Uber Logistics Challenge

Joseph Lin

Executive Summary

Bikes Rides Largely Occur During Commute Hours on Monday Through Friday

These rides were taken by the Subscriber Type Cohort: Subscribers

City of San Francisco Accounted for 90% of All Bike Share Rides

And 50% of Bike Share Stations

The San Francisco Caltrain Station and Ferry Building see the Most Rides To/From

26% of rides occured at the Caltrain Station and 10% occurred at the Ferry Building

Bike Share Stations Should Expand Along Bike Routes Especially in SoMa Area

With the Subscriber Cohort dominating the userbase, opportunities exist along Howard and Folsom St in West SoMa

Data Set

Initial Observations

Attribute	Measure
Total # of Rides	171,792
Average # of Rides/Day	934
Range of Ride Dates	March 1, 2014 – August 31,2014
Cities	Mountain View, Palo Alto, Redwood City, San Francisco, San Jose
Top City (Rides)	San Francisco
Top Station (Rides)	San Francisco Caltrain
Cohorts	83% Subscriber and 17% Customer

Processing the Data

o The following tables were aggregated to produce the LDA Data Set csv file:

Table 1: fact_trips

Column Name	Datatype
id	int
duration	numeric
start_date	timestamp
end_date	timestamp
start_station_id	int
end_station_id	int
entity_id	int
bike_id	int

Table 2: dim_stations

Column Name	Datatype
id	int
station_name	string
terminal_name	string

Table 3: dim_entity

Column Name	Datatype
id	int
entity_name	int
entity_type	string

Table 4: dim_entity_zip

Column Name	Datatype
id	int
entity_id	int
zip_code	string

Table 5: dim_timezone

Column Name	Datatype
id	int
timezone	string

Table 6: dim_bike

Column Name	Datatype
id	int
last_shop_visit	timestamp
first_ride	timestamp

o Then subsequently loaded into an iPython Notebook to create our analysis.

o Station Geographical Data was obtained by manually inputting Google Maps coordinates into a csv File

o Data Visualization Dashboards and Tools were built using Tableau, Matplotlib/Networkx/Leaflet, and D3

o The query used to create the dataset will be attached along with this presentation.

UBER

Most Rides Occur on Weekdays

Weekly Trend in Rides

Max of Total Rides by Weekday*

Day	Sun	Mon	Tue	Wed	Thu	Fri	Sat
Orders	1072	4187	4487	4300	4310	3579	1074
Time	3PM	8AM	8AM	8AM	8AM	8AM	12PM

*Observes Total # of Rides

Average Daily Rides by Weekday**

Day	Sun	Mon	Tue	Wed	Thu	Fri	Sat
Orders	411	1116	1195	1203	1178	1049	424

**Takes average of all respective weekdays

What do we notice about Bike Share Users?

Users of Bike Share tend to ride on Weekdays for what seems like their commutes (8am rides to their 9-5 work hours). This hints that more of the bike share User base are commuters than leisure riders.
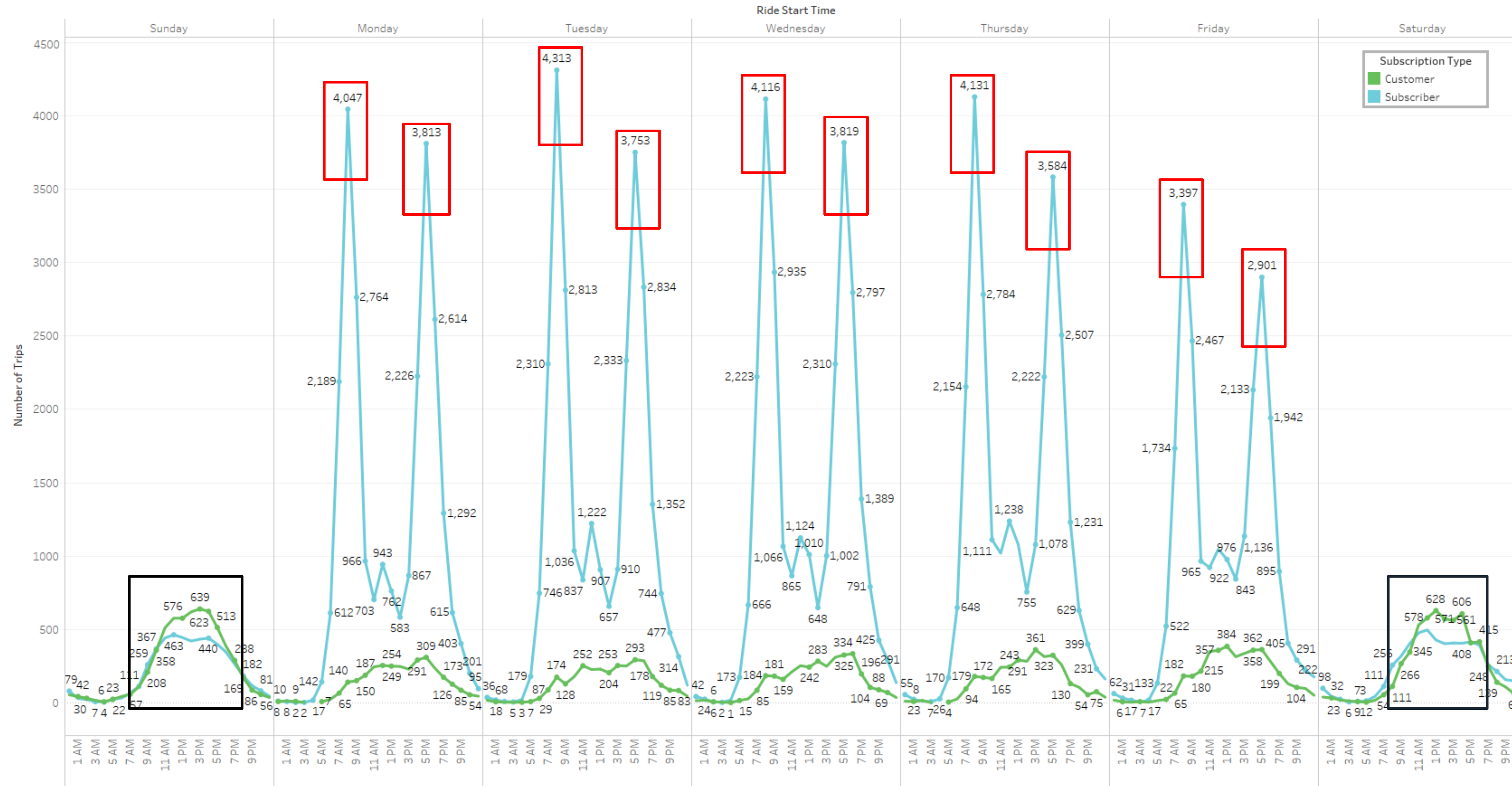

Saturday 6.66%
Sunday 6.45%
Friday 15.87%
Monday 16.89%
Thursday 17.84%
Tuesday 18.09%
Wednesday 18.20%

Saturdays and Sundays account for only 13% of all rides throughout the week
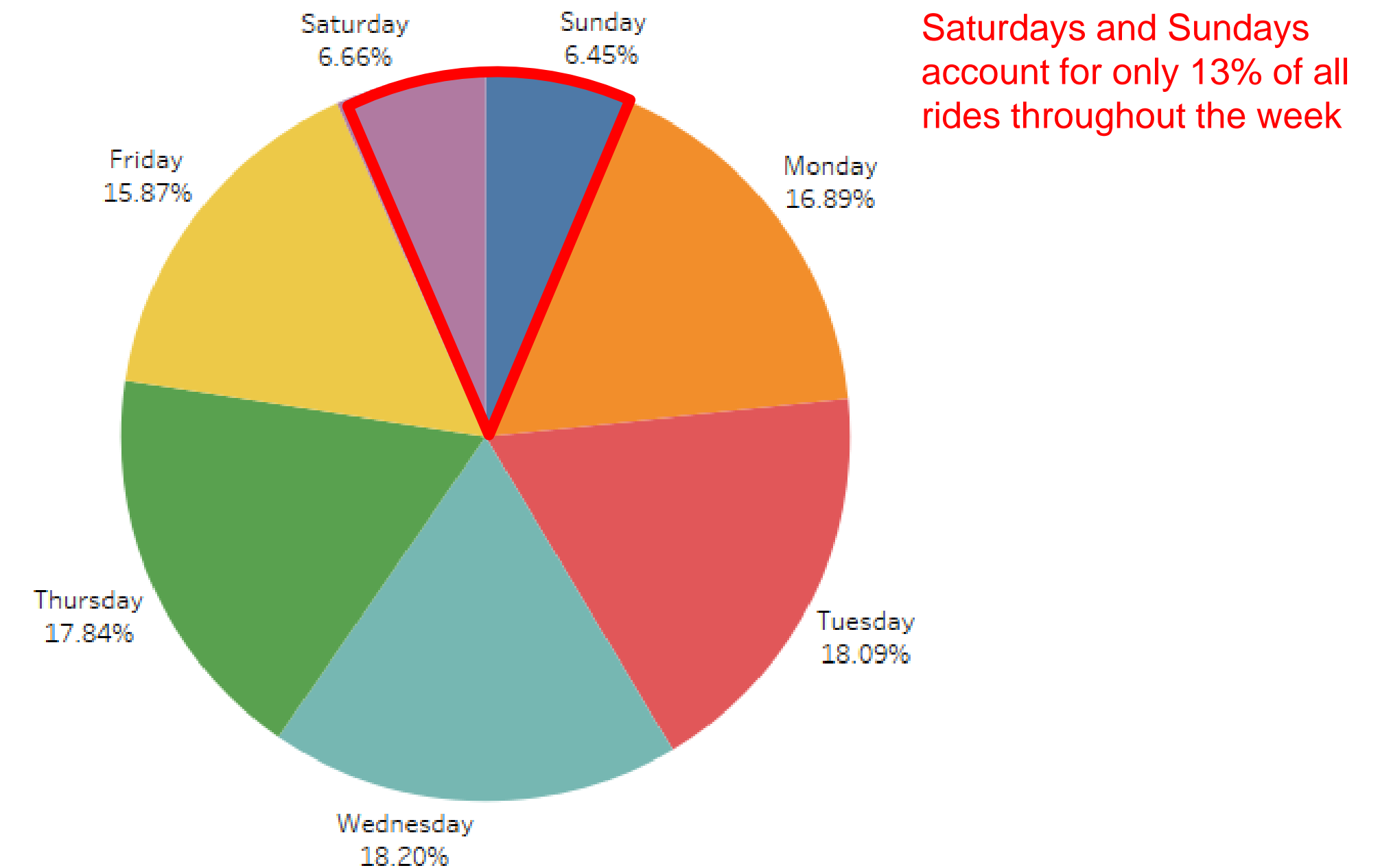
Percentage of Total Rides by Weekday

Rides Occur Largely During Commute Hours

Trend in Rides by Hour of Day of Week

Weekdays see a spike in the morning at 8am-9am, and another spike around 5pm for Subscribers

Weekends see a steady amount of rides between the hours of 11-5pm for both Customers and Subscribers

What do we learn about our cohorts?

On weekends, there are more Customers riding bikes than Subscribers, whereas on weekdays there are significantly more Subscribers riding bikes than Customers. On weekdays, Subscribers will use rides to commute to and from work at 8am and 5pm.
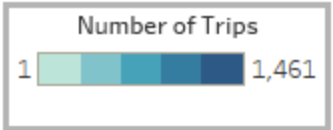
Majority of Subscribers Ride To/From The Caltrain Station Area

Start and End Rides for Subscriber Cohort

Ride Highlight Table (San Francisco)

All rides going to and from the Caltrain Stations are above the mean of 100 rides with the exception of its roundabout rides (starting and ending at the same station)

The Top Start and End Destination is Townsend at 7th, which is right next to the Caltrain Station

Subscription Type: Subscriber

Number of Trips: 1 — 1,461

Subscription Type: Subscriber

End Terminal

Start Terminal	San Francisco Caltrain (Townsend at 4th)	Market at Sansome	San Francisco Caltrain 2 (330 Townsend)	2nd at Townsend	Townsend at 7th	Harry Bridges Plaza (Ferry Building)	Temporary Transbay Terminal (Howar…)	Steuart at Market	Powell Street BART	Embarcadero at Sansome	Market at 4th	2nd at South Park	Market at 10th	Howard at 2nd	5th at Howard	Embarcadero at Folsom	Beale at Market	Commercial at Montgomery	Embarcadero at Bryant	Civic Center BART (7th at Market)	Spear at Folsom	Yerba Buena Center of the Arts (3rd @ Howard)	Mechanics Plaza (Market at Battery)	Davis at Jackson	South Van Ness at Market	2nd at Folsom
San Francisco Caltrain (T…	69	889	28	438	523	641	913	775	255	337	297	265	350	534	296	791	325	243	376	139	319	638	295	453	214	286
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Market at Sansome	721	52	319	329	174	363	152	152	180	217	97	893	136	56	106	69	62	236	76	132	79	77	19	190	153	290
2nd at Townsend	379	323	230	112	185	1,003	370	714	36	160	81	36	27	304	63	254	173	48	124	30	230	131	88	138	16	137
Harry Bridges Plaza (Fer.	487	260	326	889	329	66	172	7	68	876	112	145	71	195	95	37	23	115	243	23	64	119	196	80	29	92
Steuart at Market	916	60	607	839	120	22	33	65	51	604	78	163	40	128	28	218	6	19	247	36	115	105	103	77	33	25
Townsend at 7th	1,461	187	433	197	93	307	302	85	122	22	162	62	91	50	124	21	24	9	52	463	108	68	25	41	181	50
Market at 10th	939	218	174	22	161	58	58	58	390	14	578	120	78	63	89	13	44	58	17	163	31	165	96	43	47	64
2nd at South Park	404	999	237	50	155	211	252	136	56	47	130	63	37	141	75	59	68	45	37	14	111	101	106	22	29	85
Market at 4th	719	146	255	85	156	190	331	87	28	97	44	97	445	110	31	29	115	75	71	128	78	34	105	97	86	73
Embarcadero at Sansome	199	107	92	231	45	414	262	1,000	62	66	74	17	34	30	19	119	246	113	88	59	83	35	101	139	11	4
Beale at Market	460	40	284	320	45	116	426	19	114	263	126	130	50	33	31	52	21	227	103	34	201	31	21	70	38	22
2nd at Folsom	512	731	217	144	54	142	138	63	245	19	161	158	47	88	110	70	49	28	86	59	186	76	32	48	12	23
Powell Street BART	607	233	422	32	168	47	101	45	32	59	49	36	463	37	47	11	101	33	11	135	30	26	70	37	300	240
Grant Avenue at Columb.	208	603	108	153	63	86	141	107	135	20	142	44	42	40	30	315	216	146	28	36	58	21	35	67	26	42
South Van Ness at Marke.	408	307	102	12	120	39	133	50	341	6	167	98	61	80	73	68	43	41	13	337	41	43	66	28	42	36
Embarcadero at Folsom	851	73	363	264	61	62	28	117	32	156	33	64	8	65	54	42	67	21	152	15	15	73	62	43	12	30
Embarcadero at Bryant	390	46	161	161	81	285	56	180	15	211	30	34	8	25	15	109	43	151	77	9	122	24	141	45	3	64
Howard at 2nd	601	91	264	175	76	178	57	128	47	39	138	177	62	58	191	44	28	27	23	46	81	47	19	13	90	9
Commercial at Montgom.	311	272	108	61	20	116	206	23	69	46	103	48	35	55	91	41	122	30	163	30	90	119	112	232	39	27
5th at Howard	685	131	194	51	153	79	192	55	63	6	48	60	69	101	27	66	38	127	10	84	93	15	22	10	51	63
Mechanics Plaza (Marke.	234	26	66	84	33	99	56	70	174	65	223	71	97	27	49	107	6	123	111	93	69	20	35	149	152	14
Spear at Folsom	339	32	214	321	126	150	50	100	32	46	50	134	22	95	107	8	72	83	91	18	43	90	65	50	19	81
Civic Center BART (7th a.	158	196	86	15	547	20	69	79	90	99	118	32	174	33	51	8	58	22	11	35	11	24	43	22	232	36
Yerba Buena Center of t.	646	54	415	63	95	102	51	105	63	19	27	65	149	12	113	25	48	105	20	29	52	17	12	9	52	34
Davis at Jackson	293	147	105	154	18	68	57	49	27	181	70	19	61	68	20	39	102	170	69	15	84	6	55	106	14	18
Powell at Post (Union Sq.	248	162	136	41	118	52	38	34	40	90	27	101	101	158	39	21	68	55	15	32	22	40	126	69	23	70
Broadway St at Battery .	333	104	114	102	7	30	152	163	18	17	30	9	13	11	13	30	284	11	95	45	50	11	177	35	12	10

Key Takeaways:

Subscribers to the Bike Share Program are predominantly using the service for commuting back and forth to the Financial District, SoMa, and along Market St. Many of these subscribers begin or end their rides from the Caltrain Station as well.
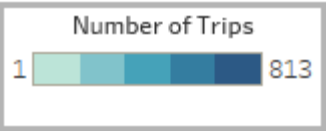
UBER

Ride Highlight Table (San Francisco)

All rides going to and from the Caltrain Stations are above the mean of 100 rides with the exception of its roundabout rides (starting and ending at the same station)

The Top Start and End Destination is the Ferry Building, which is on the Embarcadero (a predominantly tourist area)

Subscription Type: Customer

Number of Trips: 1 — 813

Subscription Type: Customer

Start Terminal	Embarcadero at Sansome	Harry Bridges Plaza (Ferry Building)	Market at 4th	Powell Street BART	San Francisco Caltrain (Townsend at 4th)	Steuart at Market	Embarcadero at Vallejo	Powell at Post (Union Square)	2nd at Townsend	Grant Avenue at Columbus Avenue	Market at 10th	Market at Sansome	Civic Center BART (7th at Market)	South Van Ness at Market	Embarcadero at Bryant	Yerba Buena Center of the Arts (3rd @ Howard)	Washington at Kearny	Mechanics Plaza (Market at Battery)	5th at Howard	Townsend at 7th	Clay at Battery	Post at Kearny	Embarcadero at Folsom	2nd at South Park	San Francisco Caltrain 2 (330 Townsend)	Beale at Market
Embarcadero at Sansome	540	348	208	135	95	128	103	113	122	111	24	90	45	24	104	53	103	98	27	13	71	43	72	27	34	50
Harry Bridges Plaza (Fer..	813	409	94	123	92	14	182	67	118	124	30	52	37	34	77	41	51	56	34	40	31	26	22	30	21	8
Market at 4th	180	116	144	29	52	92	43	37	18	49	46	35	35	49	13	11	20	19	15	12	17	5	10	7	14	17
Powell Street BART	120	92	33	136	36	53	22	28	16	26	79	34	72	63	5	6	19	21	14	25	7	8	7	15	20	10
Embarcadero at Vallejo	321	79	23	25	51	31	155	35	26	47	12	14	17	8	23	13	13	17	10	1	11	9	15	5	10	13
Powell at Post (Union Sq..	133	72	29	45	46	74	26	142	11	34	42	17	42	29	7	36	18	16	11	18	23	8	15	7	5
2nd at Townsend	92	106	23	15	20	27	53	30	108	29	13	41	23	14	23	29	19	16	7	18	26	16	31	9	11	14
Steuart at Market	181	22	49	27	56	148	48	31	54	23	33	9	17	12	20	23	6	14	20	15	3	17	12	21	19	9
San Francisco Caltrain (T..	94	108	29	49	72	51	26	21	23	12	30	26	19	16	22	32	4	8	27	31	9	14	15	15	4	8
Embarcadero at Bryant	151	102	20	8	69	31	54	18	47	21	8	11	10	8	105	10	3	8		15	18	11	21	5	11	13
Market at Sansome	156	97	27	24	31	61	36	19	31	15	15	69	16	19	8	10	11	19	5	7	12	4	11	32	14	9
Grant Avenue at Columb..	74	55	31	53	20	11	25	37	20	97	14	28	19	35	12	26	12	5	9	4	17	17	6	9	20	14
Market at 10th	41	43	57	71	35	57	10	27	6	11	131	31	10	16	5	10	6	12	12	15	6	29	2	9	13	10
Yerba Buena Center of t..	40	49	15	25	25	37	13	33	24	19	18	8	31	30	12	59	21	4	23	25	9	13	17	18	9	9
Civic Center BART (7th a..	37	36	49	53	11	29	7	32	7	20	33	17	93	46	4	12	12	10	11	15	7	8	1	7	2	6
Washington at Kearny	121	30	17	16	4	19	28	28	10	35	13	9	19	22	13	23	90	12	3	6	10	14	5	8	5	4
Mechanics Plaza (Marke..	83	59	51	51	16	15	16	39	12	7	19	11	13	11	13	9	4	70	6	1	8	5	5	6	6	2
5th at Howard	45	39	22	16	52	19	20	26	10	13	24	6	15	20	5	9	10	4	54	15	3	4	2	7	20	5
Clay at Battery	94	36	27	8	17	6	20	21	21	13	7	4	2	5	8	6	14	3	10	2	87	7	12	3	5	5
Embarcadero at Folsom	79	30	6	9	30	11	15	5	49	10	1	10	4	9	27	16		3	7	10	3	5	62	12	14	3
2nd at South Park	42	45	11	22	10	17	5	24	11	20	6	40	10	10	11	15	6	4	19	14	4	11	5	32	6	3
Townsend at 7th	9	41	8	27	66	9	2	15	36	2	12	6	31	13	10	12	1	1	13	32		1	6	13	19	3
San Francisco Caltrain 2 ..	21	30	8	25	12	9	27	7	6	7	23	14	19	13	8	6			48	43	2	3	13	3	44	3
South Van Ness at Market	13	32	47	43	20	21		17	6	7	7	21	12	51	5	6	9	7	9	4	6	6	2	5	5	9
Post at Kearny	59	24	14	13	6	34	12	21	7	20	17	8	7	16	5	3	18	7	3	5	5	55	3	10	4
Beale at Market	65	27	30	16	25	9	14	9	18	13	8	7	6	7	15	4	5	5	4	4	2	7	4	10	6	48
San Francisco City Hall	20	33	24	32	7	23	1	15	7	8	15	15	25	12		4	2	8	6	5	1	5		4	5	4
Broadway St at Battery ..	56	15	15	1	14	4	12	11	11	15	2	10	4	2	15	7	5	7	1	3	5	2	4	6	3	6
Davis at Jackson	47	8	7	21	21	5	13	5	22	13	1	10	1	3	6		10	7	2	6	3	7	1	8	2

End Terminal

Key Takeaways:

The Customers cohort in the Bike Share Program are predominantly using the service for leisure to ride along the Embarcadero. Many of these customers ride between the Ferry Building and the Fisherman's Wharf.

Network Graph Python Tool Methodology

Code in iPython Notebook

Methodology

o First, the data set was first aggregated on Start and End Destinations to look at # of Trips (only in one direction) as well as Total Trips (both To and From). Then, station geographical data was imported via a csv file, which was entered in manually using Google Maps.

o Dictionaries were then created to store the Coordinates and Total Trips (both To and From). Next, **the nodes** were created with the Coordinates, Total Trips, and Station Name attributes. Size and Color are different based on Total Trips to that Station.

o Last, **the edges** were created and weighted based on a factor of # of Trips. Thicker edges and darker edges represent frequency and directionality respectively.
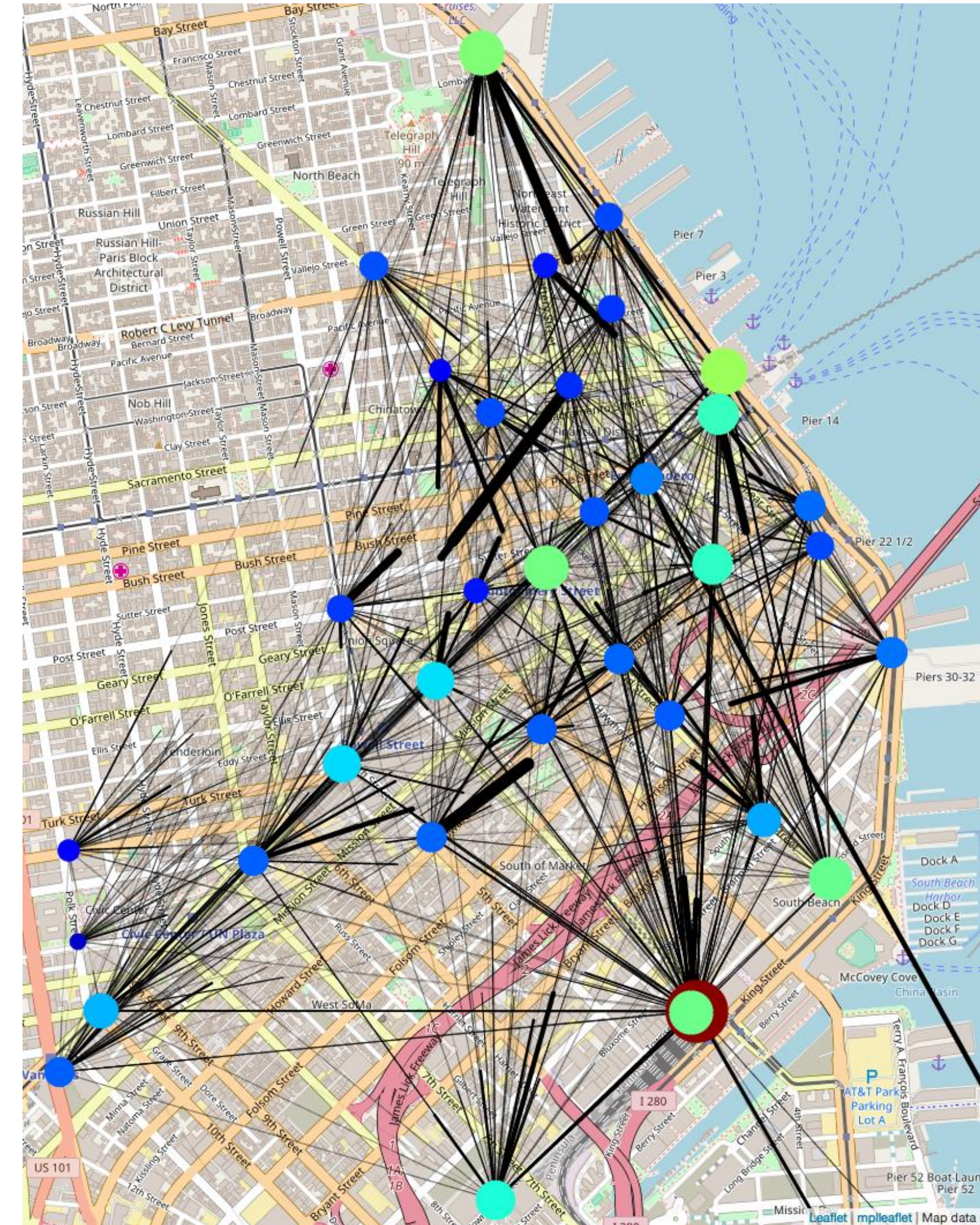
■ Very High Traffic
Most Rides (Caltrain)

■ High Traffic
Embarcadero

■ Frequent Traffic
Market St.

■ Moderate Traffic

■ Low Traffic

Bike Share Should Expand Along Bike Routes in SF

Into West SoMa along Howard and Folsom St.

Analysis

o Since the majority of Bike Share's user base is made up of Subscribers who primarily use the service to commute, there is a need to expand outward from the Caltrain Station.

o Due to the Eastern location of Caltrain in San Francisco, the logical action to take would be to **expand West of Caltrain.**

o It would also make sense to **add stations along Bike Routes.**

o To satisfy the requirements of being **West of Caltrain and along Bike Routes** the following streets were chosen:

  o Howard St.
  o Folsom St
  o 5th St, 7th St, 8th St

Insight: Many Tech companies are located in the SoMa/West SoMa region, and thus expansion into this area would allow their employees to commute via Bike Share.
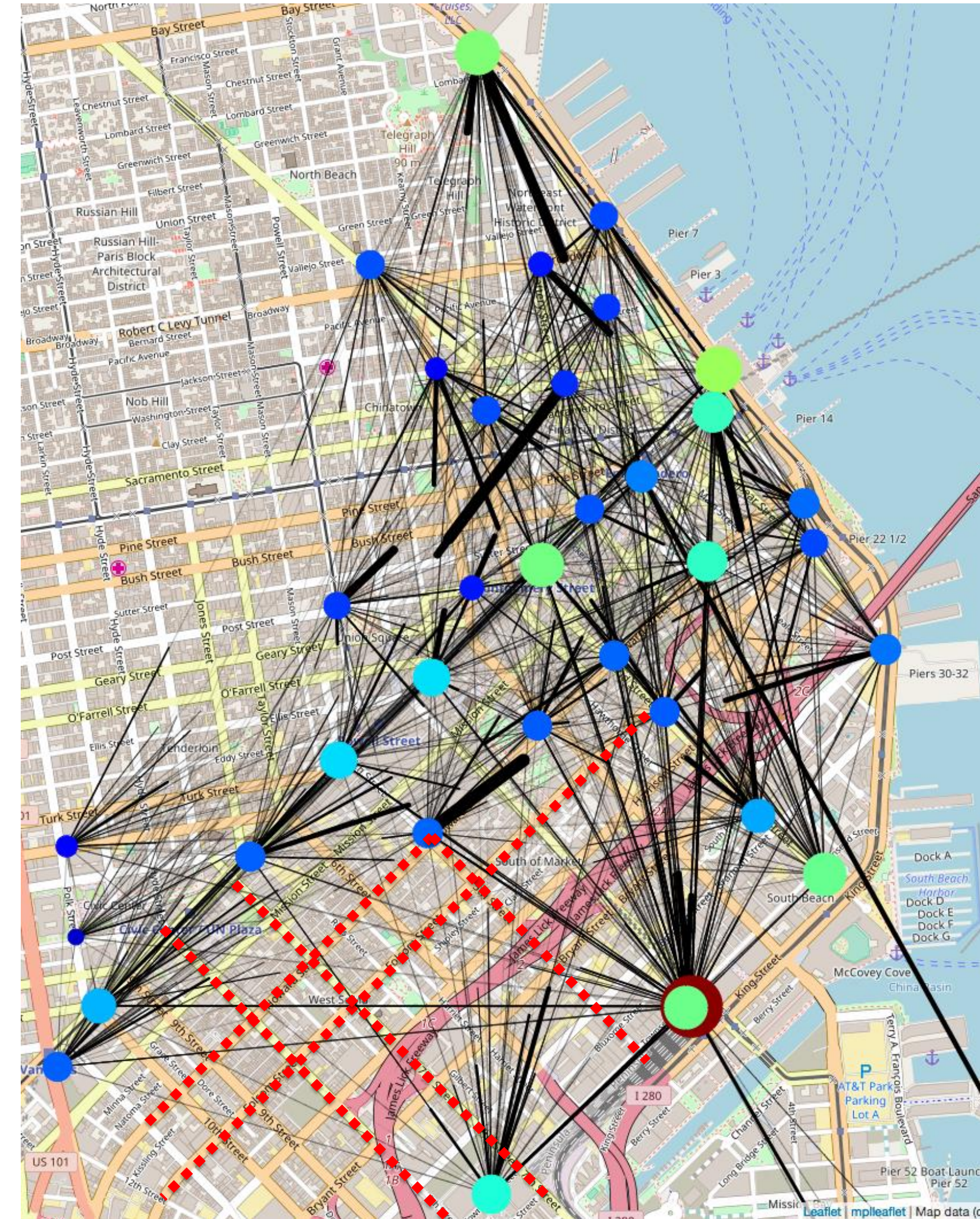
■ Very High Traffic
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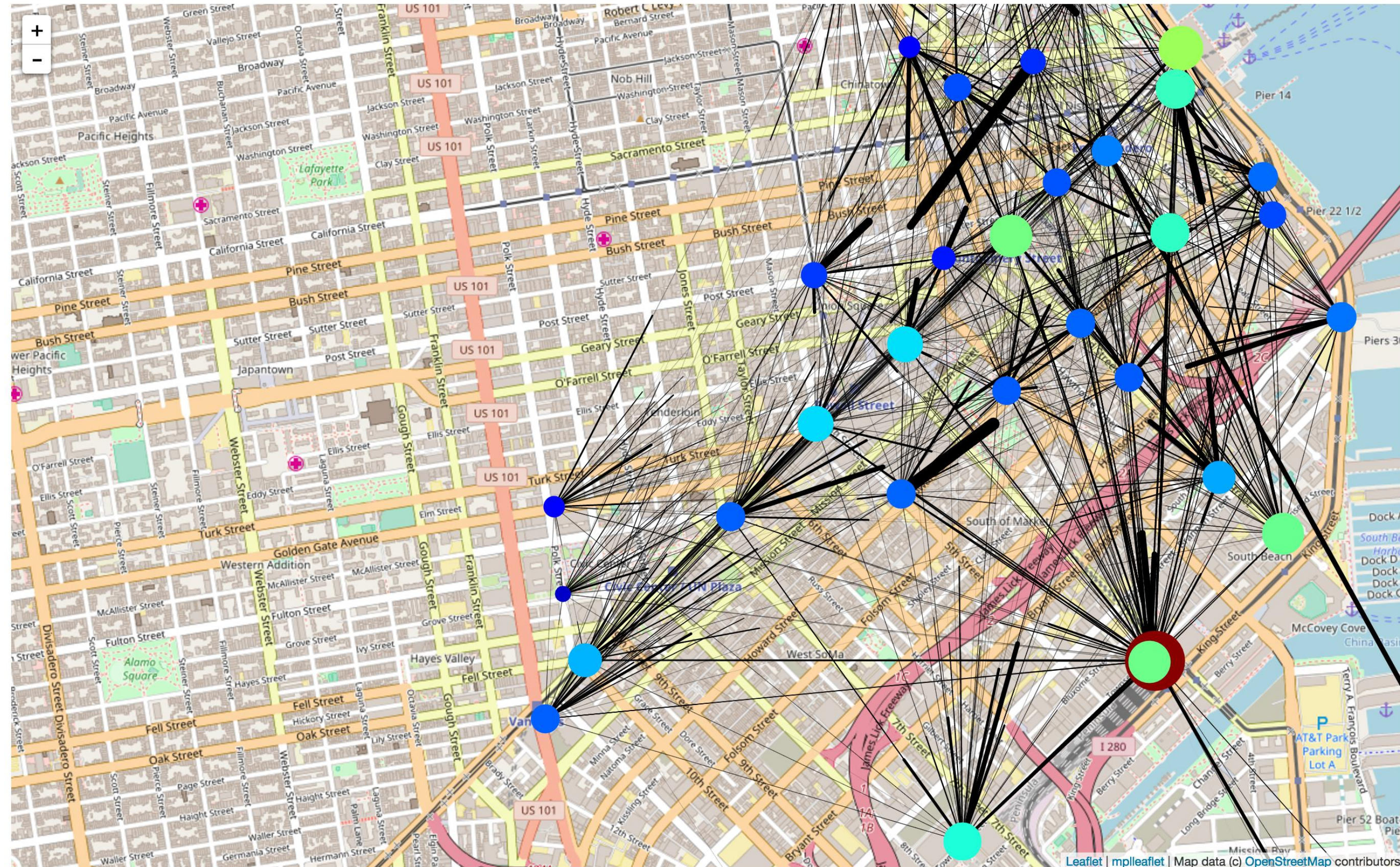Market St.

■ Moderate Traffic

■ Low Traffic

Bike Share Network Tool

Write your great subtitle here.

Sustaining and Updating the Network Tool on an on-going basis

o Since the tool lives in an iPython Notebook, the input data would be piped in like it is now via csv or queried from a database directly.

o As the bike network expands, a station database should be created, which stores new station names and geographic locations. Our Tool would then query from this database to update the Nodes on the Network Graph.

o Simply, running the tool would then transform the input data and output our **Bike Share Network Tool** to create further insights.

o Similarly, the **Tableau Logistics Bike Share Dashboard** would be connected to the same query that built our input data in order to display Cohort Data.

Bike Share Chord Diagram

Built with D3.js

Visualizing Station Travel Paths using a Chord Diagram

o This is a tool I forked from Mike Bostock's D3 Github. Using his source code I was able to display station to station network relationships after creating a matrix.

o The circumference of the circle represents the sum of the entire matrix and is sub-divided into arcs for each of its rows.

o The matrix contains the percentage of all total rides, and was built from the highlights table in Tableau, which was subsequently converted into .json format.

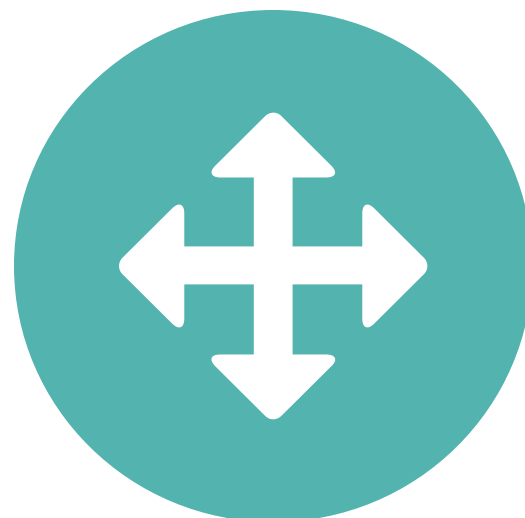***Station names are hidden due to text being larger than their containers**
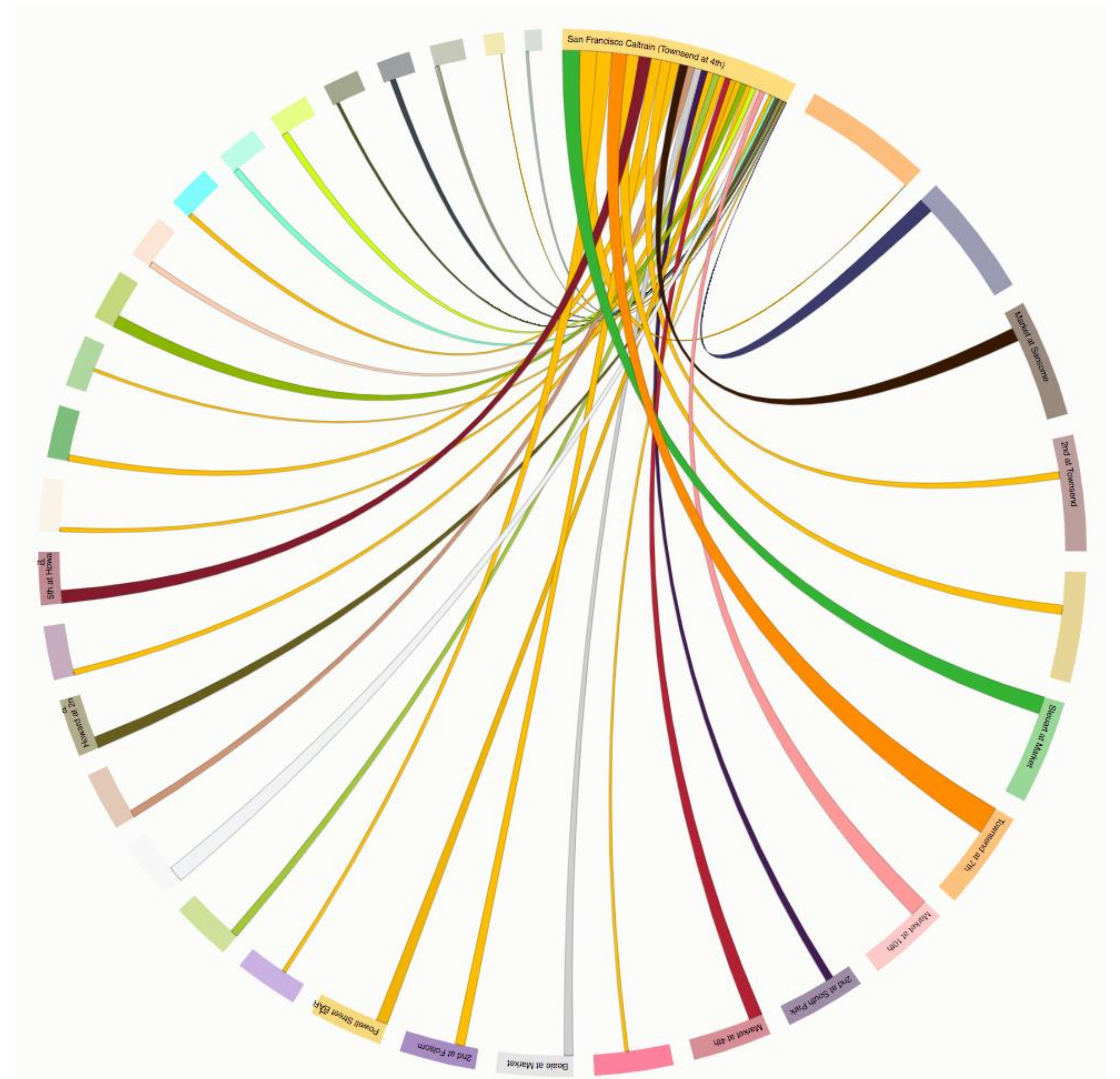
Call To Action

Bike Share Needs to Target Subscribers Cohort

Operations and Support need to ensure bikes and dock spaces are available to fulfill demand around commuter times.

Concentrate Expansion Efforts into West SoMa

With many high tech companies establishing locations in this area, bike share should act to serve commuters to this area.
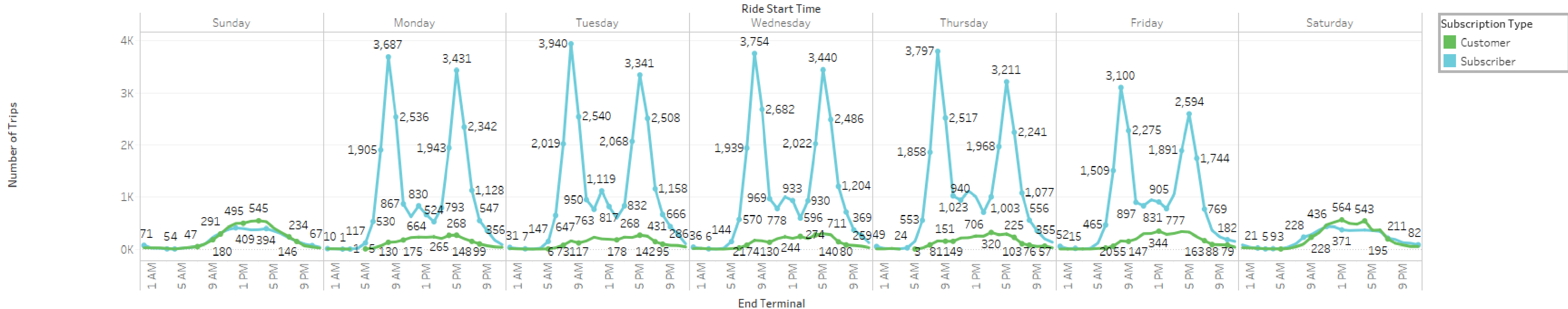
Appendix
Contains Dashboards and Tools

UBER

LOGISTICS BIKE SHARE DASHBOARD

Customer vs Subscriber by Hour

Line chart titled "Customer vs Subscriber by Hour" showing Number of Trips by Ride Start Time across days of the week (Sunday through Saturday), with Subscription Type legend: Customer (green), Subscriber (blue).

Heatmap: Start Terminal vs End Terminal (Number of Trips)

Start Terminal	San Francisco Caltrain (Townsend at 4th)	Market at Sansome	San Francisco Caltrain 2 (330 Townsend)	2nd at Townsend	Townsend at 7th	Harry Bridges Plaza (Ferry Building)	Temporary Transbay Terminal (Howar..)	Steuart at Market	Powell Street BART	Embarcadero at Sansome	Market at 4th	2nd at South Park	Market at 10th	Howard at 2nd	5th at Howard	Embarcadero at Folsom	Beale at Market	Commercial at Montgomery	Embarcadero at Bryant	Civic Center BART (7th at Market)	Spear at Folsom	Yerba Buena Center of the Arts (3rd @ Howard)	Mechanics Plaza (Market at Battery)
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Embarcadero at Sansome	199	107	92	231	45	414	262	1,000	62	66	74	17	34	30	19	119	246	113	88	59	83	35	101

Filters:
- Subscription Type: Subscriber
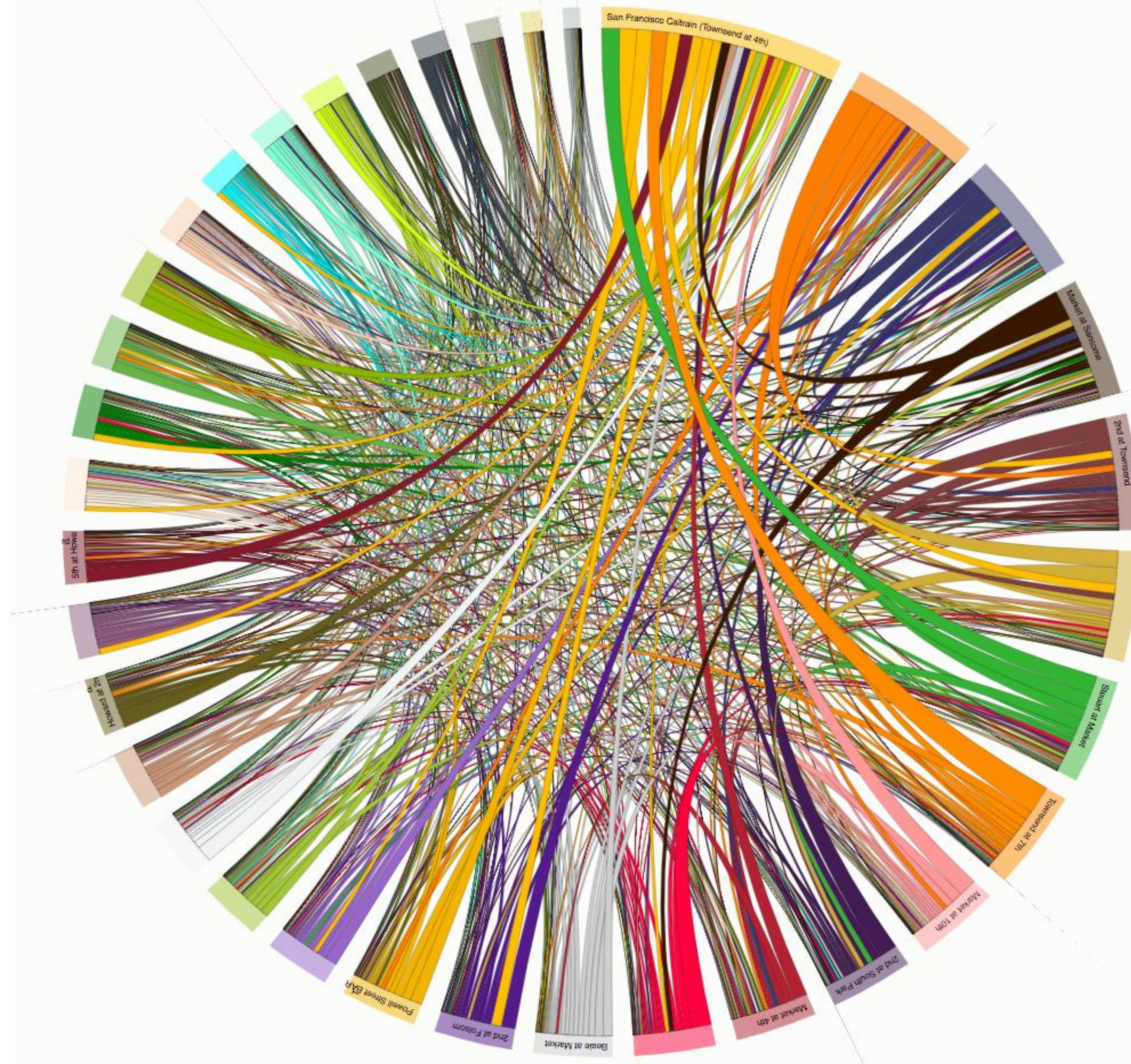- Start City: San Francisco
- End City: San Francisco

Number of Trips legend: 1 — 1,461
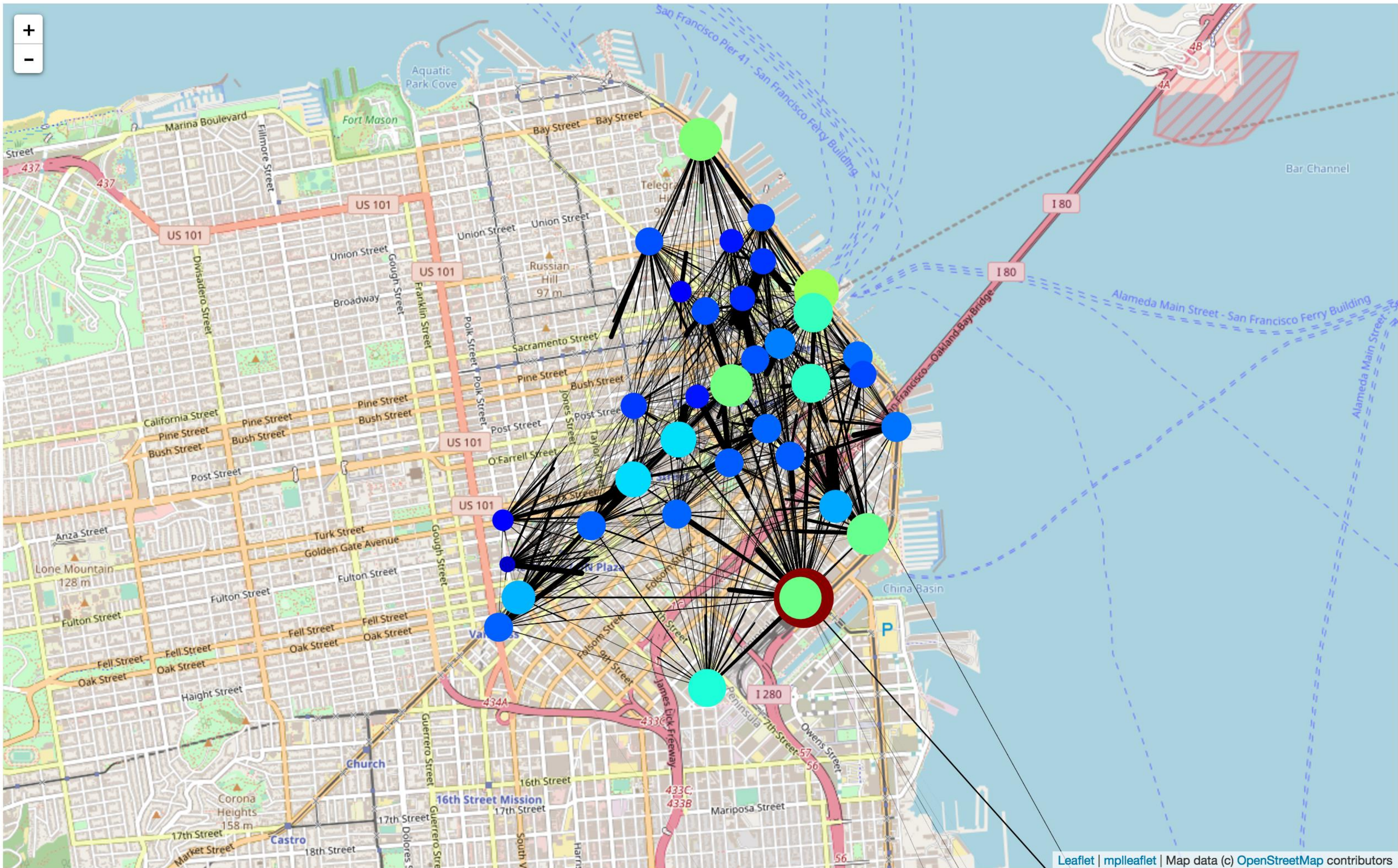
Joseph's Bike Share Chord Diagram

Built with d3.js.

November 1, 2017

References

✓ **Andrew's Modified Chord Example**
http://bl.ocks.org/AndrewRP/7468330

✓ **Seaborn Visualization Functions – Exploratory Analysis Only**
https://github.com/cgradwohl/BABS/blob/master/dandp0-bikeshareanalysis/babs_visualizations.py

✓ **Google Maps – Manual Input of Geographic Locations**

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