## **Brief Explanation of Modifications**

I started by modifying the membership functions to try and improve the wait times, I then decided to increase the segmentation from short, average, long to very short, short, average, long, very long. This allowed me to provide more control to the lights, as I could create new rules which would allow me to reduce the average waiting time. Then I expanded the rule set to accommodate the increased segmentation. Initially, my system had a heavy bias towards either the main street or the side street, leading to extreme discrepancies in waiting times. For example, one scenario showed a mean waiting time of 425.46 seconds for the main street and just 2.50 seconds for the side street. Similarly, in another scenario, the main street's waiting time increased to 443.54 seconds while the side street dropped to 0.65 seconds. At this point I reviewed the variables of the system and realised I thought the duration variables were controlling the main street, instead they controlled the side street. Therefore I adjusted the duration variables in my rules, I tweaked the system until the mean waiting times for both streets were more balanced, achieving values around 200 seconds for each. Despite this, I noticed inconsistencies in around 20-30% of my tests, leading me to explore different defuzzification methods for further stability. I looped each 15 times and got an average score for each, settling on smallest of maximum as all the others significantly increased the disparity between the mean waiting time for the side and main street.

## **Insightful Comments on Findings**

The modifications made significantly reduced the bias between the main and side streets, achieving a better balance in average waiting times. However, the occasional wild discrepancies suggest underlying sensitivity in my rule-based system. In addition the testing of defuzzification methods showed me the potential for lower mean average waiting times, due to lower side street waiting time, however, when I tried adjusting the rules to reduce the disparity the adjustments were too sensitive and would increase the disparity instead of bringing them closer together. This points to two potential factors, firstly the membership functions might need further refinement to ensure more consistent outputs across various conditions. Secondly, the system's sensitivity to slight changes in traffic flow or duration might require more robust tuning of the fuzzy logic rules to better adapt to dynamic traffic conditions. Further investigation into rule adjustments and system design is warranted for achieving better stability.