Traffic Study Report of I-210 Freeway

Project Number: PRJ6-031717

Report Submission Date: March 17, 2017

CE223L-01 Winter 2017
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Traffic Analysis Report

March 17, 2017

Vectura Systems has completed a traffic report analysis on the 210 Westbound from Bonnie Cove Avenue to South Barranca Avenue. The data was collected from Caltrans’s loop detectors on Thursday, October 1, 2015 from 12am to 11:55pm. From the PeMS data collected by Caltrans, we created seven Hourly Flow vs Time Graphs and seven Fundamental Diagrams for all stations, and four Speed vs Time graphs for the mainlines. Thereafter, we determined three consecutive hours that contained high vehicle density. Inside those three hours is the worst hour (Peak Hour). Next, GEH values were calculated and the observation graphs of VISSIM and PeMS were generated for all seven stations. Finally, GEH values were corrected to pass 85% per specifications.

Vectura Systems is committed to innovating, improving, and maintaining naval, land, and aerospace transportation infrastructure. Providing a safe and efficient transportation system is our top priority.

This traffic report is in compliance of the course objectives of this class: “1). To learn and apply the principles of traffic data collection, data analysis, and microscopic traffic simulation & 2). To learn and apply VISSIM, a microscopic traffic simulator.”

Sincerely,

Vectura Systems

Transportation Student
Upcoming EIT
1.0 Introduction

1.1 Project Background

This project mostly incorporates knowledge gained from CE223 Transportation Engineering Lab but will also reference knowledge gained from the lecture portion. This project is the culmination of Homework 2 and 3. This project calls for a traffic analysis of a given portion of the 210 Freeway on a specific date in a 24 hour time period. The analysis was mostly based on the data collected from loop detector stations owned by Caltrans.

1.2 Project Scope

In this project, Hourly Flow and Density of all seven stations were calculated. From there, Density-Flow and Density-Time graphs were plotted. Upon completion, the data and graphs were analyzed and interpreted as to why the freeway was congested at certain times.

Then, three hours of traffic were chosen. The interval chosen contained the Peak Hour, or the worst traffic in an hour. Next, four mainline graphs were plotted (Speed vs Time). This graph plotted the 24 hour time period against the speeds occurring in that time period. Additionally, GEH values were calculated and observation/simulation graphs were plotted between VISSM and PeMS hourly flow.

The deadline for this report was March 17, 2017.

1.3 Site description

Project location is located in Glendora, CA. The area of study is the 210 Westbound from Bonnie Cove Avenue and South Barranca Avenue. The area is mostly comprised of residences and several stores. The length of the portion of the freeway is about 1.56 miles. The portion of the freeway contains two onramps and one off-ramp. There are seven loop detector stations spread across the freeway portion (Figure 1).
1.4 Date Background

The assigned date for the project was Thursday October 1, 2015 from 12am to 11:55pm. Sunrise is at 6:47am and sunset is at 6:37pm. Before delving into the project, we need to know the factors that caused traffic on this portion of the freeway on this specific date.

The weather on this date was sunny with max/low temperatures of 86/70°F. The average temperature during the day of this date’s week was around 86°F [1]. This information is important because temperature is one of the many factors that affect the Four Step model – how, when, where, why do people travel to a certain destination. Weather will be elaborated in the analysis later in the report.

There were no special events on this date. However, there were a couple of concerts taking place in Los Angeles – Van Halen concert on Friday Oct 2 at 7:30pm and Supersonico concert on Sat Oct 3 at 2pm. Since these two events are on different dates than our assigned date, these events have little to no chance of contributing to our traffic congestion. Other than these events, Thursday Oct 1 is just a regular business day.

1.5 Software/Websites Used

A few websites and programs were used to help execute this project.

Google Earth
Google Earth (Pro) is a program that utilizes satellite imagery and topography information that allows the user to virtually visit any place on Earth. This program allows the user to measure distances and areas, mark paths and areas, provide elevation slope, etc.
Google Traffic
Google Traffic is a website that shows real time traffic information and status. It can show locations of traffic incidents, construction, etc and can show traffic congestions. This website also allows the user to see what traffic conditions occur on a chosen day of the week and time (6am-10pm only).

Caltrans Performance Measurement System (PeMS)
Caltrans PeMS is a website similar to Google Traffic but is much more in-depth. This website allows the user to view specific and detailed traffic information/data gathered from loop detector stations. This is where our given traffic data was from.

VISSIM
VISSIM, or “Verkehr In Städten - SIMulationsmodell (German for Traffic in cities - simulation model, Wikipedia),” is a program that allows you to create a traffic simulation. This program is a microscopic program, meaning this program will measure each and every vehicle individually.

1.6 Project Deliverables
- Seven Density vs Flow graphs
- Seven Time vs Flow graphs
- Four Speed vs Time mainline graphs.
- Seven observation/simulation graphs
- Three consecutive traffic hours with Peak Hour
- One page summary/analysis of time interval
- GEH calculations/values and corrections
2. Day Traffic Data

Before analyzing the peak hour traffic, traffic throughout the day needs to be analyzed to have a better understanding of the traffic patterns occurring.

2.1 Graphs

Below are graphs generated from Homework 2 and 3. These graphs are Density vs Flow (HW2), Time vs Flow (HW2), and Time vs Speed (HW3). The collection arrangement helps make the analysis easier (Figure 2a, 3a, 4a).

![Figure 2a. Collection of Density vs Flow graphs](image)

![Figure 2b. Density vs Flow graph for station 716613](image)
Figure 2c. Density vs Flow graph for station 767704

Figure 2d. Density vs Flow graph for station 716614
Figure 2e. Density vs Flow graph for station 717686

Figure 2f. Density vs Flow graph for station 717688
Figure 2g. Density vs Flow graph for station 772918

Figure 2h. Density vs Flow graph for station 772954
Figure 3a. Collection of Time vs Flow graphs

Figure 3b. Sample of Time vs Flow graph
Figure 3c. Time vs Flow graph for station 716614

Figure 3d. Time vs Flow graph for station 767704
Figure 3e. Time vs Flow graph for station 717688

Figure 3f. Time vs Flow graph for station 772954
Figure 3g. Time vs Flow graph for station 717686

Figure 3h. Time vs Flow graph for station 772918
Figure 4a. Collection of Speed vs Time graphs for analysis

Figure 4b. Sample Speed vs Time graph
2.2 Graph Analysis

The trend between the density – flow graphs of all the stations follow the same pattern: as density increases, flow increases, thus a linear trend. The more cars that are present on the freeway, the more cars that pass the station in one hour. Although they are similar in trends, there are differences that make the stations unique. Such differences are the scale of flow and density. The scaling, or ranges, of flow for stations 716613 and 716614 are from 0-600 and 0-700 respectively. Density goes from 0-12 and 0-14 respectively. For station 767704, the flow and density ranges from 0-1800 and 0-800 respectively. For stations 717686, 717688, 772918, and 772954, their ranges for flow and density are approximately 0-8000 and 0-400.

Why does the scaling matter? Based on the data, the graph will plot the points with a scale that starts with zero to the highest point of the data. For stations 716613 and 716614, we can assume that since the scaling range is small, there is less traffic compared to the other stations. However, instead of “eyeballing” the scale to draw a conclusion, we can also use Caltrans Level of Service (LOS) classification [2]. LOS classifies the freeway segments by density, and max service flow rate. In this case, let’s use density to classify our stations (Table 1).

<table>
<thead>
<tr>
<th>Stations</th>
<th>Time</th>
<th>Avg Density</th>
<th>LOS Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>716613</td>
<td>12am - 11:55pm</td>
<td>3</td>
<td>A</td>
</tr>
<tr>
<td>716614</td>
<td>12am - 11:55pm</td>
<td>4</td>
<td>A</td>
</tr>
<tr>
<td>717686</td>
<td>12am - 2:40am</td>
<td>11</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>2:45am - 4:10</td>
<td>19</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>4:15a - 10:05p</td>
<td>103</td>
<td>E</td>
</tr>
<tr>
<td></td>
<td>10:10p-11:55p</td>
<td>23</td>
<td>B</td>
</tr>
<tr>
<td>717688</td>
<td>12a-3:10a</td>
<td>15</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>3:15a-4:10a</td>
<td>27</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>4:15a-10:35p</td>
<td>118</td>
<td>E</td>
</tr>
<tr>
<td></td>
<td>10:40p-11:55p</td>
<td>26</td>
<td>C</td>
</tr>
<tr>
<td>767704</td>
<td>12am - 11:55pm</td>
<td>7</td>
<td>A</td>
</tr>
<tr>
<td>772918</td>
<td>12a-2:50a</td>
<td>17</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>2:55a-4:05a</td>
<td>27</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>4:10a-10:50p</td>
<td>130</td>
<td>E</td>
</tr>
<tr>
<td></td>
<td>10:55p-11:55p</td>
<td>28</td>
<td>D</td>
</tr>
<tr>
<td>772954</td>
<td>12a-3a</td>
<td>15</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>3:05a-4:10a</td>
<td>26</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>4:15a-10:35p</td>
<td>114</td>
<td>E</td>
</tr>
<tr>
<td></td>
<td>10:40p-11:55p</td>
<td>27</td>
<td>D</td>
</tr>
</tbody>
</table>

Here we can see the different times at which traffic flows change and become congested. Table 1 is a condensed summary of traffic, primarily showing the average density throughout the day.

In the CE223 Lecture, trip generation is number of trips that are made in, out, and within a zone. With every trip, there is a beginning and end. People leave their homes and either go to work, eat out, vacation, etc. The bigger the zones are, the greater the interaction. The bigger the distance between zones, the less interactions are made (Gravity Model) [3][4][5]. With this said, analysis of Time vs Flow graphs can be done.
The trend for the Time vs Flow graphs starts around zero at 12am, gradually increases until 5am, traffic is consistent throughout the day, and starts to decrease at around 7:12pm. Most businesses occur during the day so it is expected that traffic will occur at dawn. People plan their commute schedule so that they can reach their destination early or on time.

The Speed vs Time graphs show the speeds of vehicles throughout the day. Between the hours of 4:48am and 9:36am, there are points on the graph that are tightly packed between 10-20mph. At this point, traffic density is at its highest. Why? When traffic is really congested, vehicles will move between the range of bumper to bumper to 15mph. In normal circumstances, no one will move that slowly on the freeway. The only logical explanation is that if the freeway is that packed, vehicles will move that slowly. There will be more explanations and analysis of Speed vs Time graphs in Section 3 of the report.

2.3 Data Analysis

What caused traffic at the project site? Why is the data and graphs the way it was presented? In conjunction with the graphs (Figure 2a-3b) and Table 1, we can list the possible factors that affects traffic patterns.

Firstly, the weather can play a huge role here. As stated earlier, it was a hot and sunny day with a hi/lo of 86/70°F. How does this affect traffic? This factor greatly affects businesses that are outside/field work – surveyors, geotechnical engineers, mail/package deliverers, construction workers, etc. Since these types of businesses occur during the day, there is a good possibility that these people commute early so that they can work early to maximize working in cooler conditions. This would explain the beginning traffic congestion around 5am (Figure 3b).

Secondly, were there any special events on Thursday Oct 1, 2015? After researching, there were no events occurring on this date. However, there were two concerts on Oct 2nd and Oct 3rd in Los Angeles, as stated earlier. There are some people that travel very far distances to see a concert and so perhaps some of these travelers may arrive earlier than the concert date to settle into the area. Thus, there is a small probability that these events contribute to traffic congestion.

Lastly, what is the surrounding area like? There are three schools in the vicinity of the freeway: Whitcomb High School north of the freeway and Washington Elementary School and Azusa Pacific University (APU) south of the freeway. The high school and elementary school is attended by nearby residents so we can assume they are traveling through surface streets, not contributing to the freeway congestion. However, APU is a university in which many students commute to, from all over areas in District 7, thus causing congestion. Now peak hours are from 4-9am and 3-8pm because people go to and leave work/school in those respective time periods. What happens in between
those time periods? There is a shopping plaza north of 210W/Grand Avenue off ramp. The stores in the plaza are nothing noteworthy but still attracts visitors. The 210W leads up to Los Angeles and Pasadena. These two cities are big attractions (Gravity model) [4][5]. Many people commute to LA/Pasadena usually for work, school, tourism, shopping, etc.

We can conclude that Thursday October 1, 2015 was an ordinary business day, with normal, expected traffic conditions.

3.0 Peak Hour Interval Data

Now that there is an understanding of traffic conditions throughout the day, we can now do an in-depth analysis of the chosen three-hour interval with peak hour.

3.1 Graphs

Below are Observation graphs, which is basically Time (5 min interval) vs Hourly Flow between PeMS and VISSIM data. The collection arrangement of Observed graphs helps make analysis easier (Figure 5a).

![Collection of observed VISSIM/PeMS hourly flow](image)
Some of the graphs in Figure 5a pass the 85% mark. The rest of graphs are 0%. Corrections will be shown later in the report. Because of the discrepancy, we will not use these observation graphs for analysis but will be referenced.

**Figure 3b. Observed Station 772954.**

**Figure 5c. Observed Station 767704.**
Figure 5d. Observed Station 717688.

Figure 5e. Observed Station 716614.
Figure 5f. Observed Station 716613.

Figure 5g. Observed Station 717686.
3.2 Time interval

The time interval to be analyzed is between 5-8am. This interval contains the highest density of vehicles based on Speed v Time graph. Before I go on, let’s explain the graphs. These graphs show the average speed of vehicles at a certain time. Each of these graphs visually represent the speed and time measured from the loop detector stations located on the mainline of the 210 Freeway. When plotted, it shows us the trend of traffic from each station. How do we know the density of traffic when it is only a speed versus time graph? When traffic occurs, or when there is high density, that part of the freeway is densely packed. Because of that, vehicles will move much more slowly.

Based on Figures 6a-6d, around 5-6am, there are points on the graph that are tightly packed together and are located around the 15 mph mark. This suggests that around that time, this part of the freeway was densely packed and the speed at this point was around 15 mph. We can reinforce this point with Google Traffic (Figures 6a-d).
3.3 Freeway/street Traffic Analysis

Unfortunately, Google Traffic does not show traffic at 5am but it can show 6am-10pm. Let’s analyze the freeway. We can see in Figures 6a-d that traffic progressively gets worse as time goes on. Why is this? One reason is, people are heading to work, school, etc. as previously stated in HW2. Since there are a few schools and a university nearby, part of the congestion is from those locations. School starts around 8am so kids and parents wake up around 7am. To get to school on time, the commute starts between 7-8am, contributing to the freeway congestion and beginning congestion of surface streets. As for work, we can assume the traffic stems from work. People know that there will be traffic so they get up early and commute to their workplace. Unfortunately, many other people thought the same and so they do the same thing thus there is early congestion at 6am. Why 6am? Most businesses begin work at 8am so people must get to their workplace before then, thus the early congestion. This is perhaps why the time interval 5-8am contains the highest density during the day.
Interestingly enough, around 8am, traffic begins to dissipate. Well, it can be assumed that people have reached their workplace/school by the start time of 8am. At this point in time, people are arriving to their destinations. The freeway was their main route choice. Once they arrive in the approximate area, freeways are no longer needed, which means freeways get less congested, thus surface streets are used. Because of that, surface streets slowly become congested as shown in figures above. In Figures 5a-b), we can also see how the flow is heavy around 5am and decreases near 8am.

### 3.4 Peak Hour

Although people leave early for work around 6am, many others commute later in the time interval such as 7am. If school or the workplace isn’t that far from home, wake up time for someone is much later than compared to someone to works farther away and must commute earlier to get to the office on time. Because of close proximity of someone’s destination, their commute time is shorter but happens later in the time interval. These activities appear to take place between 7am and 8am, thus causing more congestion. The graphs and Google Traffic are evidence of this claim. One more piece of evidence further supports the claim that 7am and 8am are the busiest hours of the interval: PeMS data. Figure 7 below shows the density of the freeway between 5am and 8am. By taking the average of the densities of all mainline stations during the time interval, we can see which time interval has the highest density. It turns out that 7-8am has the highest density, thus making it our peak hour.

![Figure 7. PeMS density data between 5am and 8am.](image)
3.5 GEH Values

Below are the GEH values of all seven stations split into two parts to show the whole excel sheet.

![Figure 8a. GEH value.](image1)

![Figure 8b. GEH values.](image2)
As stated earlier, there were three stations that had 100% passing rate and the rest had 0% passing rate. I double checked possible errors for receiving 0% - I checked if I copied the correct column from PeMS, checked if I copied the right interval, forgot a step in VISSIM tutorial – and I couldn’t find anything wrong that I did. So I tried my best to improve the passing rate. Figure 9 shows the five minute interval data collection needed to calculate GEH values.

3.6 Passing Rate Corrections

I had attempted 15 trials to improve the passing rate based on step 7 from the VISSIM Tutorial [6]. Below is Table 2, showing the changes I made to improve the passing rate. Please note Table 2 is split up and spans two pages.

![Figure 9. Data collection in VISSIM](image)

![Figure 10. Screenshot of the Behavior tab in VISSIM. This is where changes were made in based on the VISSIM tutorial. Count 1 and Count 2 in Table 2 refers to this.](image)
### Table 2. Change Log of Passing Rate Changes

<table>
<thead>
<tr>
<th>Trial No.</th>
<th>Change Log</th>
<th>Original 100%</th>
<th>0%</th>
<th>0%</th>
<th>100%</th>
<th>100%</th>
<th>8%</th>
<th>0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial 0</td>
<td>Some behav links were mixed freeway and urban</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trial 1</td>
<td>Change all link behav to all freeway</td>
<td></td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
<td>100%</td>
<td>8%</td>
</tr>
<tr>
<td>Trial 2</td>
<td>Change all link beh to urban</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trial 3</td>
<td>Change to W99 for urban</td>
<td></td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>3%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Trial 4</td>
<td>Change W99 to W74 for urban</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trial 5</td>
<td>Have Urban W99 and Freewayt W74</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>14%</td>
</tr>
</tbody>
</table>

**Result:**

|       | 31% | 0% | 6% | 56% | 69% | 28% | 0% |

One Variable Change

Passing Rate of Stations
### Driving Behavior Parameter Changes (Urban - Count 1)

<table>
<thead>
<tr>
<th>Trial No.</th>
<th>Change Log</th>
<th>772954</th>
<th>767704</th>
<th>717688</th>
<th>716614</th>
<th>716613</th>
<th>717686</th>
<th>772918</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial 6</td>
<td>Kept Trial 2&amp;3 settings. Checkmark coop lane</td>
<td>Original</td>
<td>31%</td>
<td>0%</td>
<td>6%</td>
<td>56%</td>
<td>69%</td>
<td>14%</td>
</tr>
<tr>
<td></td>
<td>Result</td>
<td></td>
<td>100%</td>
<td>100%</td>
<td>8%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trial 7</td>
<td>Uncheck coop lane and change parameters. Keep Trial 2&amp;3 from now on. CC0=4.5 CC1=0.85 CC2=6.56</td>
<td>Original</td>
<td>31%</td>
<td>0%</td>
<td>6%</td>
<td>100%</td>
<td>100%</td>
<td>8%</td>
</tr>
<tr>
<td></td>
<td>Result</td>
<td></td>
<td>3%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trial 8</td>
<td>CC0=5 CC1=0.95 CC2=8</td>
<td>Original</td>
<td>31%</td>
<td>0%</td>
<td>3%</td>
<td>100%</td>
<td>100%</td>
<td>8%</td>
</tr>
<tr>
<td></td>
<td>Result</td>
<td></td>
<td>6%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trial 9</td>
<td>CC0=5.5 CC1=1.05 CC2=15.00</td>
<td>Original</td>
<td>31%</td>
<td>0%</td>
<td>6%</td>
<td>100%</td>
<td>100%</td>
<td>8%</td>
</tr>
<tr>
<td></td>
<td>Result</td>
<td></td>
<td>8%</td>
<td>3%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trial 10</td>
<td>CC0=5.5 CC1=1.05 CC2=22.97</td>
<td>Original</td>
<td>100%</td>
<td>0%</td>
<td>8%</td>
<td>100%</td>
<td>100%</td>
<td>8%</td>
</tr>
<tr>
<td></td>
<td>Result</td>
<td></td>
<td>97%</td>
<td>6%</td>
<td>11%</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trial 11</td>
<td>Revert param to default. Change urban to W74 and Freeway to W99</td>
<td>Original</td>
<td>97%</td>
<td>0%</td>
<td>6%</td>
<td>100%</td>
<td>100%</td>
<td>11%</td>
</tr>
<tr>
<td></td>
<td>Result</td>
<td></td>
<td>100%</td>
<td>3%</td>
<td>3%</td>
<td>14%</td>
<td>3%</td>
<td></td>
</tr>
</tbody>
</table>

### Driving Behavior Parameter Changes (Freeway - Count 2)

<table>
<thead>
<tr>
<th>Trial No.</th>
<th>Change Log</th>
<th>772954</th>
<th>767704</th>
<th>717688</th>
<th>716614</th>
<th>716613</th>
<th>717686</th>
<th>772918</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial 12</td>
<td>Change back to Urb99 &amp; Freeway99 Change F99 param. Check coop lane</td>
<td>Original</td>
<td>100%</td>
<td>3%</td>
<td>3%</td>
<td>100%</td>
<td>100%</td>
<td>14%</td>
</tr>
<tr>
<td></td>
<td>Result</td>
<td></td>
<td>0%</td>
<td></td>
<td></td>
<td>22%</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Trial 13</td>
<td>Uncheck coop lane. Change parameter CC0=4.5 CC1=0.85 CC2=6.56</td>
<td>Original</td>
<td>100%</td>
<td>0%</td>
<td>3%</td>
<td>100%</td>
<td>100%</td>
<td>22%</td>
</tr>
<tr>
<td></td>
<td>Result</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NO CHANGE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trial 14</td>
<td>CC0=5 CC1=0.95 CC2=8.00</td>
<td>Original</td>
<td>100%</td>
<td>0%</td>
<td>3%</td>
<td>100%</td>
<td>100%</td>
<td>22%</td>
</tr>
<tr>
<td></td>
<td>Result</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NO CHANGE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trial 15</td>
<td>CC0=5 CC1=0.95 CC2=8.00</td>
<td>Original</td>
<td>100%</td>
<td>0%</td>
<td>3%</td>
<td>100%</td>
<td>100%</td>
<td>22%</td>
</tr>
<tr>
<td></td>
<td>Result</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NO CHANGE</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
After attempting 15 trials to correct the passing rates to >85%, I had failed. I noticed that Trials 2, 3, and 12 yielded the best results. The final result contains changes from Trials 2, 3, and 12 (Table 3).

### Table 3. Final Result for Passing Rate Corrections

<table>
<thead>
<tr>
<th>Station</th>
<th>772954</th>
<th>767704</th>
<th>717688</th>
<th>716614</th>
<th>716613</th>
<th>717686</th>
<th>772918</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
<td>100%</td>
<td>8%</td>
<td>0%</td>
</tr>
<tr>
<td>Final Result</td>
<td>100%</td>
<td>0%</td>
<td>8%</td>
<td>100%</td>
<td>100%</td>
<td>22%</td>
<td>3%</td>
</tr>
</tbody>
</table>

### 4.0 Conclusion

This project was the culmination of Homework 2 and Homework 3. For this project we the students were given a location to analyze. The location was the I-210 Westbound Freeway, from Bonnie Cove Avenue to South Barranca Avenue. We were then given a date to analyze the traffic on a specific day in a 24 hour period. From there, data gathered from the loop detector stations could be used to analyze the traffic data. To carry out this project, VISSIM, Google Earth/Traffic, and Caltrans PeMS website were used.

Homework 2 was about generating Fundamental Diagrams (Greenshield Model). The graphs created were Hourly Flow vs Time and Time vs Density graphs. To do this, we were given directions on what to do. First, we created the outline of the project site in VISSIM (Figure 11a-b). Once that was done, we filtered the data, calculated hourly flow, and generated the Time vs Flow graphs for all seven stations. Next, we calculated the density and generated the Density vs Flow for all seven stations.

![Figure 11a. Project site outlined in VISSIM](image-url)
Homework 3 was about generating Speed vs Time graphs for mainlines, determining three consecutive hours (5-8am) of traffic that contains the Peak Hour (7-8am), or worst hour, determining GEH values, and generating Observation graphs for all seven stations. Firstly, Speed vs Time graphs were generated. Average speed and time were already given based from the PeMS data, so those two datum were plotted to create the mainline graphs. Next, based on the point(s) where was the lowest speed was plotted, the three-hour interval was chosen and analyzed. Next, we calculated GEH values for all seven stations. To do this step 6.2 from the VISSIM tutorial was followed.

Finally, the passing rate based off of GEH values needed to be corrected. Any rate that is <85%, needed corrections. After several hours, 15 attempts were made and most of the failed rates had improved but not substantially.

To my dismay, GEH values did not meet expected values. After the trials and tribulation, I gave up after the 15th simulation. I had done five simulations on the last day of class (Week 10, Oct 10) and continued the rest of the simulations on Oct 16. The last week was in preparation of finals. My last final was on Thursday Oct 16, so when I got home I didn’t want to deal with anything in the few hours that I got home. I was pretty tired and getting impatient in running the simulations. I tried my best to improve my passing rate as much as possible.

Despite not being able to get the desired outcome, overall, I learned a lot in this class. I got to learn how a traffic engineer functions, what tools they use…and on a different note, I got to learn many new things from the weekly links and its relation, or potential relation to transportation.
5.0 References


[5] Xinkai Wu lecture