APPENDIX E

Queuing Calculation Sheets

Cochrane/DePaul
Analysis of Eastbound Left-Turn Queue
Project Conditions - AM Peak Hour

Volume (vph) =	V =	211
Cycle Length (sec) =	C =	70
Effective Green (Sec) =	G =	11.3
Number of Lanes =	L =	2

Avg Vol/Red Interval Each Cycle = M = V/(3600*L)*(C-G)= 1.720

Assuming Poisson Distribution of Arrivals:

n	P(X=n)	P(X<=n)
0	0.179	0.179
1	0.308	0.487
2	0.265	0.752
3	0.152	0.904
4	0.065	0.969
5	0.022	0.992
6	0.006	0.998
7	0.002	1.000
8	0.000	1.000
9	0.000	1.000
10	0.000	1.000
11	0.000	1.000
12	0.000	1.000
13	0.000	1.000
14	0.000	1.000
15	0.000	1.000
16	0.000	1.000
17	0.000	1.000
18	0.000	1.000
19	0.000	1.000
20	0.000	1.000

Cochrane/DePaul
Analysis of Southbound Right-Turn Queue
Project Conditions - AM Peak Hour

Volume (vph) =	V =	146
Cycle Length (sec) =	C =	70
Effective Green (Sec) =	G =	21.3
Number of Lanes =	L =	2

Avg Vol/Red Interval Each Cycle = M = V/(3600*L)*(C-G)= 0.988

Assuming Poisson Distribution of Arrivals:

n	P(X=n)	P(X<=n)
0	0.372	0.372
1	0.368	0.740
2	0.182	0.922
3	0.075	0.997
4	0.015	0.997
5	0.003	0.999
6	0.000	1.000
7	0.000	1.000
8	0.000	1.000
9	0.000	1.000
10	0.000	1.000
11	0.000	1.000
12	0.000	1.000
13	0.000	1.000
14	0.000	1.000
15	0.000	1.000
16	0.000	1.000
17	0.000	1.000
18	0.000	1.000
19	0.000	1.000
20	0.000	1.000

Cochrane/DePaul
Analysis of Westbound Left-Turn Queue
Project Conditions - AM Peak Hour

Volume (vph) =	V =	0
Cycle Length (sec) =	C =	70
Effective Green (Sec) =	G =	0
Number of Lanes =	L =	1

Avg Vol/Red Interval Each Cycle = M = V/(3600*L)*(C-G)= 0.000

Assuming Poisson Distribution of Arrivals:

n	P(X=n)	P(X<=n)
0	#NUM!	#NUM!
1	0.000	#NUM!
2	0.000	#NUM!
3	0.000	#NUM!
4	0.000	#NUM!
5	0.000	#NUM!
6	0.000	#NUM!
7	0.000	#NUM!
8	0.000	#NUM!
9	0.000	#NUM!
10	0.000	#NUM!
11	0.000	#NUM!
12	0.000	#NUM!
13	0.000	#NUM!
14	0.000	#NUM!
15	0.000	#NUM!
16	0.000	#NUM!
17	0.000	#NUM!
18	0.000	#NUM!
19	0.000	#NUM!
20	0.000	#NUM!

Cochrane/DePaul
Analysis of Southbound Left-Turn Queue
Project Conditions - AM Peak Hour

Volume (vph) =	V =	47
Cycle Length (sec) =	C =	70
Effective Green (Sec) =	G =	10
Number of Lanes =	L =	1

Avg Vol/Red Interval Each Cycle = M = V/(3600*L)*(C-G)= 0.783

Assuming Poisson Distribution of Arrivals:

n	P(X=n)	P(X<=n)
0	0.457	0.457
1	0.358	0.815
2	0.176	0.991
3	0.037	0.992
4	0.007	0.999
5	0.001	1.000
6	0.000	1.000
7	0.000	1.000
8	0.000	1.000
9	0.000	1.000
10	0.000	1.000
11	0.000	1.000
12	0.000	1.000
13	0.000	1.000
14	0.000	1.000
15	0.000	1.000
16	0.000	1.000
17	0.000	1.000
18	0.000	1.000
19	0.000	1.000
20	0.000	1.000

Cochrane/DePaul
Analysis of Eastbound Left-Turn Queue
Project Conditions - PM Peak Hour

Volume (vph) =	V =	631
Cycle Length (sec) =	C =	70
Effective Green (Sec) =	G =	20.1
Number of Lanes =	L =	2

Avg Vol/Red Interval Each Cycle = M = V/3600*L/(C-G)= 4.373

Assuming Poisson Distribution of Arrivals:

n	P(X=n)	P(X<=n)
0	0.013	0.013
1	0.055	0.068
2	0.121	0.188
3	0.176	0.364
4	0.192	0.556
5	0.168	0.724
6	0.123	0.847
7	0.077	0.923
8	0.043	0.966
9	0.020	0.986
10	0.009	0.995
11	0.004	0.998
12	0.001	0.999
13	0.000	1.000
14	0.000	1.000
15	0.000	1.000
16	0.000	1.000
17	0.000	1.000
18	0.000	1.000
19	0.000	1.000
20	0.000	1.000

Cochrane/DePaul
Analysis of Southbound Right-Turn Queue
Project Conditions - PM Peak Hour

Volume (vph) =	V =	532
Cycle Length (sec) =	C =	70
Effective Green (Sec) =	G =	30.5
Number of Lanes =	L =	2

Avg Vol/Red Interval Each Cycle = M = V/3600*L/(C-G)= 2.919

Assuming Poisson Distribution of Arrivals:

n	P(X=n)	P(X<=n)
0	0.054	0.054
1	0.158	0.212
2	0.230	0.442
3	0.224	0.665
4	0.163	0.829
5	0.095	0.924
6	0.046	0.970
7	0.019	0.990
8	0.007	0.997
9	0.002	0.999
10	0.001	1.000
11	0.000	1.000
12	0.000	1.000
13	0.000	1.000
14	0.000	1.000
15	0.000	1.000
16	0.000	1.000
17	0.000	1.000
18	0.000	1.000
19	0.000	1.000
20	0.000	1.000

Cochrane/DePaul
Analysis of Westbound Left-Turn Queue
Project Conditions - PM Peak Hour

Volume (vph) =	V =	3
Cycle Length (sec) =	C =	70
Effective Green (Sec) =	G =	13.5
Number of Lanes =	L =	1

Avg Vol/Red Interval Each Cycle = M = V/3600*L/(C-G)= 0.047

Assuming Poisson Distribution of Arrivals:

n	P(X=n)	P(X<=n)
0	0.954	0.954
1	0.045	0.999
2	0.001	1.000
3	0.000	1.000
4	0.000	1.000
5	0.000	1.000
6	0.000	1.000
7	0.000	1.000
8	0.000	1.000
9	0.000	1.000
10	0.000	1.000
11	0.000	1.000
12	0.000	1.000
13	0.000	1.000
14	0.000	1.000
15	0.000	1.000
16	0.000	1.000
17	0.000	1.000
18	0.000	1.000
19	0.000	1.000
20	0.000	1.000

Cochrane/DePaul
Analysis of Southbound Left-Turn Queue
Project Conditions - PM Peak Hour

Volume (vph) =	V =	156
Cycle Length (sec) =	C =	70
Effective Green (Sec) =	G =	10.4
Number of Lanes =	L =	1

Avg Vol/Red Interval Each Cycle = M = V/3600*L/(C-G)= 3.079

Assuming Poisson Distribution of Arrivals:

n	P(X=n)	P(X<=n)
0	0.046	0.046
1	0.142	0.188
2	0.218	0.406
3	0.224	0.629
4	0.172	0.802
5	0.106	0.908
6	0.054	0.962
7	0.024	0.986
8	0.009	0.996
9	0.003	0.999
10	0.001	1.000
11	0.000	1.000
12	0.000	1.000
13	0.000	1.000
14	0.000	1.000
15	0.000	1.000
16	0.000	1.000
17	0.000	1.000
18	0.000	1.000
19	0.000	1.000
20	0.000	1.000

Cochrane/DePaul
Analysis of Eastbound Left-Turn Queue
Project Conditions - Saturday Peak Hour

Volume (vph) =	V =	885
Cycle Length (sec) =	C =	70
Effective Green (Sec) =	G =	21.8
Number of Lanes =	L =	2

Avg Veh/Red Interval Each Cycle = M = V/(3600*L)*(C-G)= 5.925

Assuming Poisson Distribution of Arrivals:

n	P(X=n)	P(X<=n)
0	0.003	0.003
1	0.016	0.019
2	0.047	0.065
3	0.093	0.158
4	0.137	0.295
5	0.163	0.458
6	0.161	0.618
7	0.136	0.754
8	0.101	0.855
9	0.066	0.921
10	0.039	0.960
11	0.021	0.982
12	0.010	0.992
13	0.005	0.997
14	0.002	0.999
15	0.001	1.000
16	0.000	1.000
17	0.000	1.000
18	0.000	1.000
19	0.000	1.000
20	0.000	1.000

Cochrane/DePaul
Analysis of Southbound Right-Turn Queue
Project Conditions - Saturday Peak Hour

Volume (vph) =	V =	691
Cycle Length (sec) =	C =	70
Effective Green (Sec) =	G =	31.8
Number of Lanes =	L =	2

Avg Veh/Red Interval Each Cycle = M = V/(3600*L)*(C-G)= 3.507

Assuming Poisson Distribution of Arrivals:

n	P(X=n)	P(X<=n)
0	0.030	0.030
1	0.105	0.135
2	0.184	0.320
3	0.216	0.535
4	0.189	0.724
5	0.133	0.857
6	0.077	0.934
7	0.038	0.973
8	0.017	0.990
9	0.007	0.997
10	0.002	0.999
11	0.001	1.000
12	0.000	1.000
13	0.000	1.000
14	0.000	1.000
15	0.000	1.000
16	0.000	1.000
17	0.000	1.000
18	0.000	1.000
19	0.000	1.000
20	0.000	1.000

Cochrane/DePaul
Analysis of Westbound Left-Turn Queue
Project Conditions - Saturday Peak Hour

Volume (vph) =	V =	2
Cycle Length (sec) =	C =	70
Effective Green (Sec) =	G =	12.9
Number of Lanes =	L =	1

Avg Veh/Red Interval Each Cycle = M = V/(3600*L)*(C-G)= 0.032

Assuming Poisson Distribution of Arrivals:

n	P(X=n)	P(X<=n)
0	0.968	0.968
1	0.031	1.000
2	0.000	1.000
3	0.000	1.000
4	0.000	1.000
5	0.000	1.000
6	0.000	1.000
7	0.000	1.000
8	0.000	1.000
9	0.000	1.000
10	0.000	1.000
11	0.000	1.000
12	0.000	1.000
13	0.000	1.000
14	0.000	1.000
15	0.000	1.000
16	0.000	1.000
17	0.000	1.000
18	0.000	1.000
19	0.000	1.000
20	0.000	1.000

Cochrane/DePaul
Analysis of Southbound Left-Turn Queue
Project Conditions - Saturday Peak Hour

Volume (vph) =	V =	163
Cycle Length (sec) =	C =	70
Effective Green (Sec) =	G =	10
Number of Lanes =	L =	1

Avg Veh/Red Interval Each Cycle = M = V/(3600*L)*(C-G)= 3.050

Assuming Poisson Distribution of Arrivals:

n	P(X=n)	P(X<=n)
0	0.047	0.047
1	0.144	0.192
2	0.220	0.412
3	0.224	0.636
4	0.171	0.807
5	0.104	0.911
6	0.053	0.964
7	0.023	0.987
8	0.009	0.996
9	0.003	0.999
10	0.001	1.000
11	0.000	1.000
12	0.000	1.000
13	0.000	1.000
14	0.000	1.000
15	0.000	1.000
16	0.000	1.000
17	0.000	1.000
18	0.000	1.000
19	0.000	1.000
20	0.000	1.000

Cochrane/DePaul
Analysis of Eastbound Left-Turn Queue
Project with Supermarket Conditions - AM Peak Hour

Volume (vph) =	V =	241
Cycle Length (sec) =	C =	70
Effective Green (Sec) =	G =	12.4
Number of Lanes =	L =	2

Avg Vehl/Red Interval Each Cycle = M = V/3600*L*(C-G)= 1.928

Assuming Poisson Distribution of Arrivals:

n	P(X=n)	P(X<=n)
0	0.145	0.145
1	0.280	0.425
2	0.270	0.696
3	0.174	0.870
4	0.084	0.954
5	0.032	0.986
6	0.010	0.996
7	0.003	0.999
8	0.001	1.000
9	0.000	1.000
10	0.000	1.000
11	0.000	1.000
12	0.000	1.000
13	0.000	1.000
14	0.000	1.000
15	0.000	1.000
16	0.000	1.000
17	0.000	1.000
18	0.000	1.000
19	0.000	1.000
20	0.000	1.000

Cochrane/DePaul
Analysis of Southbound Right-Turn Queue
Project with Supermarket Conditions - AM Peak Hour

Volume (vph) =	V =	160
Cycle Length (sec) =	C =	70
Effective Green (Sec) =	G =	22.4
Number of Lanes =	L =	2

Avg Vehl/Red Interval Each Cycle = M = V/3600*L*(C-G)= 1.058

Assuming Poisson Distribution of Arrivals:

n	P(X=n)	P(X<=n)
0	0.347	0.347
1	0.367	0.715
2	0.194	0.909
3	0.085	0.994
4	0.018	0.995
5	0.004	0.999
6	0.001	1.000
7	0.000	1.000
8	0.000	1.000
9	0.000	1.000
10	0.000	1.000
11	0.000	1.000
12	0.000	1.000
13	0.000	1.000
14	0.000	1.000
15	0.000	1.000
16	0.000	1.000
17	0.000	1.000
18	0.000	1.000
19	0.000	1.000
20	0.000	1.000

Cochrane/DePaul
Analysis of Westbound Left-Turn Queue
Project with Supermarket Conditions - AM Peak Hour

Volume (vph) =	V =	0
Cycle Length (sec) =	C =	70
Effective Green (Sec) =	G =	0
Number of Lanes =	L =	1

Avg Vehl/Red Interval Each Cycle = M = V/3600*L*(C-G)= 0.000

Assuming Poisson Distribution of Arrivals:

n	P(X=n)	P(X<=n)
0	#NUM!	#NUM!
1	0.000	#NUM!
2	0.000	#NUM!
3	0.000	#NUM!
4	0.000	#NUM!
5	0.000	#NUM!
6	0.000	#NUM!
7	0.000	#NUM!
8	0.000	#NUM!
9	0.000	#NUM!
10	0.000	#NUM!
11	0.000	#NUM!
12	0.000	#NUM!
13	0.000	#NUM!
14	0.000	#NUM!
15	0.000	#NUM!
16	0.000	#NUM!
17	0.000	#NUM!
18	0.000	#NUM!
19	0.000	#NUM!
20	0.000	#NUM!

Cochrane/DePaul
Analysis of Southbound Left-Turn Queue
Project with Supermarket Conditions - AM Peak Hour

Volume (vph) =	V =	52
Cycle Length (sec) =	C =	70
Effective Green (Sec) =	G =	10
Number of Lanes =	L =	1

Avg Vehl/Red Interval Each Cycle = M = V/3600*L*(C-G)= 0.867

Assuming Poisson Distribution of Arrivals:

n	P(X=n)	P(X<=n)
0	0.420	0.420
1	0.364	0.785
2	0.158	0.943
3	0.045	0.988
4	0.010	0.998
5	0.002	1.000
6	0.000	1.000
7	0.000	1.000
8	0.000	1.000
9	0.000	1.000
10	0.000	1.000
11	0.000	1.000
12	0.000	1.000
13	0.000	1.000
14	0.000	1.000
15	0.000	1.000
16	0.000	1.000
17	0.000	1.000
18	0.000	1.000
19	0.000	1.000
20	0.000	1.000

Cochrane/DePaul
Analysis of Eastbound Left-Turn Queue
Project with Supermarket Conditions - PM Peak Hour

Volume (vph) =	V =	732
Cycle Length (sec) =	C =	70
Effective Green (Sec) =	G =	20.5
Number of Lanes =	L =	2

Avg Vol/Red Interval Each Cycle = M = V/(3600*L)*(C-G)= 5.062

Assuming Poisson Distribution of Arrivals:

n	P(X=n)	P(X<=n)
0	0.007	0.007
1	0.034	0.040
2	0.084	0.124
3	0.140	0.265
4	0.175	0.440
5	0.175	0.616
6	0.146	0.762
7	0.105	0.866
8	0.065	0.932
9	0.036	0.968
10	0.018	0.986
11	0.008	0.995
12	0.003	0.998
13	0.001	0.999
14	0.000	1.000
15	0.000	1.000
16	0.000	1.000
17	0.000	1.000
18	0.000	1.000
19	0.000	1.000
20	0.000	1.000

Cochrane/DePaul
Analysis of Southbound Right-Turn Queue
Project with Supermarket Conditions - PM Peak Hour

Volume (vph) =	V =	609
Cycle Length (sec) =	C =	70
Effective Green (Sec) =	G =	31.3
Number of Lanes =	L =	2

Avg Vol/Red Interval Each Cycle = M = V/(3600*L)*(C-G)= 3.273

Assuming Poisson Distribution of Arrivals:

n	P(X=n)	P(X<=n)
0	0.038	0.038
1	0.124	0.162
2	0.203	0.365
3	0.221	0.586
4	0.181	0.767
5	0.119	0.886
6	0.065	0.950
7	0.030	0.981
8	0.012	0.993
9	0.005	0.998
10	0.001	0.999
11	0.000	1.000
12	0.000	1.000
13	0.000	1.000
14	0.000	1.000
15	0.000	1.000
16	0.000	1.000
17	0.000	1.000
18	0.000	1.000
19	0.000	1.000
20	0.000	1.000

Cochrane/DePaul
Analysis of Westbound Left-Turn Queue
Project with Supermarket Conditions - PM Peak Hour

Volume (vph) =	V =	3
Cycle Length (sec) =	C =	70
Effective Green (Sec) =	G =	12.6
Number of Lanes =	L =	1

Avg Vol/Red Interval Each Cycle = M = V/(3600*L)*(C-G)= 0.048

Assuming Poisson Distribution of Arrivals:

n	P(X=n)	P(X<=n)
0	0.953	0.953
1	0.046	0.999
2	0.001	1.000
3	0.000	1.000
4	0.000	1.000
5	0.000	1.000
6	0.000	1.000
7	0.000	1.000
8	0.000	1.000
9	0.000	1.000
10	0.000	1.000
11	0.000	1.000
12	0.000	1.000
13	0.000	1.000
14	0.000	1.000
15	0.000	1.000
16	0.000	1.000
17	0.000	1.000
18	0.000	1.000
19	0.000	1.000
20	0.000	1.000

Cochrane/DePaul
Analysis of Southbound Left-Turn Queue
Project with Supermarket Conditions - PM Peak Hour

Volume (vph) =	V =	212
Cycle Length (sec) =	C =	70
Effective Green (Sec) =	G =	10.5
Number of Lanes =	L =	1

Avg Vol/Red Interval Each Cycle = M = V/(3600*L)*(C-G)= 3.504

Assuming Poisson Distribution of Arrivals:

n	P(X=n)	P(X<=n)
0	0.030	0.030
1	0.105	0.135
2	0.185	0.320
3	0.216	0.536
4	0.189	0.725
5	0.132	0.857
6	0.077	0.934
7	0.038	0.972
8	0.017	0.990
9	0.007	0.997
10	0.002	0.999
11	0.001	1.000
12	0.000	1.000
13	0.000	1.000
14	0.000	1.000
15	0.000	1.000
16	0.000	1.000
17	0.000	1.000
18	0.000	1.000
19	0.000	1.000
20	0.000	1.000

Cochrane/DePaul
Analysis of Eastbound Left-Turn Queue
Project with Supermarket Conditions - Saturday Peak Hour

Volume (vph) =	V =	975
Cycle Length (sec) =	C =	70
Effective Green (Sec) =	G =	22.1
Number of Lanes =	L =	2

Avg Vehl/Red Interval Each Cycle = M = V/3600*L/(C-G)= 6.465

Assuming Poisson Distribution of Arrivals:

n	P(X=n)	P(X<=n)
0	0.002	0.002
1	0.010	0.011
2	0.032	0.043
3	0.069	0.113
4	0.112	0.225
5	0.146	0.371
6	0.158	0.529
7	0.146	0.675
8	0.118	0.793
9	0.085	0.879
10	0.055	0.934
11	0.033	0.967
12	0.018	0.984
13	0.009	0.993
14	0.004	0.997
15	0.002	0.999
16	0.001	1.000
17	0.000	1.000
18	0.000	1.000
19	0.000	1.000
20	0.000	1.000

Cochrane/DePaul
Analysis of Southbound Right-Turn Queue
Project with Supermarket Conditions - Saturday Peak Hour

Volume (vph) =	V =	735
Cycle Length (sec) =	C =	70
Effective Green (Sec) =	G =	32.1
Number of Lanes =	L =	2

Avg Vehl/Red Interval Each Cycle = M = V/3600*L/(C-G)= 3.859

Assuming Poisson Distribution of Arrivals:

n	P(X=n)	P(X<=n)
0	0.021	0.021
1	0.081	0.102
2	0.156	0.258
3	0.202	0.459
4	0.195	0.654
5	0.151	0.805
6	0.097	0.903
7	0.054	0.957
8	0.026	0.982
9	0.011	0.993
10	0.004	0.998
11	0.002	0.999
12	0.000	1.000
13	0.000	1.000
14	0.000	1.000
15	0.000	1.000
16	0.000	1.000
17	0.000	1.000
18	0.000	1.000
19	0.000	1.000
20	0.000	1.000

Cochrane/DePaul
Analysis of Westbound Left-Turn Queue
Project with Supermarket Conditions - Saturday Peak Hour

Volume (vph) =	V =	2
Cycle Length (sec) =	C =	70
Effective Green (Sec) =	G =	12.4
Number of Lanes =	L =	1

Avg Vehl/Red Interval Each Cycle = M = V/3600*L/(C-G)= 0.032

Assuming Poisson Distribution of Arrivals:

n	P(X=n)	P(X<=n)
0	0.968	0.968
1	0.031	0.999
2	0.000	1.000
3	0.000	1.000
4	0.000	1.000
5	0.000	1.000
6	0.000	1.000
7	0.000	1.000
8	0.000	1.000
9	0.000	1.000
10	0.000	1.000
11	0.000	1.000
12	0.000	1.000
13	0.000	1.000
14	0.000	1.000
15	0.000	1.000
16	0.000	1.000
17	0.000	1.000
18	0.000	1.000
19	0.000	1.000
20	0.000	1.000

Cochrane/DePaul
Analysis of Southbound Left-Turn Queue
Project with Supermarket Conditions - Saturday Peak Hour

Volume (vph) =	V =	202
Cycle Length (sec) =	C =	70
Effective Green (Sec) =	G =	10
Number of Lanes =	L =	1

Avg Vehl/Red Interval Each Cycle = M = V/3600*L/(C-G)= 3.367

Assuming Poisson Distribution of Arrivals:

n	P(X=n)	P(X<=n)
0	0.035	0.035
1	0.116	0.151
2	0.196	0.346
3	0.219	0.566
4	0.185	0.750
5	0.124	0.875
6	0.070	0.945
7	0.034	0.979
8	0.014	0.992
9	0.005	0.997
10	0.002	0.999
11	0.001	1.000
12	0.000	1.000
13	0.000	1.000
14	0.000	1.000
15	0.000	1.000
16	0.000	1.000
17	0.000	1.000
18	0.000	1.000
19	0.000	1.000
20	0.000	1.000