CEE 598: Traffic Simulation and Modelling Application

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Assignment 5

By

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1. VISSIM Simulation

a) The Following link information have been obtained:

Count: 39	No	Name	LinkBehavType	DisplayType	Level	NumLanes	Length2D	IsConn	FromLink	ToLink	HasOvtLn
1	1		1: Urban (motorized)	1: Road gray	1: Base	1	183.702				
2	2		1: Urban (motorized)	1: Road gray	1: Base	2	272.597				
3	3		1: Urban (motorized)	1: Road gray	1: Base	1	216.197				
4	4		1: Urban (motorized)	1: Road gray	1: Base	2	355.162				
5	5		1: Urban (motorized)	1: Road gray	1: Base	1	235.738				
6	6		1: Urban (motorized)	1: Road gray	1: Base	1	196.614				
7	7		1: Urban (motorized)	1: Road gray	1: Base	1	137.410				
8	8		1: Urban (motorized)	1: Road gray	1: Base	2	160.107				
9	9		1: Urban (motorized)	1: Road gray	1: Base	2	159.804				
10	10		1: Urban (motorized)	1: Road gray	1: Base	2	67.732				
11	11		1: Urban (motorized)	1: Road gray	1: Base	1	85.468				
12	12		1: Urban (motorized)	1: Road gray	1: Base	1	227.695				
13	13		1: Urban (motorized)	1: Road gray	1: Base	2	145.528				
14	14		1: Urban (motorized)	1: Road gray	1: Base	1	179.486				
15	15		1: Urban (motorized)	1: Road gray	1: Base	3	239.438				
16	16		1: Urban (motorized)	1: Road gray	1: Base	2	280.253				
17	17		1: Urban (motorized)	1: Road gray	1: Base	2	241.751				

Link list

Count: 39	No	Name	LinkBehavType	DisplayType	Level	NumLanes	Length2D	IsConn	FromLink	ToLink	HasOvtLn
18	10000		1: Urban (motorized)	1: Road gray		1	63.155	✓	1	17	
19	10001		1: Urban (motorized)	1: Road gray		1	35.451	✓	12	1	
20	10002		1: Urban (motorized)	1: Road gray		1	91.384	✓	4	5	
21	10003		1: Urban (motorized)	1: Road gr		1	64.998	✓	4	6	
22	10004		1: Urban (motorized)	1: Road gray		2	51.519	✓	10	8	
23	10005		1: Urban (motorized)	1: Road gray		2	55.205	✓	10	9	
24	10006		1: Urban (motorized)	1: Road gray		1	37.581	✓	8	11	
25	10007		1: Urban (motorized)	1: Road gray		2	141.049	✓	2	17	
26	10008		1: Urban (motorized)	1: Road gray		1	59.707	✓	12	13	
27	10009		1: Urban (motorized)	1: Road gray		1	62.750	✓	12	13	
28	10010		1: Urban (motorized)	1: Road gray		2	125.689	✓	13	16	
29	10011		1: Urban (motorized)	1: Road gray		1	131.447	✓	12	7	
30	10012		1: Urban (motorized)	1: Road gray		1	27.166	✓	2	3	
31	10013		1: Urban (motorized)	1: Road gray		1	55.210	✓	5	7	
32	10014		1: Urban (motorized)	1: Road gray		2	132.320	✓	4	16	
33	10015		1: Urban (motorized)	1: Road gray		1	117.547	✓	6	15	
34	10016		1: Urban (motorized)	1: Road gray		1	72.036	✓	3	15	
35	10017		1: Urban (motorized)	1: Road gray		1	61.094	✓	2	14	
36	10018		1: Urban (motorized)	1: Road gray		2	132.022	✓	8	15	
37	10019		1: Urban (motorized)	1: Road gray		1	46.212	✓	11	16	
38	10020		1: Urban (motorized)	1: Road gray		2	108.967	✓	9	17	
39	10021		1: Urban (motorized)	1: Road gray		1	133.550	✓	14	7	

Connector List

Count: 4	No	Name	Link	Volume(0)	VehComp(0)
1	2		10	282.0	1: Veh
2	3		4	164.0	1: Veh
3	4		12	682.0	1: Veh
4	5		2	135.0	1: Veh

Vehicle Inputs

b) After running the simulation, the Vehicle Travel Time results have been obtained as follows:

Count: 3	SimRun	TimeInt	VehicleTravelTimeMeasurement	Vehs(All)	TravTm(All)	DistTrav(All)
1	3	0-600	1	21	8.04	139.32
2	3	0-600	2	83	22.33	225.40
3	3	0-600	3	7	12.18	351.92

Travel time of Vehicles

2. The following information is provided:

GM-3 car following model:

$$\ddot{x}_{n+1}(t+\Delta t) = \frac{\alpha_0}{x_n(t) - x_{n+1}(t)}[\dot{x}_n(t) - \dot{x}_{n+1}(t)]$$

Integrating with respect to t yields:

$$\dot{x}_{n+1} = \alpha_0 ln\big(x_n(t) - x_{n+1}(t)\big) + C_1$$

$x_n(t) - x_{n+1}(t)$ Denotes the space between two vehicles, which can also be represented as$1/k$, then we have

$$u = \alpha_0 ln(1/k) + C_1$$

Let $\alpha_0 lnC_2$ be substituted for constant, C_1, then

$$u = \alpha_0 ln(C_2/k)$$

When $K = K_j$ and $u = 0$ $(vehicles\ bumper\ to\ bumper\ but\ no\ movement)$:

$$0 = \alpha_0 ln(C_2/k_j)$$

$$ln(C_2/k_j) = 0$$

$$C_2/k_j = 1\ and\ C_2 = k_j$$

Finally,

$$u = \alpha_0 ln(k_j/k)$$

3. Derivation of Q = K*V from Little's Law:

Little's law:

$$\bar{L}(t) = \frac{A(t)}{t} \times \bar{W}(t)$$

Take $\bar{L}(t)$ as number of vehicles on the roads and $\bar{W}(t)$ as average travel time

Assuming the length of the road is L:

$$\bar{L}(t)/L = \left(\frac{A(t)}{t} \times \bar{W}(t)\right)/L$$

Dividing both sides of the equation by L:

$$\bar{L}(t)/L = K$$

Where K denotes the density

$$\frac{A(t)}{t} = Q$$

Where Q denotes the arrival rate of the vehicles

$$\bar{W}(t)/L = 1/V$$

Where V denotes the average speed of all vehicles

Finally,

$$K = Q/V$$

$$Q = KV$$