APPENDIX A

Field Review Photo Log

PHOTO 1: RP 0.0, IN GARDINER LOOKING NORTH AT THE INTERSECTION WITH PARK STREET

PHOTO 2: RP 0.3, IN GARDINER LOOKING WEST

PHOTO 3: RP 0.4, IN GARDINER LOOKING WEST (NOTE PARKING)

PHOTO 4: RP 0.6, IN GARDINER LOOKING WEST

PHOTO 5: RP 1.0, LEAVING GARDINER IN A WESTERLY DIRECTION

PHOTO 6: RP 2.0, US 89 NEAR THE GARDINER AIRPORT (LOOKING WEST)

PHOTO 7: RP 3.1, LOOKING NORTHWEST

PHOTO 8: RP 4.3, LOOKING NORTH

PHOTO 9: RP 5.2, LOOKING NORTHWEST

PHOTO 10: RP 6.0, LOOKING NORTH

PHOTO 11: RP 6.8, LOOKING NORTHWEST

PHOTO 12: RP 8.0, LOOKING NORTH

PHOTO 13: RP 8.9, LOOKING NORTHWEST (NOTE CHANGE IN ROAD GRADE)

PHOTO 14: RP 10.0, LOOKING NORTHWEST

PHOTO 15: RP 10.8, LOOKING NORTHWEST

PHOTO 16: RP 12.0, LOOKING WEST

PHOTO 17: RP 13.0, LOOKING WEST (ENTERING YANKEE JIM CANYON)

PHOTO 18: RP 13.5, LOOKING WEST (NOTE ROCKFALL ON RIGHT)

PHOTO 19: RP 13.5, LOOKING WEST (NOTE ROCKFALL ON RIGHT)

PHOTO 20: RP 13.5, LOOKING WEST (NOTE ROCKFALL ON RIGHT)

PHOTO 21: RP 13.5, LOOKING WEST (NOTE ROCKFALL ON RIGHT)

PHOTO 22: RP 13.9, LOOKING EAST (IN YANKEE JIM CANYON)

PHOTO 23: RP 14.9, LOOKING WEST

PHOTO 24: RP 15.9, LOOKING NORTH (YELLOWSTONE RIVER IS ON THE LEFT)

PHOTO 25: RP 16.6, LOOKING NORTHEAST (NOTE PUBLIC ROAD INTERSECTION)

PHOTO 26: RP 17.0, LOOKING NORTHEAST

PHOTO 27: RP 18.0, LOOKING NORTHEAST

PHOTO 28: RP 19.5, LOOKING NORTH

PHOTO 29: RP 19.9, LOOKING NORTH (NOTE INTERSECTION WITH S-540)

PHOTO 30: RP 19.9, LOOKING NORTH (NOTE INTERSECTION WITH S-540)

PHOTO 31: RP 20.9, LOOKING NORTHEAST

PHOTO 32: RP 22.0, LOOKING NORTHEAST

PHOTO 33: RP 23.0, LOOKING NORTHEAST

PHOTO 34: RP 23.0, LOOKING NORTHEAST

PHOTO 35: RP 23.9, LOOKING NORTHEAST

PHOTO 36: RP 25.0, LOOKING NORTHEAST

PHOTO 37: RP 26.0, LOOKING EAST

PHOTO 38: RP 26.9, LOOKING EAST

PHOTO 39: RP 28.0, LOOKING NORTHEAST

PHOTO 40: RP 29.3, LOOKING NORTHEAST

PHOTO 41: RP 29.9, LOOKING NORTHEAST

PHOTO 42: RP 30.6, LOOKING NORTHEAST (NEAR EMIGRANT)

PHOTO 43: RP 31.9, LOOKING NORTHEAST

PHOTO 44: RP 32.9, LOOKING NORTHEAST

PHOTO 45: RP 34.7, LOOKING EAST

PHOTO 46: RP 35.1, LOOKING EAST (NOTE RV PARK ON RIGHT SIDE)

PHOTO 47: RP 36.1, LOOKING EAST

PHOTO 48: RP 36.9, LOOKING EAST

PHOTO 49: RP 37.9, LOOKING NORTH

PHOTO 50: RP 38.9, LOOKING NORTH

PHOTO 51: RP 40.0, LOOKING NORTH

PHOTO 52: RP 40.9, LOOKING NORTH

PHOTO 53: RP 41.9, LOOKING NORTH

PHOTO 54: RP 42.8, LOOKING NORTH

PHOTO 55: RP 43.9, LOOKING NORTH

PHOTO 56: RP 45.0, LOOKING NORTHEAST

PHOTO 57: RP 46.0, LOOKING NORTHEAST

PHOTO 58: RP 46.9, LOOKING NORTHEAST

PHOTO 59: RP 48.4, LOOKING EAST

PHOTO 60: RP 48.9, LOOKING NORTHEAST

PHOTO 61: RP 50.0, LOOKING NORTH

PHOTO 62: RP 51.0, LOOKING NORTH

PHOTO 63: RP 52.0, LOOKING NORTH (NOTE NON-MOTORIZED PATH ON LEFT)

APPENDIX B

As-Built Data Summary

Hydraulic Data Summary

F 43-1(2)					
Station (ft)	**RP**	**Size (in)**		**Type**	**Stream Name**
344+00	9.94	70	92	SPPS	
346+25	9.90	2(78)		CMP	Cedar Creek
352+00	9.79	70	92	SPPS	
418+63	8.53	48		CMP	
427+15	8.37	30		CMP	
480+36	7.36	60		CMP	Basset Creek
489+23	7.19	36		CMP	
493+32	7.11	30		CMP	

F-217(13)					
Station (ft)	**RP**	**Size (in)**		**Type**	**Stream Name**
NONE					

F-217(9)					
Station (ft)	**RP**	**Size (in)**		**Type**	**Stream Name**
47+00	20.21	70	91	SPPS	
61+12	20.48	48		RCP	
84+55	20.92	84	61	SPPAC	
146+96	22.10	30		RCP	
154+75	22.25	36.25	22.5	RCPAC	
169+82	22.54	28.5	18	RCPAC	
184+90	22.82	48		RCP	
231+70	23.71	42		RCP	
246+00	23.98	36.25	22.5	RCPAC	
278+06	24.59	142	91	SPPAC	No. Fork Big Cr
295+46	24.92	36		RCP	
313+80	25.26	139	89	SPPAC	
386+12	26.63	36		RCP	
388+42	26.68	30		RCP	
419+50	27.27	58.5	36	RCPAC	
505+80	28.90	114	77	SPPAC	Fridley Cr
546+56	29.67	43.75	26.625	RCAPC	Irrigation Dt
557+94	29.89	70	91	SPPS	Spring
560+13	29.93	36		RCP	
575+00	30.21	73.5	45	RCAP	No. Fork Fridley Cr
602+60	30.73	36		RCP	

F-217(10)					
Station (ft)	**RP**	**Size (in)**		**Type**	**Stream Name**
621+40	31.12	154	100	SPPAC	Park Branch Canal
664+00	31.92	43.75	26.625	RCAP	
734+22	33.25	36	22	CMAP	
734+40	33.26	91	70	SPP	
785+00	34.21	199	121	SPPAC	Eight Mile Creek
848+00	35.41	91	70	SPP	
863+05	35.69	36		RCP	
1056+50	39.36	91	70	SPP	

F-217(11)					
Station (ft)	**RP**	**Size (in)**		**Type**	**Stream Name**
1166+50	41.44	36		CMP	
1192+23	41.93	72		RCP	
1193+02	41.94	72		RCP	
1207+70	42.22	81	59	SPPAC	
1249+65	43.01	36		RCP	
1304+28	44.05	36		RCP	
1325+18	44.44	65	40	RCPA	
1416+61	46.18	30		CMP	
1505+70	47.86	72		CMP	
1519+70	48.13	36		RCP	
1537+05	48.46	72		RCP	
1558+00	48.85	60		CMP	
1585+98	49.38	112	75	SPPAC	

Horizontal Curve Summary

F 43-1(2)			
PI (STA ft)	**PI (RP)**	**Radius (ft)**	**Length (ft)**
291+82.26	10.93	11,459.20	952.50
300+84.96	10.76	4,583.68	1,174.67
334+73.45	10.12	5,729.60	701.67
431+60.58	8.28	11,459.20	2,166.67
469+93.65	7.56	22,918.40	3,760.00
528+93.77	6.44	1,637.03	350.00
549+97.98	6.04	1,909.87	300.00
568+61.81	5.69	1,145.92	250.00
592+98.89	5.23	1,909.87	300.00

F-217(13)			
PI (STA ft)	**PI (RP)**	**Radius (ft)**	**Length (ft)**
76+98.90	18.07	5,730.00	520.00

F 217(9)			
PI (STA ft)	**PI (RP)**	**Radius (ft)**	**Length (ft)**
6+78.20	19.45	3,820.00	1,263.30
67+25.00	20.59	2,865.00	745.80
139+64.80	21.97	5,730.00	2,243.30
182+64.00	22.78	5,730.00	906.70
236+44.60	23.80	11,460.00	810.00
315+37.00	25.29	2,865.00	1,103.30
327+75.90	25.53	11,460.00	375.00
436+72.80	27.59	7,640.00	2,686.70
490+12.70	28.60	1,910.00	936.70
503+98.50	28.87	1,910.00	1,061.90

F 217(10)			
PI (STA ft)	**PI (RP)**	**Radius (ft)**	**Length (ft)**
704+56.20	32.69	5,730.00	762.50
759+65.60	33.73	5,730.00	220.00
780+92.70	34.14	6,250.70	2,019.90
839+53.20	35.25	5,730.00	3,700.00
881+93.70	36.05	2,292.00	790.00
955+07.30	37.44	5,730.00	4,688.30
1066+18.80	39.54	5,730.00	1,515.80
1130+97.20	40.77	5,730.00	880.80

F 217(11)			
PI (STA ft)	**PI (RP)**	**Radius (ft)**	**Length (ft)**
1189+01.20	41.87	11,460.00	830.00
1504+34.30	47.84	7,640.00	3,546.70
1551+32.20	48.73	3,820.00	1,433.50
1569+20.00	49.07	1,432.50	329.80
1573+78.20	49.15	1,432.50	329.80
1588+34.00	49.43	2,546.70	1,594.80

Vertical Curve Summary

F 43-1(2)*											
Center (STA ft)	Center (RP)	Length (ft)	G1	G2	A	K-Value	Type	SSD (S<L)	SSD (S>L)	SSD	L (Driver Comfort)
297+00.00	10.83	2,000.00	2.30%	-0.48%	2.78	718.7	Crest	1245.4	1387.7	1245.4	-
374+00.00	9.37	700.00	-0.48%	3.82%	4.31	162.5	Sag	-	-	-	333.4
395+50.00	8.97	1,600.00	3.82%	0.24%	3.58	446.5	Crest	981.6	1101.1	981.6	-
417+00.00	8.56	1,600.00	0.24%	-4.06%	4.30	372.4	Crest	896.5	1051.1	896.5	-
429+00.00	8.33	800.00	-4.06%	1.30%	5.36	149.4	Sag	-	-	-	414.6
451+00.00	7.92	2,400.00	1.30%	-1.02%	2.32	1032.9	Crest	1493.0	1664.4	1493.0	-
472+00.00	7.52	1,000.00	-1.02%	1.08%	2.10	475.5	Sag	-	-	-	162.8
511+20.00	6.78	1,600.00	1.08%	-2.24%	3.32	482.6	Crest	1020.5	1125.4	1020.5	-
534+35.00	6.34	800.00	-2.24%	1.71%	3.95	202.6	Sag	-	-	-	305.7
547+00.00	6.10	1,600.00	1.71%	-0.86%	2.57	623.0	Crest	1159.5	1220.1	1159.5	-
566+00.00	5.74	1,600.00	-0.86%	2.56%	3.42	467.8	Sag	-	-	-	264.8

*Stationing in opposite direction of Reference Points, therefore grades are reversed

F-217(13)											
Center (STA ft)	Center (RP)	Length (ft)	G1	G2	A	K-Value	Type	SSD (S<L)	SSD (S>L)	SSD	L (Driver Comfort)
31+00.00	17.20	800.00	-0.95%	0.55%	1.50	533.3	Sag	-	-	-	116.1
47+00.00	17.50	1,000.00	0.55%	-0.80%	1.35	740.7	Crest	1264.3	1299.3	1299.3	-
56+00.00	17.67	800.00	-0.80%	1.05%	1.85	431.7	Sag	-	-	-	143.5
71+00.00	17.95	800.00	1.05%	-0.65%	1.70	471.1	Crest	1008.3	1035.5	1035.5	-
93+00.00	18.37	1,000.00	-0.65%	-1.77%	1.13	888.9	Crest	1385.0	1459.1	1459.1	-
103+00.00	18.56	800.00	-1.77%	-0.43%	1.35	594.8	Sag	-	-	-	104.1
123+00.00	18.94	800.00	-0.43%	3.06%	3.48	229.7	Sag	-	-	-	269.7
135+00.00	19.17	1,200.00	3.06%	0.24%	2.81	426.4	Crest	959.3	983.4	959.3	-

F-217(9)											
Center (STA ft)	Center (RP)	Length (ft)	G1	G2	A	K-Value	Type	SSD (S<L)	SSD (S>L)	SSD	L (Driver Comfort)
6+00.00	19.43	1,000.00	0.66%	-2.68%	3.34	299.0	Crest	803.3	822.7	803.3	-
23+00.00	19.76	800.00	-2.68%	-1.20%	1.48	539.1	Sag	-	-	-	114.9
45+00.00	20.17	800.00	-1.20%	-0.30%	0.90	888.9	Sag	-	-	-	69.7
79+50.00	20.83	800.00	-0.30%	0.97%	1.27	629.1	Sag	-	-	-	98.4
102+00.00	21.25	800.00	0.97%	-0.12%	1.09	732.9	Crest	1257.6	1388.5	1388.5	-
128+00.00	21.75	800.00	-0.12%	-1.15%	1.03	777.1	Crest	1295.0	1448.1	1448.1	-
149+00.00	22.14	800.00	-1.15%	0.34%	1.49	535.5	Sag	-	-	-	115.7
172+00.00	22.58	1,200.00	0.34%	-0.96%	1.30	920.0	Crest	1409.0	1427.2	1427.2	-
203+00.00	23.17	1,200.00	-0.96%	0.15%	1.11	1081.5	Sag	-	-	-	85.9
229+00.00	23.66	800.00	0.15%	1.06%	0.91	878.3	Sag	-	-	-	70.5
245+50.00	23.97	1,600.00	1.06%	-0.74%	1.80	889.1	Crest	1385.2	1399.6	1385.2	-
320+00.00	25.38	800.00	-0.15%	0.76%	0.91	878.3	Sag	-	-	-	70.5
348+00.00	25.91	800.00	0.76%	0.15%	0.61	1309.8	Crest	1681.2	2166.5	2166.5	-
385+00.00	26.61	800.00	0.15%	-0.47%	0.62	1300.8	Crest	1675.5	2154.5	2154.5	-
395+00.00	26.80	600.00	-0.47%	-0.20%	0.26	2294.3	Sag	-	-	-	20.2
418+00.00	27.24	800.00	-0.20%	-0.52%	0.32	2527.5	Crest	2335.4	3808.9	3808.9	-
439+00.00	27.64	1,000.00	-0.52%	-1.64%	1.12	892.9	Crest	1388.1	1463.4	1463.4	-
456+00.00	27.96	800.00	-1.64%	-0.24%	1.40	571.4	Sag	-	-	-	108.4
473+00.00	28.28	800.00	-0.24%	0.51%	0.75	1063.8	Sag	-	-	-	58.2
493+00.00	28.66	800.00	0.51%	0.70%	0.19	4255.3	Sag	-	-	-	14.6
503+00.00	28.85	800.00	0.70%	1.82%	1.12	714.3	Sag	-	-	-	86.7
520+00.00	29.17	1,400.00	1.82%	-1.84%	3.66	382.5	Crest	908.6	994.8	908.6	-
533+00.00	29.42	1,000.00	-1.84%	-0.13%	1.71	584.4	Sag	-	-	-	132.5
550+00.00	29.74	800.00	-0.13%	-0.90%	0.77	1035.1	Crest	1494.5	1796.0	1796.0	-
563+33.00	29.99	800.00	-0.90%	-0.46%	0.44	1811.2	Sag	-	-	-	34.2
582+80.00	30.36	1,000.00	-0.46%	-1.37%	0.91	1098.9	Crest	1539.9	1685.7	1685.7	-
603+00.00	30.74	2,000.00	-1.37%	0.62%	1.99	1005.0	Sag	-	-	-	154.1

F-217(10)											
Center (STA ft)	Center (RP)	Length (ft)	G1		A	K-Value	Type	SSD (S<L)	SSD (S>L)	SSD	L (Driver Comfort)
617+50.00	31.04	900.00	0.62%	-1.36%	1.98	453.8	Crest	989.6	994.1	994.1	-
627+00.00	31.22	1,000.00	-1.36%	-0.26%	1.10	906.5	Sag	-	-	-	85.4
677+00.00	32.17	800.00	-0.26%	-0.16%	0.10	8113.6	Sag	-	-	-	7.6
749+00.00	33.53	600.00	0.46%	1.17%	0.71	845.1	Sag	-	-	-	55.0
760+00.00	33.74	1,600.00	1.17%	0.00%	1.17	1367.5	Crest	1717.9	1722.2	1722.2	-
773+00.00	33.99	1,000.00	0.00%	-1.18%	1.18	847.5	Crest	1352.3	1414.4	1414.4	-
785+00.00	34.21	1,000.00	-1.18%	-0.17%	1.01	987.2	Sag	-	-	-	78.4
835+00.00	35.16	1,000.00	-0.17%	-0.66%	0.49	2028.4	Crest	2092.2	2688.6	2688.6	-
854+50.00	35.53	1,000.00	-0.64%	1.15%	1.78	560.6	Sag	-	-	-	138.1
868+00.00	35.79	1,000.00	1.15%	-0.14%	1.28	780.6	Crest	1297.9	1342.3	1342.3	-
905+00.00	36.49	1,000.00	-0.14%	-0.32%	0.18	5409.5	Crest	3416.7	6336.8	6336.8	-
930+00.00	36.96	1,000.00	-0.32%	0.07%	0.39	2564.1	Sag	-	-	-	30.2
945+00.00	37.24	1,000.00	0.07%	-0.40%	0.47	2127.7	Crest	2142.8	2795.7	2795.7	-
995+00.00	38.19	1,000.00	-0.40%	-0.64%	0.24	4166.7	Crest	2998.6	4995.8	4995.8	-
1012+00.00	38.51	1,000.00	-0.64%	-0.22%	0.42	2360.2	Sag	-	-	-	32.8
1056+00.00	39.35	1,200.00	-0.22%	2.32%	2.54	473.1	Sag	-	-	-	196.4
1075+50.00	39.72	1,600.00	2.32%	-0.42%	2.74	583.9	Crest	1122.6	1193.8	1122.6	-
1118+00.00	40.52	800.00	-0.42%	-0.66%	0.24	3340.3	Crest	2684.8	4905.2	4905.2	-

F-217(11)											
Center (STA ft)	Center (RP)	Length (ft)	G1	G2	A	K-Value	Type	SSD (S<L)	SSD (S>L)	SSD	L (Driver Comfort)
1140+00.00	40.94	1,000.00	-0.66%	-0.74%	0.08	12345.7	Crest	5161.6	13821.0	13821.0	-
1157+00.00	41.26	800.00	-0.74%	-0.51%	0.23	3463.2	Sag	-	-	-	17.9
1170+00.00	41.51	1,000.00	-0.51%	-0.98%	0.47	2127.7	Crest	2142.8	2795.7	2795.7	-
1203+00.00	42.13	1,000.00	-0.98%	-0.61%	0.37	2702.7	Sag	-	-	-	28.6
1231+00.00	42.66	1,000.00	-0.61%	-0.55%	0.06	16666.7	Sag	-	-	-	4.6
1250+00.00	43.02	1,000.00	-0.55%	-0.38%	0.17	5882.4	Sag	-	-	-	13.2
1270+00.00	43.40	800.00	-0.38%	-0.27%	0.11	7272.7	Sag	-	-	-	8.5
1280+00.00	43.59	800.00	-0.27%	-0.51%	0.24	3333.3	Crest	2682.0	4895.8	4895.8	-
1320+00.00	44.35	1,000.00	-0.51%	-0.53%	0.02	50000.0	Crest	10387.5	54450.0	54450.0	-
1351+00.00	44.93	1,000.00	-0.53%	-0.41%	0.12	8333.3	Sag	-	-	-	9.3
1400+00.00	45.86	400.00	-0.41%	-0.36%	0.05	8602.2	Sag	-	-	-	3.6
1440+00.00	46.62	800.00	-0.36%	-0.52%	0.16	5111.8	Crest	3321.3	7294.6	7294.6	-
1468+00.00	47.15	800.00	-0.52%	-0.77%	0.25	3200.0	Crest	2627.9	4716.0	4716.0	-
1487+00.00	47.51	800.00	-0.77%	-0.25%	0.52	1538.5	Sag	-	-	-	40.3
1504+00.00	47.83	1,400.00	-0.25%	-0.97%	0.72	1955.3	Crest	2054.2	2207.0	2207.0	-
1520+00.00	48.13	800.00	-0.97%	-0.48%	0.49	1649.5	Sag	-	-	-	37.5
1547+00.00	48.65	400.00	-0.48%	-2.20%	1.72	232.7	Crest	708.6	827.7	827.7	-
1552+85.00	48.76	450.00	-2.20%	1.03%	3.23	139.3	Sag	-	-	-	250.1
1563+50.00	48.96	600.00	1.03%	0.34%	0.69	869.6	Crest	1369.9	1863.8	1863.8	-
1575+80.00	49.19	400.00	0.34%	-2.54%	2.88	138.9	Crest	547.5	574.7	574.7	-
1582+60.00	49.32	500.00	-2.54%	-0.72%	1.82	275.3	Sag	-	-	-	140.6
1589+84.00	49.46	500.00	-0.72%	-0.33%	0.39	1276.2	Sag	-	-	-	30.3
1609+00.00	49.82	400.00	-0.33%	-0.58%	0.25	1612.9	Crest	1865.6	4550.8	4550.8	-

APPENDIX C

Bridge Inspection Reports

Montana Department of Transportation

INITIAL ASSESSMENT FORM FOR STRUCTURE :

P00011000+01651

Location : GARDINER Structure Name: none

General Location Data

District Code, Number, Location : **02** **Dist 2** **BUTTE**
County Code, Location : **067** **PARK**
Kind fo Hwy Code, Description : **2** **2 U.S. Numbered Hwy**
Str Owner Code, Description : **1** **State Highway Agency**
Intersecting Feature : **YELLOWSTONE RIVER**
Structure on the State Highway System : **X** Latitude : **45°01'56"**
Structure on the National Highway System : **X** Longitude : **110°42'20"**
Str Meet or Exceed NBIS Bridge Length : **X**

MDT Maintenance Section : **None**
Division Code, Location : **22** **BOZEMAN**
City Code, Location : **00000** **RURAL AREA**
Signed Route Number : **00089**
Maintained by Code, Description : **1** **State Highway Agency**
Kilometer Post, Mile Post : **0.26 km** **0.16**

Traffic Data

Current ADT : **4,490** ADT Count Year : **2009** Percent Trucks : **2 %**

Construction Data

Construction Project Number : **FHP 43 D**
Construction Station Number : **397+31.00**
Construction Drawing Number : **RECORDSE**
Construction Year : **1930**
Reconstruction Year : **1975**

Structure Loading, Rating and Posting Data

Loading Data :

Design Loading :		**2 M 13.5 (H 15)**
Inventory Load, Design :	**17.2 mton**	**2 AS Allowable Stress**
Operating Load, Design :	**27.2 mton**	**2 AS Allowable Stress**
Posting :		**5 At/Above Legal Loads**

Rating Data :

	Operating	Inventory	Posting
Truck 1 Type 3 :			
Truck 2 Type 3-S3 :			
Truck 3 Type 3-3 :	**52**		

Structure, Roadway and Clearance Data

Structure Deck, Roadway and Span Data :

Structure Length : **124.66 m**
Deck Area : **1,900.00 m sq**
Deck Roadway Width : **11.58 m**
Approach Roadway Width : **11.58 m**
Median Code, Description : **0** **No median**

Structure Vertical and Horizontal Clearance Data :

Vertical Clearance Over the Structure : **99.99 m**
Reference Feature for Vertical Clearance : **N Feature not hwy or RR**
Vertical Clearance Under the Structure : **0.00 m**
Reference Feature for Lateral Underclearance : **N Feature not hwy or RR**
Minimum Lateral Under Clearance Right : **0.00 m**
Minimum Lateral Under Clearance Left : **0.00 m**

Span Data

Main Span

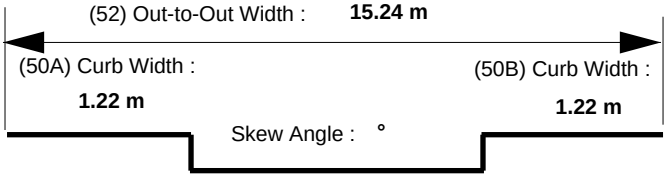
Number Spans : **3**
Material Type Code, Description : **4** **Steel continuous**
Span Design Code, Description : **9** **Truss - Deck**

Approach Span

Number of Spans : **2**
Material Type Code, Description : **1** **Concrete**
Span Design Code, Description : **4** **Tee Beam**

Deck

Deck Structure Type : **1** **Concrete Cast-in-Place**
Deck Surfacing Type : **1** **Monolithic concrete (concurrently placed with struct**
Deck Protection Type : **0** **None**
Deck Membrain Type : **0** **None**



Structure Vertical and Horizontal Clearance Data Inventory Route :

Over / Under Direction Name	Inventory Route	South, West or Bi-directional Travel			North or East Travel		
		Direction	Vertical	Horizontal	Direction	Vertical	Horizontal
Route On Structure	P00011	Both	99.99 m	11.58 m	N/A		

Montana Department of Transportation

INITIAL ASSESSMENT FORM FOR STRUCTURE :

P00011000+01651

Continue

Inspection Data

Sufficiency Rating : **55.7**
Structure Status : **Not Deficient**

Inspection Due Date : 18 April 2015
(91) Inspection Fequency (months) : **24**
Next Fracture Critical Due Date : **17 Apr 2015**
Fracture Critical Detail : **Steel trusses**

NBI Inspection Data

(90) Date of Last Inspection : 18 April 2013
Last Inspected By : Daniel Gravage - 71
(90) Inspection Date :
Inspected By :

(58) Deck Rating :	5	(68) Deck Geometry :	5	(36A) Bridge Rail Rating :	1	(62) Culvert Rating :	N
(59) Superstructure Rating :	7	(67) Structure Rating :	4	(36B) Transition Rating :	0	(61) Channel Rating :	8
(60) Substructure Rating :	7	(69) Under Clearance :	N	(36C) Approach Rail Rating :	N	(71) Waterway Adequacy :	8
(72) App Rdwy Align :	8	(41) Posting Status :	A	(36D) End Rail Rating :	0	(113) Scour Critical :	5

Unrepaired Spalls : 10 m sq
Deck Surfacing Depth : 0.00 in

Inspection Hours

Crew Hours for inspection :	1	Snooper Required :	Y
Helper Hours :	0	Snooper Hours for inspection :	1
Special Crew Hours :	28	Flagger Hours :	1
Special Equipment Hours :	-1		

Inspection Work Candidates

Candidate ID	Date Requested	Status	Priority	Effected Structure Unit	Scope of Work	Action	Covered Condition States
D21-FY2013-000011	23 April 2013	Not Approved	Low	All Spans	Bridge	Pr Maint	

A large ash tree has grown into the framework of the truss. It is causing paint failure in numerous locations. Recommend trimming or removal. The snooper truck will be required.

INITIAL ASSESSMENT FORM FOR STRUCTURE :

P00011000+01651

Continue

Element Inspection Data

********** Span : **Main-0 - -1** **********

Element Description										
Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 12 - Bare Concrete Deck										
	1	4	1440	sq.m.	X	0	100	0	0	0
						%	%	%	%	%

Previous Inspection Notes :

04/18/2013 - Deck surface in much the same condition as previous. Will continue with State 2.	SGIH
04/17/2013 - None	SFIG
04/30/2011 - Random 1/8 inch wide cracks spaced approximately 1 to 5 feet apart.	VZEE
04/17/2009 - Minor increase of spalled and delaminated areas of deck, left in State 2 for this inspection.	YEDI
03/08/2007 - An aspahlt patch covers the cracked approach section on the north end, but is ravelling. Note photo of the underside of the deck in this location. The rest of the deck has light random/transverse cracking throughout.	IZCZ
02/01/2005 - Conditions are unchanged from previous inspection.	HZLZ
09/10/2002 - The expansion joint at Bt.2 is now 'aligator' cracking also. Spall has increased in the areas around the construction joints.	TZKK
07/19/2000 - Cracking at the east end seems to be getting worse, some settlement appears. This also is creating a "duckpond" after rain or snowmelt occurrs.	BHBQ
04/24/1998 - Minor delamination at east bridge end. Two small delaminations at midspan eastbound lane. Light random cracking throughout deck surface.	VBDL

Inspection Notes:

Element 113 - Paint Stl Stringer										
	1	2	800	m.		95	0	5	0	0
						%	%	%	%	%

Previous Inspection Notes :

04/18/2013 - Minor rust areas, primarily along top flanges of stringers.	SGIH
04/17/2013 - None	SFIG
04/30/2011 - Stringers exhibited a loss of paint coating on approximately 5 percent of the surface area with moderate surface corrosion and negligible loss of section.	VZEE
04/17/2009 - None	YEDI
03/08/2007 - None	IZCZ
02/01/2005 - None	HZLZ
09/10/2002 - None	TZKK
07/19/2000 - None	BHBQ
04/24/1998 - _	VBDL

Inspection Notes:

INITIAL ASSESSMENT FORM FOR STRUCTURE :

P00011000+01651

Continue

*** * * * * * * * * * *** Span : **Main-0 - -1 (cont.) * * * * * * * * * * ***

Element Description

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 131 - Paint Stl Deck Truss										
	1	4	300	m.		95	0	5	0	0
						%	%	%	%	%

Previous Inspection Notes :

04/18/2013 - No changes to previous condition states. SGIH

04/17/2013 - None SFIG

04/30/2011 - The trusses exhibited a loss of painted coating on approximately 5 percent of the surface area with moderate surface corrosion and negligible loss of section. Small amounts of pack rust were observed at a few lower chord gusset connections. VZEE

04/17/2009 - None YEDI

03/08/2007 - Except for some very minor rusting on a few of the lower connection plates, the truss system is in very good condition. IZCZ

02/01/2005 - None HZLZ

09/10/2002 - None TZKK

07/19/2000 - None BHBQ

04/24/1998 - _ VBDL

Inspection Notes:

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 163 - Paint Gusset Plate										
	1	3	192	ea.		50	45	5	0	0
						%	%	%	%	%

Previous Inspection Notes :

04/18/2013 - None SGIH

04/17/2013 - None SFIG

04/30/2011 - Areas of pack rust observed in random locations along the lower chord. There are two 1/2 inch by 1/2 inch gouges in the south face of the gusset at L6'-west. VZEE

Inspection Notes:

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 205 - R/Conc Column										
	1	2	6	ea.		90	10	0	0	
						%	%	%	%	%

Previous Inspection Notes :

04/18/2013 - See photo of tree growth. SGIH

04/17/2013 - None SFIG

04/30/2011 - Random hairline to 1/32nd inch wided cracking. There is heavy tree overgrowth on the north face of pier 2. VZEE

04/17/2009 - None YEDI

03/08/2007 - None IZCZ

02/01/2005 - None HZLZ

09/10/2002 - None TZKK

07/19/2000 - No change. BHBQ

04/24/1998 - Hairline cracking throughout concrete columns and struts bents 3 and 4. VBDL

Inspection Notes:

INITIAL ASSESSMENT FORM FOR STRUCTURE :

P00011000+01651

Continue

*** * * * * * * * * * *** Span : **Main-0 - -1 (cont.) * * * * * * * * * * ***

Element Description

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 234 - R/Conc Cap										
	1	4	9	m.		90	10	0	0	
						%	%	%	%	%

Previous Inspection Notes :

04/18/2013 - None	SGIH
04/17/2013 - None	SFIG
04/30/2011 - There is random hairline to 1/32nd inch cracking.	VZEE
04/17/2009 - None	YEDI
03/08/2007 - None	IZCZ
02/01/2005 - None	HZLZ
09/10/2002 - None	TZKK
07/19/2000 - None	BHBQ
04/24/1998 - Hairline cracking of concrete column caps.	VBDL

Inspection Notes:

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 304 - Open Expansion Joint										
	1	4	24	m.		100	0	0		
						%	%	%	%	%

Previous Inspection Notes :

04/18/2013 - None	SGIH
04/17/2013 - None	SFIG
04/30/2011 - There are minor scrapes from snowplows.	VZEE
04/17/2009 - (2) expansion joints on main span. Sliding plate joints are part of approach spans	YEDI
03/08/2007 - None	IZCZ
02/01/2005 - None	HZLZ
09/10/2002 - None	TZKK
07/19/2000 - None	BHBQ
04/24/1998 - Dirt buildup under sliding plate but joints are still tight.	VBDL

Inspection Notes:

INITIAL ASSESSMENT FORM FOR STRUCTURE :

P00011000+01651

Continue

*** * * * * * * * * * *** Span : **Main-0 - -1 (cont.) * * * * * * * * * * ***

Element Description

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 311 - Moveable Bearing										
	1	4	3	ea.		95	5	0		
						%	%	%	%	%

Previous Inspection Notes :

04/18/2013 - None	SGIH
04/17/2013 - None	SFIG
04/30/2011 - Bearings exhibited a loss of paint coating on approximately 5 percent of the surface area with moderate corrosion and less than 5 percent loss of section.	VZEE
04/17/2009 - None	YEDI
03/08/2007 - None	IZCZ
02/01/2005 - None	HZLZ
09/10/2002 - None	TZKK
07/19/2000 - None	BHBQ
04/24/1998 - _	VBDL

Inspection Notes:

Element 313 - Fixed Bearing

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
	1	4	3	ea.		90	10	0		
						%	%	%	%	%

Previous Inspection Notes :

04/18/2013 - None	SGIH
04/17/2013 - None	SFIG
04/30/2011 - Bearings exhibited a loss of paint coating on approximately 10 percent of the surface area with moderate corrosion and less than 5 percent loss of section.	VZEE
04/17/2009 - None	YEDI
03/08/2007 - None	IZCZ
02/01/2005 - None	HZLZ
09/10/2002 - None	TZKK
07/19/2000 - None	BHBQ
04/24/1998 - _	VBDL

Inspection Notes:

INITIAL ASSESSMENT FORM FOR STRUCTURE :

P00011000+01651

Continue

*** * * * * * * * * * *** Span : **Main-0 - -1 (cont.)** *** * * * * * * * * * ***

Element Description

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 334 - Metal Rail Coated										
	1	4	499	m.		100	0	0	0	0
						%	%	%	%	%

Previous Inspection Notes :

04/18/2013 - None	SGIH
04/17/2013 - None	SFIG
04/30/2011 - There are minor scrapes on the rail.	VZEE
04/17/2009 - None	YEDI
03/08/2007 - None	IZCZ
02/01/2005 - None	HZLZ
09/10/2002 - None	TZKK
07/19/2000 - A couple of loose bolts, otherwise good.	BHBQ

Inspection Notes:

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 358 - Deck Cracking SmFlag										
X	1	3	1	ea.	X	0	100	0	0	
						%	%	%	%	%

Previous Inspection Notes :

04/18/2013 - None	SGIH
04/17/2013 - None	SFIG
04/30/2011 - There were unsealed 1/8th inch wide transverse cracks spaced from 1 to 5 feet apart.	VZEE
04/17/2009 - None	YEDI

Inspection Notes:

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 359 - Soffit Smart Flag										
X	1	3	1	ea.	X	0	0	100	0	0
						%	%	%	%	%

Previous Inspection Notes :

04/18/2013 - None	SGIH
04/17/2013 - None	SFIG
04/30/2011 - Large areas of map cracking and heavy efflorescence primarily in the southbound lanes of the approach spans, which are the orignial truss spans before the widening. The areas of cracking observed on the soffit directly correlate with the topside cracking.	VZEE

Inspection Notes:

*** * * * * * * * * * *** Span : **Appr-1 - -1** *** * * * * * * * * * ***

Element Description

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5

INITIAL ASSESSMENT FORM FOR STRUCTURE :

P00011000+01651

Continue

*** * * * * * * * * * *** Span : **Appr-1 - -1 (cont.) * * * * * * * * * * ***

Element Description

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 62 - Bare Top Flang										
	1	3	276	sq.m.	X	0	0	100	0	0
						%	%	%	%	%

Previous Inspection Notes :

04/18/2013 - No apparent change to previous conditions, continuing with State 3. SGIH

04/17/2013 - None SFIG

04/30/2011 - Large areas of map cracking primarily in the southbound lane which is the original truss, in the approach spans only. The areas of heavy cracking exhibited delamination and potholes hat have been patched with asphalt. VZEE

04/17/2009 - (2)spans, 11.5 x 12.0 ea. YEDI
Extensive "alligator" cracking and delamination on each of the approach spans, with heavy cracking and efflorescence seen on the underside of the deck (photos).

Inspection Notes:

Element 110 - R/Conc Open Girder

	1	4	146	m.		95	0	5	0	
						%	%	%	%	%

Previous Inspection Notes :

04/18/2013 - None SGIH

04/17/2013 - None SFIG

04/30/2011 - Girder haunch repairs made since the last inspection. There is random hairline cracking on all girders and a small spall above the second column from the west at bent 3. VZEE

04/17/2009 - Repairs to girder haunch are planned for summer 2009. YEDI

03/08/2007 - See photo of current condition of girder haunch. IZCZ

02/01/2005 - No apparent change from previous conditions of girder beam seats (photo). HZLZ

09/10/2002 - Concrete deterioration of the outer (south) girder haunch/beam-seat has increased since last inspection - see photo comparisons. TZKK

07/19/2000 - Delamination at the beam seat continues (see photo). BHBQ

04/24/1998 - Hairline cracking of poured in place concrete girder light deterioration of concrete beam brg upstream side column cap. VBDL

Inspection Notes:

Element 205 - R/Conc Column

	1	2	8	ea.		90	10	0	0	
						%	%	%	%	%

Previous Inspection Notes :

04/18/2013 - None SGIH

04/17/2013 - None SFIG

04/30/2011 - There is random hairline cracking. VZEE

04/17/2009 - None YEDI

03/08/2007 - None IZCZ

02/01/2005 - None HZLZ

09/10/2002 - None TZKK

07/19/2000 - None BHBQ

04/24/1998 - Minor spalls with some scaling and cracking of concrete. VBDL

Inspection Notes:

INITIAL ASSESSMENT FORM FOR STRUCTURE :

P00011000+01651

Continue

*** * * * * * * * * * *** Span : **Appr-1 - -1 (cont.)** *** * * * * * * * * * ***

Element Description

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 215 - R/Conc Abutment										
	1	2	50	m.		100	0	0	0	
						%	%	%	%	%

Previous Inspection Notes :

04/18/2013 - None SGIH
04/17/2013 - None SFIG
04/30/2011 - No defects noted at this inspection. VZEE
04/17/2009 - None YEDI
03/08/2007 - None IZCZ
02/01/2005 - None HZLZ
09/10/2002 - None TZKK
07/19/2000 - None BHBQ
04/24/1998 - Hairline cracks showing in concrete wingwalls. VBDL

Inspection Notes:

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 234 - R/Conc Cap										
	1	2	6	m.		90	10	0	0	
						%	%	%	%	%

Previous Inspection Notes :

04/18/2013 - None SGIH
04/17/2013 - None SFIG
04/30/2011 - There is random hairline cracking. VZEE
04/17/2009 - None YEDI
03/08/2007 - None IZCZ
02/01/2005 - None HZLZ
09/10/2002 - None TZKK
07/19/2000 - None BHBQ
04/24/1998 - Scaling of concrete caps with light cracking. VBDL

Inspection Notes:

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 305 - Assm Jt w/o Seal										
	1	3	24	m.		100	0	0		
						%	%	%	%	%

Previous Inspection Notes :

04/18/2013 - None SGIH
04/17/2013 - None SFIG
04/30/2011 - No defects noted at this inspection. VZEE
04/17/2009 - Sliding plate joints appear to be functioning. YEDI

Inspection Notes:

INITIAL ASSESSMENT FORM FOR STRUCTURE :

P00011000+01651

Continue

*** * * * * * * * * * *** Span : **Appr-1 - -1 (cont.) * * * * * * * * * * ***

Element Description										
Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 334 - Metal Rail Coated										
	1	3	48	m.		100	0	0	0	0
						%	%	%	%	%

Previous Inspection Notes :

04/18/2013 - None SGIH

04/17/2013 - None SFIG

04/30/2011 - Minor scrapes to the rail. VZEE

04/17/2009 - None YEDI

Inspection Notes:

General Inspection Notes

04/18/2013 - None SGIH

04/17/2013 - None SFIG

04/30/2011 - This inspection was a climbing fracture critical inspection performed by Todd Demski and Drew Garceau of Collins Engineers. The bridge is labeled from north to south per the original bridge drawings. VZEE

Deleted the cross-frame element 7/12/2012. AKJ

04/17/2009 - None YEDI

03/08/2007 - None IZCZ

02/01/2005 - None HZLZ

09/10/2002 - None TZKK

07/19/2000 - None BHBQ

04/24/1998 - None VBDL

08/06/1996 - Sufficiency Rating Calculation Accepted by ops$u5963 at 3/10/97 11:34:34 APVE
Sufficiency Rating Calculation Accepted by OPS$U9004 at 2/19/97 14:34:21
OPS$U5963 inspection comments -
Structure P00011000+01651 -
Date 8/6/96 -
Previous comments > (none)

05/01/1994 - REFI

02/01/1992 - Updated with tape 1994 NB94

04/01/1990 - Updated with tape 1992 NB92

02/01/1988 - Updated with tape 1989 NB89

07/01/1985 - Updated with tape 1987 NB87

12/01/1982 - Updated with tape 1984 NB84

02/01/1980 - Updated with tape 1982 NB82

Inspection Photos

P00011000+01651

Location GARDINER Stucture Name: none

South profile

Notes

None

N appr, view South

Notes

None

Inspection Photos

P00011000+01651

Location GARDINER Stucture Name: none

Superstructure

Notes

None

S. Appr. span

Notes

Asphalt patching hides heavy "aligator" cracking of deck.

MONTANA MDT DEPARTMENT OF TRANSPORTATION

Inspection Photos

P00011000+01651

Location GARDINER Stucture Name: none

S. Appr. span soffit

Notes

Extensive cracking and efflorescence. Note (full-depth)spall and rusting rebar exposed in left bay.

N. Appr. soffit

Notes

Much the same conditions exist on the north approach span.

Montana Department of Transportation

INITIAL ASSESSMENT FORM FOR STRUCTURE :

P00011020+04171

Location : 11M SW EMIGRANT Structure Name: none

General Location Data

District Code, Number, Location : **02** **Dist 2** **BUTTE**
County Code, Location : **067** **PARK**
Kind fo Hwy Code, Description : **2** **2 U.S. Numbered Hwy**
Str Owner Code, Description : **1** **State Highway Agency**
Intersecting Feature : **YELLOWSTONE RIVER**
Structure on the State Highway System : **X**
Structure on the National Highway System : **X**
Str Meet or Exceed NBIS Bridge Length : **X**
Latitude : **45°15'15"**
Longitude : **110°52'05"**

MDT Maintenance Section : **None**
Division Code, Location : **22** **BOZEMAN**
City Code, Location : **00000** **RURAL AREA**
Signed Route Number : **00089**
Maintained by Code, Description : **1** **State Highway Agency**
Kilometer Post, Mile Post : **32.85 km** **20.41**

Traffic Data

Current ADT : **2,140**
ADT Count Year : **2009**
Percent Trucks : **2 %**

Construction Data

Construction Project Number : **F 217-9**
Construction Station Number : **57+31.00**
Construction Drawing Number : **3892**
Construction Year : **1958**
Reconstruction Year :

Structure Loading, Rating and Posting Data

Loading Data :

Design Loading :		**5 MS 18 (HS 20)**
Inventory Load, Design :	**32.6 mton**	**B ASD Assigned**
Operating Load, Design :	**75.2 mton**	**B ASD Assigned**
Posting :		**5 At/Above Legal Loads**

Rating Data :

	Operating	Inventory	Posting
Truck 1 Type 3 :			
Truck 2 Type 3-S3 :			
Truck 3 Type 3-3 :	**99**		

Structure, Roadway and Clearance Data

Structure Deck, Roadway and Span Data :

Structure Length : **138.68 m**
Deck Area : **1,340.00 m sq**
Deck Roadway Width : **8.53 m**
Approach Roadway Width : **9.75 m**
Median Code, Description : **0** **No median**

Structure Vertical and Horizontal Clearance Data :

Vertical Clearance Over the Structure : **99.99 m**
Reference Feature for Vertical Clearance : **N Feature not hwy or RR**
Vertical Clearance Under the Structure : **0.00 m**
Reference Feature for Lateral Underclearance : **N Feature not hwy or RR**
Minimum Lateral Under Clearance Right : **0.00 m**
Minimum Lateral Under Clearance Left : **0.00 m**

Span Data

Main Span

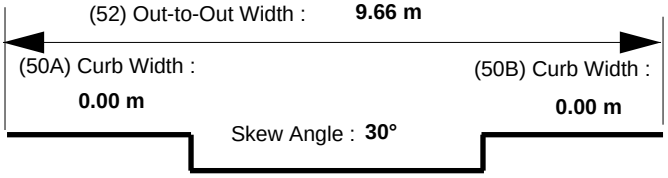
Number Spans : **4**
Material Type Code, Description : **4** **Steel continuous**
Span Design Code, Description : **2** **Stringer/Multi-beam or Girder**

Approach Span

Number of Spans : **0**
Material Type Code, Description :
Span Design Code, Description :

Deck

Deck Structure Type : **1** **Concrete Cast-in-Place**
Deck Surfacing Type : **1** **Monolithic concrete (concurrently placed with struct**
Deck Protection Type : **0** **None**
Deck Membrain Type : **0** **None**



Structure Vertical and Horizontal Clearance Data Inventory Route :

Over / Under Direction Name	Inventory Route	South, West or Bi-directional Travel			North or East Travel		
		Direction	Vertical	Horizontal	Direction	Vertical	Horizontal
Route On Structure	P00011	Both	99.99 m	8.53 m	N/A		

INITIAL ASSESSMENT FORM FOR STRUCTURE :

P00011020+04171

Continue

Inspection Data

Sufficiency Rating : **65.5**
Structure Status : **Not Deficient**

Inspection Due Date : 02 October 2014
(91) Inspection Fequency (months) : **24**

Next Under Water Insp : **02 Oct 2016**
Under Water Insp Type : **Type I**

NBI Inspection Data

(90) Date of Last Inspection :	02 October 2012	Last Inspected By :	Daniel Gravage - 71
(90) Inspection Date :		Inspected By :	

(58) Deck Rating :	6	(68) Deck Geometry :	4	(36A) Bridge Rail Rating :	1	(62) Culvert Rating :	N
(59) Superstructure Rating :	7	(67) Structure Rating :	7	(36B) Transition Rating :	1	(61) Channel Rating :	8
(60) Substructure Rating :	7	(69) Under Clearance :	N	(36C) Approach Rail Rating :	1	(71) Waterway Adequacy :	8
(72) App Rdwy Align :	8	(41) Posting Status :	A	(36D) End Rail Rating :	1	(113) Scour Critical :	5

Unrepaired Spalls : 2 m sq

Deck Surfacing Depth : 0.00 in

Inspection Hours

Crew Hours for inspection :	2	Snooper Required :	Y
Helper Hours :	-1	Snooper Hours for inspection :	1
Special Crew Hours :	-1	Flagger Hours :	-1
Special Equipment Hours :	-1		

Inspection Work Candidates

Candidate ID	Date Requested	Status	Priority	Effected Structure Unit	Scope of Work	Action	Covered Condition States

INITIAL ASSESSMENT FORM FOR STRUCTURE :

P00011020+04171

Continue

Element Inspection Data

********** Span : **Main-0 - -1** **********

Element Description										
Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 12 - Bare Concrete Deck										
	1	3	1340	sq.m.	X	0	100	0	0	0
						%	%	%	%	%

Previous Inspection Notes :

10/02/2012 - Agree with Sttae 2 condition.	FZKZ
10/13/2010 - New HMWM surface treatment since last inspection.	TZJC
10/01/2008 - No apparent changes to previous conditions.	GICO
03/06/2007 - Small spall area at Pier 3 joint hasn't changed much, thanks to periodic asphalt patching. (138.68 X 9.66 = 1339.649)	HZIF
02/10/2005 - Conditions remain much the same, with slight increase of spalled areas mentioned previously.	PNJZ
09/10/2002 - None	TZKZ
07/19/2000 - No changes.	BHBN
04/27/1998 - Several small spall areas thru out deck surface showing delamination, spall in deck surface over pier 3 at compression joint at edge of driving lanes. Underside of deck showing some efflor.	VJJX
06/06/1996 - None	CSBZ
05/01/1994 - None	REFI

Inspection Notes:

Element 107 - Paint Stl Opn Girder										
	1	2	549	m.		95	5	0	0	0
						%	%	%	%	%

Previous Inspection Notes :

10/02/2012 - Minor paint chips with associated light rusting.	FZKZ
10/13/2010 - None	TZJC
10/01/2008 - None	GICO
03/06/2007 - None	HZIF
02/10/2005 - None	PNJZ
09/10/2002 - None	TZKZ
07/19/2000 - None	BHBN
04/27/1998 - None	VJJX
06/06/1996 - None	CSBZ
05/01/1994 - None	REFI

Inspection Notes:

INITIAL ASSESSMENT FORM FOR STRUCTURE :

P00011020+04171

Continue

*** * * * * * * * * * *** Span : **Main-0 - -1 (cont.) * * * * * * * * * * ***

Element Description

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 205 - R/Conc Column										
	1	3	6	ea.		90	10	0	0	
						%	%	%	%	%

Previous Inspection Notes :

10/02/2012 - None	FZKZ
10/13/2010 - Typical exposed aggregate along the waterline of columns and web walls.	TZJC
10/01/2008 - None	GICO
03/06/2007 - None	HZIF
02/10/2005 - None	PNJZ
09/10/2002 - None	TZKZ
07/19/2000 - Piers 2, 3 & 4 are two columns joined by a web wall and spanned with a cap.	BHBN
04/27/1998 - None	VJJX
06/06/1996 - None	CSBZ
05/01/1994 - None	REFI

Inspection Notes:

Element 215 - R/Conc Abutment

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
	1	2	29	m.		100	0	0	0	
						%	%	%	%	%

Previous Inspection Notes :

10/02/2012 - None	FZKZ
10/13/2010 - None	TZJC
10/01/2008 - None	GICO
03/06/2007 - None	HZIF
02/10/2005 - None	PNJZ
09/10/2002 - None	TZKZ
07/19/2000 - None	BHBN
04/27/1998 - None	VJJX
06/06/1996 - None	CSBZ
05/01/1994 - None	REFI

Inspection Notes:

INITIAL ASSESSMENT FORM FOR STRUCTURE :

P00011020+04171

Continue

*** * * * * * * * * * *** Span : **Main-0 - -1 (cont.)** *** * * * * * * * * * ***

Element Description

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 234 - R/Conc Cap										
	1	2	31	m.		100	0	0	0	
						%	%	%	%	%

Previous Inspection Notes :

10/02/2012 - None	FZKZ
10/13/2010 - None	TZJC
10/01/2008 - None	GICO
03/06/2007 - None	HZIF
02/10/2005 - None	PNJZ
09/10/2002 - None	TZKZ
07/19/2000 - _	BHBN

Inspection Notes:

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 305 - Assm Jt w/o Seal										
	1	3	22	m.		100	0	0		
						%	%	%	%	%

Previous Inspection Notes :

10/02/2012 - None	FZKZ
10/13/2010 - Clean and in working condition.	TZJC
10/01/2008 - None	GICO
03/06/2007 - None	HZIF
02/10/2005 - None	PNJZ
09/10/2002 - None	TZKZ
07/19/2000 - None	BHBN
04/27/1998 - None	VJJX
06/06/1996 - None	CSBZ
05/01/1994 - None	REFI

Inspection Notes:

INITIAL ASSESSMENT FORM FOR STRUCTURE :

P00011020+04171

Continue

*** * * * * * * * * * *** Span : **Main-0 - -1 (cont.) * * * * * * * * * * ***

Element Description

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 311 - Moveable Bearing										
	1	2	16	ea.		95	5	0		
						%	%	%	%	%

Previous Inspection Notes :

10/02/2012 - Five pct. State 2 for rusting of rockers.	FZKZ
10/13/2010 - None	TZJC
10/01/2008 - None	GICO
03/06/2007 - None	HZIF
02/10/2005 - None	PNJZ
09/10/2002 - None	TZKZ
07/19/2000 - Same.	BHBN
04/27/1998 - Light rusting of rocker bearings under sliding plate joints at abut 1 and 5.	VJJX
06/06/1996 - None	CSBZ
05/01/1994 - None	REFI

Inspection Notes:

Element 313 - Fixed Bearing

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
	1	2	4	ea.		100	0	0		
						%	%	%	%	%

Previous Inspection Notes :

10/02/2012 - None	FZKZ
10/13/2010 - None	TZJC
10/01/2008 - None	GICO
03/06/2007 - None	HZIF
02/10/2005 - None	PNJZ
09/10/2002 - None	TZKZ
07/19/2000 - None	BHBN
04/27/1998 - None	VJJX
06/06/1996 - None	CSBZ
05/01/1994 - None	REFI

Inspection Notes:

INITIAL ASSESSMENT FORM FOR STRUCTURE :

P00011020+04171

Continue

*** * * * * * * * * * *** Span : **Main-0 - -1 (cont.) * * * * * * * * * * ***

Element Description										
Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 331 - Conc Bridge Railing										
	1	2	277	m.		100	0	0	0	
						%	%	%	%	%

Previous Inspection Notes :

10/02/2012 - None	FZKZ
10/13/2010 - None	TZJC
10/01/2008 - None	GICO
03/06/2007 - None. (138.68 X 2 = 277.36)	HZIF
02/10/2005 - None	PNJZ
09/10/2002 - None	TZKZ
07/19/2000 - None	BHBN
04/27/1998 - None	VJJX
06/06/1996 - None	CSBZ
05/01/1994 - None	REFI

Inspection Notes:

General Inspection Notes

10/02/2012 - None	FZKZ
10/13/2010 - Deleted cross-frame element 7/12/2012. AKJ	TZJC
10/01/2008 - None	GICO
03/06/2007 - None	HZIF
02/10/2005 - None	PNJZ
09/10/2002 - None	TZKZ
07/19/2000 - None	BHBN
04/27/1998 - None	VJJX
06/06/1996 - Sufficiency Rating Calculation Accepted by ops$u5963 at 3/10/97 11:34:34 Sufficiency Rating Calculation Accepted by OPS$U9004 at 2/19/97 14:34:23 U5963 inspection comments - Structure P00011020+04171 - Date 9/4/96 - Previous comments > (none)	CSBZ
05/01/1994 -	REFI
11/01/1991 - Updated with tape 1994	NB94
04/01/1990 - Updated with tape 1992	NB92
02/01/1988 - Updated with tape 1989	NB89
07/01/1985 - Updated with tape 1988	NB88
12/01/1982 - Updated with tape 1984	NB84
02/01/1980 - Updated with tape 1982	NB82

Inspection Photos

P00011020+04171

Location 11M SW EMIGRANT Stucture Name: none

West profile

Notes

View downstream.

N appr, view South

Notes

None

MONTANA MDT DEPARTMENT OF TRANSPORTATION

Inspection Photos

P00011020+04171

Location 11M SW EMIGRANT Stucture Name: none

Superstructure

Notes

None

Montana Department of Transportation

INITIAL ASSESSMENT FORM FOR STRUCTURE :

P00011024+00721

Location : 7M SW EMIGRANT Structure Name: none

General Location Data

District Code, Number, Location : **02** **Dist 2** **BUTTE**
County Code, Location : **067** **PARK**
Kind fo Hwy Code, Description : **2** **2 U.S. Numbered Hwy**
Str Owner Code, Description : **1** **State Highway Agency**
Intersecting Feature : **BIG CREEK**
Structure on the State Highway System : **X**
Structure on the National Highway System : **X**
Str Meet or Exceed NBIS Bridge Length : **X**

Latitude : **45°17'57"**
Longitude : **110°49'53"**

MDT Maintenance Section : **None**
Division Code, Location : **22** **BOZEMAN**
City Code, Location : **00000** **RURAL AREA**
Signed Route Number : **00089**
Maintained by Code, Description : **1** **State Highway Agency**
Kilometer Post, Mile Post : **38.74 km** **24.07**

Traffic Data

Current ADT : **2,140**
ADT Count Year : **2009**
Percent Trucks : **2 %**

Construction Data

Construction Project Number : **F 217-9**
Construction Station Number : **250+21.00**
Construction Drawing Number : **3903**
Construction Year : **1960**
Reconstruction Year :

Structure Loading, Rating and Posting Data

Loading Data :

Design Loading :		**5 MS 18 (HS 20)**
Inventory Load, Design :	**32.6 mton**	**B ASD Assigned**
Operating Load, Design :	**37.1 mton**	**B ASD Assigned**
Posting :		**5 At/Above Legal Loads**

Rating Data :

	Operating	Inventory	Posting
Truck 1 Type 3 :			
Truck 2 Type 3-S3 :			
Truck 3 Type 3-3 :	**74**		

Structure, Roadway and Clearance Data

Structure Deck, Roadway and Span Data :

Structure Length : **27.43 m**
Deck Area : **267.00 m sq**
Deck Roadway Width : **8.53 m**
Approach Roadway Width : **9.80 m**
Median Code, Description : **0** **No median**

Structure Vertical and Horizontal Clearance Data :

Vertical Clearance Over the Structure : **99.99 m**
Reference Feature for Vertical Clearance : **N Feature not hwy or RR**
Vertical Clearance Under the Structure : **0.00 m**
Reference Feature for Lateral Underclearance : **N Feature not hwy or RR**
Minimum Lateral Under Clearance Right : **0.00 m**
Minimum Lateral Under Clearance Left : **0.00 m**

Span Data

Main Span

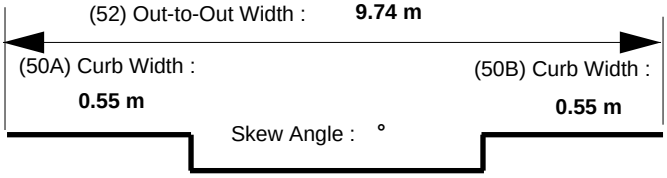
Number Spans : **3**
Material Type Code, Description : **2** **Concrete continuous**
Span Design Code, Description : **4** **Tee Beam**

Approach Span

Number of Spans : **0**
Material Type Code, Description :
Span Design Code, Description :

Deck

Deck Structure Type : **N Not applicable**
Deck Surfacing Type : **0 None (no additional concrete thickness or wearing s**
Deck Protection Type : **0 None**
Deck Membrain Type : **0 None**



Structure Vertical and Horizontal Clearance Data Inventory Route :

Over / Under Direction Name	Inventory Route	South, West or Bi-directional Travel			North or East Travel		
		Direction	Vertical	Horizontal	Direction	Vertical	Horizontal
Route On Structure	P00011	Both	99.99 m	8.53 m	N/A		

INITIAL ASSESSMENT FORM FOR STRUCTURE :

P00011024+00721

Continue

Inspection Data

Sufficiency Rating : **65.5**
Structure Status : **Not Deficient**

Inspection Due Date : 29 December 2014
(91) Inspection Fequency (months) : **24**

NBI Inspection Data

(90) Date of Last Inspection :	02 January 2013	Last Inspected By :	Daniel Gravage - 71
(90) Inspection Date :		Inspected By :	

(58) Deck Rating :	7	(68) Deck Geometry :	4	(36A) Bridge Rail Rating :	1	(62) Culvert Rating :	N
(59) Superstructure Rating :	7	(67) Structure Rating :	7	(36B) Transition Rating :	1	(61) Channel Rating :	8
(60) Substructure Rating :	7	(69) Under Clearance :	N	(36C) Approach Rail Rating :	1	(71) Waterway Adequacy :	8
(72) App Rdwy Align :	8	(41) Posting Status :	A	(36D) End Rail Rating :	1	(113) Scour Critical :	5

Unrepaired Spalls :	0 m sq	Deck Surfacing Depth :	0.00 in

Inspection Hours

Crew Hours for inspection :	1	Snooper Required :	N
Helper Hours :	-1	Snooper Hours for inspection :	-1
Special Crew Hours :	-1	Flagger Hours :	-1
Special Equipment Hours :	-1		

Inspection Work Candidates		Status	Priority	Effected Structure Unit	Scope of Work	Action	Covered Condition States
Candidate ID	Date Requested						

INITIAL ASSESSMENT FORM FOR STRUCTURE :

P00011024+00721

Continue

Element Inspection Data

********** Span : **Main-0 - -1** **********

Element Description

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 62 - Bare Top Flang deck surface										
	1	3	267	sq.m.	X	100	0	0	0	0
						%	%	%	%	%

Previous Inspection Notes :

01/02/2013 - None EOJN

12/29/2010 - HMWM seal surface in 2009. ZZLS

01/16/2009 - Minor transverse and random hairline cracking throughout deck surface. No delamination noted w/chain drag. (27.43 X 9.74 = 267.168) WZCG

Inspection Notes:

Element 110 - R/Conc Open Girder

	1	3	110	m.		100	0	0	0	
						%	%	%	%	%

Previous Inspection Notes :

01/02/2013 - None EOJN

12/29/2010 - None ZZLS

01/16/2009 - None WZCG

12/26/2006 - None ZZLW

12/08/2004 - None KPKZ

09/09/2002 - None TZKZ

02/07/2000 - No change. JBJS

12/04/1997 - Deck has several small spall areas with minor transverse and random cracking thru out deck surface. 4" long section of exposed rebar B-3 area. Chain drag did not reveal any delamination. VJKF

11/01/1995 - None YDNF

10/01/1993 - None REFI

Inspection Notes:

Element 205 - R/Conc Column

	1	2	4	ea.		100	0	0	0	
						%	%	%	%	%

Previous Inspection Notes :

01/02/2013 - None EOJN

12/29/2010 - None ZZLS

01/16/2009 - None WZCG

12/26/2006 - None ZZLW

12/08/2004 - None KPKZ

09/09/2002 - None TZKZ

02/07/2000 - None JBJS

12/04/1997 - Minor scaling of concrete at waterline. VJKF

11/01/1995 - None YDNF

10/01/1993 - None REFI

Inspection Notes:

INITIAL ASSESSMENT FORM FOR STRUCTURE :

P00011024+00721

Continue

*** * * * * * * * * * *** Span : **Main-0 - -1 (cont.) * * * * * * * * * * ***

Element Description

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 215 - R/Conc Abutment										
	1	2	23	m.		100	0	0	0	
						%	%	%	%	%

Previous Inspection Notes :

01/02/2013 - None	EOJN
12/29/2010 - None	ZZLS
01/16/2009 - None	WZCG
12/26/2006 - None	ZZLW
12/08/2004 - None	KPKZ
09/09/2002 - None	TZKZ
02/07/2000 - None	JBJS
12/04/1997 - None	VJKF
11/01/1995 - None	YDNF
10/01/1993 - None	REFI

Inspection Notes:

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 234 - R/Conc Cap										
	1	2	18	m.		100	0	0	0	
						%	%	%	%	%

Previous Inspection Notes :

01/02/2013 - None	EOJN
12/29/2010 - None	ZZLS
01/16/2009 - None	WZCG
12/26/2006 - None	ZZLW
12/08/2004 - None	KPKZ
09/09/2002 - None	TZKZ
02/07/2000 - None	JBJS
12/04/1997 - None	VJKF
11/01/1995 - None	YDNF
10/01/1993 - None	REFI

Inspection Notes:

INITIAL ASSESSMENT FORM FOR STRUCTURE :

P00011024+00721

Continue

*** * * * * * * * * * *** Span : **Main-0 - -1 (cont.) * * * * * * * * * * ***

Element Description

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 313 - Fixed Bearing										
	1	2	8	ea.		100	0	0		
						%	%	%	%	%

Previous Inspection Notes :

01/02/2013 - None	EOJN
12/29/2010 - None	ZZLS
01/16/2009 - None	WZCG
12/26/2006 - None	ZZLW
12/08/2004 - None	KPKZ
09/09/2002 - None	TZKZ
02/07/2000 - None	JBJS
12/04/1997 - None	VJKF
11/01/1995 - None	YDNF
10/01/1993 - None	REFI

Inspection Notes:

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 331 - Conc Bridge Railing										
	1	2	55	m.		100	0	0	0	
						%	%	%	%	%

Previous Inspection Notes :

01/02/2013 - None	EOJN
12/29/2010 - None	ZZLS
01/16/2009 - None	WZCG
12/26/2006 - None. (27.43 X 2 = 54.86)	ZZLW
12/08/2004 - None	KPKZ
09/09/2002 - None	TZKZ
02/07/2000 - New reinforced concrete barrier rail was constructed in front of structure's original metal rail Aug 1998. Also installed was approach railing both sides of structure and roadway tieing into new barrier rail. ELEMENT 334 (METAL BRIDGE RAIL) WAS DELETED FROM INVENTORY. BRIDGE RAIL RATINGS WERE ALL CHANGED TO 1. (BGN)	JBJS

Inspection Notes:

Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 358 - Deck Cracking SmFlag										
X	1	3	1	ea.	X	100	0	0	0	
						%	%	%	%	%

Previous Inspection Notes :

01/02/2013 - None	EOJN
12/29/2010 - None	ZZLS
01/16/2009 - HMWM surface protectant added in 2008	WZCG

Inspection Notes:

INITIAL ASSESSMENT FORM FOR STRUCTURE :

P00011024+00721

Continue

General Inspection Notes

01/02/2013 - None	EOJN
12/29/2010 - None	ZZLS
01/16/2009 - None	WZCG
12/26/2006 - None	ZZLW
12/08/2004 - None	KPKZ
09/09/2002 - None	TZKZ
02/07/2000 - None	JBJS
12/04/1997 - None	VJKF
11/01/1995 - Sufficiency Rating Calculation Accepted by ops$u5963 at 3/10/97 11:34:34 Sufficiency Rating Calculation Accepted by OPS$U9004 at 2/19/97 14:34:24	YDNF
10/01/1993 -	REFI
11/01/1991 - Updated with tape 1994	NB94
02/01/1990 - Updated with tape 1992	NB92
02/01/1988 - Updated with tape 1989	NB89
07/01/1985 - Updated with tape 1988	NB88
12/01/1982 - Updated with tape 1984	NB84
02/01/1980 - Updated with tape 1982	NB82

Inspection Photos

P00011024+00721

Location 7M SW EMIGRANT Stucture Name: none

East profile

Notes

None

S appr, view North

Notes

None

MONTANA MDT DEPARTMENT OF TRANSPORTATION

Inspection Photos

P00011024+00721

Location 7M SW EMIGRANT Stucture Name: none

Superstructure

Notes

None

Montana Department of Transportation

INITIAL ASSESSMENT FORM FOR STRUCTURE :

P00011047+09001

Location : 10 KM S LIVINGSTON Structure Name:

General Location Data

District Code, Number, Location : **02** **Dist 2** **BUTTE**
County Code, Location : **067** **PARK**
Kind fo Hwy Code, Description : **2** **2 U.S. Numbered Hwy**
Str Owner Code, Description : **1** **State Highway Agency**
Intersecting Feature : **FARM ACCESS**
Structure on the State Highway System : [X]
Structure on the National Highway System : [X]
Str Meet or Exceed NBIS Bridge Length : [ ]

Latitude : **45°34'27"**
Longitude : **110°35'13"**

MDT Maintenance Section : **None**
Division Code, Location : **22** **BOZEMAN**
City Code, Location : **00000** **RURAL AREA**
Signed Route Number : **00089**
Maintained by Code, Description : **1** **State Highway Agency**
Kilometer Post, Mile Post : **77.00 km** **47.85**

Traffic Data

Current ADT : **3,350**
ADT Count Year : **2009**
Percent Trucks : **2 %**

Construction Data

Construction Project Number :
Construction Station Number :
Construction Drawing Number :
Construction Year : **1964**
Reconstruction Year :

Structure Loading, Rating and Posting Data

Loading Data :

Design Loading :		**5 MS 18 (HS 20)**
Inventory Load, Design :	**32.6 mton**	**B ASD Assigned**
Operating Load, Design :	**32.6 mton**	**B ASD Assigned**
Posting :		**5 At/Above Legal Loads**

Rating Data :

	Operating	Inventory	Posting
Truck 1 Type 3 :			
Truck 2 Type 3-S3 :			
Truck 3 Type 3-3 :	**40**		

Structure, Roadway and Clearance Data

Structure Deck, Roadway and Span Data :

Structure Length : **4.80 m**
Deck Area : **0.00 m sq**
Deck Roadway Width : **0.00 m**
Approach Roadway Width : **9.10 m**
Median Code, Description : **0** **No median**

Structure Vertical and Horizontal Clearance Data :

Vertical Clearance Over the Structure : **99.99 m**
Reference Feature for Vertical Clearance : **N Feature not hwy or RR**
Vertical Clearance Under the Structure : **4.50 m**
Reference Feature for Lateral Underclearance : **N Feature not hwy or RR**
Minimum Lateral Under Clearance Right : **0.00 m**
Minimum Lateral Under Clearance Left : **0.00 m**

Span Data

Main Span

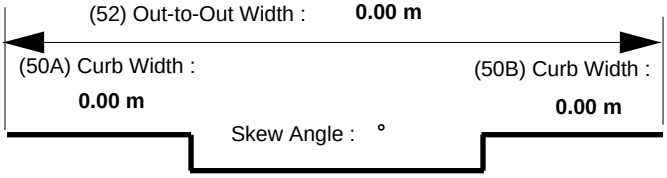
Number Spans : **1**
Material Type Code, Description : **3** **Steel**
Span Design Code, Description : **19** **Culvert (includes frame culverts)**

Approach Span

Number of Spans : **0**
Material Type Code, Description :
Span Design Code, Description :

Deck

Deck Structure Type : **N Not applicable**
Deck Surfacing Type : **N Not Applicable (applies only to strutures with no dec**
Deck Protection Type : **N Not applicable (applies only to structures with no de**
Deck Membrain Type : **N Not applicable (applies only to structures with no de**



Structure Vertical and Horizontal Clearance Data Inventory Route :

Over / Under Direction Name	Inventory Route	South, West or Bi-directional Travel			North or East Travel		
		Direction	Vertical	Horizontal	Direction	Vertical	Horizontal
Route On Structure	P00011	Both	99.99 m	9.10 m	N/A		
FARM ACCESS							

Montana Department of Transportation

INITIAL ASSESSMENT FORM FOR STRUCTURE :

P00011047+09001

Continue

Inspection Data

Sufficiency Rating : ***80**
Structure Status : **Not Deficient**

Inspection Due Date : 23 August 2013
(91) Inspection Fequency (months) : **24**

NBI Inspection Data

(90) Date of Last Inspection :	23 August 2011	Last Inspected By :	Daniel Gravage - 71
(90) Inspection Date :		Inspected By :	

(58) Deck Rating :	N	(68) Deck Geometry :	N	(36A) Bridge Rail Rating :	N	(62) Culvert Rating :	7
(59) Superstructure Rating :	N	(67) Structure Rating :	7	(36B) Transition Rating :	N	(61) Channel Rating :	N
(60) Substructure Rating :	N	(69) Under Clearance :	N	(36C) Approach Rail Rating :	N	(71) Waterway Adequacy :	N
(72) App Rdwy Align :	6	(41) Posting Status :	A	(36D) End Rail Rating :	N	(113) Scour Critical :	N

Unrepaired Spalls :	0 m sq	Deck Surfacing Depth :	0.00 in

Inspection Hours

Crew Hours for inspection :	2	Snooper Required :	
Helper Hours :	0	Snooper Hours for inspection :	0
Special Crew Hours :	0	Flagger Hours :	0
Special Equipment Hours :	0		

Inspection Work Candidates		Status	Priority	Effected Structure Unit	Scope of Work	Action	Covered Condition States
Candidate ID	Date Requested						

Element Inspection Data

********** Span : **Main-0 - Update Description** **********

Element Description										
Smart Flag	Scale Factor	Env	Quantity	Units	Insp Each	Pct Stat 1	Pct Stat 2	Pct Stat 3	Pct Stat 4	Pct Stat 5
Element 240 - Steel Culvert										
	1	2	32	m.		100	0	0	0	
						%	%	%	%	%

Previous Inspection Notes :

08/23/2011 - None ZMCZ
08/25/2009 - None RZBZ

Inspection Notes:

General Inspection Notes

08/23/2011 - None ZMCZ
08/25/2009 - None RZBZ

Inspection Photos

P00011047+09001

Location 10 KM S LIVINGSTON Stucture Name:

E appr view West

Notes

None

W appr view East

Notes

None

APPENDIX D

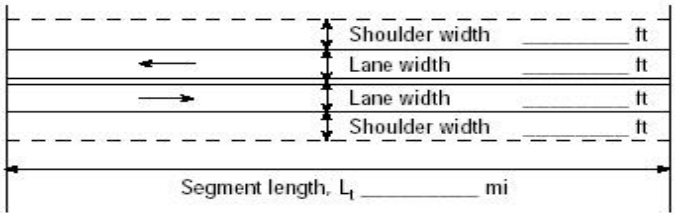
Highway LOS Analysis

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 0.0 to 0.4 (34-3-10)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Average Annual*	Analysis Year	*Existing (2012)*

Project Description: *Paradise Valley*

Input Data



Analysis direction vol., V_d *329*veh/h

Opposing direction vol., V_o *219*veh/h

Shoulder width ft *4.0*

Lane Width ft *12.0*

Segment Length mi *0.4*

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.88*

No-passing zone *100*%

% Trucks and Buses , P_T *6* %

% Recreational vehicles, P_R *4*%

Access points *mi* *40*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.3*	*1.5*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.982*	*0.971*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*381*	*256*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*10.0 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*3.6 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*48.7 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*40.1 mi/h*
		Percent free flow speed, PFFS	*82.4* %

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*	*0.994*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*376*	*250*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*38.0*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*52.8*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*69.7*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.22*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1661*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1690*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*82.4*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*373.9*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.09*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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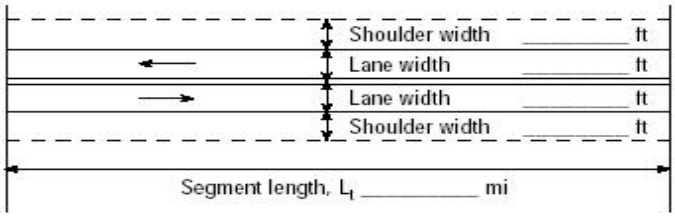
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 0.4 to 2.4 (34-3-9)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Average Annual*	Analysis Year	*Existing (2012)*

Project Description: *Paradise Valley*

Input Data



Analysis direction vol., V_d *270*veh/h

Opposing direction vol., V_o *180*veh/h

Shoulder width ft *4.0*

Lane Width ft *12.0*

Segment Length mi *2.0*

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.88*

No-passing zone *73%*

% Trucks and Buses , P_T *6 %*

% Recreational vehicles, P_R *4%*

Access points *mi* *21*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.4*	*1.5*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.977*	*0.971*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*314*	*211*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*5.3 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*3.7 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*53.5 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*45.7 mi/h*
		Percent free flow speed, PFFS	*85.5 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*	*0.994*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*309*	*206*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*30.7*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*53.2*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*62.6*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*B*
Volume to capacity ratio, *v/c*	*0.18*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1651*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1690*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*85.5*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*306.8*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*4.99*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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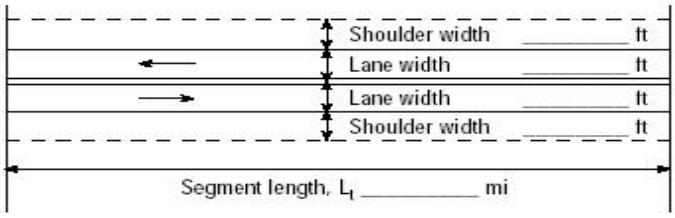
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 2.4 to 10.4 (34-3-1)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Average Annual*	Analysis Year	*Existing (2012)*

Project Description: *Paradise Valley*

Input Data



Analysis direction vol., V_d *184*veh/h

Opposing direction vol., V_o *123*veh/h

Shoulder width ft *4.0*
Lane Width ft *12.0*
Segment Length mi *8.0*

☑ Class I highway ☐ Class II highway ☐ Class III highway

Terrain ☑ Level ☐ Rolling
Grade Length mi Up/down
Peak-hour factor, PHF *0.88*
No-passing zone *53%*
% Trucks and Buses , P_T *6 %*
% Recreational vehicles, P_R *4%*
Access points *mi* *9*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.5*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.971*	*0.960*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*215*	*146*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*2.3 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*2.5 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*56.5 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*51.1 mi/h*
		Percent free flow speed, PFFS	*90.6 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*	*0.994*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*210*	*141*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*22.5*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*49.8*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*52.3*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.13*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1632*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1690*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*90.6*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*209.1*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*4.79*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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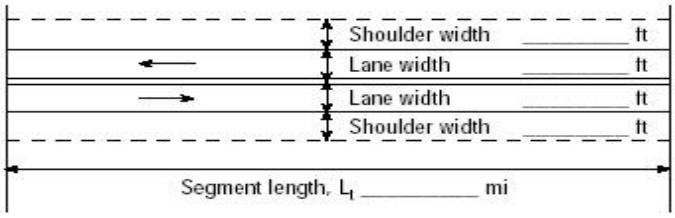
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 10.4 to 24.4 (34-3-2)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Average Annual*	Analysis Year	*Existing (2012)*

Project Description: *Paradise Valley*

Input Data



Analysis direction vol., V_d *172*veh/h

Opposing direction vol., V_o *115*veh/h

Shoulder width ft *4.0*
Lane Width ft *12.0*
Segment Length mi *13.9*

☑ Class I highway ☐ Class II highway ☐ Class III highway

Terrain ☑ Level ☐ Rolling
Grade Length mi Up/down
Peak-hour factor, PHF *0.88*
No-passing zone *55%*
% Trucks and Buses , P_T *6 %*
% Recreational vehicles, P_R *4%*
Access points *mi* *4*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.5*	*1.8*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.971*	*0.954*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*201*	*137*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*1.0 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*2.6 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*57.7 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*52.5 mi/h*
		Percent free flow speed, PFFS	*91.0 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*	*0.994*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*197*	*131*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*21.3*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*50.4*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*51.6*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.12*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1622*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1690*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*91.0*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*195.5*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*4.76*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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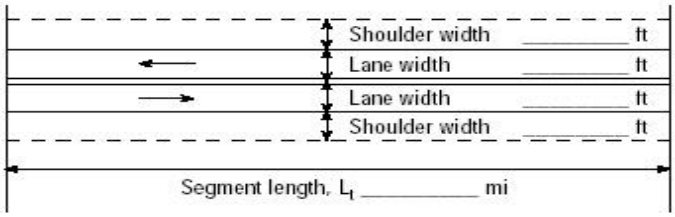
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 24.4 to 40.7 (34-3-3)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Average Annual*	Analysis Year	*Existing (2012)*

Project Description: *Paradise Valley*

Input Data



Analysis direction vol., V_d *185*veh/h

Opposing direction vol., V_o *124*veh/h

Shoulder width ft *4.0*

Lane Width ft *12.0*

Segment Length mi *16.3*

☑ Class I highway ☐ Class II highway ☐ Class III highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.88*

No-passing zone *28%*

% Trucks and Buses , P_T *6 %*

% Recreational vehicles, P_R *4%*

Access points *mi* *4*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.5*	*1.7*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.971*	*0.960*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*217*	*147*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*1.0 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*1.5 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*57.7 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*53.4 mi/h*
		Percent free flow speed, PFFS	*92.5 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*	*0.994*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*211*	*142*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*22.6*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*38.5*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*45.6*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*B*
Volume to capacity ratio, *v/c*	*0.13*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1632*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1690*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*92.5*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*210.2*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*4.80*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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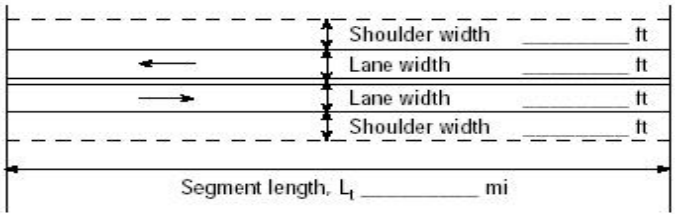
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 40.7 to 50.6 (34-2-2)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Average Annual*	Analysis Year	*Existing (2012)*

Project Description: *Paradise Valley*

Input Data



Analysis direction vol., V_d *273*veh/h

Opposing direction vol., V_o *182*veh/h

Shoulder width ft *4.0*

Lane Width ft *12.0*

Segment Length mi *9.9*

☑ Class I highway ☐ Class II highway ☐ Class III highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.88*

No-passing zone *38%*

% Trucks and Buses , P_T *6 %*

% Recreational vehicles, P_R *4%*

Access points *mi* *6*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.4*	*1.5*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.977*	*0.971*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*318*	*213*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, $FFS=S_{FM}+0.00776(v/f_{HV,ATS})$		Adj. for access points[4], f_A (Exhibit 15-8)	*1.5 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*2.5 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*57.2 mi/h*
		Average travel speed, $ATS_d=FFS-0.00776(v_{d,ATS}+v_{o,ATS})-f_{np,ATS}$	*50.6 mi/h*
		Percent free flow speed, PFFS	*88.5 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*	*0.994*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*312*	*208*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*30.9*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*43.5*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*57.0*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.19*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1651*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1690*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*88.5*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*310.2*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*4.99*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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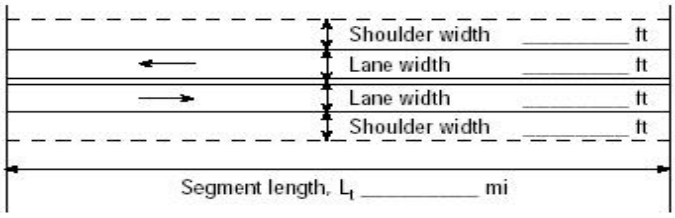
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 50.6 to 52.4 (34-2A-5)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Average Annual*	Analysis Year	*Existing (2012)*

Project Description: *Paradise Valley*

Input Data



Analysis direction vol., V_d *400*veh/h

Opposing direction vol., V_o *267*veh/h

Shoulder width ft *4.0*

Lane Width ft *12.0*

Segment Length mi *1.8*

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.88*

No-passing zone *100*%

% Trucks and Buses , P_T *6* %

% Recreational vehicles, P_R *4*%

Access points *mi* *20*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.2*	*1.4*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.988*	*0.977*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*460*	*311*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*5.0 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*3.4 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*53.7 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*44.4 mi/h*
		Percent free flow speed, PFFS	*82.6* %

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*0.994*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*455*	*305*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*44.7*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*44.0*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*71.0*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.27*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1661*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1690*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*82.6*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*454.5*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.19*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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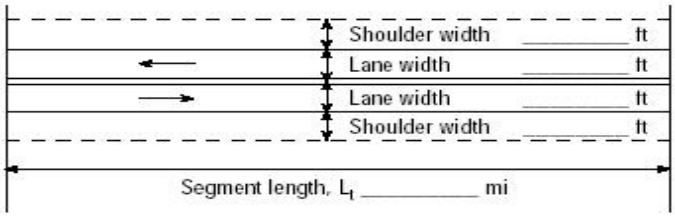
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 0.0 to 0.4 (34-3-10)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Average Annual*	Analysis Year	*Future (2035)*

Project Description: *Paradise Valley*

Input Data



Analysis direction vol., V_d *463*veh/h

Opposing direction vol., V_o *309*veh/h

Shoulder width ft *4.0*

Lane Width ft *12.0*

Segment Length mi *0.4*

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.88*

No-passing zone *100*%

% Trucks and Buses , P_T *6* %

% Recreational vehicles, P_R *4*%

Access points *mi* *40*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.2*	*1.3*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.988*	*0.982*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*533*	*358*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*10.0 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*3.0 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*48.7 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*38.8 mi/h*
		Percent free flow speed, PFFS	*79.7* %

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*0.994*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*526*	*353*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*50.3*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*39.5*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*73.9*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.31*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1669*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1690*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*79.7*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*526.1*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.26*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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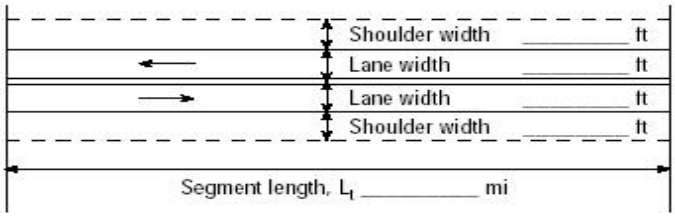
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 0.4 to 2.4 (34-3-9)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Average Annual*	Analysis Year	*Future (2035)*

Project Description: *Paradise Valley*

Input Data



Show North Arrow

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☑ Level ☐ Rolling

Analysis direction vol., V_d	*380* veh/h
Opposing direction vol., V_o	*254* veh/h
Shoulder width ft	*4.0*
Lane Width ft	*12.0*
Segment Length mi	*2.0*
Grade Length mi Up/down	
Peak-hour factor, PHF	*0.88*
No-passing zone	*73%*
% Trucks and Buses , P_T	*6* %
% Recreational vehicles, P_R	*4%*
Access points *mi*	*21*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.3*	*1.4*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.982*	*0.977*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*440*	*295*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*5.3 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*3.2 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*53.5 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*44.6 mi/h*
		Percent free flow speed, PFFS	*83.4* %

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*0.994*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*432*	*290*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*43.9*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*44.4*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*70.5*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*B*
Volume to capacity ratio, *v/c*	*0.26*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1661*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1690*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*83.4*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*431.8*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.16*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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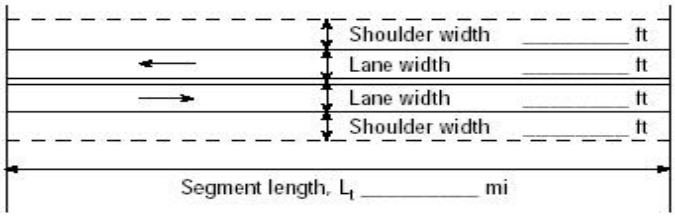
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 2.4 to 10.4 (34-3-1)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Average Annual*	Analysis Year	*Future (2035)*

Project Description: *Paradise Valley*

Input Data



Analysis direction vol., V_d *260*veh/h

Opposing direction vol., V_o *173*veh/h

Shoulder width ft *4.0*

Lane Width ft *12.0*

Segment Length mi *8.0*

☑ Class I highway ☐ Class II highway ☐ Class III highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.88*

No-passing zone *53%*

% Trucks and Buses , P_T *6 %*

% Recreational vehicles, P_R *4%*

Access points *mi* *9*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.4*	*1.5*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.977*	*0.971*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*302*	*202*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, $FFS=S_{FM}+0.00776(v/f_{HV,ATS})$		Adj. for access points[4], f_A (Exhibit 15-8)	*2.3 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*3.2 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*56.5 mi/h*
		Average travel speed, $ATS_d=FFS-0.00776(v_{d,ATS}+v_{o,ATS})-f_{np,ATS}$	*49.3 mi/h*
		Percent free flow speed, PFFS	*87.4 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*	*0.994*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*297*	*198*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*30.0*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*49.5*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*59.7*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.18*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1651*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1690*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*87.4*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*295.5*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*4.97*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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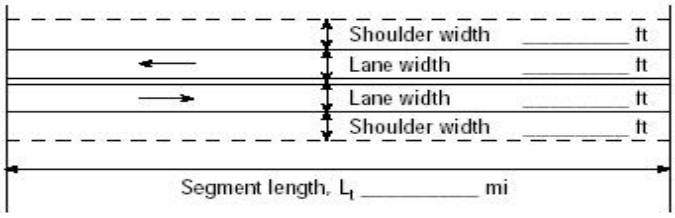
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 10.4 to 24.4 (34-3-2)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Average Annual*	Analysis Year	*Future (2035)*

Project Description: *Paradise Valley*

Input Data



Analysis direction vol., V_d *243*veh/h

Opposing direction vol., V_o *162*veh/h

Shoulder width ft *4.0*
Lane Width ft *12.0*
Segment Length mi *13.9*

☑ Class I highway ☐ Class II highway ☐ Class III highway

Terrain ☑ Level ☐ Rolling
Grade Length mi Up/down
Peak-hour factor, PHF *0.88*
No-passing zone *55%*
% Trucks and Buses , P_T *6 %*
% Recreational vehicles, P_R *4%*
Access points *mi* *4*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.4*	*1.6*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.977*	*0.965*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*283*	*191*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*1.0 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*3.3 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*57.7 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*50.8 mi/h*
		Percent free flow speed, PFFS	*88.0 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*	*0.994*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*278*	*185*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*28.4*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*50.6*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*58.8*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.17*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1641*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1690*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*88.0*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*276.1*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*4.93*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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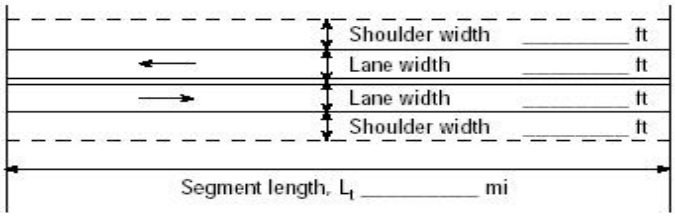
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 24.4 to 40.7 (34-3-3)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Average Annual*	Analysis Year	*Future (2035)*

Project Description: *Paradise Valley*

Input Data



Analysis direction vol., V_d *261*veh/h

Opposing direction vol., V_o *174*veh/h

Shoulder width ft *4.0*

Lane Width ft *12.0*

Segment Length mi *16.3*

☑ Class I highway ☐ Class II highway ☐ Class III highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.88*

No-passing zone *28%*

% Trucks and Buses , P_T *6 %*

% Recreational vehicles, P_R *4%*

Access points *mi* *4*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.4*	*1.5*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.977*	*0.971*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*304*	*204*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, $FFS=S_{FM}+0.00776(v/f_{HV,ATS})$		Adj. for access points[4], f_A (Exhibit 15-8)	*1.0 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*2.1 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*57.7 mi/h*
		Average travel speed, $ATS_d=FFS-0.00776(v_{d,ATS}+v_{o,ATS})-f_{np,ATS}$	*51.7 mi/h*
		Percent free flow speed, PFFS	*89.6 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*	*0.994*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*298*	*199*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*30.1*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*39.7*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*53.9*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.18*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1651*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1690*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*89.6*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*296.6*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*4.97*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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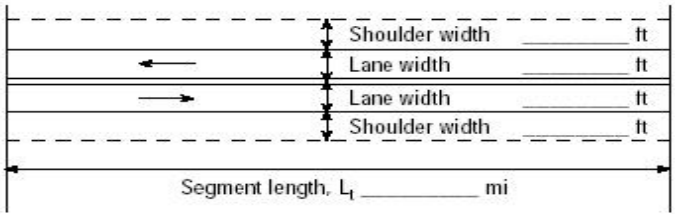
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 40.7 to 50.6 (34-2-2)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Average Annual*	Analysis Year	*Future (2035)*

Project Description: *Paradise Valley*

Input Data



Show North Arrow

☑ Class I highway ☐ Class II highway ☐ Class III highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.88*

No-passing zone *38%*

% Trucks and Buses , P_T *6 %*

% Recreational vehicles, P_R *4%*

Access points *mi* *6*/mi

Analysis direction vol., V_d *385*veh/h

Opposing direction vol., V_o *256*veh/h

Shoulder width ft *4.0*

Lane Width ft *12.0*

Segment Length mi *9.9*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.3*	*1.4*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.982*	*0.977*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*446*	*298*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*1.5 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*2.2 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*57.2 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*49.2 mi/h*
		Percent free flow speed, PFFS	*86.0 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*0.994*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*438*	*293*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*44.1*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*36.4*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*65.9*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*D*
Volume to capacity ratio, *v/c*	*0.26*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1661*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1690*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*86.0*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*437.5*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.17*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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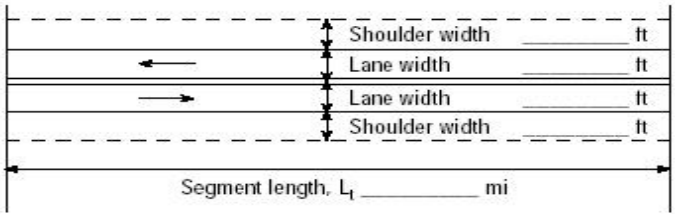
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 50.6 to 52.4 (34-2A-5)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Average Annual*	Analysis Year	*Future (2035)*

Project Description: *Paradise Valley*

Input Data



Analysis direction vol., V_d *564*veh/h

Opposing direction vol., V_o *376*veh/h

Shoulder width ft *4.0*

Lane Width ft *12.0*

Segment Length mi *1.8*

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.88*

No-passing zone *100*%

% Trucks and Buses , P_T *6* %

% Recreational vehicles, P_R *4*%

Access points *mi* *20*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.1*	*1.3*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*	*0.982*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*645*	*435*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*5.0 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*2.6 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*53.7 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*42.7 mi/h*
		Percent free flow speed, PFFS	*79.5 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*1.000*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*641*	*427*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*57.5*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*35.0*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*78.5*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.38*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1669*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1700*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*79.5*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*640.9*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.36*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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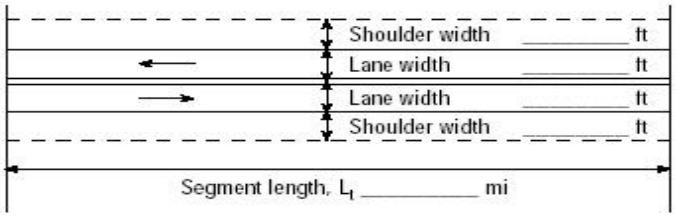
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 0.0 to 0.4 (34-3-10)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Peak Season*	Analysis Year	*Existing (2012)*

Project Description: *Paradise Valley*

Input Data



☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.88*

No-passing zone *100*%

% Trucks and Buses , P_T *6* %

% Recreational vehicles, P_R *4*%

Access points *mi* *40*/mi

Show North Arrow

Analysis direction vol., V_d *574*veh/h

Opposing direction vol., V_o *383*veh/h

Shoulder width ft *4.0*

Lane Width ft *12.0*

Segment Length mi *0.4*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.1*	*1.3*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*	*0.982*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*656*	*443*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*10.0 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*2.5 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*48.7 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*37.6 mi/h*
		Percent free flow speed, PFFS	*77.3* %

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*1.000*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*652*	*435*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*59.2*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*34.6*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*80.0*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.39*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1669*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1700*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*77.3*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*652.3*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.37*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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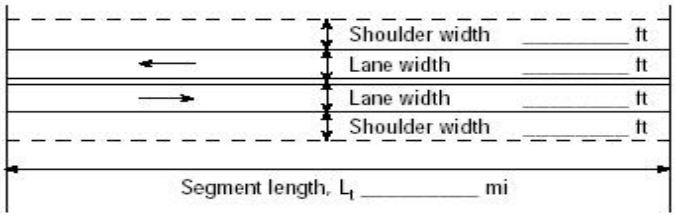
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 0.4 to 2.4 (34-3-9)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Peak Season*	Analysis Year	*Existing (2012)*

Project Description: *Paradise Valley*

Input Data



Analysis direction vol., V_d *472*veh/h

Opposing direction vol., V_o *315*veh/h

Shoulder width ft *4.0*

Lane Width ft *12.0*

Segment Length mi *2.0*

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.88*

No-passing zone *73%*

% Trucks and Buses , P_T *6 %*

% Recreational vehicles, P_R *4%*

Access points *mi* *21*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.2*	*1.3*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.988*	*0.982*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*543*	*365*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, $FFS=S_{FM}+0.00776(v/f_{HV,ATS})$		Adj. for access points[4], f_A (Exhibit 15-8)	*5.3 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*2.8 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*53.5 mi/h*
		Average travel speed, $ATS_d=FFS-0.00776(v_{d,ATS}+v_{o,ATS})-f_{np,ATS}$	*43.6 mi/h*
		Percent free flow speed, PFFS	*81.7 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*0.994*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*536*	*360*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*50.5*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*37.3*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*72.8*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.32*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1669*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1690*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*81.7*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*536.4*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.27*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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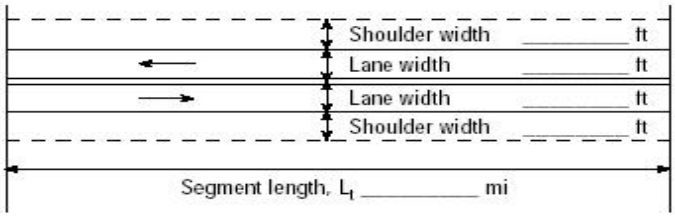
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 2.4 to 10.4 (34-3-1)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Peak Season*	Analysis Year	*Existing (2012)*

Project Description: *Paradise Valley*

Input Data



Analysis direction vol., V_d *322*veh/h

Opposing direction vol., V_o *215*veh/h

Shoulder width ft *4.0*
Lane Width ft *12.0*
Segment Length mi *8.0*

☑ Class I highway ☐ Class II highway ☐ Class III highway

Terrain ☑ Level ☐ Rolling
Grade Length mi Up/down
Peak-hour factor, PHF *0.88*
No-passing zone *53%*
% Trucks and Buses , P_T *6 %*
% Recreational vehicles, P_R *4%*
Access points *mi* *9*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.3*	*1.5*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.982*	*0.971*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*373*	*252*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*2.3 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*3.0 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*56.5 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*48.6 mi/h*
		Percent free flow speed, PFFS	*86.2 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*	*0.994*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*368*	*246*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*37.4*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*47.8*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*66.0*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*D*
Volume to capacity ratio, *v/c*	*0.22*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1651*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1690*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*86.2*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*365.9*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.08*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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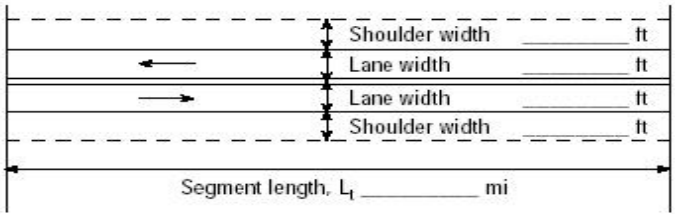
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 10.4 to 24.4 (34-3-2)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Peak Season*	Analysis Year	*Existing (2012)*

Project Description: *Paradise Valley*

Input Data



Analysis direction vol., V_d *301* veh/h

Opposing direction vol., V_o *201* veh/h

Shoulder width ft *4.0*

Lane Width ft *12.0*

Segment Length mi *13.9*

☑ Class I highway ☐ Class II highway ☐ Class III highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.88*

No-passing zone *55%*

% Trucks and Buses , P_T *6 %*

% Recreational vehicles, P_R *4%*

Access points *mi* *4*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.4*	*1.5*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.977*	*0.971*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*350*	*235*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS} (Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, $FFS=S_{FM}+0.00776(v/f_{HV,ATS})$		Adj. for access points[4], f_A (Exhibit 15-8)	*1.0 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*3.2 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*57.7 mi/h*
		Average travel speed, $ATS_d=FFS-0.00776(v_{d,ATS}+v_{o,ATS})-f_{np,ATS}$	*50.0 mi/h*
		Percent free flow speed, PFFS	*86.6 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-18 or 15-19)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*	*0.994*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*344*	*230*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*34.3*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*49.6*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*64.0*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.21*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1651*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1690*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*86.6*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*342.0*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.04*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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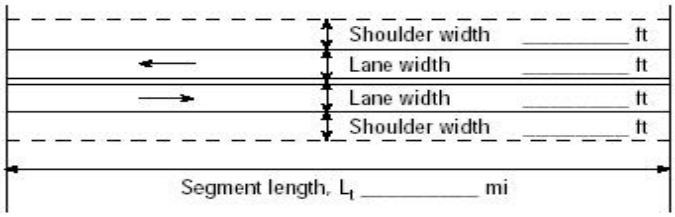
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 24.4 to 40.7 (34-3-3)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Peak Season*	Analysis Year	*Existing (2012)*

Project Description: *Paradise Valley*

Input Data



Analysis direction vol., V_d *324*veh/h

Opposing direction vol., V_o *216*veh/h

Shoulder width ft *4.0*
Lane Width ft *12.0*
Segment Length mi *16.3*

☑ Class I highway ☐ Class II highway ☐ Class III highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.88*

No-passing zone *28%*

% Trucks and Buses , P_T *6 %*

% Recreational vehicles, P_R *4%*

Access points *mi* *4*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.3*	*1.5*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.982*	*0.971*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*375*	*253*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*1.0 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*2.0 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*57.7 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*50.9 mi/h*
		Percent free flow speed, PFFS	*88.2 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.1*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*	*0.994*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*370*	*247*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*37.5*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*38.9*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*60.8*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.22*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1651*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1690*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*88.2*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*368.2*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.08*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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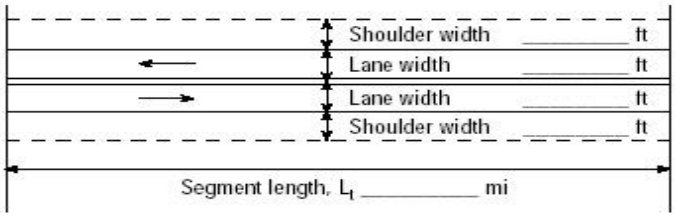
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 40.7 to 50.6 (34-2-2)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Peak Season*	Analysis Year	*Existing (2012)*

Project Description: *Paradise Valley*

Input Data



Analysis direction vol., V_d *477*veh/h

Opposing direction vol., V_o *318*veh/h

Shoulder width ft *4.0*
Lane Width ft *12.0*
Segment Length mi *9.9*

☑ Class I highway ☐ Class II highway ☐ Class III highway

Terrain ☑ Level ☐ Rolling
Grade Length mi Up/down
Peak-hour factor, PHF *0.88*
No-passing zone *38%*
% Trucks and Buses , P_T *6 %*
% Recreational vehicles, P_R *4%*
Access points *mi* *6*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.2*	*1.3*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.988*	*0.982*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*549*	*368*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*1.5 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*2.0 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*57.2 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*48.1 mi/h*
		Percent free flow speed, PFFS	*84.1 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*0.994*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*542*	*364*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*52.4*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*30.9*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*70.9*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*D*
Volume to capacity ratio, *v/c*	*0.32*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1669*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1690*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*84.1*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*542.0*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.28*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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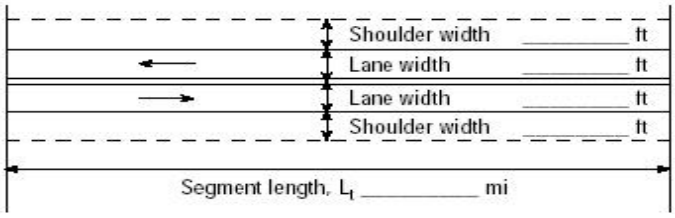
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 50.6 to 52.4 (34-2A-5)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Peak Season*	Analysis Year	*Existing (2012)*

Project Description: *Paradise Valley*

Input Data



Analysis direction vol., V_d *699*veh/h

Opposing direction vol., V_o *466*veh/h

Shoulder width ft *4.0*

Lane Width ft *12.0*

Segment Length mi *1.8*

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.88*

No-passing zone *100*%

% Trucks and Buses , P_T *6* %

% Recreational vehicles, P_R *4*%

Access points *mi* *20*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.1*	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*	*0.988*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*799*	*536*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*5.0 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*2.2 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*53.7 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*41.2 mi/h*
		Percent free flow speed, PFFS	*76.6* %

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*1.000*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*794*	*530*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*66.6*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*29.1*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*84.1*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.47*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1680*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1700*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*76.6*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*794.3*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.47*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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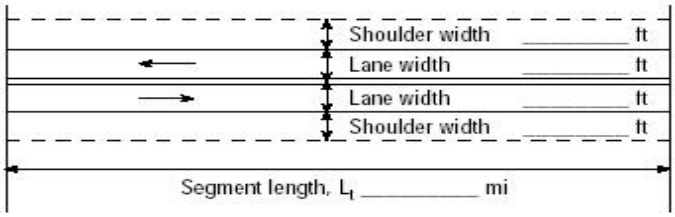
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 0.0 to 0.4 (34-3-10)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Peak Season*	Analysis Year	*Future (2035)*

Project Description: *Paradise Valley*

Input Data



Analysis direction vol., V_d *722*veh/h

Opposing direction vol., V_o *481*veh/h

Shoulder width ft *4.0*

Lane Width ft *12.0*

Segment Length mi *0.4*

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.88*

No-passing zone *100*%

% Trucks and Buses , P_T *6* %

% Recreational vehicles, P_R *4*%

Access points *mi* *40*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.1*	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*	*0.988*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*825*	*553*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*10.0 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*2.1 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*48.7 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*35.9 mi/h*
		Percent free flow speed, PFFS	*73.8* %

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*1.000*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*820*	*547*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*67.7*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*28.1*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*84.6*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*D*
Volume to capacity ratio, *v/c*	*0.49*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1680*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1700*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*73.8*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*820.5*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.49*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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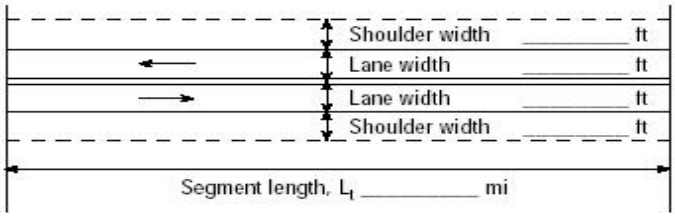
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 0.4 to 2.4 (34-3-9)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Peak Season*	Analysis Year	*Future (2035)*

Project Description: *Paradise Valley*

Input Data



Analysis direction vol., V_d *593* veh/h

Opposing direction vol., V_o *395* veh/h

Shoulder width ft *4.0*

Lane Width ft *12.0*

Segment Length mi *2.0*

☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.88*

No-passing zone *73%*

% Trucks and Buses , P_T *6 %*

% Recreational vehicles, P_R *4%*

Access points *mi* *21*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.1*	*1.3*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*	*0.982*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*678*	*457*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, $FFS=S_{FM}+0.00776(v/f_{HV,ATS})$		Adj. for access points[4], f_A (Exhibit 15-8)	*5.3 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*2.3 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*53.5 mi/h*
		Average travel speed, $ATS_d=FFS-0.00776(v_{d,ATS}+v_{o,ATS})-f_{np,ATS}$	*42.3 mi/h*
		Percent free flow speed, PFFS	*79.2 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*1.000*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*674*	*449*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*60.8*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*32.2*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*80.1*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.40*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1669*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1700*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*79.2*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*673.9*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.39*
Bicycle level of service (Exhibit 15-4)	*E*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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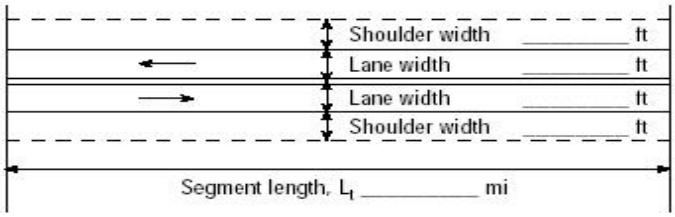
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 2.4 to 10.4 (34-3-1)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Peak Season*	Analysis Year	*Future (2035)*

Project Description: *Paradise Valley*

Input Data



Analysis direction vol., V_d *405*veh/h

Opposing direction vol., V_o *270*veh/h

Shoulder width ft *4.0*
Lane Width ft *12.0*
Segment Length mi *8.0*

☑ Class I highway ☐ Class II highway ☐ Class III highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.88*

No-passing zone *53%*

% Trucks and Buses , P_T *6 %*

% Recreational vehicles, P_R *4%*

Access points *mi* *9*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.2*	*1.4*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.988*	*0.977*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*466*	*314*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*2.3 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*2.7 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*56.5 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*47.7 mi/h*
		Percent free flow speed, PFFS	*84.6 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*0.994*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*460*	*309*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*44.8*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*38.6*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*67.9*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*D*
Volume to capacity ratio, *v/c*	*0.27*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1661*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1690*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*84.6*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*460.2*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.19*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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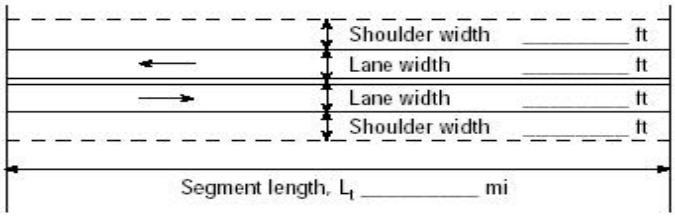
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 10.4 to 24.4 (34-3-2)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Peak Season*	Analysis Year	*Future (2035)*

Project Description: *Paradise Valley*

Input Data



Analysis direction vol., V_d *379*veh/h

Opposing direction vol., V_o *252*veh/h

Shoulder width ft *4.0*
Lane Width ft *12.0*
Segment Length mi *13.9*

☑ Class I highway ☐ Class II highway ☐ Class III highway

Terrain ☑ Level ☐ Rolling
Grade Length mi Up/down
Peak-hour factor, PHF *0.88*
No-passing zone *55%*
% Trucks and Buses , P_T *6 %*
% Recreational vehicles, P_R *4%*
Access points *mi* *4*/mi

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.3*	*1.4*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.982*	*0.977*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*439*	*293*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, $FFS=S_{FM}+0.00776(v/f_{HV,ATS})$		Adj. for access points[4], f_A (Exhibit 15-8)	*1.0 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*2.9 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*57.7 mi/h*
		Average travel speed, $ATS_d=FFS-0.00776(v_{d,ATS}+v_{o,ATS})-f_{np,ATS}$	*49.1 mi/h*
		Percent free flow speed, PFFS	*85.2 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*0.994*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*431*	*288*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*43.8*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*42.1*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*69.0*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*D*
Volume to capacity ratio, *v/c*	*0.26*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1661*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1690*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*85.2*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*430.7*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.16*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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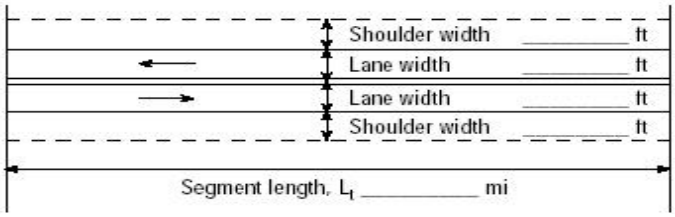
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 24.4 to 40.7 (34-3-3)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Peak Season*	Analysis Year	*Future (2035)*

Project Description: *Paradise Valley*

Input Data



Show North Arrow

☑ Class I highway ☐ Class II highway ☐ Class III highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.88*

No-passing zone *28%*

% Trucks and Buses , P_T *6 %*

% Recreational vehicles, P_R *4%*

Access points *mi* *4*/mi

Analysis direction vol., V_d *407*veh/h

Opposing direction vol., V_o *272*veh/h

Shoulder width ft *4.0*

Lane Width ft *12.0*

Segment Length mi *16.3*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.2*	*1.4*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.988*	*0.977*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*468*	*316*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*1.0 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*1.8 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*57.7 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*49.8 mi/h*
		Percent free flow speed, PFFS	*86.3 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*0.994*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*463*	*311*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*44.8*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*31.5*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*63.6*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*C*
Volume to capacity ratio, *v/c*	*0.28*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1661*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1690*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*86.3*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*462.5*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.20*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	
1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain. 2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F. 3. For the analysis direction only and for v>200 veh/h. 4. For the analysis direction only 5. Exhibit 15-20 provides coefficients a and b for Equation 15-10. 6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.	

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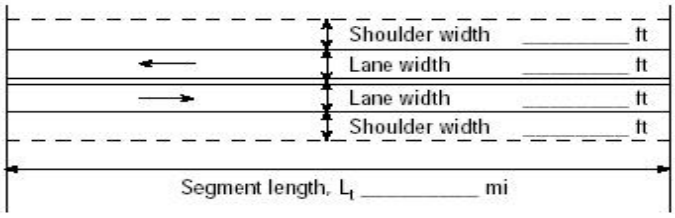
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 40.7 to 50.6 (34-2-2)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Peak Season*	Analysis Year	*Future (2035)*

Project Description: *Paradise Valley*

Input Data



Show North Arrow

☑ Class I highway ☐ Class II highway ☐ Class III highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.88*

No-passing zone *38%*

% Trucks and Buses , P_T *6 %*

% Recreational vehicles, P_R *4%*

Access points *mi* *6*/mi

Analysis direction vol., V_d *600*veh/h

Opposing direction vol., V_o *400*veh/h

Shoulder width ft *4.0*

Lane Width ft *12.0*

Segment Length mi *9.9*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.1*	*1.2*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*0.994*	*0.988*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*686*	*460*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, $FFS=S_{FM}+0.00776(v/f_{HV,ATS})$		Adj. for access points[4], f_A (Exhibit 15-8)	*1.5 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*1.7 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*57.2 mi/h*
		Average travel speed, $ATS_d=FFS-0.00776(v_{d,ATS}+v_{o,ATS})-f_{np,ATS}$	*46.6 mi/h*
		Percent free flow speed, PFFS	*81.5 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*1.000*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*682*	*455*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*60.8*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*26.6*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*76.8*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*D*
Volume to capacity ratio, *v/c*	*0.40*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1680*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1700*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*81.5*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*681.8*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.39*
Bicycle level of service (Exhibit 15-4)	*E*
Notes	

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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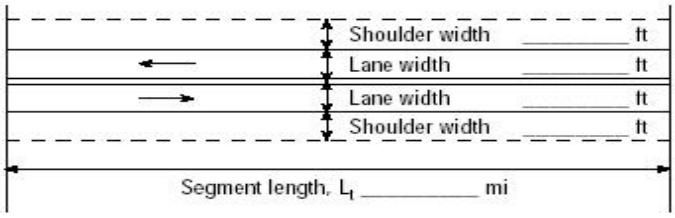
DIRECTIONAL TWO-LANE HIGHWAY SEGMENT WORKSHEET

General Information		***Site Information***	
Analyst	*Scott Randall*	Highway / Direction of Travel	*US 89*
Agency or Company	*RPA*	From/To	*RP 50.6 to 52.4 (34-2A-5)*
Date Performed	*9/5/2013*	Jurisdiction	*MDT*
Analysis Time Period	*Peak Season*	Analysis Year	*Future (2035)*

Project Description: *Paradise Valley*

Input Data



☐ Class I highway ☐ Class II highway ☑ Class III highway

Terrain ☑ Level ☐ Rolling

Grade Length mi Up/down

Peak-hour factor, PHF *0.88*

No-passing zone *100%*

% Trucks and Buses , P_T *6 %*

% Recreational vehicles, P_R *4%*

Access points *mi* *20*/mi

Analysis direction vol., V_d *879*veh/h

Opposing direction vol., V_o *586*veh/h

Shoulder width ft *4.0*

Lane Width ft *12.0*

Segment Length mi *1.8*

Average Travel Speed

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T (Exhibit 15-11 or 15-12)	*1.0*	*1.1*
Passenger-car equivalents for RVs, E_R (Exhibit 15-11 or 15-13)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV,ATS}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*0.994*
Grade adjustment factor[1], $f_{g,ATS}$ (Exhibit 15-9)	*1.00*	*1.00*
Demand flow rate[2], v_i (pc/h) $v_i=V_i/(PHF*f_{g,ATS}*f_{HV,ATS})$	*999*	*670*

Free-Flow Speed from Field Measurement		**Estimated Free-Flow Speed**	
Mean speed of sample[3], S_{FM}		Base free-flow speed[4], BFFS	*60.0 mi/h*
Total demand flow rate, both directions, *v*		Adj. for lane and shoulder width,[4] f_{LS}(Exhibit 15-7)	*1.3 mi/h*
Free-flow speed, FFS=S_{FM}+0.00776(*v*/ $f_{HV,ATS}$)		Adj. for access points[4], f_A (Exhibit 15-8)	*5.0 mi/h*
Adj. for no-passing zones, $f_{np,ATS}$ (Exhibit 15-15)	*1.7 mi/h*	Free-flow speed, FFS (FSS=BFFS-f_{LS}-f_A)	*53.7 mi/h*
		Average travel speed, ATS_d=FFS-0.00776($v_{d,ATS}$ + $v_{o,ATS}$) - $f_{np,ATS}$	*39.0 mi/h*
		Percent free flow speed, PFFS	*72.7 %*

Percent Time-Spent-Following

	Analysis Direction (d)	Opposing Direction (o)
Passenger-car equivalents for trucks, E_T(Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Passenger-car equivalents for RVs, E_R (Exhibit 15-18 or 15-19)	*1.0*	*1.0*
Heavy-vehicle adjustment factor, $f_{HV}=1/(1+P_T(E_T-1)+P_R(E_R-1))$	*1.000*	*1.000*
Grade adjustment factor[1], $f_{g,PTSF}$ (Exhibit 15-16 or Ex 15-17)	*1.00*	*1.00*
Directional flow rate[2], v_i(pc/h) $v_i=V_i/(PHF*f_{HV,PTSF}*f_{g,PTSF})$	*999*	*666*
Base percent time-spent-following[4], $BPTSF_d(\%)=100(1-e^{av_d^b})$	*75.0*	
Adj. for no-passing zone, $f_{np,PTSF}$ (Exhibit 15-21)	*22.9*	
Percent time-spent-following, $PTSF_d(\%)=BPTSF_d+f_{np,PTSF}*(v_{d,PTSF}/v_{d,PTSF}+v_{o,PTSF})$	*88.7*	

Level of Service and Other Performance Measures

Level of service, LOS (Exhibit 15-3)	*D*
Volume to capacity ratio, *v/c*	*0.59*

Capacity, $C_{d,ATS}$ (Equation 15-12) pc/h	*1690*
Capacity, $C_{d,PTSF}$ (Equation 15-13) pc/h	*1700*
Percent Free-Flow Speed $PFFS_d$(Equation 15-11 - Class III only)	*72.7*
Bicycle Level of Service	
Directional demand flow rate in outside lane, v_{OL} (Eq. 15-24) veh/h	*998.9*
Effective width, Wv (Eq. 15-29) ft	*16.00*
Effective speed factor, S_t (Eq. 15-30)	*4.79*
Bicycle level of service score, BLOS (Eq. 15-31)	*5.59*
Bicycle level of service (Exhibit 15-4)	*F*

Notes

1. Note that the adjustment factor for level terrain is 1.00,as level terrain is one of the base conditions. For the purpose of grade adjustment, specific downgrade segments are treated as level terrain.
2. If v_i(v_d or v_o) >=1,700 pc/h, terminate analysis--the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only
5. Exhibit 15-20 provides coefficients a and b for Equation 15-10.
6. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

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