Southern Polytechnic Collage of Engineering and Engineering Technology

KSU Traffic: Optimizing Campus Flow

KENNESAW STATE UNIVERSITY

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PROBLEM

Traffic is a growing problem on every campus, at KSU the problem became more prevalent when students came back to campus post COVID-19. On campus there is around 36,000 people between students and faculty, due to this during high volume class times, traffic at the West Main Entrance has become a problem.

The purpose of our project is to determine the best method of improving traffic flow at this entrance both entering and exiting campus. To improve the traffic flow we proposed two methods, altering the traffic light times to increase the number of cars able to enter or exit, and installing a new turn lane exiting right off campus. To find the best course of action we used our knowledge to determine how each method would improve from the current setup to how economical it is.

METHODS AND GOALS

In order to determine the best course of action we used multiple methods to see how different improvements would compare to our current setup as well as researching past traffic data. Using economic analysis, simulations; both Arena and Vensim, and input analyzer, we could determine the best plan to implement. The economic analysis shows if the work needed is cost efficient for the campus and Cobb County to implement. Using Arena allowed for us to create a current model and a future model to see how installing a new turn lane would affect our goal. Vensim showed us how traffic flow was with our current model and the accident rate associated, this helps to visualize if the new turn lane would decrease accidents. Input Analyzer provided us with the needed to distributions to better understand the data and the spread of data

Below is a list of our goals that we achieved through these methods:

- KSU T-Optimizer shall reduce traffic by altering traffic light times.
- KSU T-Optimizer shall have one major proposed road change.
- KSU T-Optimizer shall have a user-friendly arena simulation.
- KSU T-Optimizer shall have a 20% increase in number of cars leaving campus.
- KSU T-Optimizer shall have a 20% increase in number of cars able to enter campus.
- KSU T-Optimizer shall have a 20% increase in the number of cars exiting campus at each green light rotation.
- KSU T-Optimizer shall have a 20% increase in the number of cars exiting campus at each red-light rotation.
- KSU T-Optimizer shall have a Vensim model to back data.
- KSU T-Optimizer shall be economical for KSU and Cobb County to implement.
- KSU T-Optimizer shall allow for seasonal changes in traffic flow.
- KSU T-Optimizer shall provide a cost-benefit analysis.
- KSU T-Optimizer shall provide a proposed budget.
- KSU T-Optimizer shall fall below budget by 10%.
- KSU T-Optimizer shall improve traffic congestion relating to the I-75 ramps.

Left Turn Lane Improvements * All calculations use 260 days or working days per year			
Performance Measures	Value per unit	Daily Benefit	Annual Benefit
Car Delay value of personal travel time cost (per hr)	$18	$50.40	$13,104.00
Safety (Accidents) (per accident)	$4,525	$122	$31,673
Fuel (Per gallon)	$3.00	$1.95	$507.00
Daily Benefit		$174.17	
Annual Benefit			$45,284.20
Cost Measures			
Construction *10 year annualized capital recovery ($250,000)			$25,000
Initial Consulting * 5 year annualized capital recovery ($60,000)			$12,000
Initial Engineering * 5 year annualized capital recovery (10% of construction cost @ $25,000			$5,000
Annual Costs			$42,000
Benefit Cost Ratio			1.07 to 1

Figure 1-Economic Analysis

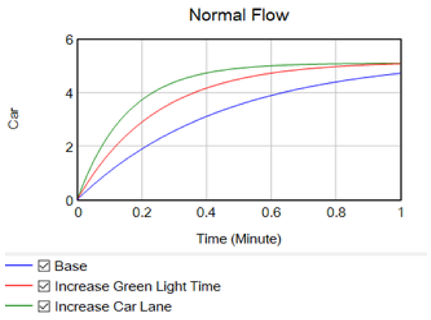

Figure 5 – Vensim Analysis

	Length of Light	
	Green Light	Red Light
Average	00:42.5	01:07.9
Minimum	00:12.0	00:38.2
Maximum	01:45.3	02:10.5

Figure 2 – Baseline Trends

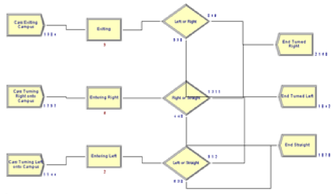

Figure 3 – Arena Current Model

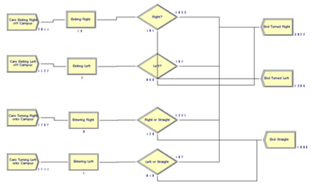

Figure 4 – Arena Future Model

Figure 6 – Current State of Traffic (During Red Light)

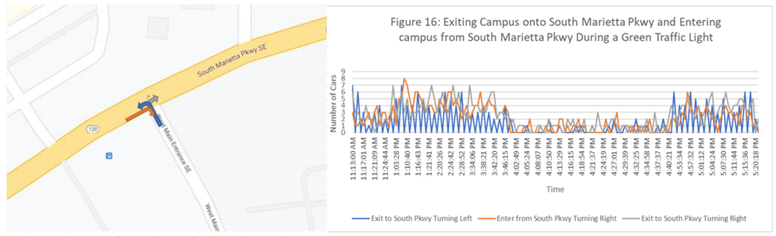

Figure 7 – Current State of Traffic (During Green Light)

FINDINGS

For our project one of our main goals was to improve traffic flow entering and exiting campus by a minimum of 20%, achieving this would mean that our project is feasible and would make a substantial difference. By collecting a total of 150 data points we were able to use the before mentioned methods to come to our conclusion.

First, we analyzed our data to create a baseline of the light times to compare our future findings to, this is shown in Figure 2. We were able to see that the red light was 42.50% longer than the green light. By focusing on this point, we were able to see that increasing the green light time and not the red, more cars would be able to exit campus.

Next, we analyzed how the time of day affected the number of cars at the light and understood peak times of traffic. In figures 6 and 7, we see that peak traffic time is around 1 and 2 pm.

Next, we used Vensim to understand the types of drivers we had and the average accidents currently. Shown in figure 5 is the normal flow of traffic and how our proposed changes would compare to the baseline. In this model, we see that both proposed changes would increase flow, but the new turning lane would provide the biggest increase in flow.

Then, using Arena modeling software we were able to create a baseline model of the current traffic situation, figure 3, and the proposed road change model, figure 4. These models provided us with a realistic simulation to model how these changes would improve traffic flow. Comparing our current model to the future model we have a 43% increase in the number of cars able to enter and exit campus.

Finally, once the increase in flow was determined, we used an economic analysis to see if the proposed road change was beneficial. Shown in figure 1, is the cost breakdown of performance and cost measures. These calculations showed that it is a feasible project.

CONCLUSION

Interpreted Data by analyzing/integrating a combination of various Simulations and comparing those to Baselines.

A formidable conclusive result showing that constructing a right turn lane on the West Main Entrance exiting campus onto S. Marietta Pkwy is the optimal solution to reducing traffic bottlenecks.

Our findings from such a capital expenditure include the following advantages:

- 43% increase in cars able to leave campus

- Increase in total traffic flow

- 40% decrease in accidents resulting from increased traffic flow

- Economically feasible with a benefit-cost ratio of 1.07 to 1.