**Question 1:**

**Vissim Travel Time Simulation**

**Part 1**

Figure showing Link list

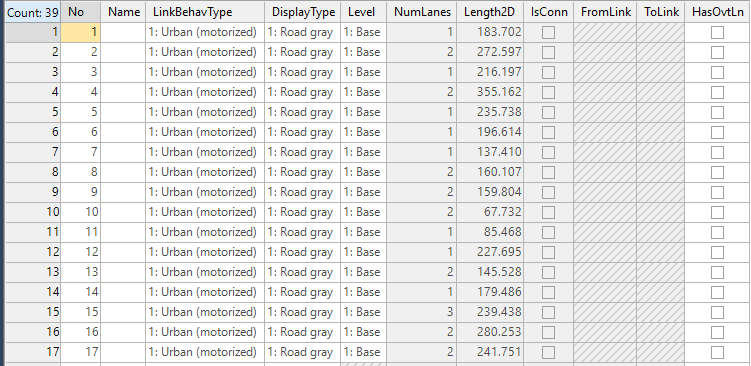


Figure showing Connector list

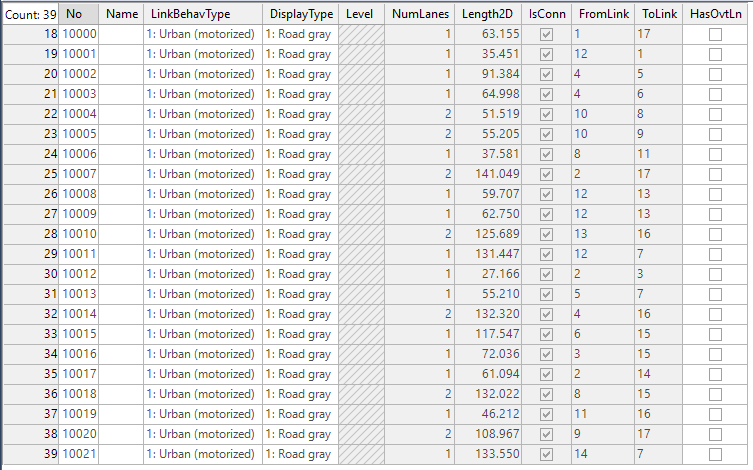
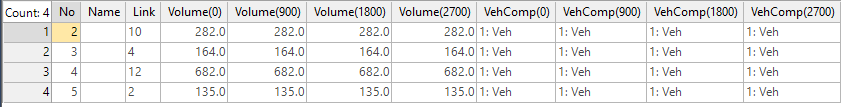
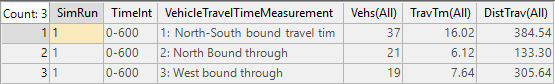


Figure Showing Vehicle Inputs



**Part 2:**

Vehicle travel time evaluation results are shown in the following figures after successful running of the simulation.



**Question 2:**

**Deriving Greenberg’s macroscopic model from GM-3 car-following model**

GM-3 car-following model:

Integrating both sides of the equation we get,

Now,

denotes the space between two vehicles, which we represent as ,

So, we re-write the equation as

Let constant be substituted for , then

Now, when , (at jam density flow is 0)

We get,

Solving we get,

Finally, the equation can be written as

This is the Greenberg’s macroscopic model logarithmic equation. (derived)

**Question 3:**

**Deriving Q=KV from Little’s law**

We know Little’s law is,

To derive the relationship, we take as number of vehicles on the roads, and as average travel time.

Assuming the length of the road is , we get

By dividing both sides of the equation for Little’s Law by

Now,

,

where denotes the density.

Again,

= Q , where Q denotes the arrival rate/flow of vehicles.

Again,

,

where means the average speed of all vehicles.

So, combining we obtain,

, or

.