

## References

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## Appendix

Departure Porch																													
Poisson Distribution		Random Arrival, Random Service and one service channel																											
Busiest Hour 21:00 - 22:00																													
Maximum flow rate 296 veh per hour																													
Slots	Dwelling time	Arrival Rate	Service Rate	$\rho$	service channels																								
Nos	mins	veh/hr	Veh / hr																										
16	2.97	296	323.23	0.91575	1																								
Expected Average Queue Length				E(m)	10.869																								
Expected average total time				E(v)	0.037	132.1958457																							
Expected average waiting time				E(w)	0.034	121.06 Sec																							
P <sub>0</sub>	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29
0.08425	0.077151937	0.070651887	0.064699465	0.05924854	0.054256846	0.04968857	0.0455	0.041666	0.038156	0.034941	0.031998	0.029302	0.026831	0.024572	0.022502	0.020606	0.01887	0.01728	0.015825	0.014491	0.01327	0.012152	0.011129	0.010191	0.009332	0.008546	0.007826	0.007267	0.0068563
0.08425	0.161401938	0.232053824	0.29675329	0.35600182	0.410258671	0.4599444	0.505444	0.54711	0.585266	0.620208	0.652205	0.681507	0.70834	0.732912	0.755414	0.776021	0.794891	0.812171	0.827996	0.842487	0.855758	0.86791	0.879039	0.88923	0.898562	0.907108	0.914934	0.922101	0.928664
When there are two service channels																													
Slots	Dwelling time	Arrival Rate	Service Rate	$\rho$	service channels																								
Nos	mins	veh/hr	Veh / hr																										
16	2.97	296	323.2323232	0.91575	2																								
Expected average queue length				E(m)	0.35834054	1.175598063																							
Expected average number in the system				E(n)	1.22	0.30																							
Expected average total time				E(v)	0.00412																								
Expected average waiting time				E(w)	0.00102978	3.71 sec																							
P <sub>0</sub>	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29
0.46662195	0.427309052	0.195654132	0.358340543	0.6563007	1.202014741	2.20149	1.56E-05	3.141846	3.141846	7.21E-11	6.03E-12	2.72E-18	6.4E-19	1.98E-13	5.23E-13	9.67E-85	4.73E-89	2.4E-258	5.4E-268	0	0	0	0						
0.46662195	0.893931004	1.089585136																											



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Annex 02

Arrival Porch																						
Poisson Distribution		Random Arrival, Random Service and one service chanel																				
Peak Hour morning 5.00 - 6.00 hour.																						
Maximum flow rate																						
Slots	Dwelling time	Arrival Rate	Service Rate	$\gamma$	service chaneels	P <sub>0</sub>	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16
Nos	mins	veh/hr	Veh / hr				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
14	2.48	292	338.71	0.86209524	1	0.1379048	0.118887	0.102492	0.088358	0.076173	0.065668	0.056612	0.048805	0.042075	0.036272	0.03127	0.026958	0.02324	0.020035	0.017272	0.01489	0.012837
						0.1379048	0.256792	0.359284	0.447642	0.523814	0.589483	0.646095	0.6949	0.736975	0.773247	0.804518	0.831476	0.854716	0.874751	0.892024	0.906914	0.919751
Expected Average Queue Length				E(m)	6.251																	
Expected average total time				E(v)	0.021																	
Expected average waiting time				E(W)	0.018	66.41																
																						
When there are two service channels																						
Slots	Dwelling time	Arrival Rate	Service Rate	$\gamma$	service chaneels	P <sub>0</sub>	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16
Nos	mins	veh/hr	Veh / hr				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
18	3.59	292	300.8356546	0.97062963	2	0.97063	0.242448	2.213078														
Expected average queue length				E(m)	0.41320348	1.059603359	0.39															
Expected average number in the system				E(n)	1.36																	
Expected average total time				E(v)	0.00466																	
Expected average waiting time				E(w)	0.00133548	4.81																
P <sub>0</sub>	P1	P2	P3	P4	P5	P6																
	1	2	3	4	5	6																
0.45185941	0.438588136	0.21285332	0.413203478	0.80213508	1.557152147	3.022836																
0.45185941	0.89044755	1.103300869																				

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Annex 03

Level of service calculation																								
Airport Roadway																								
Time	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Vehicle IN Volume (V)	107	99	93	98	128	140	90	108	89	116	109	103	86	78	162	98	126	101	107	108	130	296	246	162
With safety factor (1.3)	107	99	93	98	128	140	90	108	89	116	109	103	86	78	162	98	126	101	107	108	130	296	246	162
<b>Departure Curb</b>																								
Total lanes (4)/ Approach Lanes (2)																								
Roadway capacity ©	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264
Roadway (V/C)	0.047	0.044	0.041	0.043	0.057	0.062	0.04	0.048	0.039	0.051	0.048	0.045	0.038	0.034	0.072	0.043	0.056	0.045	0.047	0.048	0.057	0.131	0.109	0.072
Dwell time (min)	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97	2.97
Vehicle stall length (ft)	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Ra	5.297	4.901	4.604	4.851	6.336	6.93	4.455	5.346	4.406	5.742	5.396	5.099	4.257	3.861	8.019	4.851	6.237	5	5.297	5.346	6.435	14.65	12.18	8.019
Required Design stalls																								
3 for Less 5 or 1.2 for 100 or more Ra	6.621	6.126	5.754	6.064	7.92	8.663	5.569	6.683	5.507	7.178	6.744	6.373	5.321	4.826	10.02	6.064	7.796	6.249	6.621	6.683	8.044	18.32	15.22	10.02
Design Length - A	165.5	153.1	143.9	151.6	198	216.6	139.2	167.1	137.7	179.4	168.6	159.3	133	120.7	250.6	151.6	194.9	156.2	165.5	167.1	201.1	457.9	380.5	250.6
Existing curb length (18 x 33 ft) - B	462	462	462	462	462	462	462	462	462	462	462	462	462	462	462	462	462	462	462	462	462	462	462	462
Curbside utilization factor (A/B)	0.358	0.331	0.311	0.328	0.429	0.469	0.301	0.362	0.298	0.388	0.365	0.345	0.288	0.261	0.542	0.328	0.422	0.338	0.358	0.362	0.435	0.991	0.824	0.542
For Existing Curbsides 1.7 is acceptable																								
Level of service As per Utilization Factor																								
(4 Lane double parking is allowed) -J	A	A	A	A	A	A	A	A	A	A	A	A	A	A	B	A	A	A	A	A	A	C	B	A

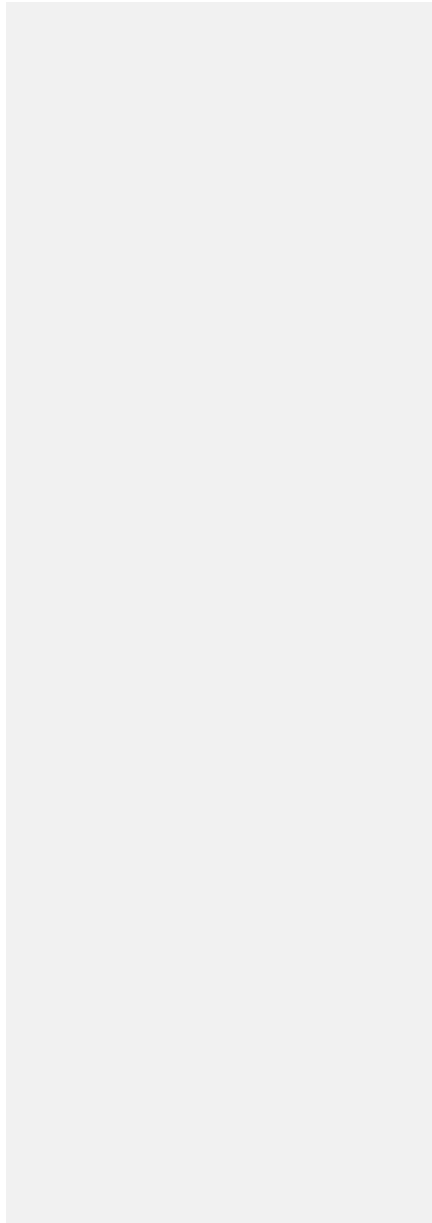
Annex 04

Time	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Vehicle IN Volume (V)	115	123	128	136	272	329	316	161	146	162	171	151	136	118	146	164	172	183	136	143	60	92	62	80
With safety factor (1.3)	115	123	128	136	272	329	316	161	146	162	171	151	136	118	146	164	172	183	136	143	60	92	62	80
<b>Arrival Curb</b>																								
Total lanes (4)/ Approach Lanes (2)																								
Roadway capacity ©	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264	2264
Roadway (W/C)	0.051	0.054	0.057	0.06	0.12	0.145	0.14	0.071	0.064	0.072	0.076	0.067	0.06	0.052	0.064	0.072	0.076	0.081	0.06	0.063	0.027	0.041	0.027	0.035
Dwell time (min)	3.59	3.59	3.59	3.59	3.59	3.59	3.59	3.59	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	2.25	3.59	3.59	3.59	3.59	3.59	3.59
Vehicle stall length (ft)	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Ra	6.881	7.36	7.659	8.137	16.27	19.69	18.91	9.633	5.475	6.075	6.413	5.663	5.1	4.425	5.475	6.15	6.45	6.863	8.137	8.556	3.59	5.505	3.71	4.787
Required Design stalls																								
3 for Less 5 or 1.2 for 100 or more Ra	8.601	9.199	9.573	10.17	20.34	24.61	23.63	12.04	6.844	7.594	8.016	7.078	6.375	5.531	6.844	7.688	8.063	8.578	10.17	10.7	4.488	6.881	4.637	5.983
Design Length - A	215	230	239.3	254.3	508.6	615.2	590.9	301	171.1	189.8	200.4	177	159.4	138.3	171.1	192.2	201.6	214.5	254.3	267.4	112.2	172	115.9	149.6
Existing curb length (18 x 33 ft) - B	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495	495
Curbside utilization factor (A/B)	0.434	0.465	0.484	0.514	1.027	1.243	1.194	0.608	0.346	0.384	0.405	0.357	0.322	0.279	0.346	0.388	0.407	0.433	0.514	0.54	0.227	0.348	0.234	0.302
For Existing Curbsides 1.7 is acceptable																								
(5 Lane double parking is allowed) -J	A	A	A	A	B	C	B	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A

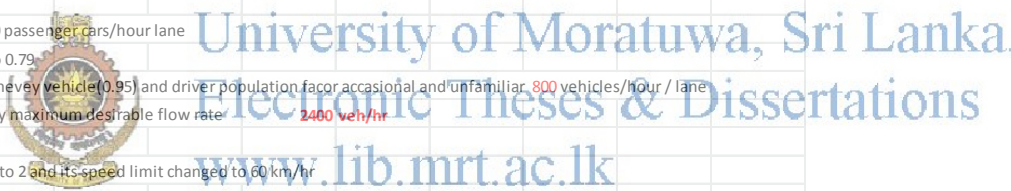
Level of service with respect to Vehicle queue									
Here BIA -Arrival curb									
Expected average waiting time in the queue is almost 2 minutes and no vehicle probability is around 8%									
As per ACRP page 55/ Table 5-4									
Upper threshold is selected as 300 seconds where vehicle moving is acceptable and not moving unacceptable									
Lower threshold is $(300/10) = 30$ sec									
From graph 5-5, the maximum tolerable limit, average queue 121 sec, the departure curb level of service is C									
Where the arrival porch level of service is B because its average queuing time is 74 sec.									



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<b>Level of service for airport terminal access</b>									
<b>Assumptions</b>									
Heavy trucks and busses represent less than 5%									
Courtesy vehicles and mini buses represent about 10% of the traffic volume on access roadways									
High proportion of drivers who are infrequent users of and are therefore unfamiliar with the airport roadways									
Roadway operate one direction only									
The posted speed limit is 40 km/h									
Target level of service <b>D</b> ( as lack of such a standard or policy)      LOS D is acceptable for existing roadways during peak hour									
<i>ACRP Page 32 Table 4.1 Level of service for airport terminal area access and circulation roadways</i>									
Refer Table									
Free flow speed 25 miles per hour									
Column D									
Maximum service flow rate 990 passenger cars/hour lane									
The given maximum (V/C) ratio 0.75									
With flow rate adjustments of heavy vehicle (0.95) and driver population factor occasional and unfamiliar, 800 vehicles/hour / lane									
Considering three lane roadway maximum desirable flow rate <b>2400 veh/hr</b>									
Roadways no of lanes changed to 2 and its speed limit changed to 60 km/hr									
(2) where speed limit 37.5 miles/hr									
Speed limit automatically reduce due to no pedestrian facilities									
Therefore free flow speed is consider as 35 miles/hr									
Minimum speed 34 miles/hr									
The given maximum (V/C) ratio 0.8									
Maximum flow                      1130 veh/hr/lane									
Due to two lanes total flow rate <b>2260 veh/hr</b> 0.253571									
therefore maximum flow rate is considered as 2260 veh/hr									
The BIA s maximum veh flow rate what we measured is 591 veh/hr                      709.2 <i>20% safety factor</i>									
The given maximum (V/C) ratio 0.8									
Calculate (V/C) <b>0.344</b>									



Level of service Airport roadway weaving section		Flow rate adjustment																												
Macroscopic method		Heavy vehicle adjustment factor	$F_{HV}$	0.976	Trucks / Buses	Recreational vehicles																								
	Data	Drive familiarity	unfamiliar drivers	0.85	Equivalence	1.5																								
			Regular commuters	1	Percentage	0.05																								
Peak hour volume	$V_i$ 990 veh/hr	Calculated	$f_p$	0.992																										
free flow speed	20 miles/hr	Peak Hour factor		0.85 Assume																										
		Equivalent passenger car units	$V_i$	1203.45 pc/hr	A	Arrival Porch through departure porch																								
					B	Departure Porch to main line																								
Weaving section configuration					C	Main Line to Arrival Porch																								
	One sided ramp weaving				D	Main Line																								
					E	Reverse Direction																								
	$LC_{RF}$ 1																													
	$LC_{FR}$ 1																													
	$N_{WL}$ 3	No of lanes from that weaving attempt can be done either one or zero lane changes																												
	$LC_{min}$	=	$LC_{RF} \times V_{RF} + LC_{FR} \times V_{FR}$	662.81	lane change per hr																									
	$VR$ 0.55																													
					<table border="1"> <thead> <tr> <th></th> <th>A</th> <th>B</th> <th>C</th> <th>D</th> <th></th> </tr> </thead> <tbody> <tr> <td></td> <td>80.0</td> <td>104.3</td> <td>112.7</td> <td>113.7</td> <td>veh/h</td> </tr> <tr> <td></td> <td>16</td> <td>26</td> <td>29</td> <td>29</td> <td>%</td> </tr> <tr> <td></td> <td>193</td> <td>319</td> <td>344</td> <td>347</td> <td>pcu / hr Demand flow rate for busiest hour</td> </tr> </tbody> </table>			A	B	C	D			80.0	104.3	112.7	113.7	veh/h		16	26	29	29	%		193	319	344	347	pcu / hr Demand flow rate for busiest hour
	A	B	C	D																										
	80.0	104.3	112.7	113.7	veh/h																									
	16	26	29	29	%																									
	193	319	344	347	pcu / hr Demand flow rate for busiest hour																									
Maximum weaving length																														
	$L_{max}$	=	$[5728(1+VR)^{1.6}] - [1566N_{WL}]$																											
		=	6859.795																											
		Beyond $L_{max}$ weaving methodology is not appropriate																												
Waving segment capacity																														
(1) By density																														
	$N$	No of lanes within the weaving segment		3																										
	$C_{IFL}$	capacity of basic freeway segment with same free flow speed as the under equivalent ideal condition per lane (pc/hr lane)		900																										
	$L_s$	Waving segment length		300.1	ft																									
	$C_{IWL}$	Capacity of weaving section under equivalent ideal conditions (pc/hr/ln)																												
	$C_{IWL}$	=	$C_{IFL} - (438.2(1+VR)^{1.6}) + (0.0765 \times L_s) + (119.8 N_{WL})$	398.2																										
Waving segment Density by density																														
	$C_w$	=	$C_{IWL} \times N \times f_{HV} \times f_p$	1156																										
(2) By waving demand flow																														
	$C_w$	=	$C_{IW} \times f_{HV} \times f_p$	4223																										
				2945																										
	$N_{WL}=3$ ,	$C_{IW}$	=	4363.64																										
						$(V \times f_{HV} \times f_p) / C_w$ 0.330949																								



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Lane change rate				
Total wave changing rate for weaving vehicles				
$LC_w$	=	$LC_{min} + 0.39[(L_s - 300)^{0.5} \times N^2 \times (1+ID)^{0.8}]$		
		674.317374		
			1 mile= 5280 foot	
		Interchange Density =	17.59413529	Interchange spacing per mile
Total wave changing rate for non-weaving vehicles				
$LC_{NW1}$	=	$(0.206 V_{NW}) + (0.542 \times L_s) - (192.6 \times N)$	-303.8	
$LC_{NW2}$	=	$2135 + 0.233(V_{NW} - 2000)$	1795.0	
$V_{NW}$	=	Nonwaving demand flow rate in the weaving segment pc/hr	540.6	$I_{NW} < 1300$ $LC_w = LC_{NW1}$ $LC_w = -303.8$
$LC_{NW3}$	=	$LC_{NW1} - (LC_{NW2} + LC_{NW1} \times ((I_{NW} - 1300)/650))$	-3579.6	
$I_{NW}$	=	$(L_s \times ID \times V_{NW})/10000$	285.5	
Total Lane changing rate				
$LC_{All}$	=	$LC_w + LC_{NW}$	370.5	
Average speed of weaving vehicles in weaving segment				
$S_w$	=	$S_{min} + [(S_{max} - S_{min})/(1+W)]$	$S_{min}$ 10 miles/hr (recommended low speed airport roadways)	
			$S_{max}$ 25 miles/hr (Posted speed limit)	
$W$	=	$0.226 \times [LC_{All}/L_s]^{0.789}$		
$W$	=	0.267	0.267	
$S_w$	=	21.84	21.8	Average speed weaving vehicles in 34.9438
Average speed of nonweaving vehicles in weaving segment				
$S_{NW}$	=	$FFS - (0.0072LC_{min}) - (0.0048 v/N)$	13.3	21.2835
Average vehicle speed in weaving segment				
$S$	=	$(V_w + V_{NW}) / ((V_w/S_w) + (V_{NW}/S_{NW}))$	$V_w$ 663	27.1233
		17.0		
Density in segment				
$D$	=	$[v/N]/S$	23.66	LOS B



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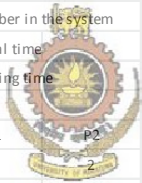
ACRP Table 4.3

BIA Passenger Movement Forecast						
Year		Annual	Annual	Annual	Daily mov	Daily mov
		Total	Arrival	Departure	Arrival	Departure
2010	p0	5266769				
2011	p1	6144432				
2012	p2	7080320	3540160	3540160	9699	9699
2013	p3	8053298	4026649	4026649	11032	11032
2014	p4	9038524	4519262	4519262	12382	12382
2015	p5	10009879	5004940	5004940	13712	13712
2016	p6	10942686	5471343	5471343	14990	14990
2017	p7	11816110	5908055	5908055	16186	16186
2018	p8	12614782	6307391	6307391	17281	17281
2019	p9	13329432	6664716	6664716	18259	18259
2020	p10	13956594	6978297	6978297	19119	19119
2021	p11	14497665	7248833	7248833	19860	19860

	2013			2014			2015			2016			2017		
	Access road	Arr Curb	Depar Curb	Access road	Arr Curb	Depar Curb	Access road	Arr Curb	Depar Curb	Access road	Arr Curb	Depar Curb	Access road	Arr Curb	Depar Curb
Daily passengers (P)	22000	11000	11000	24764	12382	12382	27424	13712	13712	29980	14990	14990	32373	16186	16186
Daily vehivles(A)	7100	3702	2980	7988	4169	3356	8846	4617	3716	9671	5047	4062	10443	5450	4386
Peak hour vehicle (B)	591	329	296	625	327	327	633	327	327	757	609	609	1566	817	658
(B)/(A)	0.083	0.089	0.099	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Air passengers per vehicle (P)/(A)	3.10	2.17	1.45	3.1	2.97	3.69	3.1	2.97	3.69	3.1	2.97	3.69	3.1	2.97	3.69
	0.040	0.040	0.039	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037
	3.10	2.97	3.69												

2018			2019			2020		
Access road	Arr Curb	Depar Curb	Access road	Arr Curb	Depar Curb	Access road	Arr Curb	Depar Curb
34561	17281	17281	36519	18259	18259	38238	19119	19119
11149	5819	4683	11780	6148	4948	12335	6437	5181
1672	873	702	1767	922	742	1850	966	777
0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
3.1	2.97	3.69	3.1	2.97	3.69	3.1	2.97	3.69
0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037	0.037

Departure Porch							
Poisson Distribution		Random Arrival, Random Service and two service chanel					
Slots	Dwelling time	Arrival Rate	Service Rate	$\gamma$	service chaneels		
Nos	mins	veh/hr	Veh / hr				
28	2.97	777	565.656566	1.373625	2	1	1.373625
Expected aaverage queue length			E(m)	0.97104826	0.39234564	2.47	
Expceted aaverage number in the system			E(n)	3.25			
Expected aaverage total time			E(v)	0.00495			
Expected aaverage waiting time			E(w)	0.0031853	1.47 sec		
P <sub>0</sub>	P1	P2	P3	P4	P5	P6	P7
	1	2	3	4	5	6	7
0.37465907	0.51464107	0.35346192	0.97104826	2.66771233	7.32887271	20.1342456	0.00693808
							29.0854915



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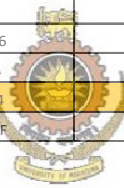
Arrival Porch							
Poisson Distribution		Random Arrival, Random Service and two service chanel					
Slots	Dwelling time	Arrival Rate	Service Rate	$\rho$	service chaneels		
Nos	mins	veh/hr	Veh / hr				
36	3.59	966	601.671309	1.60552778	2	1	1.60552778
Expected aaverage queue length			E(m)	1.44719585	0.15560833	9.30	
Expceted aaverage number in the system			E(n)	10.91			
Expected aaverage total time			E(v)	34.66			
Expected aaverage waiting time			E(w)	0.00962758	34.66 sec		
$P_0$	$P_1$	$P_2$	$P_3$	$P_4$			
0.34968245	0.56142489	0.45069163	1.44719585	4.64702627			



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Airport Roadway	Peak hour	<i>if double parking allowed</i>
Time	Peak hour	Peak hour
Vehicle IN Volume (V)	115	123
With safety factor (1.3)	966	966
Arrival Curb		
Total lanes (4)/ Approach Lanes (2)		
Roadway capacity ©	2264	2264
Roadway (V/C)	0.43	0.43
Dwell time (min)	3.59	3.59
Vehicle stall length (ft)	25	25
Ra	58	58
Required Design stalls		
3 for Less 5 or 1.2 for 100 or more Ra	72	72
Design Length - A	1806	1806
Existing curb length (18 x 33 ft) - B	594	1188
Curbside utilization factor (A/B)	3.04	1.52
For Existing Curbsides 1.7 is acceptable	LOS F	LOS D

Airport Roadway	Peak hour	<i>if double parking allowed</i>
Time	Peak hour	Peak hour
Vehicle IN Volume (V)	390	99
With safety factor (1.3)	777	777
Departure Curb		
Total lanes (4)/ Approach Lanes (2)		
Roadway capacity ©	2264	2264
Roadway (V/C)	0.34	0.3
Dwell time (min)	2.97	2.97
Vehicle stall length (ft)	25	25
Ra	38.46	38.46
Required Design stalls		
3 for Less 5 or 1.2 for 100 or more Ra	48.1	48.1
Design Length - A	1202	1202
Existing curb length (18 x 33 ft) - B	462	924
Curbside utilization factor (A/B)	2.60	1.30
For Existing Curbsides 1.7 is acceptable	LOS F	LOS C



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**Table 4-1. Levels of service for airport terminal area access and circulation roadways.**

Criteria	Level of service				
	A	B	C	D	E
	<b>Free-flow speed = 50 mph</b>				
Minimum speed (mph)	50.0	50.0	50.0	48.9	47.5
Maximum volume/capacity ratio	0.28	0.45	0.65	0.86	1.00
Maximum service flow rate (passenger cars/hour/lane)	550	900	1,300	1,710	2,000
Maximum flow (vehicles/hour/lane) (a)	440	730	1,050	1,380	1,620
	<b>Free-flow speed = 45 mph</b>				
Minimum speed (mph)	45.0	45.0	45.0	44.4	42.2
Maximum volume/capacity ratio	0.26	0.43	0.62	0.82	1.00
Maximum service flow rate (passenger cars/hour/lane)	490	810	1,170	1,550	1,900
Maximum flow (vehicles/hour/lane) (a)	400	650	940	1,250	1,530
	<b>Free-flow speed = 40 mph</b>				
Minimum speed (mph)	40.0	40.0	40.0	39.0	38.0
Maximum volume/capacity ratio	0.26	0.42	0.61	0.82	1.00
Maximum service flow rate (passenger cars/hour/lane)	450	740	1,060	1,400	1,750
Maximum flow (vehicles/hour/lane) (a)	360	600	860	1,130	1,410
	<b>Free-flow speed = 35 mph</b>				
Minimum speed (mph)	35.0	35.0	34.0	34.0	33.0
Maximum volume/capacity ratio	0.26	0.42	0.61	0.80	1.00
Maximum service flow rate (passenger cars/hour/lane)	410	670	980	1,280	1,600
Maximum flow (vehicles/hour/lane) (a)	330	540	790	1,030	1,290
	<b>Free-flow speed = 30 mph</b>				
Minimum speed (mph)	30.0	30.0	30.0	29.6	29.0
Maximum volume/capacity ratio	0.26	0.41	0.60	0.79	1.00
Maximum service flow rate (passenger cars/hour/lane)	370	600	870	1,150	1,450
Maximum flow (vehicles/hour/lane) (a)	300	480	700	930	1,170
	<b>Free-flow speed = 25 mph</b>				
Minimum speed (mph)	25.0	25.0	25.0	24.8	24.0
Maximum volume/capacity ratio	0.25	0.40	0.59	0.79	1.00
Maximum service flow rate (passenger cars/hour/lane)	310	500	740	990	1,250
Maximum flow (vehicles/hour/lane) (a)	250	400	600	800	1,010

mph = miles per hour

(a) Flow rates adjusted to account for 0.95 heavy vehicle factor and 0.85 driver population factor due to occasional or unfamiliar users.

**Table 4-3. Level-of-service criteria for weaving segments.**

Level of service	Freeway weaving segments (pc/mi/ln)	Collector-distributor roadways (pc/mi/ln)	Airport low-speed roadways (pc/mi/ln)
A	10	12	20
B	20	24	30
C	28	32	40
D	35	36	50
E	>35	>36	60
F	$v/c > 1.0$	$v/c > 1.0$	$v/c > 1.0$

Notes:  $nc/mi/ln$  = passenger cars per mile per lane.

**Table 5-4. Time spent in queue for levels of service.\***

Level of service	Small-hub and smaller medium-hub airports ( <i>a</i> )			Large medium-hub and large-hub airports ( <i>a</i> )		
	Given maximum acceptable time spent in queue in seconds ( <i>a</i> )					
	60	120	300	600	900	1,200
Maximum for LOS E	60	120	300	600	900	1,200
Maximum for LOS D	47	93	233	465	698	930
Maximum for LOS C	33	66	165	330	495	660
Maximum for LOS B	29	39	98	195	293	390
Maximum for LOS A	12	12	30	60	90	120



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**Table 5-2. Level of service criteria for airport curbside roadways.**

Criteria	Airport curbside levels of service					
	A	B	C	D	E	F
<b>When double (and triple) parking is allowed at the curbside</b>						
Maximum demand for curbside standing or parking/effective curbside length (a)	0.90	1.10	1.30	1.70	2.00	>2.00
<b>Maximum service flow rate</b>						
5-lane curbside roadway (vph)	3,400	3,280	3,100	2,710	2,400	Up to 2,400
4-lane curbside roadway (vph)	2,830	2,790	2,680	2,220	1,800	Up to 1,800
3-lane curbside roadway (vph)	2,200	1,950	1,580	860	750	Up to 750
<b>When double parking is prohibited at the curbside</b>						
Maximum demand for curbside standing or parking/effective curbside length (a)	0.70	0.85	1.00	1.20	1.35	>1.35
<b>Maximum service flow rate</b>						
4-lane curbside roadway (vph)	2,830	2,830	2,800	2,730	2,600	Up to 2,600
3-lane curbside roadway (vph)	2,350	2,250	2,000	1,760	1,600	Up to 1,600
Maximum through lane volume/capacity ratio	0.25	0.40	0.60	0.80	1.00	1.00

vph = vehicles per hour

(a) The ratio between the calculated curbside demand and the available effective curbside length.



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