Project scope has not been entirely refined due to difficulty contacting the client (Representative Elugardo unfortunately suffered a recent fall and has been unable to meet with us). Based on our preliminary discussions with our project manager and Rep. Elugardo's aid, Isabel, we've narrowed our scope to the points outlined below. We have a few outstanding questions that are currently pending confirmation form Rep. Elugardo, but as soon as we hear back we will be able to finalize our scope and approach. Currently it appears that we will focus our analysis on certain geographic areas that would benefit the most from free bus routes and/or would help generate more political clout to get a transit equity bill passed.

Additionally, based on discussions with the other Transit Equity Spark team and our Spark PM and advisor, we will be working together primarily for the data aggregation/collection portion (e.g. currently we've split the work of creating a consolidated spreadsheet of bus stops, routes, and corresponding ridership) before working independently on analyzing and visualizing the data we've collected.

Transit Equity/ Bus Routes - Fall 2020	
Contact	Representative Nika Elugardo Nika.Elugardo@mahouse.gov Isabel Torres (aide) Isabel.Torres@mahouse.gov 650-815-9674 (Isabel) **copy both on emails Office of Representative Nika Elugardo 24 Beacon Street Room B1 Boston, MA, 02133 Phone:617-722-2582
Organization	Office of Representative Nika Elugardo Suffolk 15th District
Organization Description	Nika Elugardo is a State Representative who represents the 15th Suffolk District in the Massachusetts House of Representatives. She represents the towns of Boston and Brookline.

Project Description	We know that poor people rely on public transportation and the rising costs have a significant impact on their budgets. Representative Elugardo would like to explore the feasibility for expanding free bus lines in Massachusetts for both the MBTA and regional bus authority lines. This project will identify all bus stops in Massachusetts serviced by the MBTA and regional bus authorities. It will then evaluate which stops and bus routes are serving different income levels, with a goal of identifying the routes that most serve low income areas. The second part of the project will focus on the potential cost and benefit of establishing free bus lines based on ridership and fares.
Strategic Questions to be Answered	1. What bus routes and stops, if made free, would most benefit low income riders in Massachusetts? 2. Which towns (and districts) would most benefit by a policy change to the fare change to these routes? 3. What would the cost be to the MBTA and regional transit authorities for each proposed bus route/ stop/ zones (based on ridership and fare costs)? 4. What would the cost be to making an entire regional transit area free and how would this compare? (note: the purpose of this would be to enable policymakers to calculate the cost from maintenance, fare management, etc. of a differentiated approach vs. a holistic approach) 5. Other TBD with client
Data Sets	**Regional bus routes - Mass DOT** **Ridematch - Transit API for Massachusetts** **List of Regional Bus Transit Authorities** **MBTA Fare calculator** **MBTA Data for Developers** **Road Network: TIGER line files** **Census: See Tools and Approaches for more info.** **Ridership data** **MBTA Open Data Portal** **MBTA** **Mass DOT open data portal** **Transportation APIs:** ● MBTA: https://docs.digital.mass.gov/dataset/massgis-data-mbta-rapid-transit

	• Bus Routes: https://docs.digital.mass.gov/dataset/massgis-data-mbta-bus-routes-and-stops • Look up access to transportation threshold to evaluate transportation access. Here is an API that might be useful for this exercise: https://www.walkscore.com/professional/walk-score-apis.php
Approach	**Step One:** Read this report to understand the issue. Collect data - create a spreadsheet of all the different bus stops in Massachusetts including MBTA, Regional Transit Authorities, and City/Town buses. **Step Two:** Assign an income level to each stop based on the census tract data **Step Three:** Determine average fare for each transit stop based on fares for **Step Four:** Calculate bus ridership for each transit authority **Step Five:** Identify which bus routes, stops, or zones would have the most positive effect on low income riders if free. Identify which towns would be impacted? **Step Six:** Generate visualizations: TBD with client using software such as ArcGIS or tableau as a final deliverable along with the list data.
Tools and approaches	Tract Data: Link to Shapefile (tl_2019_25_tract) `def add_census_tract(dataframe):` `  polygons = gpd.read_file("data/tl_2019_25_tract/tl_2019_25_tract.shp")` `  polygons = polygons.rename(columns={"TRACTCE": "census_tract"}, index=str)` `  polygons = polygons.to_crs("EPSG:26986")` `  gdf = dataframe` `  df = gpd.sjoin(gdf, polygons[['census_tract', 'geometry']], how='left', op='within')` `  df.drop(columns=['index_right'], inplace=True)` `  return df` Where, the input dataframe is a shapefile containing the land parcels, having the geometry column as the geographic identifier. EPSG:26986 is the Massachusetts State Plane, akin to EPSG:4326 (GPS Coordinate system). This is the coordinate format that most Massachusetts State datasets use. The coordinate numbers will look weird, but they represent an actual point on the Massachusetts State Plane. Census Data: `def get_median_hh_income():` `  '''` `  Returns Pandas DataFrame representation Median Household Income Estimate by Census Tract for MA.` `  American Community Survey (ACS) 2018 Census data used.` `  Specific table: ACS 2018 5-year detailed table "B19013_001E"`

	`` ''' URL = "https://api.census.gov/data/2018/acs/acs5?get=B19013_001E&for=tract:*&in=state:25" response = requests.get(url = URL) data = response.json() median_income_df = pd.DataFrame(data[1:len(data)-1], columns = data[0]) return median_income_df ``` Scitkit Learn and spaCy for basic machine learning and regression tools. Tableau and ArcGIS for mapping the results.
Other Readings	Study on free buses for Worcester **(READ THIS FIRST)** Livable Streets Alliance Report on Bus Equity Article on Free Buses Trend Another article on free buses in Mass More background: Transit Equity: Research and Advocacy Inspires Government Action | Data-Smart City Solutions (harvard.edu) Transportation Equity | Massachusetts Public Health Association (mapublichealth.org) National perspectives Access to Public Transit is a Matter of Racial Equity | Center for Social Inclusion (centerforsocialinclusion.org) Way long but has great resources list at end! Evaluating Transportation Equity (vtpi.org) Note: MBTA is a semi-autonomous transit authority serving mostly Eastern Mass.