SPD Values Different Movement

March 26, 2017

```python
In [1]: %matplotlib inline
        import pandas as pd
        import numpy as np
```

```python
In [2]: df = pd.read_excel('../change_values_am_peak.xlsx', 'Sheet1')
```

```python
In [3]: di_matrix = pd.read_excel('../distance_matrix_am_peak.xlsx', 'Sheet1')
```

```python
In [4]: year_wise = df.groupby("Year")
```

```python
In [5]: def find_diff_label_spd(label_group):
            movements = list(label_group.groups.keys())
            for name, group in label_group:
                movements.remove(name)
                if not movements:
                    pass
                else:
                    for label in movements:
                        di_matrix.ix[di_matrix.index.isin(group['Station']), list(label_group.ge
```

```python
In [6]: def find_spd_by_label(group):
            labels = group.groupby("Label")

            find_diff_label_spd(labels)
```

```python
In [7]: for name, group in year_wise:
            year_group = group[['Station','% Change','Label']]
            find_spd_by_label(year_group)
```

```python
In [8]: di_matrix
```

```
Out[8]:                        Addison Road  Anacostia  \
        Addison Road                      0          3
        Anacostia                        2          0
        Archives-Navy Memorial           2          1
        Arlington Cemetery               1          2
        Ballston                         3          2
        Benning Road                     3          4
        Bethesda                         3          2
```

1

Braddock Road	2	3
Branch Avenue	3	3
Brookland	2	3
Capitol Heights	3	2
Capitol South	2	3
Cheverly	3	3
Clarendon	2	3
Cleveland Park	1	3
College Park-U of MD	0	3
Columbia Heights	3	3
Congress Heights	3	3
Court House	3	4
Crystal City	2	2
Deanwood	3	3
Dunn Loring	3	4
Dupont Circle	2	3
East Falls Church	2	3
Eastern Market	3	3
Eisenhower Avenue	2	1
Farragut North	1	2
Farragut West	1	2
Federal Center SW	2	4
Federal Triangle	3	4
...	...	...
Prince George's Plaza	3	3
Reagan Washington National Airport	3	4
Rhode Island Avenue	2	3
Rockville	3	4
Rosslyn	1	2
Shady Grove	3	3
Shaw-Howard University	1	1
Silver Spring	3	4
Smithsonian	3	3
Southern Avenue	3	4
Spring Hill	1	1
Stadium-Armory	3	4
Suitland	3	4
Takoma	2	4
Tenleytown-AU	0	3
Twinbrook	2	4
Tysons Corner	1	1
U Street-Cardozo	3	4
Union Station	2	2
Van Dorn Street	2	4
Van Ness-UDC	2	3
Vienna	2	4
Virginia Square-GMU	3	3
Waterfront	1	1

```
West Falls Church                          3         2
West Hyattsville                           3         4
Wheaton                                    2         4
White Flint                                3         4
Wiehle                                     1         1
Woodley Park-Zoo                           1         3


                                    Archives-Navy Memorial  \
Addison Road                                   4
Anacostia                                      3
Archives-Navy Memorial                         0
Arlington Cemetery                             3
Ballston                                       4
Benning Road                                   4
Bethesda                                       3
Braddock Road                                  4
Branch Avenue                                  3
Brookland                                      4
Capitol Heights                                3
Capitol South                                  4
Cheverly                                       4
Clarendon                                      4
Cleveland Park                                 4
College Park-U of MD                           4
Columbia Heights                               4
Congress Heights                               4
Court House                                    4
Crystal City                                   4
Deanwood                                       3
Dunn Loring                                    4
Dupont Circle                                  4
East Falls Church                              3
Eastern Market                                 3
Eisenhower Avenue                              3
Farragut North                                 3
Farragut West                                  4
Federal Center SW                              4
Federal Triangle                               4
...                                           ...
Prince George's Plaza                          4
Reagan Washington National Airport             4
Rhode Island Avenue                            4
Rockville                                      4
Rosslyn                                        4
Shady Grove                                    3
Shaw-Howard University                         2
Silver Spring                                  4
Smithsonian                                    3
```

Southern Avenue	4
Spring Hill	1
Stadium-Armory	4
Suitland	4
Takoma	4
Tenleytown-AU	4
Twinbrook	4
Tysons Corner	1
U Street-Cardozo	4
Union Station	4
Van Dorn Street	4
Van Ness-UDC	4
Vienna	4
Virginia Square-GMU	4
Waterfront	4
West Falls Church	3
West Hyattsville	4
Wheaton	4
White Flint	4
Wiehle	1
Woodley Park-Zoo	4

	Arlington Cemetery	Ballston \
Addison Road	3	4
Anacostia	3	2
Archives-Navy Memorial	2	2
Arlington Cemetery	0	2
Ballston	3	0
Benning Road	3	3
Bethesda	3	3
Braddock Road	3	3
Branch Avenue	3	4
Brookland	3	3
Capitol Heights	3	3
Capitol South	3	4
Cheverly	3	2
Clarendon	3	3
Cleveland Park	3	3
College Park-U of MD	3	3
Columbia Heights	3	4
Congress Heights	2	2
Court House	3	3
Crystal City	4	2
Deanwood	3	4
Dunn Loring	3	4
Dupont Circle	3	3
East Falls Church	3	3
Eastern Market	3	4

Eisenhower Avenue	3	2
Farragut North	3	2
Farragut West	2	2
Federal Center SW	2	3
Federal Triangle	4	4
...	...	...
Prince George's Plaza	3	3
Reagan Washington National Airport	3	4
Rhode Island Avenue	2	2
Rockville	3	2
Rosslyn	3	2
Shady Grove	3	3
Shaw-Howard University	2	1
Silver Spring	3	3
Smithsonian	4	3
Southern Avenue	4	4
Spring Hill	1	1
Stadium-Armory	3	4
Suitland	4	4
Takoma	3	4
Tenleytown-AU	3	3
Twinbrook	3	3
Tysons Corner	1	1
U Street-Cardozo	3	4
Union Station	3	2
Van Dorn Street	3	3
Van Ness-UDC	3	3
Vienna	3	3
Virginia Square-GMU	3	2
Waterfront	2	2
West Falls Church	3	3
West Hyattsville	3	4
Wheaton	3	4
White Flint	3	4
Wiehle	1	1
Woodley Park-Zoo	3	3

	Benning Road	Bethesda	Braddock Road \
Addison Road	4	4	4
Anacostia	4	2	4
Archives-Navy Memorial	2	1	3
Arlington Cemetery	2	2	3
Ballston	3	3	4
Benning Road	0	3	4
Bethesda	3	0	4
Braddock Road	3	3	0
Branch Avenue	4	3	4
Brookland	3	3	3

Capitol Heights	4	1	4
Capitol South	3	4	4
Cheverly	4	3	4
Clarendon	2	3	4
Cleveland Park	3	3	4
College Park-U of MD	3	3	2
Columbia Heights	4	3	4
Congress Heights	3	3	2
Court House	1	3	4
Crystal City	3	2	4
Deanwood	4	3	4
Dunn Loring	4	4	4
Dupont Circle	3	3	4
East Falls Church	3	2	4
Eastern Market	4	3	3
Eisenhower Avenue	3	1	4
Farragut North	2	2	3
Farragut West	2	2	2
Federal Center SW	3	4	4
Federal Triangle	4	3	4
...	...	...	...
Prince George's Plaza	4	2	3
Reagan Washington National Airport	3	4	4
Rhode Island Avenue	3	3	3
Rockville	4	4	4
Rosslyn	2	3	3
Shady Grove	4	3	3
Shaw-Howard University	1	1	2
Silver Spring	4	3	4
Smithsonian	3	3	4
Southern Avenue	4	4	4
Spring Hill	1	1	0
Stadium-Armory	4	4	4
Suitland	4	4	4
Takoma	4	4	4
Tenleytown-AU	2	3	4
Twinbrook	3	4	4
Tysons Corner	1	1	0
U Street-Cardozo	3	4	3
Union Station	3	3	3
Van Dorn Street	4	4	4
Van Ness-UDC	3	3	4
Vienna	4	4	3
Virginia Square-GMU	3	4	3
Waterfront	2	2	2
West Falls Church	4	1	4
West Hyattsville	4	3	4
Wheaton	4	4	4

	Branch Avenue	Brookland \
White Flint	4	4	4
Wiehle	1	1	0
Woodley Park-Zoo	2	3	4

	Branch Avenue	Brookland \
Addison Road	4	4
Anacostia	3	4
Archives-Navy Memorial	1	3
Arlington Cemetery	2	3
Ballston	4	4
Benning Road	4	4
Bethesda	3	4
Braddock Road	3	3
Branch Avenue	0	4
Brookland	3	0
Capitol Heights	3	4
Capitol South	4	4
Cheverly	3	4
Clarendon	3	4
Cleveland Park	3	2
College Park-U of MD	3	4
Columbia Heights	4	3
Congress Heights	3	3
Court House	3	4
Crystal City	3	3
Deanwood	2	4
Dunn Loring	4	4
Dupont Circle	3	2
East Falls Church	3	3
Eastern Market	2	4
Eisenhower Avenue	1	4
Farragut North	2	3
Farragut West	2	2
Federal Center SW	4	4
Federal Triangle	4	4
...	...	...
Prince George's Plaza	3	4
Reagan Washington National Airport	4	4
Rhode Island Avenue	3	3
Rockville	3	4
Rosslyn	3	4
Shady Grove	2	4
Shaw-Howard University	1	2
Silver Spring	4	4
Smithsonian	3	4
Southern Avenue	4	4
Spring Hill	1	0
Stadium-Armory	4	3

Suitland	4	4
Takoma	3	3
Tenleytown-AU	3	4
Twinbrook	3	4
Tysons Corner	1	0
U Street-Cardozo	3	4
Union Station	3	4
Van Dorn Street	4	4
Van Ness-UDC	2	4
Vienna	4	4
Virginia Square-GMU	4	3
Waterfront	2	3
West Falls Church	2	4
West Hyattsville	4	4
Wheaton	4	4
White Flint	4	4
Wiehle	1	0
Woodley Park-Zoo	3	4

	...	Van Ness-UDC	Vienna \
Addison Road	...	4	2
Anacostia	...	4	3
Archives-Navy Memorial	...	3	1
Arlington Cemetery	...	3	2
Ballston	...	4	2
Benning Road	...	4	3
Bethesda	...	4	3
Braddock Road	...	4	1
Branch Avenue	...	3	3
Brookland	...	4	2
Capitol Heights	...	3	3
Capitol South	...	4	3
Cheverly	...	3	3
Clarendon	...	4	2
Cleveland Park	...	2	1
College Park-U of MD	...	4	0
Columbia Heights	...	4	3
Congress Heights	...	3	3
Court House	...	4	3
Crystal City	...	4	2
Deanwood	...	4	3
Dunn Loring	...	4	3
Dupont Circle	...	4	2
East Falls Church	...	4	2
Eastern Market	...	4	2
Eisenhower Avenue	...	2	2
Farragut North	...	3	1
Farragut West	...	3	1

Federal Center SW	...	3	2
Federal Triangle	...	4	4
...	...	...	...
Prince George's Plaza	...	4	3
Reagan Washington National Airport	...	4	3
Rhode Island Avenue	...	3	1
Rockville	...	4	4
Rosslyn	...	4	0
Shady Grove	...	4	3
Shaw-Howard University	...	2	1
Silver Spring	...	4	3
Smithsonian	...	4	2
Southern Avenue	...	3	4
Spring Hill	...	1	1
Stadium-Armory	...	4	3
Suitland	...	4	4
Takoma	...	3	2
Tenleytown-AU	...	3	1
Twinbrook	...	4	3
Tysons Corner	...	1	1
U Street-Cardozo	...	4	2
Union Station	...	4	1
Van Dorn Street	...	4	3
Van Ness-UDC	...	0	2
Vienna	...	4	0
Virginia Square-GMU	...	4	2
Waterfront	...	2	0
West Falls Church	...	4	4
West Hyattsville	...	4	2
Wheaton	...	4	1
White Flint	...	4	3
Wiehle	...	1	1
Woodley Park-Zoo	...	4	2

	Virginia Square-GMU	Waterfront \
Addison Road	4	3
Anacostia	3	3
Archives-Navy Memorial	2	4
Arlington Cemetery	2	3
Ballston	2	4
Benning Road	3	4
Bethesda	4	4
Braddock Road	2	3
Branch Avenue	4	4
Brookland	2	4
Capitol Heights	4	4
Capitol South	4	4
Cheverly	4	4

Clarendon	3	4
Cleveland Park	2	3
College Park-U of MD	3	3
Columbia Heights	3	3
Congress Heights	1	3
Court House	4	4
Crystal City	3	4
Deanwood	3	4
Dunn Loring	4	4
Dupont Circle	3	4
East Falls Church	3	4
Eastern Market	4	3
Eisenhower Avenue	3	4
Farragut North	2	4
Farragut West	1	4
Federal Center SW	3	3
Federal Triangle	4	4
...	...	...
Prince George's Plaza	3	4
Reagan Washington National Airport	4	4
Rhode Island Avenue	2	4
Rockville	3	4
Rosslyn	2	4
Shady Grove	3	4
Shaw-Howard University	1	3
Silver Spring	3	4
Smithsonian	3	4
Southern Avenue	4	4
Spring Hill	0	1
Stadium-Armory	4	4
Suitland	4	4
Takoma	3	4
Tenleytown-AU	2	3
Twinbrook	3	4
Tysons Corner	0	1
U Street-Cardozo	4	4
Union Station	3	3
Van Dorn Street	3	4
Van Ness-UDC	3	3
Vienna	3	3
Virginia Square-GMU	0	3
Waterfront	1	0
West Falls Church	4	4
West Hyattsville	4	4
Wheaton	4	4
White Flint	4	4
Wiehle	0	1
Woodley Park-Zoo	2	4

	West Falls Church	West Hyattsville \
Addison Road	3	4
Anacostia	1	4
Archives-Navy Memorial	0	2
Arlington Cemetery	2	2
Ballston	2	4
Benning Road	3	4
Bethesda	0	3
Braddock Road	2	3
Branch Avenue	1	4
Brookland	2	3
Capitol Heights	2	3
Capitol South	3	3
Cheverly	2	4
Clarendon	2	3
Cleveland Park	2	3
College Park-U of MD	2	3
Columbia Heights	2	2
Congress Heights	3	2
Court House	3	3
Crystal City	1	3
Deanwood	2	4
Dunn Loring	3	3
Dupont Circle	2	3
East Falls Church	2	2
Eastern Market	2	4
Eisenhower Avenue	0	3
Farragut North	1	2
Farragut West	1	2
Federal Center SW	3	4
Federal Triangle	3	4
...	...	...
Prince George's Plaza	1	3
Reagan Washington National Airport	3	4
Rhode Island Avenue	2	2
Rockville	3	4
Rosslyn	2	3
Shady Grove	3	4
Shaw-Howard University	1	1
Silver Spring	2	3
Smithsonian	2	3
Southern Avenue	4	4
Spring Hill	1	1
Stadium-Armory	3	3
Suitland	4	4
Takoma	3	4
Tenleytown-AU	2	3

Twinbrook	3	4
Tysons Corner	1	1
U Street-Cardozo	2	3
Union Station	2	3
Van Dorn Street	3	4
Van Ness-UDC	2	3
Vienna	4	3
Virginia Square-GMU	3	4
Waterfront	1	2
West Falls Church	0	4
West Hyattsville	3	0
Wheaton	3	3
White Flint	3	4
Wiehle	1	1
Woodley Park-Zoo	2	3

	Wheaton	White Flint	Wiehle \
Addison Road	2	5	2
Anacostia	3	5	2
Archives-Navy Memorial	2	2	2
Arlington Cemetery	1	2	2
Ballston	3	5	2
Benning Road	3	5	2
Bethesda	3	5	2
Braddock Road	2	3	1
Branch Avenue	3	5	2
Brookland	2	3	1
Capitol Heights	2	4	2
Capitol South	3	4	2
Cheverly	3	4	2
Clarendon	1	3	2
Cleveland Park	2	3	2
College Park-U of MD	1	3	2
Columbia Heights	2	5	1
Congress Heights	3	4	1
Court House	3	5	2
Crystal City	2	3	2
Deanwood	3	5	2
Dunn Loring	3	4	2
Dupont Circle	3	2	1
East Falls Church	1	2	2
Eastern Market	3	4	2
Eisenhower Avenue	2	3	2
Farragut North	2	1	2
Farragut West	2	2	1
Federal Center SW	2	3	2
Federal Triangle	3	3	2
...	...	...	...

Prince George's Plaza	3	5	2
Reagan Washington National Airport	3	4	2
Rhode Island Avenue	2	3	2
Rockville	3	4	2
Rosslyn	1	3	2
Shady Grove	3	5	2
Shaw-Howard University	1	1	2
Silver Spring	2	5	2
Smithsonian	3	3	2
Southern Avenue	3	5	2
Spring Hill	1	1	1
Stadium-Armory	3	5	2
Suitland	3	4	2
Takoma	2	3	2
Tenleytown-AU	1	3	2
Twinbrook	3	4	2
Tysons Corner	1	1	1
U Street-Cardozo	2	5	2
Union Station	2	2	2
Van Dorn Street	2	4	2
Van Ness-UDC	2	3	2
Vienna	1	5	2
Virginia Square-GMU	3	5	1
Waterfront	2	2	2
West Falls Church	3	5	2
West Hyattsville	2	5	2
Wheaton	0	5	2
White Flint	3	0	2
Wiehle	1	1	0
Woodley Park-Zoo	1	3	2

	Woodley Park-Zoo
Addison Road	3
Anacostia	4
Archives-Navy Memorial	3
Arlington Cemetery	3
Ballston	4
Benning Road	3
Bethesda	4
Braddock Road	4
Branch Avenue	4
Brookland	4
Capitol Heights	4
Capitol South	4
Cheverly	4
Clarendon	4
Cleveland Park	3
College Park-U of MD	2

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Columbia Heights                            4
Congress Heights                            3
Court House                                 4
Crystal City                                4
Deanwood                                    3
Dunn Loring                                 4
Dupont Circle                               4
East Falls Church                           4
Eastern Market                              4
Eisenhower Avenue                           4
Farragut North                              3
Farragut West                               2
Federal Center SW                           4
Federal Triangle                            4
...                                       ...
Prince George's Plaza                       4
Reagan Washington National Airport          3
Rhode Island Avenue                         3
Rockville                                   4
Rosslyn                                     3
Shady Grove                                 4
Shaw-Howard University                      2
Silver Spring                               3
Smithsonian                                 4
Southern Avenue                             4
Spring Hill                                 1
Stadium-Armory                              4
Suitland                                    4
Takoma                                      2
Tenleytown-AU                               2
Twinbrook                                   3
Tysons Corner                               1
U Street-Cardozo                            4
Union Station                               3
Van Dorn Street                             2
Van Ness-UDC                                4
Vienna                                      4
Virginia Square-GMU                         3
Waterfront                                  3
West Falls Church                           4
West Hyattsville                            4
Wheaton                                     3
White Flint                                 4
Wiehle                                      1
Woodley Park-Zoo                            0

[91 rows x 91 columns]
```

```
In [9]: di_matrix.to_excel('../distance_matrix_am_peak.xlsx', sheet_name='Sheet1')
```