**Car-Macro Results**

For the long Car model, we were able to utilize the Google Directions API to retrieve both the distance and time from each zip code defined in our model to the stadium (zip: 19148). The results are stored as comma-separated values that can be parsed easily from Python. The script needs to be run two times for each zip code in a given set $Z$, which yields a runtime of $O(|Z|)$, giving us the distance and time for both modes of transportation: driving and transit.

Exhibit xx shows a table that provides a snippet of the zip code, distance and time data when using transit to/from the stadium.

\*INSERT EXHIBIT\***Transportation and GHG Results**

We were able to source accurate distance and time estimates (as stated above) for fans traveling from each of the zip codes considered. Our model then provided estimates for idling time based on congestion levels and this led us to our first result making a direct comparison between cars and SEPTA. We obtained was the distribution of travel time across fans based on the trip generation model. We can see that close to 12,000 people can save time traveling by SEPTA instead of taking their car once we account for congestion and idling time in the stadium. In fact, with only 20 minutes more, close to 40,000 fans can switch from car to SEPTA, the benefits of which are displayed in our second comparative result.

\*INSERT GRAPH 1\*

We were able to establish accurate estimates for the average greenhouse gas emissions for both gasoline and diesel cars. We also sourced estimates for SEPTA train and bus emission per passenger mile travelled. These estimates were used to compare the relative environmental tradeoff of choosing cars over public transportation. We can see that if the aforementioned 12,000 fans switch to SEPTA we could cut down on approximately 20 million grams of CO2 per one-way trip to or from a game. If the 40,000 fans identified above were to switch, hypothetically, even after accounting for SEPTA capacity constraints and waiting time, we would save close to 80 million grams of CO2 per one-way trip.

\*INSERT GRAPH 2\*

**Output Results**

As specified in the design, the output was meant to be intuitive, accessible and impactful. The options we considered were:

\begin{itemize}

\item Mobile App (iOS, Android, Windows Phone)

\item Web Application

\item Desktop Application

\end{itemize}

The design that was settled upon was the second one, Web Application.

Mobile applications have the advantage of being very convenient but the drawback is that proficiency required across multiple platforms and programming languages as well as dealing with fragmentation across versions of mobile operating systems (especially Android) is especially difficult. Desktop applications suffer from rigidity in that they are difficult to update on-the-fly and often require tedious updates via desktop operating systems. As a result, web applications provide the perfect balance for our project, allowing for updates as well as accessibility from both desktops and mobile devices.

Once the form of output was finalized, further research was performed to ensure that we satisfied our goal of having an “intuitive” output. Brainstorming was conducted with potential users of the web application in order to determine the best layout for the information to be displayed. Basic feedback was also obtained on the overall aesthetic of the web application. Our basic implementation of the web application was divided into five pages hosted on a local Python simple server utilizing CGI scripts to serve webpages in response to user input.

Introduction Page

The introduction page serves as a landing page for users of our web application. There is an emission calculator, which takes as an input the user’s address, zip code and vehicle miles per gallon as well as fuel type (gasoline or diesel). The page also displays the date and time of the next home page as well as the weather within one hour of the start of the game in order to allow users to make a more informed decision when selecting transportation. Finally, the page provides an overview of how the web application works and how emissions are calculated by our model.

\* INSERT INTRO PAGE \*

Results Page

The results page is served when the “submit” button on the introduction page is clicked with valid information in the form. The results page displays a Google Map showing driving directions from the origin to the stadium and provides a drop-down to switch to transit directions. The page also provides a comparative table between Car and Septa across four factors: time taken, distance, carbon emissions and congestion levels. The results in the table are driven by the model that we created and serve as the main “output” of our project.

\* INSERT BOTH RESULTS EXHIBITS\*

Alternatives Page

There might be users, however, who prefer not to switch to SEPTA. Given that our overall goal was to reduce carbon emissions from fans traveling to and from games, we suggest two alternatives that fans that utilize to cut down on their carbon emissions even if they do opt to take a car to the game. The first is to purchase carbon credits from a third-party vendor and the other is to utilize a public forum to find other fans to carpool with to the next home game.

\*INSERT ALTERNATIVES EXHIBIT\*

About Page

The about page provides users with information about the motivations behind our project and a brief biography for each of the three members on our team.

\*INSERT MOTIVATION EXHIBIT\*

Feedback Page

The feedback page features a simple form that users can utilize to convey compliments/complaints to the Stadium Traffic team.

\*INSERT FEEDBACK EXHIBIT\*

Also, our website contains a privacy policy that was added in order to inform users about how the information they input will be stored and utilized as is conventional in most web applications today.