Customer Service Requests Analysis

In [3]:

```
# import libraries
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from matplotlib import style
```

In [4]:

```
data_311=pd.read_csv('311_Service_Requests_from_2010_to_Present.csv')
```

```
/usr/local/lib/python3.7/site-packages/IPython/core/interactiveshell.py:306
3: DtypeWarning: Columns (48,49) have mixed types.Specify dtype option on im
port or set low_memory=False.
  interactivity=interactivity, compiler=compiler, result=result)
```

In [5]:

```
#View top 5 records
data_311.head()
```

Out[5]:

| | Unique Key | Created Date | Closed Date | Agency | Agency Name | Complaint Type | Descriptor | Location Typ |
|---|---|---|---|---|---|---|---|---|
| **0** | 32310363 | 12/31/2015 11:59:45 PM | 01-01-16 0:55 | NYPD | New York City Police Department | Noise - Street/Sidewalk | Loud Music/Party | Street/Sidewa |
| **1** | 32309934 | 12/31/2015 11:59:44 PM | 01-01-16 1:26 | NYPD | New York City Police Department | Blocked Driveway | No Access | Street/Sidewa |
| **2** | 32309159 | 12/31/2015 11:59:29 PM | 01-01-16 4:51 | NYPD | New York City Police Department | Blocked Driveway | No Access | Street/Sidewa |
| **3** | 32305098 | 12/31/2015 11:57:46 PM | 01-01-16 7:43 | NYPD | New York City Police Department | Illegal Parking | Commercial Overnight Parking | Street/Sidewa |
| **4** | 32306529 | 12/31/2015 11:56:58 PM | 01-01-16 3:24 | NYPD | New York City Police Department | Illegal Parking | Blocked Sidewalk | Street/Sidewa |

5 rows × 53 columns

1. Understand the dataset:
2. 1 Identify the shape of the dataset

In [6]:

```
# check the shape of the dataset
data_311.shape
```

Out[6]:

```
(300698, 53)
```

In [7]:

```
# view the columns
data_311.columns
```

Out[7]:

```
Index(['Unique Key', 'Created Date', 'Closed Date', 'Agency', 'Agency Name',
       'Complaint Type', 'Descriptor', 'Location Type', 'Incident Zip',
       'Incident Address', 'Street Name', 'Cross Street 1', 'Cross Street
2',
       'Intersection Street 1', 'Intersection Street 2', 'Address Type',
       'City', 'Landmark', 'Facility Type', 'Status', 'Due Date',
       'Resolution Description', 'Resolution Action Updated Date',
       'Community Board', 'Borough', 'X Coordinate (State Plane)',
       'Y Coordinate (State Plane)', 'Park Facility Name', 'Park Borough',
       'School Name', 'School Number', 'School Region', 'School Code',
       'School Phone Number', 'School Address', 'School City', 'School Stat
e',
       'School Zip', 'School Not Found', 'School or Citywide Complaint',
       'Vehicle Type', 'Taxi Company Borough', 'Taxi Pick Up Location',
       'Bridge Highway Name', 'Bridge Highway Direction', 'Road Ramp',
       'Bridge Highway Segment', 'Garage Lot Name', 'Ferry Direction',
       'Ferry Terminal Name', 'Latitude', 'Longitude', 'Location'],
      dtype='object')
```

1. 2 Identify variables with null values

In [9]:

```
# check the null values in dataset
data_311.isnull().sum()
```

Out[9]:

```
Unique Key                          0
Created Date                        0
Closed Date                      2164
Agency                              0
Agency Name                         0
Complaint Type                      0
Descriptor                       5914
Location Type                     131
Incident Zip                     2615
Incident Address                44410
Street Name                     44410
Cross Street 1                  49279
Cross Street 2                  49779
Intersection Street 1          256840
Intersection Street 2          257336
Address Type                     2815
City                             2614
Landmark                       300349
Facility Type                    2171
Status                              0
Due Date                            3
Resolution Description              0
Resolution Action Updated Date   2187
Community Board                     0
Borough                             0
X Coordinate (State Plane)       3540
Y Coordinate (State Plane)       3540
Park Facility Name                  0
Park Borough                        0
School Name                         0
School Number                       0
School Region                       1
School Code                         1
School Phone Number                 0
School Address                      0
School City                         0
School State                        0
School Zip                          1
School Not Found                    0
School or Citywide Complaint   300698
Vehicle Type                   300698
Taxi Company Borough           300698
Taxi Pick Up Location          300698
Bridge Highway Name            300455
Bridge Highway Direction       300455
Road Ramp                      300485
Bridge Highway Segment         300485
Garage Lot Name                300698
Ferry Direction                300697
Ferry Terminal Name            300696
Latitude                         3540
Longitude                        3540
Location                         3540
dtype: int64
```

1. Perform basic data exploratory analysis:
2. 1 Utilize missing value treatment
3. 2 Analyze the date column and remove the entries if it has an incorrect timeline
4. 3 Draw a frequency plot for city-wise complaints
5. 4 Draw scatter and hexbin plots for complaint concentration across Brooklyn

In [10]:

```
#As we seen Closed Date is important column and have many missing values
data_311[data_311['Closed Date'].isnull()]
```

Out[10]:

| | Unique Key | Created Date | Closed Date | Agency | Agency Name | Complaint Type | Descriptor | Lo |
|---|---|---|---|---|---|---|---|---|
| **416** | 32305700 | 12/31/2015 02:16:04 PM | NaN | NYPD | New York City Police Department | Illegal Parking | Posted Parking Sign Violation | Str |
| **611** | 32309308 | 12/31/2015 09:58:06 AM | NaN | NYPD | New York City Police Department | Noise - Street/Sidewalk | Loud Music/Party | Str |
| **1648** | 32303348 | 12/30/2015 05:13:42 AM | NaN | NYPD | New York City Police Department | Illegal Parking | Commercial Overnight Parking | Str |
| **1816** | 32294519 | 12/29/2015 10:44:50 PM | NaN | NYPD | New York City Police Department | Derelict Vehicle | With License Plate | Str |
| **1965** | 32296487 | 12/29/2015 07:09:13 PM | NaN | NYPD | New York City Police Department | Derelict Vehicle | With License Plate | Str |
| **...** | ... | ... | ... | ... | ... | ... | ... | |
| **300273** | 30287350 | 03/29/2015 02:40:19 PM | NaN | NYPD | New York City Police Department | Blocked Driveway | No Access | Str |
| **300492** | 30284963 | 03/29/2015 08:50:15 AM | NaN | NYPD | New York City Police Department | Vending | Unlicensed | Str |
| **300496** | 30285492 | 03/29/2015 08:44:13 AM | NaN | NYPD | New York City Police Department | Vending | Unlicensed | Str |
| **300620** | 30282717 | 03/29/2015 01:55:35 AM | NaN | NYPD | New York City Police Department | Noise - Commercial | Loud Music/Party | Club/Ba |
| **300693** | 30281872 | 03/29/2015 12:33:41 AM | NaN | NYPD | New York City Police Department | Noise - Commercial | Loud Music/Party | Club/Ba |

2164 rows × 53 columns

In [11]:

```
data_311[data_311['Unique Key']==32305700]
```

Out[11]:

| | Unique Key | Created Date | Closed Date | Agency | Agency Name | Complaint Type | Descriptor | Location Type |
|---|---|---|---|---|---|---|---|---|
| **416** | 32305700 | 12/31/2015 02:16:04 PM | NaN | NYPD | New York City Police Department | Illegal Parking | Posted Parking Sign Violation | Street/Sidewalk |

1 rows × 53 columns

In [16]:

```
data_311['Created Date'] = data_311['Created Date'].astype('datetime64[ns]')
data_311['Closed Date'] = data_311['Closed Date'].astype('datetime64[ns]')
data_311[['Created Date','Closed Date']]
```

Out[16]:

| | Created Date | Closed Date |
|---|---|---|
| **0** | 2015-12-31 23:59:45 | 2016-01-01 00:55:00 |
| **1** | 2015-12-31 23:59:44 | 2016-01-01 01:26:00 |
| **2** | 2015-12-31 23:59:29 | 2016-01-01 04:51:00 |
| **3** | 2015-12-31 23:57:46 | 2016-01-01 07:43:00 |
| **4** | 2015-12-31 23:56:58 | 2016-01-01 03:24:00 |
| **...** | ... | ... |
| **300693** | 2015-03-29 00:33:41 | NaT |
| **300694** | 2015-03-29 00:33:28 | 2015-03-29 02:33:59 |
| **300695** | 2015-03-29 00:33:03 | 2015-03-29 03:40:20 |
| **300696** | 2015-03-29 00:33:02 | 2015-03-29 04:38:35 |
| **300697** | 2015-03-29 00:33:01 | 2015-03-29 04:41:50 |

300698 rows × 2 columns

In [20]:

```
data_311['Request_Closing_Time']=data_311['Closed Date']-data_311['Created Date']
data_311['Request_Closing_Time']
```

Out[20]:

```
0        0 days 00:55:15
1        0 days 01:26:16
2        0 days 04:51:31
3        0 days 07:45:14
4        0 days 03:27:02
               ...
300693               NaT
300694   0 days 02:00:31
300695   0 days 03:07:17
300696   0 days 04:05:33
300697   0 days 04:08:49
Name: Request_Closing_Time, Length: 300698, dtype: timedelta64[ns]
```

In [24]:

```
#Num of Complaints closed after Due Date
data_311['Due Date'] = data_311['Due Date'].astype('datetime64[ns]')
over_time = data_311[data_311['Due Date']<data_311['Closed Date']]['Unique Key'].count()
less_time = data_311[data_311['Due Date']>data_311['Closed Date']]['Unique Key'].count()
same_time = data_311[data_311['Due Date']==data_311['Closed Date']]['Unique Key'].count()
not_closed = data_311['Closed Date'].isnull().sum()
times = np.array([over_time,less_time,same_time,not_closed])
names = np.array(['over_time','less_time','same_time','not_closed'])
times = pd.Series(times)
names = pd.Series(names)
dataframe = pd.DataFrame({'time_taken':names, 'time':times})
dataframe
```

Out[24]:

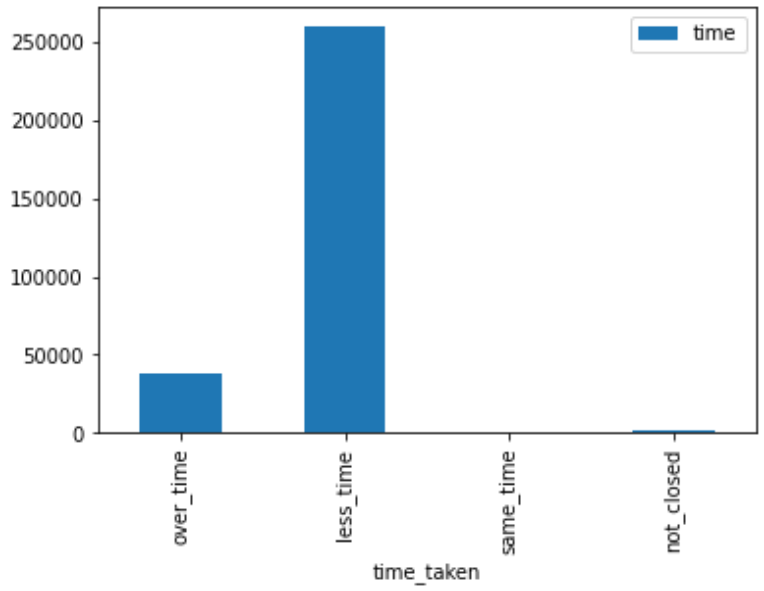
| | time_taken | time |
|---|---|---|
| **0** | over_time | 38580 |
| **1** | less_time | 259892 |
| **2** | same_time | 61 |
| **3** | not_closed | 2164 |

In [26]:

```
dataframe.plot(kind='bar',x='time_taken')
```

Out[26]:

```
<AxesSubplot:xlabel='time_taken'>
```

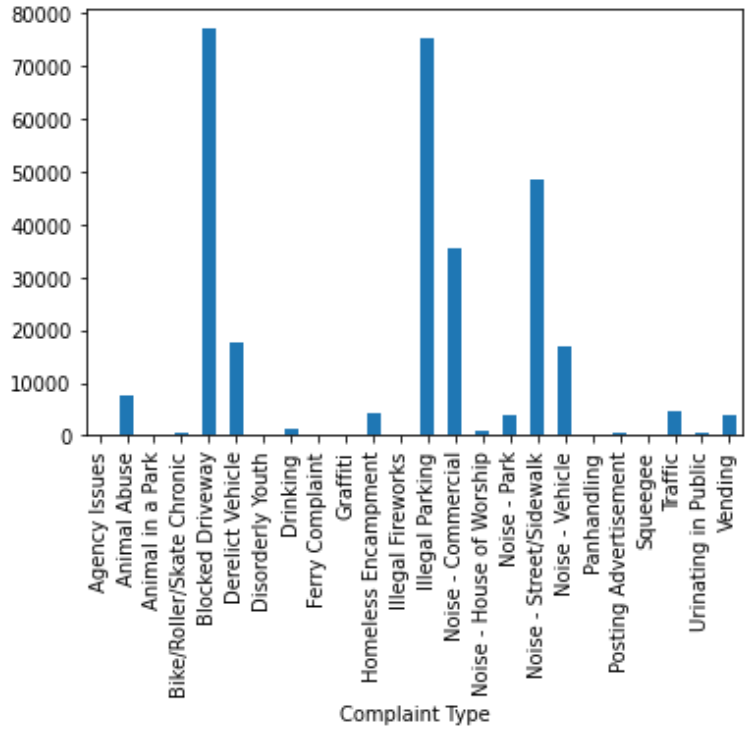


In [28]:

```
data_311.groupby('Complaint Type')['Unique Key'].count().plot(kind='bar')
```

Out[28]:

```
<AxesSubplot:xlabel='Complaint Type'>
```

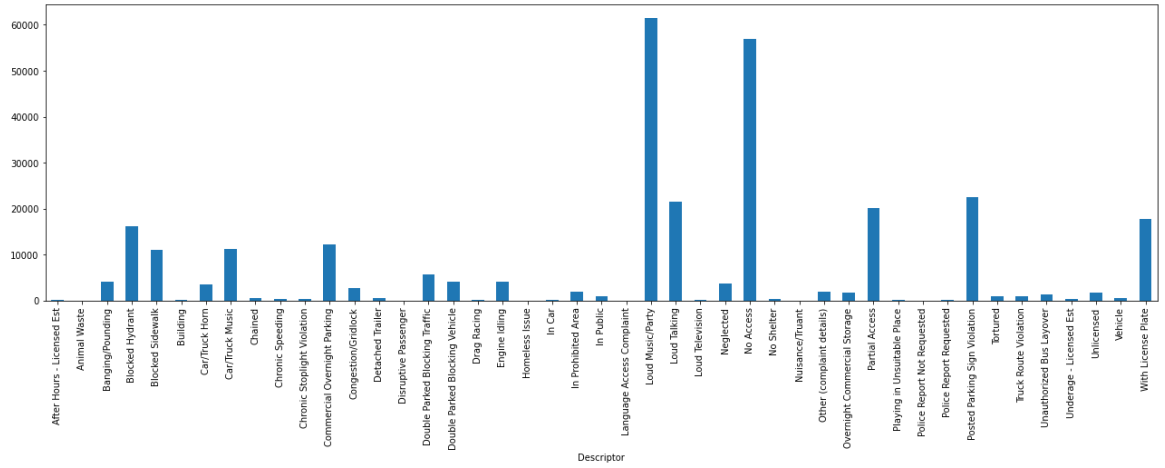


In [30]:

```
data_311.groupby('Descriptor')['Unique Key'].count().plot(kind='bar',figsize=[22,6])
```

Out[30]:

```
<AxesSubplot:xlabel='Descriptor'>
```




In [31]:

```
data_311.groupby('Status')['Status'].agg('count')
```

Out[31]:

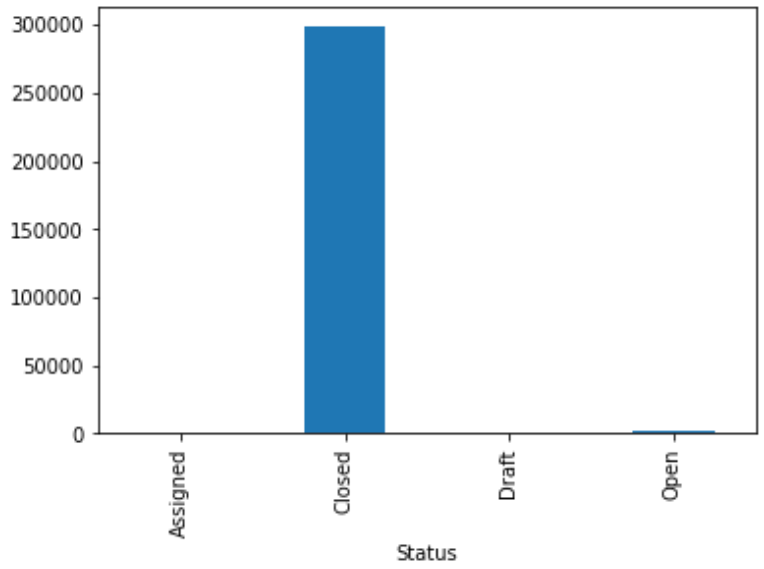
```
Status
Assigned       786
Closed      298471
Draft            2
Open          1439
Name: Status, dtype: int64
```

In [32]:

```
data_311.groupby('Status')['Status'].agg('count').plot(kind='bar')
```

Out[32]:

```
<AxesSubplot:xlabel='Status'>
```



In [33]:

```
data_311.groupby('Location Type')['Unique Key'].count()
```

Out[33]:

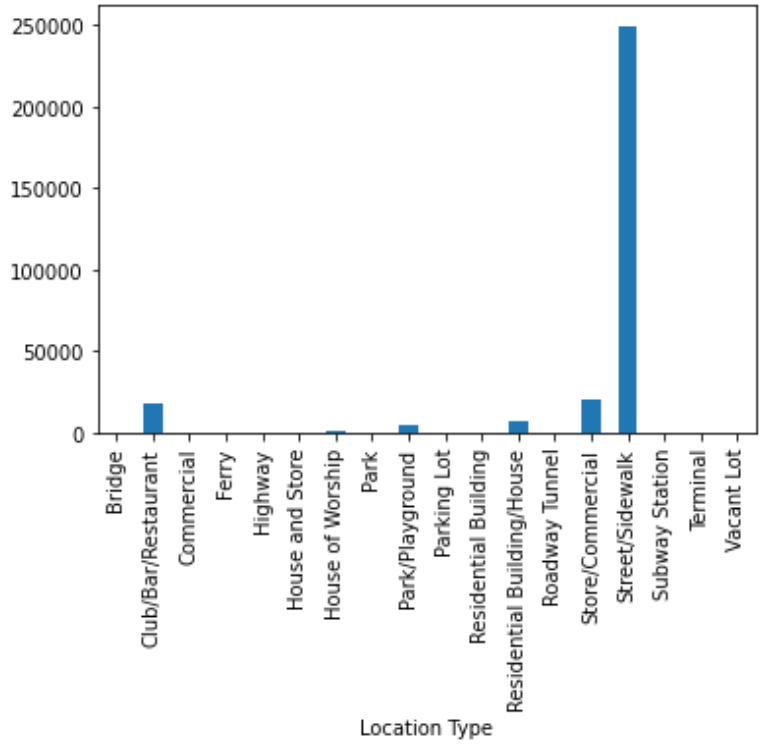
```
Location Type
Bridge                          2
Club/Bar/Restaurant         17360
Commercial                     62
Ferry                           1
Highway                       215
House and Store                93
House of Worship              929
Park                            1
Park/Playground              4773
Parking Lot                   117
Residential Building          227
Residential Building/House   6960
Roadway Tunnel                 35
Store/Commercial            20381
Street/Sidewalk            249299
Subway Station                 34
Terminal                        1
Vacant Lot                     77
Name: Unique Key, dtype: int64
```

In [34]:

```
data_311.groupby('Location Type')['Unique Key'].count().plot(kind='bar')
```

Out[34]:

```
<AxesSubplot:xlabel='Location Type'>
```



In [40]:

```
#convert Request_Closing_Time to mins
data_311['Request_Closing_Time'] = data_311['Request_Closing_Time'].astype('timedelta64
[m]')
```

In [41]:

```
data_311['Request_Closing_Time']
```

Out[41]:

```
0          55.0
1          86.0
2         291.0
3         465.0
4         207.0
          ...
300693      NaN
300694    120.0
300695    187.0
300696    245.0
300697    248.0
Name: Request_Closing_Time, Length: 300698, dtype: float64
```

In [42]:

```
data_311.groupby('Location Type')['Request_Closing_Time'].agg('mean').sort_values()
```

Out[42]:

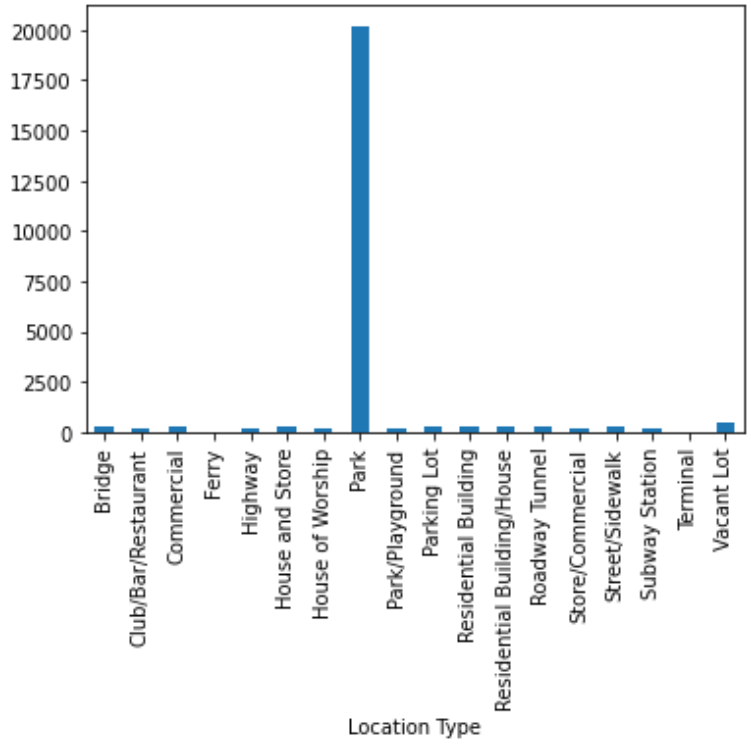
```
Location Type
Subway Station                  141.970588
Club/Bar/Restaurant             185.769954
House of Worship                191.523193
Store/Commercial                197.783035
Park/Playground                 206.836876
Highway                         223.074766
Bridge                          229.000000
Roadway Tunnel                  266.085714
Street/Sidewalk                 268.211355
Residential Building            288.775330
House and Store                 300.462366
Residential Building/House      309.203222
Parking Lot                     319.863248
Commercial                      320.193548
Vacant Lot                      448.103896
Park                          20210.000000
Ferry                                  NaN
Terminal                               NaN
Name: Request_Closing_Time, dtype: float64
```

In [43]:

```
data_311.groupby('Location Type')['Request_Closing_Time'].agg('mean').plot(kind='bar')
```

Out[43]:

```
<AxesSubplot:xlabel='Location Type'>
```

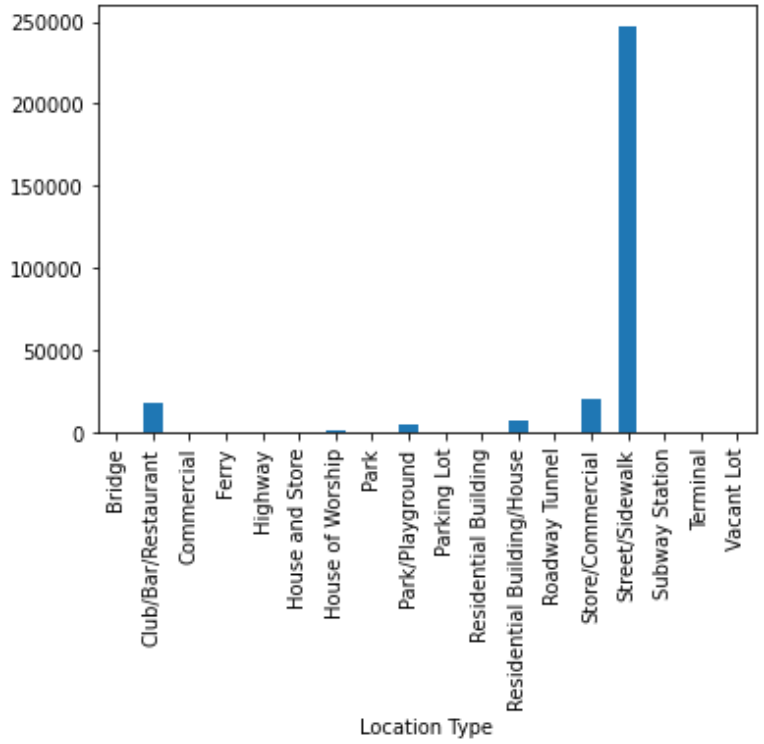


In [45]:

```
data_311.groupby('Location Type')['Request_Closing_Time'].agg('count').plot(kind='bar')
```

Out[45]:

```
<AxesSubplot:xlabel='Location Type'>
```




Complaint Type and Request_Closing_Time are related

In [46]:

```
data_311.groupby('Complaint Type')['Request_Closing_Time'].agg('mean')
```

Out[46]:

```
Complaint Type
Agency Issues                  315.333333
Animal Abuse                   312.489830
Animal in a Park             20210.000000
Bike/Roller/Skate Chronic      225.693396
Blocked Driveway               284.148041
Derelict Vehicle               441.542756
Disorderly Youth               213.167832
Drinking                       231.391373
Ferry Complaint                       NaN
Graffiti                       428.752212
Homeless Encampment            261.637908
Illegal Fireworks              165.470238
Illegal Parking                269.762894
Noise - Commercial             188.524272
Noise - House of Worship       191.287406
Noise - Park                   204.343859
Noise - Street/Sidewalk        206.415509
Noise - Vehicle                215.038220
Panhandling                    262.072131
Posting Advertisement          118.251543
Squeegee                       242.500000
Traffic                        206.614991
Urinating in Public            217.302365
Vending                        240.524901
Name: Request_Closing_Time, dtype: float64
```

In [47]:

```
df = data_311[['Complaint Type', 'Request_Closing_Time']].sort_values(by='Complaint Type'
).reset_index().drop('index',axis=1)
df.columns = ['Complaint_Type','Request_Closing_Time']
df
```

Out[47]:

| | Complaint_Type | Request_Closing_Time |
|---|---|---|
| **0** | Agency Issues | 67.0 |
| **1** | Agency Issues | 623.0 |
| **2** | Agency Issues | 162.0 |
| **3** | Agency Issues | 452.0 |
| **4** | Agency Issues | 177.0 |
| **...** | ... | ... |
| **300693** | Vending | 17.0 |
| **300694** | Vending | 19.0 |
| **300695** | Vending | 137.0 |
| **300696** | Vending | 68.0 |
| **300697** | Vending | 128.0 |

300698 rows × 2 columns

In [48]:

```
import statsmodels.api as sm
from statsmodels.formula.api import ols

lm = ols('Request_Closing_Time ~ Complaint_Type',data=df).fit()
table = sm.stats.anova_lm(lm)
print(table)
```

```
                     df        sum_sq       mean_sq           F  PR(>F)
Complaint_Type      23.0  1.455041e+09  6.326263e+07  491.829393     0.0
Residual        298511.0  3.839663e+10  1.286272e+05         NaN     NaN
```

Ho = Complaint Type and Location Type are not related.

H1 = Complaint Type and Location Type are related

In [50]:

```
df1 = data_311[pd.notnull(data_311['Location Type'])]
df2 = df1[['Complaint Type', 'Location Type']].sort_values(by='Complaint Type').reset_ind
ex().drop('index',axis=1)
df2
```

Out[50]:

| | Complaint Type | Location Type |
|---|---|---|
| **0** | Animal Abuse | Residential Building/House |
| **1** | Animal Abuse | Residential Building/House |
| **2** | Animal Abuse | Residential Building/House |
| **3** | Animal Abuse | Residential Building/House |
| **4** | Animal Abuse | Residential Building/House |
| **...** | ... | ... |
| **300562** | Vending | Street/Sidewalk |
| **300563** | Vending | Store/Commercial |
| **300564** | Vending | Street/Sidewalk |
| **300565** | Vending | Residential Building/House |
| **300566** | Vending | Street/Sidewalk |

300567 rows × 2 columns

In [51]:

```
data_crosstab = pd.crosstab(df2['Complaint Type'], df2['Location Type'], margins = False)
from scipy.stats import chi2_contingency
g,p,dof,expctd = chi2_contingency(data_crosstab)
g,p
```

Out[51]:

```
(1638407.580569627, 0.0)
```

In [ ]:

```

```