7.0 Chapter 7 MOEs and Reports

CORSIM models produce a lot of information. Depending on the size of the network, the amount of information can be overwhelming. Organizing the MOEs output from the different model scenarios in a project requires thoughtful consideration. The modeler must be able to convey the results from the entire model, as well as be able to highlight problem areas that require extra attention.

Developing both tabular and graphical displays of the model results should be done. More information can be contained in a table than on a graphic, but the graphic is necessary to understand what was modeled. Using both of these methods of conveying information creates a better understanding of the modeling work.

7.1 Tabular Summaries

In Chapter 4, a MOE model report was developed to summarize detailed information from the model. This report is useful for the modeling process, but is cumbersome when conveying results from multiple alternatives and scenarios. This information should be extracted into easier to understand tables. Areas where multiple links were used between ramps can be consolidated into an aggregate segment statistic; this can be calculated by a weighted average based on the length of the link.

The key MOEs required for freeway analysis summaries include volume, speed, density, and LOS. When performing alternatives, analysis throughput should also be compared. The key MOEs required for arterial analysis summaries include intersection and approach delay and LOS, queue length, and storage length.

7.1.1 Tables Summarizing Model Results

There are a number of table formats that can be assembled for a project. The first sets of tables are MOEs of the entire model run. These types of reports are necessary to review volume differences and the performance of the model. These tables are necessary to review the model. These tables provide the information used to create graphical summaries and comparative tables.

TABLE AM-1
2002 AM Peak Period
Freeway Measures of Effectivness
I-494 from TH 5 to TH 55, Minnetonka MN

Select Hour Interval: 7:00 AM-8:00 AM

	Location		Node		Length	Volumes			Link Statistics			Aggregate Statistics			Total Thruput		
	From	To	From	To	(ft)	Actual	Simu-lated	Differ-ence	Speed (mph)	Density (vplpm)	LOS	Speed (mph)	Density (vplpm)	LOS	Actual	Simu-lated	Differ-ence
NB 494 Mainline	NB	Begin 494 NB	110	111	1,490	1,941	1,942	1	68	14	B				5,349	5,347	-2
	NB		111	112	398	1,941	1,941	0	68	14	B	68	14	B	5,349	5,347	-2
	NB	Valley View Entrance Ramp	112	113	1,493	2,509	2,493	-16	63	15	B				6,554	6,536	-18
	NB		113	114	798	2,509	2,491	-18	67	18	B				6,554	6,535	-19
	NB		114	115	1,101	2,509	2,489	-20	67	18	B	65	17	B	6,554	6,533	-21
	NB		115	116	1,000	2,509	2,486	-23	66	18	B				6,554	6,534	-20
	NB	TH 62 Exit Ramp	116	117	1,560	2,509	2,486	-23	66	16	B				6,554	6,529	-25
	NB	TH 62 Bridge	117	118	1,147	2,151	2,125	-26	67	15	B				5,696	5,662	-34
	NB		118	119	985	2,151	2,123	-28	66	16	B	67	15	B	5,696	5,659	-37
	NB	TH 62 Entrance Ramp	119	120	1,505	2,960	2,889	-71	57	22	C				7,683	7,585	-98
	NB		120	121	2,142	2,960	2,883	-77	66	21	C				7,683	7,580	-103
	NB		121	122	1,066	2,960	2,881	-79	66	21	C				7,683	7,575	-108
	NB		122	123	926	2,960	2,880	-80	66	21	C	64	21	C	7,683	7,571	-112
	NB		123	124	1,077	2,960	2,880	-80	65	21	C				7,683	7,569	-114
	NB		124	125	1,213	2,960	2,880	-80	65	21	C				7,683	7,569	-114
	NB		125	126	685	2,960	2,878	-82	65	21	C				7,683	7,565	-118
	NB	TH 7 Exit Ramp	126	127	1,529	2,960	2,882	-78	65	19	B				7,683	7,560	-123
	NB	Before TH 7 Weave	127	128	1,093	2,892	2,816	-76	62	21	C	62	21	C	7,519	7,397	-122
	NB	TH 7 Weave	128	129	374	3,826	3,748	-78	34	36	E	34	36	E	10,060	9,956	-104
	NB	After TH 7 Weave	129	130	1,276	3,571	3,488	-83	51	33	D	51	33	D	9,329	9,233	-96
	NB	TH 7 Entrance Ramp	130	131	1,517	3,753	3,673	-80	58	29	D				9,776	9,677	-99
	NB		131	132	1,733	3,753	3,670	-83	64	28	C	62	26	C	9,776	9,670	-106
	NB	Minnetonka Exit Loop	132	133	1,476	3,753	3,667	-86	64	22	C				9,776	9,662	-114
	NB	Minnetonka Bridge	133	134	500	3,487	3,408	-79	62	27	C				9,177	9,071	-106
	NB		134	135	461	3,487	3,407	-80	58	28	D	60	27	C	9,177	9,069	-108
	NB	Minnetonka Entrance Ramp	135	136	1,538	3,914	3,816	-98	55	30	D				10,242	10,091	-151
	NB		136	137	950	3,914	3,815	-99	63	29	D				10,242	10,088	-154
	NB		137	138	1,639	3,914	3,808	-106	63	29	D	61	29	D	10,242	10,086	-156
	NB		138	139	1,550	3,914	3,802	-112	64	28	D				10,242	10,081	-161
	NB		139	140	1,400	3,914	3,800	-114	62	30	D				10,242	10,077	-165
	NB	394 Exit Ramp	140	141	1,530	3,914	3,801	-113	61	27	C				10,242	10,072	-170
	NB	Before 394 Weave	141	142	1,104	3,173	3,068	-105	65	21	C	65	21	C	7,926	7,813	-113
	NB	394 Weave	142	143	468	3,485	3,383	-102	60	13	B	60	13	B	8,710	8,587	-123
	NB	After 394 Weave	143	144	1,105	3,044	2,941	-103	64	18	B	64	18	B	7,505	7,406	-99
	NB	394 Entrance Ramp	144	145	973	4,106	3,973	-133	60	20	C				10,232	10,117	-115
	NB	Carlson Exit Ramp	145	146	943	4,106	3,970	-136	63	20	B	62	20	B	10,232	10,114	-118
	NB	Carlson Bridge	146	147	1,158	3,466	3,351	-115	65	24	C				8,758	8,667	-91
	NB		147	148	1,377	3,466	3,345	-121	65	24	C	65	24	C	8,758	8,662	-96
	NB	Carlson Entrance Ramp	148	149	1,536	3,668	3,549	-119	65	17	B				9,290	9,189	-101
NB 494 Ramps	NB	Valley View Entrance Ramp	213	212	747	568	555	-13	43	5					1,205	1,195	-10
	NB	Valley View Entrance Ramp	212	112	242	568	555	-13	24	10					1,205	1,195	-10
	NB	TH 62 Exit Ramp	117	217	176	358	362	4	44	7					858	867	9
	NB	TH 62 Entrance Ramp	220	219	379	809	775	-34	7	55					1,987	1,932	-55
	NB	TH 62 Entrance Ramp	219	119	453	809	773	-36	33	12					1,987	1,931	-56
	NB	TH 7 Exit Ramp	127	227	455	68	63	-5	44	1					164	161	-3
	NB	TH 7 Entrance Loop	252	251	99	934	936	2	24	19					2,541	2,562	21
	NB	TH 7 Entrance Loop	251	250	140	934	936	2	10	45					2,541	2,560	19
	NB	TH 7 Entrance Loop	250	228	111	934	935	1	23	20					2,541	2,560	19
	NB	TH 7 Entrance Loop	228	128	226	934	935	1	27	21					2,541	2,561	20
	NB	TH 7 Exit Loop	129	229	238	255	255	0	30	8					731	722	-9
	NB	TH 7 Entrance Ramp	231	232	750	182	191	9	42	2					447	453	6
	NB	TH 7 Entrance Ramp	232	230	283	182	187	5	5	20					447	451	4
	NB	TH 7 Entrance Ramp	230	130	415	182	187	5	30	3					447	451	4
	NB	Minnetonka Exit Loop	133	233	172	266	256	-10	34	6					599	588	-11
	NB	Minnetonka Entrance Ramp	236	235	590	427	416	-11	42	4					1,065	1,026	-39
	NB	Minnetonka Entrance Ramp	235	135	313	427	414	-13	38	6					1,065	1,026	-39
	NB	394 Exit Ramp	141	241	672	741	731	-10	53	14					2,316	2,256	-60
	NB	394 Entrance Loop	1617	242	175	312	317	5	29	5					784	775	-9
	NB	394 Entrance Loop	242	142	173	312	317	5	29	9					784	775	-9
	NB	394 Exit Loop	143	243	250	441	439	-2	31	12					1,205	1,176	-29
	NB	394 Entrance Ramp	244	144	423	1,062	1,034	-28	48	12					2,727	2,714	-13
	NB	Carlson Exit Ramp	146	246	282	640	618	-22	44	12					1,474	1,445	-29
	NB	Carlson Entrance Ramp	249	248	100	202	208	6	41	2					532	534	2
	NB	Carlson Entrance Ramp	248	148	506	202	210	8	40	3					532	534	2

Figure 38 – Sample FRESIM Moe Summary Report

TABLE ART-1a
2002 AM Peak Period
Arterial Measures of Effectivness
I-494 from TH 5 to TH 55, Minnetonka MN

Select Time Period: 7:00 AM-8:00 AM

Location	Aprch	Link	Demand volumes				Modeled Volumes				Demand Volumes			Model - Demand		Total Delay by Movement			Total Delay by Movement			Level of Service by			LOS by Approach		LOS by Intersection		Modeled Storage & Maximum Traffic Queueing (feet): Through		Left Turn		Right Turn	
			Lt	Th	Rt	total	L	T	R	total	L	T	R	Total	%	L	T	R	L	T	R	L	T	R	Delay	LOS	Delay	LOS	Link Length	Queue	Storage	Queue	Storage	Queue
Valley View East Ramp	WB	902-901	240	908	0	1148	232	898	0	1130	-8.4	-9.8	0	-18.2	-2%	62	58	0	16	4	-	B	A	-	6	A	8	A	596	108				
	EB	910-901	0	192	328	520	0	193	327	520	0	1.4	-1.2	0.2	0%	0	27	29	-	8	5	-	A	A	6	A			349	56				
Valley View West Ramp	WB	901-902	0	192	0	192	0	191	0	191	0	-1	0	-1	-1%	0	70	0	-	22	-	-	C	-	22	C			596	64				
	SB	912-902	424	0	165	589	413	0	164	577	-11	0	-0.8	-11.8	-2%	116	0	19	17	-	7	B	-	A	14	B	17	B	714	192				
	EB	913-902	0	724	0	724	0	720	0	720	0	-4	0	-4	-1%	0	131	0	-	11	-	-	B	-	11	B			739	108				
TH 62 East Ramp	WB	904-903	335	2490	0	2825	330	2436	0	2766	-5.4	-53.8	0	-59.2	-2%	351	510	0	64	13	-	E	B	-	19	B			455	420	350	336		
	SB	921-903	0	510	474	984	0	531	457	988	0	21	-17.4	3.6	0%	0	46	95	-	5	13	-	A	B	9	A	16	B	763	120				
	EB	923-903	179	0	179	358	179	0	174	353	-0.2	0	-4.8	-5	-1%	138	0	117	46	-	40	D	-	D	43	D			675	100	400	108	400	220
TH 62 West Ramp	WB	903-904	87	602	0	689	85.4	623	0	709	-1.6	21.2	0	19.6	3%	40	98	0	28	9	-	C	A	-	12	B			455	116	350	128		
	SB	922-904	0	1845	211	2056	0	1847	217	2064	0	1.8	6.4	8.2	0%	0	424	30	-	14	8	-	B	A	13	B	25	C	702	324				
	EB	924-904	980	0	161	1141	921	0	147	1068	-59	0	-13.8	-72.8	-6%	1111	0	25	72	-	10	E	-	B	64	E			442	464			400	72
Mtka East Ramp	WB	906-905	0	1050	0	1050	0	1046	0	1046	0	-4.4	0	-4.4	0%	0	157	0	-	9	-	-	A	-	9	A			857	128				
	SB	925-905	0	405	98	503	0	403	94.6	498	0	-2	-3.4	-5.4	-1%	0	125	9	-	19	6	-	B	A	16	B			514	228				
	EB	931-905	0	26	240	266	0	30.4	224	255	0	4.4	-15.8	-11.4	-4%	0	12	21	-	24	6	-	C	A	8	A			500	64				
Mtka West Ramp	WB	905-906	0	282	363	645	0	270	356	627	0	-11.8	-6.6	-18.4	-3%	0	61	63	-	13	11	-	B	B	12	B			857	136				
	SB	907-906	341	0	341	682	335	0	346	681	-5.6	0	4.6	-1	0%	161	0	60	29	-	10	C	-	B	19	B			738	212				
	EB	928-906	472	709	0	1181	468	714	0	1181	-4.4	4.8	0	0.4	0%	103	101	0	13	8	-	B	A	-	10	B			551	164				
Mtka at McGinty West Ramp	WB	906-907	0	638	197	835	0	631	182	813	0	-7.4	-14.6	-22	-3%	0	210	25	-	20	8	-	B	A	17	B			738	360				
	SB	932-907	0	238	25	263	0	241	23	264	0	3.2	-2	1.2	0%	0	55	3	-	14	7	-	B	A	13	B			331	148				
	EB	953-907	0	593	0	593	0	590	0	590	0	-3.2	0	-3.2	-1%	0	65	0	-	7	-	-	A	-	7	A			913	76				
Carlson Pkwy East Ramp	WB	909-908	123	649	0	772	127	632	0	759	4	-17.2	0	-13.2	-2%	61	94	0	29	9	-	C	A	-	12	B			814	104	300	68		
	SB	951-908	170	0	470	640	163	0	452	615	-7.4	0	-17.6	-25	-4%	45	0	91	17	-	12	B	-	B	13	B			779	52	400	56	400	224
	EB	961-908	0	421	79	500	0	418	80.8	499	0	-2.8	1.8	-1	0%	0	126	9	-	18	7	-	B	A	16	B			468	108				
Carlson Pkwy West Ramp	WB	908-909	89	502	0	591	85.2	490	0	576	-3.8	-11.6	0	-15.4	-3%	39	56	0	28	7	-	C	A	-	10	A			814	52	300	48		
	SB	950-909	395	0	503	898	383	0	496	878	-12	0	-7.4	-19.8	-2%	112	0	124	18	-	15	B	-	B	16	B			1063	164	400	128	400	248
	EB	960-909	0	377	174	551	0	377	170	548	0	0.4	-3.8	-3.4	-1%	0	113	18	-	18	6	-	B	A	14	B			469	88			300	40
TH 62 at Beach/ Clearwater	WB	903-921	376	2266	27	2669	376	2184	24.4	2585	-0.2	-81.6	-2.6	-84.4	-3%	265	1270	8	42	35	19	D	C	B	36	D			763	676			400	28
	SB	957-921	12	0	9	21	12.4	0	8.6	21	0.4	0	-0.4	0	0%	11	0	2	51	-	17	D	-	B	38	D			202	20	145	20	90	20
	EB	958-921	23	3	42	68	22.2	1.8	43	67	-0.8	-1.2	1	-1	-1%	16	1	9	43	37	13	D	D	B	23	C			414	24	300	44	250	44
	NB	959-921	20	930	320	1270	23.8	938	312	1274	3.8	7.6	-7.6	3.8	0%	21	421	40	52	27	8	D	C	A	23	C			499	268				
TH 62 at Baker	WB	904-922	139	416	208	763	141	411	212	764	1.6	-4.6	3.6	0.6	0%	109	83	29	47	12	8	D	B	A	17	B			702	0	300			
	SB	967-922	42	163	490	695	44	158	488	690	2	-5	-2	-5	-1%	33	118	203	45	45	25	D	D	C	31	C			898	0			250	
	EB	968-922	70	1449	77	1596	70	1459	76.6	1606	0	10.2	-0.4	9.8	1%	75	755	33	64	31	26	E	C	C	32	C			1335	0	250		65	
	NB	969-922	117	107	52	276	113	102	54	269	-4	-4.6	2	-6.6	-2%	88	70	6	47	41	7	D	D	A	36	D			1200	0			250	

Figure 39 – Sample NETSIM MOE Report Table

7.1.2 Comparative Summary Tables

Comparative summary tables are necessary to filter the information from the model run reports to the essential information necessary for making a decision. Below are sample tables comparing the results for existing (2005) conditions and two alternatives each for opening year (2015) and future year (2025).

STH 35 Southbound Freeway Operations Summary

	Design Year									
	2005		2015 (a)		2015 (b)		2025 (a)		2025 (b)	
Analysis Segment	Speed	Density/ LOS	Speed	Density/ LOS	Speed	Density/ LOS	Speed	Density/ LOS	Speed	Density/ LOS
I-94 Eastbound Ramp	64(63)	N/A(1)	64(62)*	N/A(1)	64(63)	8/A (23/C)	64(63)	9/A (27/D)	(63)	(27 /D)
From I-94 merge to High Ridge Exit	64 (62)	5/A (13/B)	63 (61)*	7/A (15 /B)	64 (62)	6/A (16 /B)	64 (59)	7/A (20 /C)	(61)	(19 /B)
From High Ridge Exit to High Ridge Entrance	64 (64)	4/A (10 /B)	64 (64)*	5/A (9 /A)	65 (64)	5/A (11 /B)	65 (63)	6/A (13 /B)	(64)	(13 /B)
High Ridge Entrance	64 (63)	7/A (11 /B)	63 (63)*	8/A (11 /A)	63 (63)	9/A (13 /B)	62 (62)	11/B (15 /B)	(62)	(15 /B)

*600 vehicle per hour shortfall, results under-estimated

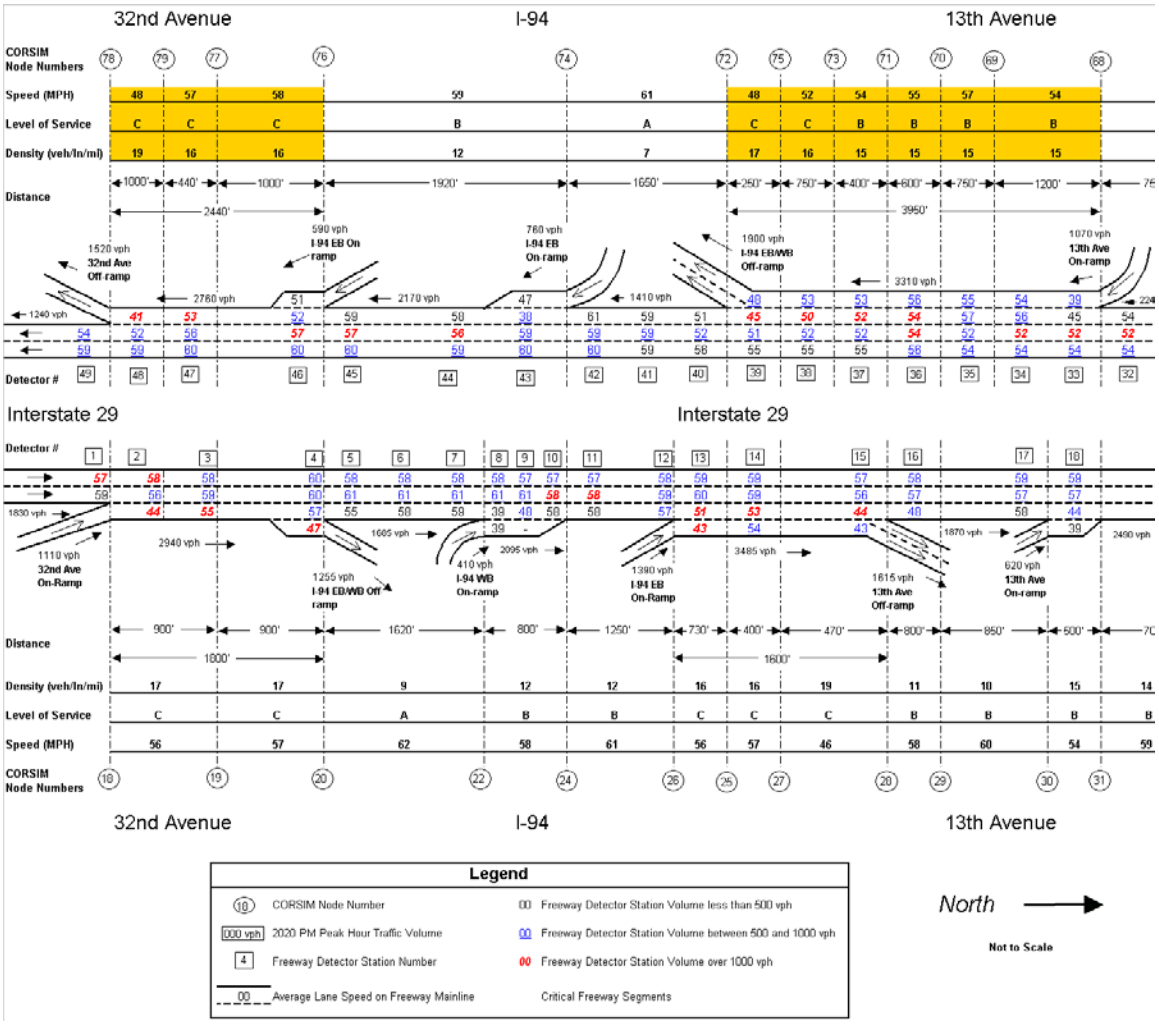
Northbound I-35W PM Peak Period Operational Comparisons
Interim Condition

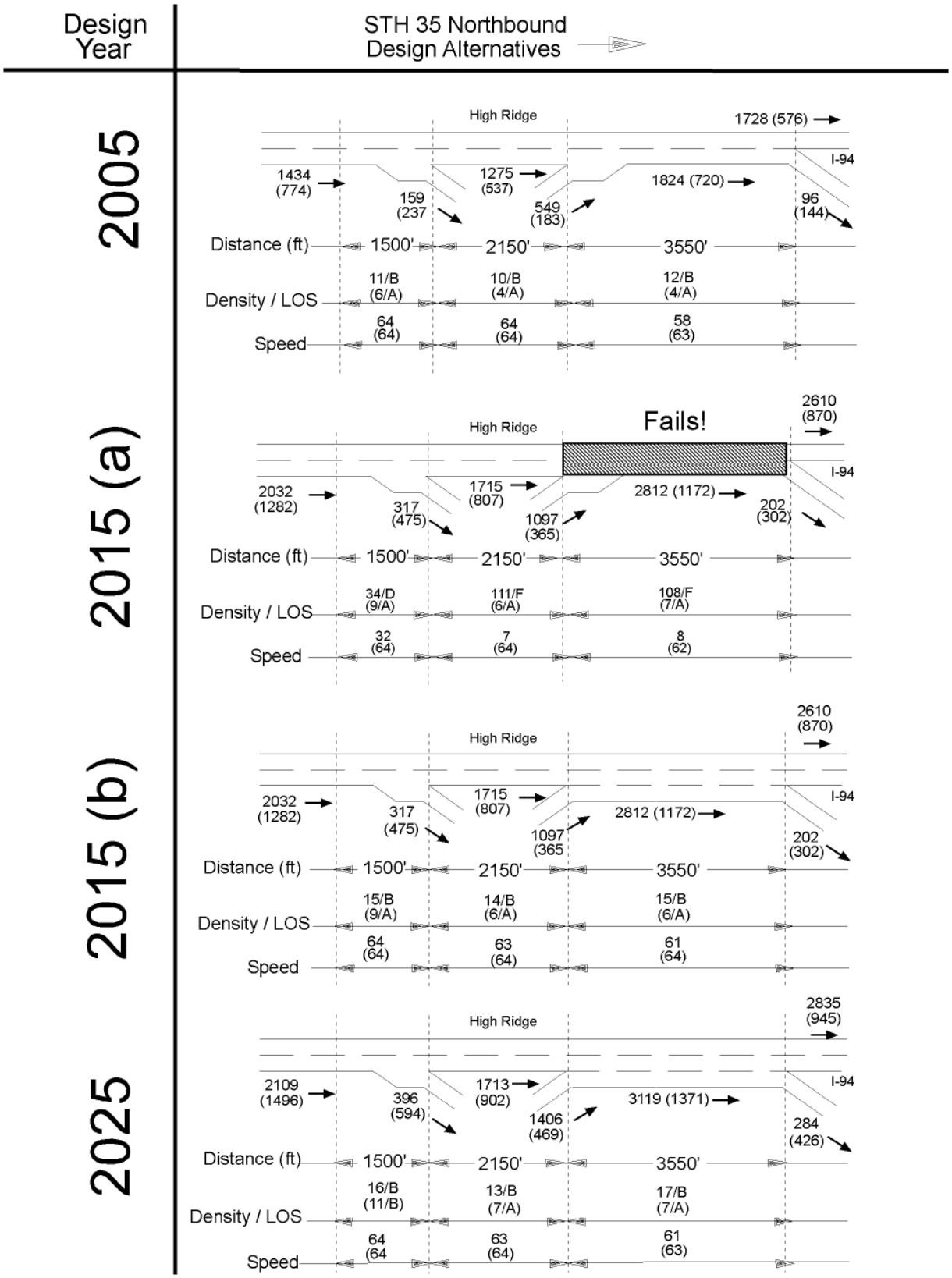
Segment Description		3 Hour Volume Served				3 Hour Volume Served				Peak Hour Density		
From	To	3d v2a	3d v2b	3d v2e	3d v2f	3d v2a	3d v2b	3d v2e	3d v2f	3d v2a	3d v2b	3d v2e
NB I-35W	EB TH 62 Entrance	8,955	8,951	8,951	8,953	3	0	0	2	21	21	21
EB TH 62 Entrance	WB TH 62 Entrance	13,192	11,881	13,193	13,194	1311	0	1313	1313	24	57	24
WB TH 62 Entrance	60th St Entrance	18,091	14,365	16,131	18,089	3726	0	1766	3724	24	84	36
60th St Entrance	Diamond Lake Rd Exit	18,820	14,636	16,418	18,815	4184	0	1782	4179	19	86	42
Diamond Lake Rd Exit	Diamond Lake Rd Entrance	18,096	13,874	15,900	18,101	4222	0	2026	4227	21	112	78
Diamond Lake Rd Entrance	46th St Exit	19,031	13,781	15,679	19,037	5250	0	1897	5255	21	123	115
46th St Exit	46th St Entrance	17,755	12,822	14,892	17,774	4933	0	2071	4952	31	135	92
46th St Exit	36th St Exit											
46th St Entrance	38th St Exit	19,885	14,569	16,452	19,903	5316	0	1883	5334	32	114	70
36th Street Exit	35th Street Entrance											
38th St Exit	38th St Entrance	18,716	13,883	15,266	18,716	4833	0	1382	4833	26	88	44
35th Street Entrance	31st St Exit											
38th St Entrance	31st St Exit	20,815	15,623	17,263	20,835	5191	0	1640	5211	24	62	35
31st St Exit	Lake St Transit Exit	19,439	14,409	16,048	19,405	5030	0	1639	4996	26	52	27
Lake St Transit Exit	28th St Exit	19,432	14,363	16,040	19,404	5069	0	1677	5042	25	51	24
28th St Exit	Lake St Transit Entrance	18,137	13,399	14,950	18,084	4738	0	1551	4685	35	51	22
Lake St Transit Exit	Lake St Transit Entrance											
Lake St Transit Entrance	Lake St Entrance	18,140	13,398	14,953	18,087	4742	0	1555	4690	44	46	20
Lake St Entrance	Downtown/WB I-94 Exit	20,901	16,067	17,613	20,829	4834	0	1546	4762	36	41	21
Lake St Transit Entrance	Downtown/WB I-94 Exit											
Downtown/WB I-94 Exit	5th Ave Entrance	9,779	7,331	8,095	9,692	2448	0	765	2361	50	23	27
Downtown/WB I-94 Exit	EB I-94 Exit (new)											
EB I-94 Exit	5th Ave Entrance											
5th Ave Entrance	EB I-94 Entrance	11452	9005	9766	11367	2448	0	762	2362	49	28	32
EB I-94 Entrance	EB I-94 Exit	15,752	13,362	13,854	15,662	2390	0	492	2300	46	28	31
EB I-94 Exit	Washington Ave U of M Exit	13,173	11,384	11,695	13,036	1789	0	311	1651	39	27	29
Washington Ave U of M Exit	NB TH 55 Entrance	10,912	9,576	9,809	10,819	1336	0	233	1243	37	30	32
NB TH 55 Entrance	NB I-35W	14,241	12,906	13,136	14,148	1335	0	230	1242	23	20	21
Downtown Spur												
35W Diverge		11,125	8,738	9,517	11,135	2388	0	780	2397	24	19	21
	WB I-94 Exit	11,123	8,739	9,518	11,134	2383	0	779	2395	26	21	23
WB I-94 Exit	Downtown	5,597	4,338	4,712	5,559	1258	0	374	1220	18	15	16

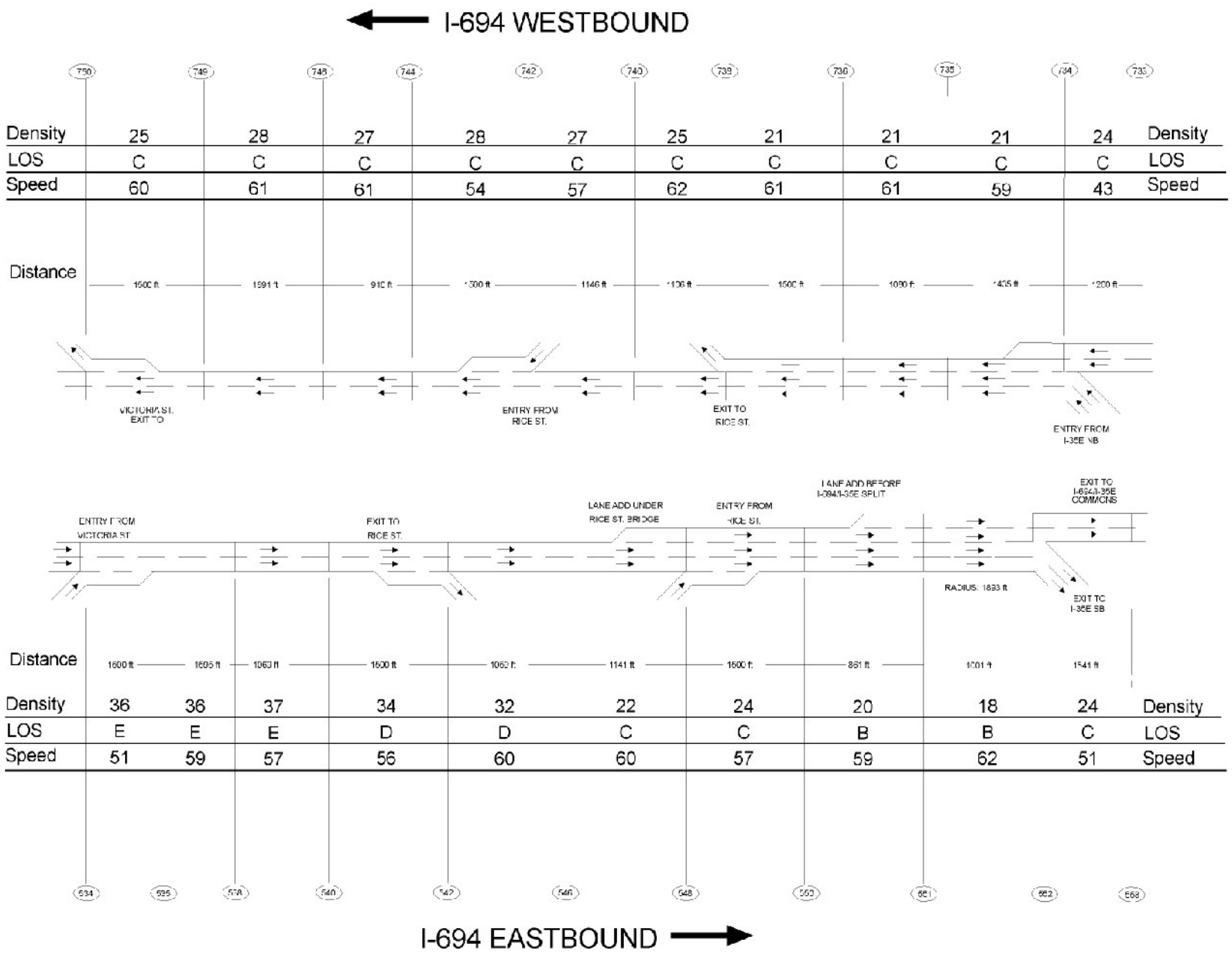
	Density Range from
LOS D	26
LOS E	35
LOS F	45

7.2 Graphical Summaries

Graphical summaries are prepared using lane schematic diagrams developed during the modeling process. The information can be displayed by a single alternative or with multiple alternatives on one page for a side-by-side comparison. Below are sample graphics of both types.




Design Year
STH 35 Northbound Design Alternatives
2005
High Ridge
1728 (576)
I-94
1434 (774)
1275 (537)
1824 (720)
159 (237)
549 (183)
96 (144)
Distance (ft)
1500'
2150'
3550'
Density / LOS
11/B (6/A)
10/B (4/A)
12/B (4/A)
Speed
64 (64)
64 (64)
58 (63)
2015 (a)
High Ridge
Fails!
2610 (870)
I-94
2032 (1282)
1715 (807)
2812 (1172)
317 (475)
1097 (365)
202 (302)
Distance (ft)
1500'
2150'
3550'
Density / LOS
34/D (9/A)
111/F (6/A)
108/F (7/A)
Speed
32 (64)
7 (64)
8 (62)
2015 (b)
High Ridge
2610 (870)
I-94
2032 (1282)
1715 (807)
2812 (1172)
317 (475)
1097 (365
202 (302)
Distance (ft)
1500'
2150'
3550'
Density / LOS
15/B (9/A)
14/B (6/A)
15/B (6/A)
Speed
64 (64)
63 (64)
61 (64)
2025
High Ridge
2835 (945)
I-94
2109 (1496)
1713 (902)
3119 (1371)
396 (594)
1406 (469)
284 (426)
Distance (ft)
1500'
2150'
3550'
Density / LOS
16/B (11/B)
13/B (7/A)
17/B (7/A)
Speed
64 (64
63 (64)
61 (63)


I-694 WESTBOUND
750
749
748
744
742
740
739
736
735
734
733
Density 25 28 27 28 27 25 21 21 21 24 Density
LOS C C C C C C C C C C LOS
Speed 60 61 61 54 57 62 61 61 59 43 Speed
Distance
1600 ft
1591 ft
910 ft
1500 ft
1146 ft
1136 ft
1500 ft
1090 ft
1405 ft
1200 ft
VICTORIA ST. EXIT TO
ENTRY FROM RICE ST.
EXIT TO RICE ST.
ENTRY FROM I-35E NB
ENTRY FROM VICTORIA ST.
EXIT TO RICE ST.
LANE ADD UNDER RICE ST. BRIDGE
ENTRY FROM RICE ST.
LANE ADD BEFORE I-694/I-35E SPLIT
EXIT TO I-694/I-35E COMMONS
RADIUS 1833 ft
EXIT TO I-35E SB
Distance
1600 ft
1695 ft
1060 ft
1600 ft
1062 ft
1141 ft
1600 ft
881 ft
1001 ft
1541 ft
Density 36 36 37 34 32 22 24 20 18 24 Density
LOS E E E D D C C B B C LOS
Speed 51 59 57 56 60 60 57 59 62 51 Speed
534
535
538
540
542
546
548
553
561
562
568
I-694 EASTBOUND

7.3 Final Documentation

Documentation relating to CORSIM modeling is ongoing throughout a project. Intermediate technical memorandums, documentation of the model calibration, study reports, and interstate access requests are the types of documents that may need to be prepared. The number of deliverables should be scoped out at the beginning of the project. The number of documents necessary is proportionate to the size of the model and project. A larger project may require more intermediate documents to facilitate the decision-making process, whereas a smaller project may require one report. The following sections provide guidance to different types of documentation.

The graphics and reports discussed in Section 7.2 are to be used for documentation. The graphics and tables may be tailored to meet the needs of the project. The types of analyses and reports include the following:

- Alternative analysis
- Sensitivity analysis
- Calibration report/tech memo
- MOE report/tech memo

7.3.1 Model Manual

The model manual was discussed in Chapter 5. This is the documentation of the model inputs, field observations, calibration adjustments, and model results. The model manual is important in that all interstate access requests must have information sufficient for Mn/DOT and/or FHWA to conduct an independent analysis. Due to the stochastic nature of traffic models and the high probability of errors in model coding and incorrect judgment, these models must "hold" up to scrutiny. The model manual is an electronic submittal with hard copy printouts of project drawings and narrative descriptions of the material provided. The submittal shall include, but not be limited to, the following items:

- Link Node Diagrams for all alternatives in micro-station
  - Plan sheets of the link node diagrams should also be provided
- Lane Schematics
- QA/QC Tables
- Traffic Demand Data
  - Arterial turning movement counts raw and balanced summarized in the arterial database format illustrated in Chapter 4.
  - Freeway mainline and ramp traffic volumes (summarized in the format illustrated in Chapter 4
  - Balance traffic dataset
  - O-D matrix calculations summarized in the format illustrated in Chapter 4
- Traffic Control Data
  - Ramp metering rates
  - Signal timing data from signal controller printouts and field observations
- Transit Data
- Electronic Files
  - CORSIM *.trf files
  - Synchro files *.sy6 files

- CADD files
- Graphics and tables

7.3.2 Technical Memorandums

Technical memorandums are intermediate reports of technical issues pertaining to the model during the course of the project. These memos are usually defined at the beginning of the project; however, during the project, the need to elaborate on a particular issue may be necessary. Below are some of the intermediate tech memos that may need to be prepared.

- **Calibration Memorandum.** Summarizes the changes made related to calibration and provides justification for the changes and supportive statistics. MOEs including volume throughput and speed comparisons between observed and modeled must be included.

- **Traffic Forecasts and Forecasting Methodology.** Traffic forecasts need to be approved by Mn/DOT. Since forecasts need to be part of the alternatives analysis, they need to be finalized early in the process. This memorandum can be incorporated into the final documentation.

- **Intermediate Modeling Issues.** During the modeling process, unusual model problems may arise where an unconventional approach may be required. This may require documentation in support of a meeting to discuss the problem and potential solutions.

- **MOE Summary Report.** The results of an analysis may be summarized in a summary report that contains the MOEs for the alternatives tested.

7.3.3 Freeway Study Report

The Freeway Study Report is an intermediate document that is used to discuss in detail design, traffic forecasts, and operational issues for all alternatives considered for either an interchange modification or new interchange access request. The Freeway Study Report should be written to contain the information necessary to prepare the interstate access request document. This document may contain more information and provide documentation of alternatives considered. A sample outline is as follows:

I. Project Overview
II. Existing Conditions
    A. Traffic Operations
    B. Geometry
    C. Crashes
III. Traffic Forecast Methodology
IV. Interchange Design Selection
V. Year Opening Analysis
    A. Build
    B. No-Build

VI. Future Year Analysis
   A. Build
   B. No-build
VII. Sensitivity Analysis
VIII. Safety Analysis
VIII. Conclusion

If the findings and recommendations are agreed to in the Freeway Study Report, then the Freeway Study Report can be appended to include a discussion of the eight policy items that need to be satisfied for interstate access approval.

7.3.4 Interstate Access Request

Final documentation includes technical memorandums, a Freeway Study Report, and an Interstate Access Report (IAR). Each study could have a slightly different focus, but the information requirements from the model and the method by which the model is prepared will be the same. IAR requirements are based on "Federal Highway Administration Docket No. 98-3460, Additional Interchanges to the Interstate System," Federal Register 63, February 11, 1998.

An IAR is required for all new or modified interchanges. Summarized below are the deliverables required to fulfill operational analysis requirements that feed into the IAR:

Background

The FHWA has retained all approval rights to the control of access to the interstate system. This is necessary to protect the integrity of interstate system and the extensive investment associated with it. To obtain approval from FHWA to access the interstate, a request for access, in conformance with this guidance, must be submitted to FHWA through the Mn/DOT.

FHWA access approval is required when access on the interstate system is added or modified. This applies to all access changes on the interstate system regardless of funding and oversight. Each entrance or exit point, including "locked gate" and temporary construction access, to the mainline interstate is considered to be an access point. This guidance is limited to:

- New Interchanges
- Modifications to existing interchanges involving access control revisions for new ramps or relocation or elimination of existing ramps
- Modification of the access control on arterial roadways at interchanges

Interchange reconfiguration is considered to be a change in access even though the number of actual points of access may not change. For example, replacing one of the direct ramps of a diamond interchange with a loop or changing a cloverleaf interchange into a fully directional interchange is considered as revised access.

Access approval is a two step process that was developed to help the state manage risk and provide flexibility. It is intended to identify fatal flaws and to help ensure the investment in the environmental document is not wasted. The first step is a finding of

operational and engineering "acceptability". The second step is the final "approval". Often these are done at the same time; however, it is not necessary. The finding of operational and engineering acceptability is the more lengthy and time consuming of the two steps; it requires consideration of the eight policy points addressed hereinafter.

All new partial interchanges, new interchanges in the Metro Division, and new or major modifications to freeway to freeway interchanges go to FHWA headquarters in Washington, D.C. for this determination of "acceptability". Because both the Division Office and headquarter review the document, this could be a lengthy process. Final approval is relatively quick once the operational and engineering acceptability has been determined.

The FHWA approval constitutes a federal action and, as such, requires that National Environmental Policy Act (NEPA) procedures are followed. Compliance with the NEPA procedures need not precede the determination of engineering and operations "acceptability". However, final "approval" of access cannot precede the completion of NEPA. Once NEPA has been completed, "approval" of access is granted as long as no changes resulted to the "accepted" concept.

Access Request

The access request with a recommendation must be submitted by Mn/DOT to the FHWA Division Office regardless of who is initiating the request. Prior to submittal to FHWA, the request shall be reviewed by Metro Division's Traffic Engineering Office and the region's access manager.

The request should be a standalone document. The referencing of information in other documents (feasibility study, environmental documents) is discouraged. The information from these documents should be provided in the appropriate section of the access request. Excerpts may be included as appendices.

It should consist of an introduction that describes the project and its need. The document should be clearly written for someone that is not familiar with the project, the area, or the state. Vicinity maps are very helpful. There are many cases where the request will be reviewed and approved by someone that is not familiar with the project or the area.

The request shall address the eight policy points italicized below. Some general guidance on what is expected is provided. Typically, the better access request packages have taken each requirement and dedicated a section of the request to illustrate how that requirement is met. Example: Chapter 1 is policy point 1 with its attachments.

7.3.4.1 IAR Policy Requirements

The IAR must satisfy each of the eight policy items described below. Commentary has been provided to elaborate on what is needed to satisfy the policy. Additional justification and explanation may be required on a project-by-project basis. A meeting with FHWA and Mn/DOT should be held to discuss the specific requirements for each project.

1. *The existing interchanges and/or local roads and streets in the corridor can neither provide the necessary access nor be improved to satisfactorily accommodate the*

design year traffic demands while at the same time providing the access intended by the proposal.

Describe the proposed new or revised access and explain the need for the access point. Need must be established by showing: 1) that the current or future traffic cannot be accommodated by improvements to the existing roadway network and the existing interchanges/ramps, and 2) that the traffic demanding the new/revised access is regional traffic (longer trips) rather than local traffic circulation. Capacity required for local traffic (shorter trips) is not an adequate need explanation.

2. *All reasonable alternatives for design options, location and transportation system management type improvements (such as ramp metering, mass transit, and HOV facilities) have been assessed and provided for if currently justified, or provisions are included for accommodating such facilities if a future need is identified.*

Describe the different alternatives considered and why the selected alternative was chosen. This description should include why the layout for the selected alternative was chosen, include the other configurations and if something is prohibiting the use of an alternative design. (Example: Considered a flyover but jurisdictional wetlands prohibits its construction, a loop ramp was considered, but it cannot handle the volume of traffic required.) Cost is usually not the only reason; it plays in the decision, but is not justification for a poor design.

Answer the question, why this design?

3. *The proposed access point does not have a significant adverse impact on the safety and operation of the interstate facility based on an analysis of current and future traffic. The operational analysis for existing conditions shall, particularly in urbanized areas, include analysis of sections of interstate to and including at least the first adjacent existing or proposed interchange on either side. Cross roads and other roads and streets shall be included in the analysis to the extent necessary to assure their ability to collect and distribute traffic to and from the interchange with new or revised access points.*

A traffic and operational analysis needs to be performed that includes an analysis of adjacent segments of the freeway, as well as nearby existing and proposed interchanges. The results must demonstrate at year of implementation and design year the adequacy of:

- Freeway mainline
- Freeway weaving
- Freeway diverge
- Ramp merge
- Ramp/cross road intersection
- Cross roads and other local streets ability to effectively collect and distribute traffic from the new of revised interchange.

Analysis results should be presented in the request at critical points (e.g., weave, merge, diverge, accident sites, HOV lanes) along the affected section of interstate (mainline and ramps) and on the surface street system for both the AM and PM. Show new congestion points that would be introduced by the proposal, and congestion points that should be improved or eliminated, any locations at which congestion is compounded, and any surface street conditions that would affect traffic entering or exiting the interstate. This should be presented for existing, year of opening, and 20-year future design year.

The limits of the analysis on the interstate shall, at a minimum, be through the adjacent interchanges on either side of the proposed access. In urban areas, it is often necessary to consider the two adjacent interchanges in both directions. Distances to and projected impacts on adjacent interchanges should be provided in the request.

The limits of the analyses on the existing or improved surface street system will be the extent of the system necessary to show that the surface street system can safely and adequately handle any new traffic loads resulting from the new/revised access point.

The analysis can be based on the current HCM operational analysis procedures if this methodology is adequate. If the project area is congested or complicated (e.g., significant weaving activity or closely spaced interchanges), micro-simulation will be required. In the Metro Division area, micro-simulation will be required in most cases. FHWA is best prepared to accept and review CORSIM analysis and will be able to respond to requests in a timelier manner. We will accept other commonly used micro-simulation programs if pre-approved in advanced and agreed upon at the initial coordination meeting. The request must contain freeway mainline and crossroad/local street traffic volumes (ADT and DHV) including turning movements for current year, implementation year, and design year, and the number of mainline and crossroad lanes including auxiliary lanes or collector distributor roads.

4. *An accident analysis must identify accident history and rates in the freeway section and surface streets affected and project the crash rates, which will result from traffic flow and geometric conditions imposed by the proposed access. The proposed access connects to a public road only and will provide for all traffic movements. Less than "full interchanges" for special purposes access for transit vehicles, for HOVs, or into park and ride lots may be considered on a case-by-case basis. The proposed access will be designed to meet or exceed current standards for federal-aid projects on the interstate system.*

It should be illustrated that the access connects to a public road and will provide all traffic movements. If a less than "full interchange" is being requested, justification must be provided. It must be shown why the missing traffic movements are not being provided and are not required.

If the interchange is being built in phases where there will be a time where a less than "full interchange" is provided, the phasing and operations should be described in detail.

5. *The proposal considers and is consistent with local and regional land use and transportation plans. Prior to final approval, all requests for new or revised access must be consistent with the metropolitan and/or statewide transportation plan, as*

appropriate, the applicable provisions of 23 CFR part 450, and the transportation conformity requirements of 40 CFR parts 51 and 93.

The proposed new/revised access will affect adjacent land use and vice versa with respect to traffic demand generated. Therefore, the request, including transportation management strategies incorporated, shall reference and demonstrate the consistency of the proposed access with: land use plans, zoning controls and transportation ordinances, and regional and local transportation plans that include the proposal.

6. *In areas where the potential exists for future multiple interchange additions, all requests for new or revised access are supported by a comprehensive interstate network study with recommendations that address all proposed and desired access within the context of a long-term plan.*

If the access request is occurring in a developing area or in an area that has the potential for future interchange additions, it should be shown how this access has been part of a comprehensive interstate network study and is consistent with it. The request must demonstrate that the proposed new/revised access is compatible with other feasible new access points. A reference to the study and brief summary of the study and its recommendations should be provided. Do not attach the study.

7. *The request for a new or revised access generated by new or expanded development demonstrates appropriate coordination between the development and related or otherwise required transportation system improvements.*

When the request for a new or revised access is generated by new or expanded development, demonstrate appropriate coordination between the development and related or otherwise required transportation system improvements.

Show that those proposed new/revised access points driven by private development include commitments to complete the non-interchange improvements that are necessary for the interchange to work as proposed.

8. *The request for new or revised access contains information relative to the planning requirements and the status of the environmental processing of the proposal.*

The request should conform to the plan. The status of the environmental processing should include the type of environmental document and when it was signed. If it has not yet been signed, briefly describe the status and schedule of the document along with its anticipated completion.

7.3.4.2 Basic Information for Traffic Analysis of Added Access to Interstate

Data must be sufficient so that FHWA and Mn/DOT can do an independent analysis. Mn/DOT's Modeling Guidelines and the Advance CORSIM Training Manual are key references that document the modeling requirements for the operational analysis. Specific situations or project may require additional information or requirements beyond what is defined. In urban areas with closely spaced interchanges and heavy congestion occurs, it may be necessary to go beyond the adjacent interchanges.