Planning for Priority with Pings

Using High Resolution Transit Geolocation Data to Analyze Performance and Identify Intersections that Contribute to Transit Delay

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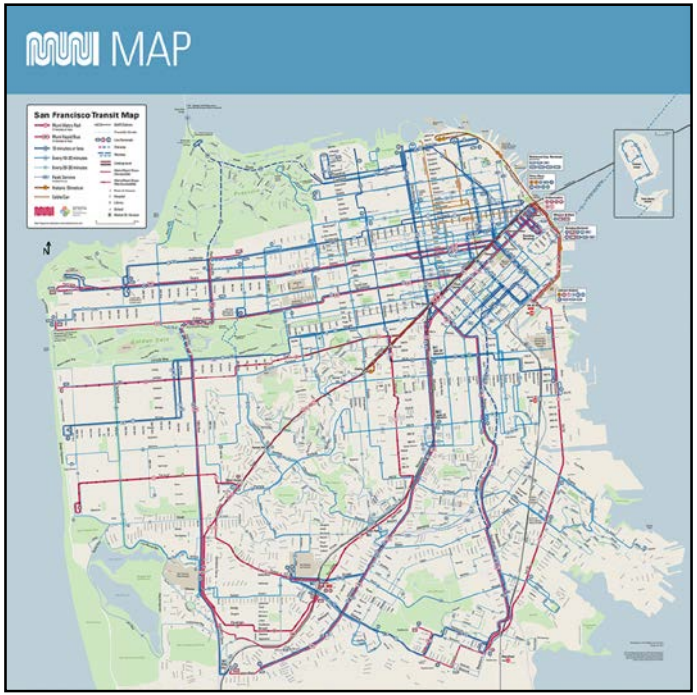
Presentation Outline

- Title breakdown!
- Current transit metrics
- Need for high res data analysis
- Data collection and methodology overview
- Metric #1 – transit signal delay
- Metric #2 - % of buses stopped at intersection
- Next steps



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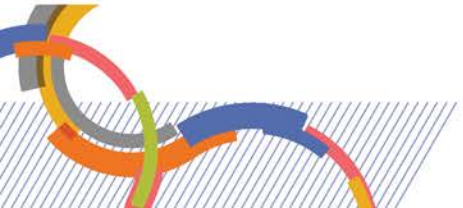

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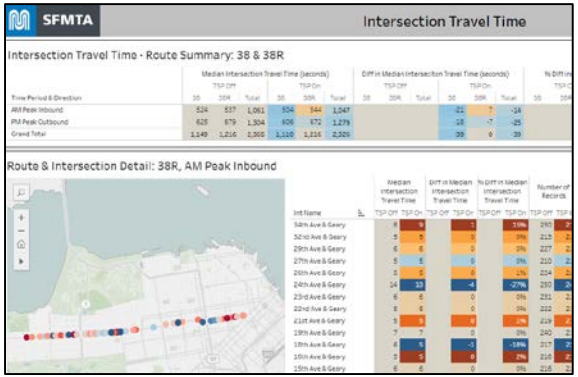

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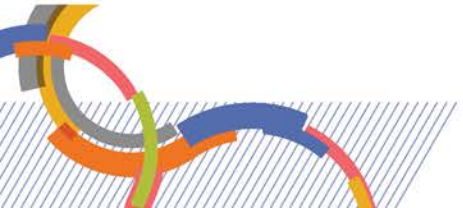
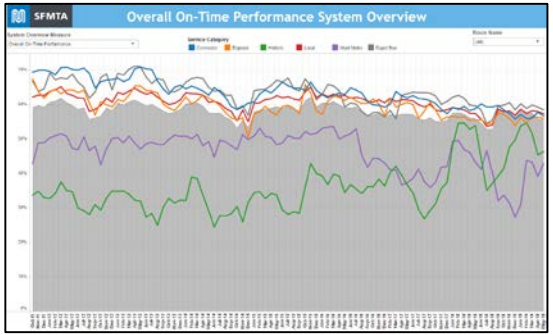
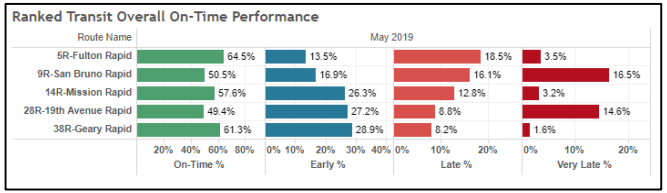


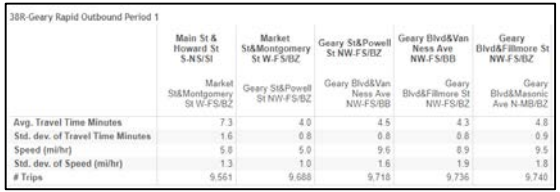
Currently Available Metrics



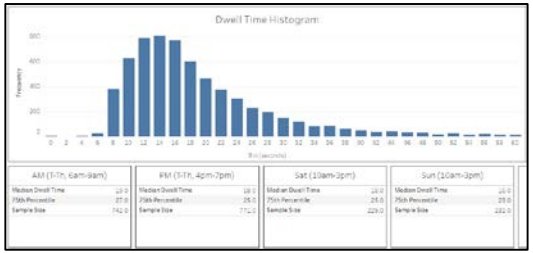
Mode Based On Time Performance



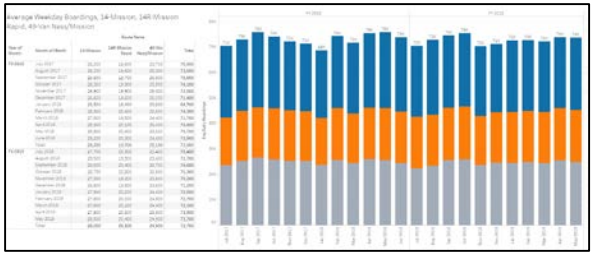
Route Based On Time Performance



Timepoint to Timepoint Travel Time



Stop Level Dwell Times



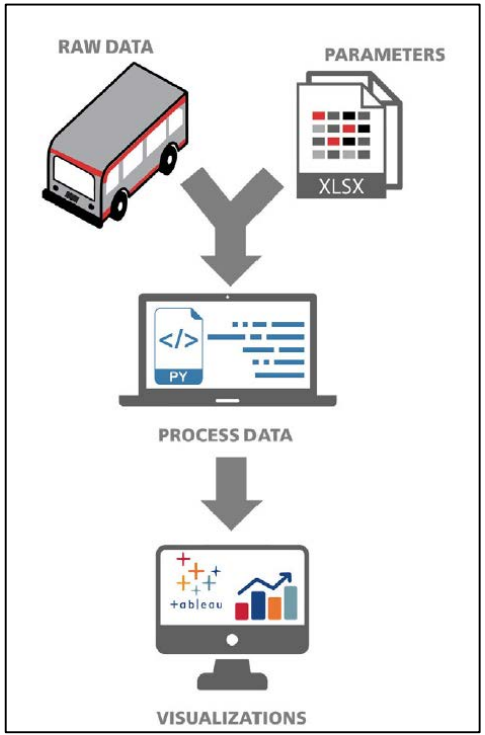
Route Level Ridership

Data Collection Effort

- On board equipment collects data
  - Approximately 500 buses equipped
- Daily data dump in yard over WiFi
- Weekly transmission of all data (~4 GB)
  - Began collecting data in November, 2018
- Data processing occurs weekly
  - Currently on local machine
  - Future: through IT in a production data warehouse

2.7 million GPS points from one day of data

Methodology Overview

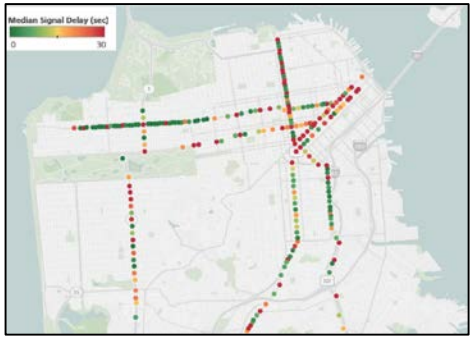


Metric #1 – Transit Signal Delay

- Processing
  - Isolated data to individual trips
  - Matched trip to schedule
  - Determined points of interest, matched to nearest
- Consumable data
  - Pushed to Tableau server
  - Can be pivoted by route, direction, location, time of day, etc.

Processing – target upstream and downstream points

Intersection Name	Median Delay (sec)	Number of Records
25th St & Mission	4	372
24th St & Mission	14	380
23rd St & Mission	11	367
22nd St & Mission	19	365
21st St & Mission	2	350
20th St & Mission	3	347
19th St & Mission	16	343
18th St & Mission	20	346
17th St & Mission	2	343
16th St & Mission	3	339
15th St & Mission	7	329
14th St & Mission	17	332



Analysis – Tabulated and mapped delay information by TOD, direction, route

Metric #2 - % of Buses Stopped at Intersection

- Processing
  - Isolated data to individual trips
  - Matched trip to schedule
  - Draw approach zones for signals
  - Determine if buses traveled <2MPH
- Consumable data
  - Pushed to Tableau server
  - Can be pivoted by route, direction, location, time of day, etc.

Processing – define and utilize approach zones

Intersection Name	% Stopped	Number of Records
25th St & Mission	29%	400
24th St & Mission	47%	408
23rd St & Mission	41%	415
22nd St & Mission	69%	379
21st St & Mission	5%	374
20th St & Mission	14%	378
19th St & Mission	55%	396
18th St & Mission	70%	394
17th St & Mission	4%	377
16th St & Mission	33%	375
15th St & Mission	34%	380
14th St & Mission	59%	362

Analysis – Tabulated and mapped bus stopped % information by TOD, direction, route

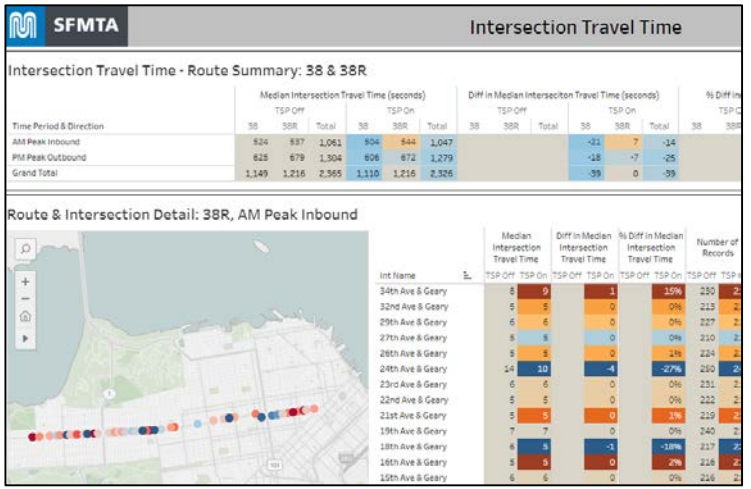
For More Details…

```
#During Daylight Saving (comment out if not) - March to November
allPoints['TimestampPacific'] = allPoints['TimestampNew'] - pd.Timedel

allPoints['tripID'] = allPoints['tripID'].astype(str)
allPoints['date'] = allPoints['TimestampPacific'].dt.strftime('%Y-%m-%
allPoints['trip_Date'] = allPoints['date'] +" "+ allPoints['tripID']

#display(allPoints.tail())


# Loop through each zone to get minimums in each per trip_Date

for z, zone in allZones.iterrows():

    try:
        pointsInZone = allPoints.loc[(allPoints['route'] == zo
                                      (allPoints['DIRECTION'] =
                                      (allPoints['lat'] > zone[
                                      (allPoints['lng'] > zone[
                                      (allPoints['lat'] < zone[
                                      (allPoints['lng'] < zone[
                                     ]

        # Go to next zone if filter yielded nothing
        if pointsInZone.empty:
            continue

        # Determine the minimum value in each zone
        minPoints = pointsInZone.loc[pointsInZone.groupby("tri

        # True if stopped, False if didn't stop
        minPoints['stopped'] = minPoints["speed"]<2

        # Add values from current Zone series to each record
        minPoints['zoneID'] = zone['zoneID']
        minPoints['CNN'] = zone['CNN']
        minPoints['intName'] = zone['intName']
        minPoints['intSequence'] = zone['intSequence']
        minPoints['includesNearsideStop'] = zone['includesNearsideStop

        #LOOK INTO THIS: at some point, the order of the columns chang
```

```
        mergedData["segmentID"] = segment["segmentID"]
        mergedData["CNN"] = segment["CNN"]
        mergedData["intName"] = segment["nAme"]
        mergedData["freeFlowTT"] = segment["freeFlowTT"]
        mergedData["includesNearsideStop"] = segment["includesNearsideStop"]


        # Calculate delay
        mergedData["delay"] = mergedData["travelTime"] - mergedData["freeFlowTT"]


        # Flag extreme outliers (True if > 10 minutes to get through intersection)
        mergedData["extremeOutlier"] = (mergedData["travelTime"]>600)


        # Drop extra data
        mergedData.drop(['PUBLICROUTENAME','TRIPID','LASTUPDATE','TimestampNew'],axis=1,inplace=True

        #resultsDF = pd.concat([resultsDF,mergedData])


        return mergedData

    except:
        print("ERROR!")
        # Add code here to better track errors (create list and add to list)

def progressBar(chunkCounter, totalChunks, currentSegment, totalSegments, progress=0):
    newProgress = int(100 * float(currentSegment)/float(totalSegments))
    if newProgress >= (progress+5):
        clear_output()
        print("Progress: ",newProgress,"% complete (",currentSegment,"of",totalSegments,"trips analy
        progress = newProgress
    return progress
```

Next Steps

- Conduct before/after studies
- Productionalize processing efforts
- Include intersections with nearside stops
- Address poor GPS readings in NE due to Urban canyon effect



Acknowledgement

Ian Martin
Student Intern
Summers 2018, 2019

Thank You!

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