

Railway Traffic - Full

April 14, 2017

```
In [18]: %matplotlib inline
import pandas as pd
import numpy as np
from sklearn.cluster import AgglomerativeClustering
import matplotlib.pyplot as plt
import scipy.spatial.distance as ssd
import compute_distance_matrix as cdm
```

```
In [13]: data = pd.read_excel('../maindb.xlsx', 'Sheet1')
```

```
In [14]: data.head(10)
```

```
Out[14]:
```

	Station	Year	Passengerdensity
0	Addison RoadAM Peak	20109	2303
1	Addison RoadEvening	20109	211
2	Addison RoadLate Night Peak	20109	5
3	Addison RoadMidday	20109	748
4	Addison RoadPM Peak	20109	399
5	AnacostiaAM Peak	20109	3141
6	AnacostiaEvening	20109	604
7	AnacostiaLate Night Peak	20109	20
8	AnacostiaMidday	20109	1860
9	AnacostiaPM Peak	20109	1664

```
In [15]: df = data.groupby(['Station', 'Year'])['Passengerdensity'].mean().to_frame().reset_index
```

```
In [5]: di_matrix = cdm.extract_data(df)
```

Distance matrix computation complete.

```
In [6]: di_matrix
```

```
Out[6]:
```

	Addison RoadAM Peak \
Addison RoadAM Peak	0
Addison RoadEvening	49
Addison RoadLate Night Peak	51
Addison RoadMidday	50

Addison RoadPM Peak	49
AnacostiaAM Peak	47
AnacostiaEvening	49
AnacostiaLate Night Peak	49
AnacostiaMidday	47
AnacostiaPM Peak	48
Archives-Navy MemorialAM Peak	48
Archives-Navy MemorialEvening	50
Archives-Navy MemorialLate Night Peak	49
Archives-Navy MemorialMidday	51
Archives-Navy MemorialPM Peak	50
Arlington CemeteryAM Peak	51
Arlington CemeteryEvening	49
Arlington CemeteryLate Night Peak	19
Arlington CemeteryMidday	51
Arlington CemeteryPM Peak	51
BallstonAM Peak	45
BallstonEvening	48
BallstonLate Night Peak	49
BallstonMidday	48
BallstonPM Peak	47
Benning RoadAM Peak	49
Benning RoadEvening	49
Benning RoadLate Night Peak	49
Benning RoadMidday	49
Benning RoadPM Peak	51
...	...
West Falls ChurchAM Peak	44
West Falls ChurchEvening	46
West Falls ChurchLate Night Peak	50
West Falls ChurchMidday	50
West Falls ChurchPM Peak	47
West HyattsvilleAM Peak	44
West HyattsvilleEvening	48
West HyattsvilleLate Night Peak	51
West HyattsvilleMidday	48
West HyattsvillePM Peak	48
WheatonAM Peak	45
WheatonEvening	48
WheatonLate Night Peak	49
WheatonMidday	49
WheatonPM Peak	46
White FlintAM Peak	45
White FlintEvening	50
White FlintLate Night Peak	49
White FlintMidday	49
White FlintPM Peak	43
WiehleAM Peak	10

WiehleEvening	6
WiehleLate Night Peak	6
WiehleMidday	11
WiehlePM Peak	8
Woodley Park-ZooAM Peak	45
Woodley Park-ZooEvening	50
Woodley Park-ZooLate Night Peak	51
Woodley Park-ZooMidday	48
Woodley Park-ZooPM Peak	48

	Addison RoadEvening \
Addison RoadAM Peak	49
Addison RoadEvening	0
Addison RoadLate Night Peak	49
Addison RoadMidday	47
Addison RoadPM Peak	50
AnacostiaAM Peak	50
AnacostiaEvening	48
AnacostiaLate Night Peak	51
AnacostiaMidday	47
AnacostiaPM Peak	50
Archives-Navy MemorialAM Peak	49
Archives-Navy MemorialEvening	46
Archives-Navy MemorialLate Night Peak	49
Archives-Navy MemorialMidday	49
Archives-Navy MemorialPM Peak	49
Arlington CemeteryAM Peak	49
Arlington CemeteryEvening	50
Arlington CemeteryLate Night Peak	21
Arlington CemeteryMidday	51
Arlington CemeteryPM Peak	50
BallstonAM Peak	51
BallstonEvening	47
BallstonLate Night Peak	51
BallstonMidday	49
BallstonPM Peak	51
Benning RoadAM Peak	50
Benning RoadEvening	50
Benning RoadLate Night Peak	48
Benning RoadMidday	47
Benning RoadPM Peak	50
...	...
West Falls ChurchAM Peak	48
West Falls ChurchEvening	48
West Falls ChurchLate Night Peak	50
West Falls ChurchMidday	51
West Falls ChurchPM Peak	51
West HyattsvilleAM Peak	46

West HyattsvilleEvening	48
West HyattsvilleLate Night Peak	51
West HyattsvilleMidday	50
West HyattsvillePM Peak	47
WheatonAM Peak	49
WheatonEvening	49
WheatonLate Night Peak	51
WheatonMidday	49
WheatonPM Peak	49
White FlintAM Peak	50
White FlintEvening	46
White FlintLate Night Peak	50
White FlintMidday	48
White FlintPM Peak	49
WiehleAM Peak	10
WiehleEvening	5
WiehleLate Night Peak	6
WiehleMidday	11
WiehlePM Peak	8
Woodley Park-ZooAM Peak	47
Woodley Park-ZooEvening	50
Woodley Park-ZooLate Night Peak	50
Woodley Park-ZooMidday	49
Woodley Park-ZooPM Peak	50

	Addison RoadLate Night Peak \
Addison RoadAM Peak	51
Addison RoadEvening	49
Addison RoadLate Night Peak	0
Addison RoadMidday	51
Addison RoadPM Peak	51
AnacostiaAM Peak	51
AnacostiaEvening	51
AnacostiaLate Night Peak	51
AnacostiaMidday	50
AnacostiaPM Peak	51
Archives-Navy MemorialAM Peak	51
Archives-Navy MemorialEvening	51
Archives-Navy MemorialLate Night Peak	50
Archives-Navy MemorialMidday	51
Archives-Navy MemorialPM Peak	49
Arlington CemeteryAM Peak	50
Arlington CemeteryEvening	49
Arlington CemeteryLate Night Peak	21
Arlington CemeteryMidday	51
Arlington CemeteryPM Peak	50
BallstonAM Peak	51
BallstonEvening	51

BallstonLate Night Peak	51
BallstonMidday	50
BallstonPM Peak	51
Benning RoadAM Peak	51
Benning RoadEvening	50
Benning RoadLate Night Peak	49
Benning RoadMidday	50
Benning RoadPM Peak	51
...	...
West Falls ChurchAM Peak	51
West Falls ChurchEvening	51
West Falls ChurchLate Night Peak	44
West Falls ChurchMidday	51
West Falls ChurchPM Peak	51
West HyattsvilleAM Peak	50
West HyattsvilleEvening	47
West HyattsvilleLate Night Peak	50
West HyattsvilleMidday	48
West HyattsvillePM Peak	50
WheatonAM Peak	51
WheatonEvening	50
WheatonLate Night Peak	50
WheatonMidday	51
WheatonPM Peak	49
White FlintAM Peak	50
White FlintEvening	51
White FlintLate Night Peak	47
White FlintMidday	48
White FlintPM Peak	51
WiehleAM Peak	10
WiehleEvening	5
WiehleLate Night Peak	4
WiehleMidday	11
WiehlePM Peak	9
Woodley Park-ZooAM Peak	50
Woodley Park-ZooEvening	49
Woodley Park-ZooLate Night Peak	51
Woodley Park-ZooMidday	51
Woodley Park-ZooPM Peak	50

Addison RoadMidday \

Addison RoadAM Peak	50
Addison RoadEvening	47
Addison RoadLate Night Peak	51
Addison RoadMidday	0
Addison RoadPM Peak	49
AnacostiaAM Peak	48
AnacostiaEvening	49

AnacostiaLate Night Peak	50
AnacostiaMidday	41
AnacostiaPM Peak	51
Archives-Navy MemorialAM Peak	48
Archives-Navy MemorialEvening	49
Archives-Navy MemorialLate Night Peak	49
Archives-Navy MemorialMidday	47
Archives-Navy MemorialPM Peak	45
Arlington CemeteryAM Peak	51
Arlington CemeteryEvening	49
Arlington CemeteryLate Night Peak	20
Arlington CemeteryMidday	50
Arlington CemeteryPM Peak	51
BallstonAM Peak	49
BallstonEvening	45
BallstonLate Night Peak	51
BallstonMidday	46
BallstonPM Peak	49
Benning RoadAM Peak	44
Benning RoadEvening	50
Benning RoadLate Night Peak	50
Benning RoadMidday	46
Benning RoadPM Peak	46
...	...
West Falls ChurchAM Peak	49
West Falls ChurchEvening	51
West Falls ChurchLate Night Peak	50
West Falls ChurchMidday	48
West Falls ChurchPM Peak	49
West HyattsvilleAM Peak	48
West HyattsvilleEvening	50
West HyattsvilleLate Night Peak	50
West HyattsvilleMidday	47
West HyattsvillePM Peak	45
WheatonAM Peak	51
WheatonEvening	51
WheatonLate Night Peak	50
WheatonMidday	43
WheatonPM Peak	48
White FlintAM Peak	50
White FlintEvening	49
White FlintLate Night Peak	50
White FlintMidday	47
White FlintPM Peak	51
WiehleAM Peak	10
WiehleEvening	6
WiehleLate Night Peak	6
WiehleMidday	9

WiehlePM Peak	9
Woodley Park-ZooAM Peak	48
Woodley Park-ZooEvening	50
Woodley Park-ZooLate Night Peak	50
Woodley Park-ZooMidday	50
Woodley Park-ZooPM Peak	51

	Addison RoadPM Peak	AnacostiaAM Peak \
Addison RoadAM Peak	49	47
Addison RoadEvening	50	50
Addison RoadLate Night Peak	51	51
Addison RoadMidday	49	48
Addison RoadPM Peak	0	47
AnacostiaAM Peak	47	0
AnacostiaEvening	47	50
AnacostiaLate Night Peak	50	50
AnacostiaMidday	46	49
AnacostiaPM Peak	49	48
Archives-Navy MemorialAM Peak	48	49
Archives-Navy MemorialEvening	48	49
Archives-Navy MemorialLate Night Peak	51	51
Archives-Navy MemorialMidday	50	50
Archives-Navy MemorialPM Peak	50	49
Arlington CemeteryAM Peak	51	51
Arlington CemeteryEvening	50	49
Arlington CemeteryLate Night Peak	21	20
Arlington CemeteryMidday	51	51
Arlington CemeteryPM Peak	51	51
BallstonAM Peak	50	46
BallstonEvening	50	49
BallstonLate Night Peak	49	51
BallstonMidday	50	49
BallstonPM Peak	49	46
Benning RoadAM Peak	50	41
Benning RoadEvening	44	49
Benning RoadLate Night Peak	51	50
Benning RoadMidday	48	49
Benning RoadPM Peak	48	50
...
West Falls ChurchAM Peak	48	49
West Falls ChurchEvening	48	47
West Falls ChurchLate Night Peak	50	50
West Falls ChurchMidday	51	51
West Falls ChurchPM Peak	48	47
West HyattsvilleAM Peak	45	47
West HyattsvilleEvening	49	47
West HyattsvilleLate Night Peak	50	51
West HyattsvilleMidday	46	50

West HyattsvillePM Peak	46	48
WheatonAM Peak	49	50
WheatonEvening	47	51
WheatonLate Night Peak	50	50
WheatonMidday	48	48
WheatonPM Peak	48	49
White FlintAM Peak	48	46
White FlintEvening	50	51
White FlintLate Night Peak	50	51
White FlintMidday	50	50
White FlintPM Peak	48	46
WiehleAM Peak	10	9
WiehleEvening	5	6
WiehleLate Night Peak	6	6
WiehleMidday	11	11
WiehlePM Peak	9	9
Woodley Park-ZooAM Peak	49	44
Woodley Park-ZooEvening	49	51
Woodley Park-ZooLate Night Peak	50	49
Woodley Park-ZooMidday	49	49
Woodley Park-ZooPM Peak	51	51

AnacostiaEvening \

Addison RoadAM Peak	49
Addison RoadEvening	48
Addison RoadLate Night Peak	51
Addison RoadMidday	49
Addison RoadPM Peak	47
AnacostiaAM Peak	50
AnacostiaEvening	0
AnacostiaLate Night Peak	51
AnacostiaMidday	49
AnacostiaPM Peak	50
Archives-Navy MemorialAM Peak	47
Archives-Navy MemorialEvening	48
Archives-Navy MemorialLate Night Peak	50
Archives-Navy MemorialMidday	47
Archives-Navy MemorialPM Peak	51
Arlington CemeteryAM Peak	49
Arlington CemeteryEvening	50
Arlington CemeteryLate Night Peak	21
Arlington CemeteryMidday	51
Arlington CemeteryPM Peak	51
BallstonAM Peak	46
BallstonEvening	49
BallstonLate Night Peak	51
BallstonMidday	49
BallstonPM Peak	48

Benning RoadAM Peak	50
Benning RoadEvening	47
Benning RoadLate Night Peak	49
Benning RoadMidday	47
Benning RoadPM Peak	50
...	...
West Falls ChurchAM Peak	48
West Falls ChurchEvening	51
West Falls ChurchLate Night Peak	51
West Falls ChurchMidday	50
West Falls ChurchPM Peak	49
West HyattsvilleAM Peak	46
West HyattsvilleEvening	47
West HyattsvilleLate Night Peak	51
West HyattsvilleMidday	48
West HyattsvillePM Peak	46
WheatonAM Peak	50
WheatonEvening	51
WheatonLate Night Peak	51
WheatonMidday	46
WheatonPM Peak	49
White FlintAM Peak	48
White FlintEvening	48
White FlintLate Night Peak	50
White FlintMidday	50
White FlintPM Peak	48
WiehleAM Peak	10
WiehleEvening	6
WiehleLate Night Peak	6
WiehleMidday	11
WiehlePM Peak	9
Woodley Park-ZooAM Peak	48
Woodley Park-ZooEvening	47
Woodley Park-ZooLate Night Peak	50
Woodley Park-ZooMidday	50
Woodley Park-ZooPM Peak	50

AnacostiaLate Night Peak \

Addison RoadAM Peak	49
Addison RoadEvening	51
Addison RoadLate Night Peak	51
Addison RoadMidday	50
Addison RoadPM Peak	50
AnacostiaAM Peak	50
AnacostiaEvening	51
AnacostiaLate Night Peak	0
AnacostiaMidday	49
AnacostiaPM Peak	51

Archives-Navy MemorialAM Peak	50
Archives-Navy MemorialEvening	51
Archives-Navy MemorialLate Night Peak	51
Archives-Navy MemorialMidday	51
Archives-Navy MemorialPM Peak	50
Arlington CemeteryAM Peak	51
Arlington CemeteryEvening	48
Arlington CemeteryLate Night Peak	20
Arlington CemeteryMidday	51
Arlington CemeteryPM Peak	51
BallstonAM Peak	51
BallstonEvening	51
BallstonLate Night Peak	49
BallstonMidday	51
BallstonPM Peak	50
Benning RoadAM Peak	50
Benning RoadEvening	51
Benning RoadLate Night Peak	50
Benning RoadMidday	51
Benning RoadPM Peak	50
...	...
West Falls ChurchAM Peak	51
West Falls ChurchEvening	50
West Falls ChurchLate Night Peak	49
West Falls ChurchMidday	50
West Falls ChurchPM Peak	50
West HyattsvilleAM Peak	49
West HyattsvilleEvening	51
West HyattsvilleLate Night Peak	48
West HyattsvilleMidday	51
West HyattsvillePM Peak	48
WheatonAM Peak	51
WheatonEvening	50
WheatonLate Night Peak	50
WheatonMidday	51
WheatonPM Peak	51
White FlintAM Peak	50
White FlintEvening	51
White FlintLate Night Peak	47
White FlintMidday	50
White FlintPM Peak	51
WiehleAM Peak	10
WiehleEvening	6
WiehleLate Night Peak	6
WiehleMidday	9
WiehlePM Peak	9
Woodley Park-ZooAM Peak	49
Woodley Park-ZooEvening	51

Woodley Park-ZooLate Night Peak	51
Woodley Park-ZooMidday	50
Woodley Park-ZooPM Peak	51

	AnacostiaMidday	AnacostiaPM Peak \
Addison RoadAM Peak	47	48
Addison RoadEvening	47	50
Addison RoadLate Night Peak	50	51
Addison RoadMidday	41	51
Addison RoadPM Peak	46	49
AnacostiaAM Peak	49	48
AnacostiaEvening	49	50
AnacostiaLate Night Peak	49	51
AnacostiaMidday	0	51
AnacostiaPM Peak	51	0
Archives-Navy MemorialAM Peak	50	49
Archives-Navy MemorialEvening	51	50
Archives-Navy MemorialLate Night Peak	51	49
Archives-Navy MemorialMidday	49	50
Archives-Navy MemorialPM Peak	46	50
Arlington CemeteryAM Peak	49	51
Arlington CemeteryEvening	48	49
Arlington CemeteryLate Night Peak	21	21
Arlington CemeteryMidday	50	51
Arlington CemeteryPM Peak	51	51
BallstonAM Peak	48	48
BallstonEvening	48	45
BallstonLate Night Peak	51	51
BallstonMidday	45	50
BallstonPM Peak	49	47
Benning RoadAM Peak	47	46
Benning RoadEvening	48	47
Benning RoadLate Night Peak	49	51
Benning RoadMidday	47	49
Benning RoadPM Peak	50	47
...
West Falls ChurchAM Peak	49	48
West Falls ChurchEvening	49	49
West Falls ChurchLate Night Peak	50	51
West Falls ChurchMidday	49	51
West Falls ChurchPM Peak	47	49
West HyattsvilleAM Peak	47	48
West HyattsvilleEvening	49	51
West HyattsvilleLate Night Peak	50	50
West HyattsvilleMidday	43	49
West HyattsvillePM Peak	46	49
WheatonAM Peak	47	46
WheatonEvening	50	49

WheatonLate Night Peak	49	51
WheatonMidday	46	49
WheatonPM Peak	50	47
White FlintAM Peak	49	48
White FlintEvening	49	49
White FlintLate Night Peak	51	50
White FlintMidday	48	50
White FlintPM Peak	48	49
WiehleAM Peak	8	10
WiehleEvening	6	6
WiehleLate Night Peak	6	6
WiehleMidday	10	11
WiehlePM Peak	7	9
Woodley Park-ZooAM Peak	49	47
Woodley Park-ZooEvening	51	50
Woodley Park-ZooLate Night Peak	50	50
Woodley Park-ZooMidday	50	51
Woodley Park-ZooPM Peak	50	51

	...	WiehleAM Peak \
Addison RoadAM Peak	...	10
Addison RoadEvening	...	10
Addison RoadLate Night Peak	...	10
Addison RoadMidday	...	10
Addison RoadPM Peak	...	10
AnacostiaAM Peak	...	9
AnacostiaEvening	...	10
AnacostiaLate Night Peak	...	10
AnacostiaMidday	...	8
AnacostiaPM Peak	...	10
Archives-Navy MemorialAM Peak	...	10
Archives-Navy MemorialEvening	...	10
Archives-Navy MemorialLate Night Peak	...	10
Archives-Navy MemorialMidday	...	10
Archives-Navy MemorialPM Peak	...	10
Arlington CemeteryAM Peak	...	10
Arlington CemeteryEvening	...	10
Arlington CemeteryLate Night Peak	...	3
Arlington CemeteryMidday	...	10
Arlington CemeteryPM Peak	...	10
BallstonAM Peak	...	10
BallstonEvening	...	10
BallstonLate Night Peak	...	10
BallstonMidday	...	8
BallstonPM Peak	...	9
Benning RoadAM Peak	...	9
Benning RoadEvening	...	10
Benning RoadLate Night Peak	...	10

Benning Road	Midday	...	10
Benning Road	PM Peak	...	9
...	
West Falls Church	AM Peak	...	10
West Falls Church	Evening	...	10
West Falls Church	Late Night Peak	...	10
West Falls Church	Midday	...	10
West Falls Church	PM Peak	...	10
West Hyattsville	AM Peak	...	8
West Hyattsville	Evening	...	10
West Hyattsville	Late Night Peak	...	10
West Hyattsville	Midday	...	10
West Hyattsville	PM Peak	...	10
Wheaton	AM Peak	...	9
Wheaton	Evening	...	9
Wheaton	Late Night Peak	...	9
Wheaton	Midday	...	10
Wheaton	PM Peak	...	10
White Flint	AM Peak	...	10
White Flint	Evening	...	10
White Flint	Late Night Peak	...	10
White Flint	Midday	...	10
White Flint	PM Peak	...	10
Wiehle	AM Peak	...	0
Wiehle	Evening	...	6
Wiehle	Late Night Peak	...	6
Wiehle	Midday	...	10
Wiehle	PM Peak	...	6
Woodley Park-Zoo	AM Peak	...	9
Woodley Park-Zoo	Evening	...	10
Woodley Park-Zoo	Late Night Peak	...	10
Woodley Park-Zoo	Midday	...	10
Woodley Park-Zoo	PM Peak	...	10

	WiehleEvening	WiehleLate Night Peak \
Addison Road	AM Peak	6
Addison Road	Evening	5
Addison Road	Late Night Peak	5
Addison Road	Midday	6
Addison Road	PM Peak	5
Anacostia	AM Peak	6
Anacostia	Evening	6
Anacostia	Late Night Peak	6
Anacostia	Midday	6
Anacostia	PM Peak	6
Archives-Navy Memorial	AM Peak	6
Archives-Navy Memorial	Evening	6
Archives-Navy Memorial	Late Night Peak	6

Archives-Navy Memorial	Midday	6	6
Archives-Navy Memorial	PM Peak	5	5
Arlington Cemetery	AM Peak	6	6
Arlington Cemetery	Evening	6	5
Arlington Cemetery	Late Night Peak	2	2
Arlington Cemetery	Midday	6	6
Arlington Cemetery	PM Peak	6	6
Ballston	AM Peak	6	6
Ballston	Evening	6	6
Ballston	Late Night Peak	6	6
Ballston	Midday	6	6
Ballston	PM Peak	6	6
Benning Road	AM Peak	6	6
Benning Road	Evening	6	6
Benning Road	Late Night Peak	6	6
Benning Road	Midday	5	6
Benning Road	PM Peak	6	6
...
West Falls Church	AM Peak	6	6
West Falls Church	Evening	6	6
West Falls Church	Late Night Peak	6	6
West Falls Church	Midday	6	6
West Falls Church	PM Peak	6	6
West Hyattsville	AM Peak	6	6
West Hyattsville	Evening	6	6
West Hyattsville	Late Night Peak	6	6
West Hyattsville	Midday	5	5
West Hyattsville	PM Peak	5	6
Wheaton	AM Peak	6	6
Wheaton	Evening	6	6
Wheaton	Late Night Peak	5	5
Wheaton	Midday	5	6
Wheaton	PM Peak	5	5
White Flint	AM Peak	6	6
White Flint	Evening	6	6
White Flint	Late Night Peak	6	6
White Flint	Midday	6	6
White Flint	PM Peak	6	6
Wiehle	AM Peak	6	6
Wiehle	Evening	0	5
Wiehle	Late Night Peak	5	0
Wiehle	Midday	6	6
Wiehle	PM Peak	6	6
Woodley Park-Zoo	AM Peak	6	6
Woodley Park-Zoo	Evening	6	6
Woodley Park-Zoo	Late Night Peak	6	6
Woodley Park-Zoo	Midday	6	5
Woodley Park-Zoo	PM Peak	6	6

	WiehleMidday	WiehlePM Peak \
Addison RoadAM Peak	11	8
Addison RoadEvening	11	8
Addison RoadLate Night Peak	11	9
Addison RoadMidday	9	9
Addison RoadPM Peak	11	9
AnacostiaAM Peak	11	9
AnacostiaEvening	11	9
AnacostiaLate Night Peak	9	9
AnacostiaMidday	10	7
AnacostiaPM Peak	11	9
Archives-Navy MemorialAM Peak	10	9
Archives-Navy MemorialEvening	11	9
Archives-Navy MemorialLate Night Peak	11	9
Archives-Navy MemorialMidday	11	9
Archives-Navy MemorialPM Peak	10	9
Arlington CemeteryAM Peak	11	9
Arlington CemeteryEvening	11	9
Arlington CemeteryLate Night Peak	3	3
Arlington CemeteryMidday	11	9
Arlington CemeteryPM Peak	11	9
BallstonAM Peak	11	9
BallstonEvening	11	9
BallstonLate Night Peak	10	9
BallstonMidday	11	7
BallstonPM Peak	11	9
Benning RoadAM Peak	11	9
Benning RoadEvening	11	9
Benning RoadLate Night Peak	10	9
Benning RoadMidday	11	9
Benning RoadPM Peak	10	8
...
West Falls ChurchAM Peak	11	9
West Falls ChurchEvening	11	9
West Falls ChurchLate Night Peak	11	9
West Falls ChurchMidday	11	9
West Falls ChurchPM Peak	10	9
West HyattsvilleAM Peak	11	7
West HyattsvilleEvening	11	9
West HyattsvilleLate Night Peak	9	9
West HyattsvilleMidday	11	8
West HyattsvillePM Peak	9	9
WheatonAM Peak	11	9
WheatonEvening	11	8
WheatonLate Night Peak	11	8
WheatonMidday	11	9
WheatonPM Peak	11	8

White FlintAM Peak	11	9
White FlintEvening	11	9
White FlintLate Night Peak	10	9
White FlintMidday	11	8
White FlintPM Peak	11	9
WiehleAM Peak	10	6
WiehleEvening	6	6
WiehleLate Night Peak	6	6
WiehleMidday	0	8
WiehlePM Peak	8	0
Woodley Park-ZooAM Peak	11	9
Woodley Park-ZooEvening	11	9
Woodley Park-ZooLate Night Peak	11	9
Woodley Park-ZooMidday	11	9
Woodley Park-ZooPM Peak	11	9

	Woodley Park-ZooAM Peak	\
Addison RoadAM Peak	45	
Addison RoadEvening	47	
Addison RoadLate Night Peak	50	
Addison RoadMidday	48	
Addison RoadPM Peak	49	
AnacostiaAM Peak	44	
AnacostiaEvening	48	
AnacostiaLate Night Peak	49	
AnacostiaMidday	49	
AnacostiaPM Peak	47	
Archives-Navy MemorialAM Peak	48	
Archives-Navy MemorialEvening	49	
Archives-Navy MemorialLate Night Peak	51	
Archives-Navy MemorialMidday	51	
Archives-Navy MemorialPM Peak	45	
Arlington CemeteryAM Peak	51	
Arlington CemeteryEvening	50	
Arlington CemeteryLate Night Peak	21	
Arlington CemeteryMidday	50	
Arlington CemeteryPM Peak	51	
BallstonAM Peak	48	
BallstonEvening	47	
BallstonLate Night Peak	50	
BallstonMidday	50	
BallstonPM Peak	46	
Benning RoadAM Peak	51	
Benning RoadEvening	49	
Benning RoadLate Night Peak	50	
Benning RoadMidday	48	
Benning RoadPM Peak	51	
...	...	

West Falls ChurchAM Peak	49
West Falls ChurchEvening	49
West Falls ChurchLate Night Peak	50
West Falls ChurchMidday	50
West Falls ChurchPM Peak	50
West HyattsvilleAM Peak	46
West HyattsvilleEvening	47
West HyattsvilleLate Night Peak	51
West HyattsvilleMidday	49
West HyattsvillePM Peak	47
WheatonAM Peak	49
WheatonEvening	51
WheatonLate Night Peak	50
WheatonMidday	50
WheatonPM Peak	48
White FlintAM Peak	46
White FlintEvening	51
White FlintLate Night Peak	51
White FlintMidday	49
White FlintPM Peak	48
WiehleAM Peak	9
WiehleEvening	6
WiehleLate Night Peak	6
WiehleMidday	11
WiehlePM Peak	9
Woodley Park-ZooAM Peak	0
Woodley Park-ZooEvening	50
Woodley Park-ZooLate Night Peak	51
Woodley Park-ZooMidday	50
Woodley Park-ZooPM Peak	50

Woodley Park-ZooEvening \

Addison RoadAM Peak	50
Addison RoadEvening	50
Addison RoadLate Night Peak	49
Addison RoadMidday	50
Addison RoadPM Peak	49
AnacostiaAM Peak	51
AnacostiaEvening	47
AnacostiaLate Night Peak	51
AnacostiaMidday	51
AnacostiaPM Peak	50
Archives-Navy MemorialAM Peak	50
Archives-Navy MemorialEvening	49
Archives-Navy MemorialLate Night Peak	50
Archives-Navy MemorialMidday	50
Archives-Navy MemorialPM Peak	48
Arlington CemeteryAM Peak	51

Arlington CemeteryEvening	50
Arlington CemeteryLate Night Peak	21
Arlington CemeteryMidday	51
Arlington CemeteryPM Peak	50
BallstonAM Peak	49
BallstonEvening	50
BallstonLate Night Peak	51
BallstonMidday	51
BallstonPM Peak	50
Benning RoadAM Peak	49
Benning RoadEvening	46
Benning RoadLate Night Peak	50
Benning RoadMidday	49
Benning RoadPM Peak	50
...	...
West Falls ChurchAM Peak	49
West Falls ChurchEvening	49
West Falls ChurchLate Night Peak	48
West Falls ChurchMidday	49
West Falls ChurchPM Peak	51
West HyattsvilleAM Peak	50
West HyattsvilleEvening	49
West HyattsvilleLate Night Peak	50
West HyattsvilleMidday	47
West HyattsvillePM Peak	50
WheatonAM Peak	50
WheatonEvening	49
WheatonLate Night Peak	48
WheatonMidday	50
WheatonPM Peak	51
White FlintAM Peak	48
White FlintEvening	50
White FlintLate Night Peak	48
White FlintMidday	48
White FlintPM Peak	51
WiehleAM Peak	10
WiehleEvening	6
WiehleLate Night Peak	6
WiehleMidday	11
WiehlePM Peak	9
Woodley Park-ZooAM Peak	50
Woodley Park-ZooEvening	0
Woodley Park-ZooLate Night Peak	51
Woodley Park-ZooMidday	50
Woodley Park-ZooPM Peak	50
Woodley Park-ZooLate Night Peak \	
Addison RoadAM Peak	51

Addison RoadEvening	50
Addison RoadLate Night Peak	51
Addison RoadMidday	50
Addison RoadPM Peak	50
AnacostiaAM Peak	49
AnacostiaEvening	50
AnacostiaLate Night Peak	51
AnacostiaMidday	50
AnacostiaPM Peak	50
Archives-Navy MemorialAM Peak	51
Archives-Navy MemorialEvening	51
Archives-Navy MemorialLate Night Peak	50
Archives-Navy MemorialMidday	51
Archives-Navy MemorialPM Peak	49
Arlington CemeteryAM Peak	51
Arlington CemeteryEvening	49
Arlington CemeteryLate Night Peak	20
Arlington CemeteryMidday	51
Arlington CemeteryPM Peak	49
BallstonAM Peak	51
BallstonEvening	50
BallstonLate Night Peak	50
BallstonMidday	51
BallstonPM Peak	50
Benning RoadAM Peak	50
Benning RoadEvening	49
Benning RoadLate Night Peak	51
Benning RoadMidday	51
Benning RoadPM Peak	51
...	...
West Falls ChurchAM Peak	51
West Falls ChurchEvening	51
West Falls ChurchLate Night Peak	50
West Falls ChurchMidday	50
West Falls ChurchPM Peak	51
West HyattsvilleAM Peak	51
West HyattsvilleEvening	50
West HyattsvilleLate Night Peak	51
West HyattsvilleMidday	50
West HyattsvillePM Peak	51
WheatonAM Peak	50
WheatonEvening	51
WheatonLate Night Peak	49
WheatonMidday	50
WheatonPM Peak	50
White FlintAM Peak	50
White FlintEvening	51
White FlintLate Night Peak	51

White FlintMidday	50
White FlintPM Peak	51
WiehleAM Peak	10
WiehleEvening	6
WiehleLate Night Peak	6
WiehleMidday	11
WiehlePM Peak	9
Woodley Park-ZooAM Peak	51
Woodley Park-ZooEvening	51
Woodley Park-ZooLate Night Peak	0
Woodley Park-ZooMidday	51
Woodley Park-ZooPM Peak	51

	Woodley Park-ZooMidday \
Addison RoadAM Peak	48
Addison RoadEvening	49
Addison RoadLate Night Peak	51
Addison RoadMidday	50
Addison RoadPM Peak	49
AnacostiaAM Peak	49
AnacostiaEvening	50
AnacostiaLate Night Peak	50
AnacostiaMidday	50
AnacostiaPM Peak	51
Archives-Navy MemorialAM Peak	48
Archives-Navy MemorialEvening	49
Archives-Navy MemorialLate Night Peak	51
Archives-Navy MemorialMidday	51
Archives-Navy MemorialPM Peak	49
Arlington CemeteryAM Peak	51
Arlington CemeteryEvening	50
Arlington CemeteryLate Night Peak	21
Arlington CemeteryMidday	49
Arlington CemeteryPM Peak	49
BallstonAM Peak	51
BallstonEvening	50
BallstonLate Night Peak	50
BallstonMidday	49
BallstonPM Peak	47
Benning RoadAM Peak	49
Benning RoadEvening	50
Benning RoadLate Night Peak	51
Benning RoadMidday	50
Benning RoadPM Peak	51
...	...
West Falls ChurchAM Peak	50
West Falls ChurchEvening	50
West Falls ChurchLate Night Peak	51

West Falls Church	Midday	47
West Falls Church	PM Peak	50
West Hyattsville	AM Peak	50
West Hyattsville	Evening	50
West Hyattsville	Late Night Peak	51
West Hyattsville	Midday	50
West Hyattsville	PM Peak	51
Wheaton	AM Peak	48
Wheaton	Evening	50
Wheaton	Late Night Peak	50
Wheaton	Midday	50
Wheaton	PM Peak	50
White Flint	AM Peak	50
White Flint	Evening	50
White Flint	Late Night Peak	51
White Flint	Midday	48
White Flint	PM Peak	50
Wiehle	AM Peak	10
Wiehle	Evening	6
Wiehle	Late Night Peak	5
Wiehle	Midday	11
Wiehle	PM Peak	9
Woodley Park-Zoo	AM Peak	50
Woodley Park-Zoo	Evening	50
Woodley Park-Zoo	Late Night Peak	51
Woodley Park-Zoo	Midday	0
Woodley Park-Zoo	PM Peak	47
Woodley Park-Zoo		PM Peak
Addison Road	AM Peak	48
Addison Road	Evening	50
Addison Road	Late Night Peak	50
Addison Road	Midday	51
Addison Road	PM Peak	51
Anacostia	AM Peak	51
Anacostia	Evening	50
Anacostia	Late Night Peak	51
Anacostia	Midday	50
Anacostia	PM Peak	51
Archives-Navy Memorial	AM Peak	51
Archives-Navy Memorial	Evening	49
Archives-Navy Memorial	Late Night Peak	51
Archives-Navy Memorial	Midday	51
Archives-Navy Memorial	PM Peak	51
Arlington Cemetery	AM Peak	51
Arlington Cemetery	Evening	50
Arlington Cemetery	Late Night Peak	21
Arlington Cemetery	Midday	51

Arlington CemeteryPM Peak	49
BallstonAM Peak	48
BallstonEvening	49
BallstonLate Night Peak	49
BallstonMidday	50
BallstonPM Peak	49
Benning RoadAM Peak	51
Benning RoadEvening	51
Benning RoadLate Night Peak	51
Benning RoadMidday	49
Benning RoadPM Peak	51
...	...
West Falls ChurchAM Peak	51
West Falls ChurchEvening	49
West Falls ChurchLate Night Peak	51
West Falls ChurchMidday	50
West Falls ChurchPM Peak	51
West HyattsvilleAM Peak	50
West HyattsvilleEvening	48
West HyattsvilleLate Night Peak	50
West HyattsvilleMidday	51
West HyattsvillePM Peak	50
WheatonAM Peak	48
WheatonEvening	51
WheatonLate Night Peak	51
WheatonMidday	50
WheatonPM Peak	49
White FlintAM Peak	47
White FlintEvening	47
White FlintLate Night Peak	49
White FlintMidday	50
White FlintPM Peak	51
WiehleAM Peak	10
WiehleEvening	6
WiehleLate Night Peak	6
WiehleMidday	11
WiehlePM Peak	9
Woodley Park-ZooAM Peak	50
Woodley Park-ZooEvening	50
Woodley Park-ZooLate Night Peak	51
Woodley Park-ZooMidday	47
Woodley Park-ZooPM Peak	0

[455 rows x 455 columns]

```
In [47]: for i in [5,10,15,20,25]:
          print('Clustering with threshold ', i, '%')
```

```

        clustering = AgglomerativeClustering(n_clusters=int(250/i))
        clustering.fit(di_matrix)

Clustering with threshold  5 %
Clustering with threshold 10 %
Clustering with threshold 15 %
Clustering with threshold 20 %
Clustering with threshold 25 %

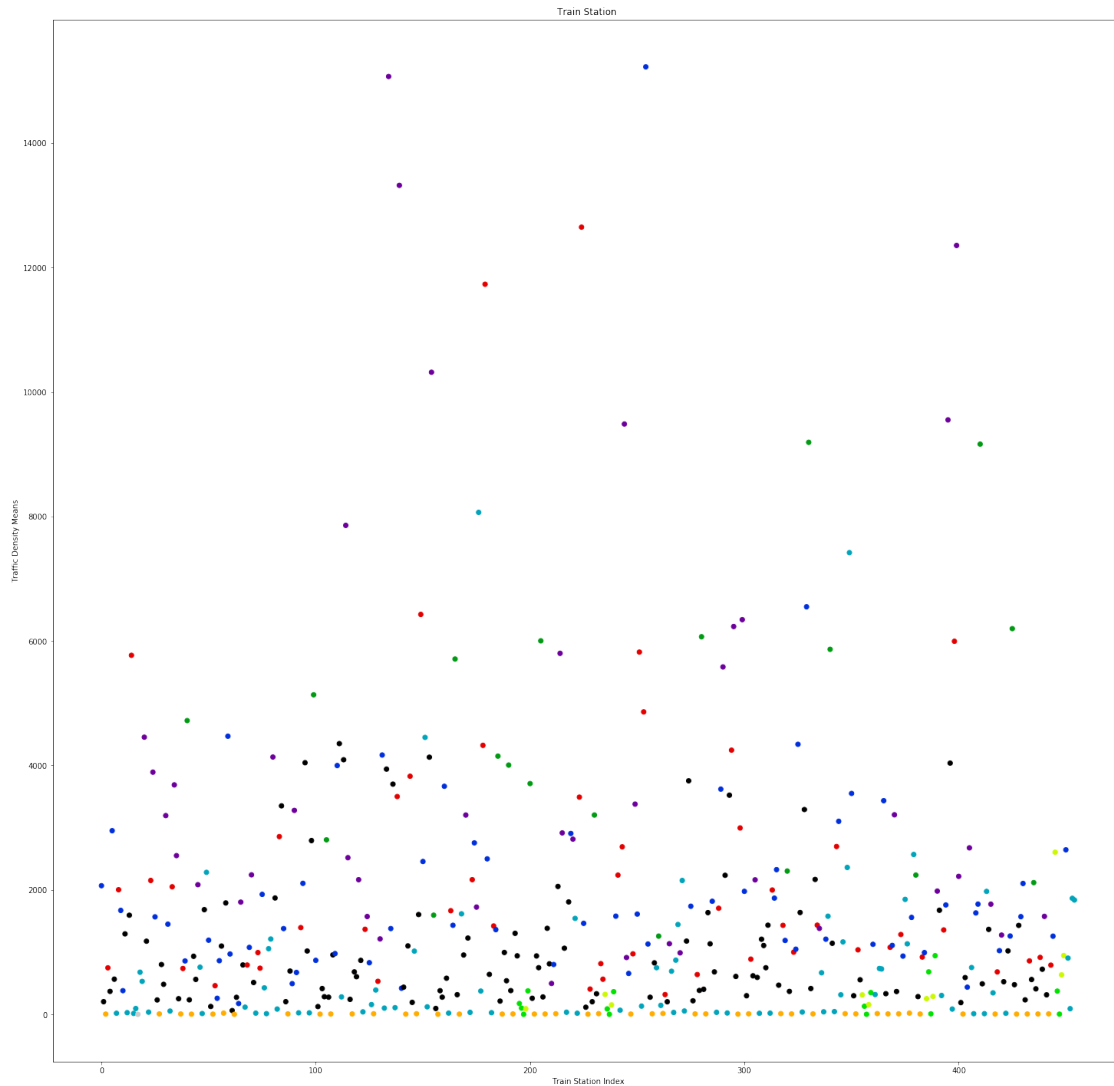
In [53]: Y = df.groupby('Station')['Passengerdensity'].mean().as_matrix()
        X = df.groupby('Station').mean().reset_index().index

        plt.scatter(X,Y, c=clustering.labels_, cmap=plt.cm.spectral)
        plt.title('Train Station ')
        plt.xlabel('Train Station Index')
        plt.ylabel('Traffic Density Means')

        plt.rcParams["figure.figsize"] = [5,5]

        plt.show()

```



```
In [40]: stations = df['Station'].unique()
cluster = dict()
for i in range(clustering.labels_.size):
    label = clustering.labels_[i]
    if label not in cluster:
        cluster[label] = list()
    else:
        cluster[label].append(stations[i])
```

```
In [79]: st_clusters = pd.DataFrame(dict([ ('Cluster ' + str(k),pd.Series(v)) for k,v in cluster.items()]))
```

```
In [80]: st_clusters
```

```
Out[80]:
```

Cluster	0	\
Cluster 0	Addison Road	PM Peak

Cluster 1	BallstonPM Peak
Cluster 2	AnacostiaAM Peak
Cluster 3	Archives-Navy MemorialLate Night Peak
Cluster 4	Crystal CityPM Peak
Cluster 5	GreensboroEvening
Cluster 6	McLeanAM Peak
Cluster 7	Benning RoadLate Night Peak
Cluster 8	AnacostiaMidday
Cluster 9	

	1	2	\
Cluster 0	AnacostiaEvening	Archives-Navy MemorialEvening	
Cluster 1	BethesdaAM Peak	BethesdaPM Peak	
Cluster 2	AnacostiaPM Peak	Archives-Navy MemorialAM Peak	
Cluster 3	Arlington CemeteryAM Peak	Arlington CemeteryEvening	
Cluster 4	Dunn LoringAM Peak	Forest GlenAM Peak	
Cluster 5	GreensboroLate Night Peak	GreensboroPM Peak	
Cluster 6	McLeanMidday	Spring HillAM Peak	
Cluster 7	Braddock RoadLate Night Peak	Branch AvenueLate Night Peak	
Cluster 8	Archives-Navy MemorialPM Peak	BallstonMidday	
Cluster 9			

	3	4	\
Cluster 0	Archives-Navy MemorialMidday	BallstonEvening	
Cluster 1	Braddock RoadAM Peak	BrooklandAM Peak	
Cluster 2	Benning RoadAM Peak	BethesdaEvening	
Cluster 3	Arlington CemeteryMidday	Arlington CemeteryPM Peak	
Cluster 4	Franconia-SpringfieldAM Peak	GlenmontAM Peak	
Cluster 5	McLeanEvening	McLeanLate Night Peak	
Cluster 6	Spring HillMidday	Tysons CornerAM Peak	
Cluster 7	Capitol HeightsLate Night Peak	Capitol SouthLate Night Peak	
Cluster 8	BethesdaMidday	Braddock RoadMidday	
Cluster 9			

	5	6	\
Cluster 0	Benning RoadEvening	Benning RoadMidday	
Cluster 1	ClarendonAM Peak	Cleveland ParkAM Peak	
Cluster 2	Braddock RoadPM Peak	Capitol HeightsAM Peak	
Cluster 3	BallstonLate Night Peak	BethesdaLate Night Peak	
Cluster 4	GreenbeltAM Peak	GrosvenorAM Peak	
Cluster 5	McLeanPM Peak	Spring HillEvening	
Cluster 6	Tysons CornerMidday	WiehleAM Peak	
Cluster 7	CheverlyLate Night Peak	Congress HeightsLate Night Peak	
Cluster 8	Capitol HeightsMidday	ClarendonMidday	
Cluster 9			

	7	8	\
Cluster 0	Benning RoadPM Peak	Braddock RoadEvening	

Cluster 1	Columbia HeightsAM Peak	Court HouseAM Peak
Cluster 2	Capitol HeightsPM Peak	Capitol SouthAM Peak
Cluster 3	BrooklandEvening	BrooklandLate Night Peak
Cluster 4	HuntingtonAM Peak	Largo Town CenterAM Peak
Cluster 5	Spring HillLate Night Peak	Spring HillPM Peak
Cluster 6	WiehleMidday	WiehlePM Peak
Cluster 7	DeanwoodLate Night Peak	Dunn LoringLate Night Peak
Cluster 8	Cleveland ParkMidday	Cleveland ParkPM Peak
Cluster 9		

		9	...	\
Cluster 0	Branch Avenue	Evening	...	
Cluster 1	Dupont Circle	PM Peak	...	
Cluster 2	Capitol South	PM Peak	...	
Cluster 3	Brookland	PM Peak	...	
Cluster 4	Morgan Blvd.	AM Peak	...	
Cluster 5	Tysons Corner	Evening	...	
Cluster 6			...	
Cluster 7	East Falls Church	Late Night Peak	...	
Cluster 8	Columbia Heights	Midday	...	
Cluster 9			...	

		109		110		111	\
Cluster 0	ViennaPM Peak	Waterfront	Evening	Waterfront	Midday		
Cluster 1							
Cluster 2							
Cluster 3							
Cluster 4							
Cluster 5							
Cluster 6							
Cluster 7							
Cluster 8							
Cluster 9							

			112		113	\
Cluster 0	West Falls Church	Evening	West Falls Church	Midday		
Cluster 1						
Cluster 2						
Cluster 3						
Cluster 4						
Cluster 5						
Cluster 6						
Cluster 7						
Cluster 8						
Cluster 9						

			114		115		116	\
Cluster 0	West Hyattsville	Evening	West Hyattsville	PM Peak	Wheaton	Evening		

```

Cluster 1
Cluster 2
Cluster 3
Cluster 4
Cluster 5
Cluster 6
Cluster 7
Cluster 8
Cluster 9

```

```

                                117                                118
Cluster 0  WheatonPM Peak  White FlintEvening
Cluster 1
Cluster 2
Cluster 3
Cluster 4
Cluster 5
Cluster 6
Cluster 7
Cluster 8
Cluster 9

```

```
[10 rows x 119 columns]
```

```
In [82]: st_clusters.to_excel('../Station Clusters.xlsx', 'Sheet1')
```

```
In [ ]:
```