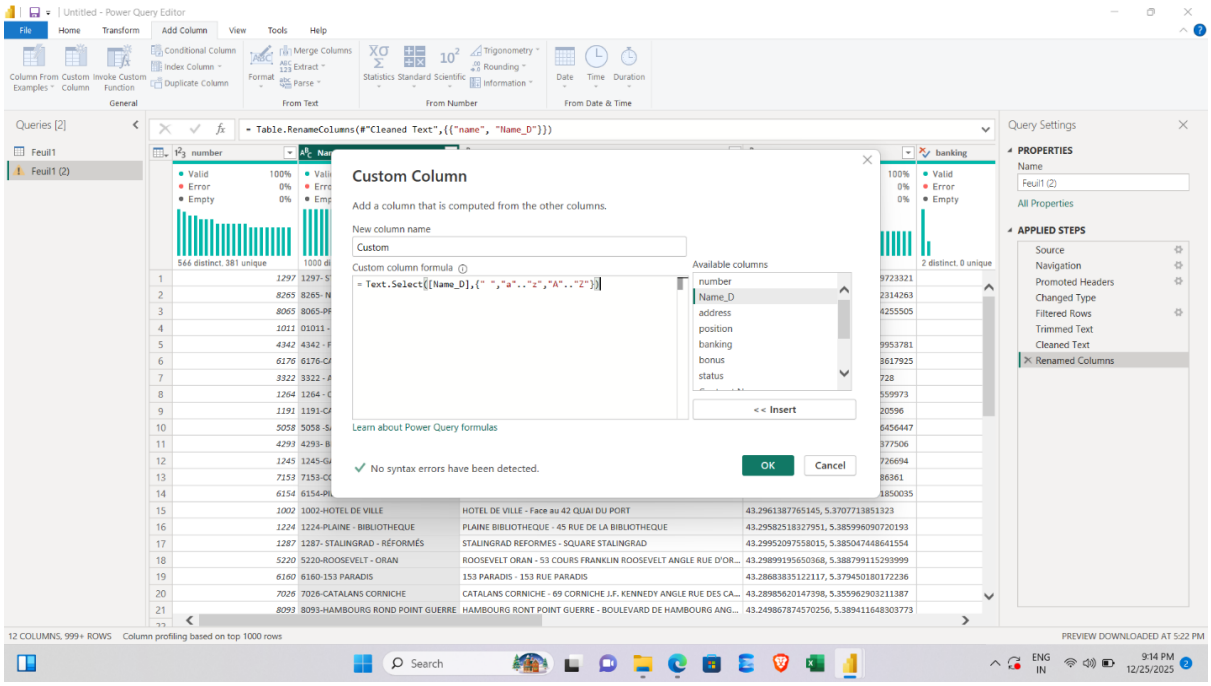


Check the Column Quality In the data

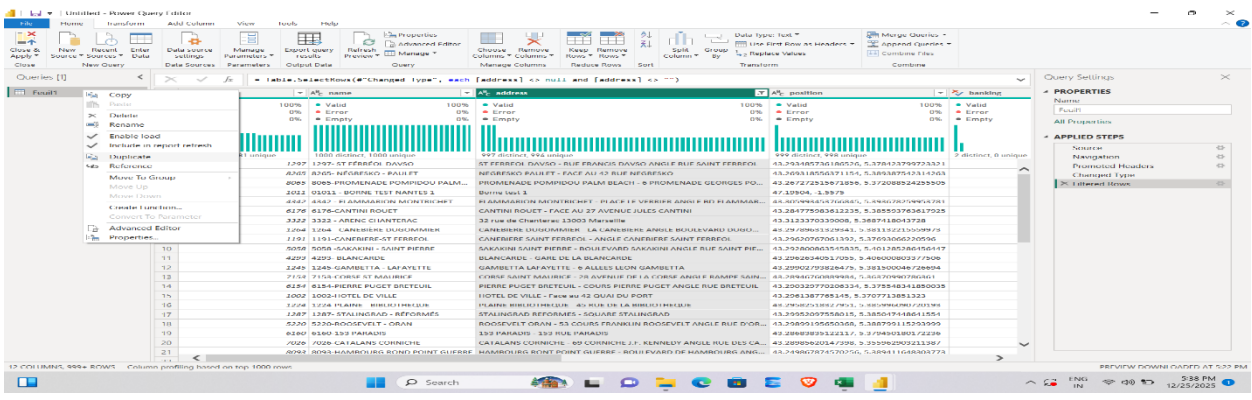


Using Custom Column to clean the name column by using

Text.Select([name], {“ “,”a”..”z”,”A”..”Z”}) for select only text values mention in formula



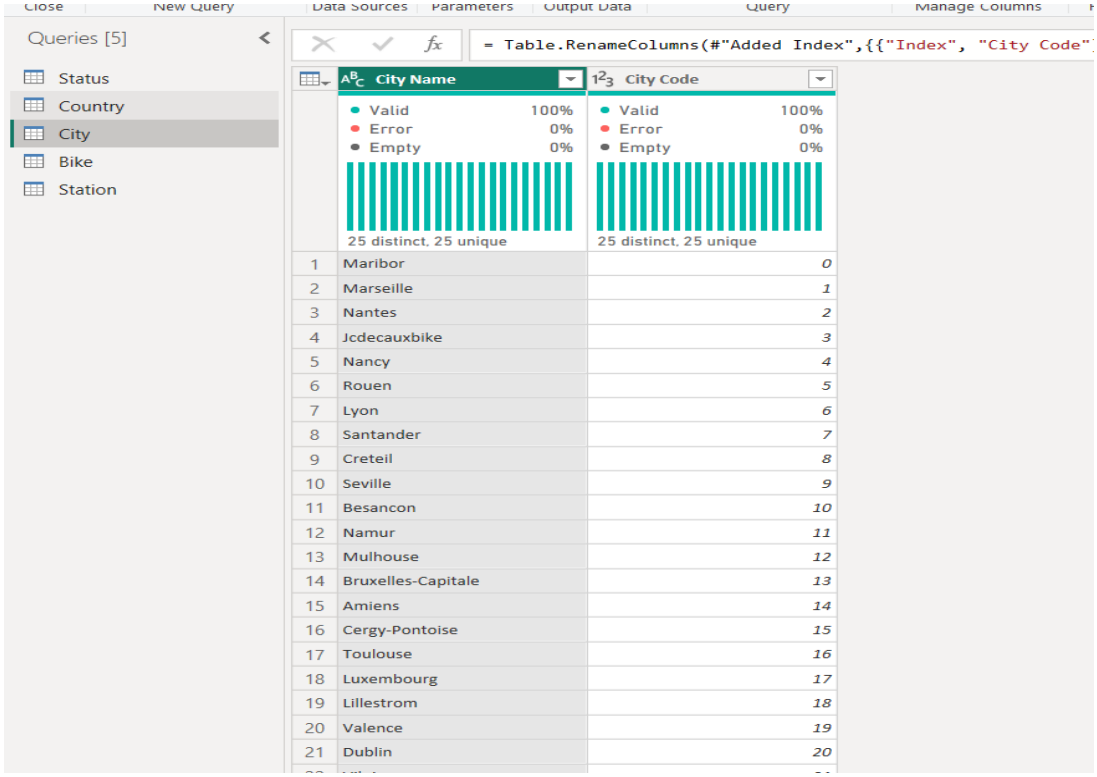
Duplicate the table to create a Dim table as much as possible



Created a Dim table As City then Specific the primary key to join with raw data

City Dim Table

Code Column Created after Removing Duplicate values from City column.

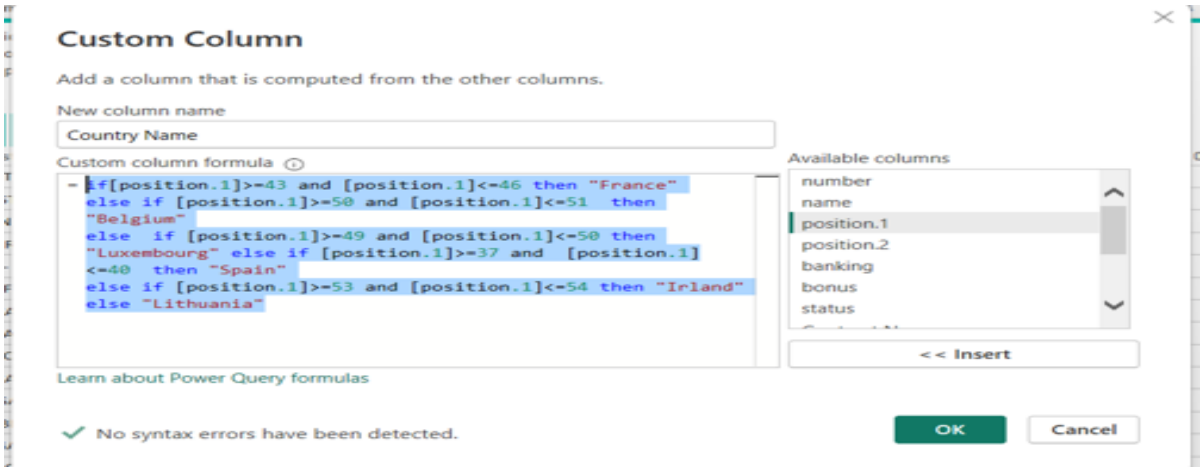


	City Name	City Code
1	Maribor	0
2	Marseille	1
3	Nantes	2
4	Jcdecauxbike	3
5	Nancy	4
6	Rouen	5
7	Lyon	6
8	Santander	7
9	Creteil	8
10	Seville	9
11	Besancon	10
12	Namur	11
13	Mulhouse	12
14	Bruxelles-Capitale	13
15	Amiens	14
16	Cergy-Pontoise	15
17	Toulouse	16
18	Luxembourg	17
19	Lillestrom	18
20	Valence	19
21	Dublin	20

Created a **Country** as Dim Table based on position column from Raw data.

Based on Latitude and Longitude values in position column find the location of data and created a Dim Table.

Latitude	Longitude	Country
46.548877	15.635027	Slovenia
43.293486	5.378424	France
47.195040	-1.557500	France
50.850346	4.351721	Belgium
52.520008	13.404954	Germany



Country_Name=if[position.1]>=43 and [position.1]<=46 then "France"

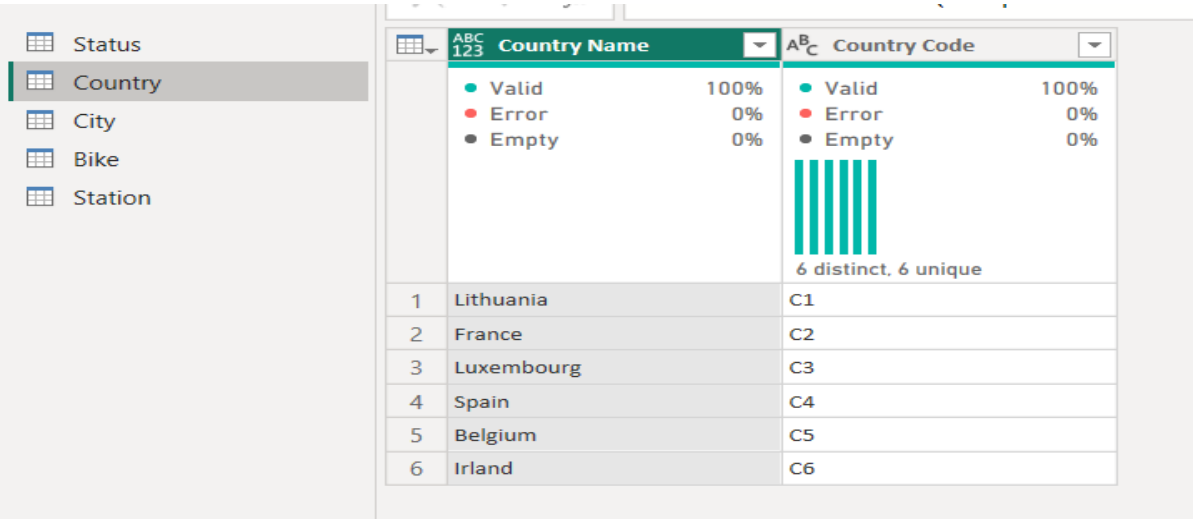
else if [position.1]>=50 and [position.1]<=51 then "Belgium"

else if [position.1]>=49 and [position.1]<=50 then "Luxembourg" else if [position.1]>=37 and [position.1]<=40 then "Spain"

else if [position.1]>=53 and [position.1]<=54 then "Irland"

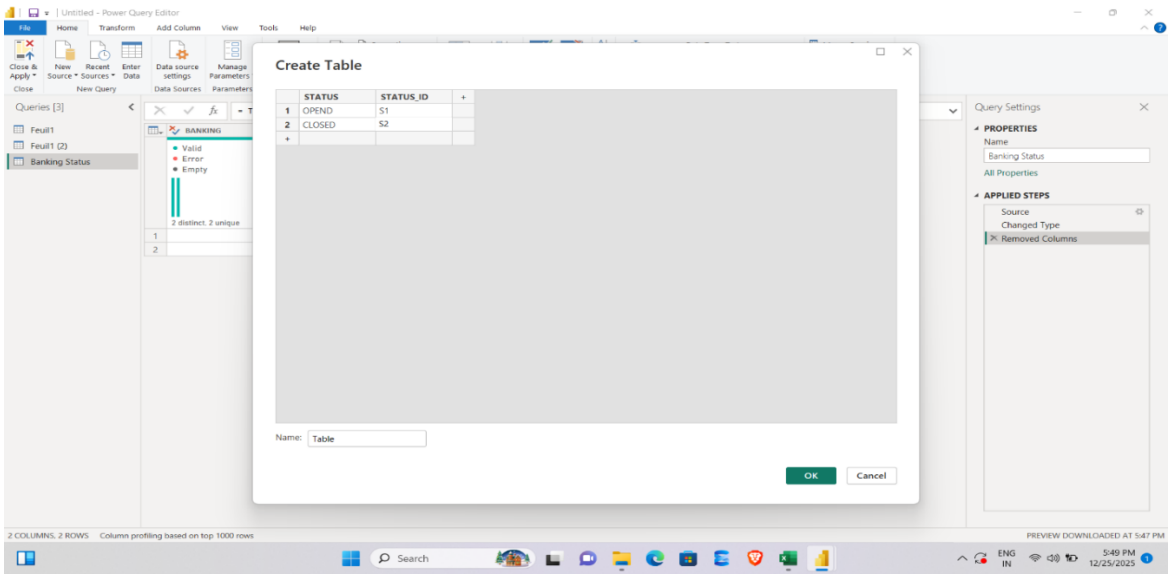
else "Lithuania") (Position.1 column as **Latitude)**

Country as Dim Table

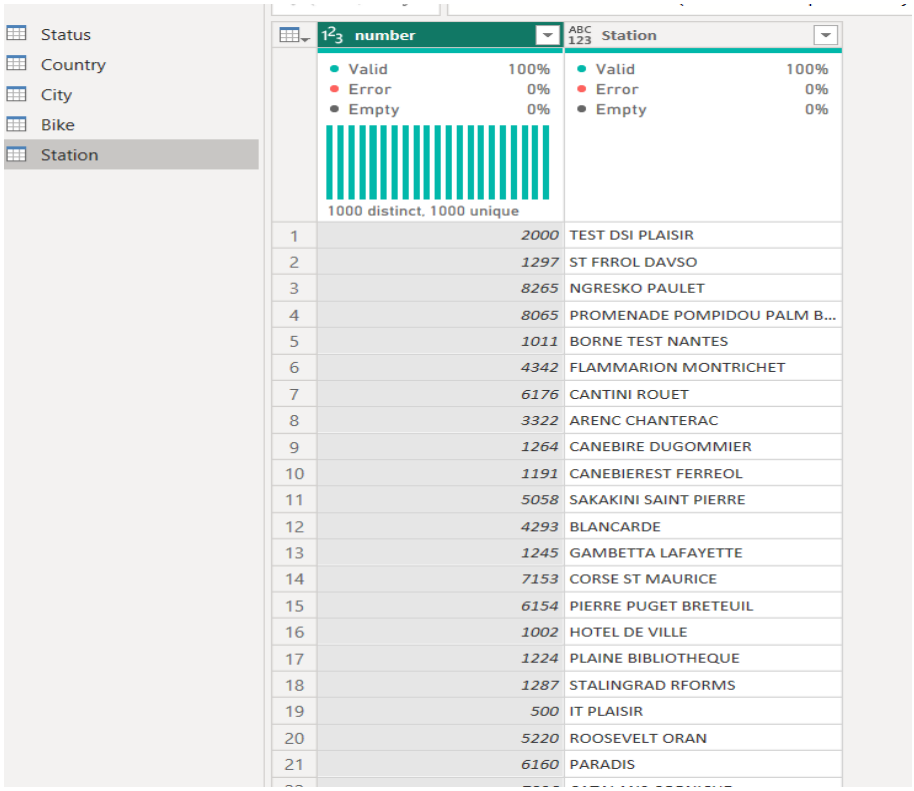


Created a Status as Dim Table based on Status column from Raw data.

By Using Enter Data in Manually.



Created a Station as Dim Table based on Name column from Raw data and join based on Number.



	number	Station
1	2000	TEST DSI PLAISIR
2	1297	ST FRROL DAVSO
3	8265	NGRESKO PAULET
4	8065	PROMENADE POMPIDOU PALM B...
5	1011	BORNE TEST NANTES
6	4342	FLAMMARION MONTRICHET
7	6176	CANTINI ROUET
8	3322	ARENC CHANTERAC
9	1264	CANEBIRE DUGOMMIER
10	1191	CANEBIEREST FERREOL
11	5058	SAKAKINI SAINT PIERRE
12	4293	BLANCARDE
13	1245	GAMBETTA LAFAYETTE
14	7153	CORSE ST MAURICE
15	6154	PIERRE PUGET BRETEUIL
16	1002	HOTEL DE VILLE
17	1224	PLAINE BIBLIOTHEQUE
18	1287	STALINGRAD RFORMS
19	500	IT PLAISIR
20	5220	ROOSEVELT ORAN
21	6160	PARADIS

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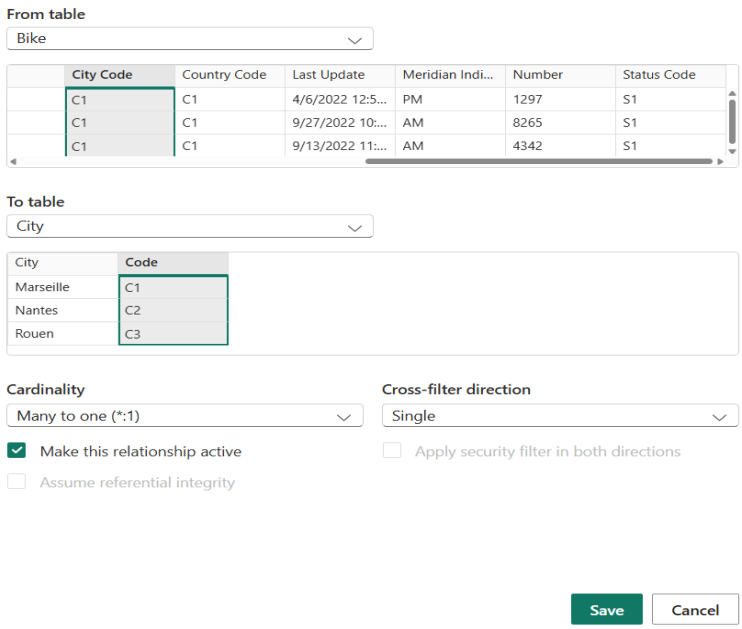
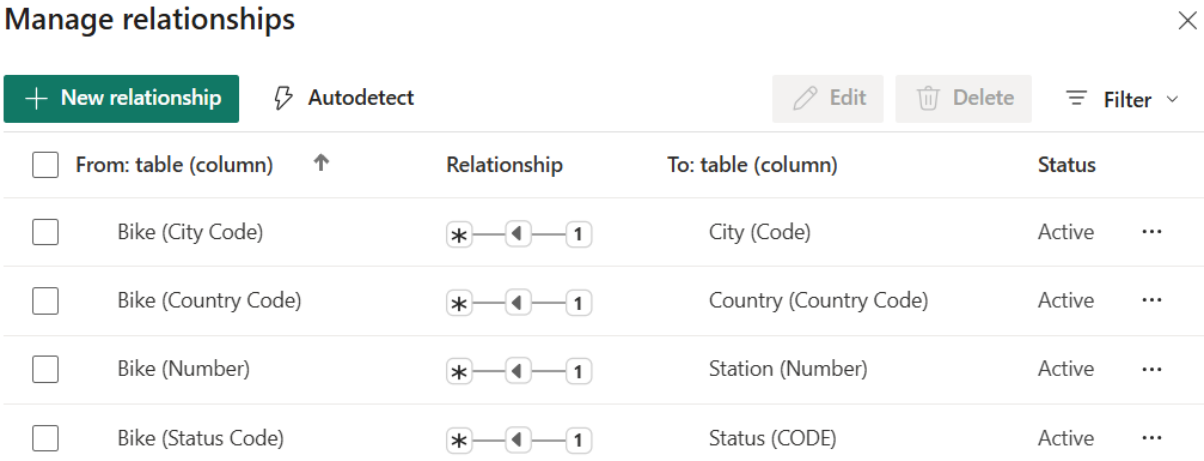
7. Data Modelling and DAX (Power BI)

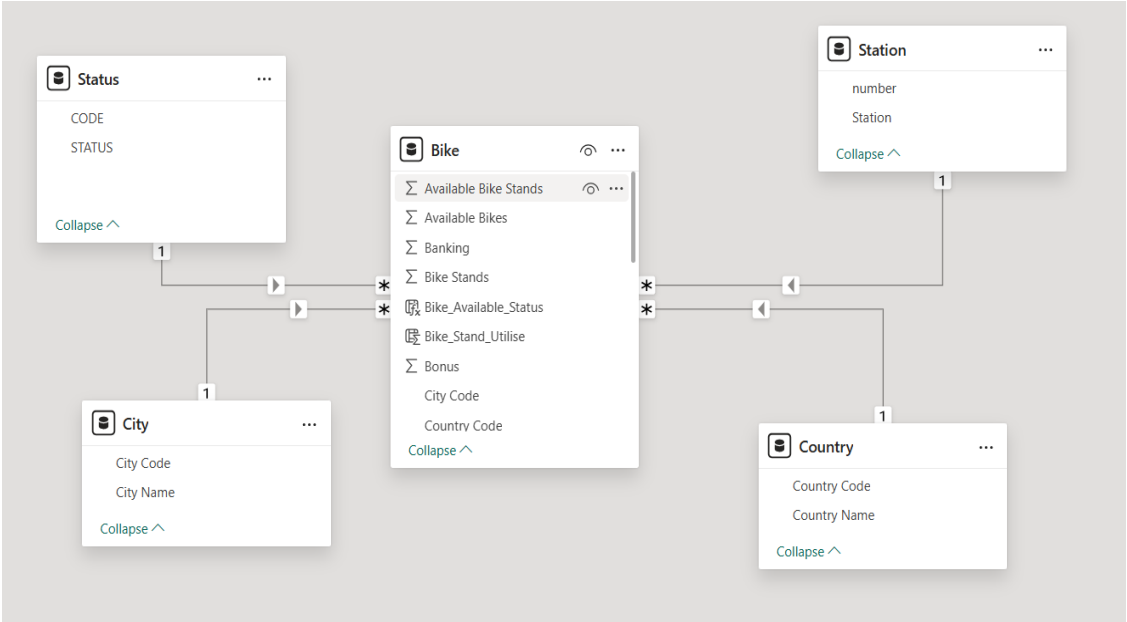
Data Modelling

- Fact: Bike
- Dimension Tables: City, Station, Country, Status
- Define Relationships: One to Many (1, *)





- **Data Model:** Established relationships between tables, defined cardinality it's come under Star schema.



DAX & Calculations

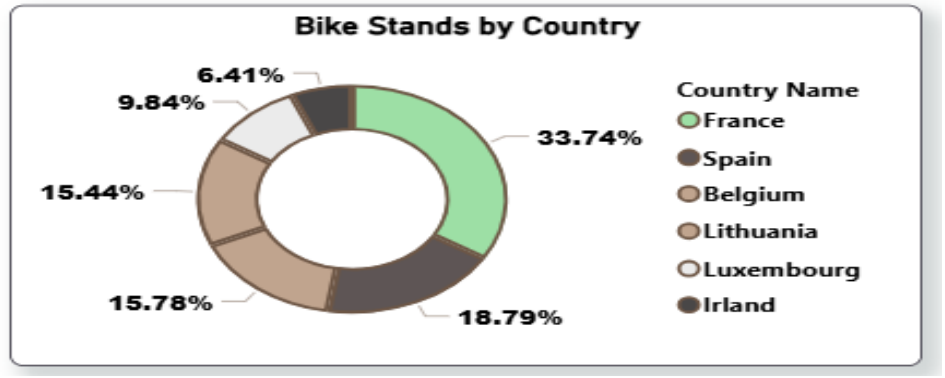
Calculated Columns:

- **Bike_Available_Status** = IF([Available Bikes]=0,"No Bike Available","Bike Available") to know the bikes available or not.
- **Bike Stand Utilize** = (Bike[Bike Stands] -Bike[Available Bike Stands]) for how much bike stand Utilize
- **Meridian Indicator** created a column using power query editor for finding the values in morning and night.

Measures:

- **Top5_Bike_Stands** = CALCULATE(SUM(Bike[Bike Stands]),FILTER(VALUES(City[City]),RANKX(all(City[City]),[Total_Bike_Stands_Bike],,DESC)<=5) For Finding the top 5 stands by city
- **Bottom5_Bike_Stands** = CALCULATE(SUM(Bike[Bike Stands]),FILTER(VALUES(City[City]),RANKX(all(City[City]),[Total_Bike_Stands_Bike],,ASC)<=5)) For Finding the bottom 5 stands by city
- **% of Bike Utilize** = sum(Bike[Bike Stand Utilize])/sum(Bike[Bike Stands]) For Finding how much bike stand utilize, after change the data format into percentage its show values in percentage
- **% Of Bike Stand Available** = sum(Bike[Available Bike Stands])/sum(Bike[Bike Stands]) For Finding how much bike stand available, after change the data format into percentage its show values in percentage
- **Bike_Count_Status** = COUNTA(Bike[Bike_Available_Status])
- **Available_Bike_Count** = CALCULATE(COUNTA(Bike[Bike_Available_Status]),Bike[Bike_Available_Status]="Bike Available")
- **No_Bike_Available_Count** = CALCULATE(COUNTA(Bike[Bike_Available_Status]),Bike[Bike_Available_Status]="No Bike Available")
- **% of Bike_Available** = [Available_Bike_Count]/[Bike_Count_Status] For Finding how % bike available, after change the data format into percentage its show values in percentage
- **% of No_Bike_Available** = [No_Bike_Available_Count]/[Bike_Count_Status] Finding how % No bike available, after change the data format into percentage its show values in percentage

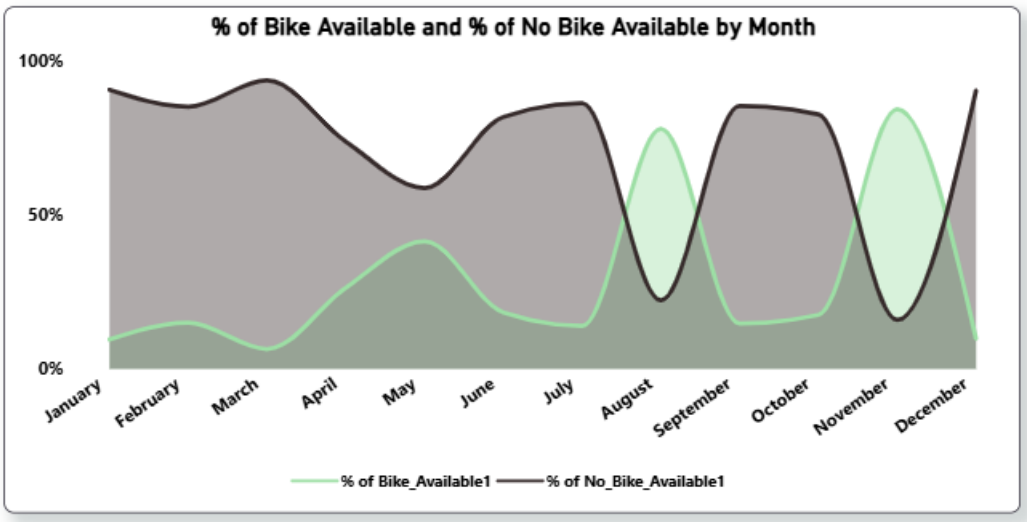
Data Visualization:



🔍 Key Insights – Bike Stands by Country

- **France** dominates bike infrastructure, contributing **33.74% of total bike stands.**
  → This indicates strong investment and mature cycling infrastructure.
- **Ireland ranks second with 18.79%,** showing significant availability despite its smaller geographic size.
  → Suggests efficient urban bike-sharing deployment.
- **Luxembourg (15.78%) and Lithuania (15.44%)** contribute almost equally.
  → These countries show balanced and consistent bike stand distribution.
- **Belgium accounts for 9.84%,** reflecting moderate adoption compared to peers.
  → Potential scope for expansion in bike infrastructure.
- **Spain has the lowest share at 6.41%.**
  → Indicates underdeveloped or emerging bike-stand infrastructure relative to other countries.

Monthly Bike Availability Trend



Key Insights

Strong inverse relationship:

When bike availability increases, no-bike availability decreases, and vice versa. This indicates efficient utilization tracking.

Highest bike availability occurs in:

- August
- November

These months show peak system readiness and better bike circulation.

Lowest bike availability is observed in:

- January–February
- July
- December

This suggests higher demand, maintenance downtime, or seasonal constraints.

No-bike availability peaks in:

- March
- June
- December

These periods may reflect increased usage, operational issues, or weather-driven demand spikes.

Seasonal Trends

- **Mid-year volatility (June–August):**
  Sharp fluctuations indicate operational stress, possibly due to tourism, weather, or increased commuter usage.
- **Year-end pressure (December):**
  High no-bike availability suggests demand outpacing supply or reduced operational capacity.

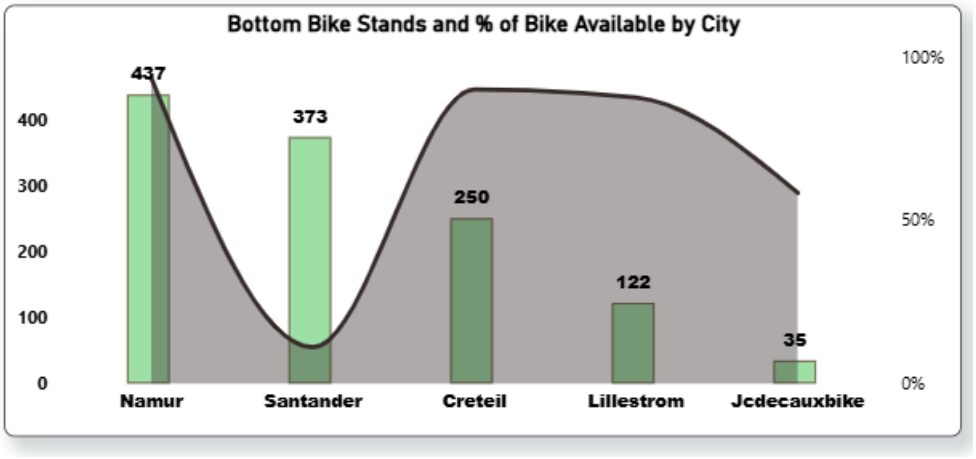
Operational Insights

Predictable seasonal demand patterns exist, enabling better planning.

Preventive maintenance and bike redistribution should be prioritized before:

- Summer peak (June–July)
- Year-end surge (November–December)

Bottom Bike Stands and % of Bike Available by City



Namur

- Has the highest number of bike stands (437) among the bottom-performing cities.
- Despite higher capacity, bike availability % is low, indicating high demand or poor redistribution.

Santander

- 373 bike stands, but shows the lowest bike availability percentage.
- Suggests frequent stock-outs, possibly due to demand peaks or operational inefficiencies.

Creteil

- Moderate bike stands (250) with the highest bike availability % among the listed cities.
- Indicates efficient bike circulation and station balancing.

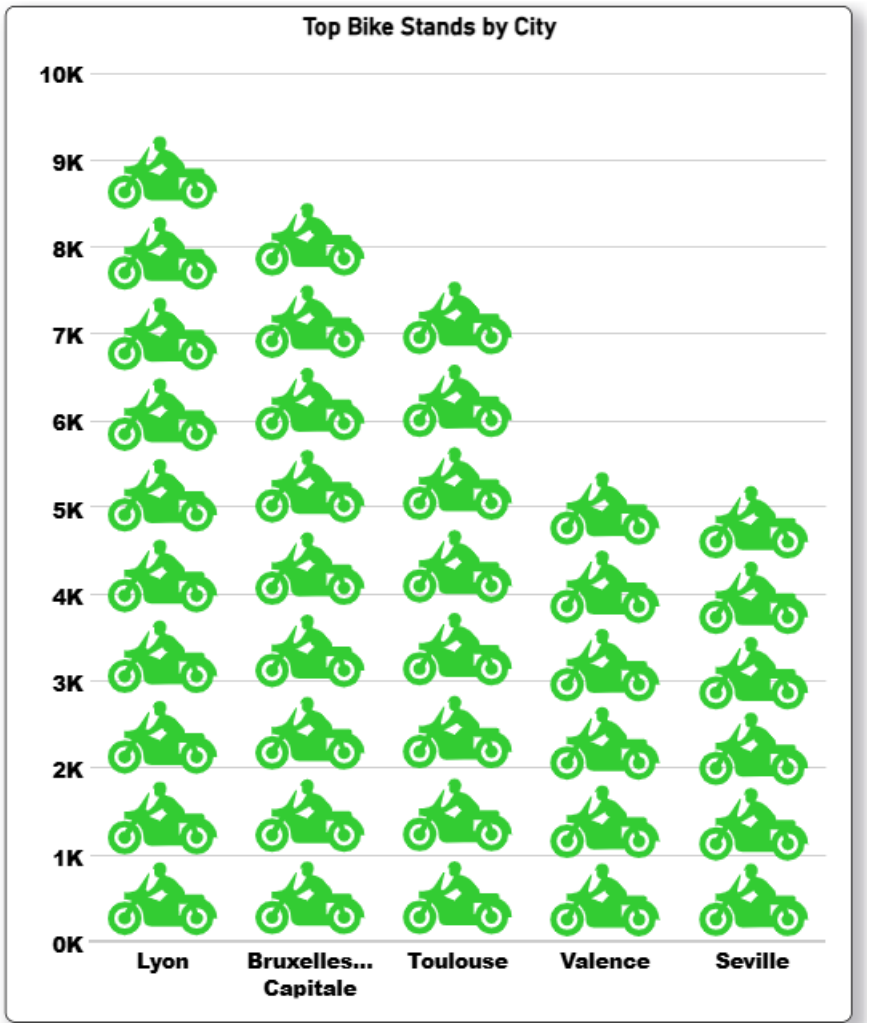
Lillestrom

- Lower stand count (122) with declining availability.
- Risk of undersupply, especially during peak usage hours.

Jcdceauxbike

- Very low infrastructure (35 bike stands).
- Availability remains limited, showing capacity constraints rather than demand issues.

Top Bike Stand Cities



Lyon leads significantly in bike stand availability, reaching close to **9,000+ stands.**

- Indicates a highly developed bike-sharing ecosystem and strong commuter adoption.

Brussels Capital ranks second, with bike stands concentrated **around 8,000+.**

- Reflects strong policy support for sustainable urban mobility.

Toulouse holds the third position (~7,000+ stands).

- Shows consistent investment, though still trailing top cities.

Valence and Seville have moderate bike stand counts **(around 4,000–5,000).**

- Bike infrastructure is present but less extensive compared to leading cities

2. Toulouse and Lyon form the second tier

- Both cities range between **6K–7K bike stands**
- Reflects **well-developed but balanced systems**
- Capacity appears aligned with urban population and commuting needs

3. Valence and Seville show moderate availability

- Around **4K–5K bike stands**
- Adequate coverage but with **limited buffer during peak hours**
- May face shortages during seasonal or event-based demand spikes

4. Clear infrastructure hierarchy across cities

- Visible step-down pattern from Brussels → Toulouse/Lyon → Valence/Seville
- Highlights **planned prioritization** of bike infrastructure by city size and demand

. Station-level Observations

Station-wise Bike Stand Availability, Utilization, and Bike Availability

Station	% Available	% Utilize	% of Bike	% of No_Bike
AOT	80.00%	20.00%	100.00%	
AOT PRESSENS	52.63%	47.37%	100.00%	
AOUT RACINE	93.33%	6.67%		100.00%
BORNE CGB ATELIER	93.02%	6.98%	50.00%	50.00%
GLOIRE STBERTRAND	72.73%	27.27%	50.00%	50.00%
HARDT	50.00%	50.00%	78.57%	21.43%
NOVEMBRE	2.86%	97.14%	100.00%	
NOVEMBRE GASTON BERGER	0.00%	100.00%	100.00%	
NOVEMBRE NGOGOUSSES	58.90%	41.10%	100.00%	
PERRACHE PETIT	0.00%	100.00%	100.00%	
ALBERT THOMAS VILLON	5.00%	95.00%	100.00%	
ALBI NICOL	64.00%	36.00%	100.00%	
ALBIGNY GARE	16.67%	83.33%	100.00%	
ALBRIC PONT	93.75%	6.25%		100.00%
ALLEE DE LEUROPE	41.67%	58.33%	100.00%	
ALSACE ANATOLE FRANCE	95.00%	5.00%		100.00%
AMBROISE PAR	50.00%	50.00%	100.00%	
ANATOLE FRANCE	90.00%	10.00%	100.00%	
ANATOLE FRANCE BARBUSSE	0.00%	100.00%		100.00%
ANATOLE FRANCE ZOLA	76.92%	23.08%	100.00%	
ANDREI SAKHAROV	83.33%	16.67%	100.00%	
ARAUCARIA	2.63%	97.37%	50.00%	50.00%
ARENC CHANTERAC	65.00%	35.00%	100.00%	
ARISTIDE BRIAND	37.84%	62.16%	100.00%	
ATELIER VLOV	33.33%	66.67%	100.00%	
ATLANTA VASSEUR	57.14%	42.86%	100.00%	
ATOMIUM	83.72%	16.28%	100.00%	
Total	**56.15%**	**43.85%**	**75.32%**	**24.68%**

Overall Summary

- **Stand Availability of Stations: 56.15%**
- **Stand Utilization of Stations: 43.85%**
- **Bike Availability of Stations: 75.32%**
- **No-Bike Rate of Stations: 24.68%**

Overall system performance is **moderate**, but **1 in 4 stations still face bike unavailability**.

Key Station-Level Insights

- **High Performing Stations**

Stations with **high availability & low utilization** (well-balanced supply):

- **AOT** – 80% available, 100% bike availability
- **ANATOLE FRANCE** – 90% available, 100% bike availability
- **ANDREI SAKHAROV** – 83.33% available
- **ATRIUM** – 83.72% available

These stations show **good redistribution and sufficient capacity**.

Overutilized / Critical Stations

Stations with **very high utilization and low availability** (risk of stock-outs):

- **NOVEMBRE** – 97.14% utilized, only 2.86% availability
- **NOVEMBRE GASTON BERGER** – 100% utilization, 0% availability
- **PERRACHE PETIT** – 100% utilization, 0% availability
- **ANATOLE FRANCE BARBUSSE** – 100% utilization

These stations are **severely undersupplied** and require **urgent bike redistribution**.

Balanced but At-Risk Stations

Stations with **near 50–60% availability and utilization**:

- **HARDI** – 50% / 50%
- **AMBROISE PAR** – 50% / 50%
- **ATLANTA VASSEUR** – 57.14% / 42.86%

Small demand increases could **push these stations into shortages**.

Stations with High No-Bike Percentage

Stations showing **100% No-Bike availability** at times:

- **AOUT RACINE**
- **ALSACE ANATOLE FRANCE**
- **ABRIC PONT**

Indicates **complete bike depletion periods**, impacting user satisfaction.

Key Patterns Observed

- **High utilization directly correlates with low availability**, confirming demand-driven shortages.
- Several stations show **100% bike availability but poor stand availability**, indicating **bike parking constraints**.
- Infrastructure alone is insufficient—**dynamic bike redistribution is critical**.

Actionable Recommendations

- 🚲 **Increase bike redistribution frequency** at overutilized stations.
- 📍 **Add temporary bike docks** at consistently full stations.
- 📊 Use **predictive demand modeling** for peak hours and high-risk stations.
- 🏆 Replicate best practices from **AOT & ANATOLE FRANCE** stations.

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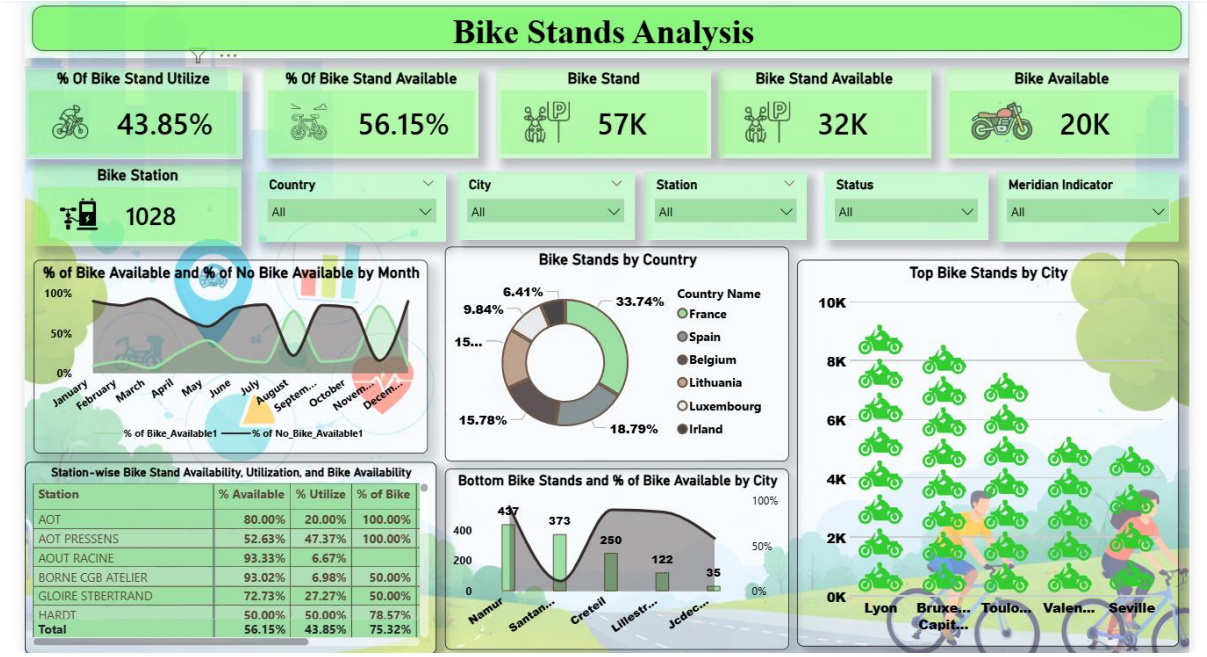

BIKE STANDS ANALYSIS

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1. Descriptive Analysis

- **Total Bike Stands: 57,000**
- **Available Bike Stands: 32,000**
- **Bikes Available: 20,000**
- **Total Bike Stations: 1,028**
- **Bike Stand Utilization: 43.85%**
- **Bike Stand Availability: 56.15%**

Descriptive Highlights

- More than half of bike stands are available, indicating sufficient infrastructure.
- France leads bike stand distribution (33.74%), followed by Ireland (18.79%).
- Top cities such as Lyon, Brussels Capital, and Toulouse dominate bike stand capacity.
- Monthly trends show clear seasonality in bike availability and usage.

2. Diagnostic Analysis

Key Causes Identified

High Utilization Stations

- Stations like NOVEMBRE, PERRACHE PETIT, ANATOLE FRANCE BARBUSSE show near 100% utilization.
- These stations face frequent bike shortages due to high commuter demand.

Capacity vs Availability Gap

- Cities such as Namur and Santander have a large number of bike stands but low bike availability.
- This indicates inefficient bike redistribution, not lack of infrastructure.

Seasonal Effects

Higher bike availability during August and November.

Higher no-bike availability during March, June, and December due to:

- Weather conditions
- Tourist inflow
- Peak commuting hours

3. Predictive Analysis

Expected Trends

Demand peaks expected during:

- Mid-year (June–July)
- Year-end (November–December)

Without corrective action:

- No-bike availability may exceed 30%
- High-utilization stations will experience frequent service disruptions

Risk Areas

Overutilized stations will continue facing:

- Bike shortages
- Customer dissatisfaction
- Longer wait times

4. Prescriptive Analysis

Recommended Actions

🚲 Operational Improvements

- Increase real-time bike redistribution for high-demand stations.
- Introduce predictive demand-based rebalancing.

📍 Infrastructure Optimization

- Add temporary bike docks at critical shortage locations.
- Expand infrastructure in mid-tier cities like Valence and Seville.

📊 Data-Driven Management

- Use historical patterns to forecast demand.
- Set alerts when utilization exceeds 85%.

🏆 Best Practice Replication

- Replicate efficient models from Lyon and Creteil.

5. Key Insights

- 43.85% utilization indicates healthy adoption with scope for expansion.
- 25% of stations experience bike shortages at peak times.
- Operational efficiency outweighs infrastructure size.
- Seasonality strongly impacts bike availability.
- Balanced cities perform better than high-capacity but poorly managed ones.

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10. Conclusions

The Bike Stands system is infrastructure-ready but operationally uneven. While total bike stand capacity is adequate, inefficient redistribution and seasonal demand spikes cause localized shortages.

By implementing predictive analytics, real-time redistribution, and targeted infrastructure expansion, the system can:

- Reduce bike shortages
- Improve commuter satisfaction
- Strengthen sustainable urban mobility