In [1]:
```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
```

In [2]:
```
df=pd.read_csv('Uber Request Data.csv')
```

In [3]:
```
df.head()
```

Out[3]:

	Request id	Pickup point	Driver id	Status	Request timestamp	Drop timestamp
0	619	Airport	1.0	Trip Completed	11/7/2016 11:51	11/7/2016 13:00
1	867	Airport	1.0	Trip Completed	11/7/2016 17:57	11/7/2016 18:47
2	1807	City	1.0	Trip Completed	12/7/2016 9:17	12/7/2016 9:58
3	2532	Airport	1.0	Trip Completed	12/7/2016 21:08	12/7/2016 22:03
4	3112	City	1.0	Trip Completed	13-07-2016 08:33:16	13-07-2016 09:25:47

In [4]:
```
df.tail()
```

Out[4]:

	Request id	Pickup point	Driver id	Status	Request timestamp	Drop timestamp
6740	6745	City	NaN	No Cars Available	15-07-2016 23:49:03	NaN
6741	6752	Airport	NaN	No Cars Available	15-07-2016 23:50:05	NaN
6742	6751	City	NaN	No Cars Available	15-07-2016 23:52:06	NaN
6743	6754	City	NaN	No Cars Available	15-07-2016 23:54:39	NaN
6744	6753	Airport	NaN	No Cars Available	15-07-2016 23:55:03	NaN

In [5]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 6745 entries, 0 to 6744
Data columns (total 6 columns):
 #   Column             Non-Null Count  Dtype  
---  ------             --------------  -----  
 0   Request id         6745 non-null   int64  
 1   Pickup point       6745 non-null   object 
 2   Driver id          4095 non-null   float64
 3   Status             6745 non-null   object 
 4   Request timestamp  6745 non-null   object 
 5   Drop timestamp     2831 non-null   object 
dtypes: float64(1), int64(1), object(4)
memory usage: 316.3+ KB
```

In [6]:
```
df.describe()
```

Out[6]:

	Request id	Driver id
count	6745.000000	4095.000000
mean	3384.644922	149.501343
std	1955.099667	86.051994
min	1.000000	1.000000
25%	1691.000000	75.000000
50%	3387.000000	149.000000
75%	5080.000000	224.000000
max	6766.000000	300.000000

In [7]:
```
# Finding out the statistical summary for both numerical and object columns in one
df.describe(include="all")
```

Out[7]:

	Request id	Pickup point	Driver id	Status	Request timestamp	Drop timestamp
count	6745.000000	6745	4095.000000	6745	6745	2831
unique	NaN	2	NaN	3	5618	2598
top	NaN	City	NaN	Trip Completed	11/7/2016 19:02	11/7/2016 13:00
freq	NaN	3507	NaN	2831	6	4
mean	3384.644922	NaN	149.501343	NaN	NaN	NaN
std	1955.099667	NaN	86.051994	NaN	NaN	NaN
min	1.000000	NaN	1.000000	NaN	NaN	NaN
25%	1691.000000	NaN	75.000000	NaN	NaN	NaN
50%	3387.000000	NaN	149.000000	NaN	NaN	NaN
75%	5080.000000	NaN	224.000000	NaN	NaN	NaN
max	6766.000000	NaN	300.000000	NaN	NaN	NaN

In [8]:
```
# To check any null values present in the dataset
df.isnull().values.any()
```

Out[8]:
```
True
```

In [9]:
```
# To check which columns has null values
df.isnull().any()
```

Out[9]:
```
Request id           False
Pickup point         False
Driver id             True
Status               False
Request timestamp    False
Drop timestamp        True
dtype: bool
```

In [10]:
```
df.isnull()
```

Out[10]:

	Request id	Pickup point	Driver id	Status	Request timestamp	Drop timestamp
0	False	False	False	False	False	False
1	False	False	False	False	False	False
2	False	False	False	False	False	False
3	False	False	False	False	False	False
4	False	False	False	False	False	False
...	...	...	...	...	...	...
6740	False	False	True	False	False	True
6741	False	False	True	False	False	True
6742	False	False	True	False	False	True
6743	False	False	True	False	False	True
6744	False	False	True	False	False	True

6745 rows × 6 columns

In [11]:
```
# Check columns wise null value
df.isnull().sum()
```

Out[11]:
```
Request id              0
Pickup point            0
Driver id            2650
Status                  0
Request timestamp       0
Drop timestamp       3914
dtype: int64
```

In [12]:
```
# total numbers 0f null values present in the dataset
df.isnull().sum().sum()
```

Out[12]:
```
6564
```

In [13]:
```
# Show the % of NaNs in each columns
df.isnull().sum()/len(df)*100
```

Out[13]:
```
Request id            0.000000
Pickup point          0.000000
Driver id            39.288362
Status                0.000000
Request timestamp     0.000000
Drop timestamp       58.028169
dtype: float64
```

In [14]:
```
df.shape[0]
```

Out[14]:
```
6745
```

In [15]:
```
len(df)
```

Out[15]:
```
6745
```

Cleaning/Handling the data

- We see that for the column "Request timestamp", the format of DateTime is different for different sections of data. Some have it separated by "-" and some have it separated by "/".
- Let us first replace the "/" with "-" to have uniformity and then convert the entier column to standard datatime format using "pd.to_datatime" function. Refer to lines 10,11 and 12.

In [16]:
```
df["Request timestamp"].value_counts()
```

Out[16]:
```
11/7/2016 19:02        6
11/7/2016 17:57        6
11/7/2016 8:37         6
11/7/2016 9:40         6
12/7/2016 21:42        5
                      ..
15-07-2016 18:08:33    1
15-07-2016 04:50:54    1
14-07-2016 18:42:23    1
13-07-2016 19:26:50    1
15-07-2016 23:55:03    1
Name: Request timestamp, Length: 5618, dtype: int64
```

In [17]:
```
df["Request timestamp"]=pd.to_datetime(df["Request timestamp"])
```

After doing the datatime conversion, if we pull the info again, we see that "Request timestamp" is converted to "datetime".

In [18]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 6745 entries, 0 to 6744
Data columns (total 6 columns):
 #   Column             Non-Null Count  Dtype
---  ------             --------------  -----
 0   Request id         6745 non-null   int64
 1   Pickup point       6745 non-null   object
 2   Driver id          4095 non-null   float64
 3   Status             6745 non-null   object
 4   Request timestamp  6745 non-null   datetime64[ns]
 5   Drop timestamp     2831 non-null   object
dtypes: datetime64[ns](1), float64(1), int64(1), object(3)
memory usage: 316.3+ KB
```

Similarly convert "Drop timestamp" column from "object" to "datatime"

In [19]:
```
df["Drop timestamp"]=pd.to_datetime(df["Drop timestamp"])
```

In [20]:
```
df
```

Out[20]:

	Request id	Pickup point	Driver id	Status	Request timestamp	Drop timestamp
0	619	Airport	1.0	Trip Completed	2016-11-07 11:51:00	2016-11-07 13:00:00
1	867	Airport	1.0	Trip Completed	2016-11-07 17:57:00	2016-11-07 18:47:00
2	1807	City	1.0	Trip Completed	2016-12-07 09:17:00	2016-12-07 09:58:00
3	2532	Airport	1.0	Trip Completed	2016-12-07 21:08:00	2016-12-07 22:03:00
4	3112	City	1.0	Trip Completed	2016-07-13 08:33:16	2016-07-13 09:25:47
...	...	...	...	...	...	...
6740	6745	City	NaN	No Cars Available	2016-07-15 23:49:03	NaT
6741	6752	Airport	NaN	No Cars Available	2016-07-15 23:50:05	NaT
6742	6751	City	NaN	No Cars Available	2016-07-15 23:52:06	NaT
6743	6754	City	NaN	No Cars Available	2016-07-15 23:54:39	NaT
6744	6753	Airport	NaN	No Cars Available	2016-07-15 23:55:03	NaT

6745 rows × 6 columns

In [21]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 6745 entries, 0 to 6744
Data columns (total 6 columns):
 #   Column             Non-Null Count  Dtype         
---  ------             --------------  -----         
 0   Request id         6745 non-null   int64         
 1   Pickup point       6745 non-null   object        
 2   Driver id          4095 non-null   float64       
 3   Status             6745 non-null   object        
 4   Request timestamp  6745 non-null   datetime64[ns]
 5   Drop timestamp     2831 non-null   datetime64[ns]
dtypes: datetime64[ns](2), float64(1), int64(1), object(2)
memory usage: 316.3+ KB
```

In [22]:
```
df["Drop timestamp"]
```

Out[22]:
```
0      2016-11-07 13:00:00
1      2016-11-07 18:47:00
2      2016-12-07 09:58:00
3      2016-12-07 22:03:00
4      2016-07-13 09:25:47
               ...
6740                   NaT
6741                   NaT
6742                   NaT
6743                   NaT
6744                   NaT
Name: Drop timestamp, Length: 6745, dtype: datetime64[ns]
```

We now add 2 columns "req_hour"(which is Hour of the request during the day) and "req_day"(which is the day of the month) to determine and catogorise the load of cab service requests.

In [23]:
```
# Create req_hour column using fetching the hour number from the request timestamp
df['req_hour']=df["Request timestamp"].dt.hour
```

In [24]:
```
#df["Request timestamp"].dt.time
```

In [25]:
```
#df["Request timestamp"].dt.minute
```

In [26]:
```
df
```

Out[26]:

	Request id	Pickup point	Driver id	Status	Request timestamp	Drop timestamp	req_hour
0	619	Airport	1.0	Trip Completed	2016-11-07 11:51:00	2016-11-07 13:00:00	11
1	867	Airport	1.0	Trip Completed	2016-11-07 17:57:00	2016-11-07 18:47:00	17
2	1807	City	1.0	Trip Completed	2016-12-07 09:17:00	2016-12-07 09:58:00	9
3	2532	Airport	1.0	Trip Completed	2016-12-07 21:08:00	2016-12-07 22:03:00	21
4	3112	City	1.0	Trip Completed	2016-07-13 08:33:16	2016-07-13 09:25:47	8
...	...	...	...	...	...	...	...
6740	6745	City	NaN	No Cars Available	2016-07-15 23:49:03	NaT	23
6741	6752	Airport	NaN	No Cars Available	2016-07-15 23:50:05	NaT	23
6742	6751	City	NaN	No Cars Available	2016-07-15 23:52:06	NaT	23
6743	6754	City	NaN	No Cars Available	2016-07-15 23:54:39	NaT	23
6744	6753	Airport	NaN	No Cars Available	2016-07-15 23:55:03	NaT	23

6745 rows × 7 columns

In [27]:
```
 # Fetching the day number from the request timestampdf
df['req_day']=df["Request timestamp"].dt.day
```

In [28]:
```
df
```

Out[28]:

	Request id	Pickup point	Driver id	Status	Request timestamp	Drop timestamp	req_hour	req_day
0	619	Airport	1.0	Trip Completed	2016-11-07 11:51:00	2016-11-07 13:00:00	11	7
1	867	Airport	1.0	Trip Completed	2016-11-07 17:57:00	2016-11-07 18:47:00	17	7
2	1807	City	1.0	Trip Completed	2016-12-07 09:17:00	2016-12-07 09:58:00	9	7
3	2532	Airport	1.0	Trip Completed	2016-12-07 21:08:00	2016-12-07 22:03:00	21	7
4	3112	City	1.0	Trip Completed	2016-07-13 08:33:16	2016-07-13 09:25:47	8	13
...	...	...	...	...	...	...	...	...
6740	6745	City	NaN	No Cars Available	2016-07-15 23:49:03	NaT	23	15
6741	6752	Airport	NaN	No Cars Available	2016-07-15 23:50:05	NaT	23	15
6742	6751	City	NaN	No Cars Available	2016-07-15 23:52:06	NaT	23	15
6743	6754	City	NaN	No Cars Available	2016-07-15 23:54:39	NaT	23	15
6744	6753	Airport	NaN	No Cars Available	2016-07-15 23:55:03	NaT	23	15

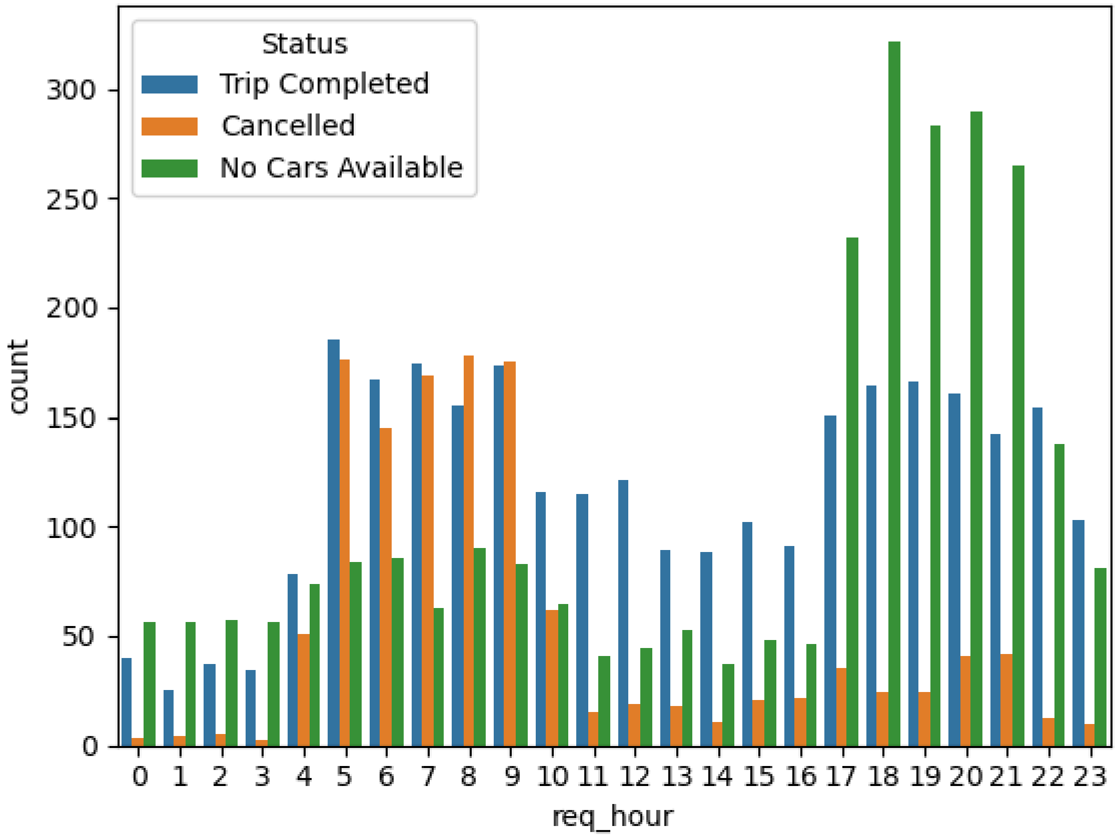
6745 rows × 8 columns

Note:

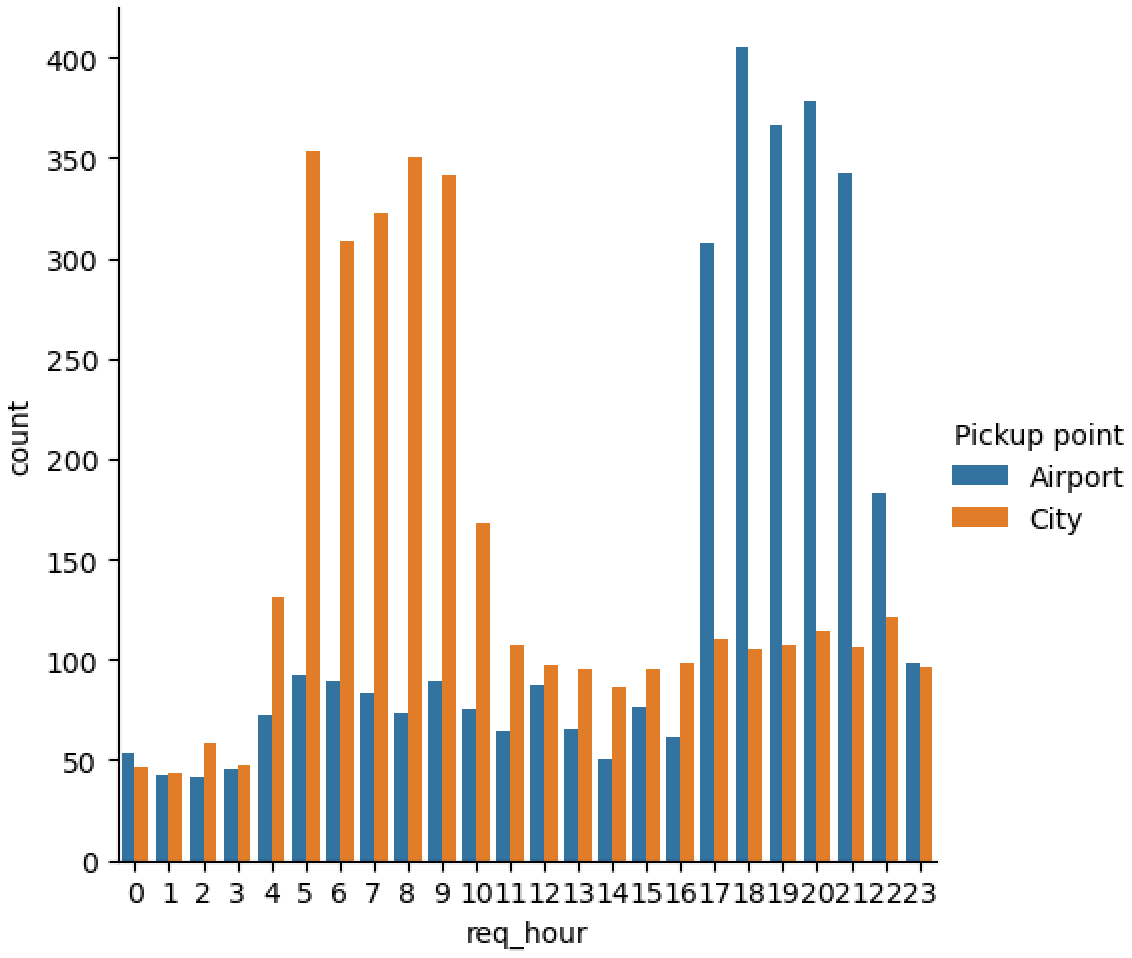
- The NaNs/missing values in the column "Driver_Id" can be ignored.
- This is because we see that since there were NO CARS AVAILABLE at point of the day after the user tried to book a cab, no driver was alloted the trip and hence the driver_id is empty.
- Similary, we can ignore the NaNs/missing values in the column "Drop timestamp" as for all of them, the trip is either CANCELLED or NO CARS AVAILABLE.
- In both the above cases, the data is missing due to a genuine reason and not that it got lost during data collection. Hence, I have not substitued them with any other values based on any logic.

3. Visualize and Analyse¶

In [29]:
```
sns.countplot(x="req_hour",data=df,hue="Status")
plt.show()
```



In [30]:
```
sns.catplot(x="req_hour",data=df,hue="Pickup point",kind="count")
plt.show()
```



Plot of Status of the trip at different hours of the day and also pick up locations shows that, 1) Between hours 5AM-9AM, the load on cabs are high with almost equal amount of trips getting completed and cancelled. 2)

Between hours 5PM-9PM, the load on cabs are significantly high. Hence, there is mismatch between cab demand and availabilty. Hence, we see more of "No cars Available Status". 3) Between hours 5AM-9AM, the users from city is significantly high. 4) Between hours 5PM-9PM, the users from Airport is significantly high. Adding a new column Time_Slot to make categories of hours from the req_hour column

In [31]:
```
df["Time_Slot"]=0
```

In [32]:
```
df.head()
```

Out[32]:

	Request id	Pickup point	Driver id	Status	Request timestamp	Drop timestamp	req_hour	req_day	Time_Slot
0	619	Airport	1.0	Trip Completed	2016-11-07 11:51:00	2016-11-07 13:00:00	11	7	0
1	867	Airport	1.0	Trip Completed	2016-11-07 17:57:00	2016-11-07 18:47:00	17	7	0
2	1807	City	1.0	Trip Completed	2016-12-07 09:17:00	2016-12-07 09:58:00	9	7	0
3	2532	Airport	1.0	Trip Completed	2016-12-07 21:08:00	2016-12-07 22:03:00	21	7	0
4	3112	City	1.0	Trip Completed	2016-07-13 08:33:16	2016-07-13 09:25:47	8	13	0

In [33]:
```
for i in df["req_hour"]:
    if df.iloc[i,6]<5:
        df.iloc[i,8]="Pre_Morning"
    elif 5<=df.iloc[i,6]<10:
        df.iloc[i,8]="Morning_Rush"

    elif 10<=df.iloc[i,6]<17:
        df.iloc[i,8]="Day_Time"

    elif 17<=df.iloc[i,6]<22:
        df.iloc[i,8]="Evening_Rush"
    else:
        df.iloc[i,8]="Late_Night"
    i=i+1
```

In [ ]:

In [34]:
```
df.head()
```

Out[34]:

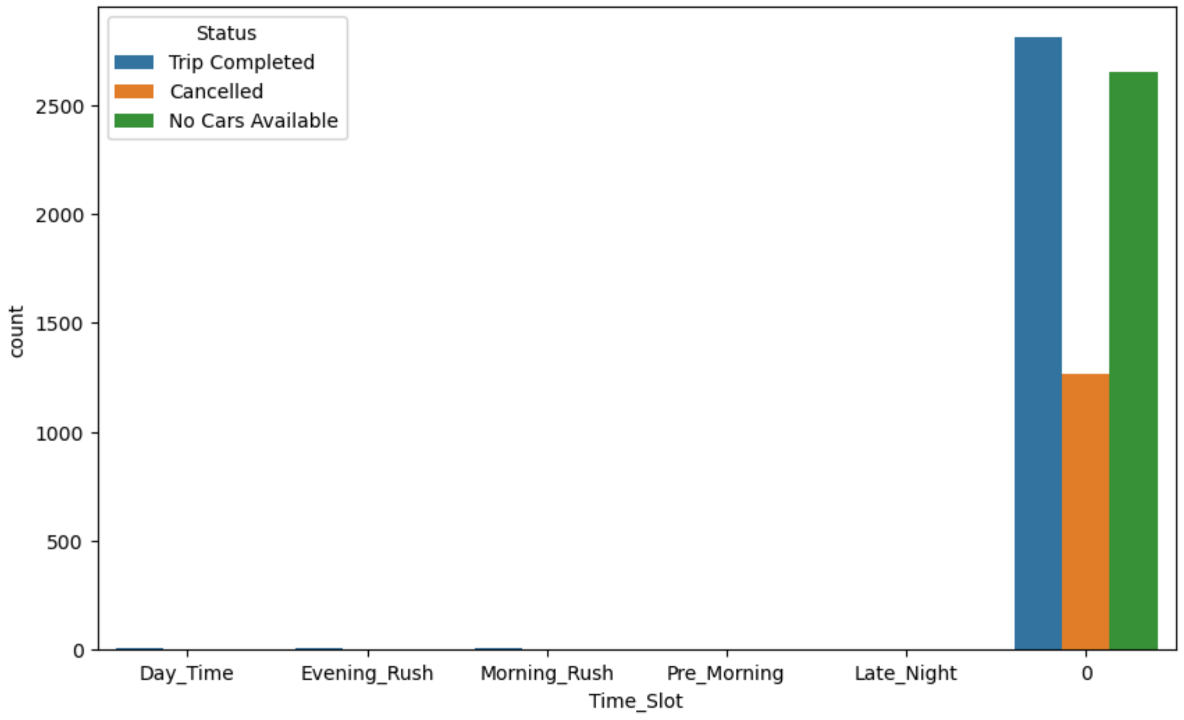
	Request id	Pickup point	Driver id	Status	Request timestamp	Drop timestamp	req_hour	req_day	Time_Slot
0	619	Airport	1.0	Trip Completed	2016-11-07 11:51:00	2016-11-07 13:00:00	11	7	Day_Time
1	867	Airport	1.0	Trip Completed	2016-11-07 17:57:00	2016-11-07 18:47:00	17	7	Evening_Rush
2	1807	City	1.0	Trip Completed	2016-12-07 09:17:00	2016-12-07 09:58:00	9	7	Morning_Rush
3	2532	Airport	1.0	Trip Completed	2016-12-07 21:08:00	2016-12-07 22:03:00	21	7	Evening_Rush
4	3112	City	1.0	Trip Completed	2016-07-13 08:33:16	2016-07-13 09:25:47	8	13	Morning_Rush

In [35]:
```
df["Time_Slot"].value_counts()
```

Out[35]:
```
0               6721
Morning_Rush       8
Day_Time           7
Evening_Rush       7
Pre_Morning        1
Late_Night         1
Name: Time_Slot, dtype: int64
```

You see from the above value counts, the "Morning_Rush" and "Evening_Rush" are the hours with maximum load.

In [36]:
```
plt.figure(figsize=(10,6))
sns.countplot(x="Time_Slot",hue="Status",data=df)
plt.show()
```



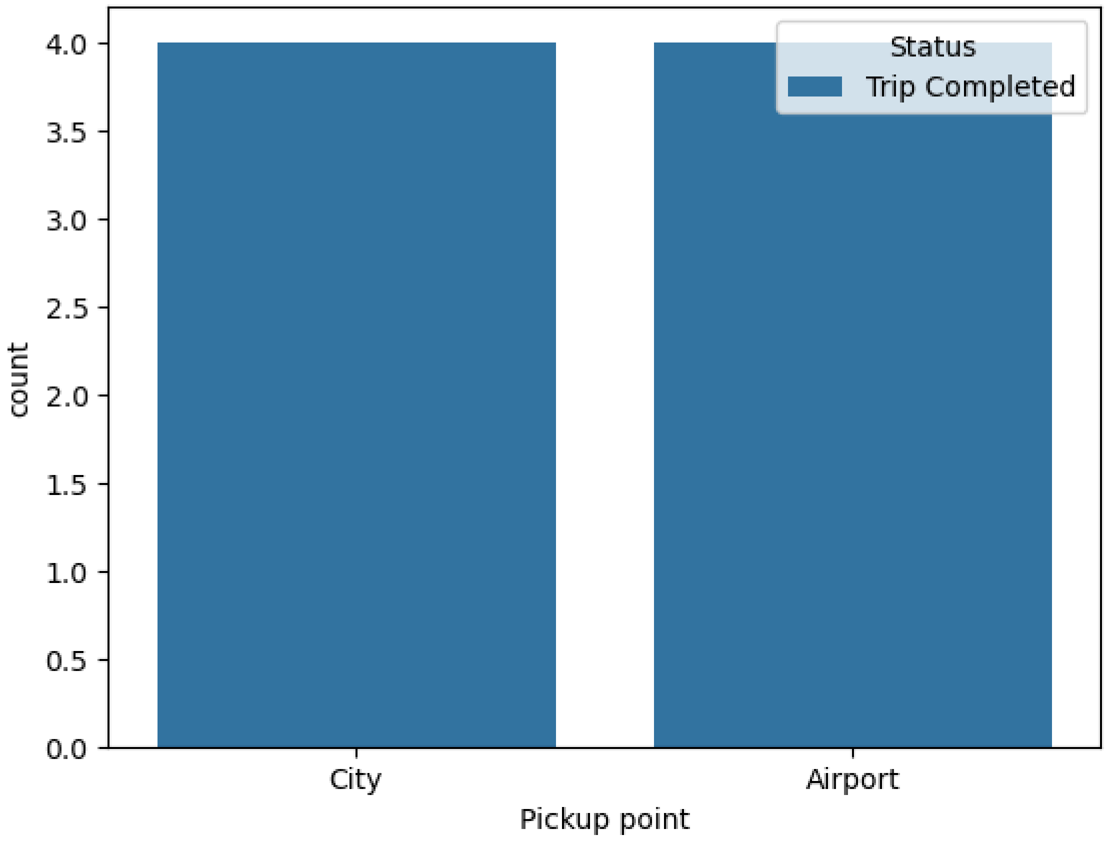
In [37]:
```
df_morning_rush=df[df['Time_Slot']=='Morning_Rush']
```

In [38]:
```
df[df['Time_Slot']=='Morning_Rush']
```

Out[38]:

	Request id	Pickup point	Driver id	Status	Request timestamp	Drop timestamp	req_hour	req_day	Time_Slot
2	1807	City	1.0	Trip Completed	2016-12-07 09:17:00	2016-12-07 09:58:00	9	7	Morning_Rush
4	3112	City	1.0	Trip Completed	2016-07-13 08:33:16	2016-07-13 09:25:47	8	13	Morning_Rush
6	4270	Airport	1.0	Trip Completed	2016-07-14 06:15:32	2016-07-14 07:13:15	6	14	Morning_Rush
7	5510	Airport	1.0	Trip Completed	2016-07-15 05:11:52	2016-07-15 06:07:52	5	15	Morning_Rush
9	267	City	2.0	Trip Completed	2016-11-07 06:46:00	2016-11-07 07:25:00	6	7	Morning_Rush
10	1467	Airport	2.0	Trip Completed	2016-12-07 05:08:00	2016-12-07 06:02:00	5	7	Morning_Rush
13	3075	City	2.0	Trip Completed	2016-07-13 08:02:53	2016-07-13 09:16:19	8	13	Morning_Rush
23	3096	Airport	3.0	Trip Completed	2016-07-13 08:17:29	2016-07-13 09:22:37	8	13	Morning_Rush

In [39]:
```
sns.countplot(x="Pickup point",hue="Status",data=df_morning_rush)
plt.show()
```



In [40]:
```
# Pickup point= Airport

df_airport_cancelled=df_morning_rush[(df_morning_rush["Pickup point"]=="Airport") &
                                     (df_morning_rush["Status"]=="Cancelled")]
len(df_airport_cancelled)
```

```
Out[40]: 0
```

```
In [41]: # Pickup point= City

         df_city_cancelled=df_morning_rush[(df_morning_rush["Pickup point"]=="City") &
                                            (df_morning_rush["Status"]=="Cancelled")]
         len(df_city_cancelled)
```

```
Out[41]: 0
```

```
In [42]: df_morning_rush[(df_morning_rush['Pickup point']=='City') & (df_morning_rush['Statu
```

```
Out[42]: 4
```

Evening_rush

```
In [43]: df_Evening_rush=df[df['Time_Slot']=='Evening_Rush']
```

```
In [44]: df_Evening_rush[(df_Evening_rush['Pickup point']=='City') & (df_Evening_rush['Statu
```

```
Out[44]: 0
```

```
In [45]: df_Evening_rush['Status'].value_counts()
```

```
Out[45]: Trip Completed    7
         Name: Status, dtype: int64
```

```
In [46]: df_Evening_rush[(df_Evening_rush['Pickup point']=='Airport') & (df_Evening_rush['St
```

```
Out[46]: 0
```

1) We understood the dataset with the number of user requests were done and the number of columns(6745,6) along with other facts such as number/percentage of NaNs in each columns and format of dataTime in the request and drop timestamp columns. 2) We standardised format of dataTime in the request and drop timestamp columns. 3) Figured a logical reason as to why the NaNs in Driver_id and drop timestamp columns should be ignored. 4) Extracted the day number and hour from the request timestamp column to perform a deeper analysis. 5) Between hours 5AM-9AM, the load on cabs are high with almost equal amount of trips getting completed and cancelled. 6) Between hours 5PM-9PM, the load on cabs are significantly high. Hence, there is mismatch between cab demand and availabilty. Hence, we see more of "No cars Available Status". 7) Between hours 5AM-9AM, the users from city is significantly high. 8) Between hours 5PM-9PM, the users from Airport is significantly high. 9) The "Morning_Rush" and "Evening_Rush" are the hours with maximum load(i.e more number of users requesting cab services). 10) We also saw the load during "Morning_rush" and "Evening_Rush" from both pick-up points "City" and "Airport". 11) During the evening rush hour, we saw a significant number of No CARS AVAILABLE status for the trip bookings from "Airport".

```
In [ ]:
```