EDA on Vande Bharat ¶

Performed by Piyush Borhade

Importing required libraries!

In [1]:

```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
```

In [2]:

```
df = pd.read_csv("Vande Bharat.csv")
df
```

Out[2]:

	Sr. No.	Train Name	Train Number	Originating City	Originating Station	Terminal City
0	1	New Delhi - Varanasi Vande Bharat Express	22435/22436	Delhi	New Delhi	Varanasi
1	2	New Delhi - Shri Mata Vaishno Devi Katra Vande...	22439/22440	Delhi	New Delhi	Katra
2	3	Mumbai Central - Gandhinagar Capital Vande Bha...	20901/20902	Mumbai	Mumbai Central	Gandhinagar
3	4	New Delhi - Amb Andaura Vande Bharat Express	22447/22448	Delhi	New Delhi	Andaura
4	5	MGR Chennai Central - Mysuru Vande Bharat Express	20607/20608	Chennai	Chennai Central	Mysuru
5	6	Bilaspur - Nagpur Vande Bharat Express	20825/20826	Bilaspur, Chhattisgarh	Bilaspur Junction	Nagpur
6	7	Howrah - New Jalpaiguri Vande Bharat Express	22301/22302	Kolkata	Howrah Junction	Siliguri
7	8	Visakhapatnam - Secunderabad Vande Bharat Express	20833/20834	Visakhapatnam	Visakhapatnam Junction	Hyderabad
8	9	Mumbai CSMT - Solapur Vande Bharat Express	22225/22226	Mumbai	Chhatrapati Shivaji Terminus	Solapur
9	10	Mumbai CSMT - Sainagar Shirdi Vande Bharat Exp...	22223/22224	Mumbai	Chhatrapati Shivaji Terminus	Shirdi
10	11	Rani Kamalapati (Habibganj) - Hazrat Nizamuddi...	20171/20172	Bhopal	Habibganj (Rani Kamalapati)	Delhi
11	12	Secunderabad - Tirupati Vande Bharat Express	20701/20702	Hyderabad	Secunderabad Junction	Tirupati
12	13	MGR Chennai Central - Coimbatore Vande Bharat ...	20643/20644	Chennai	Chennai Central	Coimbatore
13	14	Delhi Cantonment - Ajmer Vande Bharat Express	20977/20978	Delhi	Delhi Cantonment	Ajmer
14	15	Kasaragod - Thiruvananthapuram Vande Bharat Ex...	20633/20634	Kasaragod	Kasaragod	Thiruvananthapuram
15	16	Howrah - Puri Vande Bharat Express	22895/22896	Kolkata	Howrah Junction	Puri

	Sr. No.	Train Name	Train Number	Originating City	Originating Station	Terminal City
16	17	Anand Vihar Terminal - Dehradun Vande Bharat E...	22457/22458	Delhi	Anand Vihar Terminal	Dehradun
17	18	New Jalpaiguri - Guwahati Vande Bharat Express	22227/22228	Siliguri	New Jalpaiguri Junction	Guwahati
18	19	Mumbai CSMT - Madgaon Vande Bharat Express	22229/22230	Mumbai	Chhatrapati Shivaji Terminus	Madgaon
19	19	Mumbai CSMT - Madgaon Vande Bharat Express	22229/22230	Mumbai	Chhatrapati Shivaji Terminus	Madgaon
20	20	Patna - Ranchi Vande Bharat Express	22349/22350	Patna	Patna Junction	Ranchi
21	21	KSR Bengaluru - Dharwad Vande Bharat Express	20661/20662	Bangalore	Bangalore City	Hubbali - Dharwad
22	22	Rani Kamalapati (Habibganj) - Jabalpur Vande B...	20173/20174	Bhopal	Habibganj (Rani Kamalapati)	Jabalpur
23	23	Indore - Bhopal Vande Bharat Express	20911/20912	Indore	Indore Junction	Bhopal
24	24	Jodhpur - Sabarmati (Ahmedabad) Vande Bharat E...	12461/12462	Jodhpur	Jodhpur Junction	Ahmedabad
25	25	Gorakhpur - Lucknow Charbagh Vande Bharat Express	22549/22550	Gorakhpur	Gorakhpur Junction	Charbagh

In [3]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 26 entries, 0 to 25
Data columns (total 16 columns):
 #   Column               Non-Null Count  Dtype 
---  ------               --------------  ----- 
 0   Sr. No.              26 non-null     int64 
 1   Train Name           26 non-null     object
 2   Train Number         26 non-null     object
 3   Originating City     26 non-null     object
 4   Originating Station  26 non-null     object
 5   Terminal City        26 non-null     object
 6   Terminal Station     26 non-null     object
 7   Operator             26 non-null     object
 8   No. of Cars          26 non-null     int64 
 9   Frequency            26 non-null     object
 10  Distance             26 non-null     object
 11  Travel Time          26 non-null     object
 12  Speed                26 non-null     object
 13  Average Speed        26 non-null     object
 14  Inauguration         26 non-null     object
 15  Average occupancy    26 non-null     object
dtypes: int64(2), object(14)
memory usage: 3.4+ KB
```

So our dataset consists of 16 columns in which 14 columns have 'object' as their datatype and the remaining 2 columns have 'int' datatype.

In [4]:

```
df.shape
```

Out[4]:

```
(26, 16)
```

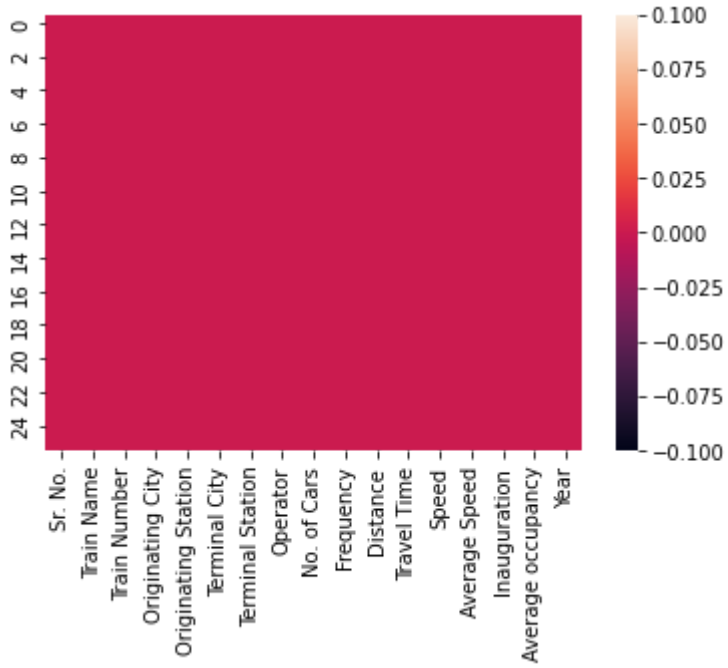
This dataset is from Kaggle and our dataset has 26 rows and 16 columns

In [41]:

```
sns.heatmap(df.isna())
```

Out[41]:

```
<AxesSubplot:>
```



In [39]:

```
df.isna().sum()
```

Out[39]:

```
Sr. No.               0
Train Name            0
Train Number          0
Originating City      0
Originating Station   0
Terminal City         0
Terminal Station      0
Operator              0
No. of Cars           0
Frequency             0
Distance              0
Travel Time           0
Speed                 0
Average Speed         0
Inauguration          0
Average occupancy     0
Year                  0
dtype: int64
```

In [43]:

```
df.duplicated().sum()
```

Out[43]:

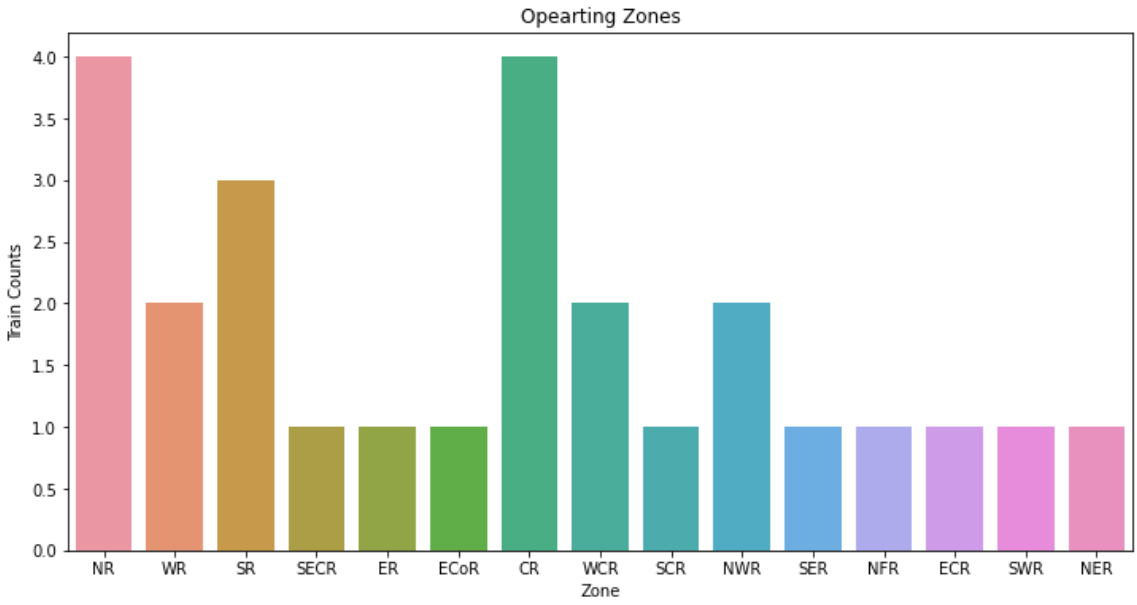
```
0
```

```
Conclusion:

We can observe that our dataset does not have duplicate values as well as null value
```

Different Operating Zones

In [11]:

```
plt.figure(figsize=(12,6))
sns.countplot(x='Operator',data=df)
plt.title("Opearting Zones")
plt.xlabel("Zone")
plt.ylabel("Train Counts")
plt.show()
```

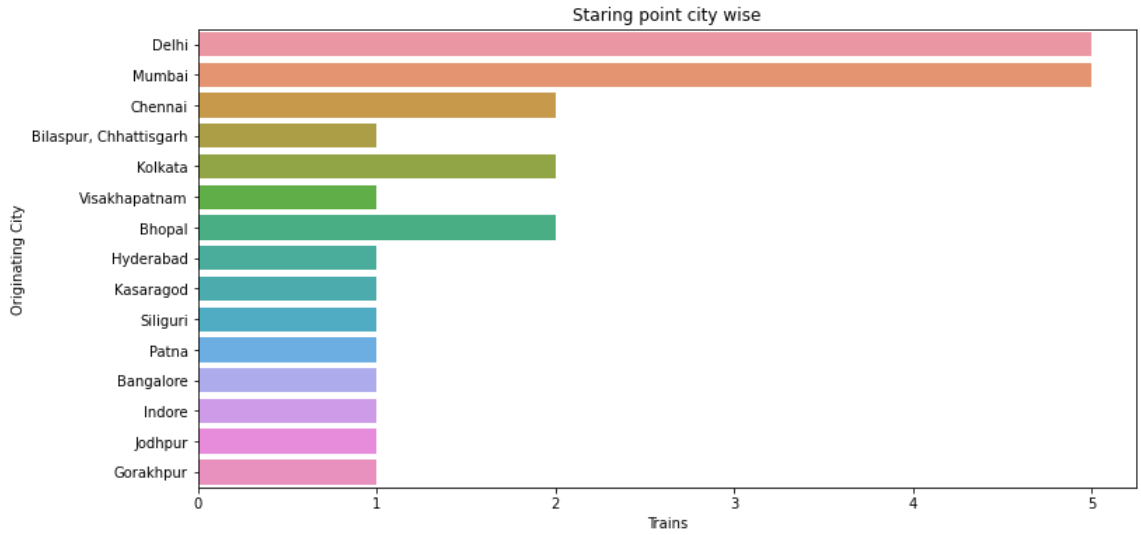



```
Conclusion:

NR and CR operates highest train whose count is 4 trains
then comes the SR with 3 trains operated
following with WR, WCR and NWR consisting 2 trains
and the reamining operates 1 train.
```

Vande Bharat Express - Source/Originating Station

In [12]:

```
plt.figure(figsize=(12,6))
sns.countplot(y='Originating City',data=df)
plt.title("Staring point city wise")
plt.ylabel("Originating City")
plt.xlabel("Trains")
plt.show()
```

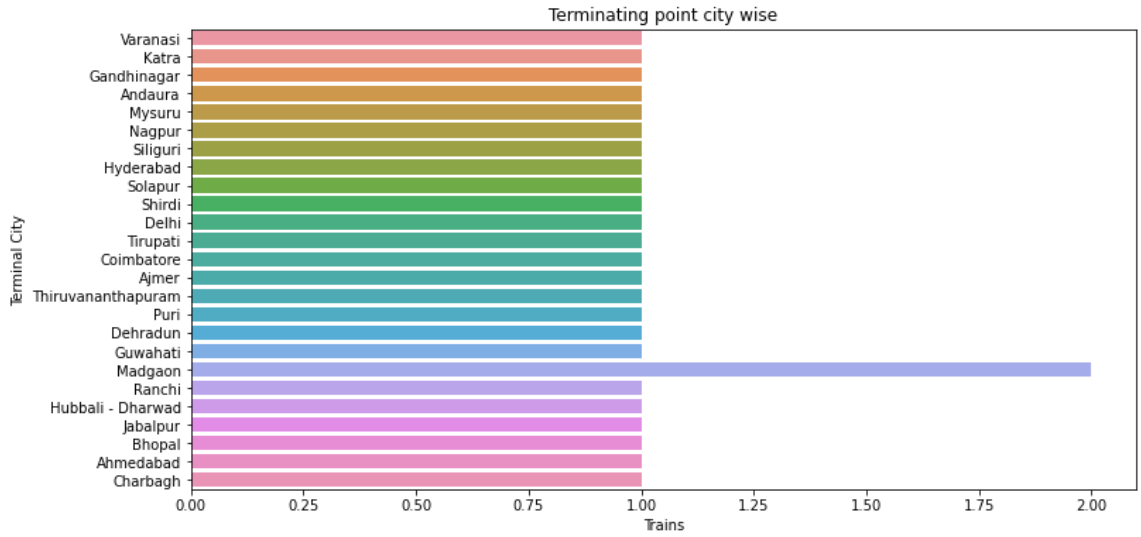



```
Conclusion:

Delhi,Mumbai has 5 trains originating,
nextly Chennai, Kolkata, Bhopal with 2 trains originating.
```

Vande Bharat Express - Terminal Cities

In [13]:

```
plt.figure(figsize=(12,6))
sns.countplot(y='Terminal City',data=df)
plt.title("Terminating point city wise")
plt.ylabel("Terminal City")
plt.xlabel("Trains")
plt.show()
```



```
Conclusion:

Madgaon is the city 2 terminating points which is highest among all the cities
```

In [14]:

```
df.columns
```

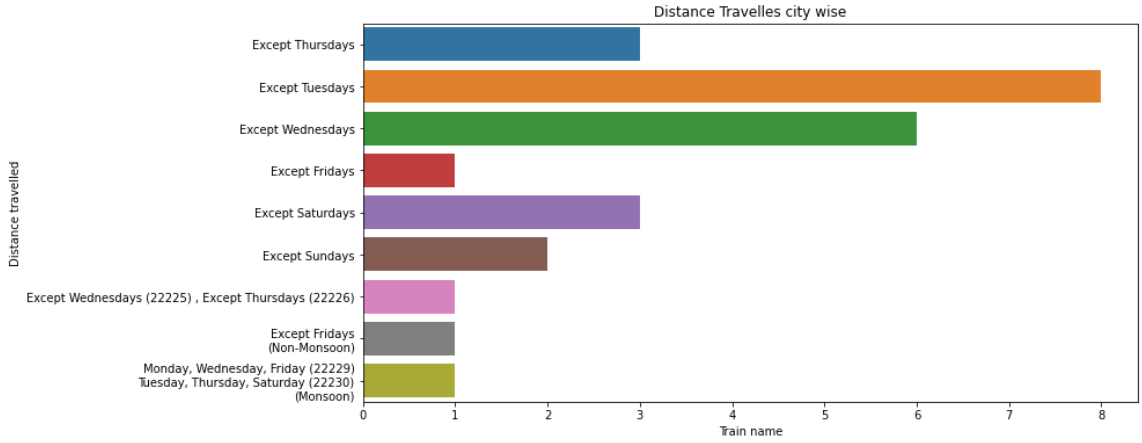
Out[14]:

```
Index(['Sr. No.', 'Train Name', 'Train Number', 'Originating City',
       'Originating Station', 'Terminal City', 'Terminal Station', 'Operat
or',
       'No. of Cars', 'Frequency', 'Distance', 'Travel Time', 'Speed',
       'Average Speed', 'Inauguration', 'Average occupancy', 'Year'],
      dtype='object')
```

Frequency of train on days

In [15]:

```
plt.figure(figsize=(12,6))
sns.countplot(y=df['Frequency'])
plt.title("Distance Travelles city wise")
plt.ylabel("Distance travelled")
plt.xlabel("Train name")
plt.show()
```




```
Conclusion:

Most of the trains are runned 'Except Tuesday' with around 8 trains running
then 'Except Wednesday' is running which is around 6
```

Originating Cities - Zone wise

In [16]:

```
df.columns
```

Out[16]:

```
Index(['Sr. No.', 'Train Name', 'Train Number', 'Originating City',
       'Originating Station', 'Terminal City', 'Terminal Station', 'Operat
or',
       'No. of Cars', 'Frequency', 'Distance', 'Travel Time', 'Speed',
       'Average Speed', 'Inauguration', 'Average occupancy', 'Year'],
      dtype='object')
```

In [20]:

```
df[['Originating City','Terminal City','Operator','Speed']].groupby(['Originating City',
```

Out[20]:

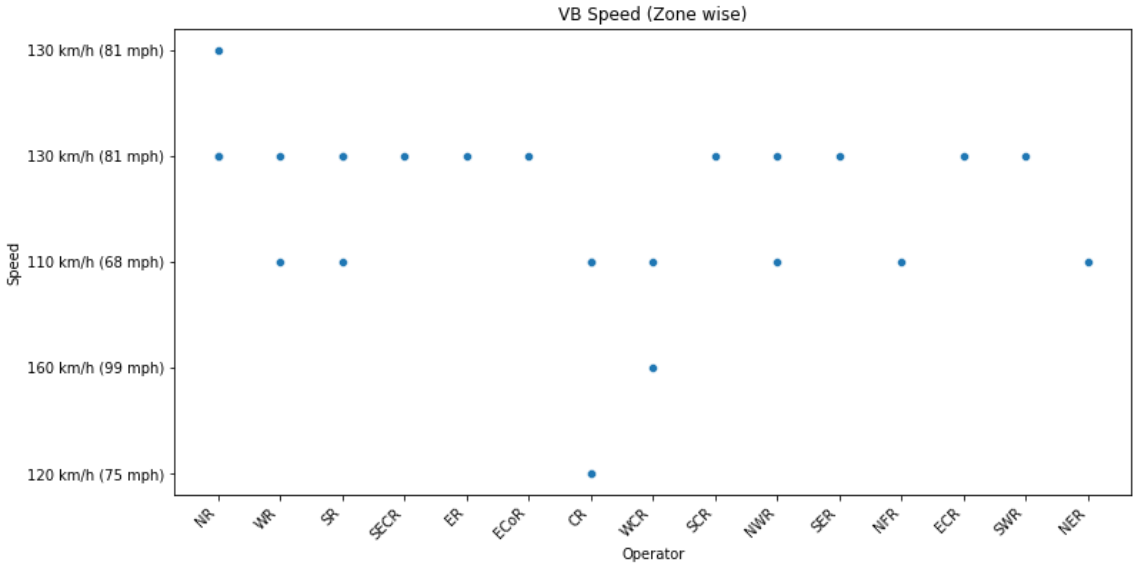
```
Originating City        Terminal City       Operator  Speed
Bangalore               Hubbali - Dharwad   SWR       130 km/h (81 mph)
1
Bhopal                  Delhi               WCR       160 km/h (99 mph)
1
                        Jabalpur            WCR       110 km/h (68 mph)
1
Bilaspur, Chhattisgarh  Nagpur              SECR      130 km/h (81 mph)
1
Chennai                 Coimbatore          SR        130 km/h (81 mph)
1
                        Mysuru              SR        130 km/h (81 mph)
1
Delhi                   Ajmer               NWR       110 km/h (68 mph)
1
                        Andaura             NR        130 km/h (81 mph)
1
                        Dehradun            NR        130 km/h (81 mph)
1
                        Katra               NR        130 km/h (81 mph)
1
                        Varanasi            NR        130 km/h (81 mph)
1
Gorakhpur               Charbagh            NER       110 km/h (68 mph)
1
Hyderabad               Tirupati            SCR       130 km/h (81 mph)
1
Indore                  Bhopal              WR        110 km/h (68 mph)
1
Jodhpur                 Ahmedabad           NWR       130 km/h (81 mph)
1
Kasaragod               Thiruvananthapuram  SR        110 km/h (68 mph)
1
Kolkata                 Puri                SER       130 km/h (81 mph)
1
                        Siliguri            ER        130 km/h (81 mph)
1
Mumbai                  Gandhinagar         WR        130 km/h (81 mph)
1
                        Madgaon             CR        120 km/h (75 mph)
2
                        Shirdi              CR        110 km/h (68 mph)
1
                        Solapur             CR        110 km/h (68 mph)
1
Patna                   Ranchi              ECR       130 km/h (81 mph)
1
Siliguri                Guwahati            NFR       110 km/h (68 mph)
1
Visakhapatnam           Hyderabad           ECoR      130 km/h (81 mph)
1
dtype: int64
```

```
Conclusion:

Train originates from Delhi has highest terminal cities (5)

Train originates from Mumbai has Second highest terminal cities (4)
```

Speed of Vande Bharat with respect to Operator

In [24]:

```
plt.figure(figsize=(12,6))
sns.scatterplot(data=df,x='Operator', y='Speed')
plt.xticks(rotation=45, ha='right')
plt.title('VB Speed (Zone wise)')
plt.show()
```

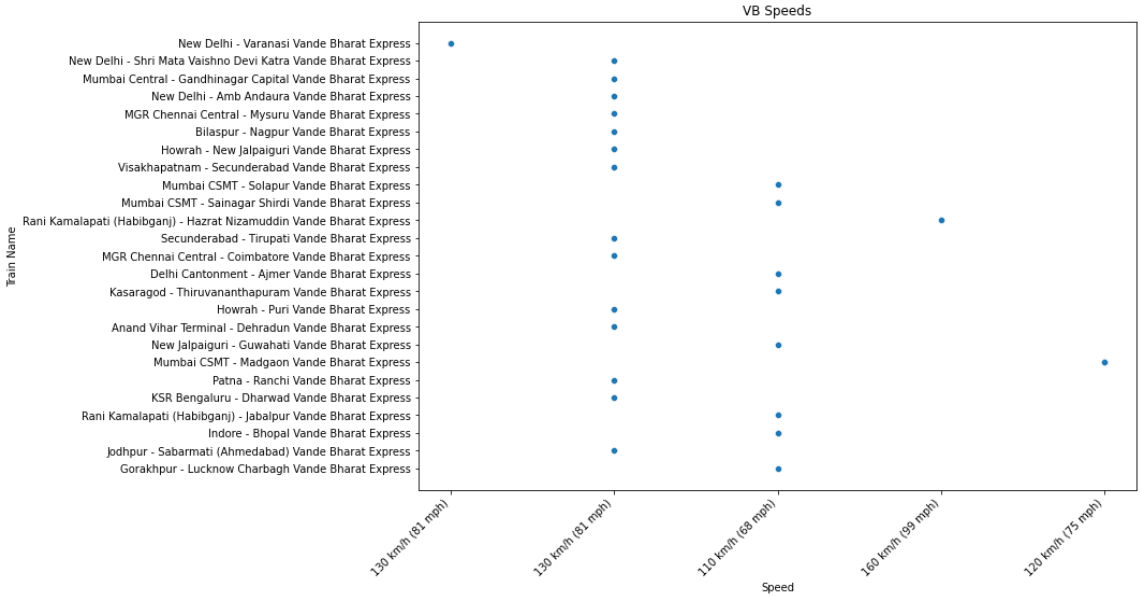



```
Conclusion:

NR operator has most highest speed i.e 130kms/hr

CR operator has least speed among all express i.e 120kms/hr
```

Vande bharat speed!

In [28]:

```
plt.figure(figsize=(12,8))
sns.scatterplot(data=df,y='Train Name', x='Speed')
plt.xticks(rotation=45, ha='right')
plt.title('VB Speeds')
plt.show()
```



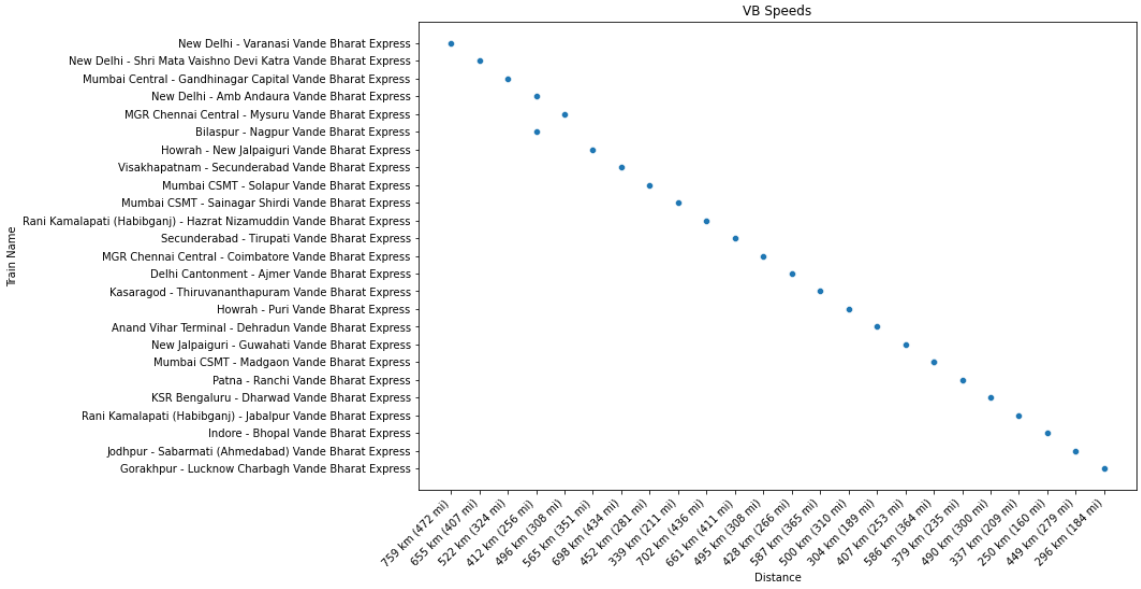
Conclusion:

New Delhi-Varanasi Vande Bharat Express is fastest among other all whose speed is around 130km/hr.

Distance travelled by Vande Bharat

In [30]:

```
plt.figure(figsize=(12,8))
sns.scatterplot(data=df,y='Train Name', x='Distance')
plt.xticks(rotation=45, ha='right')
plt.title('VB Speeds')
plt.show()
```



Conclusion:

New Delhi-Varanasi Vande Bharat Express travells highest distance which is almost 760 kms

The least distance travelled by any Vande Bharat express is around 296 kms and it is Gorakhpur-Lucknow Charbagh Vande Bharat Express

Vande Bharat Express - Inauguration Year

In [32]:

```
vb1 = df[["Train Name","Originating City","Terminal City","Operator","Speed","Inaugurati
vb1.head()
```

Out[32]:

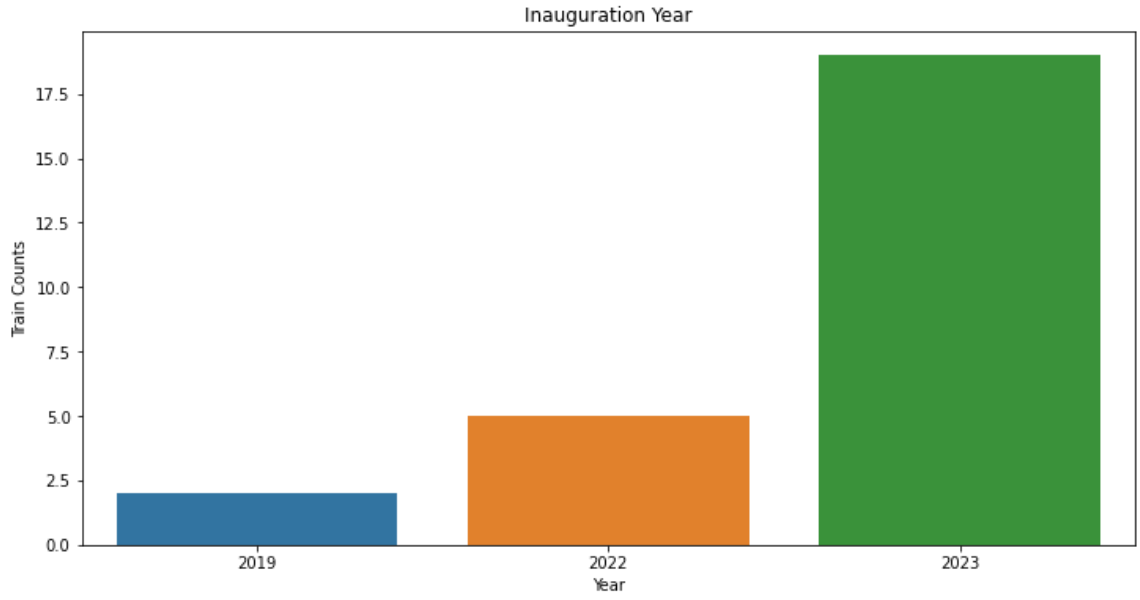
	Train Name	Originating City	Terminal City	Operator	Speed	Inauguration
0	New Delhi - Varanasi Vande Bharat Express	Delhi	Varanasi	NR	130 km/h (81 mph)	2/15/2019
1	New Delhi - Shri Mata Vaishno Devi Katra Vande...	Delhi	Katra	NR	130 km/h (81 mph)	10/3/2019
2	Mumbai Central - Gandhinagar Capital Vande Bha...	Mumbai	Gandhinagar	WR	130 km/h (81 mph)	9/30/2022
3	New Delhi - Amb Andaura Vande Bharat Express	Delhi	Andaura	NR	130 km/h (81 mph)	10/13/2022
4	MGR Chennai Central - Mysuru Vande Bharat Express	Chennai	Mysuru	SR	130 km/h (81 mph)	11/11/2022

In [ ]:

```
df['Year'] = pd.DatetimeIndex(df['Inauguration']).year
df
```

In [31]:

```
plt.figure(figsize=(12,6))
sns.countplot(x='Year',data=df)
plt.title("Inauguration Year")
plt.xlabel("Year")
plt.ylabel("Train Counts")
plt.show()
```



Conclusion:

```
18 Vande Bharat Express has been inaugurated in the year 2023 (till date)
5 Vande Bharat Express had been inaugurated in the year 2022
2 Vande Bharat Express had been inaugurated in the year 2019
```

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