HCS Freeway Analysis Study Segments MOE - Calibrated Version
SAMP Environmental Review - Surface Transportation Analysis
Concord Engineering
1/29/2024

				2032 NA			Existing			2032 NA									
Facility	ID	Study Segments	Analyzed Type	LOS	Avg Speed (S, mph)	Avg Density (D, pc/mi/ln)	LOS	Avg Speed (S, mph)	Avg Density (D, pc/mi/ln)	Volume							Mainline Adjustment Factor		
										Mainline	Off-ramp	On-Ramp	Weaving Mnln-Mnln	Weaving Rmp-Mnln	Weaving Rmp-Rmp	Weaving Mnln-Rmp	Speed Adj. Factor	Capacity Adj. Factor	Demand Adj.Factor
Sub Area A – SR 518 EB	A1	EB SR 518 from SR 509 NB Off Ramp to DMM EB off Ramp	Weaving	C	46.0	21.1	B	56.1	13.5				1645	760	64	150		0.900	
	A2	EB SR 518 from DMM EB off Ramp to DMM Interchange	Basic	C	63.0	20.4	B	64.0	17.0	2405								0.852	
Sub Area B – SR 518 WB	B1	WB SR 518 from DMM Undercrossing to Diverge Influence Point	Basic	C	57.2	26.0	C	60.0	19.7	2890								0.852	
	B2	WB SR 518 from DMM Diverge Influence Point to SR 509 NB On Ramp	Diverge	C	50.4	29.9	B	50.5	23.6		1120							0.852	
Sub Area C – SR 518 EB /I-5 & I-405 NB	C1	EB SR 518 from 51st St Off Ramp to I-5 NB Off Ramp	Basic (Drop)	E	35.3	43.7	E	38.8	38.0	3285							0.800	0.700	1.300
	C2	EB SR 518 from I-5 NB Off Ramp to I-5 SB Off Ramp	Basic (Drop)	F	34.5	45.0	F	34.5	45.0	2220	) I-5 NB On from EB SR 518						0.800	0.700	1.300
	C3	NB I-405 from I-5 SB Off Ramp to I-5 SB On Ramp	N/A[1] (Skipped)	-	-	-	-	-	-										
	C4	NB I-405 from I-5 SB On Ramp to I-5 NB On Ramp	Basic (Add)[2]	F	44.5	45.0	F	34.5	45.0	4115	ff to I-405 NB + (+) I-5 SB to I-405 NB							0.852	1.300
	C5	NB I-405 from I-5 NB On Ramp to Southcenter Pkwy	Basic (Add)[2]	F	44.5	45.0	F	34.5	45.0	5695								0.852	1.300
Sub Area D – SR 518 WB/ I-5 & I-405 SB	D1	SB I-405 from Interurban Ave S 3-Lane Start Point to I-5 NB Off/Southcenter Off Ramp	Basic (Drop)[2]	F	34.5	45.0	F	34.5	45.0	4805							0.800	0.700	1.300
	D2	SB I-405 from I-5 NB Off Ramp to I-5 NB On Ramp	Basic	F	34.5	45.0	F	34.5	45.0	3135							0.800	0.700	1.300
	D3	SB I-405 from I-5 NB On Ramp to I-5 SB Off Ramp	Weaving	F	26.3	83.2	F	26.8	83.2				1615	985	478	1520	0.700	0.900	1.300
	D4	WB SR 518 from I-5 SB Off Ramp to I-5 SB On Ramp	Basic	F	34.5	45.0	F	34.5	45.0	2600							0.800	0.700	1.300
	D5	WB SR 518 from I-5 SB On Ramp to 51st St On Ramp	Basic (Add)	F	34.5	45.0	F	34.5	45.0	3645	-5 + (+) I-5 SB Off to WB SR 518						0.800	0.700	1.300
Sub Area E – I-5 SB	E1	SB I-5 at Southcenter Blvd/SR 518 Off Ramp Diverge Area	Major Diverge[2,3]	E	39.0	39.5	E	39.0	35.8	8520	1985						0.600	0.800	1.300
	E2	SB I-5 from Southcenter Blvd/SR 518 Off Ramp to I-405 NB Off Ramp	Basic (Drop)[2]	E	39.0	39.4	E	39.0	35.1	(-) I-5 SB to 405 NB							0.600	0.800	
	E3	SB I-5 from I-405 NB Off Ramp to I-405 SB On Ramp	Basic	F	20.0	71.9	E	39.0	37.4	4195	(+) 405 SB to I-5 SB						0.600	0.800	1.300
	E4	SB I-5 from I-405 SB On Ramp to Klickitat SB On Ramp	Basic (Add)[2]	F	18.1	76.6	F	27.7	49.8	5715							0.800	0.800	1.300
	E5	SB I-5 at Klickitat SB On Ramp Merge Area	Merge[2]	F	23.9	64.4	F	24.3	63.3			1220					0.800	0.800	
	E6	SB I-5 from Klickitat SB On Ramp Merge Area to 188th St SB Off Ramp Diverge Area	Basic[2]	F	39.5	45.0	F	27.4	58.7	6935							0.800	0.800	1.300
	E7	SB I-5 at 188th St SB Off Ramp Diverge Area	Diverge[2]	F	50.3	28.2	F	27.0	57.9		1210						0.800	0.800	
	E8	SB I-5 from 188th St SB Off Ramp Diverge Area to Lane Reduction Point	Basic[2]	F	50.8	27.5	F	16.5	79.5								0.800	0.800	
	E9	SB I-5 from Lane Reduction Point to 188th St SB On Ramp	Basic[2]	F	22.7	71.9	F	19.9	77.9	5725								0.852	1.300
	E10	SB I-5 at 188th St SB On Ramp Merge Area	Merge[2]	F	57.3	33.1	F	31.6	55.7			780						0.852	
	E11	SB I-5 from 188th St SB On Ramp Merge Area to 200th St SB Off Ramp Diverge Area	Overlap[2]	F	57.3	33.1	F	29.4	58.7									0.852	
	E12	SB I-5 at 200th St SB Off Ramp Diverge Area	Diverge[2]	F	60.0	31.1	F	29.4	58.7		440							0.852	
	E13	SB I-5 from 200th St SB Off Ramp to 200th St SB On Ramp	Basic[2]	F	32.0	51.6	F	23.0	70.0									0.852	
	E14	SB I-5 at 200th St SB On Ramp Merge Area	Merge[2]	F	32.3	56.3	F	31.3	58.0			520						0.852	
Sub Area F – I-5 NB	F1	NB I-5 at Military Rd NB Off Ramp Diverge Area	Diverge[2]	C	61.7	21.3	C	61.3	24.5	4770	260							0.852	
	F2	NB I-5 from Military Rd NB Off Ramp to Military Rd NB On Ramp	Basic[2]	C	63.9	19.5	C	61.7	22.9									0.852	
	F3	NB I-5 at Military Rd NB On Ramp Merge Area	Merge[2]	C	59.4	24.0	C	59.1	26.2			710						0.852	
	F4	NB I-5 from Military Rd NB On Ramp to 188th St NB Off Ramp	Basic[2]	C	61.5	23.2	C	59.2	26.0									0.852	
	F5	NB I-5 at 188th St NB Off Ramp Diverge Area	Diverge[2]	C	62.4	22.8	D	62.5	24.6		650							0.852	
	F6	NB I-5 from 188th St NB Off Ramp to 188th St NB On Ramp	Basic[2]	C	64.0	19.3	C	62.2	22.2									0.852	
	F7	NB I-5 at 188th St NB On Ramp Merge Area	Merge[2]	D	58.3	27.6	D	58.2	29.1			1360						0.852	
	F8	NB I-5 from 188th St NB On Ramp to Southcenter Pkwy Off Ramp	Basic[2]	D	57.7	27.8	D	55.5	30.4									0.852	
	F9	NB I-5 at Southcenter Pkwy Off Ramp Diverge Area	Diverge[2]	C	62.0	25.9	C	62.1	27.2		750							0.852	
	F10	NB I-5 from Southcenter Pkwy Off Ramp to SR 518 WB/I-405 EB Off Ramp	Basic[2]	C	61.9	22.6	C	59.8	25.3									0.852	
	F11	NB I-5 at SR 518 WB/I-405 EB Off Ramp Diverge Area	Major Diverge[2,3]	C	57.1	24.5	C	57.1	26.5		2565							0.852	
	F12	NB I-5 from SR 518 WB/I-405 EB Off Ramp to I-405 WB HOV On Ramp	Basic	B	65.0	14.6	B	65.0	16.3	2615								0.852	
	F13	NB I-5 from I-405 WB HOV On Ramp to I-405 WB On Ramp	Basic	B	65.0	12.3	B	65.0	13.4	2865		(+) 405 WB to I-5 NB (HOV))						0.852	
	F14	NB I-5 at I-405 WB On Ramp Merge Area	Merge	B	60.9	17.8	B	60.5	19.6			1070	) 518 EB to I-5 NB					0.852	
	F15	NB I-5 from SR 518 EB On Ramp to Southcenter Blvd NB On Ramp	Basic (Add)[2]	B	64.7	17.4	B	64.5	18.0	5000								0.852	
	F16	NB I-5 at Southcenter Blvd NB On Ramp Merge Area	Merge[2]	B	60.0	17.6	B	59.9	17.9			890						0.852	

Note:

Distance rounded to nearest 10.

[1]- One-lane freeway mainline cannot be analyzed in HCS.

[2]- HOV lane ignored due to the analysis constraint of HCS.

[3]- A major diverge area is one in which two primary roadways, each having multiple lanes, diverge from a single freeway segment. Major Diverge type analyzed as basic segment with Major Diverge checkbox checked . For major diverge areas, a model exists for computing the average density across all approaching freeway lanes within 1,500 ft of the diverge.

[4]- WSDOT Level of Service Standard for State Routes is LOS D.

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				2032 PA			Existing			2032 PA									
										Volume							Mainline Adjustment Factor		
Facility	ID	Study Segments	Analyzed Type	LOS	Avg Speed (S, mph)	Avg Density (D, pc/mi/ln)	LOS	Avg Speed (S, mph)	Avg Density (D, pc/mi/ln)	Mainline	Off-ramp	On-Ramp	Weaving Mnln-Mnln	Weaving Rmp-Mnln	Weaving Rmp-Rmp	Weaving Mnln-Rmp	Speed Adj. Factor	Capacity Adj. Factor	Demand Adj.Factor
Sub Area A – SR 518 EB	A1	EB SR 518 from SR 509 NB Off Ramp to DMM EB off Ramp	Weaving	C	45.2	22.0	B	56.1	13.5				1635	800	73	165		0.900	
	A2	EB SR 518 from DMM EB off Ramp to DMM Interchange	Basic	C	62.9	20.7	B	64.0	17.0	2435								0.852	
Sub Area B – SR 518 WB	B1	WB SR 518 from DMM Undercrossing to Diverge Influence Point	Basic	D	55.9	27.9	C	60.0	19.7	3022								0.852	
	B2	WB SR 518 from DMM Diverge Influence Point to SR 509 NB On Ramp	Diverge	C	50.4	31.2	B	50.5	23.6		1115							0.852	
Sub Area C – SR 518 EB /I-5 & I-405 NB	C1	EB SR 518 from 51st St Off Ramp to I-5 NB Off Ramp	Basic (Drop)	F	34.5	45.0	E	38.8	38.0	3355							0.800	0.700	1.300
	C2	EB SR 518 from I-5 NB Off Ramp to I-5 SB Off Ramp	Basic (Drop)	F	34.5	45.0	F	34.5	45.0	2219	(-) I-5 NB On from EB SR 518						0.800	0.700	1.300
	C3	NB I-405 from I-5 SB Off Ramp to I-5 SB On Ramp	N/A[1] (Skipped)	-	-	-	-	-	-										
	C4	NB I-405 from I-5 SB On Ramp to I-5 NB On Ramp	Basic (Add)[2]	F	44.5	45.0	F	34.5	45.0	4155	ff to I-405 NB + (+) I-5 SB to I-405 NB							0.852	1.300
	C5	NB I-405 from I-5 NB On Ramp to Southcenter Pkwy	Basic (Add)[2]	F	44.5	45.0	F	34.5	45.0	5735								0.852	1.300
Sub Area D – SR 518 WB/ I-5 & I-405 SB	D1	SB I-405 from Interurban Ave S 3-Lane Start Point to I-5 NB Off/Southcenter Off Ramp	Basic (Drop)[2]	F	34.5	45.0	F	34.5	45.0	4848							0.800	0.700	1.300
	D2	SB I-405 from I-5 NB Off Ramp to I-5 NB On Ramp	Basic	F	34.5	45.0	F	34.5	45.0	3178							0.800	0.700	1.300
	D3	SB I-405 from I-5 NB On Ramp to I-5 SB Off Ramp	Weaving	F	26.4	82.9	F	26.8	83.2				1658	1061	507	1520	0.700	0.900	1.300
	D4	WB SR 518 from I-5 SB Off Ramp to I-5 SB On Ramp	Basic	F	34.5	45.0	F	34.5	45.0	2719							0.800	0.700	1.300
	D5	WB SR 518 from I-5 SB On Ramp to 51st St On Ramp	Basic (Add)	F	34.5	45.0	F	34.5	45.0	3832	I-5 + (+) I-5 SB Off to WB SR 518						0.800	0.700	1.300
Sub Area E – I-5 SB	E1	SB I-5 at Southcenter Blvd/SR 518 Off Ramp Diverge Area	Major Diverge[2,3]	E	39.0	40.0	E	39.0	35.8	8618	2053	assume same HOV vol					0.600	0.800	1.300
	E2	SB I-5 from Southcenter Blvd/SR 518 Off Ramp to I-405 NB Off Ramp	Basic (Drop)[2]	E	39.0	39.4	E	39.0	35.1		(-) I-5 SB to 405 NB						0.600	0.800	
	E3	SB I-5 from I-405 NB Off Ramp to I-405 SB On Ramp	Basic	F	20.0	71.9	E	39.0	37.4	4225		(+) 405 SB to I-5 SB					0.600	0.800	1.300
	E4	SB I-5 from I-405 SB On Ramp to Klickitat SB On Ramp	Basic (Add)[2]	F	18.1	76.6	F	27.7	49.8	5745							0.800	0.800	1.300
	E5	SB I-5 at Klickitat SB On Ramp Merge Area	Merge[2]	F	23.9	64.4	F	24.3	63.3			1179					0.800	0.800	
	E6	SB I-5 from Klickitat SB On Ramp Merge Area to 188th St SB Off Ramp Diverge Area	Basic[2]	F	39.5	45.0	F	27.4	58.7	6924							0.800	0.800	1.300
	E7	SB I-5 at 188th St SB Off Ramp Diverge Area	Diverge[2]	F	50.3	28.2	F	27.0	57.9		1220						0.800	0.800	
	E8	SB I-5 from 188th St SB Off Ramp Diverge Area to Lane Reduction Point	Basic[2]	F	50.9	27.3	F	16.5	79.5								0.800	0.800	
	E9	SB I-5 from Lane Reduction Point to 188th St SB On Ramp	Basic[2]	F	22.7	71.9	F	19.9	77.9	5704								0.852	1.300
	E10	SB I-5 at 188th St SB On Ramp Merge Area	Merge[2]	F	57.3	33.1	F	31.6	55.7			785						0.852	
	E11	SB I-5 from 188th St SB On Ramp Merge Area to 200th St SB Off Ramp Diverge Area	Overlap[2]	F	57.3	33.1	F	29.4	58.7									0.852	
	E12	SB I-5 at 200th St SB Off Ramp Diverge Area	Diverge[2]	F	60.0	31.1	F	29.4	58.7		455							0.852	
	E13	SB I-5 from 200th St SB Off Ramp to 200th St SB On Ramp	Basic[2]	F	33.4	49.5	F	23.0	70.0									0.852	
	E14	SB I-5 at 200th St SB On Ramp Merge Area	Merge[2]	F	32.5	55.8	F	31.3	58.0			520						0.852	
Sub Area F – I-5 NB	F1	NB I-5 at Military Rd NB Off Ramp Diverge Area	Diverge[2]	C	61.7	21.7	C	61.3	24.5	4854	260							0.852	
	F2	NB I-5 from Military Rd NB Off Ramp to Military Rd NB On Ramp	Basic[2]	C	63.7	19.9	C	61.7	22.9									0.852	
	F3	NB I-5 at Military Rd NB On Ramp Merge Area	Merge[2]	C	59.3	24.5	C	59.1	26.2			710						0.852	
	F4	NB I-5 from Military Rd NB On Ramp to 188th St NB Off Ramp	Basic[2]	C	61.1	23.7	C	59.2	26.0									0.852	
	F5	NB I-5 at 188th St NB Off Ramp Diverge Area	Diverge[2]	C	62.3	23.2	D	62.5	24.6		640							0.852	
	F6	NB I-5 from 188th St NB Off Ramp to 188th St NB On Ramp	Basic[2]	C	63.7	19.8	C	62.2	22.2									0.852	
	F7	NB I-5 at 188th St NB On Ramp Merge Area	Merge[2]	D	58.2	28.2	D	58.2	29.1			1375						0.852	
	F8	NB I-5 from 188th St NB On Ramp to Southcenter Pkwy Off Ramp	Basic[2]	D	56.9	28.7	D	55.5	30.4									0.852	
	F9	NB I-5 at Southcenter Pkwy Off Ramp Diverge Area	Diverge[2]	C	61.9	26.4	C	62.1	27.2		750							0.852	
	F10	NB I-5 from Southcenter Pkwy Off Ramp to SR 518 WB/I-405 EB Off Ramp	Basic[2]	C	61.4	23.3	C	59.8	25.3									0.852	
	F11	NB I-5 at SR 518 WB/I-405 EB Off Ramp Diverge Area	Major Diverge[2,3]	C	57.1	25.0	C	57.1	26.5		2641							0.852	
	F12	NB I-5 from SR 518 WB/I-405 EB Off Ramp to I-405 WB HOV On Ramp	Basic	B	65.0	14.8	B	65.0	16.3	2648								0.852	
	F13	NB I-5 from I-405 WB HOV On Ramp to I-405 WB On Ramp	Basic	B	65.0	12.4	B	65.0	13.4	2898		(+) 405 WB to I-5 NB (HOV))						0.852	
	F14	NB I-5 at I-405 WB On Ramp Merge Area	Merge	B	60.8	17.9	B	60.5	19.6			1070	(+) 518 EB to I-5 NB					0.852	
	F15	NB I-5 from SR 518 EB On Ramp to Southcenter Blvd NB On Ramp	Basic (Add)[2]	B	64.6	17.8	B	64.5	18.0	5104								0.852	
	F16	NB I-5 at Southcenter Blvd NB On Ramp Merge Area	Merge[2]	B	59.9	17.9	B	59.9	17.9			890						0.852	

Note:

Distance rounded to nearest 10.

[1]- One-lane freeway mainline cannot be analyzed in HCS.

[2]- HOV lane ignored due to the analysis constraint of HCS.

[3]- A major diverge area is one in which two primary roadways, each having multiple lanes, diverge from a single freeway segment. Major Diverge type analyzed as basic segment with Major Diverge checkbox checked˙ For major diverge areas, a model exists for computing the average density across all approaching freeway lanes within 1,500 ft of the diverge.

[4]- WSDOT Level of Service Standard for State Routes is LOS D˙

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				2037 NA			Existing			2037 NA									
										Volume							Mainline Adjustment Factor		
Facility	ID	Study Segments	Analyzed Type	LOS	Avg Speed (S, mph)	Avg Density (D, pc/mi/ln)	LOS	Avg Speed (S, mph)	Avg Density (D, pc/mi/ln)	Mainline	Off-ramp	On-Ramp	Weaving Mnln-Mnln	Weaving Rmp-Mnln	Weaving Rmp-Rmp	Weaving Mnln-Rmp	Speed Adj. Factor	Capacity Adj. Factor	Demand Adj.Factor
Sub Area A – SR 518 EB	A1	EB SR 518 from SR 509 NB Off Ramp to DMM EB off Ramp	Weaving	C	45.4	22.9	B	56.1	13.5				1780	800	66	160		0.900	
	A2	EB SR 518 from DMM EB off Ramp to DMM Interchange	Basic	C	62.1	22.3	B	64.0	17.0	2580								0.852	
Sub Area B – SR 518 WB	B1	WB SR 518 from DMM Undercrossing to Diverge Influence Point	Basic	D	54.0	30.4	C	60.0	19.7	3190								0.852	
	B2	WB SR 518 from DMM Diverge Influence Point to SR 509 NB On Ramp	Diverge	C	50.2	33.1	B	50.5	23.6		1210							0.852	
Sub Area C – SR 518 EB /I-5 & I-405 NB	C1	EB SR 518 from 51st St Off Ramp to I-5 NB Off Ramp	Basic (Drop)	F	34.5	45.0	E	38.8	38.0	3580							0.800	0.700	1.300
	C2	EB SR 518 from I-5 NB Off Ramp to I-5 SB Off Ramp	Basic (Drop)	F	34.5	45.0	F	34.5	45.0	2335	) I-5 NB On from EB SR 518						0.800	0.700	1.300
	C3	NB I-405 from I-5 SB Off Ramp to I-5 SB On Ramp	N/A[1] (Skipped)	-	-	-	-	-	-										
	C4	NB I-405 from I-5 SB On Ramp to I-5 NB On Ramp	Basic (Add)[2]	F	44.5	45.0	F	34.5	45.0	4210	ff to I-405 NB + (+) I-5 SB to I-405 NB							0.852	1.300
	C5	NB I-405 from I-5 NB On Ramp to Southcenter Pkwy	Basic (Add)[2]	F	44.5	45.0	F	34.5	45.0	5800								0.852	1.300
Sub Area D – SR 518 WB/ I-5 & I-405 SB	D1	SB I-405 from Interurban Ave S 3-Lane Start Point to I-5 NB Off/Southcenter Off Ramp	Basic (Drop)[2]	F	34.5	45.0	F	34.5	45.0	5145							0.800	0.700	1.300
	D2	SB I-405 from I-5 NB Off Ramp to I-5 NB On Ramp	Basic	F	34.5	45.0	F	34.5	45.0	3435							0.800	0.700	1.300
	D3	SB I-405 from I-5 NB On Ramp to I-5 SB Off Ramp	Weaving	F	26.7	81.7	F	26.8	83.2				1875	1015	461	1560	0.700	0.900	1.300
	D4	WB SR 518 from I-5 SB Off Ramp to I-5 SB On Ramp	Basic	F	34.5	45.0	F	34.5	45.0	2890							0.800	0.700	1.300
	D5	WB SR 518 from I-5 SB On Ramp to 51st St On Ramp	Basic (Add)	F	34.5	45.0	F	34.5	45.0	3995	-5 + (+) I-5 SB Off to WB SR 518						0.800	0.700	1.300
Sub Area E – I-5 SB	E1	SB I-5 at Southcenter Blvd/SR 518 Off Ramp Diverge Area	Major Diverge[2,3]	E	39.0	40.6	E	39.0	35.8	8750	2075						0.600	0.800	1.300
	E2	SB I-5 from Southcenter Blvd/SR 518 Off Ramp to I-405 NB Off Ramp	Basic (Drop)[2]	E	39.0	40.1	E	39.0	35.1	(-) I-5 SB to 405 NB							0.600	0.800	
	E3	SB I-5 from I-405 NB Off Ramp to I-405 SB On Ramp	Basic	F	20.0	71.9	E	39.0	37.4	4275	(+) 405 SB to I-5 SB						0.600	0.800	1.300
	E4	SB I-5 from I-405 SB On Ramp to Klickitat SB On Ramp	Basic (Add)[2]	F	18.0	76.8	F	27.7	49.8	5835							0.800	0.800	1.300
	E5	SB I-5 at Klickitat SB On Ramp Merge Area	Merge[2]	F	23.8	64.6	F	24.3	63.3			1320					0.800	0.800	
	E6	SB I-5 from Klickitat SB On Ramp Merge Area to 188th St SB Off Ramp Diverge Area	Basic[2]	F	39.5	45.0	F	27.4	58.7	7155							0.800	0.800	1.300
	E7	SB I-5 at 188th St SB Off Ramp Diverge Area	Diverge[2]	F	50.1	28.4	F	27.0	57.9		1350						0.800	0.800	
	E8	SB I-5 from 188th St SB Off Ramp Diverge Area to Lane Reduction Point	Basic[2]	F	51.4	26.3	F	16.5	79.5								0.800	0.800	
	E9	SB I-5 from Lane Reduction Point to 188th St SB On Ramp	Basic[2]	F	22.7	71.9	F	19.9	77.9	5805								0.852	1.300
	E10	SB I-5 at 188th St SB On Ramp Merge Area	Merge[2]	F	57.1	33.8	F	31.6	55.7			870						0.852	
	E11	SB I-5 from 188th St SB On Ramp Merge Area to 200th St SB Off Ramp Diverge Area	Overlap[2]	F	57.1	33.8	F	29.4	58.7									0.852	
	E12	SB I-5 at 200th St SB Off Ramp Diverge Area	Diverge[2]	F	59.8	31.2	F	29.4	58.7		500							0.852	
	E13	SB I-5 from 200th St SB Off Ramp to 200th St SB On Ramp	Basic[2]	F	33.4	48.9	F	23.0	70.0									0.852	
	E14	SB I-5 at 200th St SB On Ramp Merge Area	Merge[2]	F	32.6	55.6	F	31.3	58.0			570						0.852	
Sub Area F – I-5 NB	F1	NB I-5 at Military Rd NB Off Ramp Diverge Area	Diverge[2]	C	61.7	20.5	C	61.3	24.5	4590	290							0.852	
	F2	NB I-5 from Military Rd NB Off Ramp to Military Rd NB On Ramp	Basic[2]	C	64.4	18.4	C	61.7	22.9									0.852	
	F3	NB I-5 at Military Rd NB On Ramp Merge Area	Merge[2]	C	59.5	23.3	C	59.1	26.2			780						0.852	
	F4	NB I-5 from Military Rd NB On Ramp to 188th St NB Off Ramp	Basic[2]	C	62.1	22.3	C	59.2	26.0									0.852	
	F5	NB I-5 at 188th St NB Off Ramp Diverge Area	Diverge[2]	C	62.2	22.3	D	62.5	24.6		720							0.852	
	F6	NB I-5 from 188th St NB Off Ramp to 188th St NB On Ramp	Basic[2]	C	64.4	18.3	C	62.2	22.2									0.852	
	F7	NB I-5 at 188th St NB On Ramp Merge Area	Merge[2]	D	58.1	27.5	D	58.2	29.1			1510						0.852	
	F8	NB I-5 from 188th St NB On Ramp to Southcenter Pkwy Off Ramp	Basic[2]	D	58.1	27.3	D	55.5	30.4									0.852	
	F9	NB I-5 at Southcenter Pkwy Off Ramp Diverge Area	Diverge[2]	C	61.8	25.7	C	62.1	27.2		830							0.852	
	F10	NB I-5 from Southcenter Pkwy Off Ramp to SR 518 WB/I-405 EB Off Ramp	Basic[2]	C	62.4	21.9	C	59.8	25.3									0.852	
	F11	NB I-5 at SR 518 WB/I-405 EB Off Ramp Diverge Area	Major Diverge[2,3]	C	57.1	23.9	C	57.1	26.5		2605							0.852	
	F12	NB I-5 from SR 518 WB/I-405 EB Off Ramp to I-405 WB HOV On Ramp	Basic	B	65.0	13.6	B	65.0	16.3	2435								0.852	
	F13	NB I-5 from I-405 WB HOV On Ramp to I-405 WB On Ramp	Basic	B	65.0	11.5	B	65.0	13.4	2695		(+) 405 WB to I-5 NB (HOV))						0.852	
	F14	NB I-5 at I-405 WB On Ramp Merge Area	Merge	B	60.9	17.1	B	60.5	19.6			1100	) 518 EB to I-5 NB					0.852	
	F15	NB I-5 from SR 518 EB On Ramp to Southcenter Blvd NB On Ramp	Basic (Add)[2]	B	64.7	17.6	B	64.5	18.0	5040								0.852	
	F16	NB I-5 at Southcenter Blvd NB On Ramp Merge Area	Merge[2]	C	59.8	18.1	B	59.9	17.9			990						0.852	

Note:

Distance rounded to nearest 10.

[1]- One-lane freeway mainline cannot be analyzed in HCS.

[2]- HOV lane ignored due to the analysis constraint of HCS.

[3]- A major diverge area is one in which two primary roadways, each having multiple lanes, diverge from a single freeway segment. Major Diverge type analyzed as basic segment with Major Diverge checkbox checked . For major diverge areas, a model exists for computing the average density across all approaching freeway lanes within 1,500 ft of the diverge.

[4]- WSDOT Level of Service Standard for State Routes is LOS D.

HCS Freeway Analysis Study Segments MOE - Calibrated Version
SAMP Environmental Review - Surface Transportation Analysis
Concord Engineering
1/29/2024

				2037 PA			Existing			2037 PA									
										Volume							Mainline Adjustment Factor		
Facility	ID	Study Segments	Analyzed Type	LOS	Avg Speed (S, mph)	Avg Density (D, pc/mi/ln)	LOS	Avg Speed (S, mph)	Avg Density (D, pc/mi/ln)	Mainline	Off-ramp	On-Ramp	Weaving Mnln-Mnln	Weaving Rmp-Mnln	Weaving Rmp-Rmp	Weaving Mnln-Rmp	Speed Adj. Factor	Capacity Adj. Factor	Demand Adj.Factor
Sub Area A – SR 518 EB	A1	EB SR 518 from SR 509 NB Off Ramp to DMM EB off Ramp	Weaving	C	44.4	24.4	B	56.1	13.5				1800	855	78	180		0.900	
	A2	EB SR 518 from DMM EB off Ramp to DMM Interchange	Basic	C	61.5	23.2	B	64.0	17.0	2655								0.852	
Sub Area B – SR 518 WB	B1	WB SR 518 from DMM Undercrossing to Diverge Influence Point	Basic	D	51.4	33.8	C	60.0	19.7	3370								0.852	
	B2	WB SR 518 from DMM Diverge Influence Point to SR 509 NB On Ramp	Diverge	C	50.2	35.0	B	50.5	23.6		1235							0.852	
Sub Area C – SR 518 EB /I-5 & I-405 NB	C1	EB SR 518 from 51st St Off Ramp to I-5 NB Off Ramp	Basic (Drop)	F	34.5	45.0	E	38.8	38.0	3745							0.800	0.700	1.300
	C2	EB SR 518 from I-5 NB Off Ramp to I-5 SB Off Ramp	Basic (Drop)	F	34.5	45.0	F	34.5	45.0	2383	) I-5 NB On from EB SR 518						0.800	0.700	1.300
	C3	NB I-405 from I-5 SB Off Ramp to I-5 SB On Ramp	N/A[1] (Skipped)	-	-	-	-	-	-										
	C4	NB I-405 from I-5 SB On Ramp to I-5 NB On Ramp	Basic (Add)[2]	F	44.5	45.0	F	34.5	45.0	4277	ff to I-405 NB + (+) I-5 SB to I-405 NB							0.852	1.300
	C5	NB I-405 from I-5 NB On Ramp to Southcenter Pkwy	Basic (Add)[2]	F	44.5	45.0	F	34.5	45.0	5867								0.852	1.300
Sub Area D – SR 518 WB/ I-5 & I-405 SB	D1	SB I-405 from Interurban Ave S 3-Lane Start Point to I-5 NB Off/Southcenter Off Ramp	Basic (Drop)[2]	F	34.5	45.0	F	34.5	45.0	5235							0.800	0.700	1.300
	D2	SB I-405 from I-5 NB Off Ramp to I-5 NB On Ramp	Basic	F	34.5	45.0	F	34.5	45.0	3525							0.800	0.700	1.300
	D3	SB I-405 from I-5 NB On Ramp to I-5 SB Off Ramp	Weaving	F	26.8	81.4	F	26.8	83.2				1965	1097	485	1560	0.700	0.900	1.300
	D4	WB SR 518 from I-5 SB Off Ramp to I-5 SB On Ramp	Basic	F	34.5	45.0	F	34.5	45.0	3062							0.800	0.700	1.300
	D5	WB SR 518 from I-5 SB On Ramp to 51st St On Ramp	Basic (Add)	F	34.5	45.0	F	34.5	45.0	4285	-5 + (+) I-5 SB Off to WB SR 518						0.800	0.700	1.300
Sub Area E – I-5 SB	E1	SB I-5 at Southcenter Blvd/SR 518 Off Ramp Diverge Area	Major Diverge[2,3]	F	39.0	31.5	E	39.0	35.8	8898	2193	assume same HOV vol					0.600	0.800	1.300
	E2	SB I-5 from Southcenter Blvd/SR 518 Off Ramp to I-405 NB Off Ramp	Basic (Drop)[2]	F	20.6	69.5	E	39.0	35.1	(-) I-5 SB to 405 NB							0.600	0.800	
	E3	SB I-5 from I-405 NB Off Ramp to I-405 SB On Ramp	Basic	F	20.0	71.9	E	39.0	37.4	4305	(+) 405 SB to I-5 SB						0.600	0.800	1.300
	E4	SB I-5 from I-405 SB On Ramp to Klickitat SB On Ramp	Basic (Add)[2]	F	18.0	76.8	F	27.7	49.8	5865							0.800	0.800	1.300
	E5	SB I-5 at Klickitat SB On Ramp Merge Area	Merge[2]	F	23.8	64.6	F	24.3	63.3			1301					0.800	0.800	
	E6	SB I-5 from Klickitat SB On Ramp Merge Area to 188th St SB Off Ramp Diverge Area	Basic[2]	F	39.5	45.0	F	27.4	58.7	7166							0.800	0.800	1.300
	E7	SB I-5 at 188th St SB Off Ramp Diverge Area	Diverge[2]	F	50.1	28.4	F	27.0	57.9		1360						0.800	0.800	
	E8	SB I-5 from 188th St SB Off Ramp Diverge Area to Lane Reduction Point	Basic[2]	F	51.4	26.2	F	16.5	79.5								0.800	0.800	
	E9	SB I-5 from Lane Reduction Point to 188th St SB On Ramp	Basic[2]	F	22.7	71.9	F	19.9	77.9	5806								0.852	1.300
	E10	SB I-5 at 188th St SB On Ramp Merge Area	Merge[2]	F	57.0	33.8	F	31.6	55.7			875						0.852	
	E11	SB I-5 from 188th St SB On Ramp Merge Area to 200th St SB Off Ramp Diverge Area	Overlap[2]	F	57.0	33.8	F	29.4	58.7									0.852	
	E12	SB I-5 at 200th St SB Off Ramp Diverge Area	Diverge[2]	F	59.7	31.2	F	29.4	58.7		520							0.852	
	E13	SB I-5 from 200th St SB Off Ramp to 200th St SB On Ramp	Basic[2]	F	34.4	47.5	F	23.0	70.0									0.852	
	E14	SB I-5 at 200th St SB On Ramp Merge Area	Merge[2]	F	33.0	55.1	F	31.3	58.0			580						0.852	
Sub Area F – I-5 NB	F1	NB I-5 at Military Rd NB Off Ramp Diverge Area	Diverge[2]	C	61.7	20.9	C	61.3	24.5	4675	290							0.852	
	F2	NB I-5 from Military Rd NB Off Ramp to Military Rd NB On Ramp	Basic[2]	C	64.2	18.8	C	61.7	22.9									0.852	
	F3	NB I-5 at Military Rd NB On Ramp Merge Area	Merge[2]	C	59.5	23.7	C	59.1	26.2			780						0.852	
	F4	NB I-5 from Military Rd NB On Ramp to 188th St NB Off Ramp	Basic[2]	C	61.7	22.8	C	59.2	26.0									0.852	
	F5	NB I-5 at 188th St NB Off Ramp Diverge Area	Diverge[2]	C	62.3	22.6	D	62.5	24.6		710							0.852	
	F6	NB I-5 from 188th St NB Off Ramp to 188th St NB On Ramp	Basic[2]	C	64.3	18.7	C	62.2	22.2									0.852	
	F7	NB I-5 at 188th St NB On Ramp Merge Area	Merge[2]	D	58.0	28.1	D	58.2	29.1			1530						0.852	
	F8	NB I-5 from 188th St NB On Ramp to Southcenter Pkwy Off Ramp	Basic[2]	D	57.3	28.3	D	55.5	30.4									0.852	
	F9	NB I-5 at Southcenter Pkwy Off Ramp Diverge Area	Diverge[2]	C	61.8	26.2	C	62.1	27.2		830							0.852	
	F10	NB I-5 from Southcenter Pkwy Off Ramp to SR 518 WB/I-405 EB Off Ramp	Basic[2]	C	62.0	22.5	C	59.8	25.3									0.852	
	F11	NB I-5 at SR 518 WB/I-405 EB Off Ramp Diverge Area	Major Diverge[2,3]	C	57.1	24.4	C	57.1	26.5		2687							0.852	
	F12	NB I-5 from SR 518 WB/I-405 EB Off Ramp to I-405 WB HOV On Ramp	Basic	B	65.0	13.8	B	65.0	16.3	2468								0.852	
	F13	NB I-5 from I-405 WB HOV On Ramp to I-405 WB On Ramp	Basic	B	65.0	11.7	B	65.0	13.4	2728		(+) 405 WB to I-5 NB (HOV))						0.852	
	F14	NB I-5 at I-405 WB On Ramp Merge Area	Merge	B	60.9	17.3	B	60.5	19.6			1100	(+) 518 EB to I-5 NB					0.852	
	F15	NB I-5 from SR 518 EB On Ramp to Southcenter Blvd NB On Ramp	Basic (Add)[2]	C	64.5	18.2	B	64.5	18.0	5190								0.852	
	F16	NB I-5 at Southcenter Blvd NB On Ramp Merge Area	Merge[2]	C	59.7	18.6	B	59.9	17.9			990						0.852	

Note:

Distance rounded to nearest 10.

[1]- One-lane freeway mainline cannot be analyzed in HCS.

[2]- HOV lane ignored due to the analysis constraint of HCS.

[3]- A major diverge area is one in which two primary roadways, each having multiple lanes, diverge from a single freeway segment. Major Diverge type analyzed as basic segment with Major Diverge checkbox checked . For major diverge areas, a model exists for computing the average density across all approaching freeway lanes within 1,500 ft of the diverge.

[4]- WSDOT Level of Service Standard for State Routes is LOS D.

HCS Freeway Weaving Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	A1 - EB SR 518 from SR 509 NB Off Ramp to DMM EB off Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	140	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	0.67	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten
Proportion of CAVs in Traffic Stream	0	Final Capacity Adjustment Factor (CAF)	0.900

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1645	760	64	150
Peak Hour Factor (PHF)	0.96	0.86	0.94	0.79
Total Trucks, %	2.00	3.00	0.00	0.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.980	0.971	1.000	1.000
Flow Rate (v_i), pc/h	1749	910	68	190
Weaving Flow Rate (v_W), pc/h	1100	Ideal Conditions Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	1817	Density-Based Capacity ($c_{IWL} \times N \times f_{HV}$), veh/h		5489
Total Flow Rate (v), pc/h	2917	Demand Flow-Based Capacity ($c_{IW} \times f_{HV}$), veh/h		6232
Volume Ratio (VR)	0.377	Weaving Area Capacity (c_W), veh/h		5489
Minimum Lane Change Rate (LC_{MIN}), lc/h	1100	Adjusted Weaving Area Capacity (c_{WA}), veh/h		4940
Maximum Weaving Length (L_{MAX}), ft	6424	Volume-to-Capacity Ratio (v/c)		0.58

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	17	Average Weaving Speed (S_W), mi/h	38.3
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	0	Average Non-Weaving Speed (S_{NW}), mi/h	52.4
Weaving Lane Change Rate (LC_W), lc/h	1100	Average Speed (S), mi/h	46.0
Weaving Lane Change Rate (LC_{All}), lc/h	1100	Density (D), pc/mi/ln	21.1

Weaving Intensity Factor (W)	1.149	Level of Service (LOS)	C

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	3	Segment Name	A2 - EB SR 518 from DMM EB off Ramp to DMM Interchange
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	2	Terrain Type	Level
Segment Length (L), ft	1290	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	2405	Heavy Vehicle Adjustment Factor (f_{HV})	0.980
Peak Hour Factor (PHF)	0.95	Flow Rate (v_p), pc/h/ln	1292
Total Trucks, %	2.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.65
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	63.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	20.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	B1 - WB SR 518 from DMM Undercrossing to Diverge Influence Point
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	2	Terrain Type	Level
Segment Length (L), ft	940	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	2890	Heavy Vehicle Adjustment Factor (f_{HV})	0.980
Peak Hour Factor (PHF)	0.99	Flow Rate (v_p), pc/h/ln	1490
Total Trucks, %	2.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1960
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.76
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	57.2
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	26.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	B2 - WB SR 518 from DMM Diverge Influence Point to SR 509 NB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	60.0	35.0
Segment Length (L) / Deceleration Length (LD), ft	1500	890
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor (CAF)	0.852	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	2890	1120
Peak Hour Factor (PHF)	0.98	0.95
Total Trucks, %	2.00	1.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.980	0.990
Flow Rate (v_i), pc/h	3009	1191
Capacity (c_{md}), pc/h	4600	2000
Adjusted Capacity (c_{md}), pc/h	3919	1900
Volume-to-Capacity Ratio (v/c)	0.77	0.63

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	0
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (D_S)	0.535
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	-

Distance to Downstream Ramp (L_{DOWN}), ft	-	Off-Ramp Influence Area Speed (S_R), mi/h	50.4
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	1.000	Outer Lanes Freeway Speed (S_O), mi/h	65.8
Flow in Lanes 1 and 2 (v_{12}), pc/h	3009	Ramp Junction Speed (S), mi/h	50.4
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	29.9
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	22.1

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	C1 - EB SR 518 from 51st St Off Ramp to I-5 NB Off Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	1030	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.700
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	3285	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor (PHF)	0.97	Flow Rate (v_p), pc/h/ln	1541
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1554
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.99
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	35.3
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	43.7
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	C2 - EB SR 518 from I-5 NB Off Ramp to I-5 SB Off Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	2	Terrain Type	Level
Segment Length (L), ft	650	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.700
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	2220	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor (PHF)	0.95	Flow Rate (v_p), pc/h/ln	1611
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1554
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.04
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	34.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	C4 - NB I-405 from I-5 SB On Ramp to I-5 NB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	2	Terrain Type	Level
Segment Length (L), ft	670	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	4115	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor (PHF)	0.96	Flow Rate (v_p), pc/h/ln	2955
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.48
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	44.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	C5 - NB I-405 from I-5 NB On Ramp to Southcenter Pkwy
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	1180	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	5695	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor (PHF)	0.98	Flow Rate (v_p), pc/h/ln	2671
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.33
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	44.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	D1 - SB I-405 from Interurban Ave S 3-Lane Start Point to I-5 NB Off/ Southcenter Off Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	1820	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.700
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	4805	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor (PHF)	0.99	Flow Rate (v_p), pc/h/ln	2209
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1554
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.42
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	34.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	D2 - SB I-405 from I-5 NB Off Ramp to I-5 NB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	2	Terrain Type	Level
Segment Length (L), ft	1350	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.700
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	3135	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor (PHF)	0.98	Flow Rate (v_p), pc/h/ln	2184
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1554
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.41
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	34.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Freeway Weaving Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	D3 - SB I-405 from I-5 NB On Ramp to I-5 SB Off Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	570	Number of Maneuver Lanes (N_{WL}), ln	0
Weaving Configuration	Two-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	2
Interchange Density (ID), int/mi	0.67	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.700
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten
Proportion of CAVs in Traffic Stream	0	Final Capacity Adjustment Factor (CAF)	0.900

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1755	985	478	1520
Peak Hour Factor (PHF)	0.98	0.94	0.96	0.97
Total Trucks, %	5.00	2.00	2.00	4.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.952	0.980	0.980	0.962
Flow Rate (v_i), pc/h	2445	1355	645	2118
Weaving Flow Rate (v_W), pc/h	645	Ideal Conditions Capacity (c_{IFL}), pc/h/ln		2200
Non-Weaving Flow Rate (v_{NW}), pc/h	5918	Density-Based Capacity ($c_{IWL} \times N \times f_{HV}$), veh/h		5010
Total Flow Rate (v), pc/h	6563	Demand Flow-Based Capacity ($c_{IW} \times f_{HV}$), veh/h		-
Volume Ratio (VR)	0.100	Weaving Area Capacity (c_W), veh/h		5010
Minimum Lane Change Rate (LC_{MIN}), lc/h	1289	Adjusted Weaving Area Capacity (c_{WA}), veh/h		4509
Maximum Weaving Length (L_{MAX}), ft	6672	Volume-to-Capacity Ratio (v/c)		1.00

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	225	Average Weaving Speed (S_W), mi/h	33.1
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	950	Average Non-Weaving Speed (S_{NW}), mi/h	25.7
Weaving Lane Change Rate (LC_W), lc/h	1376	Average Speed (S), mi/h	26.3
Weaving Lane Change Rate (LC_{All}), lc/h	2326	Density (D), pc/mi/ln	83.2

Weaving Intensity Factor (W)	0.685	Level of Service (LOS)	F

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	D4 - WB SR 518 from I-5 SB Off Ramp to I-5 SB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	2	Terrain Type	Level
Segment Length (L), ft	1280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.700
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	2600	Heavy Vehicle Adjustment Factor (f_{HV})	0.980
Peak Hour Factor (PHF)	0.90	Flow Rate (v_p), pc/h/ln	1916
Total Trucks, %	2.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1554
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.23
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	34.5
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	D5 - WB SR 518 from I-5 SB On Ramp to 51st St On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	760	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.700
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	3645	Heavy Vehicle Adjustment Factor (f_{HV})	0.980
Peak Hour Factor (PHF)	0.98	Flow Rate (v_p), pc/h/ln	1644
Total Trucks, %	2.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1554
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.06
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	34.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	E1 - SB I-5 at Southcenter Blvd/ SR 518 Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	6	2
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LD), ft	1500	840
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided Major Diverge

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	0.600	1.000
Demand Adjustment Factor (DAF)	1.300	1.300
Capacity Adjustment Factor (CAF)	0.800	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	8520	1985
Peak Hour Factor (PHF)	0.94	0.98
Total Trucks, %	15.00	9.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.870	0.917
Flow Rate (v_i), pc/h	13544	2871
Capacity (c_{md}), pc/h	13500	4200
Adjusted Capacity (c_{md}), pc/h	10800	3990
Volume-to-Capacity Ratio (v/c)	1.25	0.72

Density and LOS

Average Density (D), pc/mi/ln	39.5	Average Speed (S), mi/h	39.0
Density in Ramp Influence Area (D_{MD}), pc/mi/ln	39.5	Level of Service (LOS)	E

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	E2 - SB I-5 from Southcenter Blvd/SR 518 Off Ramp to I-405 NB Off Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	6	Terrain Type	Level
Segment Length (L), ft	2240	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.600
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.800
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	5940	Heavy Vehicle Adjustment Factor (f_{HV})	0.855
Peak Hour Factor (PHF)	0.98	Flow Rate (v_p), pc/h/ln	1536
Total Trucks, %	17.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1760
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.87
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	39.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	39.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	39.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	E3 - SB I-5 from I-405 NB Off Ramp to I-405 SB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	620	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.600
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.800
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	4195	Heavy Vehicle Adjustment Factor (f_{HV})	0.800
Peak Hour Factor (PHF)	0.99	Flow Rate (v_p), pc/h/ln	1722
Total Trucks, %	25.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1760
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.81
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	20.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	71.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	39.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	E4 - SB I-5 from I-405 SB On Ramp to Klickitat SB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	5	Terrain Type	Level
Segment Length (L), ft	4330	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.800
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	5715	Heavy Vehicle Adjustment Factor (f_{HV})	0.840
Peak Hour Factor (PHF)	0.97	Flow Rate (v_p), pc/h/ln	1824
Total Trucks, %	19.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1776
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.78
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	18.1
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	76.6
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	E5 - SB I-5 at Klickitat SB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA), ft	1500	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	0.800	1.000
Demand Adjustment Factor (DAF)	1.000	1.300
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.800	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	7430	1220
Peak Hour Factor (PHF)	0.97	0.92
Total Trucks, %	19.00	0.02
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.840	1.000
Flow Rate (v_i), pc/h	9119	1724
Capacity (c_{md}), pc/h	11250	2100
Adjusted Capacity (c_{md}), pc/h	9000	1995
Volume-to-Capacity Ratio (v/c)	0.85	0.86

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.495
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1986

Distance to Downstream Ramp (L_{DOWN}), ft	-	On-Ramp Influence Area Speed (S_R), mi/h	47.0
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	0.002	Outer Lanes Freeway Speed (S_O), mi/h	46.7
Flow in Lanes 1 and 2 (v_{12}), pc/h	2648	Ramp Junction Speed (S), mi/h	23.9
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	4372	Average Density (D), pc/mi/ln	64.4
Level of Service (LOS)	F	Density in Ramp Influence Area (D_R), pc/mi/ln	29.5

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	E6 - SB I-5 from Klickitat SB On Ramp Merge Area to 188th St SB Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	5	Terrain Type	Level
Segment Length (L), ft	2000	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.800
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	6935	Heavy Vehicle Adjustment Factor (f_{HV})	0.862
Peak Hour Factor (PHF)	0.98	Flow Rate (v_p), pc/h/ln	1776
Total Trucks, %	16.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1776
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.00
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	39.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	E7 - SB I-5 at 188th St SB Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LD), ft	1500	240
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	0.800	1.000
Demand Adjustment Factor (DAF)	1.000	1.300
Capacity Adjustment Factor (CAF)	0.800	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	9016	1210
Peak Hour Factor (PHF)	0.98	0.90
Total Trucks, %	16.00	9.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.862	0.917
Flow Rate (v_i), pc/h	10673	1906
Capacity (c_{md}), pc/h	11250	2100
Adjusted Capacity (c_{md}), pc/h	9000	1995
Volume-to-Capacity Ratio (v/c)	0.99	0.96

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (D_S)	0.470
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1466

Distance to Downstream Ramp (L_{DOWN}), ft	-	Off-Ramp Influence Area Speed (S_R), mi/h	47.3
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.436	Outer Lanes Freeway Speed (S_O), mi/h	55.2
Flow in Lanes 1 and 2 (v_{12}), pc/h	4172	Ramp Junction Speed (S), mi/h	50.3
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	28.2
Level of Service (LOS)	F	Density in Ramp Influence Area (D_R), pc/mi/ln	38.0

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	E9 - SB I-5 from Lane Reduction Point to 188th St SB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	2330	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	5725	Heavy Vehicle Adjustment Factor (f_{HV})	0.855
Peak Hour Factor (PHF)	0.97	Flow Rate (v_p), pc/h/ln	2243
Total Trucks, %	17.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.81
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	22.7
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	71.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	E10 - SB I-5 at 188th St SB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Acceleration Length (LA), ft	1440	520
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.300
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.852	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	7443	780
Peak Hour Factor (PHF)	0.97	0.99
Total Trucks, %	17.00	4.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.855	0.962
Flow Rate (v_i), pc/h	8973	1065
Capacity (c_{md}), pc/h	9400	2000
Adjusted Capacity (c_{md}), pc/h	8009	1900
Volume-to-Capacity Ratio (v/c)	0.93	0.56

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.438
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1957

Distance to Downstream Ramp (LDOWN), ft	2940	On-Ramp Influence Area Speed (SR), mi/h	54.9
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.085	Outer Lanes Freeway Speed (SO), mi/h	59.8
Flow in Lanes 1 and 2 (v12), pc/h	2610	Ramp Junction Speed (S), mi/h	57.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	3675	Average Density (D), pc/mi/ln	33.1
Level of Service (LOS)	F	Density in Ramp Influence Area (DR), pc/mi/ln	30.5

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	4	Segment Name	E12 - SB I-5 at 200th St SB Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Deceleration Length (LD), ft	1440	180
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.300
Capacity Adjustment Factor (CAF)	0.852	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	8457	440
Peak Hour Factor (PHF)	0.97	0.80
Total Trucks, %	15.00	4.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.870	0.962
Flow Rate (v_i), pc/h	10020	743
Capacity (c_{md}), pc/h	9400	2000
Adjusted Capacity (c_{md}), pc/h	8009	1900
Volume-to-Capacity Ratio (v/c)	0.93	0.39

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	2940	Speed Index (D_S)	0.495
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1894

Distance to Downstream Ramp (L_{DOWN}), ft	1730	Off-Ramp Influence Area Speed (S_R), mi/h	53.6
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.436	Outer Lanes Freeway Speed (S_O), mi/h	67.8
Flow in Lanes 1 and 2 (v_{12}), pc/h	3671	Ramp Junction Speed (S), mi/h	60.0
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	31.1
Level of Service (LOS)	F	Density in Ramp Influence Area (D_R), pc/mi/ln	34.2

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	6	Segment Name	E14 - SB I-5 at 200th St SB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Acceleration Length (LA), ft	1500	470
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.300
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.852	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	7885	520
Peak Hour Factor (PHF)	0.96	0.96
Total Trucks, %	14.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.877	0.980
Flow Rate (v_i), pc/h	9364	719
Capacity (c_{md}), pc/h	9400	2000
Adjusted Capacity (c_{md}), pc/h	8009	1900
Volume-to-Capacity Ratio (v/c)	0.91	0.38

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	1730	Speed Index (M_S)	0.676
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2700

Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	49.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.128	Outer Lanes Freeway Speed (SO), mi/h	56.1
Flow in Lanes 1 and 2 (v12), pc/h	3964	Ramp Junction Speed (S), mi/h	32.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	4683	Average Density (D), pc/mi/ln	56.3
Level of Service (LOS)	F	Density in Ramp Influence Area (DR), pc/mi/ln	38.8

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	F1 - NB I-5 at Military Rd NB Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Deceleration Length (L_D), ft	1500	290
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor (CAF)	1.000	0.852
Capacity Adj. Factor for CAVs, CAF_{CAV}	1.000	-

Demand and Capacity

Demand Volume (V_i), veh/h	4770	260
Peak Hour Factor (PHF)	0.97	0.93
Total Trucks, %	7.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.971
Flow Rate (v_i), pc/h	5259	288
Capacity (c_{md}), pc/h	9400	2000
Adjusted Capacity (c_{md}), pc/h	9400	1704
Volume-to-Capacity Ratio (v/c)	0.56	0.17

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (D_S)	0.454
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1402

Distance to Downstream Ramp (LDOWN), ft	900	Off-Ramp Influence Area Speed (SR), mi/h	54.6
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.436	Outer Lanes Freeway Speed (SO), mi/h	69.7
Flow in Lanes 1 and 2 (v12), pc/h	2455	Ramp Junction Speed (S), mi/h	61.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	21.3
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	22.8

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	3	Segment Name	F3 - NB I-5 at Military Rd NB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Acceleration Length (LA), ft	1500	710
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.852	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	4510	710
Peak Hour Factor (PHF)	0.97	0.97
Total Trucks, %	7.00	1.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.990
Flow Rate (v_i), pc/h	4973	739
Capacity (c_{md}), pc/h	9400	2000
Adjusted Capacity (c_{md}), pc/h	8009	1900
Volume-to-Capacity Ratio (v/c)	0.71	0.39

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	900	Speed Index (M_S)	0.331
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1492

Distance to Downstream Ramp (LDOWN), ft	5090	On-Ramp Influence Area Speed (SR), mi/h	57.4
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.125	Outer Lanes Freeway Speed (SO), mi/h	61.4
Flow in Lanes 1 and 2 (v12), pc/h	1989	Ramp Junction Speed (S), mi/h	59.4
Flow Entering Ramp-Infl. Area (vR12), pc/h	2728	Average Density (D), pc/mi/ln	24.0
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	22.0

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	5	Segment Name	F5 - NB I-5 at 188th St NB Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LD), ft	1500	180
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor (CAF)	0.852	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	5220	650
Peak Hour Factor (PHF)	0.98	0.95
Total Trucks, %	7.00	8.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.926
Flow Rate (v_i), pc/h	5697	739
Capacity (c_{md}), pc/h	9400	2100
Adjusted Capacity (c_{md}), pc/h	8009	1995
Volume-to-Capacity Ratio (v/c)	0.71	0.37

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	5090	Speed Index (D_S)	0.365
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1398

Distance to Downstream Ramp (L_{DOWN}), ft	2260	Off-Ramp Influence Area Speed (S_R), mi/h	56.6
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.436	Outer Lanes Freeway Speed (S_O), mi/h	69.8
Flow in Lanes 1 and 2 (v_{12}), pc/h	2901	Ramp Junction Speed (S), mi/h	62.4
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	22.8
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	27.6

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	7	Segment Name	F7 - NB I-5 at 188th St NB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA), ft	1500	570
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.852	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	4570	1360
Peak Hour Factor (PHF)	0.99	0.92
Total Trucks, %	7.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.980
Flow Rate (v_i), pc/h	4937	1508
Capacity (c_{md}), pc/h	9400	2100
Adjusted Capacity (c_{md}), pc/h	8009	1995
Volume-to-Capacity Ratio (v/c)	0.80	0.76

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	2260	Speed Index (M_S)	0.397
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1481

Distance to Downstream Ramp (LDOWN), ft	7350	On-Ramp Influence Area Speed (SR), mi/h	55.9
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.029	Outer Lanes Freeway Speed (SO), mi/h	61.5
Flow in Lanes 1 and 2 (v12), pc/h	1975	Ramp Junction Speed (S), mi/h	58.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	3483	Average Density (D), pc/mi/ln	27.6
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	28.4

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	9	Segment Name	F9 - NB I-5 at Southcenter Pkwy Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LD), ft	1500	840
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor (CAF)	0.852	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	5930	750
Peak Hour Factor (PHF)	0.98	0.91
Total Trucks, %	6.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.980
Flow Rate (v_i), pc/h	6417	841
Capacity (c_{md}), pc/h	9400	2100
Adjusted Capacity (c_{md}), pc/h	8009	1995
Volume-to-Capacity Ratio (v/c)	0.80	0.42

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	7350	Speed Index (D_S)	0.374
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1573

Distance to Downstream Ramp (L_{DOWN}), ft	-	Off-Ramp Influence Area Speed (S_R), mi/h	56.4
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.436	Outer Lanes Freeway Speed (S_O), mi/h	69.1
Flow in Lanes 1 and 2 (v_{12}), pc/h	3272	Ramp Junction Speed (S), mi/h	62.0
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	25.9
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	24.8

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	11	Segment Name	F11 - NB I-5 at SR 518 WB/I-405 EB Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	2
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Deceleration Length (LD), ft	1500	400
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided Major Diverge

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor (CAF)	0.852	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	5180	2565
Peak Hour Factor (PHF)	0.98	0.97
Total Trucks, %	6.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.952
Flow Rate (v_i), pc/h	5605	2778
Capacity (c_{md}), pc/h	9400	4000
Adjusted Capacity (c_{md}), pc/h	8009	3800
Volume-to-Capacity Ratio (v/c)	0.70	0.73

Density and LOS

Average Density (D), pc/mi/ln	24.5	Average Speed (S), mi/h	57.1
Density in Ramp Influence Area (D_{MD}), pc/mi/ln	24.5	Level of Service (LOS)	C

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	F12 - NB I-5 from SR 518 WB/I-405 EB Off Ramp to I-405 WB HOV On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	2130	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	2615	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.98	Flow Rate (v_p), pc/h/ln	951
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.48
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	65.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	14.6
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	F13 - NB I-5 from I-405 WB HOV On Ramp to I-405 WB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	150	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	2865	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.96	Flow Rate (v_p), pc/h/ln	798
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.40
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	65.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	12.3
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	F14 - NB I-5 at I-405 WB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	1130
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.852	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	2865	1070
Peak Hour Factor (PHF)	0.96	0.99
Total Trucks, %	7.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.952
Flow Rate (v_i), pc/h	3192	1135
Capacity (c_{md}), pc/h	9400	2100
Adjusted Capacity (c_{md}), pc/h	8009	1995
Volume-to-Capacity Ratio (v/c)	0.54	0.57

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.263
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	958

Distance to Downstream Ramp (L_{DOWN}), ft	-	On-Ramp Influence Area Speed (S_R), mi/h	59.0
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	0.356	Outer Lanes Freeway Speed (S_O), mi/h	63.4
Flow in Lanes 1 and 2 (v_{12}), pc/h	1277	Ramp Junction Speed (S), mi/h	60.9
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	2412	Average Density (D), pc/mi/ln	17.8
Level of Service (LOS)	B	Density in Ramp Influence Area (D_R), pc/mi/ln	16.8

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	F15 - NB I-5 from SR 518 EB On Ramp to Southcenter Blvd NB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	5	Terrain Type	Level
Segment Length (L), ft	700	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	5000	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1128
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.56
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	64.7
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	17.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	F16 - NB I-5 at Southcenter Blvd NB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Acceleration Length (LA), ft	1500	1070
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.852	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	5000	890
Peak Hour Factor (PHF)	0.94	0.95
Total Trucks, %	6.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.952
Flow Rate (v_i), pc/h	5641	984
Capacity (c_{md}), pc/h	11750	2000
Adjusted Capacity (c_{md}), pc/h	10011	1900
Volume-to-Capacity Ratio (v/c)	0.66	0.52

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.304
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1286

Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	58.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.095	Outer Lanes Freeway Speed (SO), mi/h	62.2
Flow in Lanes 1 and 2 (v12), pc/h	1715	Ramp Junction Speed (S), mi/h	60.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	2699	Average Density (D), pc/mi/ln	17.6
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	19.4

HCS Freeway Weaving Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	A1 - EB SR 518 from SR 509 NB Off Ramp to DMM EB off Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	140	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	0.67	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten
Proportion of CAVs in Traffic Stream	0	Final Capacity Adjustment Factor (CAF)	0.900

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1635	800	73	165
Peak Hour Factor (PHF)	0.96	0.86	0.94	0.79
Total Trucks, %	2.00	3.00	0.00	0.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.980	0.971	1.000	1.000
Flow Rate (v_i), pc/h	1738	958	78	209
Weaving Flow Rate (v_w), pc/h	1167	Ideal Conditions Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	1816	Density-Based Capacity ($c_{IWL} \times N \times f_{HV}$), veh/h		5454
Total Flow Rate (v), pc/h	2983	Demand Flow-Based Capacity ($c_{IW} \times f_{HV}$), veh/h		6009
Volume Ratio (VR)	0.391	Weaving Area Capacity (c_W), veh/h		5454
Minimum Lane Change Rate (LC_{MIN}), lc/h	1167	Adjusted Weaving Area Capacity (c_{WA}), veh/h		4909
Maximum Weaving Length (L_{MAX}), ft	6580	Volume-to-Capacity Ratio (v/c)		0.59

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	17	Average Weaving Speed (S_W), mi/h	37.7
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	0	Average Non-Weaving Speed (S_{NW}), mi/h	51.8
Weaving Lane Change Rate (LC_W), lc/h	1167	Average Speed (S), mi/h	45.2

Weaving Lane Change Rate (LC_{All}), lc/h	1167	Density (D), pc/mi/ln	22.0
Weaving Intensity Factor (W)	1.204	Level of Service (LOS)	C

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	3	Segment Name	A2 - EB SR 518 from DMM EB off Ramp to DMM Interchange
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	2	Terrain Type	Level
Segment Length (L), ft	1290	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	0.33
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	2435	Heavy Vehicle Adjustment Factor (f_{HV})	0.980
Peak Hour Factor (PHF)	0.95	Flow Rate (v_p), pc/h/ln	1308
Total Trucks, %	2.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.65
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	62.9
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	20.7
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	B1 - WB SR 518 from DMM Undercrossing to Diverge Influence Point
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	2	Terrain Type	Level
Segment Length (L), ft	940	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	3022	Heavy Vehicle Adjustment Factor (f_{HV})	0.980
Peak Hour Factor (PHF)	0.99	Flow Rate (v_p), pc/h/ln	1558
Total Trucks, %	2.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1960
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.79
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	55.9
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	27.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	B2 - WB SR 518 from DMM Diverge Influence Point to SR 509 NB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	60.0	35.0
Segment Length (L) / Deceleration Length (LD), ft	1500	890
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor (CAF)	0.852	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	3022	1115
Peak Hour Factor (PHF)	0.98	0.95
Total Trucks, %	2.00	1.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.980	0.990
Flow Rate (v_i), pc/h	3147	1186
Capacity (c_{md}), pc/h	4600	2000
Adjusted Capacity (c_{md}), pc/h	3919	1900
Volume-to-Capacity Ratio (v/c)	0.80	0.62

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	0
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (D_S)	0.535
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	-

Distance to Downstream Ramp (L_{DOWN}), ft	-	Off-Ramp Influence Area Speed (S_R), mi/h	50.4
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	1.000	Outer Lanes Freeway Speed (S_O), mi/h	65.8
Flow in Lanes 1 and 2 (v_{12}), pc/h	3147	Ramp Junction Speed (S), mi/h	50.4
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	31.2
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	23.3

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	C1 - EB SR 518 from 51st St Off Ramp to I-5 NB Off Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	1030	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.700
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	3355	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor (PHF)	0.97	Flow Rate (v_p), pc/h/ln	1575
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1554
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.01
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	34.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	C2 - EB SR 518 from I-5 NB Off Ramp to I-5 SB Off Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	2	Terrain Type	Level
Segment Length (L), ft	650	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.700
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	2219	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor (PHF)	0.95	Flow Rate (v_p), pc/h/ln	1610
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1554
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.04
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	34.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	C4 - NB I-405 from I-5 SB On Ramp to I-5 NB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	2	Terrain Type	Level
Segment Length (L), ft	670	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	4155	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor (PHF)	0.96	Flow Rate (v_p), pc/h/ln	2984
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.49
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	44.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	C5 - NB I-405 from I-5 NB On Ramp to Southcenter Pkwy
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	1180	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	5735	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor (PHF)	0.98	Flow Rate (v_p), pc/h/ln	2689
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.34
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	44.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	D1 - SB I-405 from Interurban Ave S 3-Lane Start Point to I-5 NB Off/ Southcenter Off Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	1820	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.700
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	4848	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor (PHF)	0.99	Flow Rate (v_p), pc/h/ln	2229
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1554
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.43
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	34.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	D2 - SB I-405 from I-5 NB Off Ramp to I-5 NB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	2	Terrain Type	Level
Segment Length (L), ft	1350	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.700
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	3178	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor (PHF)	0.98	Flow Rate (v_p), pc/h/ln	2214
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1554
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.42
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	34.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Freeway Weaving Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	D3 - SB I-405 from I-5 NB On Ramp to I-5 SB Off Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	570	Number of Maneuver Lanes (N_{WL}), ln	0
Weaving Configuration	Two-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	2
Interchange Density (ID), int/mi	0.67	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.700
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten
Proportion of CAVs in Traffic Stream	0	Final Capacity Adjustment Factor (CAF)	0.900

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1755	1061	507	1520
Peak Hour Factor (PHF)	0.98	0.94	0.96	0.97
Total Trucks, %	5.00	2.00	2.00	4.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.952	0.980	0.980	0.962
Flow Rate (v_i), pc/h	2445	1362	638	2118
Weaving Flow Rate (v_w), pc/h	638	Ideal Conditions Capacity (c_{IFL}), pc/h/ln		2200
Non-Weaving Flow Rate (v_{NW}), pc/h	5925	Density-Based Capacity ($c_{IWL} \times N \times f_{HV}$), veh/h		5003
Total Flow Rate (v), pc/h	6563	Demand Flow-Based Capacity ($c_{IW} \times f_{HV}$), veh/h		-
Volume Ratio (VR)	0.104	Weaving Area Capacity (c_W), veh/h		5003
Minimum Lane Change Rate (LC_{MIN}), lc/h	1276	Adjusted Weaving Area Capacity (c_{WA}), veh/h		4503
Maximum Weaving Length (L_{MAX}), ft	6710	Volume-to-Capacity Ratio (v/c)		1.00

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	225	Average Weaving Speed (S_W), mi/h	33.1
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	952	Average Non-Weaving Speed (S_{NW}), mi/h	25.8
Weaving Lane Change Rate (LC_W), lc/h	1363	Average Speed (S), mi/h	26.4

Weaving Lane Change Rate (LC_{All}), lc/h	2315	Density (D), pc/mi/ln	82.9
Weaving Intensity Factor (W)	0.683	Level of Service (LOS)	F

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	D4 - WB SR 518 from I-5 SB Off Ramp to I-5 SB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	2	Terrain Type	Level
Segment Length (L), ft	1280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.700
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	2719	Heavy Vehicle Adjustment Factor (f_{HV})	0.980
Peak Hour Factor (PHF)	0.90	Flow Rate (v_p), pc/h/ln	2004
Total Trucks, %	2.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1554
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.29
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	34.5
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	D5 - WB SR 518 from I-5 SB On Ramp to 51st St On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	760	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.700
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	3832	Heavy Vehicle Adjustment Factor (f_{HV})	0.980
Peak Hour Factor (PHF)	0.98	Flow Rate (v_p), pc/h/ln	1729
Total Trucks, %	2.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1554
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.11
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	34.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	E1 - SB I-5 at Southcenter Blvd/ SR 518 Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	6	2
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LD), ft	1500	840
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided Major Diverge

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	0.600	1.000
Demand Adjustment Factor (DAF)	1.300	1.300
Capacity Adjustment Factor (CAF)	0.800	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	8618	2053
Peak Hour Factor (PHF)	0.94	0.98
Total Trucks, %	15.00	9.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.870	0.917
Flow Rate (v_i), pc/h	13699	2970
Capacity (c_{md}), pc/h	13500	4200
Adjusted Capacity (c_{md}), pc/h	10800	3990
Volume-to-Capacity Ratio (v/c)	1.27	0.74

Density and LOS

Average Density (D), pc/mi/ln	40.0	Average Speed (S), mi/h	39.0
Density in Ramp Influence Area (D_{MD}), pc/mi/ln	40.0	Level of Service (LOS)	E

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	E2 - SB I-5 from Southcenter Blvd/SR 518 Off Ramp to I-405 NB Off Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	6	Terrain Type	Level
Segment Length (L), ft	2240	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.600
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.800
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	5949	Heavy Vehicle Adjustment Factor (f_{HV})	0.855
Peak Hour Factor (PHF)	0.98	Flow Rate (v_p), pc/h/ln	1538
Total Trucks, %	17.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1760
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.87
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	39.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	39.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	39.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	E3 - SB I-5 from I-405 NB Off Ramp to I-405 SB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	620	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.600
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.800
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	4225	Heavy Vehicle Adjustment Factor (f_{HV})	0.800
Peak Hour Factor (PHF)	0.99	Flow Rate (v_p), pc/h/ln	1734
Total Trucks, %	25.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1760
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.81
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	20.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	71.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	39.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	E4 - SB I-5 from I-405 SB On Ramp to Klickitat SB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	5	Terrain Type	Level
Segment Length (L), ft	4330	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.800
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	5745	Heavy Vehicle Adjustment Factor (f_{HV})	0.840
Peak Hour Factor (PHF)	0.97	Flow Rate (v_p), pc/h/ln	1833
Total Trucks, %	19.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1776
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.78
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	18.1
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	76.6
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	E5 - SB I-5 at Klickitat SB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	0.800	1.000
Demand Adjustment Factor (DAF)	1.000	1.300
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.800	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	7469	1179
Peak Hour Factor (PHF)	0.97	0.92
Total Trucks, %	19.00	0.02
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.840	1.000
Flow Rate (v_i), pc/h	9165	1666
Capacity (c_{md}), pc/h	11250	2100
Adjusted Capacity (c_{md}), pc/h	9000	1995
Volume-to-Capacity Ratio (v/c)	0.85	0.84

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.483
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2000

Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	47.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.010	Outer Lanes Freeway Speed (SO), mi/h	46.6
Flow in Lanes 1 and 2 (v12), pc/h	2666	Ramp Junction Speed (S), mi/h	23.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	4332	Average Density (D), pc/mi/ln	64.4
Level of Service (LOS)	F	Density in Ramp Influence Area (DR), pc/mi/ln	29.2

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	E6 - SB I-5 from Klickitat SB On Ramp Merge Area to 188th St SB Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	5	Terrain Type	Level
Segment Length (L), ft	2000	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.800
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	6924	Heavy Vehicle Adjustment Factor (f_{HV})	0.862
Peak Hour Factor (PHF)	0.98	Flow Rate (v_p), pc/h/ln	1776
Total Trucks, %	16.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1776
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.00
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	39.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	E7 - SB I-5 at 188th St SB Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LD), ft	1500	240
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	0.800	1.000
Demand Adjustment Factor (DAF)	1.000	1.300
Capacity Adjustment Factor (CAF)	0.800	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	9001	1220
Peak Hour Factor (PHF)	0.98	0.90
Total Trucks, %	16.00	9.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.862	0.917
Flow Rate (v_i), pc/h	10655	1922
Capacity (c_{md}), pc/h	11250	2100
Adjusted Capacity (c_{md}), pc/h	9000	1995
Volume-to-Capacity Ratio (v/c)	0.99	0.96

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (D_S)	0.471
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1462

Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	47.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.436	Outer Lanes Freeway Speed (SO), mi/h	55.2
Flow in Lanes 1 and 2 (v12), pc/h	4181	Ramp Junction Speed (S), mi/h	50.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	28.2
Level of Service (LOS)	F	Density in Ramp Influence Area (DR), pc/mi/ln	38.0

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	E9 - SB I-5 from Lane Reduction Point to 188th St SB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	2330	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	5704	Heavy Vehicle Adjustment Factor (f_{HV})	0.855
Peak Hour Factor (PHF)	0.97	Flow Rate (v_p), pc/h/ln	2235
Total Trucks, %	17.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.81
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	22.7
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	71.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	E10 - SB I-5 at 188th St SB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Acceleration Length (L_A), ft	1440	520
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.300
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.852	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	7415	785
Peak Hour Factor (PHF)	0.97	0.99
Total Trucks, %	17.00	4.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.855	0.962
Flow Rate (v_i), pc/h	8941	1071
Capacity (c_{md}), pc/h	9400	2000
Adjusted Capacity (c_{md}), pc/h	8009	1900
Volume-to-Capacity Ratio (v/c)	0.93	0.56

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.439
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1957

Distance to Downstream Ramp (LDOWN), ft	2940	On-Ramp Influence Area Speed (SR), mi/h	54.9
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.084	Outer Lanes Freeway Speed (SO), mi/h	59.8
Flow in Lanes 1 and 2 (v12), pc/h	2610	Ramp Junction Speed (S), mi/h	57.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	3681	Average Density (D), pc/mi/ln	33.1
Level of Service (LOS)	F	Density in Ramp Influence Area (DR), pc/mi/ln	30.5

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	4	Segment Name	E12 - SB I-5 at 200th St SB Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Deceleration Length (LD), ft	1440	180
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.300
Capacity Adjustment Factor (CAF)	0.852	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	8436	455
Peak Hour Factor (PHF)	0.97	0.80
Total Trucks, %	15.00	4.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.870	0.962
Flow Rate (v_i), pc/h	9996	769
Capacity (c_{md}), pc/h	9400	2000
Adjusted Capacity (c_{md}), pc/h	8009	1900
Volume-to-Capacity Ratio (v/c)	0.93	0.40

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	2940	Speed Index (D_S)	0.497
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1887

Distance to Downstream Ramp (LDOWN), ft	1730	Off-Ramp Influence Area Speed (SR), mi/h	53.6
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.436	Outer Lanes Freeway Speed (SO), mi/h	67.8
Flow in Lanes 1 and 2 (v12), pc/h	3685	Ramp Junction Speed (S), mi/h	60.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	31.1
Level of Service (LOS)	F	Density in Ramp Influence Area (DR), pc/mi/ln	34.3

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	6	Segment Name	E14 - SB I-5 at 200th St SB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	470
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.300
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.852	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	7844	520
Peak Hour Factor (PHF)	0.96	0.96
Total Trucks, %	14.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.877	0.980
Flow Rate (v_i), pc/h	9317	719
Capacity (c_{md}), pc/h	9400	2000
Adjusted Capacity (c_{md}), pc/h	8009	1900
Volume-to-Capacity Ratio (v/c)	0.91	0.38

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	1730	Speed Index (M_S)	0.676
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2700

Distance to Downstream Ramp (L_{DOWN}), ft	-	On-Ramp Influence Area Speed (S_R), mi/h	49.5
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	0.128	Outer Lanes Freeway Speed (S_O), mi/h	56.1
Flow in Lanes 1 and 2 (v_{12}), pc/h	3917	Ramp Junction Speed (S), mi/h	32.5
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	4636	Average Density (D), pc/mi/ln	55.8
Level of Service (LOS)	F	Density in Ramp Influence Area (D_R), pc/mi/ln	38.4

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	F1 - NB I-5 at Military Rd NB Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Deceleration Length (LD), ft	1500	290
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor (CAF)	1.000	0.852
Capacity Adj. Factor for CAVs, CAF_{CAV}	1.000	-

Demand and Capacity

Demand Volume (V_i), veh/h	4854	260
Peak Hour Factor (PHF)	0.97	0.93
Total Trucks, %	7.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.971
Flow Rate (v_i), pc/h	5352	288
Capacity (c_{md}), pc/h	9400	2000
Adjusted Capacity (c_{md}), pc/h	9400	1704
Volume-to-Capacity Ratio (v/c)	0.57	0.17

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (D_S)	0.454
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1428

Distance to Downstream Ramp (LDOWN), ft	900	Off-Ramp Influence Area Speed (SR), mi/h	54.6
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.436	Outer Lanes Freeway Speed (SO), mi/h	69.6
Flow in Lanes 1 and 2 (v12), pc/h	2496	Ramp Junction Speed (S), mi/h	61.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	21.7
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	23.1

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	3	Segment Name	F3 - NB I-5 at Military Rd NB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	710
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.852	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	4594	710
Peak Hour Factor (PHF)	0.97	0.97
Total Trucks, %	7.00	1.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.990
Flow Rate (v_i), pc/h	5065	739
Capacity (c_{md}), pc/h	9400	2000
Adjusted Capacity (c_{md}), pc/h	8009	1900
Volume-to-Capacity Ratio (v/c)	0.72	0.39

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	900	Speed Index (M_S)	0.333
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1520

Distance to Downstream Ramp (LDOWN), ft	5090	On-Ramp Influence Area Speed (SR), mi/h	57.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.125	Outer Lanes Freeway Speed (SO), mi/h	61.3
Flow in Lanes 1 and 2 (v12), pc/h	2026	Ramp Junction Speed (S), mi/h	59.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	2765	Average Density (D), pc/mi/ln	24.5
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	22.3

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	5	Segment Name	F5 - NB I-5 at 188th St NB Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (L_D), ft	1500	180
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor (CAF)	0.852	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	5304	640
Peak Hour Factor (PHF)	0.98	0.95
Total Trucks, %	7.00	8.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.926
Flow Rate (v_i), pc/h	5788	728
Capacity (c_{md}), pc/h	9400	2100
Adjusted Capacity (c_{md}), pc/h	8009	1995
Volume-to-Capacity Ratio (v/c)	0.72	0.36

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	5090	Speed Index (D_S)	0.364
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1427

Distance to Downstream Ramp (L_{DOWN}), ft	2260	Off-Ramp Influence Area Speed (S_R), mi/h	56.6
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.436	Outer Lanes Freeway Speed (S_O), mi/h	69.6
Flow in Lanes 1 and 2 (v_{12}), pc/h	2934	Ramp Junction Speed (S), mi/h	62.3
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	23.2
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	27.9

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	7	Segment Name	F7 - NB I-5 at 188th St NB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	570
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.852	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	4664	1375
Peak Hour Factor (PHF)	0.99	0.92
Total Trucks, %	7.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.980
Flow Rate (v_i), pc/h	5039	1525
Capacity (c_{md}), pc/h	9400	2100
Adjusted Capacity (c_{md}), pc/h	8009	1995
Volume-to-Capacity Ratio (v/c)	0.82	0.76

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	2260	Speed Index (M_S)	0.404
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1512

Distance to Downstream Ramp (LDOWN), ft	7350	On-Ramp Influence Area Speed (SR), mi/h	55.7
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.027	Outer Lanes Freeway Speed (SO), mi/h	61.4
Flow in Lanes 1 and 2 (v12), pc/h	2016	Ramp Junction Speed (S), mi/h	58.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	3541	Average Density (D), pc/mi/ln	28.2
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	28.9

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	9	Segment Name	F9 - NB I-5 at Southcenter Pkwy Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LD), ft	1500	840
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor (CAF)	0.852	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	6039	750
Peak Hour Factor (PHF)	0.98	0.91
Total Trucks, %	6.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.980
Flow Rate (v_i), pc/h	6535	841
Capacity (c_{md}), pc/h	9400	2100
Adjusted Capacity (c_{md}), pc/h	8009	1995
Volume-to-Capacity Ratio (v/c)	0.82	0.42

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	7350	Speed Index (D_S)	0.374
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1606

Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	56.4
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.436	Outer Lanes Freeway Speed (SO), mi/h	68.9
Flow in Lanes 1 and 2 (v12), pc/h	3324	Ramp Junction Speed (S), mi/h	61.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	26.4
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	25.3

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	11	Segment Name	F11 - NB I-5 at SR 518 WB/I-405 EB Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	2
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Deceleration Length (LD), ft	1500	400
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided Major Diverge

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor (CAF)	0.852	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	5289	2641
Peak Hour Factor (PHF)	0.98	0.97
Total Trucks, %	6.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.952
Flow Rate (v_i), pc/h	5723	2860
Capacity (c_{md}), pc/h	9400	4000
Adjusted Capacity (c_{md}), pc/h	8009	3800
Volume-to-Capacity Ratio (v/c)	0.71	0.75

Density and LOS

Average Density (D), pc/mi/ln	25.0	Average Speed (S), mi/h	57.1
Density in Ramp Influence Area (D_{MD}), pc/mi/ln	25.0	Level of Service (LOS)	C

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	F12 - NB I-5 from SR 518 WB/I-405 EB Off Ramp to I-405 WB HOV On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	2130	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	2648	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.98	Flow Rate (v_p), pc/h/ln	963
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.48
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	65.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	14.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	F13 - NB I-5 from I-405 WB HOV On Ramp to I-405 WB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	150	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	2898	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.96	Flow Rate (v_p), pc/h/ln	807
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.40
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	65.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	12.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	F14 - NB I-5 at I-405 WB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	1130
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.852	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	2898	1070
Peak Hour Factor (PHF)	0.96	0.99
Total Trucks, %	7.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.952
Flow Rate (v_i), pc/h	3229	1135
Capacity (c_{md}), pc/h	9400	2100
Adjusted Capacity (c_{md}), pc/h	8009	1995
Volume-to-Capacity Ratio (v/c)	0.54	0.57

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.263
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	969

Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	59.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.356	Outer Lanes Freeway Speed (SO), mi/h	63.3
Flow in Lanes 1 and 2 (v12), pc/h	1292	Ramp Junction Speed (S), mi/h	60.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	2427	Average Density (D), pc/mi/ln	17.9
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	16.9

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	F15 - NB I-5 from SR 518 EB On Ramp to Southcenter Blvd NB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	5	Terrain Type	Level
Segment Length (L), ft	700	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	5104	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1152
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.58
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	64.6
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	17.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2032 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	F16 - NB I-5 at Southcenter Blvd NB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	1070
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.852	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	5104	890
Peak Hour Factor (PHF)	0.94	0.95
Total Trucks, %	6.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.952
Flow Rate (v_i), pc/h	5758	984
Capacity (c_{md}), pc/h	11750	2000
Adjusted Capacity (c_{md}), pc/h	10011	1900
Volume-to-Capacity Ratio (v/c)	0.67	0.52

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.306
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1313

Distance to Downstream Ramp (L_{DOWN}), ft	-	On-Ramp Influence Area Speed (S_R), mi/h	58.0
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	0.095	Outer Lanes Freeway Speed (S_O), mi/h	62.1
Flow in Lanes 1 and 2 (v_{12}), pc/h	1750	Ramp Junction Speed (S), mi/h	59.9
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	2734	Average Density (D), pc/mi/ln	17.9
Level of Service (LOS)	B	Density in Ramp Influence Area (D_R), pc/mi/ln	19.7

HCS Freeway Weaving Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	A1 - EB SR 518 from SR 509 NB Off Ramp to DMM EB off Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	140	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	0.67	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten
Proportion of CAVs in Traffic Stream	0	Final Capacity Adjustment Factor (CAF)	0.900

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1780	800	66	160
Peak Hour Factor (PHF)	0.96	0.86	0.94	0.79
Total Trucks, %	2.00	3.00	0.00	0.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.980	0.971	1.000	1.000
Flow Rate (v_i), pc/h	1892	958	70	203
Weaving Flow Rate (v_W), pc/h	1161	Ideal Conditions Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	1962	Density-Based Capacity ($c_{IWL} \times N \times f_{HV}$), veh/h		5501
Total Flow Rate (v), pc/h	3123	Demand Flow-Based Capacity ($c_{IW} \times f_{HV}$), veh/h		6316
Volume Ratio (VR)	0.372	Weaving Area Capacity (c_W), veh/h		5501
Minimum Lane Change Rate (LC_{MIN}), lc/h	1161	Adjusted Weaving Area Capacity (c_{WA}), veh/h		4951
Maximum Weaving Length (L_{MAX}), ft	6369	Volume-to-Capacity Ratio (v/c)		0.62

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	18	Average Weaving Speed (S_W), mi/h	37.7
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	0	Average Non-Weaving Speed (S_{NW}), mi/h	51.6
Weaving Lane Change Rate (LC_W), lc/h	1161	Average Speed (S), mi/h	45.4
Weaving Lane Change Rate (LC_{All}), lc/h	1161	Density (D), pc/mi/ln	22.9

Weaving Intensity Factor (W)	1.199	Level of Service (LOS)	C

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	3	Segment Name	A2 - EB SR 518 from DMM EB off Ramp to DMM Interchange
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	2	Terrain Type	Level
Segment Length (L), ft	1290	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	0.33
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	2580	Heavy Vehicle Adjustment Factor (f_{HV})	0.980
Peak Hour Factor (PHF)	0.95	Flow Rate (v_p), pc/h/ln	1386
Total Trucks, %	2.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.69
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	62.1
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	22.3
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	B1 - WB SR 518 from DMM Undercrossing to Diverge Influence Point
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	2	Terrain Type	Level
Segment Length (L), ft	940	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	3190	Heavy Vehicle Adjustment Factor (f_{HV})	0.980
Peak Hour Factor (PHF)	0.99	Flow Rate (v_p), pc/h/ln	1644
Total Trucks, %	2.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1960
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.84
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	54.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	30.4
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	B2 - WB SR 518 from DMM Diverge Influence Point to SR 509 NB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	60.0	35.0
Segment Length (L) / Deceleration Length (LD), ft	1500	890
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor (CAF)	0.852	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	3190	1210
Peak Hour Factor (PHF)	0.98	0.95
Total Trucks, %	2.00	1.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.980	0.990
Flow Rate (v_i), pc/h	3322	1287
Capacity (c_{md}), pc/h	4600	2000
Adjusted Capacity (c_{md}), pc/h	3919	1900
Volume-to-Capacity Ratio (v/c)	0.85	0.68

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	0
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (D_S)	0.544
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	-

Distance to Downstream Ramp (L_{DOWN}), ft	-	Off-Ramp Influence Area Speed (S_R), mi/h	50.2
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	1.000	Outer Lanes Freeway Speed (S_O), mi/h	65.8
Flow in Lanes 1 and 2 (v_{12}), pc/h	3322	Ramp Junction Speed (S), mi/h	50.2
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	33.1
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	24.8

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	C1 - EB SR 518 from 51st St Off Ramp to I-5 NB Off Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	1030	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.700
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	3580	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor (PHF)	0.97	Flow Rate (v_p), pc/h/ln	1680
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1554
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.08
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	34.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	C2 - EB SR 518 from I-5 NB Off Ramp to I-5 SB Off Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	2	Terrain Type	Level
Segment Length (L), ft	650	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.700
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	2335	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor (PHF)	0.95	Flow Rate (v_p), pc/h/ln	1694
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1554
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.09
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	34.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	C4 - NB I-405 from I-5 SB On Ramp to I-5 NB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	2	Terrain Type	Level
Segment Length (L), ft	670	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	4210	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor (PHF)	0.96	Flow Rate (v_p), pc/h/ln	3023
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.51
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	44.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	C5 - NB I-405 from I-5 NB On Ramp to Southcenter Pkwy
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	1180	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	5800	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor (PHF)	0.98	Flow Rate (v_p), pc/h/ln	2720
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.36
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	44.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	D1 - SB I-405 from Interurban Ave S 3-Lane Start Point to I-5 NB Off/ Southcenter Off Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	1820	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.700
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	5145	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor (PHF)	0.99	Flow Rate (v_p), pc/h/ln	2365
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1554
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.52
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	34.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	D2 - SB I-405 from I-5 NB Off Ramp to I-5 NB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	2	Terrain Type	Level
Segment Length (L), ft	1350	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.700
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	3435	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor (PHF)	0.98	Flow Rate (v_p), pc/h/ln	2394
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1554
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.54
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	34.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Freeway Weaving Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	D3 - SB I-405 from I-5 NB On Ramp to I-5 SB Off Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	570	Number of Maneuver Lanes (N_{WL}), ln	0
Weaving Configuration	Two-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	2
Interchange Density (ID), int/mi	0.67	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.700
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten
Proportion of CAVs in Traffic Stream	0	Final Capacity Adjustment Factor (CAF)	0.900

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1703	1015	461	1560
Peak Hour Factor (PHF)	0.98	0.94	0.96	0.97
Total Trucks, %	5.00	2.00	2.00	4.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.952	0.980	0.980	0.962
Flow Rate (v_i), pc/h	2373	1384	616	2173
Weaving Flow Rate (v_W), pc/h	616	Ideal Conditions Capacity (c_{IFL}), pc/h/ln		2200
Non-Weaving Flow Rate (v_{NW}), pc/h	5930	Density-Based Capacity ($c_{IWL} \times N \times f_{HV}$), veh/h		5020
Total Flow Rate (v), pc/h	6546	Demand Flow-Based Capacity ($c_{IW} \times f_{HV}$), veh/h		-
Volume Ratio (VR)	0.096	Weaving Area Capacity (c_W), veh/h		5020
Minimum Lane Change Rate (LC_{MIN}), lc/h	1232	Adjusted Weaving Area Capacity (c_{WA}), veh/h		4518
Maximum Weaving Length (L_{MAX}), ft	6633	Volume-to-Capacity Ratio (v/c)		1.00

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	225	Average Weaving Speed (S_W), mi/h	33.2
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	953	Average Non-Weaving Speed (S_{NW}), mi/h	26.2
Weaving Lane Change Rate (LC_W), lc/h	1319	Average Speed (S), mi/h	26.7
Weaving Lane Change Rate (LC_{All}), lc/h	2272	Density (D), pc/mi/ln	81.7

Weaving Intensity Factor (W)	0.673	Level of Service (LOS)	F

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	D4 - WB SR 518 from I-5 SB Off Ramp to I-5 SB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	2	Terrain Type	Level
Segment Length (L), ft	1280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.700
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	2890	Heavy Vehicle Adjustment Factor (f_{HV})	0.980
Peak Hour Factor (PHF)	0.90	Flow Rate (v_p), pc/h/ln	2130
Total Trucks, %	2.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1554
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.37
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	34.5
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	D5 - WB SR 518 from I-5 SB On Ramp to 51st St On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	760	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.700
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	3995	Heavy Vehicle Adjustment Factor (f_{HV})	0.980
Peak Hour Factor (PHF)	0.98	Flow Rate (v_p), pc/h/ln	1803
Total Trucks, %	2.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1554
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.16
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	34.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	E1 - SB I-5 at Southcenter Blvd/ SR 518 Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	6	2
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LD), ft	1500	840
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided Major Diverge

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	0.600	1.000
Demand Adjustment Factor (DAF)	1.300	1.300
Capacity Adjustment Factor (CAF)	0.800	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	8750	2075
Peak Hour Factor (PHF)	0.94	0.98
Total Trucks, %	15.00	9.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.870	0.917
Flow Rate (v_i), pc/h	13909	3002
Capacity (c_{md}), pc/h	13500	4200
Adjusted Capacity (c_{md}), pc/h	10800	3990
Volume-to-Capacity Ratio (v/c)	1.29	0.75

Density and LOS

Average Density (D), pc/mi/ln	40.6	Average Speed (S), mi/h	39.0
Density in Ramp Influence Area (D_{MD}), pc/mi/ln	40.6	Level of Service (LOS)	E

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	E2 - SB I-5 from Southcenter Blvd/SR 518 Off Ramp to I-405 NB Off Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	6	Terrain Type	Level
Segment Length (L), ft	2240	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.600
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.800
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	6053	Heavy Vehicle Adjustment Factor (f_{HV})	0.855
Peak Hour Factor (PHF)	0.98	Flow Rate (v_p), pc/h/ln	1565
Total Trucks, %	17.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1760
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.89
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	39.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	40.1
Total Ramp Density Adjustment	-	Level of Service (LOS)	E
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	39.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	E3 - SB I-5 from I-405 NB Off Ramp to I-405 SB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	620	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.600
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.800
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	4275	Heavy Vehicle Adjustment Factor (f_{HV})	0.800
Peak Hour Factor (PHF)	0.99	Flow Rate (v_p), pc/h/ln	1754
Total Trucks, %	25.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1760
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.81
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	20.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	71.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	39.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	E4 - SB I-5 from I-405 SB On Ramp to Klickitat SB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	5	Terrain Type	Level
Segment Length (L), ft	4330	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.800
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	5835	Heavy Vehicle Adjustment Factor (f_{HV})	0.840
Peak Hour Factor (PHF)	0.97	Flow Rate (v_p), pc/h/ln	1862
Total Trucks, %	19.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1776
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.78
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	18.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	76.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	E5 - SB I-5 at Klickitat SB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	0.800	1.000
Demand Adjustment Factor (DAF)	1.000	1.300
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.800	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	7586	1320
Peak Hour Factor (PHF)	0.97	0.92
Total Trucks, %	19.00	0.02
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.840	1.000
Flow Rate (v_i), pc/h	9310	1865
Capacity (c_{md}), pc/h	11250	2100
Adjusted Capacity (c_{md}), pc/h	9000	1995
Volume-to-Capacity Ratio (v/c)	0.85	0.93

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.570
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2043

Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	46.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.000	Outer Lanes Freeway Speed (SO), mi/h	46.4
Flow in Lanes 1 and 2 (v12), pc/h	2724	Ramp Junction Speed (S), mi/h	23.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	4589	Average Density (D), pc/mi/ln	64.6
Level of Service (LOS)	F	Density in Ramp Influence Area (DR), pc/mi/ln	31.1

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	E6 - SB I-5 from Klickitat SB On Ramp Merge Area to 188th St SB Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	5	Terrain Type	Level
Segment Length (L), ft	2000	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.800
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	7155	Heavy Vehicle Adjustment Factor (f_{HV})	0.862
Peak Hour Factor (PHF)	0.98	Flow Rate (v_p), pc/h/ln	1776
Total Trucks, %	16.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1776
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.00
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	39.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	E7 - SB I-5 at 188th St SB Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LD), ft	1500	240
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	0.800	1.000
Demand Adjustment Factor (DAF)	1.000	1.300
Capacity Adjustment Factor (CAF)	0.800	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	9302	1350
Peak Hour Factor (PHF)	0.98	0.90
Total Trucks, %	16.00	9.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.862	0.917
Flow Rate (v_i), pc/h	11011	2126
Capacity (c_{md}), pc/h	11250	2100
Adjusted Capacity (c_{md}), pc/h	9000	1995
Volume-to-Capacity Ratio (v/c)	0.99	1.07

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (D_S)	0.489
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1404

Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	47.1
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.436	Outer Lanes Freeway Speed (SO), mi/h	55.5
Flow in Lanes 1 and 2 (v12), pc/h	4296	Ramp Junction Speed (S), mi/h	50.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	28.4
Level of Service (LOS)	F	Density in Ramp Influence Area (DR), pc/mi/ln	39.0

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	E9 - SB I-5 from Lane Reduction Point to 188th St SB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	2330	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	5805	Heavy Vehicle Adjustment Factor (f_{HV})	0.855
Peak Hour Factor (PHF)	0.97	Flow Rate (v_p), pc/h/ln	2275
Total Trucks, %	17.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.81
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	22.7
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	71.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	E10 - SB I-5 at 188th St SB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Acceleration Length (LA), ft	1440	520
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.300
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.852	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	7547	870
Peak Hour Factor (PHF)	0.97	0.99
Total Trucks, %	17.00	4.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.855	0.962
Flow Rate (v_i), pc/h	9099	1188
Capacity (c_{md}), pc/h	9400	2000
Adjusted Capacity (c_{md}), pc/h	8009	1900
Volume-to-Capacity Ratio (v/c)	0.93	0.63

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.458
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1957

Distance to Downstream Ramp (L_{DOWN}), ft	2940	On-Ramp Influence Area Speed (S_R), mi/h	54.5
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	0.069	Outer Lanes Freeway Speed (S_O), mi/h	59.8
Flow in Lanes 1 and 2 (v_{12}), pc/h	2609	Ramp Junction Speed (S), mi/h	57.1
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	3797	Average Density (D), pc/mi/ln	33.8
Level of Service (LOS)	F	Density in Ramp Influence Area (D_R), pc/mi/ln	31.4

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	4	Segment Name	E12 - SB I-5 at 200th St SB Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Deceleration Length (L_D), ft	1440	180
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.300
Capacity Adjustment Factor (CAF)	0.852	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	8678	500
Peak Hour Factor (PHF)	0.97	0.80
Total Trucks, %	15.00	4.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.870	0.962
Flow Rate (v_i), pc/h	10283	845
Capacity (c_{md}), pc/h	9400	2000
Adjusted Capacity (c_{md}), pc/h	8009	1900
Volume-to-Capacity Ratio (v/c)	0.93	0.44

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	2940	Speed Index (D_S)	0.504
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1865

Distance to Downstream Ramp (L_{DOWN}), ft	1730	Off-Ramp Influence Area Speed (S_R), mi/h	53.4
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.436	Outer Lanes Freeway Speed (S_O), mi/h	67.9
Flow in Lanes 1 and 2 (v_{12}), pc/h	3728	Ramp Junction Speed (S), mi/h	59.8
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	31.2
Level of Service (LOS)	F	Density in Ramp Influence Area (D_R), pc/mi/ln	34.7

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	6	Segment Name	E14 - SB I-5 at 200th St SB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Acceleration Length (LA), ft	1500	470
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.300
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.852	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	8028	570
Peak Hour Factor (PHF)	0.96	0.96
Total Trucks, %	14.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.877	0.980
Flow Rate (v_i), pc/h	9535	788
Capacity (c_{md}), pc/h	9400	2000
Adjusted Capacity (c_{md}), pc/h	8009	1900
Volume-to-Capacity Ratio (v/c)	0.91	0.41

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	1730	Speed Index (M_S)	0.676
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2700

Distance to Downstream Ramp (L_{DOWN}), ft	-	On-Ramp Influence Area Speed (S_R), mi/h	49.5
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	0.119	Outer Lanes Freeway Speed (S_O), mi/h	56.1
Flow in Lanes 1 and 2 (v_{12}), pc/h	4135	Ramp Junction Speed (S), mi/h	32.6
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	4923	Average Density (D), pc/mi/ln	55.6
Level of Service (LOS)	F	Density in Ramp Influence Area (D_R), pc/mi/ln	40.6

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	F1 - NB I-5 at Military Rd NB Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Deceleration Length (LD), ft	1500	290
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor (CAF)	1.000	0.852
Capacity Adj. Factor for CAVs, CAF_{CAV}	1.000	-

Demand and Capacity

Demand Volume (V_i), veh/h	4590	290
Peak Hour Factor (PHF)	0.97	0.93
Total Trucks, %	7.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.971
Flow Rate (v_i), pc/h	5061	321
Capacity (c_{md}), pc/h	9400	2000
Adjusted Capacity (c_{md}), pc/h	9400	1704
Volume-to-Capacity Ratio (v/c)	0.54	0.19

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (D_S)	0.457
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1337

Distance to Downstream Ramp (LDOWN), ft	900	Off-Ramp Influence Area Speed (SR), mi/h	54.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.436	Outer Lanes Freeway Speed (SO), mi/h	70.0
Flow in Lanes 1 and 2 (v12), pc/h	2388	Ramp Junction Speed (S), mi/h	61.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	20.5
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	22.2

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	3	Segment Name	F3 - NB I-5 at Military Rd NB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	710
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.852	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	4300	780
Peak Hour Factor (PHF)	0.97	0.97
Total Trucks, %	7.00	1.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.990
Flow Rate (v_i), pc/h	4741	812
Capacity (c_{md}), pc/h	9400	2000
Adjusted Capacity (c_{md}), pc/h	8009	1900
Volume-to-Capacity Ratio (v/c)	0.69	0.43

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	900	Speed Index (M_S)	0.330
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1423

Distance to Downstream Ramp (LDOWN), ft	5090	On-Ramp Influence Area Speed (SR), mi/h	57.4
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.116	Outer Lanes Freeway Speed (SO), mi/h	61.7
Flow in Lanes 1 and 2 (v12), pc/h	1896	Ramp Junction Speed (S), mi/h	59.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	2708	Average Density (D), pc/mi/ln	23.3
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	21.8

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	5	Segment Name	F5 - NB I-5 at 188th St NB Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LD), ft	1500	180
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor (CAF)	0.852	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	5080	720
Peak Hour Factor (PHF)	0.98	0.95
Total Trucks, %	7.00	8.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.926
Flow Rate (v_i), pc/h	5544	818
Capacity (c_{md}), pc/h	9400	2100
Adjusted Capacity (c_{md}), pc/h	8009	1995
Volume-to-Capacity Ratio (v/c)	0.69	0.41

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	5090	Speed Index (D_S)	0.372
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1333

Distance to Downstream Ramp (L_{DOWN}), ft	2260	Off-Ramp Influence Area Speed (S_R), mi/h	56.4
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.436	Outer Lanes Freeway Speed (S_O), mi/h	70.0
Flow in Lanes 1 and 2 (v_{12}), pc/h	2879	Ramp Junction Speed (S), mi/h	62.2
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	22.3
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	27.4

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	7	Segment Name	F7 - NB I-5 at 188th St NB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA), ft	1500	570
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.852	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	4360	1510
Peak Hour Factor (PHF)	0.99	0.92
Total Trucks, %	7.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.980
Flow Rate (v_i), pc/h	4710	1675
Capacity (c_{md}), pc/h	9400	2100
Adjusted Capacity (c_{md}), pc/h	8009	1995
Volume-to-Capacity Ratio (v/c)	0.80	0.84

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	2260	Speed Index (M_S)	0.407
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1413

Distance to Downstream Ramp (LDOWN), ft	7350	On-Ramp Influence Area Speed (SR), mi/h	55.6
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.008	Outer Lanes Freeway Speed (SO), mi/h	61.7
Flow in Lanes 1 and 2 (v12), pc/h	1884	Ramp Junction Speed (S), mi/h	58.1
Flow Entering Ramp-Infl. Area (vR12), pc/h	3559	Average Density (D), pc/mi/ln	27.5
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	29.0

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	9	Segment Name	F9 - NB I-5 at Southcenter Pkwy Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LD), ft	1500	840
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor (CAF)	0.852	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	5870	830
Peak Hour Factor (PHF)	0.98	0.91
Total Trucks, %	6.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.980
Flow Rate (v_i), pc/h	6352	931
Capacity (c_{md}), pc/h	9400	2100
Adjusted Capacity (c_{md}), pc/h	8009	1995
Volume-to-Capacity Ratio (v/c)	0.79	0.47

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	7350	Speed Index (D_S)	0.382
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1529

Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	56.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.436	Outer Lanes Freeway Speed (SO), mi/h	69.2
Flow in Lanes 1 and 2 (v12), pc/h	3295	Ramp Junction Speed (S), mi/h	61.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	25.7
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	25.0

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	11	Segment Name	F11 - NB I-5 at SR 518 WB/I-405 EB Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	2
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Deceleration Length (LD), ft	1500	400
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided Major Diverge

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor (CAF)	0.852	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	5040	2605
Peak Hour Factor (PHF)	0.98	0.97
Total Trucks, %	6.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.952
Flow Rate (v_i), pc/h	5454	2821
Capacity (c_{md}), pc/h	9400	4000
Adjusted Capacity (c_{md}), pc/h	8009	3800
Volume-to-Capacity Ratio (v/c)	0.68	0.74

Density and LOS

Average Density (D), pc/mi/ln	23.9	Average Speed (S), mi/h	57.1
Density in Ramp Influence Area (D_{MD}), pc/mi/ln	23.9	Level of Service (LOS)	C

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	F12 - NB I-5 from SR 518 WB/I-405 EB Off Ramp to I-405 WB HOV On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	2130	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	2435	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.98	Flow Rate (v_p), pc/h/ln	886
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.44
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	65.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	13.6
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	F13 - NB I-5 from I-405 WB HOV On Ramp to I-405 WB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	150	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	2695	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.96	Flow Rate (v_p), pc/h/ln	750
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.37
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	65.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	11.5
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	F14 - NB I-5 at I-405 WB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	1130
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.852	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	2695	1100
Peak Hour Factor (PHF)	0.96	0.99
Total Trucks, %	7.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.952
Flow Rate (v_i), pc/h	3002	1167
Capacity (c_{md}), pc/h	9400	2100
Adjusted Capacity (c_{md}), pc/h	8009	1995
Volume-to-Capacity Ratio (v/c)	0.52	0.58

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.261
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	901

Distance to Downstream Ramp (L_{DOWN}), ft	-	On-Ramp Influence Area Speed (S_R), mi/h	59.0
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	0.352	Outer Lanes Freeway Speed (S_O), mi/h	63.6
Flow in Lanes 1 and 2 (v_{12}), pc/h	1201	Ramp Junction Speed (S), mi/h	60.9
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	2368	Average Density (D), pc/mi/ln	17.1
Level of Service (LOS)	B	Density in Ramp Influence Area (D_R), pc/mi/ln	16.4

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	F15 - NB I-5 from SR 518 EB On Ramp to Southcenter Blvd NB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	5	Terrain Type	Level
Segment Length (L), ft	700	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	5040	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1137
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.57
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	64.7
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	17.6
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - No Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	F16 - NB I-5 at Southcenter Blvd NB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Acceleration Length (LA), ft	1500	1070
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.852	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	5040	990
Peak Hour Factor (PHF)	0.94	0.95
Total Trucks, %	6.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.952
Flow Rate (v_i), pc/h	5686	1095
Capacity (c_{md}), pc/h	11750	2000
Adjusted Capacity (c_{md}), pc/h	10011	1900
Volume-to-Capacity Ratio (v/c)	0.68	0.58

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.312
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1296

Distance to Downstream Ramp (L_{DOWN}), ft	-	On-Ramp Influence Area Speed (S_R), mi/h	57.8
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	0.081	Outer Lanes Freeway Speed (S_O), mi/h	62.1
Flow in Lanes 1 and 2 (v_{12}), pc/h	1729	Ramp Junction Speed (S), mi/h	59.8
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	2824	Average Density (D), pc/mi/ln	18.1
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	20.4

HCS Freeway Weaving Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	A1 - EB SR 518 from SR 509 NB Off Ramp to DMM EB off Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	140	Number of Maneuver Lanes (N_{WL}), ln	2
Weaving Configuration	One-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	0
Interchange Density (ID), int/mi	0.67	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten
Proportion of CAVs in Traffic Stream	0	Final Capacity Adjustment Factor (CAF)	0.900

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1800	855	78	180
Peak Hour Factor (PHF)	0.96	0.86	0.94	0.79
Total Trucks, %	2.00	3.00	0.00	0.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.980	0.971	1.000	1.000
Flow Rate (v_i), pc/h	1913	1024	83	228
Weaving Flow Rate (v_w), pc/h	1252	Ideal Conditions Capacity (c_{IFL}), pc/h/ln		2350
Non-Weaving Flow Rate (v_{NW}), pc/h	1996	Density-Based Capacity ($c_{IWL} \times N \times f_{HV}$), veh/h		5469
Total Flow Rate (v), pc/h	3248	Demand Flow-Based Capacity ($c_{IW} \times f_{HV}$), veh/h		6103
Volume Ratio (VR)	0.385	Weaving Area Capacity (c_W), veh/h		5469
Minimum Lane Change Rate (LC_{MIN}), lc/h	1252	Adjusted Weaving Area Capacity (c_{WA}), veh/h		4922
Maximum Weaving Length (L_{MAX}), ft	6513	Volume-to-Capacity Ratio (v/c)		0.65

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	19	Average Weaving Speed (S_W), mi/h	37.0
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	0	Average Non-Weaving Speed (S_{NW}), mi/h	50.8
Weaving Lane Change Rate (LC_W), lc/h	1252	Average Speed (S), mi/h	44.4

Weaving Lane Change Rate (LC_{All}), lc/h	1252	Density (D), pc/mi/ln	24.4
Weaving Intensity Factor (W)	1.273	Level of Service (LOS)	C

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	3	Segment Name	A2 - EB SR 518 from DMM EB off Ramp to DMM Interchange
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	2	Terrain Type	Level
Segment Length (L), ft	1290	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	2655	Heavy Vehicle Adjustment Factor (f_{HV})	0.980
Peak Hour Factor (PHF)	0.95	Flow Rate (v_p), pc/h/ln	1426
Total Trucks, %	2.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.71
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	61.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	23.2
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	B1 - WB SR 518 from DMM Undercrossing to Diverge Influence Point
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	2	Terrain Type	Level
Segment Length (L), ft	940	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	60.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	3370	Heavy Vehicle Adjustment Factor (f_{HV})	0.980
Peak Hour Factor (PHF)	0.99	Flow Rate (v_p), pc/h/ln	1737
Total Trucks, %	2.00	Capacity (c), pc/h/ln	2300
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1960
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.89
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	51.4
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	33.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	D
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	60.0		

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	B2 - WB SR 518 from DMM Diverge Influence Point to SR 509 NB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	2	1
Free-Flow Speed (FFS), mi/h	60.0	35.0
Segment Length (L) / Deceleration Length (LD), ft	1500	890
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor (CAF)	0.852	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	3370	1235
Peak Hour Factor (PHF)	0.98	0.95
Total Trucks, %	2.00	1.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.980	0.990
Flow Rate (v_i), pc/h	3509	1313
Capacity (c_{md}), pc/h	4600	2000
Adjusted Capacity (c_{md}), pc/h	3919	1900
Volume-to-Capacity Ratio (v/c)	0.90	0.69

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	0
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (D_S)	0.546
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	-

Distance to Downstream Ramp (LDOWN), ft	-	Off-Ramp Influence Area Speed (SR), mi/h	50.2
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	1.000	Outer Lanes Freeway Speed (SO), mi/h	65.8
Flow in Lanes 1 and 2 (v12), pc/h	3509	Ramp Junction Speed (S), mi/h	50.2
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	35.0
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	26.4

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Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	C1 - EB SR 518 from 51st St Off Ramp to I-5 NB Off Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	1030	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.700
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	3745	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor (PHF)	0.97	Flow Rate (v_p), pc/h/ln	1757
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1554
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.13
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	34.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	C2 - EB SR 518 from I-5 NB Off Ramp to I-5 SB Off Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	2	Terrain Type	Level
Segment Length (L), ft	650	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.700
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	2383	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor (PHF)	0.95	Flow Rate (v_p), pc/h/ln	1729
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1554
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.11
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	34.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	C4 - NB I-405 from I-5 SB On Ramp to I-5 NB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	2	Terrain Type	Level
Segment Length (L), ft	670	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	4277	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor (PHF)	0.96	Flow Rate (v_p), pc/h/ln	3071
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.53
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	44.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	C5 - NB I-405 from I-5 NB On Ramp to Southcenter Pkwy
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	1180	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	5867	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor (PHF)	0.98	Flow Rate (v_p), pc/h/ln	2751
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.37
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	44.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	D1 - SB I-405 from Interurban Ave S 3-Lane Start Point to I-5 NB Off/ Southcenter Off Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	1820	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.700
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	5235	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor (PHF)	0.99	Flow Rate (v_p), pc/h/ln	2407
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1554
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.55
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	34.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	D2 - SB I-405 from I-5 NB Off Ramp to I-5 NB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	2	Terrain Type	Level
Segment Length (L), ft	1350	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.700
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	3525	Heavy Vehicle Adjustment Factor (f_{HV})	0.952
Peak Hour Factor (PHF)	0.98	Flow Rate (v_p), pc/h/ln	2456
Total Trucks, %	5.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1554
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.58
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	34.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Freeway Weaving Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	D3 - SB I-405 from I-5 NB On Ramp to I-5 SB Off Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Segment Type	Freeway
Segment Length (L_S), ft	570	Number of Maneuver Lanes (N_{WL}), ln	0
Weaving Configuration	Two-Sided	Ramp-to-Freeway Lane Changes (LC_{RF}), lc	1
Terrain Type	Level	Freeway-to-Ramp Lane Changes (LC_{FR}), lc	1
Percent Grade, %	-	Ramp-to-Ramp Lane Changes (LC_{RR}), lc	2
Interchange Density (ID), int/mi	0.67	Cross Weaving Managed Lane	No

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.700
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten
Proportion of CAVs in Traffic Stream	0	Final Capacity Adjustment Factor (CAF)	0.900

Demand and Capacity

	FF	RF	RR	FR
Demand Volume (V_i), veh/h	1703	1097	485	1560
Peak Hour Factor (PHF)	0.98	0.94	0.96	0.97
Total Trucks, %	5.00	2.00	2.00	4.00
Heavy Vehicle Adjustment Factor (f_{HV})	0.952	0.980	0.980	0.962
Flow Rate (v_i), pc/h	2373	1396	604	2173
Weaving Flow Rate (v_w), pc/h	604	Ideal Conditions Capacity (c_{IFL}), pc/h/ln		2200
Non-Weaving Flow Rate (v_{NW}), pc/h	5942	Density-Based Capacity ($c_{IWL} \times N \times f_{HV}$), veh/h		5016
Total Flow Rate (v), pc/h	6546	Demand Flow-Based Capacity ($c_{IW} \times f_{HV}$), veh/h		-
Volume Ratio (VR)	0.099	Weaving Area Capacity (c_W), veh/h		5016
Minimum Lane Change Rate (LC_{MIN}), lc/h	1208	Adjusted Weaving Area Capacity (c_{WA}), veh/h		4514
Maximum Weaving Length (L_{MAX}), ft	6662	Volume-to-Capacity Ratio (v/c)		1.00

Speed and Density

Non-Weaving Vehicle Index (I_{NW})	226	Average Weaving Speed (S_W), mi/h	33.3
Non-Weaving Lane Change Rate (LC_{NW}), lc/h	955	Average Non-Weaving Speed (S_{NW}), mi/h	26.3
Weaving Lane Change Rate (LC_W), lc/h	1295	Average Speed (S), mi/h	26.8

Weaving Lane Change Rate (LC_{All}), lc/h	2250	Density (D), pc/mi/ln	81.4
Weaving Intensity Factor (W)	0.668	Level of Service (LOS)	F

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	D4 - WB SR 518 from I-5 SB Off Ramp to I-5 SB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	2	Terrain Type	Level
Segment Length (L), ft	1280	Percent Grade, %	-
Measured or Base Free-Flow Speed	Base	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	65.0	Total Ramp Density (TRD), ramps/mi	0.00
Lane Width, ft	12	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	10		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.700
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	3062	Heavy Vehicle Adjustment Factor (f_{HV})	0.980
Peak Hour Factor (PHF)	0.90	Flow Rate (v_p), pc/h/ln	2257
Total Trucks, %	2.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1554
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.45
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	0.0	Average Speed (S), mi/h	34.5
Right-Side Lateral Clearance Adj. (f_{RLC})	0.0	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	0.0	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	D5 - WB SR 518 from I-5 SB On Ramp to 51st St On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	760	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.700
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	4285	Heavy Vehicle Adjustment Factor (f_{HV})	0.980
Peak Hour Factor (PHF)	0.98	Flow Rate (v_p), pc/h/ln	1933
Total Trucks, %	2.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1554
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.24
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	34.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	E1 - SB I-5 at Southcenter Blvd/ SR 518 Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	6	2
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LD), ft	1500	840
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided Major Diverge

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	0.600	1.000
Demand Adjustment Factor (DAF)	1.300	1.300
Capacity Adjustment Factor (CAF)	0.800	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	8898	2193
Peak Hour Factor (PHF)	0.94	0.98
Total Trucks, %	15.00	9.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.870	0.917
Flow Rate (v_i), pc/h	14144	3173
Capacity (c_{md}), pc/h	13500	4200
Adjusted Capacity (c_{md}), pc/h	10800	3990
Volume-to-Capacity Ratio (v/c)	1.00	0.80

Density and LOS

Average Density (D), pc/mi/ln	31.5	Average Speed (S), mi/h	39.0
Density in Ramp Influence Area (D_{MD}), pc/mi/ln	31.5	Level of Service (LOS)	F

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	E2 - SB I-5 from Southcenter Blvd/SR 518 Off Ramp to I-405 NB Off Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	6	Terrain Type	Level
Segment Length (L), ft	2240	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.600
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.800
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	6047	Heavy Vehicle Adjustment Factor (f_{HV})	0.855
Peak Hour Factor (PHF)	0.98	Flow Rate (v_p), pc/h/ln	1564
Total Trucks, %	17.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1760
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.81
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	20.6
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	69.5
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	39.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	E3 - SB I-5 from I-405 NB Off Ramp to I-405 SB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	620	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.600
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.800
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	4305	Heavy Vehicle Adjustment Factor (f_{HV})	0.800
Peak Hour Factor (PHF)	0.99	Flow Rate (v_p), pc/h/ln	1766
Total Trucks, %	25.00	Capacity (c), pc/h/ln	2200
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1760
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.81
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	20.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	71.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	39.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	E4 - SB I-5 from I-405 SB On Ramp to Klickitat SB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	5	Terrain Type	Level
Segment Length (L), ft	4330	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.800
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	5865	Heavy Vehicle Adjustment Factor (f_{HV})	0.840
Peak Hour Factor (PHF)	0.97	Flow Rate (v_p), pc/h/ln	1871
Total Trucks, %	19.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1776
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.78
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	18.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	76.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	E5 - SB I-5 at Klickitat SB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (LA), ft	1500	1500
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	0.800	1.000
Demand Adjustment Factor (DAF)	1.000	1.300
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.800	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	7625	1301
Peak Hour Factor (PHF)	0.97	0.92
Total Trucks, %	19.00	0.02
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.840	1.000
Flow Rate (v_i), pc/h	9357	1838
Capacity (c_{md}), pc/h	11250	2100
Adjusted Capacity (c_{md}), pc/h	9000	1995
Volume-to-Capacity Ratio (v/c)	0.85	0.92

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.567
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2057

Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	46.3
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.000	Outer Lanes Freeway Speed (SO), mi/h	46.4
Flow in Lanes 1 and 2 (v12), pc/h	2743	Ramp Junction Speed (S), mi/h	23.8
Flow Entering Ramp-Infl. Area (vR12), pc/h	4581	Average Density (D), pc/mi/ln	64.6
Level of Service (LOS)	F	Density in Ramp Influence Area (DR), pc/mi/ln	31.0

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	E6 - SB I-5 from Klickitat SB On Ramp Merge Area to 188th St SB Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	5	Terrain Type	Level
Segment Length (L), ft	2000	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	0.800
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.800
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	7166	Heavy Vehicle Adjustment Factor (f_{HV})	0.862
Peak Hour Factor (PHF)	0.98	Flow Rate (v_p), pc/h/ln	1776
Total Trucks, %	16.00	Capacity (c), pc/h/ln	2220
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	1776
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	1.00
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	39.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	45.0
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	52.0		

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	E7 - SB I-5 at 188th St SB Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LD), ft	1500	240
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	0.800	1.000
Demand Adjustment Factor (DAF)	1.000	1.300
Capacity Adjustment Factor (CAF)	0.800	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	9316	1360
Peak Hour Factor (PHF)	0.98	0.90
Total Trucks, %	16.00	9.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.862	0.917
Flow Rate (v_i), pc/h	11028	2142
Capacity (c_{md}), pc/h	11250	2100
Adjusted Capacity (c_{md}), pc/h	9000	1995
Volume-to-Capacity Ratio (v/c)	0.99	1.07

Speed and Density

Upstream Equilibrium Distance (LEQ), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (LUP), ft	-	Speed Index (D_S)	0.491
Downstream Equilibrium Distance (LEQ), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1400

Distance to Downstream Ramp (L_{DOWN}), ft	-	Off-Ramp Influence Area Speed (S_R), mi/h	47.1
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.436	Outer Lanes Freeway Speed (S_O), mi/h	55.5
Flow in Lanes 1 and 2 (v_{12}), pc/h	4305	Ramp Junction Speed (S), mi/h	50.1
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	28.4
Level of Service (LOS)	F	Density in Ramp Influence Area (D_R), pc/mi/ln	39.1

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	E9 - SB I-5 from Lane Reduction Point to 188th St SB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	2330	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.300
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	5806	Heavy Vehicle Adjustment Factor (f_{HV})	0.855
Peak Hour Factor (PHF)	0.97	Flow Rate (v_p), pc/h/ln	2275
Total Trucks, %	17.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.81
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	22.7
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	71.9
Total Ramp Density Adjustment	-	Level of Service (LOS)	F
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	E10 - SB I-5 at 188th St SB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Acceleration Length (L_A), ft	1440	520
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.300
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.852	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	7548	875
Peak Hour Factor (PHF)	0.97	0.99
Total Trucks, %	17.00	4.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.855	0.962
Flow Rate (v_i), pc/h	9101	1195
Capacity (c_{md}), pc/h	9400	2000
Adjusted Capacity (c_{md}), pc/h	8009	1900
Volume-to-Capacity Ratio (v/c)	0.93	0.63

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.460
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1957

Distance to Downstream Ramp (L_{DOWN}), ft	2940	On-Ramp Influence Area Speed (S_R), mi/h	54.4
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FM})	0.068	Outer Lanes Freeway Speed (S_O), mi/h	59.8
Flow in Lanes 1 and 2 (v_{12}), pc/h	2609	Ramp Junction Speed (S), mi/h	57.0
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	3804	Average Density (D), pc/mi/ln	33.8
Level of Service (LOS)	F	Density in Ramp Influence Area (D_R), pc/mi/ln	31.4

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	4	Segment Name	E12 - SB I-5 at 200th St SB Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Deceleration Length (LD), ft	1440	180
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.300
Capacity Adjustment Factor (CAF)	0.852	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	8685	520
Peak Hour Factor (PHF)	0.97	0.80
Total Trucks, %	15.00	4.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.870	0.962
Flow Rate (v_i), pc/h	10292	878
Capacity (c_{md}), pc/h	9400	2000
Adjusted Capacity (c_{md}), pc/h	8009	1900
Volume-to-Capacity Ratio (v/c)	0.93	0.46

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	2940	Speed Index (D_S)	0.507
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1856

Distance to Downstream Ramp (L_{DOWN}), ft	1730	Off-Ramp Influence Area Speed (S_R), mi/h	53.3
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.436	Outer Lanes Freeway Speed (S_O), mi/h	68.0
Flow in Lanes 1 and 2 (v_{12}), pc/h	3747	Ramp Junction Speed (S), mi/h	59.7
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	31.2
Level of Service (LOS)	F	Density in Ramp Influence Area (D_R), pc/mi/ln	34.9

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	6	Segment Name	E14 - SB I-5 at 200th St SB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	470
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.300
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.852	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	8009	580
Peak Hour Factor (PHF)	0.96	0.96
Total Trucks, %	14.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.877	0.980
Flow Rate (v_i), pc/h	9513	801
Capacity (c_{md}), pc/h	9400	2000
Adjusted Capacity (c_{md}), pc/h	8009	1900
Volume-to-Capacity Ratio (v/c)	0.91	0.42

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	1730	Speed Index (M_S)	0.676
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	2700

Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	49.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.118	Outer Lanes Freeway Speed (SO), mi/h	56.1
Flow in Lanes 1 and 2 (v12), pc/h	4113	Ramp Junction Speed (S), mi/h	33.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	4914	Average Density (D), pc/mi/ln	55.1
Level of Service (LOS)	F	Density in Ramp Influence Area (DR), pc/mi/ln	40.6

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	F1 - NB I-5 at Military Rd NB Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Deceleration Length (LD), ft	1500	290
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor (CAF)	1.000	0.852
Capacity Adj. Factor for CAVs, CAF_{CAV}	1.000	-

Demand and Capacity

Demand Volume (V_i), veh/h	4675	290
Peak Hour Factor (PHF)	0.97	0.93
Total Trucks, %	7.00	3.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.971
Flow Rate (v_i), pc/h	5155	321
Capacity (c_{md}), pc/h	9400	2000
Adjusted Capacity (c_{md}), pc/h	9400	1704
Volume-to-Capacity Ratio (v/c)	0.55	0.19

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (D_S)	0.457
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1363

Distance to Downstream Ramp (L_{DOWN}), ft	900	Off-Ramp Influence Area Speed (S_R), mi/h	54.5
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.436	Outer Lanes Freeway Speed (S_O), mi/h	69.9
Flow in Lanes 1 and 2 (v_{12}), pc/h	2429	Ramp Junction Speed (S), mi/h	61.7
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	20.9
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	22.5

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	3	Segment Name	F3 - NB I-5 at Military Rd NB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	710
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.852	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	4385	780
Peak Hour Factor (PHF)	0.97	0.97
Total Trucks, %	7.00	1.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.990
Flow Rate (v_i), pc/h	4835	812
Capacity (c_{md}), pc/h	9400	2000
Adjusted Capacity (c_{md}), pc/h	8009	1900
Volume-to-Capacity Ratio (v/c)	0.71	0.43

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	900	Speed Index (M_S)	0.332
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1451

Distance to Downstream Ramp (LDOWN), ft	5090	On-Ramp Influence Area Speed (SR), mi/h	57.4
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.116	Outer Lanes Freeway Speed (SO), mi/h	61.6
Flow in Lanes 1 and 2 (v12), pc/h	1934	Ramp Junction Speed (S), mi/h	59.5
Flow Entering Ramp-Infl. Area (vR12), pc/h	2746	Average Density (D), pc/mi/ln	23.7
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	22.1

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	5	Segment Name	F5 - NB I-5 at 188th St NB Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (LD), ft	1500	180
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor (CAF)	0.852	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	5165	710
Peak Hour Factor (PHF)	0.98	0.95
Total Trucks, %	7.00	8.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.926
Flow Rate (v_i), pc/h	5637	807
Capacity (c_{md}), pc/h	9400	2100
Adjusted Capacity (c_{md}), pc/h	8009	1995
Volume-to-Capacity Ratio (v/c)	0.70	0.40

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	5090	Speed Index (D_S)	0.371
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1362

Distance to Downstream Ramp (LDOWN), ft	2260	Off-Ramp Influence Area Speed (SR), mi/h	56.5
Prop. Freeway Vehicles in Lane 1 and 2 (PFD)	0.436	Outer Lanes Freeway Speed (SO), mi/h	69.9
Flow in Lanes 1 and 2 (v12), pc/h	2913	Ramp Junction Speed (S), mi/h	62.3
Flow Entering Ramp-Infl. Area (vR12), pc/h	-	Average Density (D), pc/mi/ln	22.6
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	27.7

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	7	Segment Name	F7 - NB I-5 at 188th St NB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	570
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.852	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	4455	1530
Peak Hour Factor (PHF)	0.99	0.92
Total Trucks, %	7.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.980
Flow Rate (v_i), pc/h	4813	1697
Capacity (c_{md}), pc/h	9400	2100
Adjusted Capacity (c_{md}), pc/h	8009	1995
Volume-to-Capacity Ratio (v/c)	0.81	0.85

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	2260	Speed Index (M_S)	0.416
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1444

Distance to Downstream Ramp (LDOWN), ft	7350	On-Ramp Influence Area Speed (SR), mi/h	55.4
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.006	Outer Lanes Freeway Speed (SO), mi/h	61.6
Flow in Lanes 1 and 2 (v12), pc/h	1925	Ramp Junction Speed (S), mi/h	58.0
Flow Entering Ramp-Infl. Area (vR12), pc/h	3622	Average Density (D), pc/mi/ln	28.1
Level of Service (LOS)	D	Density in Ramp Influence Area (DR), pc/mi/ln	29.4

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	9	Segment Name	F9 - NB I-5 at Southcenter Pkwy Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Deceleration Length (L_D), ft	1500	840
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor (CAF)	0.852	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	5985	830
Peak Hour Factor (PHF)	0.98	0.91
Total Trucks, %	6.00	2.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.980
Flow Rate (v_i), pc/h	6476	931
Capacity (c_{md}), pc/h	9400	2100
Adjusted Capacity (c_{md}), pc/h	8009	1995
Volume-to-Capacity Ratio (v/c)	0.81	0.47

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	7350	Speed Index (D_S)	0.382
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1564

Distance to Downstream Ramp (L_{DOWN}), ft	-	Off-Ramp Influence Area Speed (S_R), mi/h	56.2
Prop. Freeway Vehicles in Lane 1 and 2 (P_{FD})	0.436	Outer Lanes Freeway Speed (S_O), mi/h	69.1
Flow in Lanes 1 and 2 (v_{12}), pc/h	3349	Ramp Junction Speed (S), mi/h	61.8
Flow Entering Ramp-Infl. Area (v_{R12}), pc/h	-	Average Density (D), pc/mi/ln	26.2
Level of Service (LOS)	C	Density in Ramp Influence Area (D_R), pc/mi/ln	25.5

HCS Freeway Diverge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	11	Segment Name	F11 - NB I-5 at SR 518 WB/I-405 EB Off Ramp Diverge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	2
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Deceleration Length (LD), ft	1500	400
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided Major Diverge

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor (CAF)	0.852	0.950
Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten	-

Demand and Capacity

Demand Volume (V_i), veh/h	5155	2687
Peak Hour Factor (PHF)	0.98	0.97
Total Trucks, %	6.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.952
Flow Rate (v_i), pc/h	5578	2910
Capacity (c_{md}), pc/h	9400	4000
Adjusted Capacity (c_{md}), pc/h	8009	3800
Volume-to-Capacity Ratio (v/c)	0.70	0.77

Density and LOS

Average Density (D), pc/mi/ln	24.4	Average Speed (S), mi/h	57.1
Density in Ramp Influence Area (D_{MD}), pc/mi/ln	24.4	Level of Service (LOS)	C

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	F12 - NB I-5 from SR 518 WB/I-405 EB Off Ramp to I-405 WB HOV On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	3	Terrain Type	Level
Segment Length (L), ft	2130	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	2468	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.98	Flow Rate (v_p), pc/h/ln	898
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.45
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	65.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	13.8
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	F13 - NB I-5 from I-405 WB HOV On Ramp to I-405 WB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	4	Terrain Type	Level
Segment Length (L), ft	150	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	2728	Heavy Vehicle Adjustment Factor (f_{HV})	0.935
Peak Hour Factor (PHF)	0.96	Flow Rate (v_p), pc/h/ln	760
Total Trucks, %	7.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.38
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	65.0
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	11.7
Total Ramp Density Adjustment	-	Level of Service (LOS)	B
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	F14 - NB I-5 at I-405 WB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	4	1
Free-Flow Speed (FFS), mi/h	65.0	45.0
Segment Length (L) / Acceleration Length (L_A), ft	1500	1130
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.852	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	2728	1100
Peak Hour Factor (PHF)	0.96	0.99
Total Trucks, %	7.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.935	0.952
Flow Rate (v_i), pc/h	3039	1167
Capacity (c_{md}), pc/h	9400	2100
Adjusted Capacity (c_{md}), pc/h	8009	1995
Volume-to-Capacity Ratio (v/c)	0.53	0.58

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.262
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	912

Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	59.0
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.352	Outer Lanes Freeway Speed (SO), mi/h	63.5
Flow in Lanes 1 and 2 (v12), pc/h	1216	Ramp Junction Speed (S), mi/h	60.9
Flow Entering Ramp-Infl. Area (vR12), pc/h	2383	Average Density (D), pc/mi/ln	17.3
Level of Service (LOS)	B	Density in Ramp Influence Area (DR), pc/mi/ln	16.5

HCS Basic Freeway Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	1	Segment Name	F15 - NB I-5 from SR 518 EB On Ramp to Southcenter Blvd NB On Ramp
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

Number of Lanes (N), ln	5	Terrain Type	Level
Segment Length (L), ft	700	Percent Grade, %	-
Measured or Base Free-Flow Speed	Measured	Grade Length, mi	-
Base Free-Flow Speed (BFFS), mi/h	-	Total Ramp Density (TRD), ramps/mi	-
Lane Width, ft	-	Free-Flow Speed (FFS), mi/h	65.0
Right-Side Lateral Clearance, ft	-		

Adjustment Factors

Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Weather Type	Non-Severe Weather	Demand Adjustment Factor (DAF)	1.000
Incident Type	No Incident	Capacity Adjustment Factor (CAF)	0.852
Proportion of CAVs in Traffic Stream	0	Capacity Adj. Factor for CAVs, CAF_{CAV}	Overwritten

Demand and Capacity

Demand Volume (V), veh/h	5190	Heavy Vehicle Adjustment Factor (f_{HV})	0.943
Peak Hour Factor (PHF)	0.94	Flow Rate (v_p), pc/h/ln	1171
Total Trucks, %	6.00	Capacity (c), pc/h/ln	2350
Single-Unit Trucks (SUT), %	-	Adjusted Capacity (c_{adj}), pc/h/ln	2002
Tractor-Trailers (TT), %	-	Volume-to-Capacity Ratio (v/c)	0.58
Passenger Car Equivalent (E_T)	2.00		

Speed and Density

Lane Width Adjustment (f_{LW})	-	Average Speed (S), mi/h	64.5
Right-Side Lateral Clearance Adj. (f_{RLC})	-	Density (D), pc/mi/ln	18.2
Total Ramp Density Adjustment	-	Level of Service (LOS)	C
Adjusted Free-Flow Speed (FFS_{adj}), mi/h	65.0		

HCS Freeway Merge Report

Project Information

Analyst	Concord Engineering	Date	10/6/2023
Agency		Analysis Year	2037 - Proposed Action
Jurisdiction		Time Analyzed	PM Peak
Project Description	SAMP	Units	U.S. Customary
Segment Number	2	Segment Name	F16 - NB I-5 at Southcenter Blvd NB On Ramp Merge Area
Analysis Period Number	1	Segment Analysis Period	16:45-17:00

Geometric Data

	Freeway	Ramp
Number of Lanes (N), ln	5	1
Free-Flow Speed (FFS), mi/h	65.0	35.0
Segment Length (L) / Acceleration Length (LA), ft	1500	1070
Terrain Type	Level	Level
Percent Grade, %	-	-
Segment Type / Ramp Type	Freeway	Right-Sided One-Lane

Adjustment Factors

Driver Population	All Familiar	All Familiar
Weather Type	Non-Severe Weather	Non-Severe Weather
Incident Type	No Incident	-
Proportion of CAVs in Traffic Stream	0	-
Final Speed Adjustment Factor (SAF)	1.000	1.000
Demand Adjustment Factor (DAF)	1.000	1.000
Capacity Adjustment Factor for CAVs, CAF_{CAV}	Overwritten	-
Final Capacity Adjustment Factor (CAF)	0.852	0.950

Demand and Capacity

Demand Volume (V_i), veh/h	5190	990
Peak Hour Factor (PHF)	0.94	0.95
Total Trucks, %	6.00	5.00
Single-Unit Trucks (SUT), %	-	-
Tractor-Trailers (TT), %	-	-
Heavy Vehicle Adjustment Factor (f_{HV})	0.943	0.952
Flow Rate (v_i), pc/h	5855	1095
Capacity (c_{md}), pc/h	11750	2000
Adjusted Capacity (c_{md}), pc/h	10011	1900
Volume-to-Capacity Ratio (v/c)	0.69	0.58

Speed and Density

Upstream Equilibrium Distance (L_{EQ}), ft	-	Number of Outer Lanes on Freeway (N_O), ln	2
Distance to Upstream Ramp (L_{UP}), ft	-	Speed Index (M_S)	0.315
Downstream Equilibrium Distance (L_{EQ}), ft	-	Flow Outer Lanes (v_{OA}), pc/h/ln	1335

Distance to Downstream Ramp (LDOWN), ft	-	On-Ramp Influence Area Speed (SR), mi/h	57.8
Prop. Freeway Vehicles in Lane 1 and 2 (PFM)	0.081	Outer Lanes Freeway Speed (SO), mi/h	62.0
Flow in Lanes 1 and 2 (v12), pc/h	1780	Ramp Junction Speed (S), mi/h	59.7
Flow Entering Ramp-Infl. Area (vR12), pc/h	2875	Average Density (D), pc/mi/ln	18.6
Level of Service (LOS)	C	Density in Ramp Influence Area (DR), pc/mi/ln	20.8