Statistics and Analysis of Bus Route Simulation
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When simulating the operation of a potential bus route for your company, many interesting statistics were produced by rigorous testing. A wide variety of results were obtained, based in part on the desired results. Two of the main results we considered were customer satisfaction, and company profit. We found that keeping your customer happy, and making the maximal amount of profit don't always go hand-in-hand. Depending on your goals as a company, we are convinced you can make the best decision based upon the data we have provided below.

The simulation we created was implemented with a priority queue, also known as an agenda. This allowed us to discreetly simulate the arrival and departure of thousands of potential customers. To more accurately portray the real world, we implemented a method of creating more riders during the traditional rush hour times of the day, namely 6:00 to 9:00 AM, and 3:00 to 6:30 PM. We have provided data for both types of simulation, including rush-hour and non-rush hour enabled simulations.
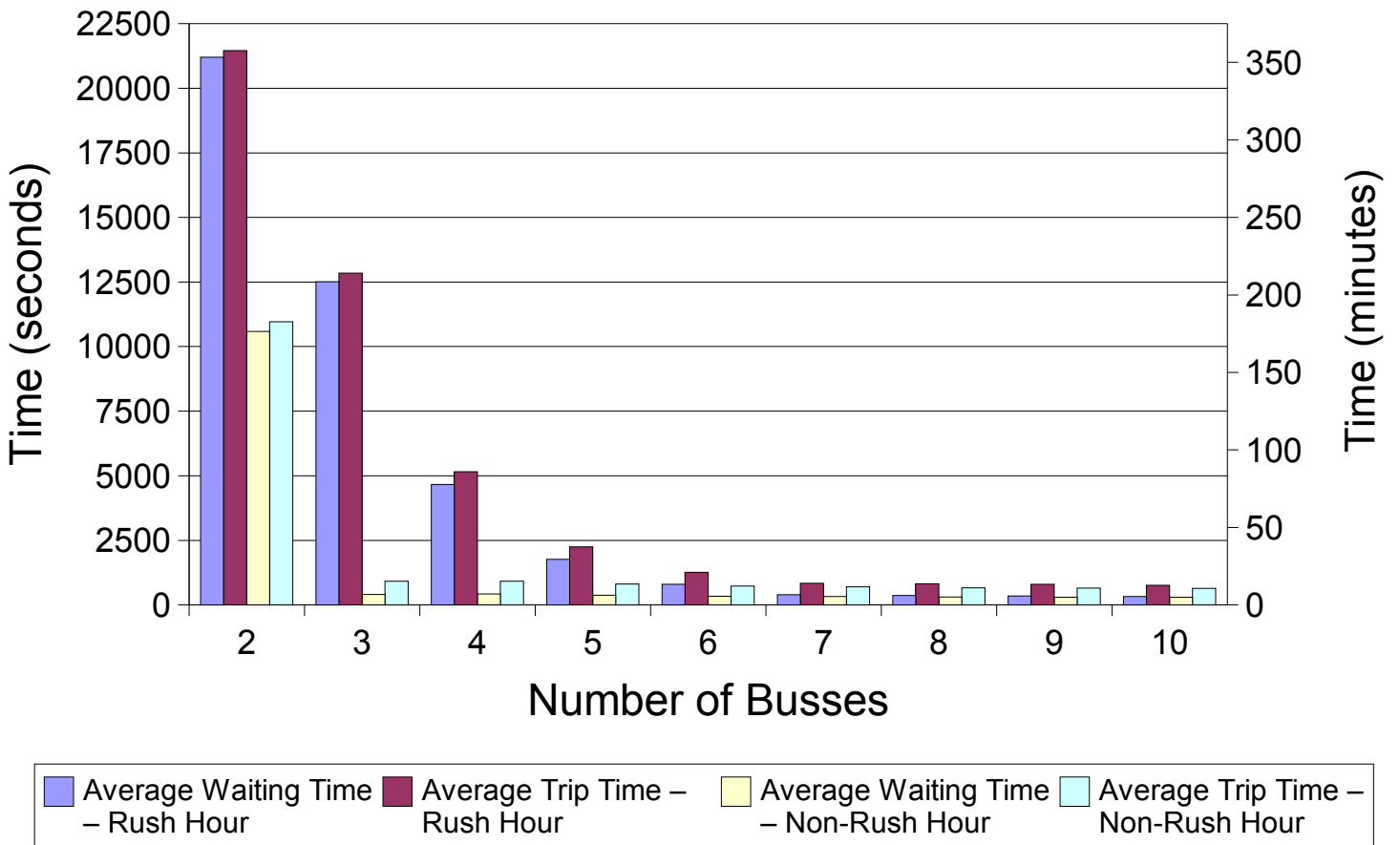
The simulation was of a 20 stop bus loop, consisting of 20 blocks in a downtown business district. The simulation was run from 4:00 AM until 2:00 AM the next day. When the busses start in the morning, they are evenly distributed around the route, starting at their respective stops. Riders arrive at each stop on the route, at somewhat random time intervals. For non rush-hour time periods, riders appear at about one every 50 seconds, give or take 25 seconds. During rush-hour, riders will appear about every 20 seconds, give or take 10 seconds. This equates to approximately 58 riders per hour during non-rush-hours, and 145 riders per hour during rush hour.

To further enhance the value of this report, we investigated the average income and expenses you are likely to encounter. We assumed a fare of $1.25 during non-rush-hours, and $1.75 during rush-hour. To find the expenses incurred each day, we researched the cost of operating each bus, including fuel expenses and driver's wages. Looking at current fuel market prices, we found the price of diesel fuel to be about $2.00 per gallon. We researched the fuel mileage of an average city bus, which is 5 miles per gallon. This equates to approximately 2.5¢ per bus per block. Average bus drive wages are $13.50 per hour. Taking into account these things, your potential profit is included in this report. Keep in mind, that maximizing your company's profit may adversely affect your customer satisfaction.

Priority: Customer Satisfaction

     If customer satisfaction is your top priority, low waiting time, fast trip times, and short lines will be of utmost importance to your company. As can be seen in the following chart, the configuration that optimizes these criteria is that of seven busses in operation. This gives an average waiting time of about 6.5 minutes and an average trip time of 14 minutes. Daily company profit would be approximately $66,375.
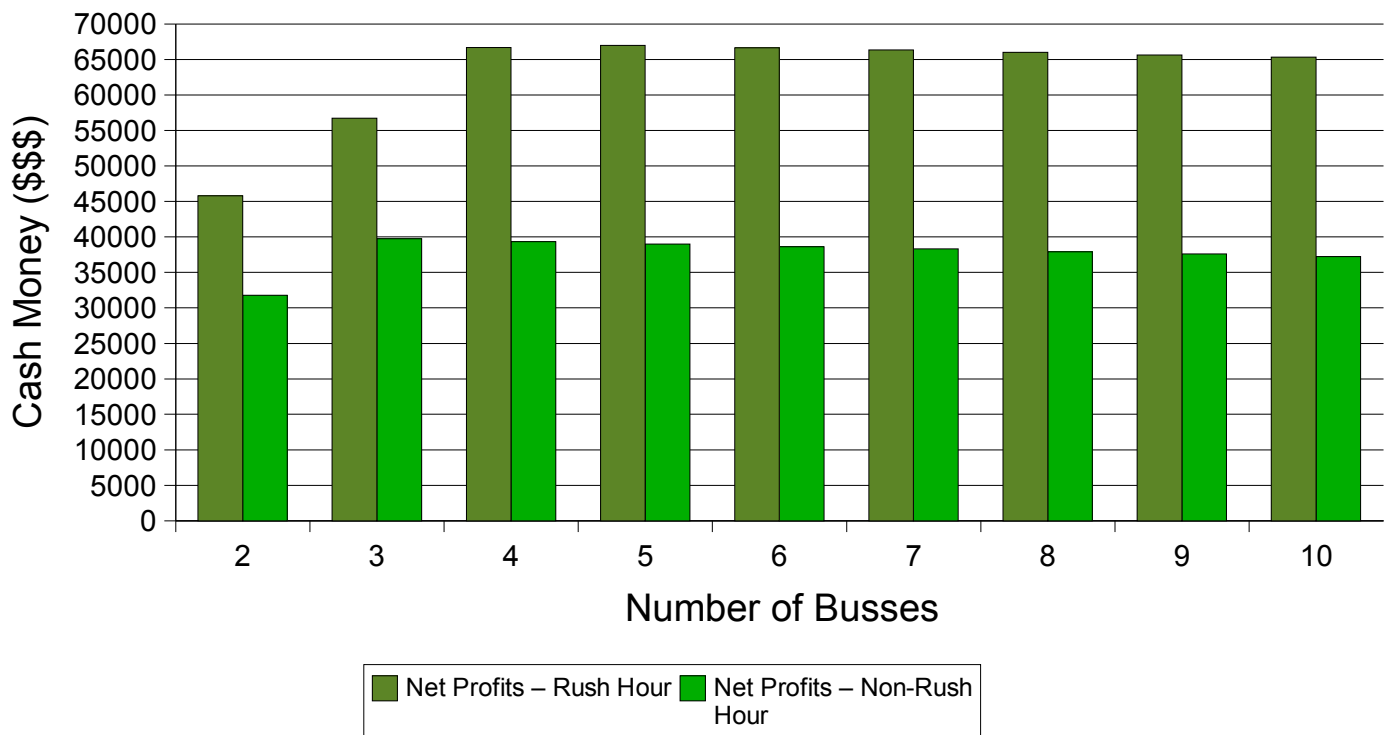
Time-Based Statistics

Legend:
- Average Waiting Time – Rush Hour
- Average Trip Time – Rush Hour
- Average Waiting Time – Non-Rush Hour
- Average Trip Time – Non-Rush Hour

Priority: Company Profits

　　　If maximizing your company's profits are the top priority, we suggest the following configuration. According to the following chart, with five busses running, your estimated daily profit would be $66,375, taking into account all of the previously mentioned factors. Please note, this figure does not include expenses relating to maintenance, administrative overhead, capital depreciation, or fluctuation in the fuel market. Average rider waiting time would be 29.5 minutes, which is twice the national average. The average trip time is 38 minutes, which might force some customers to pursue quicker means of transportation.
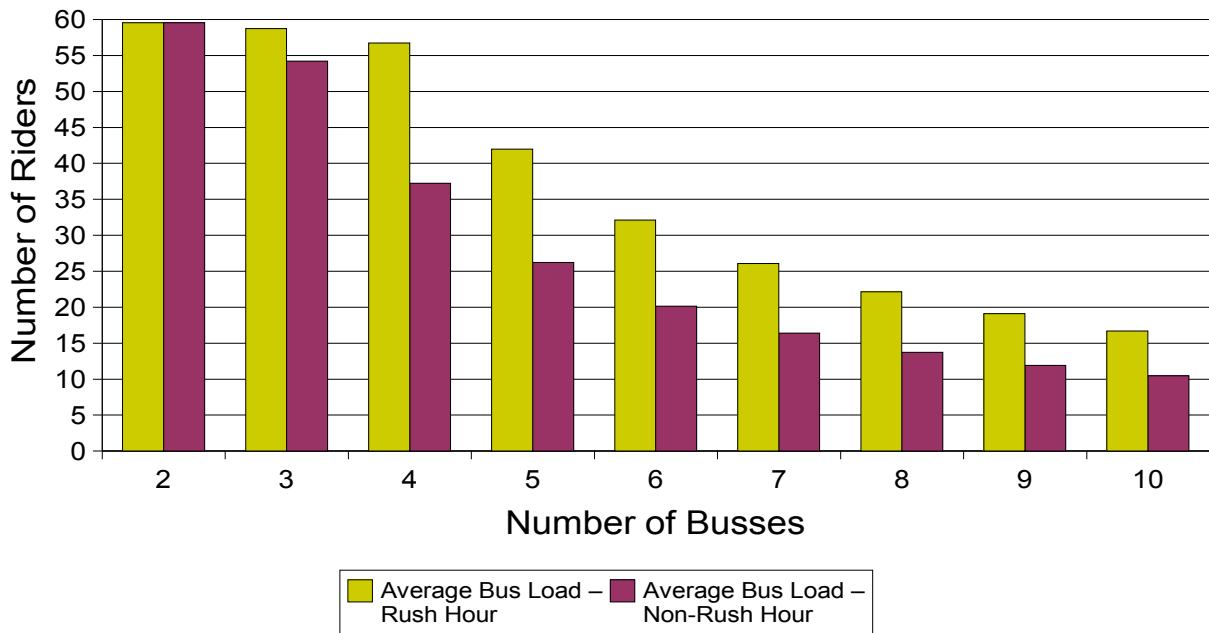
Net Profits

Legend: ■ Net Profits – Rush Hour ■ Net Profits – Non-Rush Hour

X-axis: Number of Busses

Y-axis: Cash Money ($$$)

Overall Recommendation

      Keeping in mind customer satisfaction, as well as company profits, we have the perfect solution. With a fleet of six busses, both priorities can be fulfilled. An average waiting time of 13 minutes, is well below the national average of 15 minutes. The average trip time would be about 21 minutes, which is a very reasonable number. This configuration is a good compromise between customer satisfaction and corporate profits. The expected company profit difference is $613. This is certainly a small price to pay for dramatically reduced waiting and travel times. We have enclosed additional charts and our actual data at the end of this report.

Average Bus Load

Chart showing "Average Bus Load" with Number of Riders (y-axis, 0 to 60) versus Number of Busses (x-axis, 2 to 10).

Legend: Average Bus Load – Rush Hour; Average Bus Load – Non-Rush Hour

Bus Stop Statistics

Chart showing "Bus Stop Statistics" with Riders / Stops (y-axis, 0 to 40000) versus Number of Busses (x-axis, 2 to 10).

Legend: Total Riders Delivered – Rush Hour; Total Riders Delivered – Non-Rush Hour; Total Stops Made – Rush Hour; Total Stops Made – Non-Rush Hour