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Performance Analysis  
of a Single Server  
Queueing System

CSE 4550

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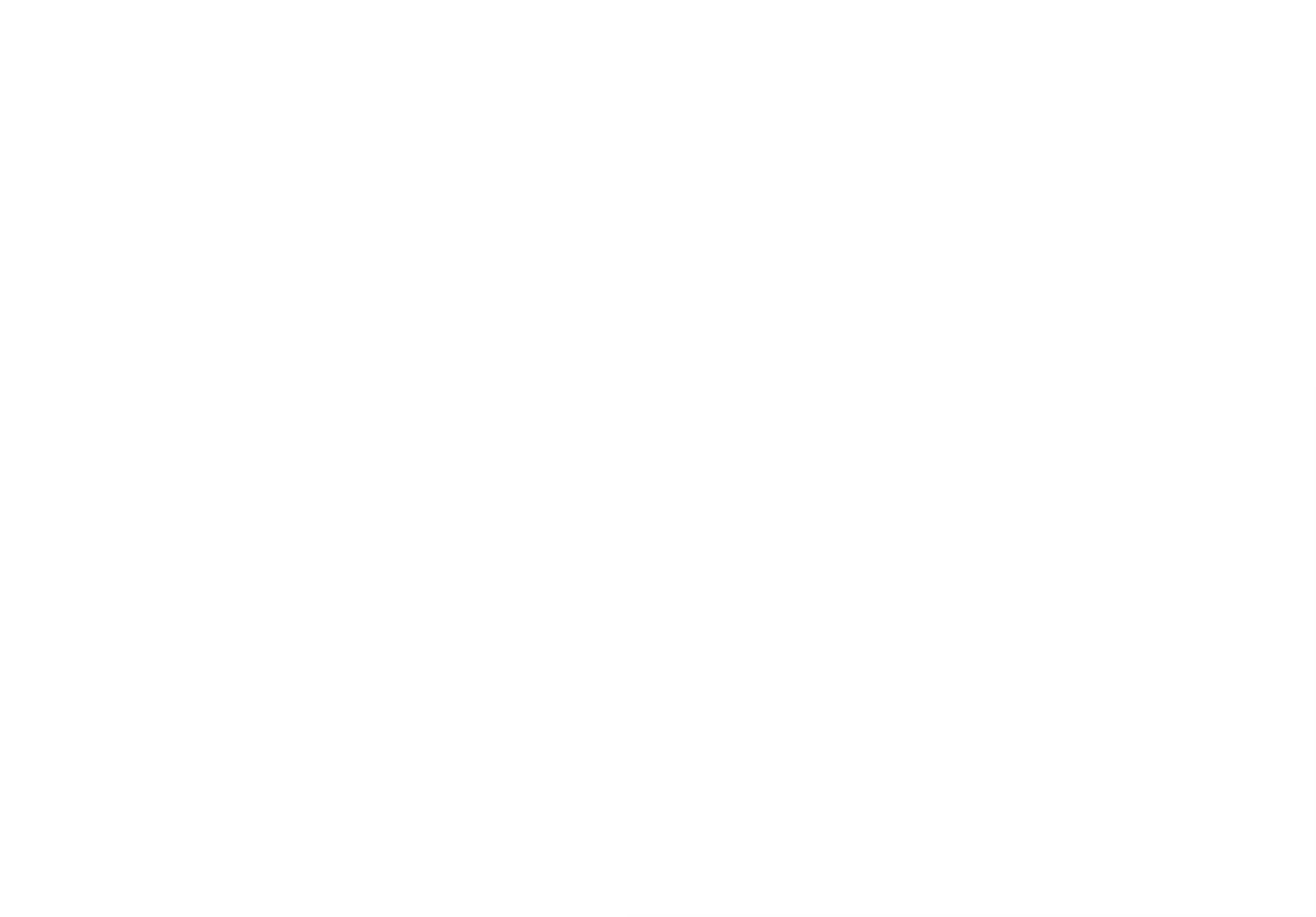
# Description

In this report, we present the results of output statistics derived from our Single Server Queueing System simulation. The output statistics that were considered are:

* Average queueing delay per customer
* Average system time per customer
* Average queue length
* Server utilization
* Average system size

These values were calculated based on randomly generated arrival and departure times for 100 customers. The mean arrival time was assumed to be exponentially distributed at 1 time-units. The mean departure time was assumed to be exponentially distributed and was varied between 0.05 to 1 time-units.

# Flowchart

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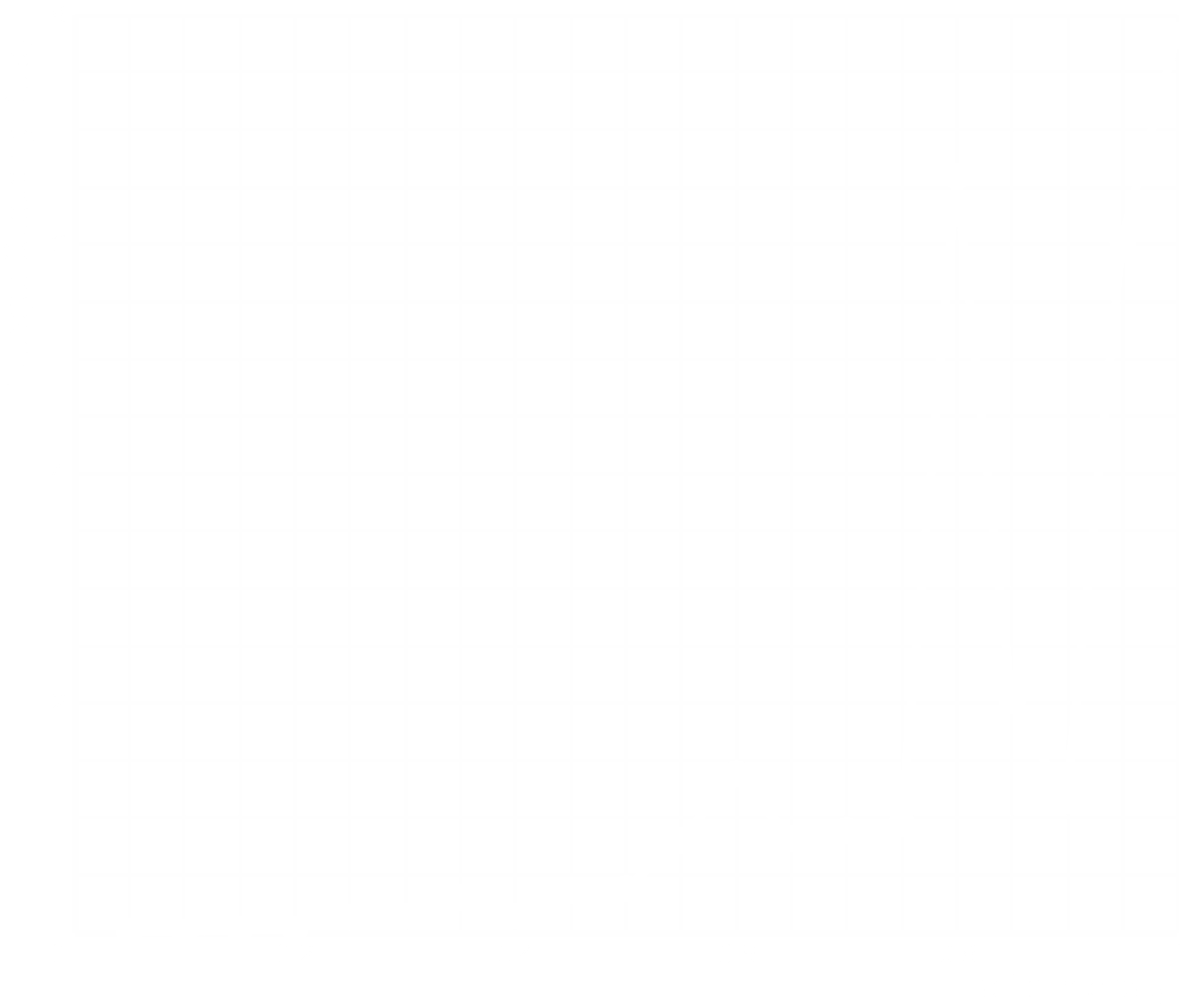
# Simulation Results

## Collected Data

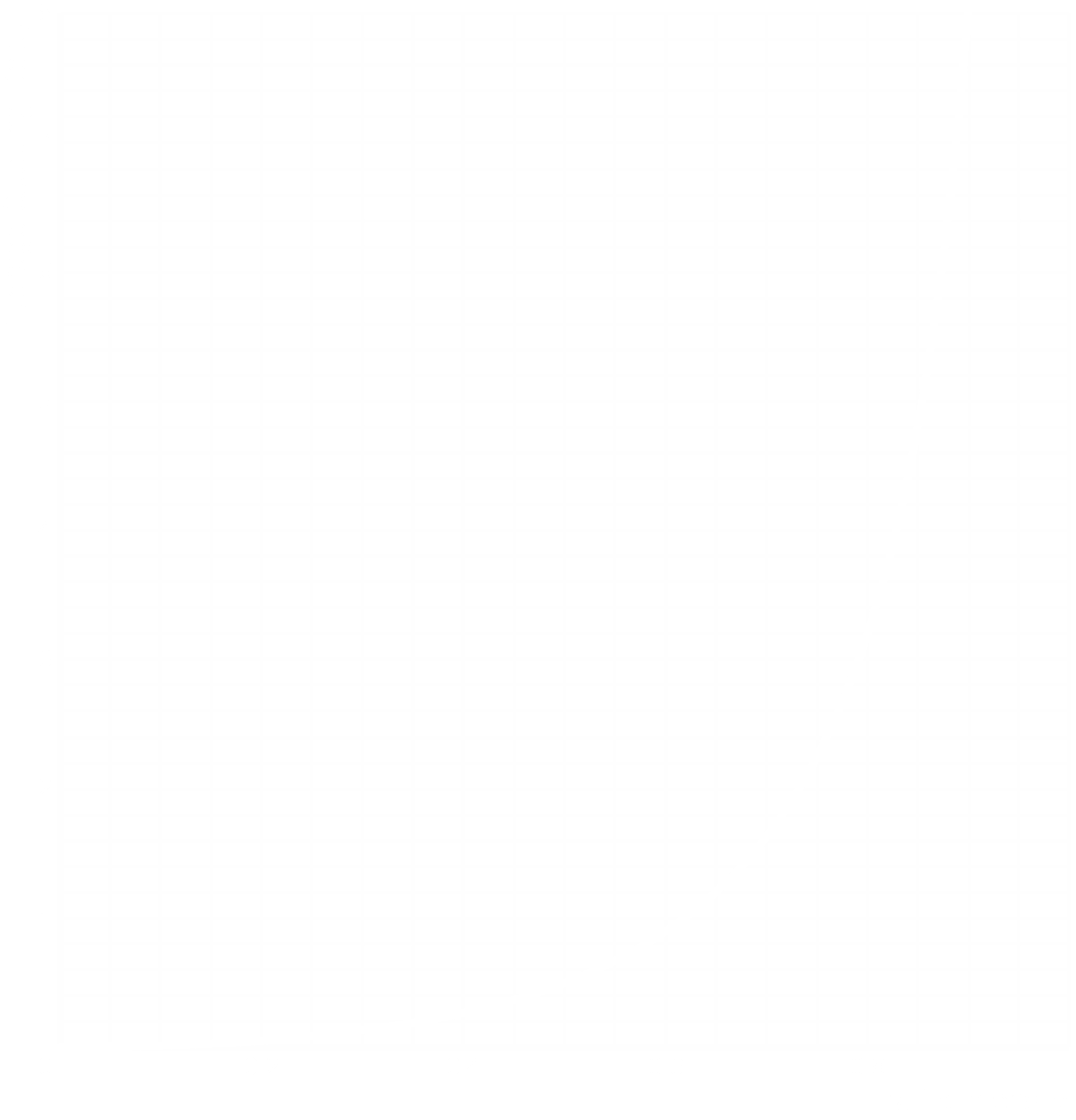
|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Arrival Mean** | **Departure Mean** | **Traffic Intensity** | **Average Queuing Delay** | **Average System Time** | **Average Customer Count in System** | **Average Queue Length** | **Server Utilization** |
| 1 | 0.05 | 0.05 | 0.00351767 | 0.0593798 | 0.0592945 | 0.00351261 | 0.0557819 |
| 1 | 0.1 | 0.1 | 0.00146747 | 0.080813 | 0.0765855 | 0.00139071 | 0.0751948 |
| 1 | 0.15 | 0.15 | 0.0233788 | 0.169427 | 0.147781 | 0.020392 | 0.127389 |
| 1 | 0.2 | 0.2 | 0.0291695 | 0.222214 | 0.196171 | 0.0257509 | 0.170421 |
| 1 | 0.25 | 0.25 | 0.13276 | 0.387092 | 0.40125 | 0.137615 | 0.263634 |
| 1 | 0.3 | 0.3 | 0.139267 | 0.452859 | 0.458556 | 0.141019 | 0.317537 |
| 1 | 0.35 | 0.35 | 0.302025 | 0.711868 | 0.794925 | 0.337264 | 0.457661 |
| 1 | 0.4 | 0.4 | 0.141746 | 0.538473 | 0.498302 | 0.131171 | 0.367131 |
| 1 | 0.45 | 0.45 | 0.361653 | 0.863443 | 0.911264 | 0.381683 | 0.529581 |
| 1 | 0.5 | 0.5 | 0.379557 | 0.899932 | 1.02502 | 0.432316 | 0.592709 |
| 1 | 0.55 | 0.55 | 0.798687 | 1.28191 | 1.46038 | 0.909881 | 0.550502 |
| 1 | 0.6 | 0.6 | 1.38351 | 2.03508 | 2.46611 | 1.67654 | 0.789571 |
| 1 | 0.65 | 0.65 | 0.812413 | 1.50468 | 1.43761 | 0.776196 | 0.661409 |
| 1 | 0.7 | 0.7 | 0.885703 | 1.56452 | 1.41801 | 0.802758 | 0.615248 |
| 1 | 0.75 | 0.75 | 0.949837 | 1.59952 | 1.47479 | 0.875769 | 0.599025 |
| 1 | 0.8 | 0.8 | 6.59591 | 7.48151 | 7.48538 | 6.59932 | 0.886063 |
| 1 | 0.85 | 0.85 | 2.0213 | 2.80367 | 2.87278 | 2.07112 | 0.801661 |
| 1 | 0.9 | 0.9 | 1.14639 | 1.94331 | 1.61814 | 0.954563 | 0.663578 |
| 1 | 0.95 | 0.95 | 6.02489 | 6.96477 | 6.74139 | 5.83166 | 0.909731 |
| 1 | 1 | 1 | 7.82453 | 8.84015 | 8.01884 | 7.09757 | 0.921268 |

## Average Queueing Delay

### Simulation Results



### Analytical Solution

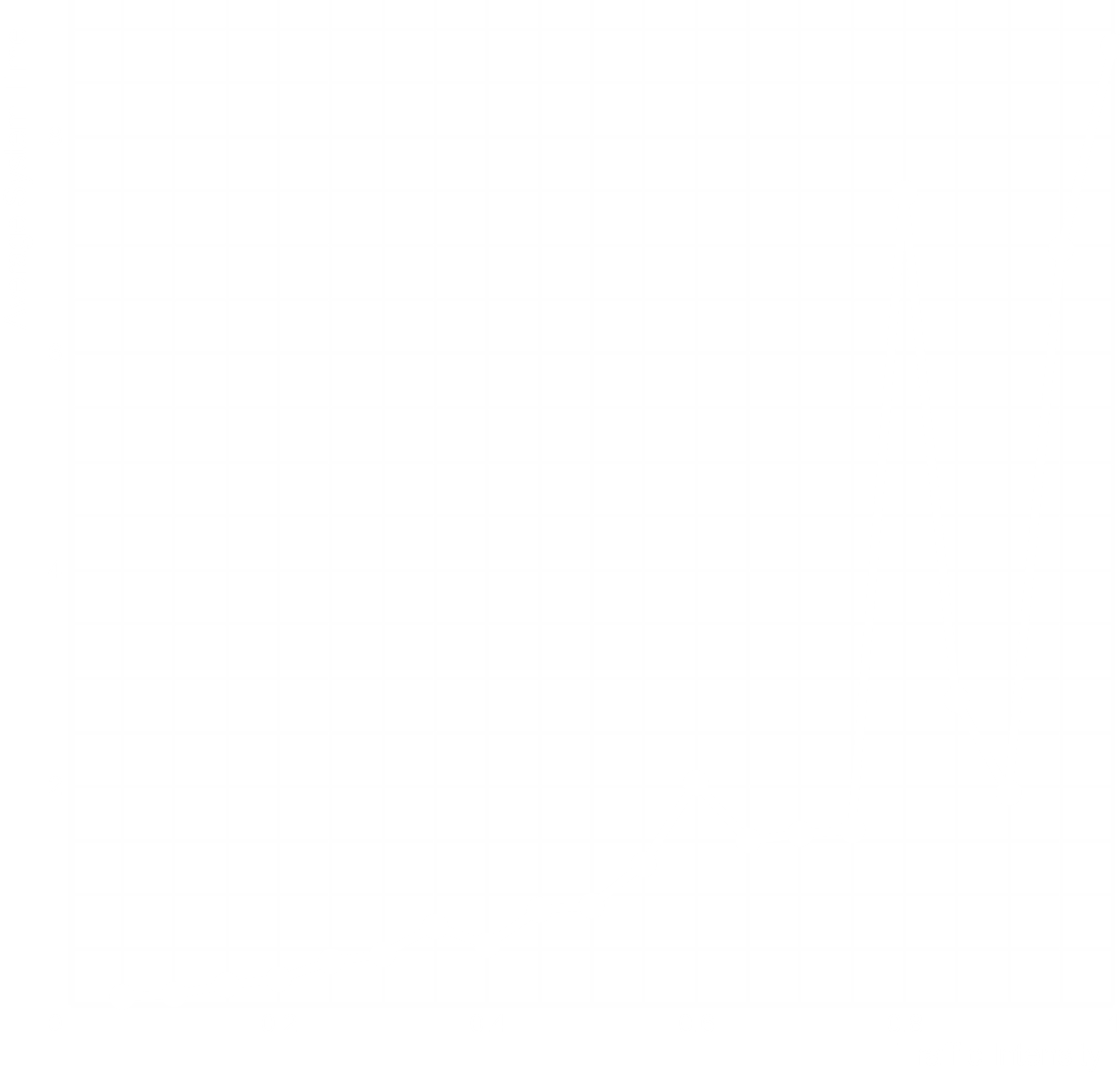


(since )

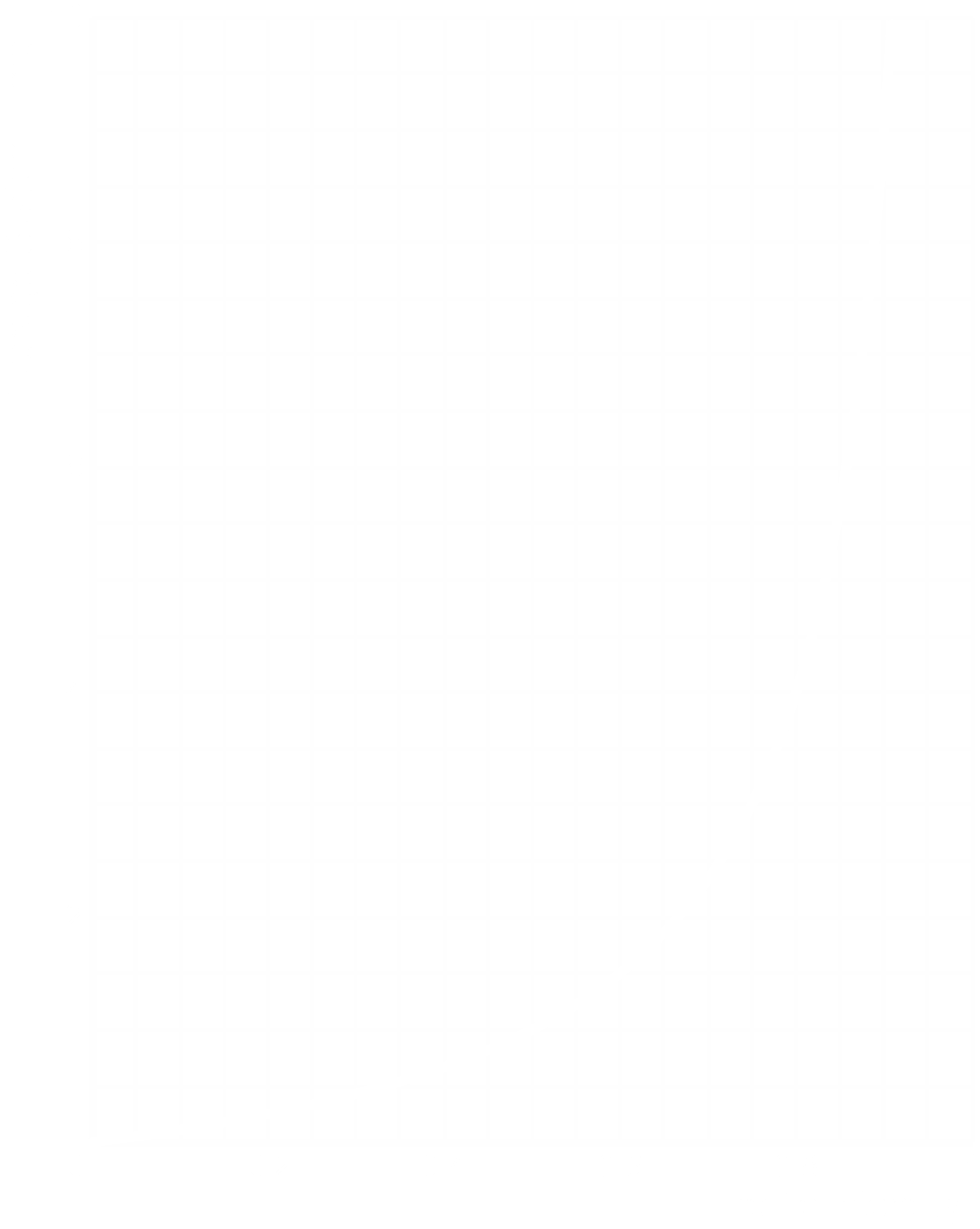
where is the Average Queueing Delay and is the Traffic Intensity.

## Average System Time

### Simulation Results



### Analytical Solution

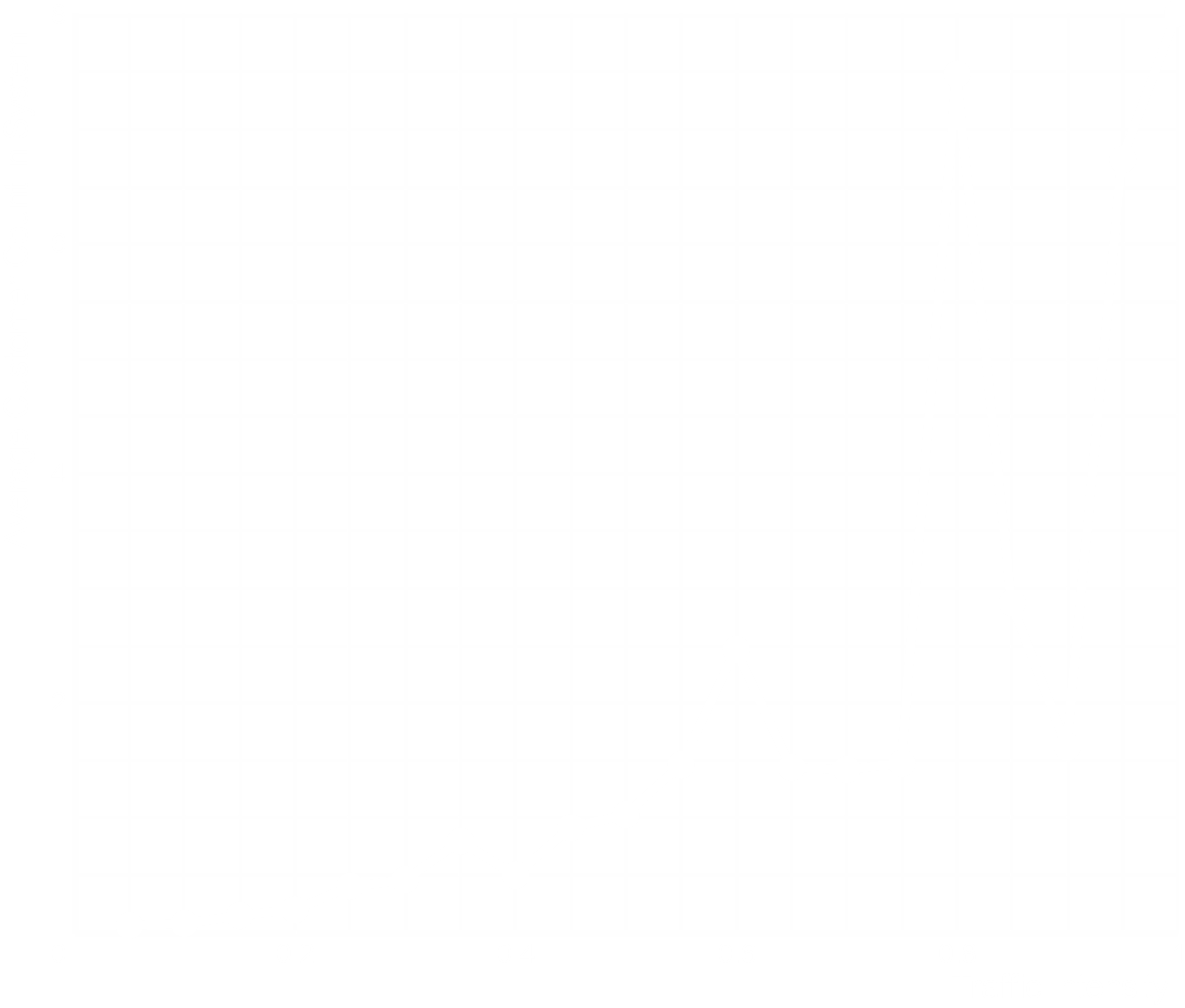


(since )

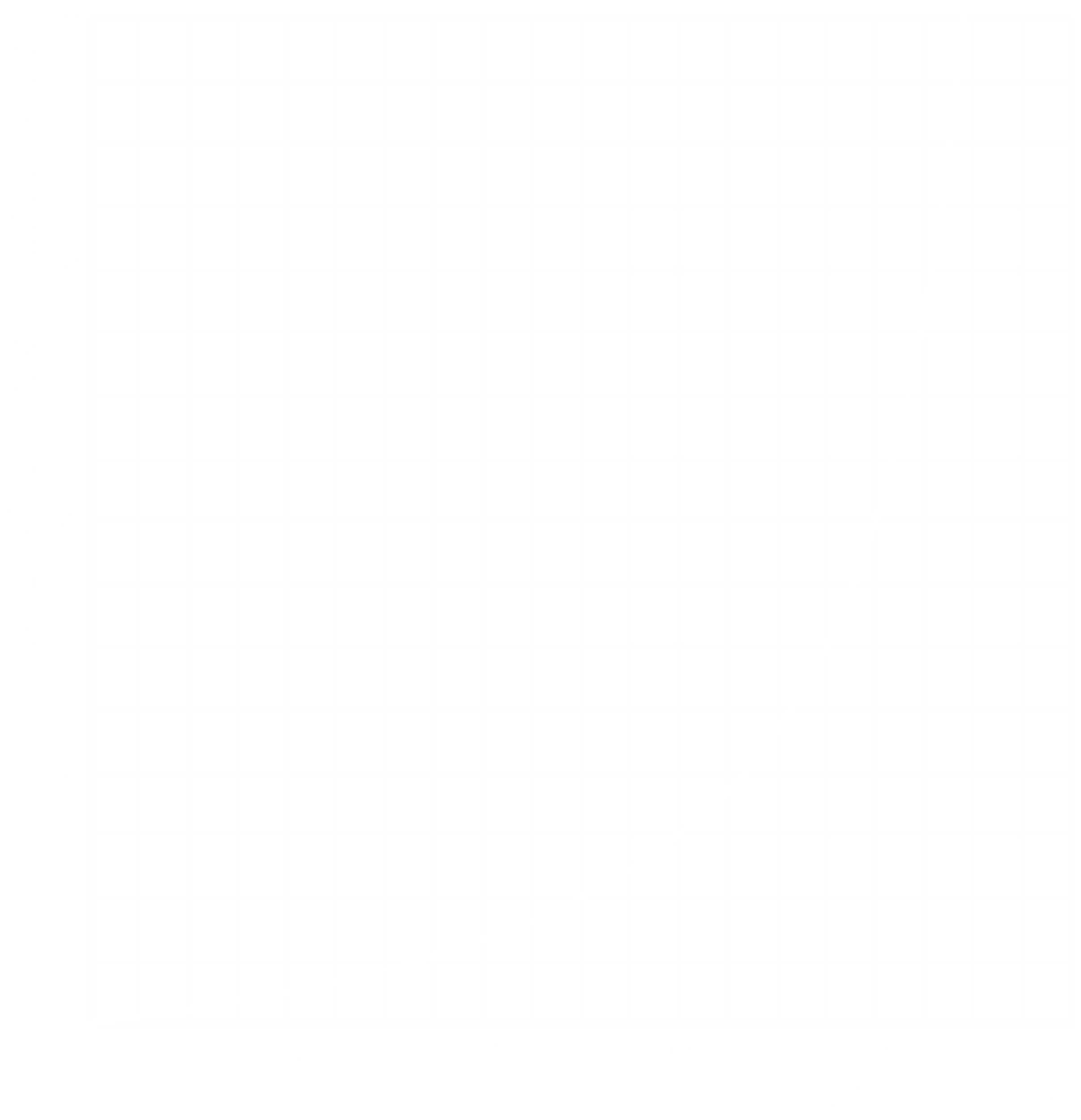
where is the Average System Time and is the Traffic Intensity.

## Average Customer Count in System

### Simulation Results



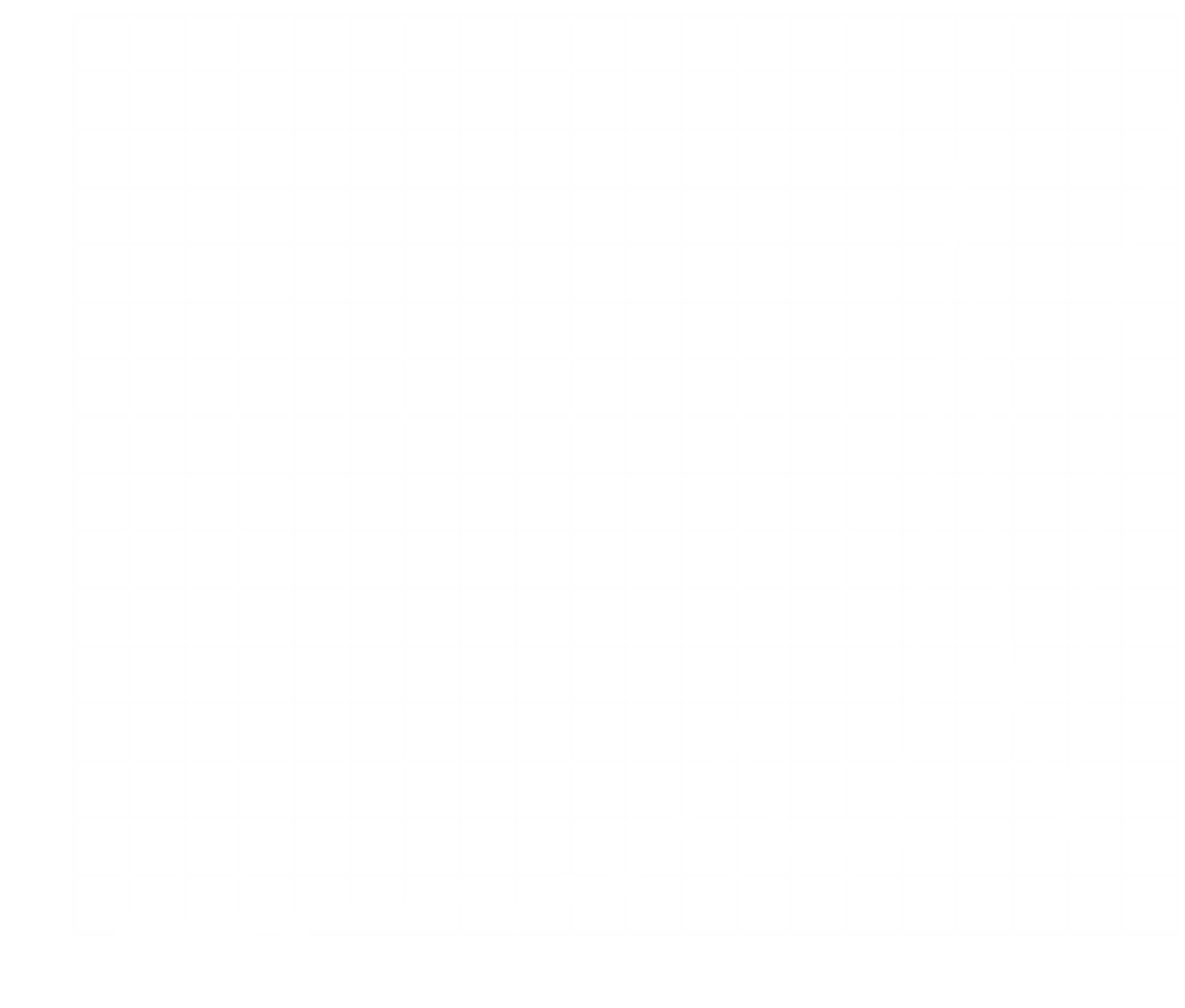
### Analytical Solution



where is the Average Customer Count in the System and is the Traffic Intensity.

## Average Queue Length

### Simulation Results



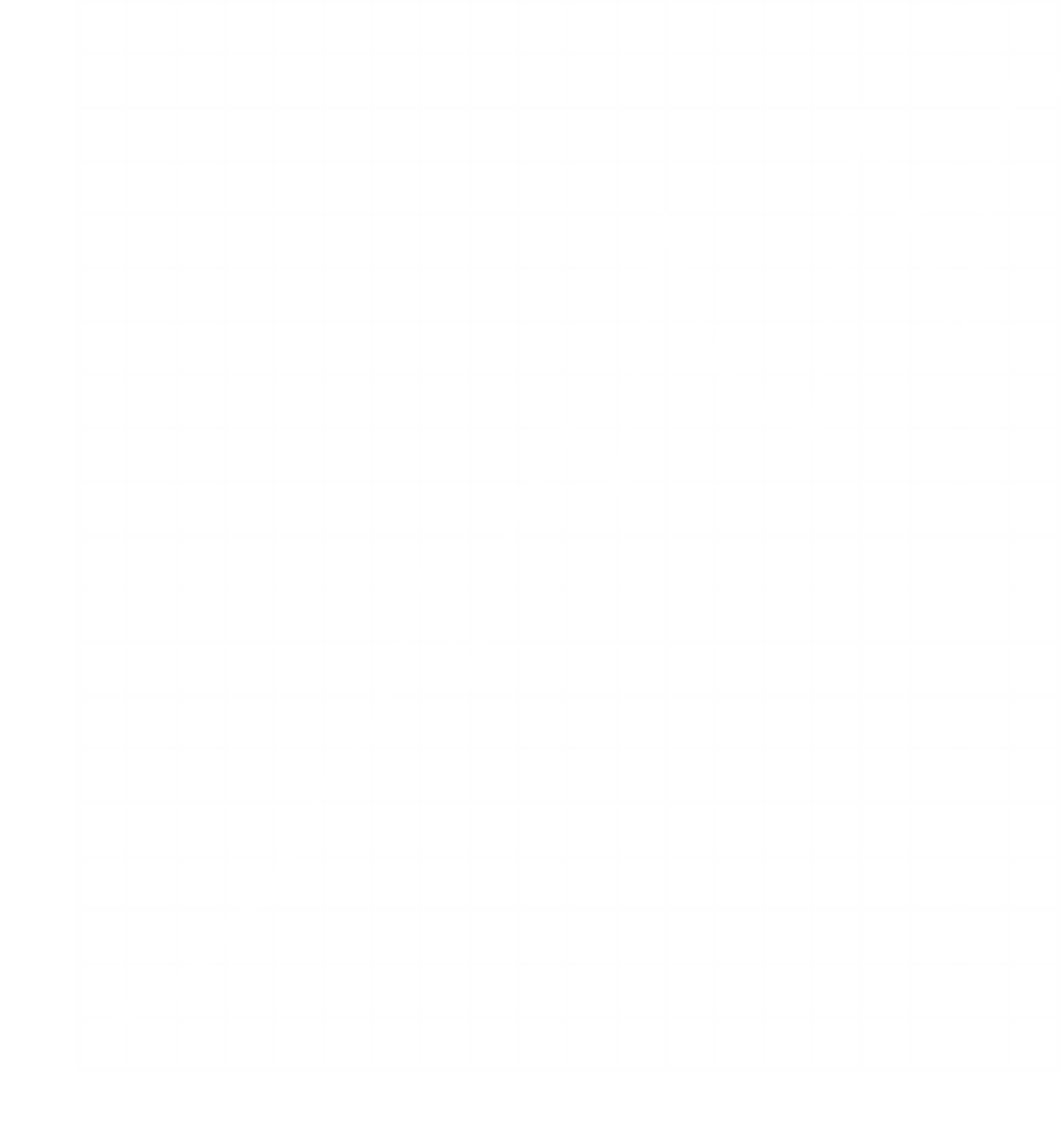
### Analytical Solution



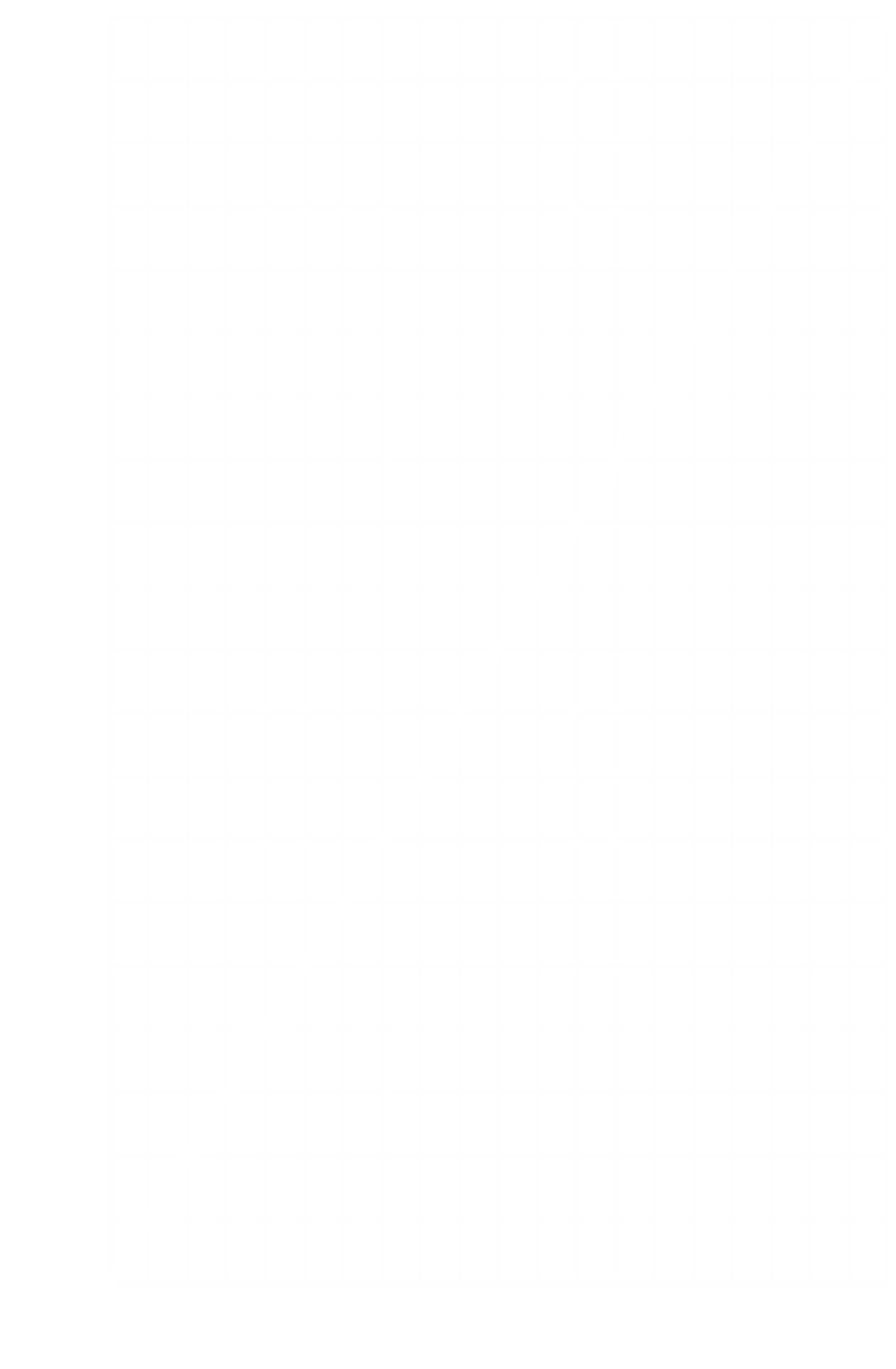
where is the Average Queue Length and is the Traffic Intensity.

## Server Utilization

### Simulation Results



### Analytical Solution



Server Utilization

where is the Traffic Intensity.