trip_mode_split_visualization

November 8, 2019

[1]:
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
sns.set(style="darkgrid")
%matplotlib inline
import math
```

[2]:
```
activities = pd.read_csv('activities_dataframe.csv', index_col=False)
activities = activities.set_index(['person_id', 'act_num']).fillna(0).
 ↪drop('Unnamed: 0', 1)
activities['act_start_time'] = activities['act_start_time'].astype(str)
activities['act_end_time'] = activities['act_end_time'].astype(str)
activities['act_start_time'] = activities['act_start_time'].replace('0', '00:00:
 ↪00')
activities['act_end_time'] = activities['act_end_time'].replace('0', '00:00:00')
activities.head()
```

[2]:

		act_type	act_nearest_link	\
person_id	act_num			
010100-2012000073297-0-813746	1	Home	20972	
	2	Work	78866	
	3	Home	20972	
010100-2012000073297-0-813747	1	Home	20972	
	2	Shopping	32192	

		act_start_time	act_end_time
person_id	act_num		
010100-2012000073297-0-813746	1	00:00:00	08:18:00
	2	08:26:40	19:04:00
	3	19:12:44	00:00:00
010100-2012000073297-0-813747	1	00:00:00	14:19:00
	2	14:21:47	23:09:00

[3]:
```
a = pd.read_csv('trips_dataframe.csv', index_col=False)
a['planned_mode'].value_counts().nlargest(n=10)
```

[3]:
```
car              125558
ride_hail           672
```

```
walk_transit        662
drive_transit         4
Name: planned_mode, dtype: int64
```

[4]:
```
trips = pd.read_csv('trips_dataframe.csv', index_col=False)
trips = trips.set_index(['person_id', 'dest_act_num']).drop(['Unnamed: 0',
                                                             'cost',␣
 ↪'realized_mode',
                                                             'incentive',
                                                             'simulation_id'],␣
 ↪axis=1)
trips['trip_duration'] = trips['trip_end'].sub(trips['trip_start'], axis = 0)
trips = trips.drop(['025900-2014000086688-0-3490800',␣
 ↪'025900-2013001118097-0-2601636']) # two invalid rows

trips['planned_mode'] = trips['planned_mode'].replace("walk_transit", "transit")
trips['planned_mode'] = trips['planned_mode'].replace("drive_transit",␣
 ↪"transit")

trips['depart_hour'] = trips['trip_start'].apply(lambda x: x/3600).round(0) #␣
 ↪calculating departing hour
trips['planned_mode'] = trips['planned_mode'].fillna("walk") # replace null␣
 ↪values to "walk"

trips['dist_interval(km)'] = trips['distance'].apply(lambda x: x/1000).round(0)
trips.sample(n=5)
```

```
/Users/admin/anaconda3/lib/python3.7/site-packages/pandas/core/generic.py:3812:
PerformanceWarning: dropping on a non-lexsorted multi-index without a level
parameter may impact performance.
  new_axis = axis.drop(labels, errors=errors)
```

[4]:

person_id	dest_act_num	trip_num	orig_act_num	trip_start	trip_end	distance
020600-2014000677121-0-7558634	3	2	2	61620	61707	1591.400
015600-2016000158622-0-942928	6	5	5	75840	76085	5790.477
025800-2012001385840-0-1965743	3	2	2	37080	37535	10070.628
023001-2015000163897-0-7312788	2	1	1	26820	27092	5453.868
030202-2012000074862-0-2730930	2	1	1	29700	30131	9238.105

```
                                                planned_mode  trip_duration  \
person_id                       dest_act_num
020600-2014000677121-0-7558634 3                         car             87
015600-2016000158622-0-942928  6                         car            245
025800-2012001385840-0-1965743 3                         car            455
023001-2015000163897-0-7312788 2                         car            272
030202-2012000074862-0-2730930 2                         car            431

                                                depart_hour  dist_interval(km)
person_id                       dest_act_num
020600-2014000677121-0-7558634 3                       17.0                2.0
015600-2016000158622-0-942928  6                       21.0                6.0
025800-2012001385840-0-1965743 3                       10.0               10.0
023001-2015000163897-0-7312788 2                        7.0                5.0
030202-2012000074862-0-2730930 2                        8.0                9.0
```

[5]:
```
trips['trip_duration'].describe()
```

[5]:
```
count    127755.000000
mean        275.442488
std         321.407356
min           1.000000
25%         148.000000
50%         223.000000
75%         336.000000
max       22214.000000
Name: trip_duration, dtype: float64
```

[6]:
```
trips['planned_mode'].value_counts().nlargest(n=10)
```

[6]:
```
car          125558
walk            859
ride_hail       672
transit         666
Name: planned_mode, dtype: int64
```

[7]:
```
df = trips.merge(activities, left_index = True, right_on=['person_id',␣
↪'act_num']).drop(['act_start_time', 'act_end_time'], axis=1)
df.head()
```

[7]:
```
                                        trip_num  orig_act_num  trip_start  \
person_id                       act_num
045100-2013000757209-0-1960261 2               1             1       18000
                               3               2             2       74460
013400-2014000660557-0-4882674 2               1             1       18000
                               3               2             2       74580
045200-2016000479692-0-4885314 2               1             1       18000

                                        trip_end  distance planned_mode  \
```

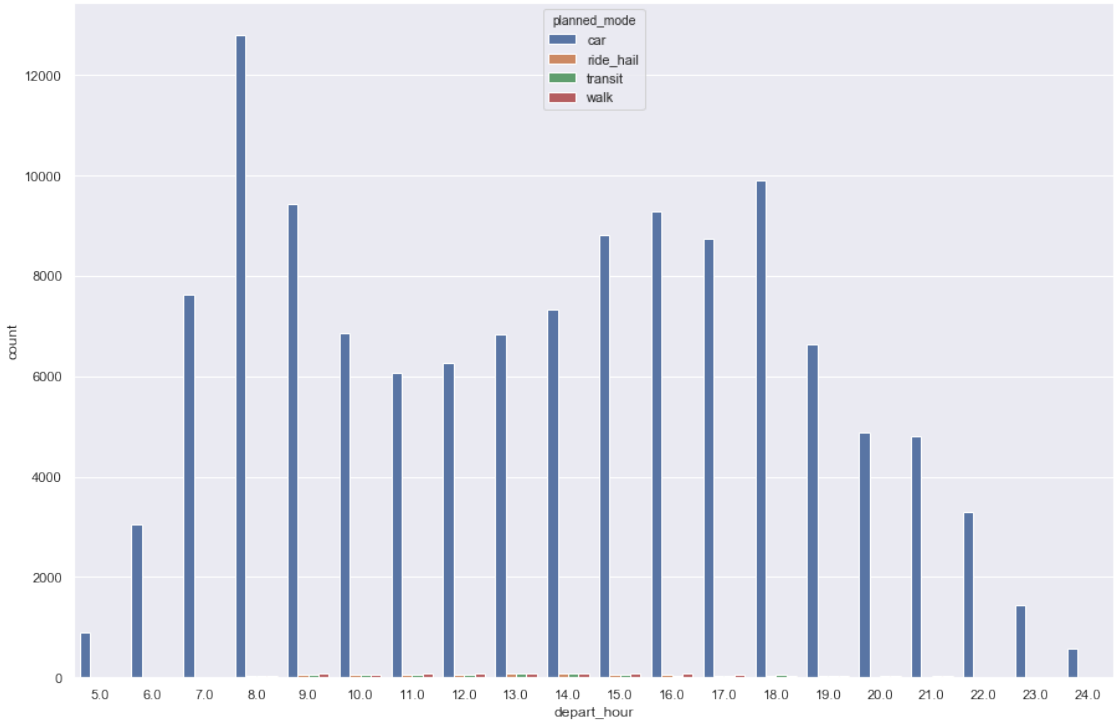
```
person_id                          act_num
045100-2013000757209-0-1960261 2           18293  6537.952          car
                               3           74768  6592.506          car
013400-2014000660557-0-4882674 2           18372  7659.778          car
                               3           74963  7481.115          car
045200-2016000479692-0-4885314 2           18293  6537.952          car

                                        trip_duration  depart_hour  \
person_id                          act_num
045100-2013000757209-0-1960261 2                  293          5.0
                               3                  308         21.0
013400-2014000660557-0-4882674 2                  372          5.0
                               3                  383         21.0
045200-2016000479692-0-4885314 2                  293          5.0

                                        dist_interval(km) act_type  \
person_id                          act_num
045100-2013000757209-0-1960261 2                    7.0     Work
                               3                    7.0     Home
013400-2014000660557-0-4882674 2                    8.0     Work
                               3                    7.0     Home
045200-2016000479692-0-4885314 2                    7.0     Work

                                        act_nearest_link
person_id                          act_num
045100-2013000757209-0-1960261 2                  67140
                               3                  91618
013400-2014000660557-0-4882674 2                   5130
                               3                  33272
045200-2016000479692-0-4885314 2                  67140
```

[8]:
```
df['planned_mode'].value_counts().nlargest(n=10)
```

[8]:
```
car          125558
walk            859
ride_hail       672
transit         666
Name: planned_mode, dtype: int64
```

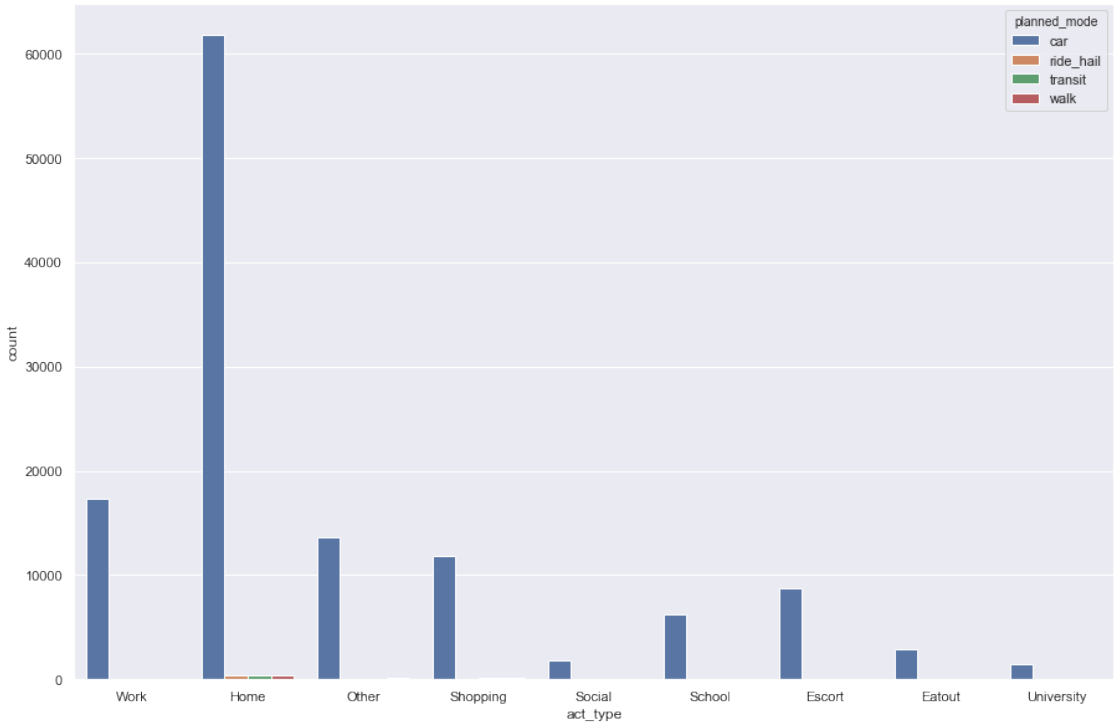
[9]:
```
plt.figure(figsize=(15, 10))
sns.countplot(x='depart_hour', hue='planned_mode', data=df)
```

[9]:
```
<matplotlib.axes._subplots.AxesSubplot at 0xa21057cf8>
```



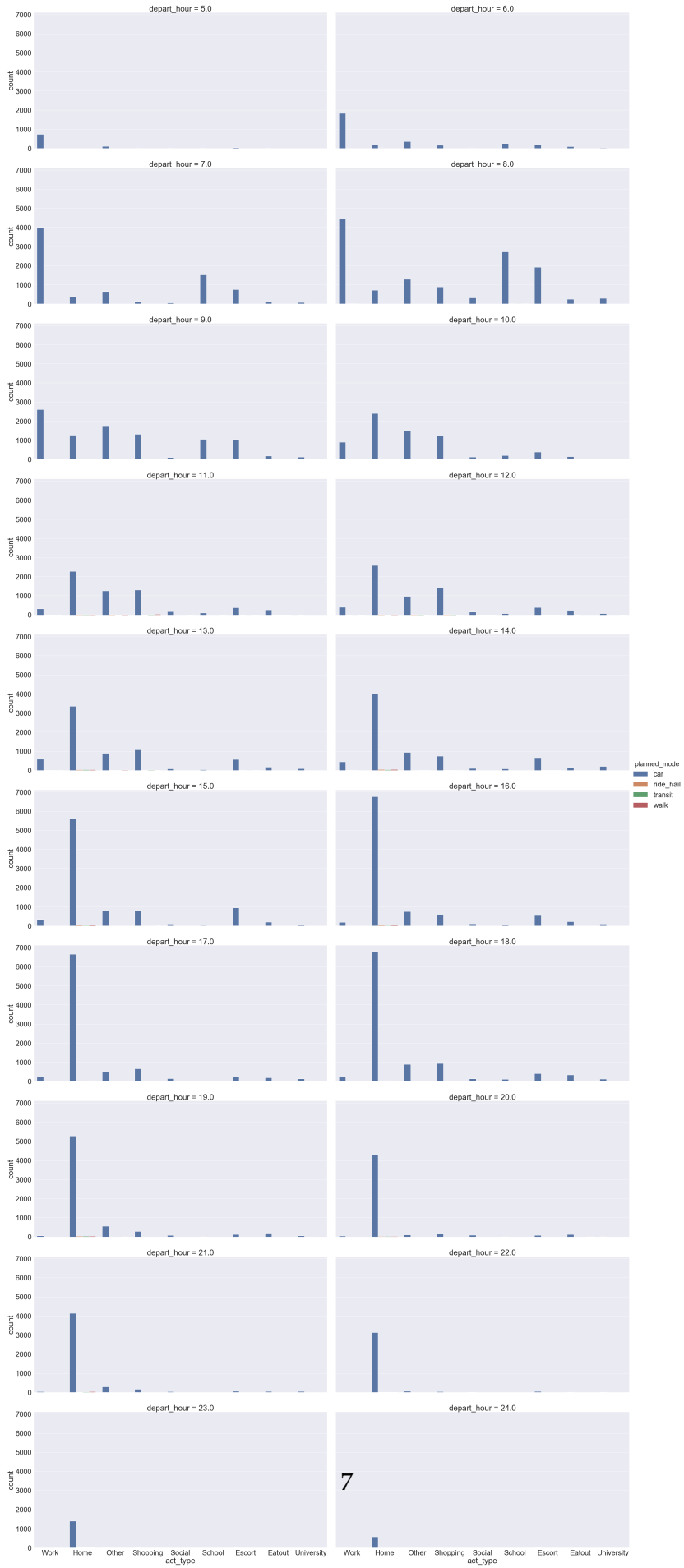
[10]:
```
plt.figure(figsize=(15, 10))
sns.countplot(x='act_type', hue='planned_mode', data=df)
```

[10]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x1a223df400>
```



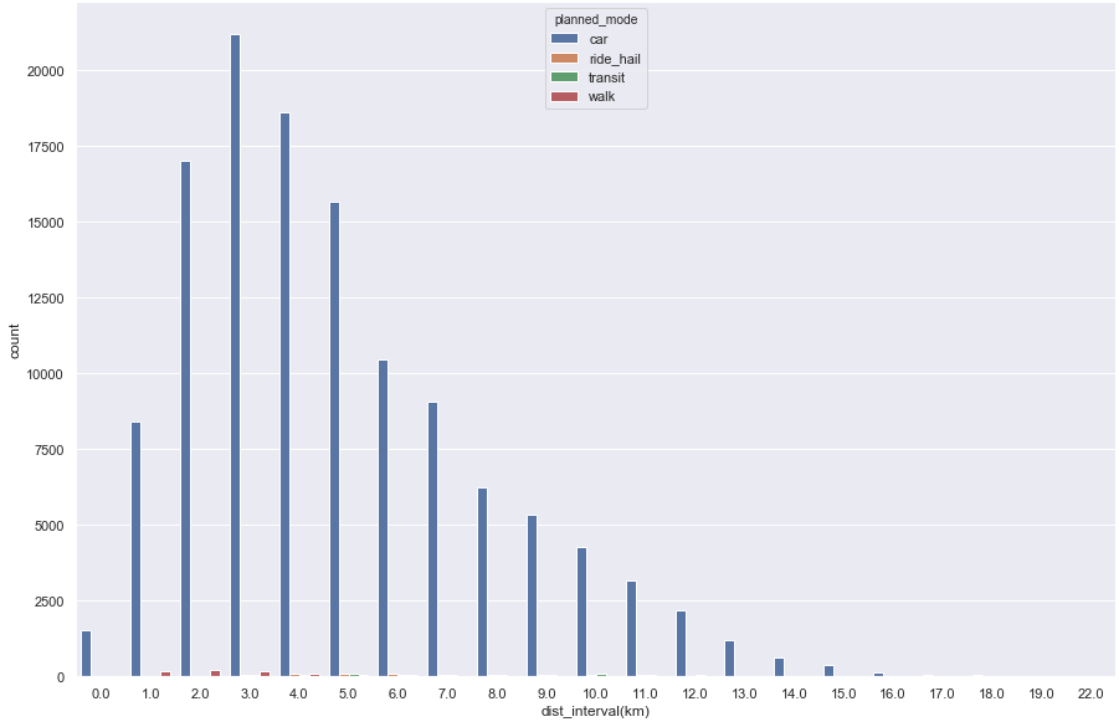
[11]:
```
sns.set(font_scale=3)
sns.catplot(x='act_type', hue='planned_mode', col='depart_hour', kind='count',␣
 ↪data=df, height=10, aspect=2, col_wrap=2)
```

[11]:
```
<seaborn.axisgrid.FacetGrid at 0x1a22a285c0>
```


depart_hour = 5.0
depart_hour = 6.0
depart_hour = 7.0
depart_hour = 8.0
depart_hour = 9.0
depart_hour = 10.0
depart_hour = 11.0
depart_hour = 12.0
depart_hour = 13.0
depart_hour = 14.0
depart_hour = 15.0
depart_hour = 16.0
depart_hour = 17.0
depart_hour = 18.0
depart_hour = 19.0
depart_hour = 20.0
depart_hour = 21.0
depart_hour = 22.0
depart_hour = 23.0
depart_hour = 24.0
count
0
1000
2000
3000
4000
5000
6000
7000
Work
Home
Other
Shopping
Social
School
Escort
Eatout
University
act_type
planned_mode
car
ride_hail
transit
walk

[12]:
```
sns.set(font_scale=1)
plt.figure(figsize=(15, 10))
sns.countplot(x='dist_interval(km)', hue='planned_mode', data=df)
```

[12]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x1a22a7b0f0>
```



==========

0.0.1 Mode mapping

[13]:
```
network = pd.read_csv('network.csv')
network_link = network[['linkId', 'fromLocationX', 'fromLocationY']]
```

[14]:
```
# convert helper function to produce the link df for graphing
def convert(df):
    new_df = df['act_nearest_link'].value_counts().to_frame().reset_index().\
    rename(columns={'index':'linkId', 'act_nearest_link': 'size', 'depart_hour':
 ↪ 'depart_hour'}).\
    join(network_link.set_index('linkId'), 'linkId').set_index('linkId')
    return new_df
```

[15]:
```
df.head()
```

[15]:
```
                                        trip_num  orig_act_num  trip_start  \
person_id                       act_num
045100-2013000757209-0-1960261  2              1             1       18000
                                3              2             2       74460
013400-2014000660557-0-4882674  2              1             1       18000
                                3              2             2       74580
045200-2016000479692-0-4885314  2              1             1       18000

                                        trip_end  distance planned_mode  \
person_id                       act_num
045100-2013000757209-0-1960261  2          18293  6537.952          car
                                3          74768  6592.506          car
013400-2014000660557-0-4882674  2          18372  7659.778          car
                                3          74963  7481.115          car
045200-2016000479692-0-4885314  2          18293  6537.952          car

                                        trip_duration  depart_hour  \
person_id                       act_num
045100-2013000757209-0-1960261  2                 293          5.0
                                3                 308         21.0
013400-2014000660557-0-4882674  2                 372          5.0
                                3                 383         21.0
045200-2016000479692-0-4885314  2                 293          5.0

                                        dist_interval(km) act_type  \
person_id                       act_num
045100-2013000757209-0-1960261  2                     7.0     Work
                                3                     7.0     Home
013400-2014000660557-0-4882674  2                     8.0     Work
                                3                     7.0     Home
045200-2016000479692-0-4885314  2                     7.0     Work

                                        act_nearest_link
person_id                       act_num
045100-2013000757209-0-1960261  2                  67140
                                3                  91618
013400-2014000660557-0-4882674  2                   5130
                                3                  33272
045200-2016000479692-0-4885314  2                  67140
```

[16]:
```
# clear the double index from the df used above, since we only need the link info, depart time for time periods,
# and planned_mode for the demand visualization, drop all other columns

mode_to_link = df[['act_nearest_link', 'depart_hour', 'planned_mode']].reset_index()
#.reset_index().set_index('act_nearest_link')
```

```
mode_to_link = mode_to_link.drop(['person_id', 'act_num'], axis = 1)
mode_to_link.head()
```

[16]:

	act_nearest_link	depart_hour	planned_mode
0	67140	5.0	car
1	91618	21.0	car
2	5130	5.0	car
3	33272	21.0	car
4	67140	5.0	car

[17]:
```
# per your request, and also by the fact that each link doesn't associate to a␣
 ↪mode one-to-one(ly)
# I chose to seperate the modes and further seperate them by the hours used␣
 ↪from the demand mapping
# * like last time, the time range is based on the departing time

car = mode_to_link.loc[mode_to_link['planned_mode'] == 'car']
transit = mode_to_link.loc[mode_to_link['planned_mode'] == 'transit']
walk = mode_to_link.loc[mode_to_link['planned_mode'] == 'walk']
ride_hail = mode_to_link.loc[mode_to_link['planned_mode'] == 'ride_hail']
```

[18]:
```
car_early_morning_mode = convert(car[(car['depart_hour'] >= 0) &␣
 ↪(car['depart_hour'] < 6)])
car_am_peak_mode = convert(car[(car['depart_hour'] >= 6) & (car['depart_hour']␣
 ↪< 9)])
car_mid_day_mode = convert(car[(car['depart_hour'] >= 9) & (car['depart_hour']␣
 ↪< 16)])
car_pm_peak_mode = convert(car[(car['depart_hour'] >= 16) & (car['depart_hour']␣
 ↪< 19)])
car_night_mode = convert(car[(car['depart_hour'] >= 19)])
```

[19]:
```
transit_early_morning_mode = convert(transit[(transit['depart_hour'] >= 0) &␣
 ↪(transit['depart_hour'] < 6)])
transit_am_peak_mode = convert(transit[(transit['depart_hour'] >= 6) &␣
 ↪(transit['depart_hour'] < 9)])
transit_mid_day_mode = convert(transit[(transit['depart_hour'] >= 9) &␣
 ↪(transit['depart_hour'] < 16)])
transit_pm_peak_mode = convert(transit[(transit['depart_hour'] >= 16) &␣
 ↪(transit['depart_hour'] < 19)])
transit_night_mode = convert(transit[(transit['depart_hour'] >= 19)])
```

[20]:
```
walk_early_morning_mode = convert(walk[(walk['depart_hour'] >= 0) &␣
 ↪(walk['depart_hour'] < 6)])
walk_am_peak_mode = convert(walk[(walk['depart_hour'] >= 6) &␣
 ↪(walk['depart_hour'] < 9)])
walk_mid_day_mode = convert(walk[(walk['depart_hour'] >= 9) &␣
 ↪(walk['depart_hour'] < 16)])
```

```
walk_pm_peak_mode = convert(walk[(walk['depart_hour'] >= 16) &␣
 ↪(walk['depart_hour'] < 19)])
walk_night_mode = convert(walk[(walk['depart_hour'] >= 19)])
```

[21]:
```
ride_hail_early_morning_mode = convert(ride_hail[(ride_hail['depart_hour'] >=␣
 ↪0) & (ride_hail['depart_hour'] < 6)])
ride_hail_am_peak_mode = convert(ride_hail[(ride_hail['depart_hour'] >= 6) &␣
 ↪(ride_hail['depart_hour'] < 9)])
ride_hail_mid_day_mode = convert(ride_hail[(ride_hail['depart_hour'] >= 9) &␣
 ↪(ride_hail['depart_hour'] < 16)])
ride_hail_pm_peak_mode = convert(ride_hail[(ride_hail['depart_hour'] >= 16) &␣
 ↪(ride_hail['depart_hour'] < 19)])
ride_hail_night_mode = convert(ride_hail[(ride_hail['depart_hour'] >= 19)])
```

[22]:
```
car_early_morning_mode.head()

# now this df contains the info we need to plot
    # size of the circle for the demand
    # location x, y
    # ideally, I would perfer to see four different modes on the same plot for␣
 ↪each time period, which (could)
        # give a better visualization of comparison of those demands?
```

[22]:

linkId	size	fromLocationX	fromLocationY
67140	72	550552.467544	4.184258e+06
43278	38	551565.279209	4.180402e+06
32856	28	551631.268344	4.181062e+06
77826	27	546960.500214	4.174605e+06
38054	26	550137.648151	4.182594e+06

[23]:
```
# the overlaying layer of network dots of better geological visual
network_loc = network[['attributeOrigType', 'fromLocationX', 'fromLocationY']]
# git rid of some outlier points for better visual
network_loc = network_loc[(network_loc['fromLocationX'] < 560000) &␣
 ↪(network_loc['fromLocationY'] > 4170000)]
```

==========

0.0.2 Mode: Car

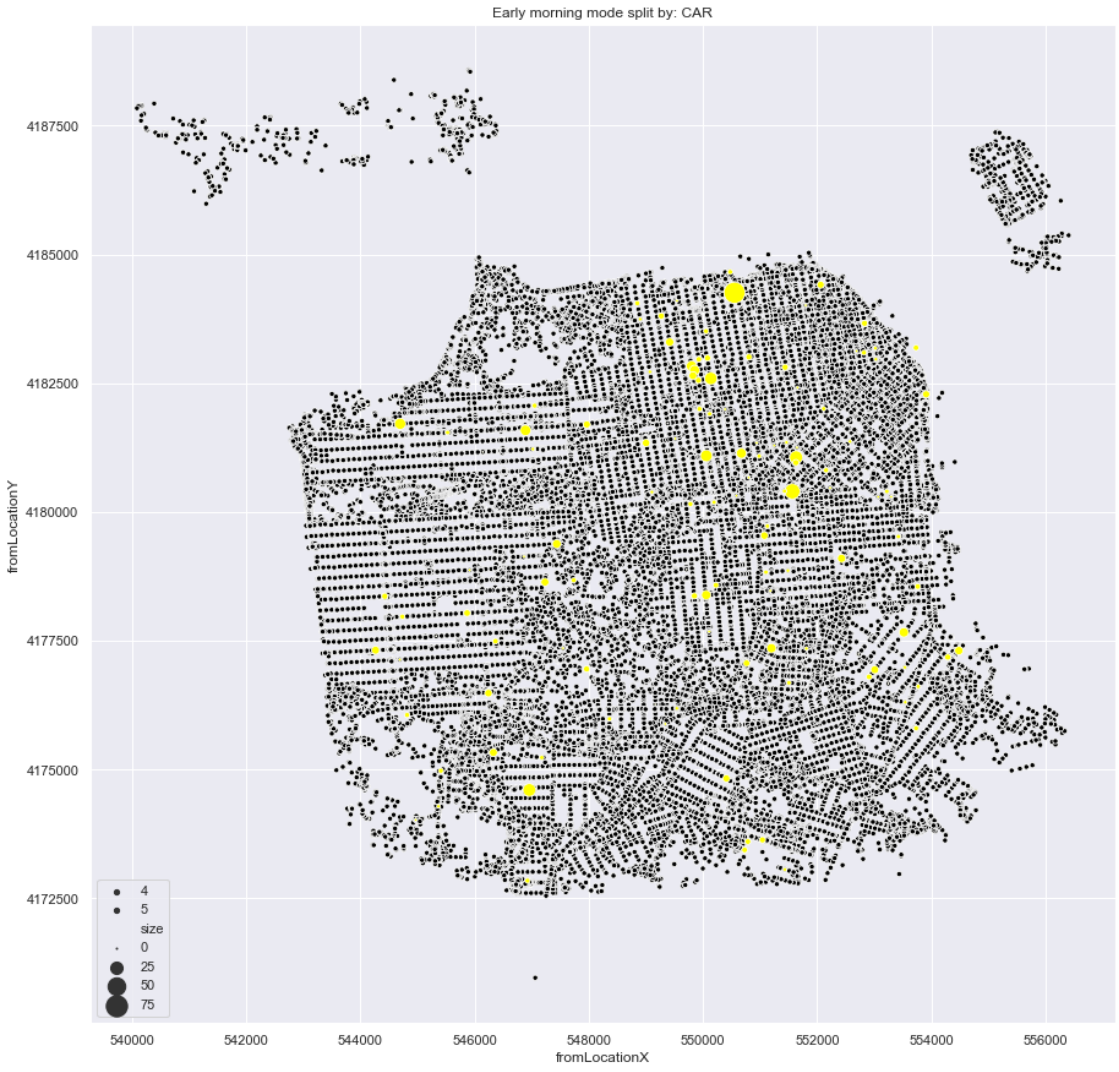
[24]:
```
car_early_morning_mode.sort_values(by=['size'], ascending=False).head()
```

[24]:

linkId	size	fromLocationX	fromLocationY
67140	72	550552.467544	4.184258e+06
43278	38	551565.279209	4.180402e+06
32856	28	551631.268344	4.181062e+06
77826	27	546960.500214	4.174605e+06
38054	26	550137.648151	4.182594e+06

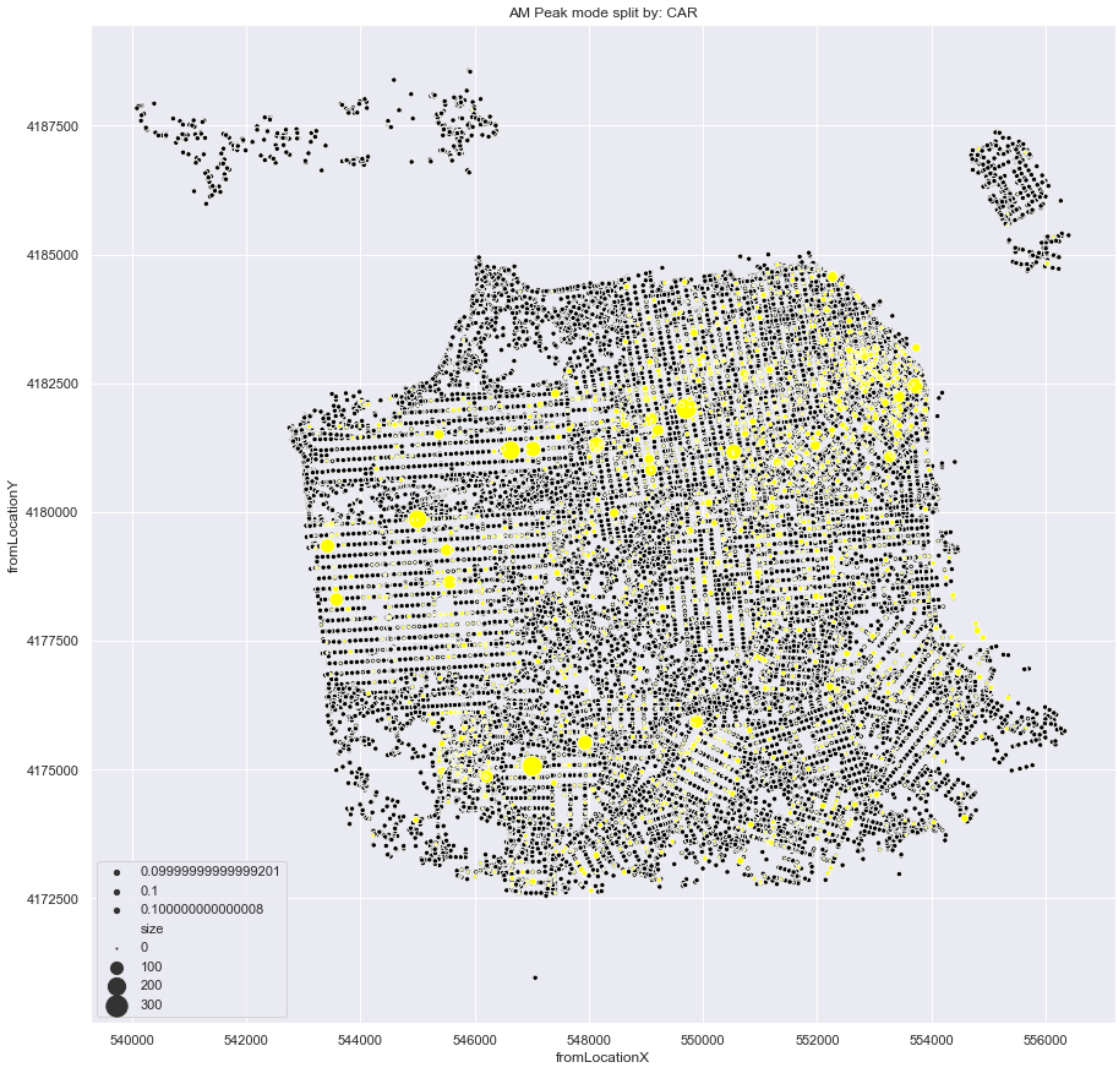
[25]:
```
fig, ax = plt.subplots(figsize=(15, 15))

sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=network_loc, size=5,
                color='black',
                ax=ax)
sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=car_early_morning_mode,
                size='size',
                sizes=(1, 300),
                color='yellow',
                 ax = ax).set_title('Early morning mode split by: CAR')
```

[25]:
```
Text(0.5, 1.0, 'Early morning mode split by: CAR')
```



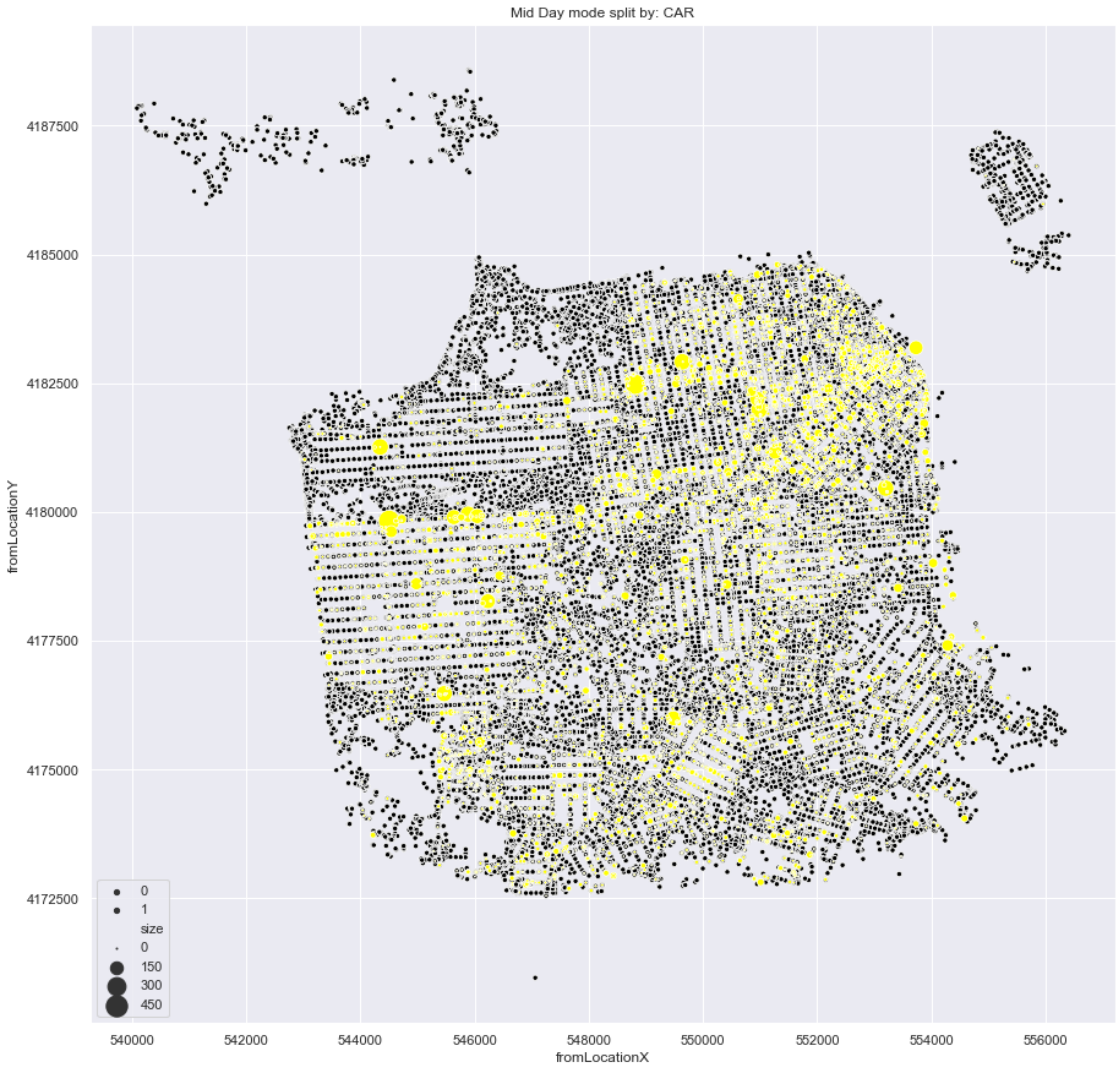
[26]:
```
fig, ax = plt.subplots(figsize=(15, 15))

sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=network_loc, size=0.1,
                color='black',
                ax=ax)
sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=car_am_peak_mode,
                size='size',
                sizes=(1, 300),
                color='yellow',
                 ax = ax).set_title('AM Peak mode split by: CAR')
```

[26]:
```
Text(0.5, 1.0, 'AM Peak mode split by: CAR')
```



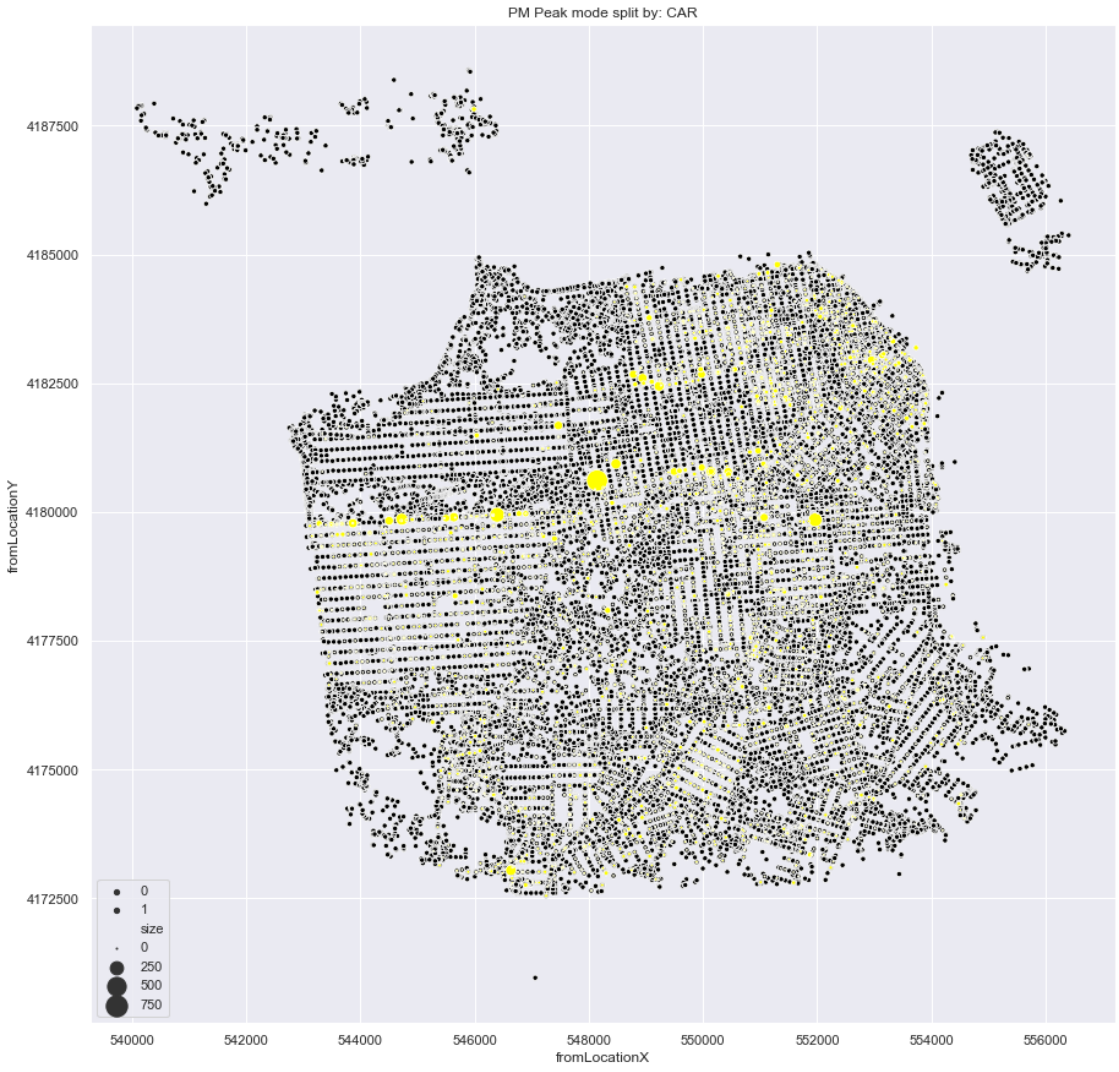
[27]:
```
fig, ax = plt.subplots(figsize=(15, 15))

sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=network_loc, size=1,
                color='black',
                ax=ax)
sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=car_mid_day_mode,
                size='size',
                sizes=(1, 300),
                color='yellow',
                 ax = ax).set_title('Mid Day mode split by: CAR')
```

[27]:
```
Text(0.5, 1.0, 'Mid Day mode split by: CAR')
```



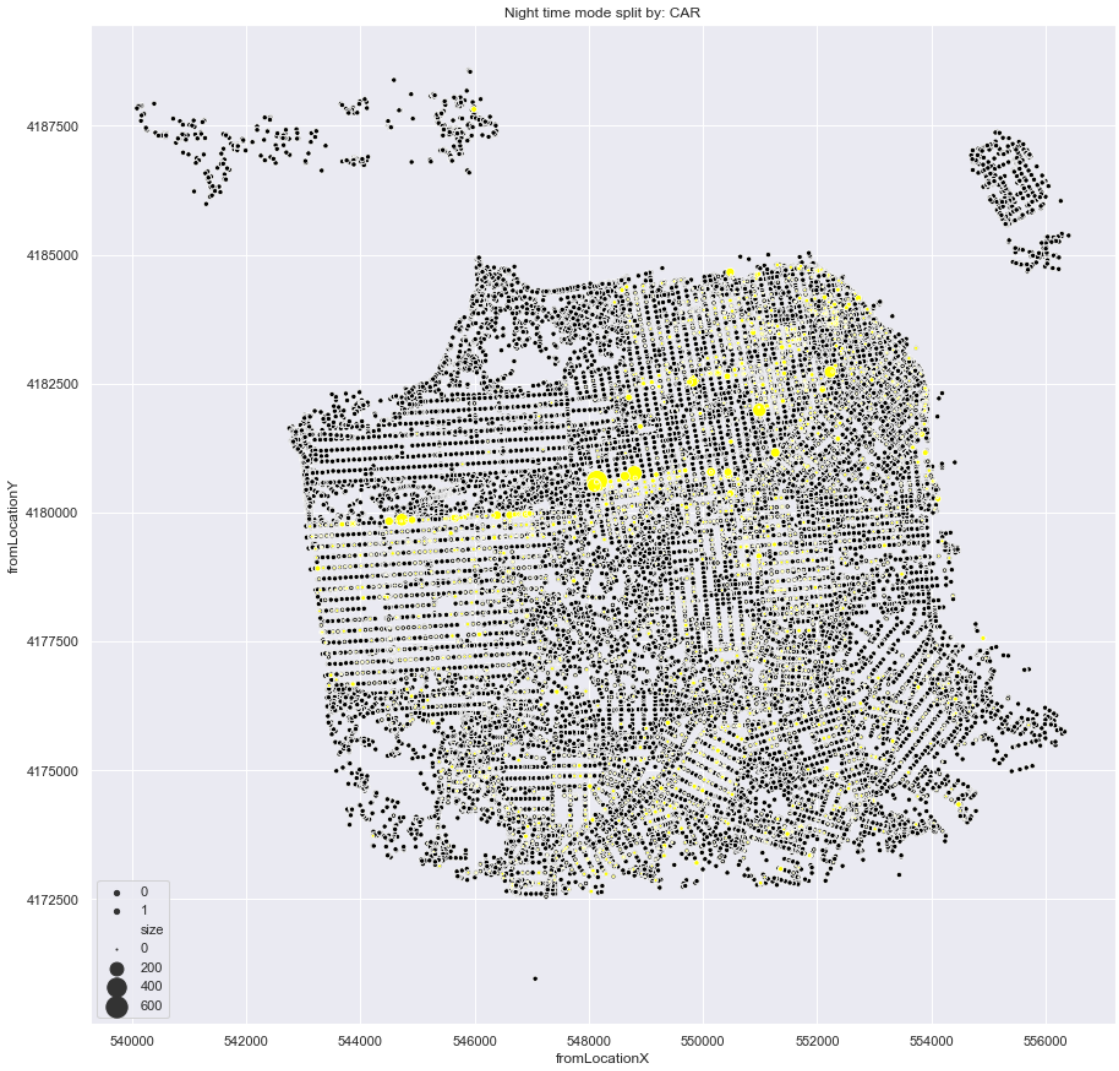
[28]:
```
fig, ax = plt.subplots(figsize=(15, 15))

sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=network_loc, size=1,
                color='black',
                ax=ax)
sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=car_pm_peak_mode,
                size='size',
                sizes=(1, 300),
                color='yellow',
                 ax = ax).set_title('PM Peak mode split by: CAR')
```

[28]:
```
Text(0.5, 1.0, 'PM Peak mode split by: CAR')
```



[29]:
```
fig, ax = plt.subplots(figsize=(15, 15))

sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=network_loc, size=1,
                color='black',
                ax=ax)
sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=car_night_mode,
                size='size',
                sizes=(1, 300),
                color='yellow',
                 ax = ax).set_title('Night time mode split by: CAR')
```

[29]:
```
Text(0.5, 1.0, 'Night time mode split by: CAR')
```

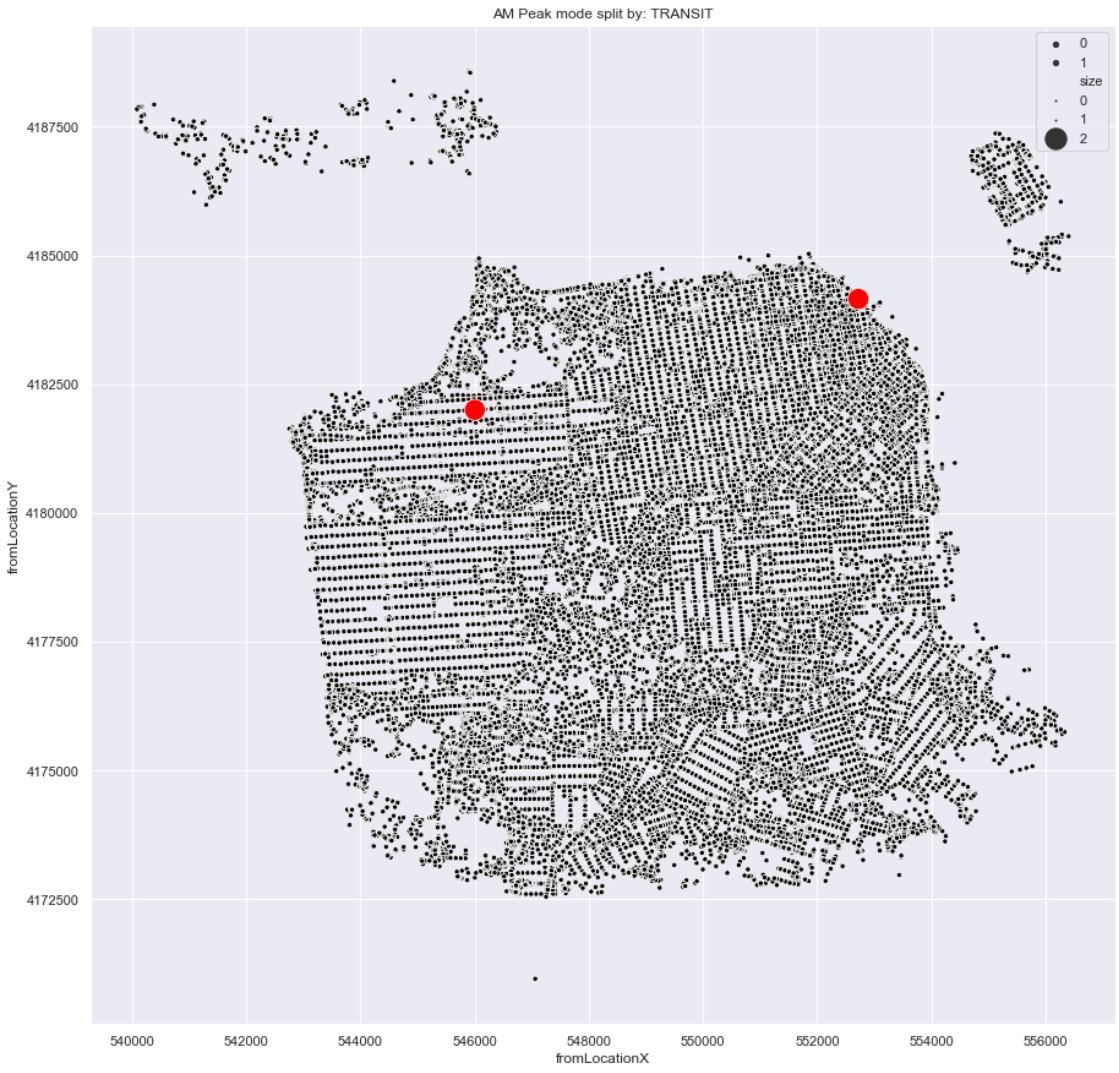


==========

0.0.3 Mode: transit

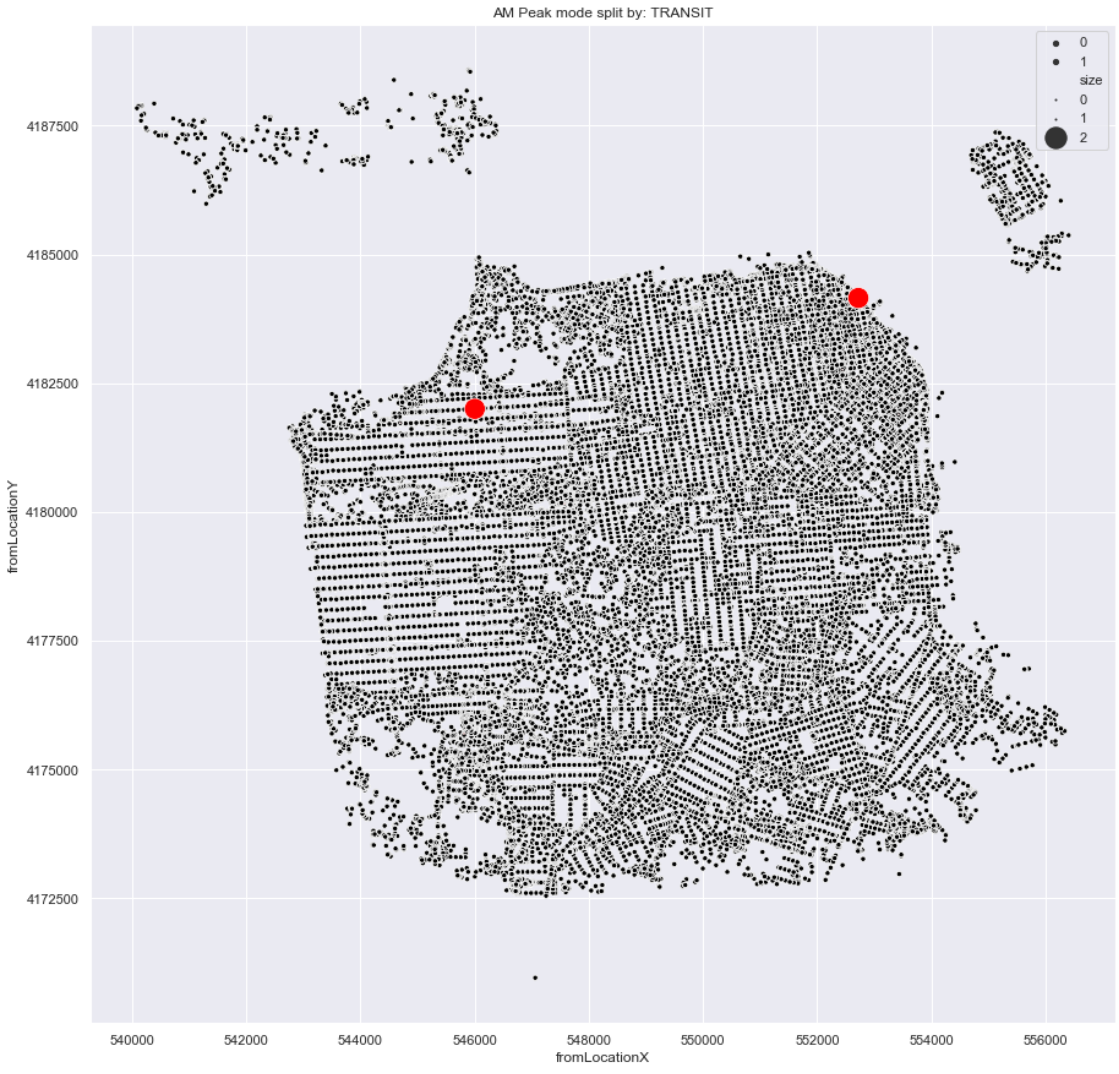
[30]:
```
fig, ax = plt.subplots(figsize=(15, 15))

sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=network_loc, size=1,
                color='black',
                ax=ax)
sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=transit_am_peak_mode,
                size='size',
                sizes=(1, 300),
                color='red',
                 ax = ax).set_title('AM Peak mode split by: TRANSIT')
```

[30]:
```
Text(0.5, 1.0, 'AM Peak mode split by: TRANSIT')
```



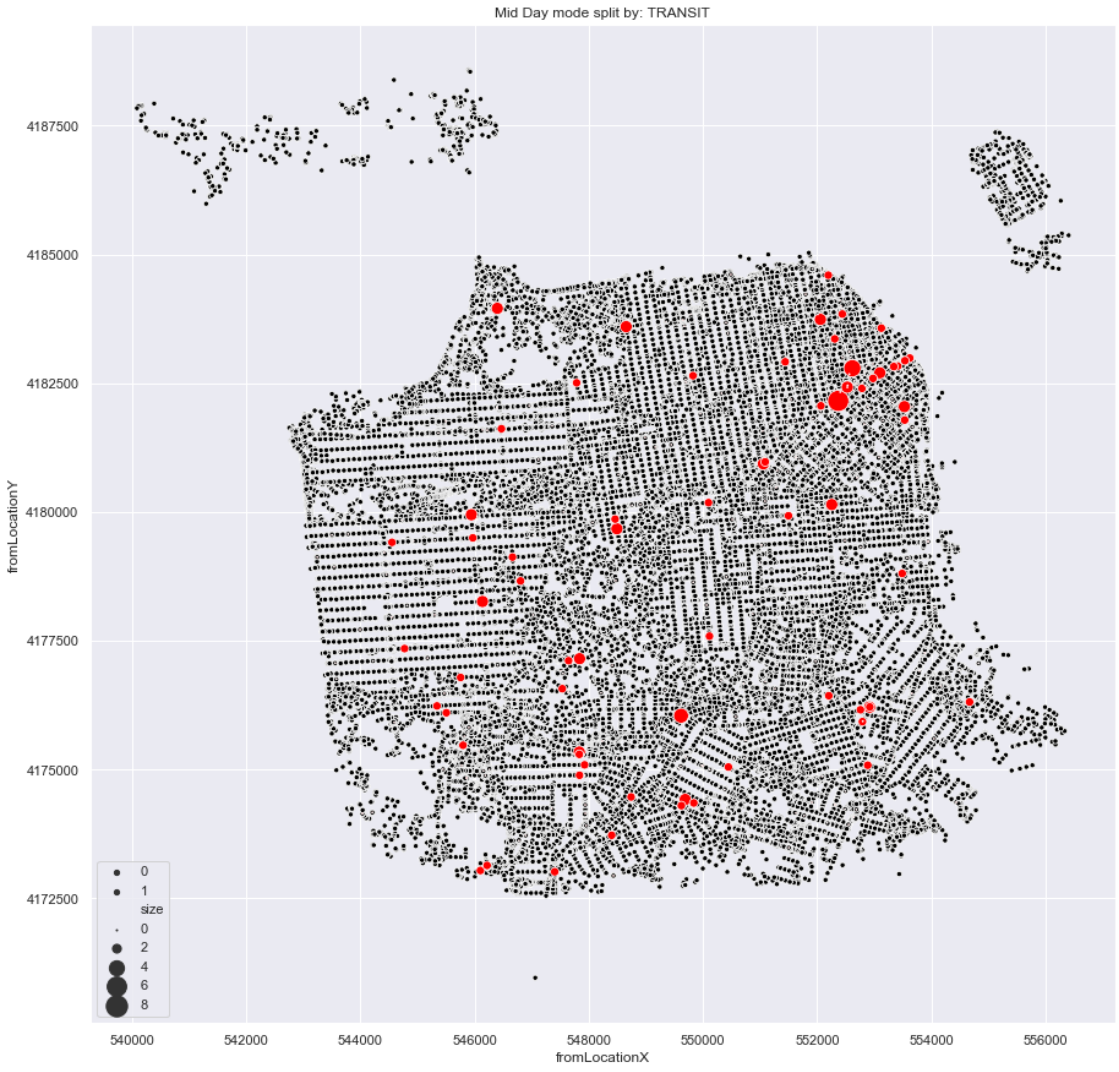
[31]:
```
fig, ax = plt.subplots(figsize=(15, 15))

sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=network_loc, size=1,
                color='black',
                ax=ax)
sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=transit_am_peak_mode,
                size='size',
                sizes=(1, 300),
                color='red',
                 ax = ax).set_title('AM Peak mode split by: TRANSIT')
```

[31]:
```
Text(0.5, 1.0, 'AM Peak mode split by: TRANSIT')
```



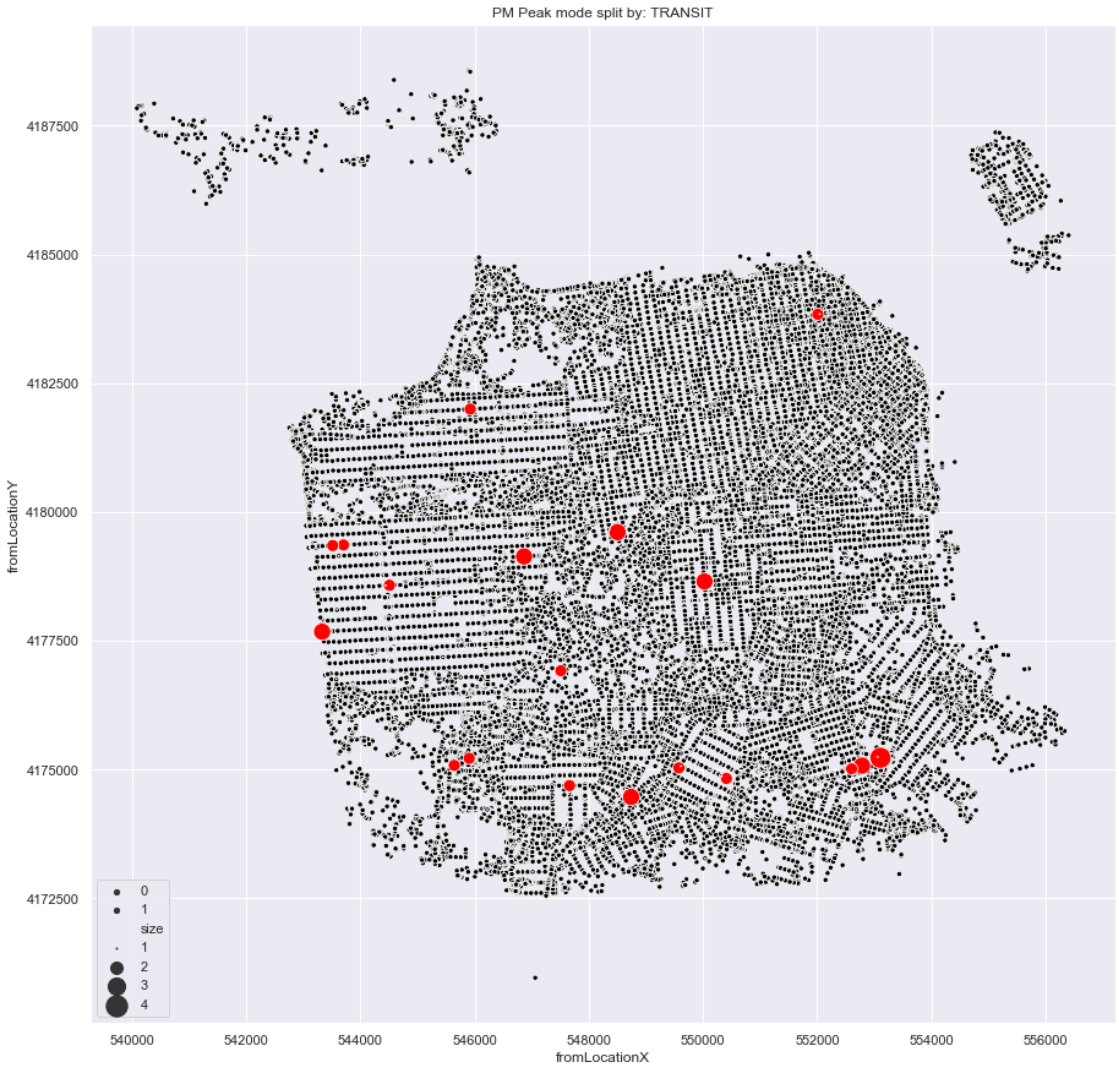
[32]:
```
fig, ax = plt.subplots(figsize=(15, 15))

sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=network_loc, size=1,
                color='black',
                ax=ax)
sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=transit_mid_day_mode,
                size='size',
                sizes=(1, 300),
                color='red',
                 ax = ax).set_title('Mid Day mode split by: TRANSIT')
```

[32]:
```
Text(0.5, 1.0, 'Mid Day mode split by: TRANSIT')
```



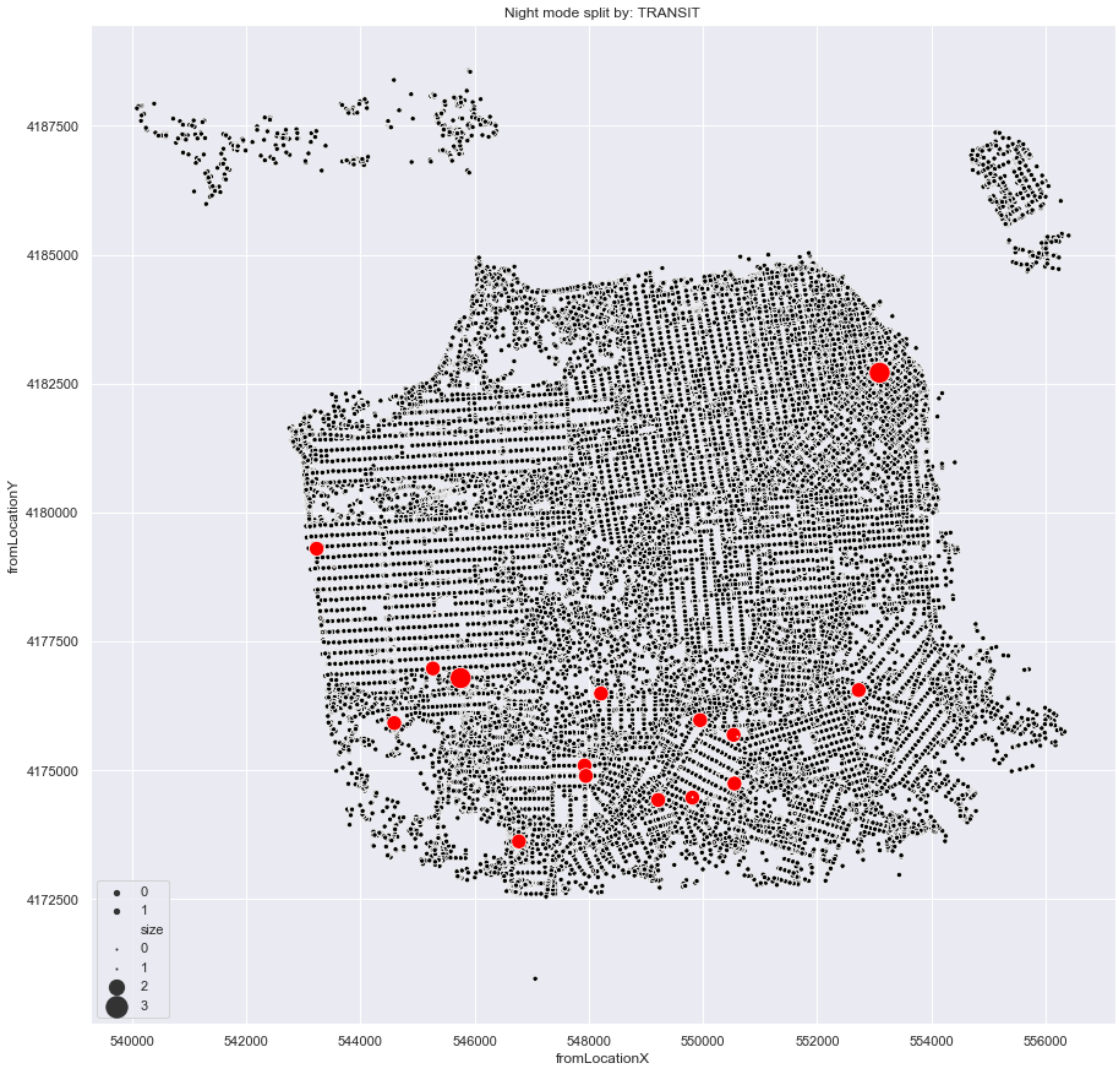
[33]:
```
fig, ax = plt.subplots(figsize=(15, 15))

sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=network_loc, size=1,
                color='black',
                ax=ax)
sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=transit_pm_peak_mode,
                size='size',
                sizes=(1, 300),
                color='red',
                 ax = ax).set_title('PM Peak mode split by: TRANSIT')
```

[33]:
```
Text(0.5, 1.0, 'PM Peak mode split by: TRANSIT')
```



[34]:
```
fig, ax = plt.subplots(figsize=(15, 15))

sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=network_loc, size=1,
                color='black',
                ax=ax)
sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=transit_night_mode,
                size='size',
                sizes=(1, 300),
                color='red',
                 ax = ax).set_title('Night mode split by: TRANSIT')
```

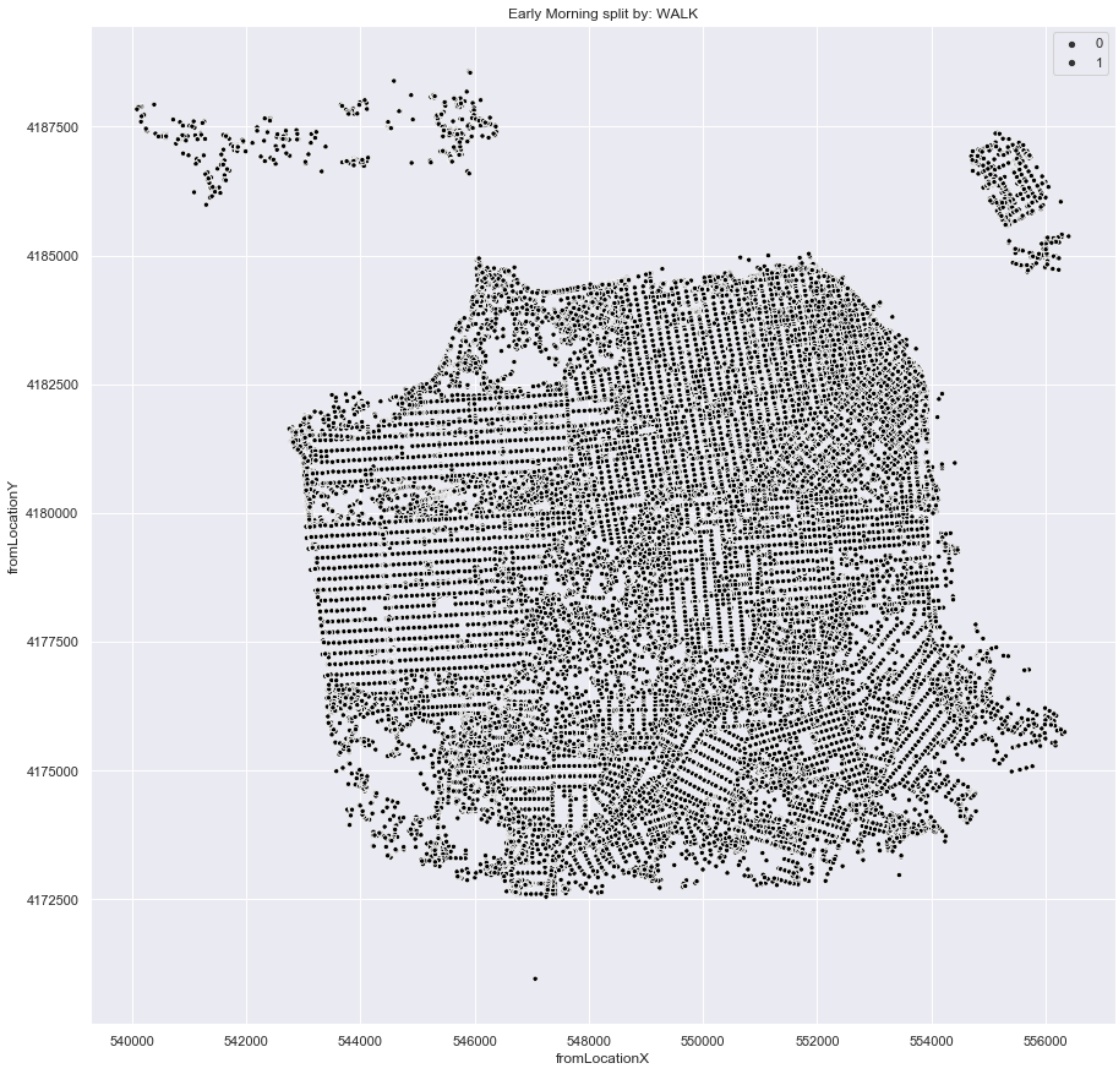
[34]:
```
Text(0.5, 1.0, 'Night mode split by: TRANSIT')
```



0.0.4 Mode: Walk

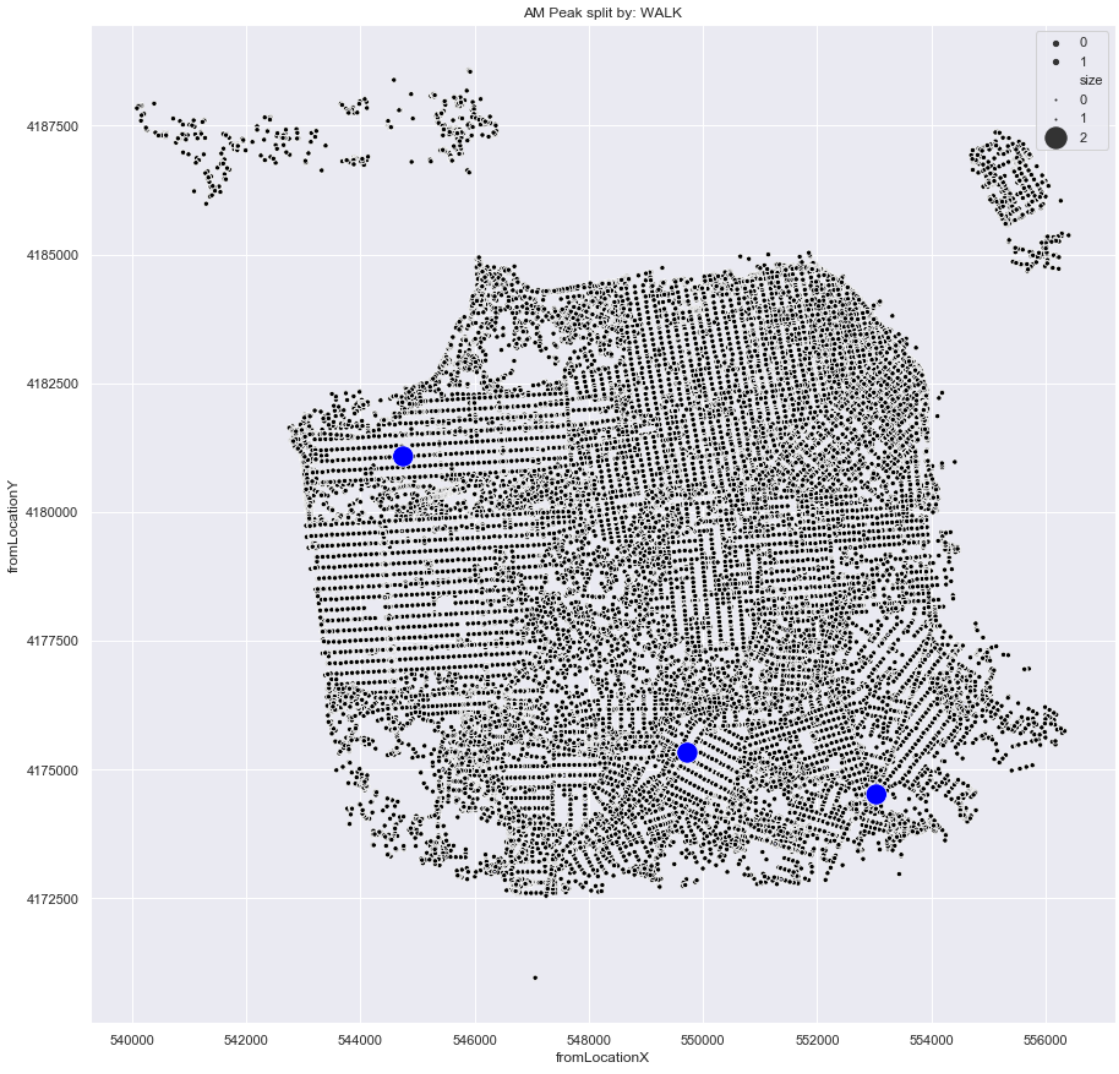
[35]:
```
fig, ax = plt.subplots(figsize=(15, 15))

sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=network_loc, size=1,
                color='black',
                ax=ax)
sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data= walk_early_morning_mode,
                size='size',
                sizes=(1, 300),
                color='blue',
                 ax = ax).set_title('Early Morning split by: WALK')
```

[35]:
```
Text(0.5, 1.0, 'Early Morning split by: WALK')
```



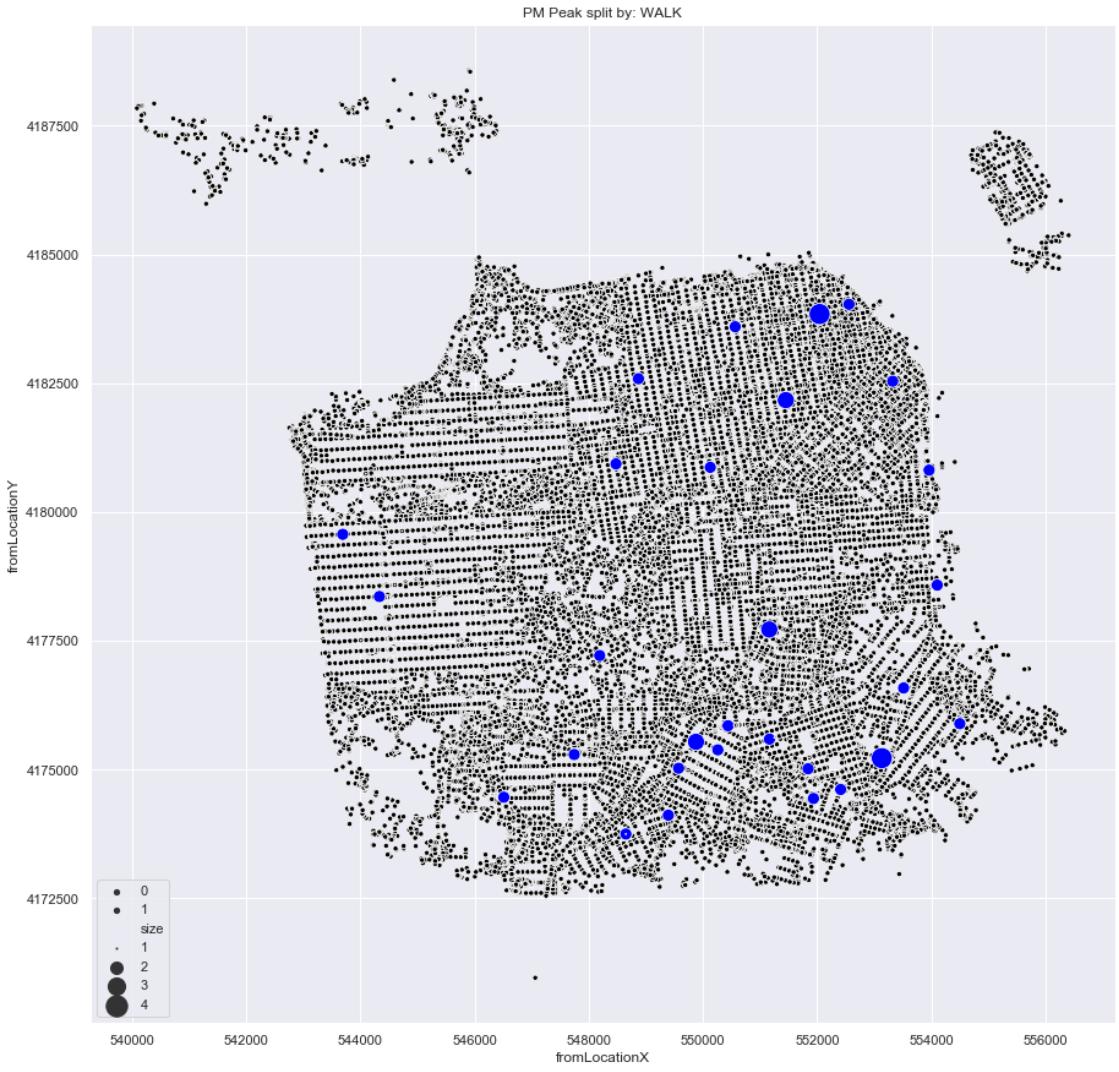
[36]:
```
fig, ax = plt.subplots(figsize=(15, 15))

sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=network_loc, size=1,
                color='black',
                ax=ax)
sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=walk_am_peak_mode,
                size='size',
                sizes=(1, 300),
                color='blue',
                 ax = ax).set_title('AM Peak split by: WALK')
```

[36]:
```
Text(0.5, 1.0, 'AM Peak split by: WALK')
```



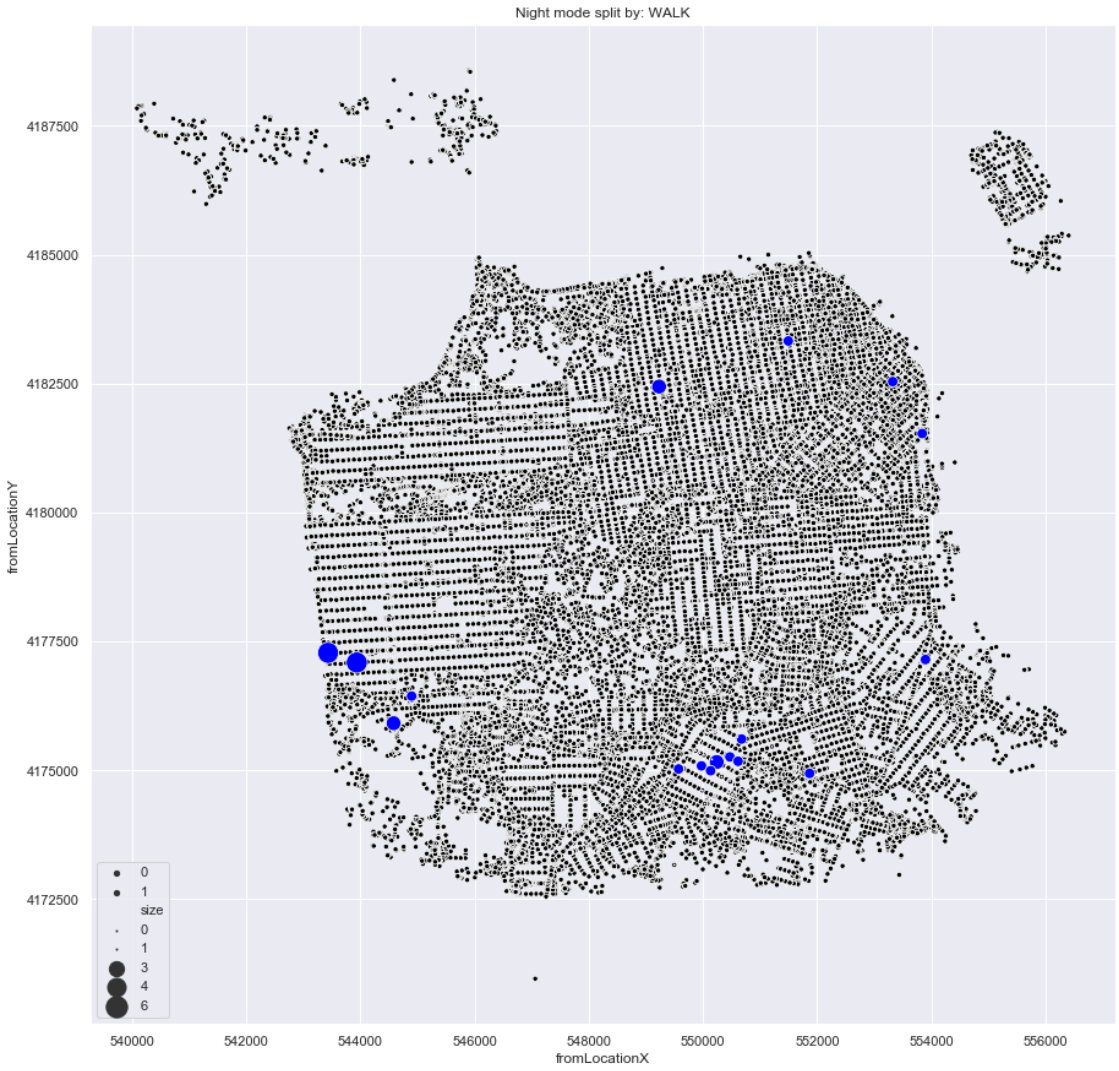
[37]:
```
fig, ax = plt.subplots(figsize=(15, 15))

sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=network_loc, size=1,
                color='black',
                ax=ax)
sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=walk_pm_peak_mode,
                size='size',
                sizes=(1, 300),
                color='blue',
                 ax = ax).set_title('PM Peak split by: WALK')
```

[37]:
```
Text(0.5, 1.0, 'PM Peak split by: WALK')
```



[38]:
```
fig, ax = plt.subplots(figsize=(15, 15))

sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=network_loc, size=1,
                color='black',
                ax=ax)
sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=walk_night_mode,
                size='size',
                sizes=(1, 300),
                color='blue',
                 ax = ax).set_title('Night mode split by: WALK')
```

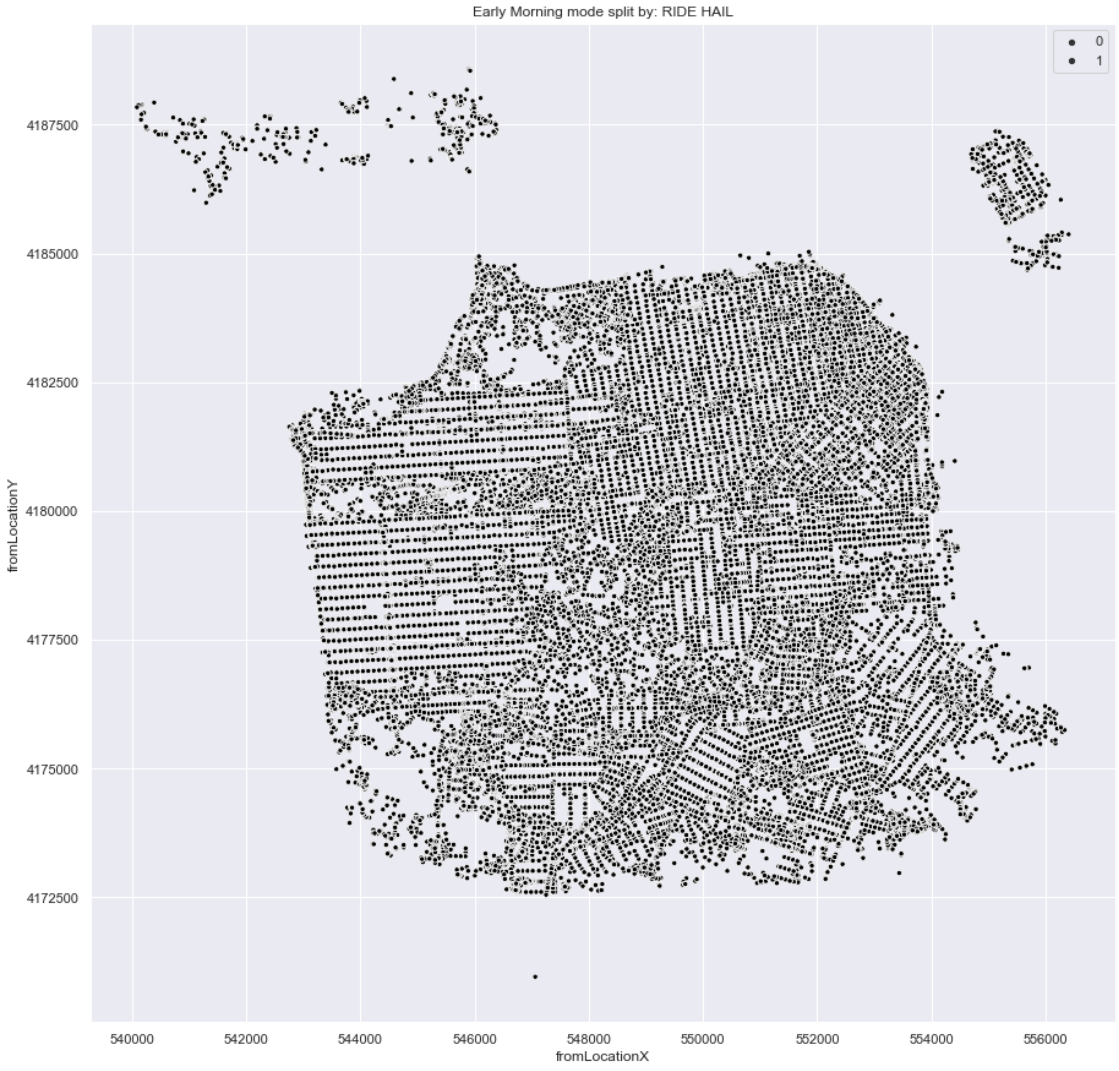
[38]:
```
Text(0.5, 1.0, 'Night mode split by: WALK')
```



0.0.5 Mode: Ride Hail

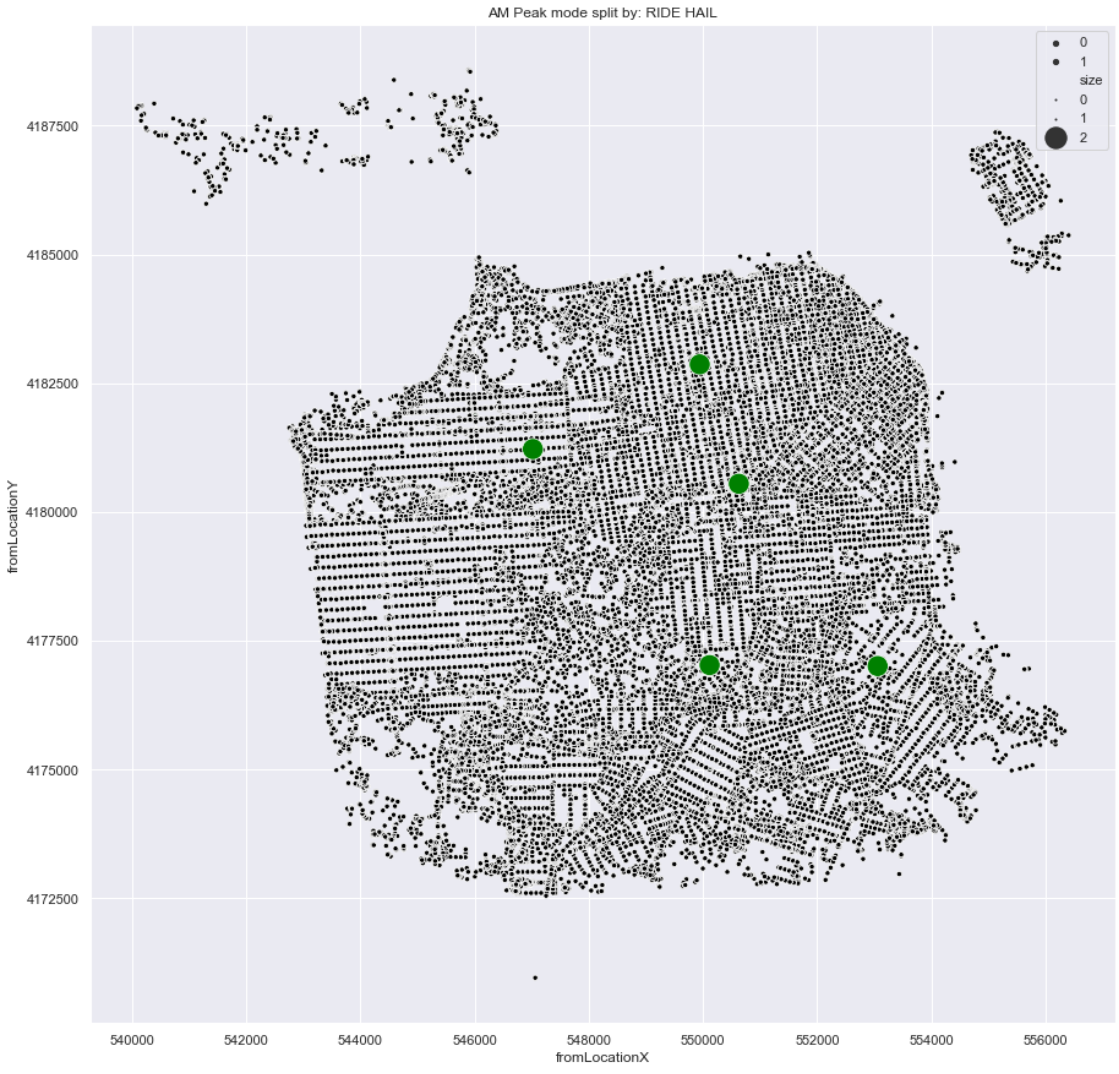
[39]:
```
fig, ax = plt.subplots(figsize=(15, 15))

sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=network_loc, size=1,
                color='black',
                ax=ax)
sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=ride_hail_early_morning_mode,
                size='size',
                sizes=(1, 300),
                color='green',
                 ax = ax).set_title('Early Morning mode split by: RIDE HAIL')
```

[39]:
```
Text(0.5, 1.0, 'Early Morning mode split by: RIDE HAIL')
```



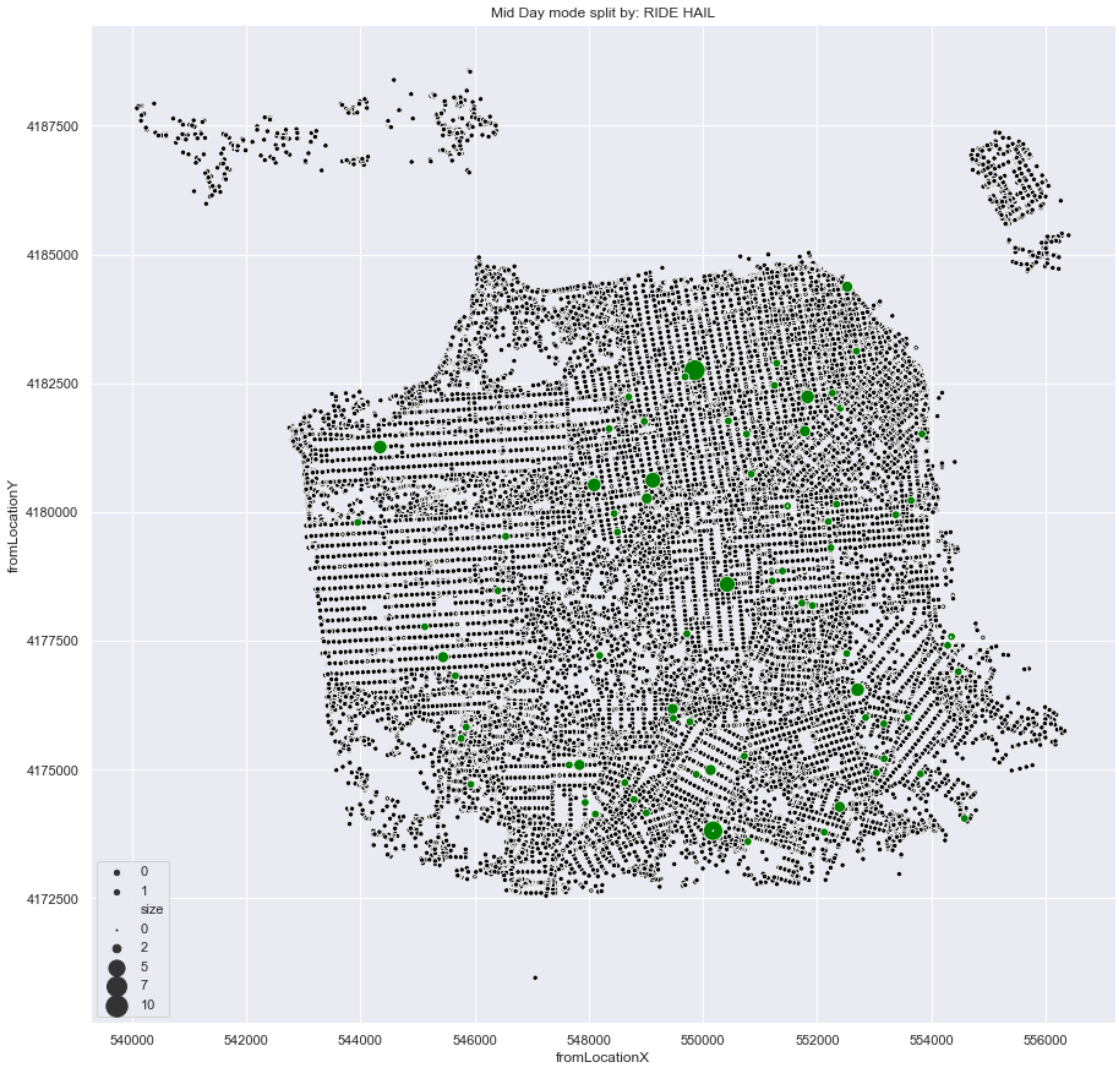
[40]:
```
fig, ax = plt.subplots(figsize=(15, 15))

sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=network_loc, size=1,
                color='black',
                ax=ax)
sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=ride_hail_am_peak_mode,
                size='size',
                sizes=(1, 300),
                color='green',
                 ax = ax).set_title('AM Peak mode split by: RIDE HAIL')
```

[40]:
```
Text(0.5, 1.0, 'AM Peak mode split by: RIDE HAIL')
```



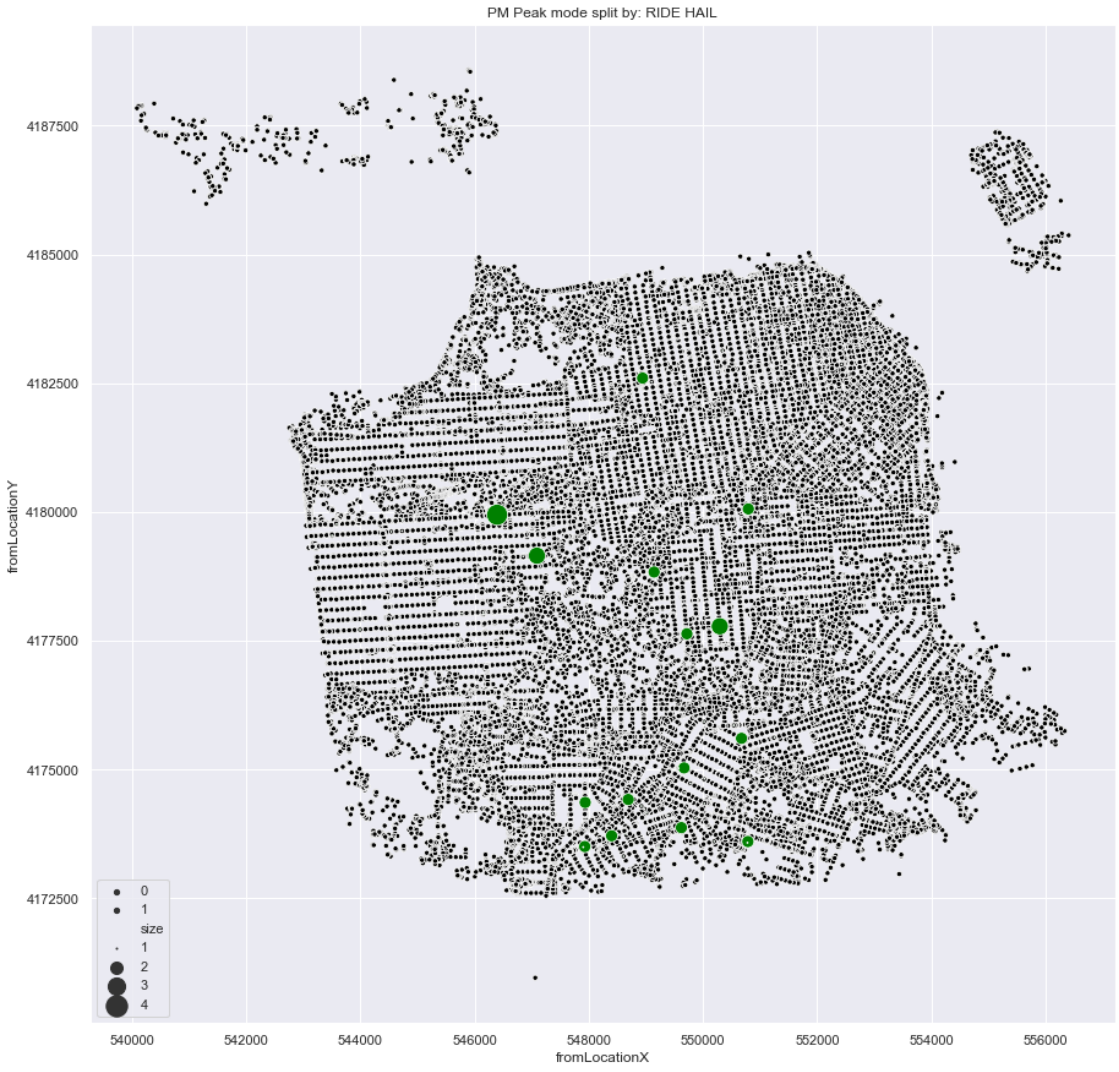
[41]:
```
fig, ax = plt.subplots(figsize=(15, 15))

sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=network_loc, size=1,
                color='black',
                ax=ax)
sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=ride_hail_mid_day_mode,
                size='size',
                sizes=(1, 300),
                color='green',
                 ax = ax).set_title('Mid Day mode split by: RIDE HAIL')
```

[41]:
```
Text(0.5, 1.0, 'Mid Day mode split by: RIDE HAIL')
```



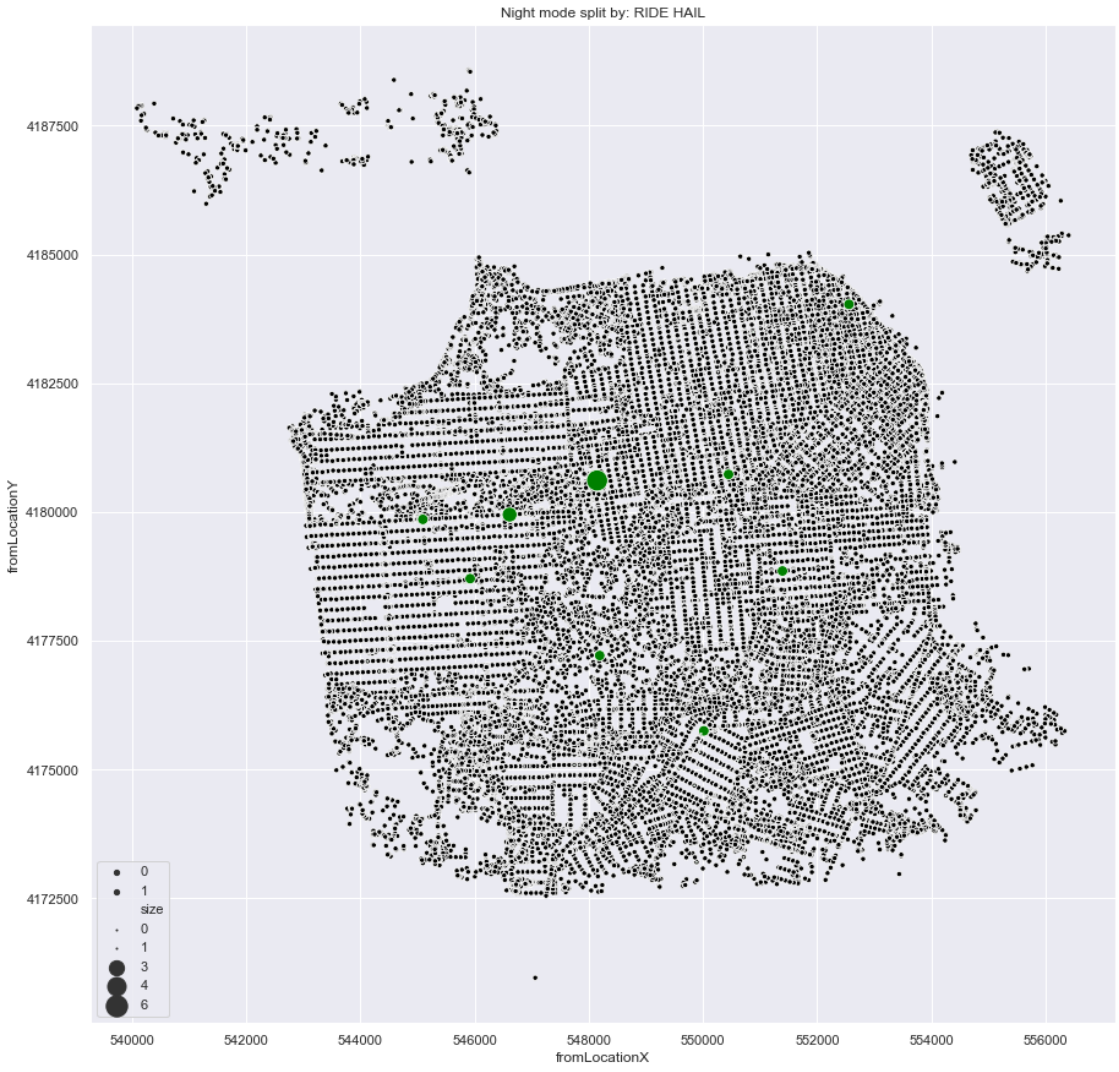
[42]:
```
fig, ax = plt.subplots(figsize=(15, 15))

sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=network_loc, size=1,
                color='black',
                ax=ax)
sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=ride_hail_pm_peak_mode,
                size='size',
                sizes=(1, 300),
                color='green',
                 ax = ax).set_title('PM Peak mode split by: RIDE HAIL')
```

[42]:
```
Text(0.5, 1.0, 'PM Peak mode split by: RIDE HAIL')
```



[43]:
```
fig, ax = plt.subplots(figsize=(15, 15))

sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=network_loc, size=1,
                color='black',
                ax=ax)
sns.scatterplot(x="fromLocationX", y="fromLocationY",
                data=ride_hail_night_mode,
                size='size',
                sizes=(1, 300),
                color='green',
                 ax = ax).set_title('Night mode split by: RIDE HAIL')
```

[43]:
```
Text(0.5, 1.0, 'Night mode split by: RIDE HAIL')
```



[ ]: