

Under Build conditions during the AM and PM peak hours, northbound and southbound Route 15 Bypass operates with light traffic conditions including all merge and diverge junctions serving the Battlefield Parkway interchange.

Under No Build conditions, the signalized intersection of Route 15 Bypass and Battlefield Parkway creates stops and delays along Route 15 Bypass and average speeds of 12 mph to 14 mph on northbound and southbound Route 15 Bypass in the vicinity of Battlefield Parkway. Under 2030 Build conditions, travel speeds along northbound and southbound Route 15 Bypass segments range from 42 mph to 44 mph in the vicinity of the Battlefield Parkway interchange.

The removal of the traffic signal at the Route 15 Bypass at Battlefield Parkway intersection will reduce delays along both Route 15 Bypass and Battlefield Parkway. Northbound and southbound Route 15 Bypass through movement delays will be eliminated (reduction of 24 seconds to 42 seconds). The proposed Battlefield Parkway interchange roundabouts will operate with no more than 3 seconds of overall delay during both the AM and PM peak hours with no queues extending into upstream intersections or the Route 15 Bypass mainline.

2050 Conditions

Under 2050 Build conditions, travel times along northbound Route 15 Bypass are 26 seconds (10 percent) less than No Build conditions during the AM peak hour and 35 seconds (13 percent) less than No Build conditions during the PM peak hour. Southbound Route 15 Bypass travel times are 51 seconds (19 percent) less than No Build conditions during the AM peak hour and 30 seconds (11 percent) less than No Build conditions during the PM peak hour.

Under Build conditions during the AM and PM peak hours, northbound and southbound Route 15 Bypass operates with light traffic conditions including all merge and diverge junctions serving the Battlefield Parkway interchange.

Under No Build conditions, the signalized intersection of Route 15 Bypass and Battlefield Parkway creates stops and delays along Route 15 Bypass and average speeds of 12 mph to 13 mph on northbound and southbound Route 15 Bypass in the vicinity of Battlefield Parkway. Under 2050 Build conditions, travel speeds along northbound and southbound Route 15 Bypass segments range from 42 mph to 44 mph in the vicinity of the Battlefield Parkway interchange.

The removal of the traffic signal at the Route 15 Bypass at Battlefield Parkway intersection will reduce delays along both Route 15 Bypass and Battlefield Parkway. Northbound and southbound Route 15 Bypass through movement delays will be eliminated (reduction of 25 seconds to 49 seconds). The proposed Battlefield Parkway interchange roundabouts will operate with no more than 4 seconds of overall delay during both the AM and PM peak hours with no queues extending into upstream intersection or the Route 15 Bypass mainline.

The construction of an interchange at the Route 15 Bypass at Battlefield Parkway intersection will remove the last remaining traffic signal along Route 15 Bypass in conjunction with the other No Build projects to fulfill the region's vision to provide limited-access facility along Route 15 Bypass.

Route 15 Bypass northbound and southbound segment results for the existing, 2030 No Build, 2030 Build, 2050 No Build, and 2050 Build conditions are shown in **Table 7-21** and **Table 7-22** during the AM peak hour and in **Table 7-23** and **Table 7-24** during the PM peak hour. Intersection results for the existing, 2030 No Build, 2030 Build, 2050 No Build, and 2050 Build conditions are shown in **Table 7-25** during the AM peak hour and **Table 7-26** during the PM peak hour.

Table 7-21: Summary of Northbound Route 15 Segments – AM Peak Hour

Length (ft)	Existing Route 15 Bypass Northbound (8:50 AM) Peak Hour						2030 No Build Route 15 Bypass Northbound (8:50 AM) Peak Hour						2050 No Build Route 15 Bypass Northbound (8:50 AM) Peak Hour						2060 Build Route 15 Bypass Northbound (8:50 AM) Peak Hour						
	Length (ft)	Location	Type	Lane Speed (mph)	Average Speed (mph)	Average Density (vpmpl)	Length (ft)	Location	Type	Lane Speed (mph)	Average Speed (mph)	Average Density (vpmpl)	Length (ft)	Location	Type	Lane Speed (mph)	Average Speed (mph)	Average Density (vpmpl)	Length (ft)	Location	Type	Lane Speed (mph)	Average Speed (mph)	Average Density (vpmpl)	
2418		NB US 15 BYP north of Route 7	Mainline	44	44	6	230	Lanes	Diverge	44	44	8	230	Lanes	Diverge	44	44	9	230	Lanes	Diverge	44	44	9	
2418				44	44	6	230	Lanes	Diverge	44	44	8	230	Lanes	Diverge	44	44	9	230	Lanes	Diverge	44	44	9	
314		NB US 15 BYP approach to Fort Evans Rd	Mainline	12	12	42	388						388						388						
314				10	10	38																			
475		NB US 15 BYP north of Fort Evans Rd	Mainline	38	37	11	395						395						395						
278				39	38	11																			
38		NB US 15 BYP approach to Edwards Ferry Rd	Mainline	35	31	15																			
38				35	31	15																			
459		NB US 15 BYP approach to Edwards Ferry Rd	Mainline	29	27	10																			
459				22	22	16																			
249				19	18	16																			
249				13	13	11																			
249				13	13	11																			
53		NB US 15 BYP approach to Edwards Ferry Rd	Mainline	7	4	40	395						395												
53				7	4	40																			
53				1	1	139																			
4111				42	42	11																			
		NB US 15 BYP north of Edwards Ferry Rd	Mainline		42		201						201						201						
					42		201						201						201						
4111				42	42	12	1300						1300						1300						
467		NB US 15 BYP approach to Battlefield Pkwy	Mainline	26	10	25	467						467						467						
467				10	14	25	467						467						467						
467				12	20	20	467						467						467						
604		NB US 15 BYP north of Battlefield Pkwy	Mainline	20	24	8	1117						1117						1117						
604				20	24	8	1117						1117						1117						
642		NB US 15 BYP approach to Battlefield Pkwy	Mainline	41	41	20	467						467						467						
642				41	41	20	467						467						467						
85		NB US 15 BYP approach to Dry Hollow Rd	Mainline	43	43	15	1458						1458						1458						
85				43	43	15	1458						1458						1458						
2837		NB US 15 BYP north of Dry Hollow Rd	Mainline	42	42	20	1373						1373						1373						
2837				42	42	20	1373						1373						1373						
				43	43	12	1449						1449						1449						
				43	43	12	1449						1449						1449						

Table 7-25: Summary of Intersection Results – AM Peak Hour

Existing AM (8:00-9:00 AM)				2030 No Build AM (8:00-9:00 AM)				2030 Build AM (8:00-9:00 AM)				2050 No Build AM (8:00-9:00 AM)				2050 Build AM (8:00-9:00 AM)																		
Approach	Movement	Delay (sec/veh)	Approach Delay (sec/veh)	Intersection Delay (sec/veh)	Max Queue Length (ft)	Storage Length (ft)	Approach	Movement	Delay (sec/veh)	Approach Delay (sec/veh)	Intersection Delay (sec/veh)	Max Queue Length (ft)	Storage Length (ft)	Approach	Movement	Delay (sec/veh)	Approach Delay (sec/veh)	Intersection Delay (sec/veh)	Max Queue Length (ft)	Storage Length (ft)	Approach	Movement	Delay (sec/veh)	Approach Delay (sec/veh)	Intersection Delay (sec/veh)	Max Queue Length (ft)	Storage Length (ft)	Approach	Movement	Delay (sec/veh)	Approach Delay (sec/veh)	Intersection Delay (sec/veh)	Max Queue Length (ft)	Storage Length (ft)
Route 15 Bypass at Route 15 Business																																		
NB	Through	11.7	2.4	0.0	85	-	NB	Through	0.7	0.4	0.8	0	-	NB	Through	0.8	0.8	0.8	0	-	NB	Through	0.8	0.8	0.8	0	-	NB	Through	0.8	0.8	0.8	0	-
NB	Left	0.6	1.0	2.0	0	10	NB	Left	4.1	4.1	3.7	312	0	NB	Left	4.7	4.1	4.1	324	0	NB	Left	4.7	4.1	4.1	324	0	NB	Left	4.7	4.1	4.1	324	0
NB	Right	2.8	2.8	0.0	152	18	NB	Right	1.8	1.8	1.9	182	18	NB	Right	1.9	1.9	1.9	182	18	NB	Right	1.9	1.9	1.9	182	18	NB	Right	1.9	1.9	1.9	182	18
SB	Through	4.0	9.1	0.0	142	152	SB	Through	7.0	23.3	23.3	232	232	SB	Through	7.9	23.3	23.3	232	232	SB	Through	7.9	23.3	23.3	232	232	SB	Through	7.9	23.3	23.3	232	232
SB	Left	0.0	0.0	0.0	0	0	SB	Left	0.0	0.0	0.0	0	0	SB	Left	0.0	0.0	0.0	0	0	SB	Left	0.0	0.0	0.0	0	0	SB	Left	0.0	0.0	0.0	0	0
SB	Right	0.0	0.0	0.0	0	0	SB	Right	0.0	0.0	0.0	0	0	SB	Right	0.0	0.0	0.0	0	0	SB	Right	0.0	0.0	0.0	0	0	SB	Right	0.0	0.0	0.0	0	0
WB	Through	0.0	0.0	0.0	0	0	WB	Through	0.0	0.0	0.0	0	0	WB	Through	0.0	0.0	0.0	0	0	WB	Through	0.0	0.0	0.0	0	0	WB	Through	0.0	0.0	0.0	0	0
WB	Left	0.0	0.0	0.0	0	0	WB	Left	0.0	0.0	0.0	0	0	WB	Left	0.0	0.0	0.0	0	0	WB	Left	0.0	0.0	0.0	0	0	WB	Left	0.0	0.0	0.0	0	0
WB	Right	0.0	0.0	0.0	0	0	WB	Right	0.0	0.0	0.0	0	0	WB	Right	0.0	0.0	0.0	0	0	WB	Right	0.0	0.0	0.0	0	0	WB	Right	0.0	0.0	0.0	0	0
Route 15 Bypass at Dry Hollow Road/Old Balls Bluff Road																																		
NB	Through	8.1	8.1	0.0	0	0	NB	Through	1.2	1.2	1.2	11	11	NB	Through	1.2	1.2	1.2	11	11	NB	Through	1.2	1.2	1.2	11	11	NB	Through	1.2	1.2	1.2	11	11
NB	Left	0.0	0.0	0.0	0	85	NB	Left	0.0	0.0	0.0	0	0	NB	Left	0.0	0.0	0.0	0	0	NB	Left	0.0	0.0	0.0	0	0	NB	Left	0.0	0.0	0.0	0	0
NB	Right	0.0	0.0	0.0	0	0	NB	Right	0.0	0.0	0.0	0	0	NB	Right	0.0	0.0	0.0	0	0	NB	Right	0.0	0.0	0.0	0	0	NB	Right	0.0	0.0	0.0	0	0
SB	Through	2.1	2.1	0.0	0	190	SB	Through	0.7	0.7	0.9	0	0	SB	Through	0.8	0.8	1.0	0	0	SB	Through	0.8	0.8	1.0	0	0	SB	Through	0.8	0.8	1.0	0	0
SB	Left	0.0	0.0	0.0	0	0	SB	Left	0.0	0.0	0.0	0	0	SB	Left	0.0	0.0	0.0	0	0	SB	Left	0.0	0.0	0.0	0	0	SB	Left	0.0	0.0	0.0	0	0
SB	Right	0.0	0.0	0.0	0	0	SB	Right	0.0	0.0	0.0	0	0	SB	Right	0.0	0.0	0.0	0	0	SB	Right	0.0	0.0	0.0	0	0	SB	Right	0.0	0.0	0.0	0	0
WB	Through	0.0	0.0	0.0	0	0	WB	Through	0.0	0.0	0.0	0	0	WB	Through	0.0	0.0	0.0	0	0	WB	Through	0.0	0.0	0.0	0	0	WB	Through	0.0	0.0	0.0	0	0
WB	Left	0.0	0.0	0.0	0	0	WB	Left	0.0	0.0	0.0	0	0	WB	Left	0.0	0.0	0.0	0	0	WB	Left	0.0	0.0	0.0	0	0	WB	Left	0.0	0.0	0.0	0	0
WB	Right	0.0	0.0	0.0	0	0	WB	Right	0.0	0.0	0.0	0	0	WB	Right	0.0	0.0	0.0	0	0	WB	Right	0.0	0.0	0.0	0	0	WB	Right	0.0	0.0	0.0	0	0
Route 15 Bypass at Battleground Parkway																																		
NB	Through	40.3	27.7	29.6	404	470	NB	Through	69.9	32.0	32.0	482	470	NB	Through	84.0	35.8	35.8	516	470	NB	Through	84.0	35.8	35.8	516	470	NB	Through	84.0	35.8	35.8	516	470
NB	Left	5.9	5.9	5.9	491	470	NB	Left	5.8	5.8	5.8	478	470	NB	Left	6.5	5.8	5.8	513	470	NB	Left	6.5	5.8	5.8	513	470	NB	Left	6.5	5.8	5.8	513	470
NB	Right	32.8	33.3	33.3	549	470	NB	Right	41.9	42.1	42.1	1075	470	NB	Right	49.2	49.2	49.2	1154	470	NB	Right	49.2	49.2	49.2	1154	470	NB	Right	49.2	49.2	49.2	1154	470
SB	Through	28.0	28.0	30.7	312	260	SB	Through	31.0	32.9	32.9	372	260	SB	Through	31.5	31.5	31.5	355	260	SB	Through	31.5	31.5	31.5	355	260	SB	Through	31.5	31.5	31.5	355	260
SB	Left	0.0	0.0	0.0	0	0	SB	Left	0.0	0.0	0.0	0	0	SB	Left	0.0	0.0	0.0	0	0	SB	Left	0.0	0.0	0.0	0	0	SB	Left	0.0	0.0	0.0	0	0
SB	Right	0.0	0.0	0.0	0	0	SB	Right	0.0	0.0	0.0	0	0	SB	Right	0.0	0.0	0.0	0	0	SB	Right	0.0	0.0	0.0	0	0	SB	Right	0.0	0.0	0.0	0	0
WB	Through	0.0	0.0	0.0	0	0	WB	Through	0.0	0.0	0.0	0	0	WB	Through	0.0	0.0	0.0	0	0	WB	Through	0.0	0.0	0.0	0	0	WB	Through	0.0	0.0	0.0	0	0
WB	Left	0.0	0.0	0.0	0	0	WB	Left	0.0	0.0	0.0	0	0	WB	Left	0.0	0.0	0.0	0	0	WB	Left	0.0	0.0	0.0	0	0	WB	Left	0.0	0.0	0.0	0	0
WB	Right	0.0	0.0	0.0	0	0	WB	Right	0.0	0.0	0.0	0	0	WB	Right	0.0	0.0	0.0	0	0	WB	Right	0.0	0.0	0.0	0	0	WB	Right	0.0	0.0	0.0	0	0
Route 15 Bypass Ramps at Battleground Parkway																																		
NB	Through	15.5	27.3	31.9	262	320	NB	Through	23.6	9.3	9.3	343	320	NB	Through	26.7	9.3	9.3	376	320	NB	Through	26.7	9.3	9.3	376	320	NB	Through	26.7	9.3	9.3	376	320
NB	Left	0.0	0.0	0.0	0	0	NB	Left	0.0	0.0	0.0	0	0	NB	Left	0.0	0.0	0.0	0	0	NB	Left	0.0	0.0	0.0	0	0	NB	Left	0.0	0.0	0.0	0	0
NB	Right	0.0	0.0	0.0	0	0	NB	Right	0.0	0.0	0.0	0	0	NB	Right	0.0	0.0	0.0	0	0	NB	Right	0.0	0.0	0.0	0	0	NB	Right	0.0	0.0	0.0	0	0
SB	Through	34.8	31.9	25.6	262	301	SB	Through	40.6	37.5	37.5	332	320	SB	Through	47.0	43.6	43.6	449	320	SB	Through	47.0	43.6	43.6	449	320	SB	Through	47.0	43.6	43.6	449	320
SB	Left	0.0	0.0	0.0	0	0	SB	Left	0.0	0.0	0.0	0	0	SB	Left	0.0	0.0	0.0	0	0	SB	Left	0.0	0.0	0.0	0	0	SB	Left	0.0	0.0	0.0	0	0
SB	Right	0.0	0.0	0.0	0	0	SB	Right	0.0	0.0	0.0	0	0	SB	Right	0.0	0.0	0.0	0	0	SB	Right	0.0	0.0	0.0	0	0	SB	Right	0.0	0.0	0.0	0	0
WB	Through	0.0	0.0	0.0	0	0	WB	Through	0.0	0.0	0.0	0	0	WB	Through	0.0	0.0	0.0	0	0	WB	Through	0.0	0.0	0.0	0	0	WB	Through	0.0	0.0	0.0	0	0
WB	Left	0.0	0.0	0.0	0	0	WB	Left	0.0	0.0	0.0	0	0	WB	Left	0.0	0.0	0.0	0	0	WB	Left	0.0	0.0	0.0	0	0	WB	Left	0.0	0.0	0.0	0	0
WB	Right	0.0	0.0	0.0	0	0	WB	Right	0.0	0.0	0.0	0	0	WB	Right	0.0	0.0	0.0	0	0	WB	Right	0.0	0.0	0.0	0	0	WB	Right	0.0	0.0	0.0	0	0
Route 15 Bypass Ramps at Edwards Ferry Road (SBU)																																		
NB	Through	15.7	23.7	23.7	332	560	NB	Through	18.8	43.4	43.4	348	520	NB	Through	31.7	42.2	42.2	372	520	NB	Through	31.7	42.2	42.2	372	520	NB	Through	31.7	42.2	42.2	372	520
NB	Left	4.3	4.3	4.3	328	328	NB	Left	3.8	42.8	42.8	238	328	NB	Left	3.7	42.2	42.2	226	328	NB	Left	3.7	42.2	42.2	226	328	NB	Left	3.7	42.2	42.2	226	328
NB	Right	27.2	33.5	33.5	664	555	NB	Right	69.5	37.0	37.0	1108	520	NB	Right	65.0	39.5	39.5	162	520	NB	Right	65.0	39.5	39.5	162	520	NB	Right	65.0	39.5	39.5	162	520
SB	Through	24.9	30.6	29.4	664	370	SB	Through	11.6	41.3	41.3	483	400	SB	Through	12.1	41.0	41.0	173	400	SB	Through	12.1	41.0	41.0	173								

Existing AM (8:00-9:30 AM)				2030 No Build AM (8:00-9:30 AM)				2038 No Build AM (8:00-9:30 AM)				2050 No Build AM (8:00-9:30 AM)				2050 Build AM (8:00-9:30 AM)				
Approach	Movement	Delay (sec/veh)	Intersection (sec/veh)	Approach	Movement	Delay (sec/veh)	Intersection (sec/veh)	Approach	Movement	Delay (sec/veh)	Intersection (sec/veh)	Approach	Movement	Delay (sec/veh)	Intersection (sec/veh)	Approach	Movement	Delay (sec/veh)	Intersection (sec/veh)	
		Length (ft)	Queue Length (ft)			Length (ft)	Queue Length (ft)			Length (ft)	Queue Length (ft)			Length (ft)	Queue Length (ft)			Length (ft)	Queue Length (ft)	
NB	Left	18.0	11.4	37.7	94	125	94	37.6	139.9	38.9	119	125	38.4	19.1	38.4	NB	Left	38.4	119	125
	Right	6.4	5.7	6.9	102	125	102	6.7	139.9	7.0	127	125	7.1	4.7	7.1	NB	Right	7.1	127	125
	Through	6.2	5.7	5.4	135	255	135	5.1	4.7	5.3	4.8	5.9	5.2	4.7	5.2	EB	Through	5.2	125	255
	WB	2.9	4.7	2.5	165	275	165	2.3	3.1	2.3	3.4	3.4	2.2	2.7	2.2	WB	Through	2.2	152	275
SB	Left	6.9	4.7	5.7	137	275	137	4.5	3.1	4.5	116	275	4.6	2.4	4.6	SB	Left	4.6	152	275
	Right	4.3	4.7	3.0	137	275	137	2.8	3.1	2.8	116	275	2.4	2.4	2.4	SB	Right	2.4	152	275
	Through	3.0	4.7	3.0	137	275	137	2.8	3.1	3.0	116	275	2.4	2.4	2.4	SB	Through	2.4	152	275
	WB	4.3	4.7	3.0	137	275	137	2.8	3.1	3.0	116	275	2.4	2.4	2.4	WB	Through	2.4	152	275
EB	Left	20.2	7.8	34.0	108	180	108	41.8	13.0	41.8	114	180	41.8	13.0	41.8	EB	Left	41.8	114	180
	Right	6.0	6.0	5.5	108	180	108	6.0	13.0	6.1	114	180	6.1	13.0	6.1	EB	Right	6.1	114	180
	Through	15.5	11.2	8.7	205	255	205	38.8	25.7	41.3	209	255	41.3	25.1	41.3	EB	Through	41.3	209	255
	WB	7.3	11.2	6.6	215	255	215	7.1	13.1	7.0	112	255	7.0	13.4	7.0	WB	Through	7.0	112	255
WB	Left	3.2	1.0	7.1	95	235	95	6.4	5.9	6.4	117	235	6.4	6.9	6.4	WB	Left	6.4	117	235
	Right	0.5	1.0	6.8	117	235	117	6.2	5.9	6.2	112	235	6.2	6.9	6.2	WB	Right	6.2	112	235
	Through	1.2	1.0	9.8	115	235	115	2.6	6.7	2.8	110	235	2.8	6.9	2.8	WB	Through	2.8	110	235
	WB	0.8	0.9	12.2	115	250	115	6.7	6.7	6.7	135	250	6.7	11.6	6.7	WB	Through	6.7	135	250
NB	Left	2.8	7.3	2.9	40	40	40	8.0	7.4	8.0	42	40	7.9	7.4	7.9	NB	Left	7.9	42	40
	Right	0.0	7.3	6.7	40	40	40	6.8	7.4	6.7	42	40	6.7	7.4	6.7	NB	Right	6.7	42	40
	Through	9.3	8.0	10.6	109	109	109	10.0	8.3	10.8	126	109	10.8	8.4	10.8	NB	Through	10.8	126	109
	WB	7.5	1.9	3.7	91	290	91	3.2	0.9	3.2	82	290	3.2	0.9	3.2	WB	Through	3.2	82	290
EB	Left	3.3	0.8	0.4	6	290	6	0.8	0.9	0.8	11	290	0.8	0.9	0.8	EB	Left	0.8	11	290
	Right	0.9	0.8	0.7	9	290	9	0.8	0.9	0.7	11	290	0.7	0.9	0.7	EB	Right	0.7	11	290
	Through	0.2	0.3	0.3	38	300	38	0.4	0.4	0.3	32	300	0.3	0.4	0.3	EB	Through	0.3	32	300
	WB	0.4	0.5	0.5	39	300	39	0.4	0.4	0.5	19	300	0.5	0.6	0.5	WB	Through	0.5	19	300
NB	Left	9.6	8.8	10.1	85	100	85	9.9	9.0	10.4	96	100	9.7	8.9	9.7	NB	Left	9.7	96	100
	Right	0.0	8.8	8.0	86	100	86	0.0	9.0	8.1	97	100	0.0	8.9	8.1	NB	Right	8.1	97	100
	Through	7.8	8.1	8.6	74	77	74	8.5	7.9	9.0	68	77	8.4	7.8	8.4	NB	Through	8.4	68	77
	WB	2.9	1.5	0.3	78	295	78	0.0	0.4	0.0	72	295	0.0	0.3	0.0	WB	Through	0.0	72	295
EB	Left	7.0	0.3	0.3	38	300	38	0.3	0.4	0.3	2	300	0.3	0.4	0.3	EB	Left	0.3	2	300
	Right	0.2	0.3	0.3	38	300	38	0.3	0.4	0.3	2	300	0.3	0.4	0.3	EB	Right	0.3	2	300
	Through	0.7	0.4	0.4	44	310	44	2.1	0.5	2.4	53	310	2.2	0.5	2.2	EB	Through	2.2	53	310
	WB	2.2	0.4	0.4	17	310	17	0.4	0.5	0.4	23	310	0.4	0.5	0.4	WB	Through	0.4	23	310
NB	Left	0.0	0.0	0.0	0	0	0	0.0	6.3	0.0	22	0	0.0	6.7	0.0	NB	Left	0.0	22	0
	Right	0.0	0.0	5.0	0	0	0	5.0	6.3	4.7	32	0	4.9	6.7	0.0	NB	Right	4.9	32	0
	Through	7.2	17.2	7.3	88	50	88	28.0	16.7	24.5	76	50	27.1	17.2	24.5	NB	Through	27.1	76	50
	WB	2.6	6.4	6.7	87	160	87	7.2	6.7	7.3	83	160	7.3	6.3	7.3	WB	Through	7.3	83	160
EB	Left	5.5	5.4	6.1	126	160	126	6.8	5.8	6.3	137	160	6.3	5.1	6.3	EB	Left	6.3	137	160
	Right	5.7	5.4	6.1	126	160	126	6.1	5.8	6.1	137	160	6.1	5.1	6.1	EB	Right	6.1	137	160
	Through	2.4	5.3	5.3	137	245	137	2.6	5.6	2.3	143	245	2.6	5.5	2.6	EB	Through	2.6	143	245
	WB	5.4	5.3	5.3	137	245	137	5.7	5.6	6.0	196	245	6.0	5.5	6.0	WB	Through	6.0	196	245
NB	Left	0.0	0.0	20.6	0	0	0	26.9	6.9	31.3	22	0	26.1	6.7	26.1	NB	Left	26.1	22	0
	Right	0.0	0.0	5.0	0	0	0	5.1	6.9	4.7	32	0	4.9	6.7	0.0	NB	Right	4.9	32	0
	Through	7.2	17.2	7.3	88	50	88	28.0	16.3	24.5	76	50	27.1	17.2	24.5	NB	Through	27.1	76	50
	WB	2.6	6.4	6.7	87	160	87	7.2	6.7	7.3	83	160	7.3	6.3	7.3	WB	Through	7.3	83	160
EB	Left	5.5	5.4	6.1	126	160	126	6.8	5.8	6.3	137	160	6.3	5.1	6.3	EB	Left	6.3	137	160
	Right	5.7	5.4	6.1	126	160	126	6.1	5.8	6.1	137	160	6.1	5.1	6.1	EB	Right	6.1	137	160
	Through	2.4	5.3	5.3	137	245	137	2.6	5.6	2.3	143	245	2.6	5.5	2.6	EB	Through	2.6	143	245
	WB	5.4	5.3	5.3	137	245	137	5.7	5.6	6.0	196	245	6.0	5.5	6.0	WB	Through	6.0	196	245
NB	Left	0.0	0.0	2.4	0	0	0	2.6	6.9	3.1	22	0	2.5	6.7	2.5	NB	Left	2.5	22	0
	Right	0.0	0.0	5.0	0	0	0	5.1	6.9	4.7	32	0	4.9	6.7	0.0	NB	Right	4.9	32	0
	Through	7.2	17.2	7.3	88	50	88	28.0	16.3	24.5	76	50	27.1	17.2	24.5	NB	Through	27.1	76	50
	WB	2.6	6.4	6.7	87	160	87	7.2	6.7	7.3	83	160	7.3	6.3	7.3	WB	Through	7.3	83	160
EB	Left	5.5	5.4	6.1	126	160	126	6.8	5.8	6.3	137	160	6.3	5.1	6.3	EB	Left	6.3	137	160
	Right	5.7	5.4	6.1	126	160	126	6.1	5.8	6.1	137	160	6.1	5.1	6.1	EB	Right	6.1	137	160
	Through	2.4	5.3	5.3	137	245	137	2.6	5.6	2.3	143	245	2.6	5.5	2.6	EB	Through	2.6	143	245
	WB	5.4	5.3	5.3	137	245	137	5.7	5.6	6.0	196	245	6.0	5.5	6.0	WB	Through	6.0	196	245
NB	Left	0.0	0.0	2.4	0	0	0	2.6	6.9	3.1	22	0	2.5	6.7	2.5	NB	Left	2.5	22	0
	Right	0.0	0.0	5.0	0	0	0	5.1	6.9	4.7	32	0	4.9	6.7	0.0	NB	Right	4.9	32	0
	Through	7.2	17.2	7.3	88	50	88	28.0	16.3	24.5	76	50	27.1	17.2	24.5	NB	Through	27.1	76	50
	WB	2.6	6.4	6.7	87	160	87	7.2	6.7	7.3	83	160	7.3	6.3	7.3	WB	Through	7.3	83	160
EB	Left	5.5	5.4	6.1	126	160	126	6.8	5.8	6.3	137	160	6.3	5.1	6.3	EB	Left	6.3	137	160
	Right	5.7	5.4	6.1	126	160	126	6.1	5.8	6.1	137	160	6.1	5.1	6.1	EB	Right	6.1	137	160
	Through	2.4	5.3	5.3	137	245	137	2.6	5.6	2.3	143	245	2.6	5.5	2.6	EB	Through	2.6	143	245
	WB	5.4	5.3	5.3	137	245	137	5.7	5.6	6.0	196	245	6.0	5.5	6.0	WB	Through	6.0	196	245

Existing PM (4:45-5:45 PM)			2030 No Build PM (4:45-5:45 PM)			2030 Build PM (4:45-5:45 PM)			2050 No Build PM (4:45-5:45 PM)			2050 Build PM (4:45-5:45 PM)							
Approach	Delay (sec/veh)	Intersection (sec/veh)	Max Queue Length (ft)	Storage Length (ft)	Approach	Delay (sec/veh)	Intersection (sec/veh)	Max Queue Length (ft)	Storage Length (ft)	Approach	Delay (sec/veh)	Intersection (sec/veh)	Max Queue Length (ft)	Storage Length (ft)	Approach	Delay (sec/veh)	Intersection (sec/veh)	Max Queue Length (ft)	Storage Length (ft)
Left	10.9	Battlefield Parkway at Plaza Street	115	125	Left	39.8	49.2	221	125	Left	47.9	47.9	269	125	Left	49.1	49.1	270	125
Right	6.6	Battlefield Parkway at Plaza Street	125	125	Right	9.0	11.8	239	125	Right	11.6	11.6	277	125	Right	11.9	11.9	277	125
Through	10.4	Battlefield Parkway at Plaza Street	150	255	Through	8.3	6.1	150	255	Through	7.9	7.3	163	255	Through	6.7	6.2	132	255
Left	9.3	Battlefield Parkway at Plaza Street	150	275	Left	8.6	6.2	178	275	Left	8.2	8.2	132	275	Left	6.0	4.7	105	275
Right	6.2	Battlefield Parkway at Plaza Street	150	178	Right	6.6	3.7	178	178	Right	4.2	4.2	132	178	Right	4.0	4.0	105	178
Left	10.9	Battlefield Parkway at Healdstone Drive	106	180	Left	46.1	46.3	104	180	Left	47.4	47.4	114	180	Left	47.9	47.9	114	180
Right	6.6	Battlefield Parkway at Healdstone Drive	180	180	Right	7.2	4.8	108	180	Right	8.6	8.6	118	180	Right	7.5	25.6	118	180
Through	10.4	Battlefield Parkway at Healdstone Drive	138	255	Through	7.2	5.2	108	255	Through	8.6	8.6	118	255	Through	7.5	25.6	118	255
Left	83.3	Battlefield Parkway at Healdstone Drive	138	255	Left	50.5	52.1	224	255	Left	49.4	49.4	217	255	Left	50.8	50.8	221	255
Right	32.8	Battlefield Parkway at Healdstone Drive	139	224	Right	41.0	44.5	224	224	Right	47.3	47.3	217	224	Right	50.0	30.8	221	224
Through	33.2	Battlefield Parkway at Healdstone Drive	140	233	Through	8.1	9.3	233	235	Through	8.9	8.9	236	235	Through	9.5	10.9	229	235
Left	11.6	Battlefield Parkway at Healdstone Drive	230	235	Left	6.9	5.0	159	235	Left	5.3	5.3	96	235	Left	5.7	4.9	98	235
Right	30.0	Battlefield Parkway at Healdstone Drive	208	235	Right	2.9	2.2	160	235	Right	2.1	2.1	96	235	Right	2.3	2.3	97	235
Through	8.7	Battlefield Parkway at Healdstone Drive	66	250	Through	5.7	5.7	222	250	Through	6.1	6.1	204	250	Through	6.0	6.0	211	250
Left	4.4	Battlefield Parkway at Healdstone Drive	73	250	Left	1.1	1.1	108	250	Left	1.1	1.1	204	250	Left	6.4	5.4	111	250
Right	0.6	Battlefield Parkway at Healdstone Drive	88	250	Right	1.1	1.1	108	250	Right	1.1	1.1	204	250	Right	6.4	5.4	111	250
Through	2.7	Battlefield Parkway at Healdstone Drive	88	250	Through	1.0	0.9	110	250	Through	1.1	1.1	204	250	Through	6.4	5.4	111	250
Left	2.8	Battlefield Parkway at Balls Bluff Rd	38	36	Left	7.8	7.8	36	36	Left	7.2	7.2	36	36	Left	8.5	8.5	36	36
Right	0.0	Battlefield Parkway at Balls Bluff Rd	38	36	Right	6.7	6.7	36	36	Right	6.7	6.7	36	36	Right	6.7	6.7	36	36
Through	11.0	Battlefield Parkway at Balls Bluff Rd	80	74	Through	9.6	8.5	74	74	Through	10.2	8.4	77	74	Through	8.4	7.2	76	74
Left	10.0	Battlefield Parkway at Balls Bluff Rd	79	74	Left	7.1	6.5	73	73	Left	7.4	7.4	76	73	Left	6.5	6.5	75	73
Right	6.0	Battlefield Parkway at Balls Bluff Rd	106	290	Right	5.1	4.1	94	290	Right	5.7	5.7	88	290	Right	4.4	4.4	70	290
Through	0.3	Battlefield Parkway at Balls Bluff Rd	48	18	Through	0.3	1.6	18	18	Through	0.2	2.0	12	18	Through	0.3	1.7	0	290
Left	0.7	Battlefield Parkway at Balls Bluff Rd	30	290	Left	0.8	0.9	0	290	Left	0.8	0.8	0	290	Left	0.8	0.8	0	290
Right	1.4	Battlefield Parkway at Balls Bluff Rd	30	300	Right	1.2	1.2	32	300	Right	1.1	1.1	16	300	Right	0.1	0.1	0	300
Through	2.7	Battlefield Parkway at Balls Bluff Rd	80	47	Through	1.0	0.9	47	47	Through	1.1	1.1	46	47	Through	0.9	0.9	49	47
Left	8.9	Battlefield Parkway at Smartts Lane	71	80	Left	9.2	9.3	80	80	Left	9.7	9.7	81	80	Left	9.5	9.5	78	80
Right	0.0	Battlefield Parkway at Smartts Lane	72	81	Right	9.1	8.5	81	81	Right	9.5	8.7	82	81	Right	9.6	8.6	79	81
Through	7.7	Battlefield Parkway at Smartts Lane	80	90	Through	7.6	7.8	90	90	Through	7.7	7.7	90	90	Through	7.7	7.7	88	90
Left	8.9	Battlefield Parkway at Smartts Lane	48	46	Left	9.0	8.4	45	46	Left	9.0	9.0	45	46	Left	8.4	8.4	45	46
Right	0.0	Battlefield Parkway at Smartts Lane	52	50	Right	7.0	6.8	50	50	Right	7.2	7.2	48	50	Right	6.6	6.6	48	50
Through	7.0	Battlefield Parkway at Smartts Lane	52	295	Through	0.3	1.8	18	290	Through	0.2	2.0	12	18	Through	0.3	1.7	0	290
Left	2.3	Battlefield Parkway at Smartts Lane	30	295	Left	2.9	2.5	33	295	Left	3.6	3.6	25	295	Left	2.8	2.8	27	295
Right	0.0	Battlefield Parkway at Smartts Lane	30	300	Right	0.8	0.8	32	300	Right	0.7	0.7	20	300	Right	0.2	0.2	20	300
Through	1.9	Battlefield Parkway at Smartts Lane	10	30	Through	1.6	1.7	32	30	Through	1.4	1.4	59	30	Through	1.4	1.4	49	30
Left	0.3	Battlefield Parkway at Smartts Lane	49	310	Left	0.2	0.4	43	310	Left	0.2	0.4	40	310	Left	0.2	0.3	41	310
Right	0.8	Battlefield Parkway at Smartts Lane	18	14	Right	0.8	0.7	14	14	Right	0.8	0.8	14	14	Right	0.7	0.7	8	14
Through	0.4	Battlefield Parkway at Smartts Lane	18	14	Through	0.4	0.4	14	14	Through	0.4	0.4	14	14	Through	0.4	0.4	21	14
Left	22.7	Battlefield Parkway at Shanks Evans Road / Balls Bluff Elementary School	32	33	Left	18.0	25.9	33	33	Left	18.0	18.0	30	33	Left	18.7	18.7	34	33
Right	0.0	Battlefield Parkway at Shanks Evans Road / Balls Bluff Elementary School	32	33	Right	0.0	16.6	33	33	Right	0.0	12.3	30	33	Right	0.0	12.3	34	33
Through	5.8	Battlefield Parkway at Shanks Evans Road / Balls Bluff Elementary School	39	50	Through	5.1	4.9	39	50	Through	5.2	5.2	36	50	Through	5.0	5.0	41	50
Left	20.9	Battlefield Parkway at Shanks Evans Road / Balls Bluff Elementary School	50	50	Left	20.3	12.7	49	50	Left	22.8	14.0	50	50	Left	20.4	20.4	52	50
Right	0.0	Battlefield Parkway at Shanks Evans Road / Balls Bluff Elementary School	50	50	Right	0.0	13.1	48	50	Right	0.0	14.0	50	50	Right	0.0	12.9	52	50
Through	3.9	Battlefield Parkway at Shanks Evans Road / Balls Bluff Elementary School	70	160	Through	5.6	4.1	60	160	Through	4.7	2.5	56	160	Through	4.7	4.7	56	160
Left	3.2	Battlefield Parkway at Shanks Evans Road / Balls Bluff Elementary School	70	160	Left	5.6	4.1	60	160	Left	4.7	2.5	56	160	Left	4.7	4.7	56	160
Right	1.8	Battlefield Parkway at Shanks Evans Road / Balls Bluff Elementary School	76	220	Right	1.4	1.8	63	220	Right	1.4	1.8	61	220	Right	1.3	1.4	54	220
Through	3.3	Battlefield Parkway at Shanks Evans Road / Balls Bluff Elementary School	166	245	Through	2.7	3.3	99	245	Through	2.9	2.9	133	245	Through	2.2	2.2	103	245
Left	3.8	Battlefield Parkway at Shanks Evans Road / Balls Bluff Elementary School	166	245	Left	2.0	2.0	128	245	Left	2.1	2.1	133	245	Left	1.7	1.7	103	245
Right	3.5	Battlefield Parkway at Shanks Evans Road / Balls Bluff Elementary School	183	195	Right	1.5	1.5	144	195	Right	1.4	1.4	150	195	Right	1.5	1.5	120	195
Through	2.0	Battlefield Parkway at Shanks Evans Road / Balls Bluff Elementary School	183	195	Through	1.5	1.5	144	195	Through	1.4	1.4	150	195	Through	1.5	1.5	120	195

8. SAFETY AND CRASH ANALYSIS

8.1 CRASH DATA

Crash data within the study area was reviewed for a five-year period from January 1, 2015, through December 31, 2019. Crash data were obtained from the VDOT Power Bi Crash Analysis Tool. **Figure 8-1** depicts the crash locations by type and severity.

8.1.1 Corridorwide Crashes

A total of 355 crashes were reported along the Route 15 Bypass, Battlefield Parkway, and other minor roadways located within the study area between January 2015 and December 2019. **Table 8-1** summarizes the crashes by collision type, severity, surface condition, weather condition, crash year, and time of the day.

- 89 crashes (25 percent) resulted in injuries and no crashes resulted in a fatality
- 202 (57 percent) were rear end collisions
- 52 (15 percent) were angle crashes
- 28 (8 percent) were fixed-object crashes
- 41 (12 percent) were sideswipe crashes
- 291 (82 percent) occurred on dry surface conditions and 64 (18 percent) occurred on wet, snowy/icy, or other surface conditions
- Two crashes involved pedestrians including one in the vicinity of the Route 15 Bypass at Edwards Ferry Road intersection and one in the vicinity of the Route 15 Bypass at Fort Evans Road intersection. Both pedestrian crashes resulted in injuries.
- One bicycle-related crash was reported along Route 15 Bypass between the Fort Evans Road and Edwards Ferry Road intersections involving a bicyclist that attempted to cross Route 15 Bypass away from any intersections and crosswalks. The bicycle-related crash resulted in injuries.
- 140 crashes occurred on northbound Route 15 Bypass and 74 crashes occurred on southbound Route 15 Bypass
- 23 crashes occurred on eastbound Battlefield Parkway and 25 crashes occurred on westbound Battlefield Parkway
- Ninety-three (93) crashes were reported on other study area minor roadways

The average crash rate along Route 15 Bypass was 160 crashes per 100 million vehicle-miles traveled (VMT). The average crash rate on Battlefield Parkway was 226 crashes per 100 million VMT.

As shown in **Figure 8-2**, the peak year for crashes was 2015. Since then, the total number of crashes per year within the study area decreased by 17 percent (from 82 in 2015 to 68 in 2019).

Figure 8-3 provides weekday (Monday through Friday) crashes by time of day within the study area. Eighty-one (81) percent of reported crashes occurred on weekdays. As shown, the greatest portion of crashes occurred during the PM peak period from 4:00 PM to 5:00 PM with 16 percent of all weekday crashes occurring during this one-hour period. Additionally, 58 percent of weekday crashes were reported during the six-hour period between 2:00 PM and 8:00 PM.

Figure 8-1: Crashes by Type and Severity (Sheet 1 of 6)

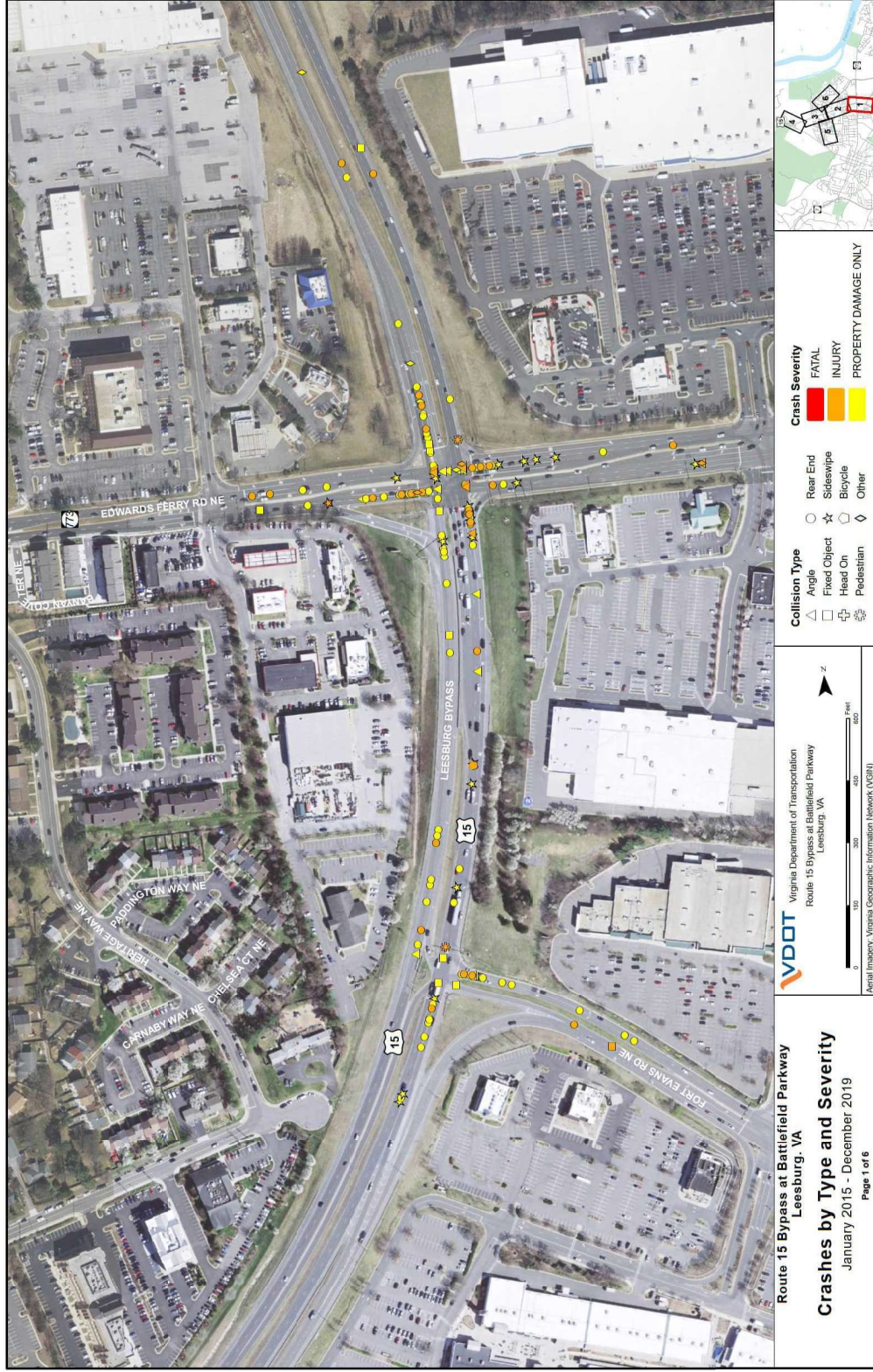


Figure 8-1: Crashes by Type and Severity (Sheet 2 of 6)

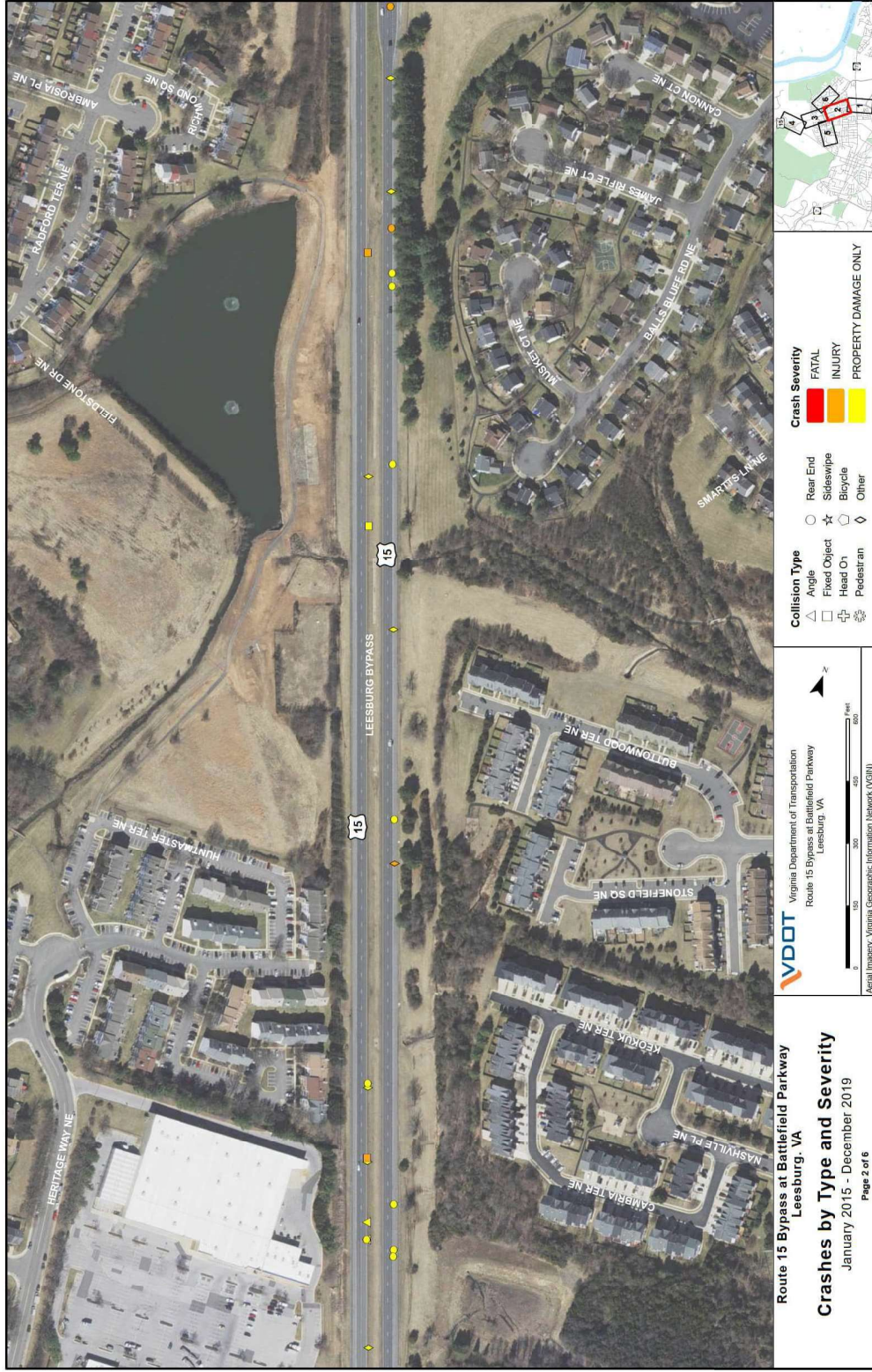


Figure 8-1: Crashes by Type and Severity (Sheet 3 of 6)

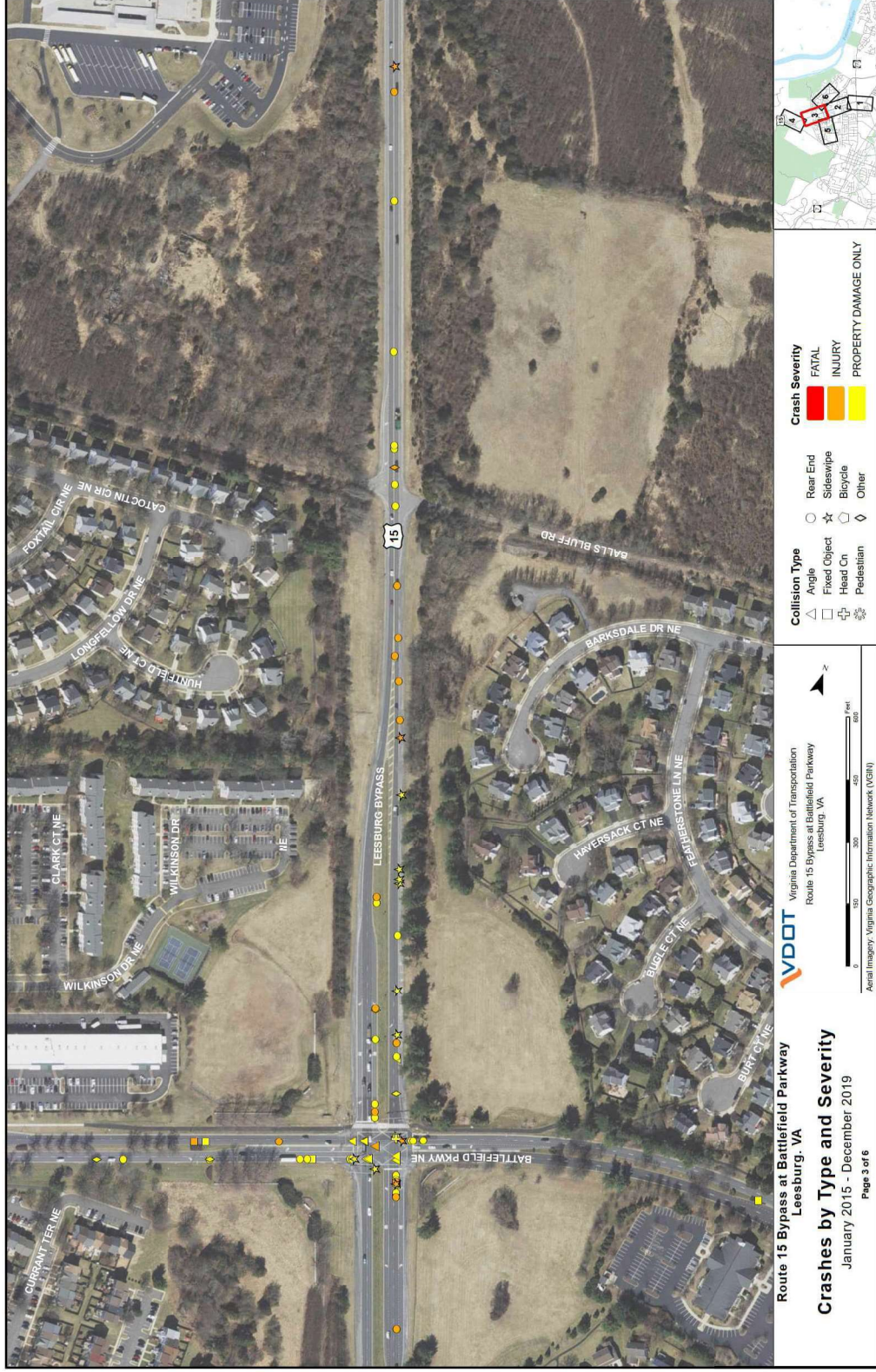


Figure 8-1: Crashes by Type and Severity (Sheet 4 of 6)

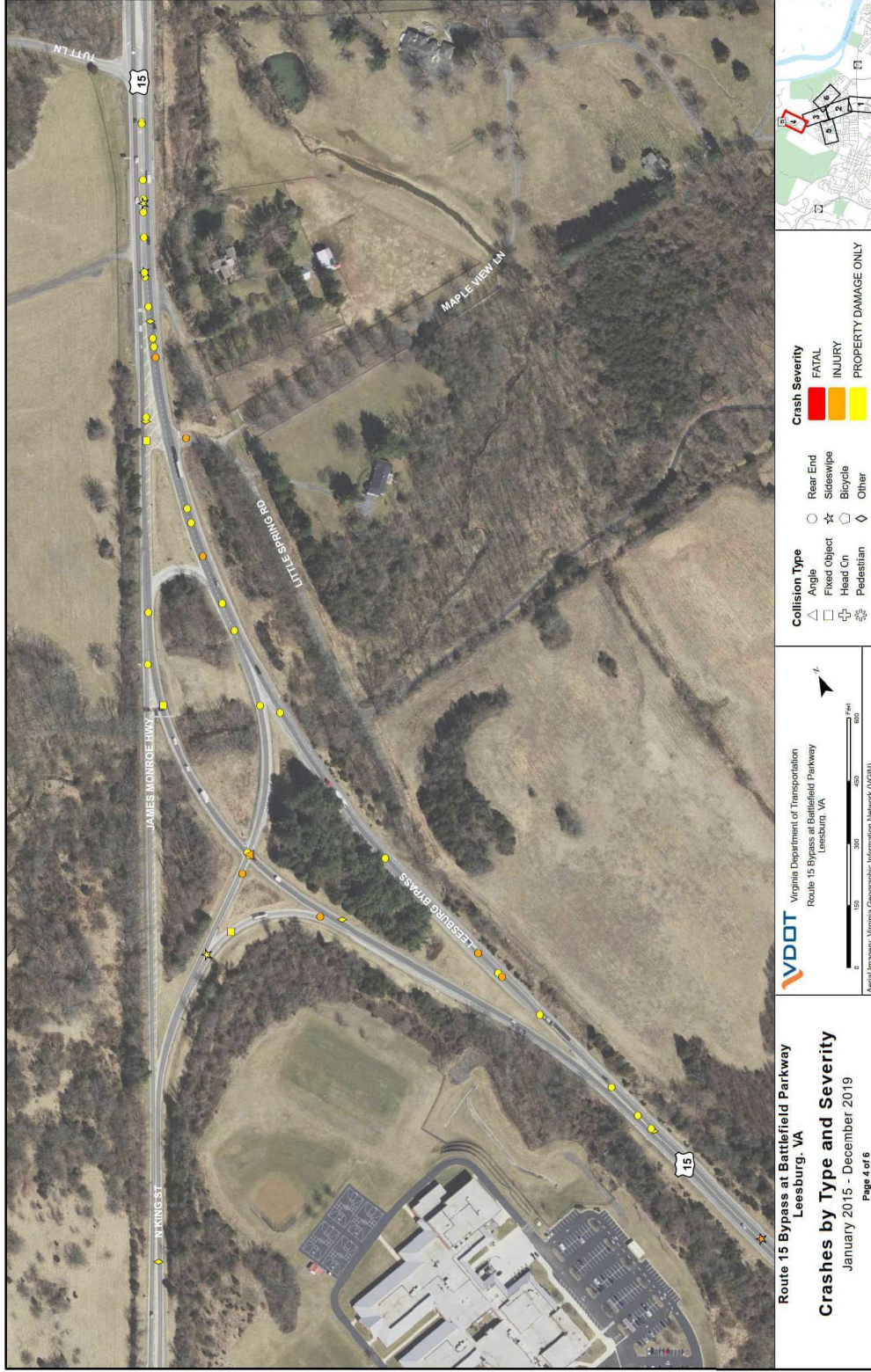


Figure 8-1: Crashes by Type and Severity (Sheet 5 of 6)

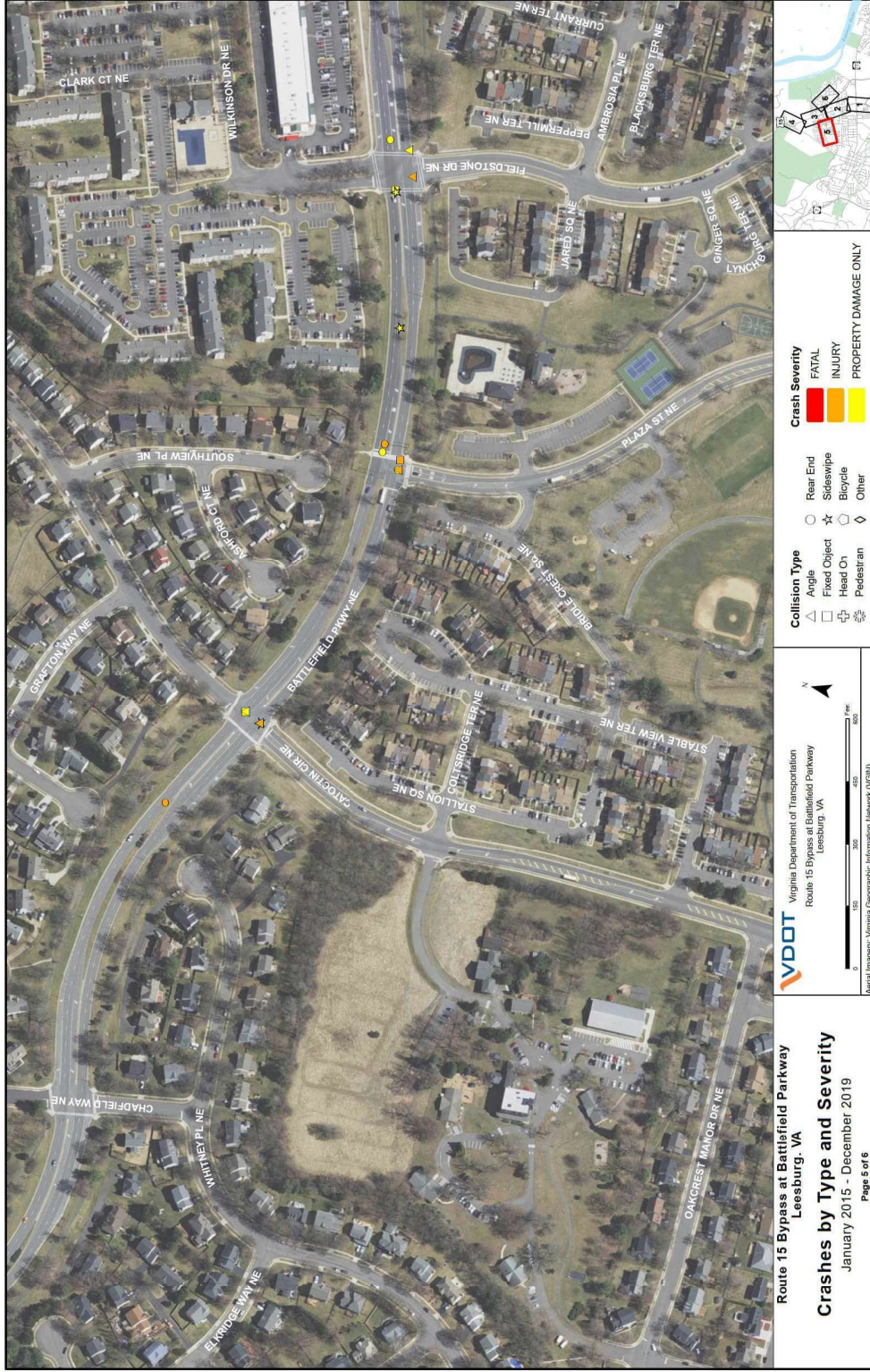


Figure 8-1: Crashes by Type and Severity (Sheet 6 of 6)

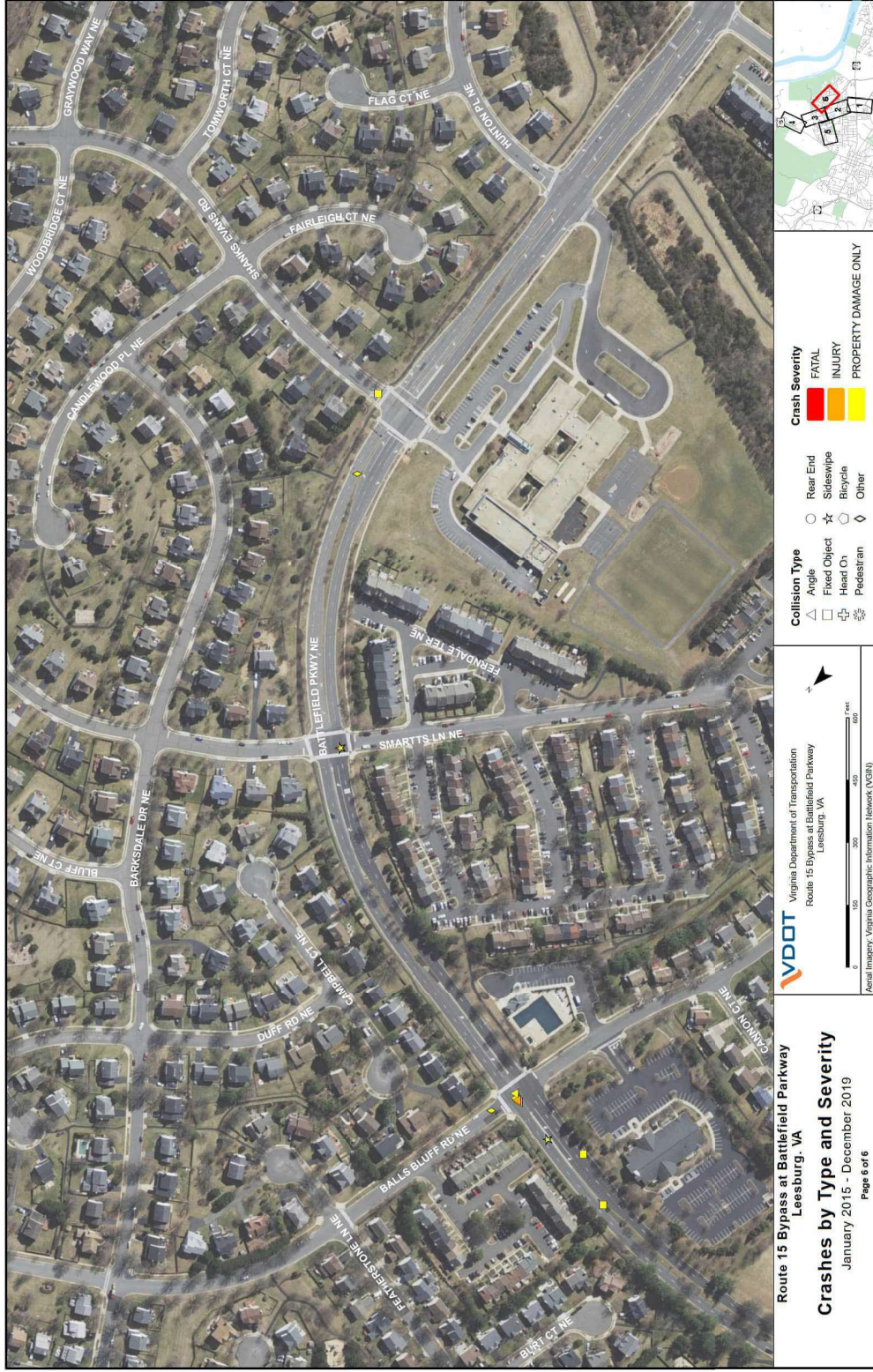


Table 8-1: Route 15 Bypass & Battlefield Parkway Crash Summary

Crash Type		Number of Crashes					Total Crashes	Percent of Total Crashes
		NB Route 15 Bypass	SB Route 15 Bypass	EB Battlefield Parkway	WB Battlefield Parkway	Remaining Study Area		
Collision Type	Rear End	86	46	7	8	55	202	56.9%
	Sideswipe	21	4	3	4	9	41	11.5%
	Angle	16	6	8	7	15	52	14.6%
	Fixed Object	3	10	3	5	7	28	7.9%
	Pedestrian	2	0	0	0	0	2	0.6%
	Bike	1	0	0	0	0	1	0.3%
	Other	11	8	2	1	7	29	8.2%
Crash Severity	Fatal Injury	0	0	0	0	0	0	0.0%
	Ambulatory Injury	3	0	0	1	1	5	1.4%
	Visible Injury	29	12	3	5	22	71	20.0%
	Non-Visible Injury	3	2	1	1	6	13	3.7%
	Property Damage Only	105	60	19	18	64	266	74.9%
Surface Condition	Dry	119	63	17	20	72	291	82.0%
	Wet	19	9	4	3	0	35	9.9%
	Snowy/Icy/Slush	2	1	2	2	1	8	2.3%
	Other	0	1	0	0	20	21	5.9%
Weather Condition	No Adverse Conditions (Clear/Cloudy)	121	65	17	20	73	296	83.4%
	Rain/Mist	15	8	4	3	18	48	13.5%
	Snow/Sleet/Hail	4	1	2	2	1	10	2.8%
	Fog	0	0	0	0	1	1	0.3%
	Other	0	0	0	0	0	0	0.0%
Crash Year	2015	30	19	5	7	21	82	23.1%
	2016	38	12	3	4	22	79	22.3%
	2017	18	17	4	5	17	61	17.2%
	2018	22	11	8	6	18	65	18.3%
	2019	32	15	3	3	15	68	19.2%
Time	12 AM - 3 AM	1	0	0	0	3	4	1.1%
	3 AM - 6 AM	2	5	0	2	2	11	3.1%
	6 AM - 9 AM	15	9	3	2	8	37	10.4%
	9 AM - 12 PM	14	14	3	1	13	45	12.7%
	12 PM - 3 PM	16	15	4	3	22	60	16.9%
	3 PM - 6 PM	51	14	6	10	28	109	30.7%
	6 PM - 9 PM	27	14	6	6	10	63	17.7%
	9 PM - 12 AM	14	3	1	1	7	26	7.3%
Total Crashes by Facility		140	74	23	25	93	355	100.0%

Figure 8-2: Crashes by Year by Facility

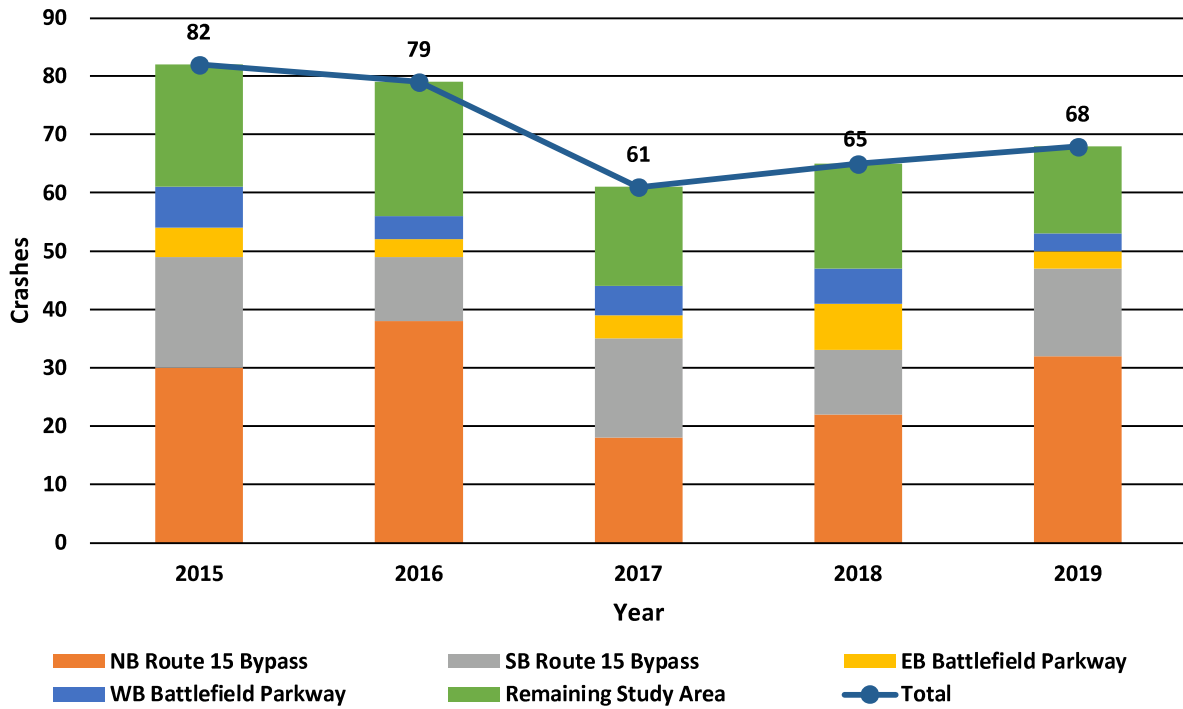
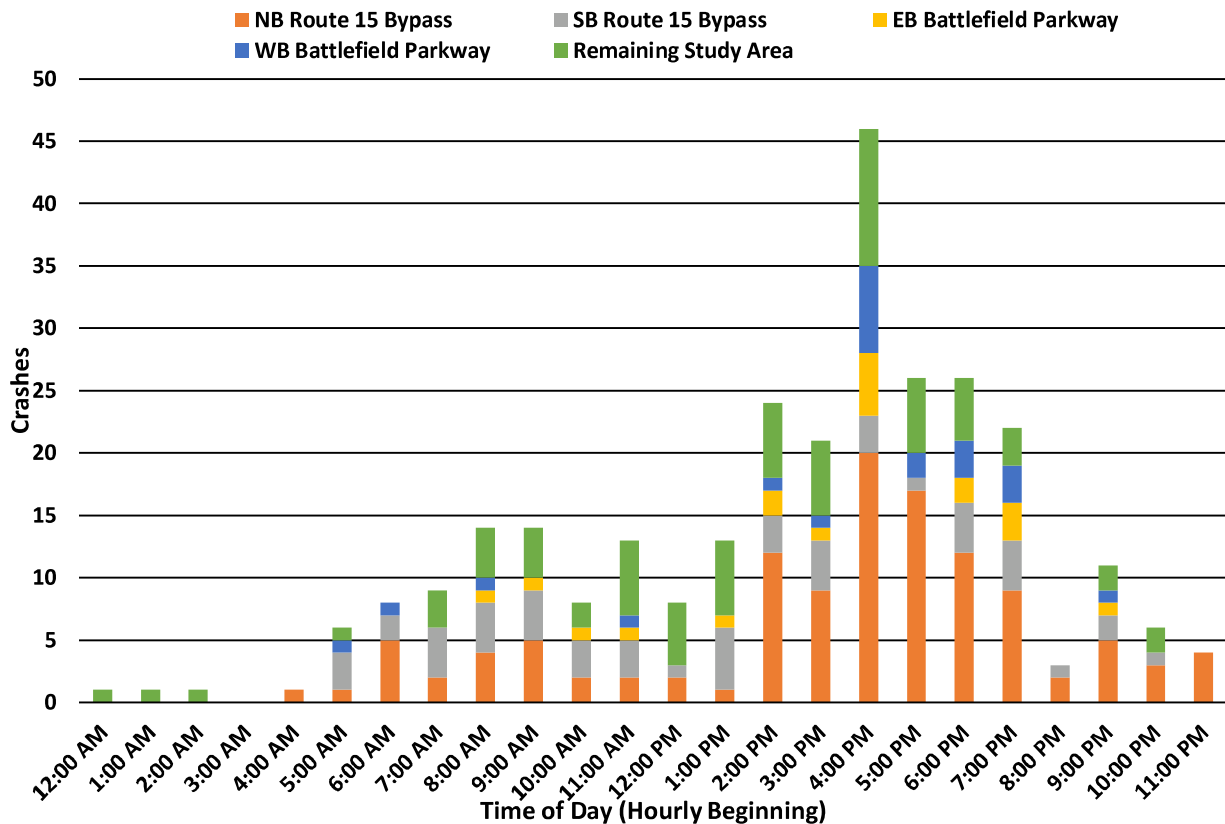


Figure 8-3: Weekday (Monday – Friday) Crashes by Time of Day



To further analyze the crash data and identify crash trends, the Route 15 Bypass and Battlefield Parkway study corridor was separated into 24 segments along the Route 15 Bypass and 12 segments along Battlefield Parkway, each covering a 0.10-mile roadway segment. Tenth-mile segments were established at consistent locations along Route 15 Bypass and Battlefield Parkway. Crashes reported along the Route 15 Bypass and Battlefield Parkway were associated with a specific 0.10-mile segment based on geospatial data. For example, crashes associated with mile point 1.0 represent the roadway segment from mile point 0.95 to 1.04. Crash rates per 100 million VMT for each 0.10-mile segment along the Route 15 Bypass and Battlefield Parkway are summarized in **Table 8-2a** and **Table 8-2b**. Crash rates along the Route 15 Bypass and Battlefield Parkway are provided in 0.10-mile segments in **Figure 8-4a** and **Figure 8-4b**, respectively.

Calculated crash rates along the Route 15 Bypass were compared to VDOT's annually published 2019 average crash rates per 100 million VMT for Statewide Urban Other Principal Arterials and Northern Virginia Primary Road and crash rates along Battlefield Parkway were compared to average crash rates for Statewide Urban Minor Arterials. Of the 24 individual 0.10-mile segments along Route 15 Bypass, 6 segments (25 percent) have a total crash rate greater than the Statewide Urban Other Principal Arterials average crash rate of 193.7 crashes per 100 million VMT and 11 (46 percent) have a total crash rate greater than the 2019 Northern Virginia Primary Roads average crash rate of 122.3 crashes per 100 million VMT. Of the 12 total 0.10-mile segments analyzed along Battlefield Parkway, 6 segments (50 percent) have a total crash rate greater than the Statewide Urban Minor Arterials average crash rate of 228.2 crashes per 100 million VMT.

Along the Route 15 Bypass, crash rates are greatest approaching the Edwards Ferry Road intersection at mile point 219.4 with a crash rate of 1039.2 crashes per 100 million VMT which is more than 5 times the average crash rate for Urban Other Principal Arterials. Crash rates at the Route 15 Bypass and Battlefield Parkway intersection are more than twice the 2019 Urban Other Principal Arterials average crash rate and more than three times the 2019 Northern Virginia Primary Roads average crash rate.

Along Battlefield Parkway, crash rates are greatest approaching the Route 15 Bypass and Battlefield Parkway intersection with a crash rate of 913.2 crashes per 100 million VMT which is more than four times the average crash rate for Urban Minor Arterials.

Table 8-2a: Route 15 Bypass Crash Rate (per 100 million VMT) Comparison by Tenth-Mile Segment

Mile Point	Intersection	Route 15 Bypass Crash Rate (100 Million VMT)
219.1	Route 15 Bypass at Fort Evans Road	209.9
219.2		93.3
219.3		81.6
219.4	Route 15 Bypass at Edwards Ferry Road	1039.2
219.5		151.2
219.6		94.5
219.7		188.9
219.8		18.9
219.9		18.9
220.0		75.6
220.1		75.6
220.2		56.7
220.3	Route 15 Bypass at Battlefield Parkway	396.8
220.4		207.8
220.5	Begin/End of Divided Highway	151.2
220.6	Route 15 Bypass at Balls Bluff Road/Dry Hollow Road	210.7
220.7		21.1
220.8		21.1
220.9		42.1
221.0	Begin/End of Divided Highway	147.5
221.1		42.1
221.2	Route 15 Bypass at Route 15 Business	63.2
221.3		168.6
221.4	Residential Driveway at 17200 James Monroe Highway	274.0
Route 15 Bypass Average Crash Rate		159.9
2019 Northern Virginia Primary Roads Average Crash Rate		122.3
2019 Statewide Urban Other Principal Arterials Average Crash Rate		193.7

¹ Highlighted values indicate segments where the crash rate exceeds the Northern Virginia Primary Roads average crash rate

Table 8-2b: Battlefield Parkway Crash Rate (per 100 million VMT) Comparison by Tenth-Mile Segment

Mile Point	Intersection	Battlefield Parkway Crash Rate (100 Million VMT)
0.3	Battlefield Parkway at Catoctin Circle	461.4
0.4		0.0
0.5	Battlefield Parkway at Plaza Street	346.1
0.6	Battlefield Parkway at Fieldstone Drive	288.4
0.7		346.1
0.8	Route 15 Bypass at Battlefield Parkway	913.2
0.9		0.0
1.0	Battlefield Parkway at Balls Bluff Road	365.3
1.1		0.0
1.2	Battlefield Parkway at Smartts Lane	49.8
1.3		0.0
1.4	Battlefield Parkway at Shank Evans Road	49.8
Battlefield Parkway Average Crash Rate		225.8
2019 Statewide Urban Minor Arterials Average Crash Rate		228.2

¹ Highlighted values indicate segments where the crash rate exceeds the Statewide Urban Minor Arterials average crash rate

Figure 8-4a: Route 15 Bypass Crash Rates by Mile Point

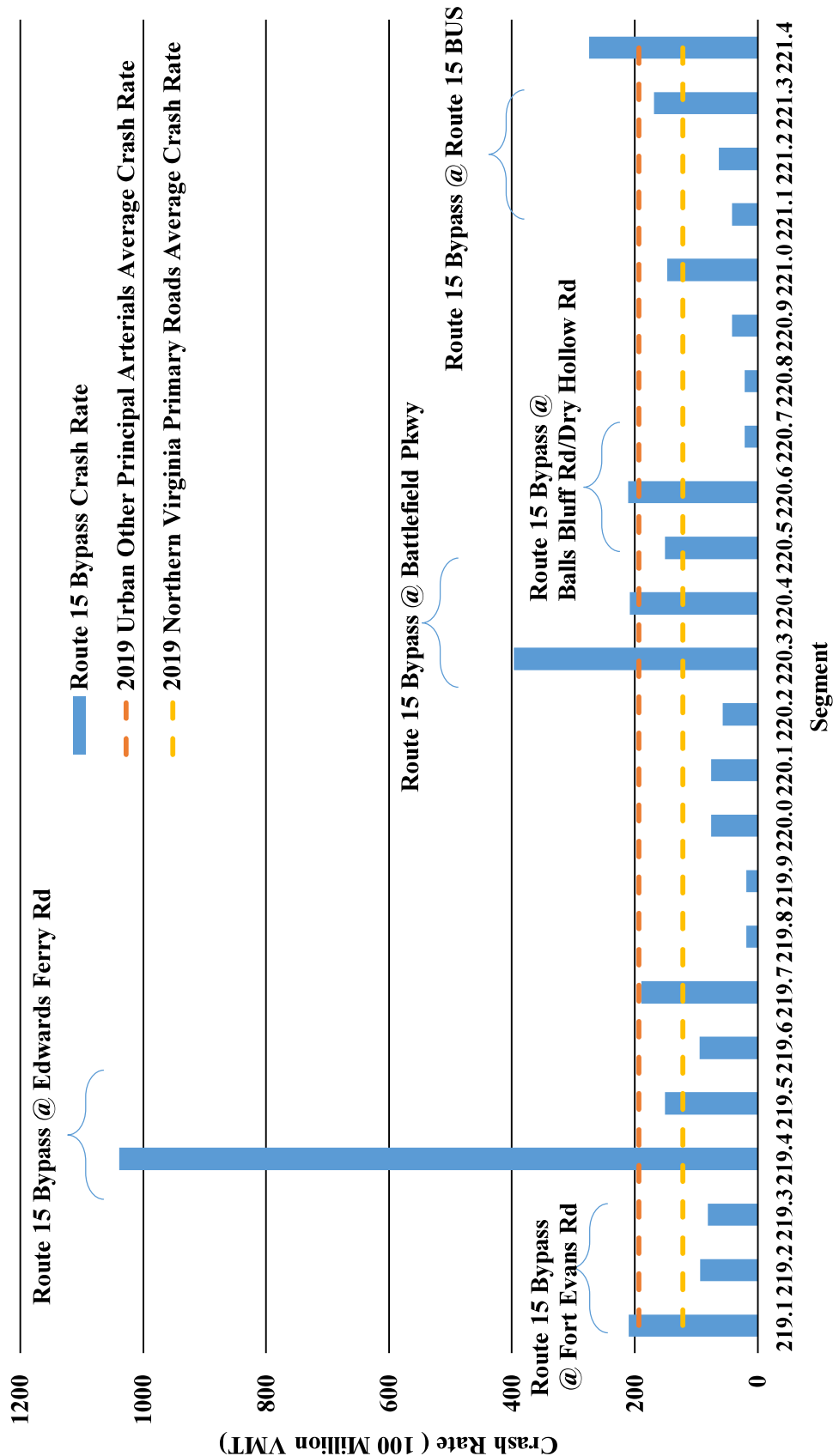
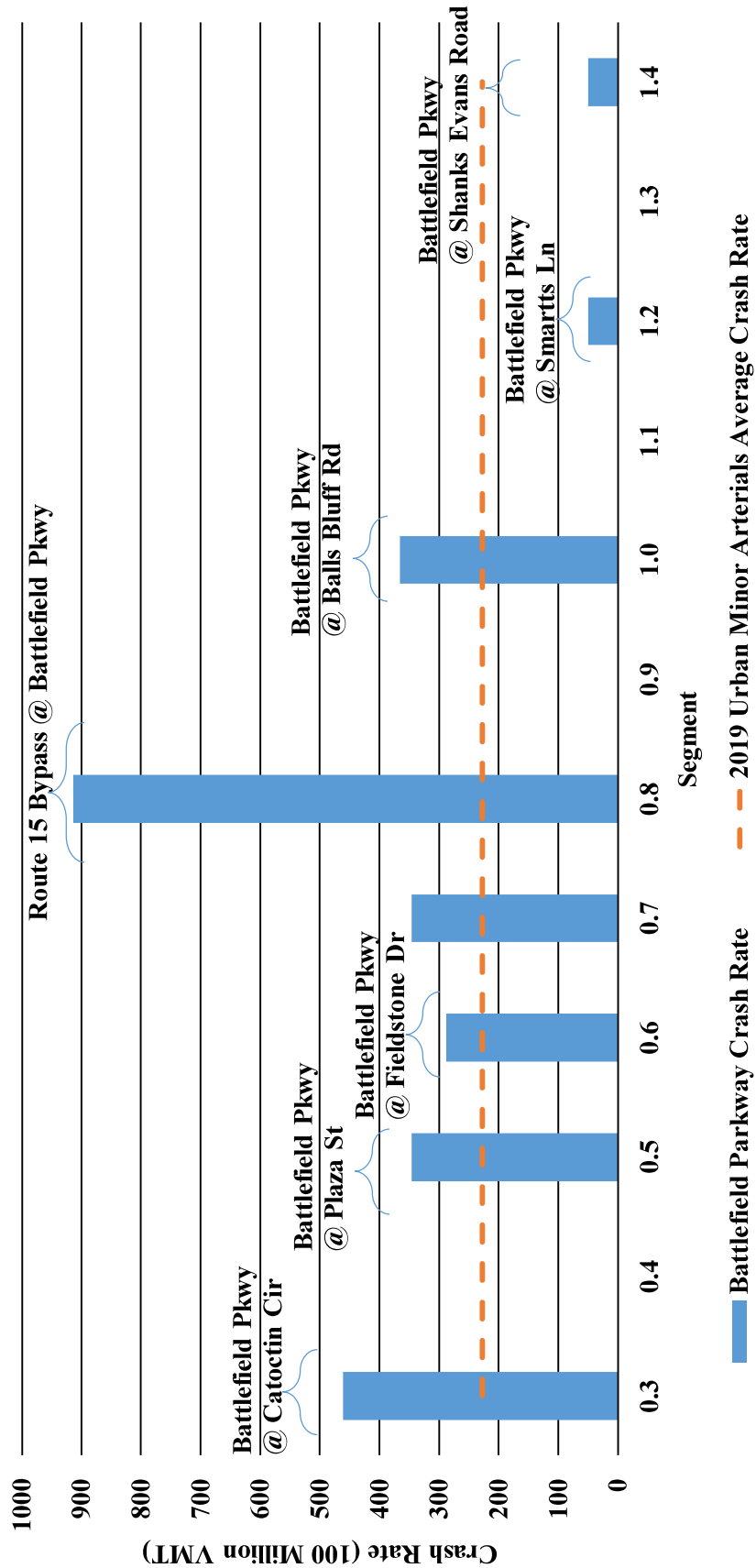


Figure 8-4b: Battlefield Parkway Crash Rates by Mile Point



8.1.2 Intersection Crashes

A total of 229 intersection crashes were identified at the eleven study intersections during the five-year study period including 56 (24 percent) injury crashes.

Table 8-3 summarizes the crashes by intersection and severity. As shown, the intersection of the Route 15 Bypass at Edwards Ferry Road experienced the highest number of total crashes and injury crashes with 111 total crashes including 28 injury crashes. The Route 15 Bypass at Battlefield Parkway intersection experienced the second highest number of total crashes and injury crashes with 45 total crashes including 10 injury crashes. The Route 15 Bypass at Fort Evans Road intersection experienced the third highest number of total crashes and injury crashes with 38 total crashes including 6 injury crashes. These three intersections account for 85 percent of the crashes at the 11 total intersections.

Table 8-3: Intersection Crashes by Severity (January 2015 – December 2019)

Intersections	Fatal Injury	Severe Injury	Visible Injury	Non-Visible Injury	Property Damage Only	Total
Route 15 Bypass & Fort Evans Road	0	0	4	2	32	38
Route 15 Bypass & Edwards Ferry Road	0	1	25	2	83	111
Route 15 Bypass & Battlefield Parkway	0	0	10	0	35	45
Route 15 Bypass & Balls Bluff Road/Dry Hollow Road	0	0	1	0	4	5
Route 15 Bypass & Route 15 Business/Route 15	0	0	4	1	2	7
Battlefield Parkway & Smartts Lane	0	0	0	0	1	1
Battlefield Parkway & Shanks Evans Road	0	0	0	0	1	1
Battlefield Parkway & Plaza Street	0	0	2	1	2	5
Battlefield Parkway & Fieldstone Drive	0	0	1	0	4	5
Battlefield Parkway & Catoctin Circle	0	0	1	0	6	7
Battlefield Parkway & Balls Bluff Road	0	0	2	0	2	4
Total	0	1	50	6	172	229

Table 8-4 summarizes the crashes by intersection and type. As shown, rear end crashes are the most predominant crash type at the study intersections with 130 (57 percent) rear end crashes. Of these, 64 (49 percent) occurred at the Route 15 Bypass at Edwards Ferry Road intersection, 28 (22 percent) occurred at the Route 15 Bypass at Battlefield Parkway intersection, and 27 (21 percent) occurred at the Route 15 Bypass at Fort Evans Road intersection. Angle crashes were the next most predominant crash type with 48 (21 percent). Of the 48 angle crashes 22 (46 percent) occurred at the Route 15 Bypass at Edwards Ferry Road intersection and 8 (17 percent) occurred at the Route 15 Bypass at Battlefield Parkway intersection.

Table 8-4: Intersection Crashes by Type (January 2015 – December 2019)

Intersections	Rear End	Angle	Sideswipe	Fixed Object	Head On	Pedestrian	Bicycle	Other	Total
Route 15 Bypass & Fort Evans Road	27	2	3	4	0	1	0	1	38
Route 15 Bypass & Edwards Ferry Road	64	22	13	5	1	1	0	5	111
Route 15 Bypass & Battlefield Parkway	28	8	5	1	1	0	0	2	45
Route 15 Bypass & Balls Bluff Road/Dry Hollow Road	4	0	0	0	0	0	0	1	5
Route 15 Bypass & Route 15 Business/Route 15	3	4	0	0	0	0	0	0	7
Battlefield Parkway & Smartts Lane	0	0	1	0	0	0	0	0	1
Battlefield Parkway & Shanks Evans Road	0	0	0	1	0	0	0	0	1
Battlefield Parkway & Plaza Street	3	1	0	1	0	0	0	0	5
Battlefield Parkway & Fieldstone Drive	1	2	1	1	0	0	0	0	5
Battlefield Parkway & Catoctin Circle	0	5	1	1	0	0	0	0	7
Battlefield Parkway & Balls Bluff Road	0	4	0	0	0	0	0	0	4
Total	130	48	24	14	2	2	0	9	229

Table 8-5 summarizes the crash rates by intersection in crashes per million entering vehicles. As shown, the Route 15 Bypass and Edwards Ferry Road intersection has the highest crash rate with 1.41 crashes per million entering vehicles and the Route 15 Bypass at Battlefield Parkway intersection had the second highest crash rate with 0.65 crashes per million entering vehicles.

Table 8-5: Intersection Crash Rates (Crashes per Million Entering Vehicles)

Intersection	Number of Crashes	Crash Rate (Million Entering Vehicles)
Route 15 Bypass & Fort Evans Road	38	0.35
Route 15 Bypass & Edwards Ferry Road	111	1.41
Route 15 Bypass & Battlefield Parkway	45	0.65
Route 15 Bypass & Balls Bluff Road/Dry Hollow Road ¹	5	0.11
Route 15 Bypass & Route 15 Business/Route 15	7	0.11
Battlefield Parkway & Smartts Lane ¹	1	0.05
Battlefield Parkway & Shanks Evans Road ¹	1	0.05
Battlefield Parkway & Plaza Street	5	0.20
Battlefield Parkway & Fieldstone Drive ¹	5	0.29
Battlefield Parkway & Catoctin Circle	7	0.32
Battlefield Parkway & Balls Bluff Road ¹	4	0.24

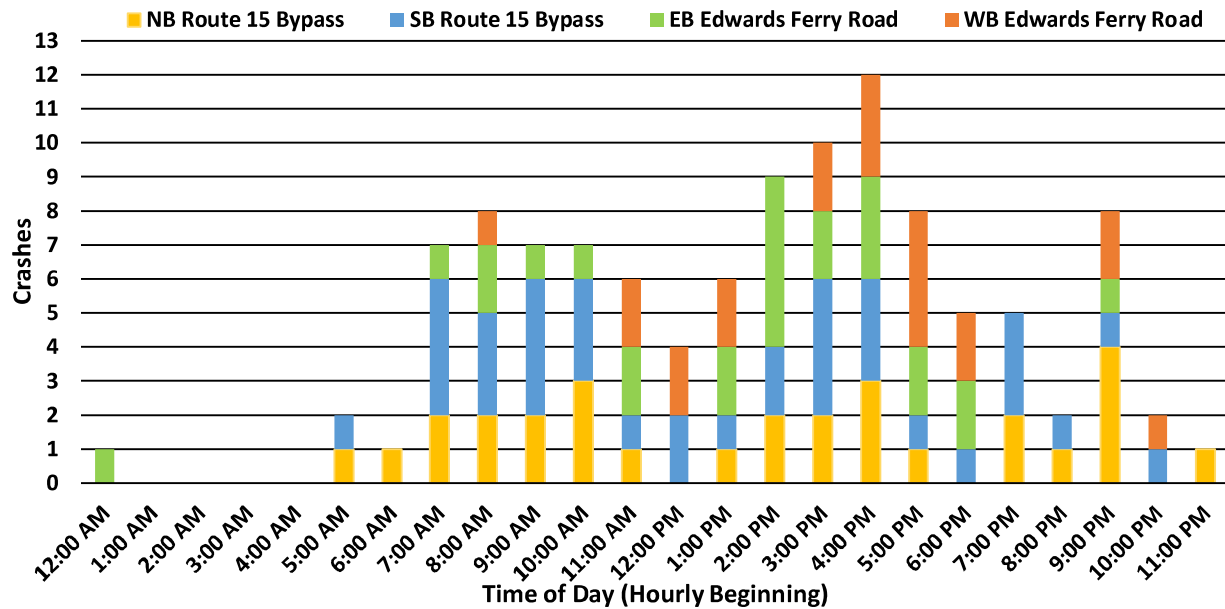
¹ ADT not available for minor street approach and therefore not included in the crash rate calculation

8.1.2.1 Route 15 Bypass at Edwards Ferry Road Intersection

The Route 15 Bypass at Edwards Ferry Road signalized intersection has the highest number of total intersection crashes with 111 crashes including 28 injury crashes, 64 rear end crashes, and 22 angle crashes. The high frequency of rear end crashes can be partially attributed to heavy congestion during peak periods. One pedestrian crash occurred in the vicinity of the Route 15 Bypass at Edwards Ferry Road intersection and resulted in an injury. As noted in Chapter 4, an interchange is planned at this signalized intersection which will significantly reduce the potential for both rear end and angle crashes.

Figure 8-5 depicts crashes along the Route 15 Bypass at Edwards Ferry Road intersection by time of day. The highest number of crashes were reported during the evening peak hours with 35 percent of crashes reported between 2 PM and 6 PM. There was also a high number of crashes reported between 9 PM and 10 PM. The reason for the high number of crashes during this hour is not known.

Figure 8-5: Route 15 Bypass at Edwards Ferry Road Crashes by Time of Day

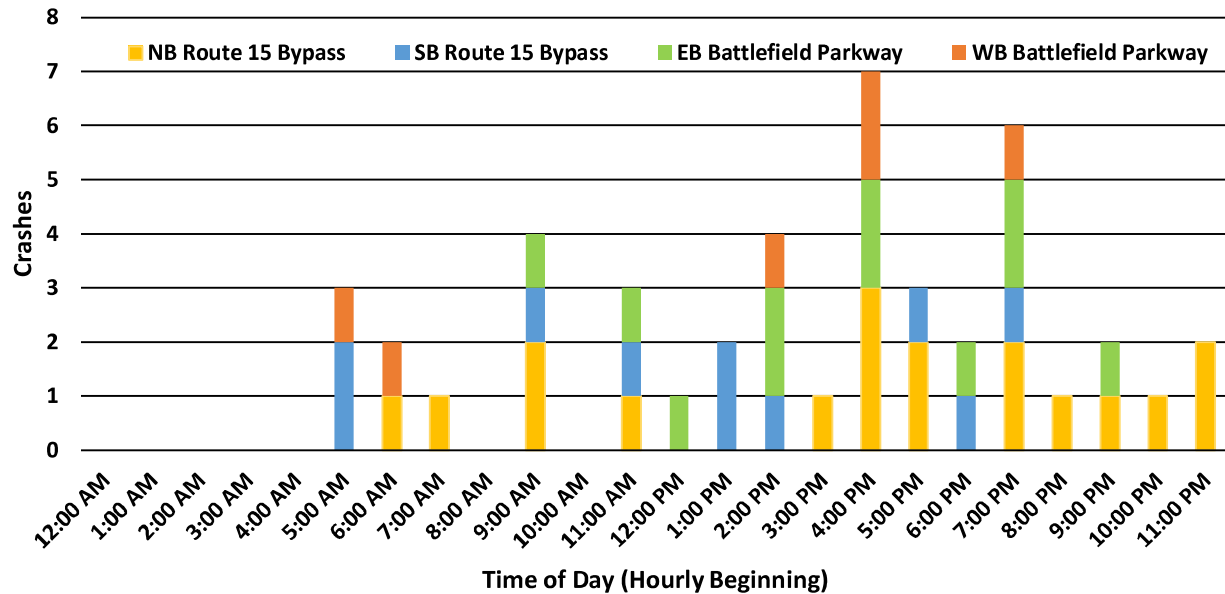


8.1.2.2 Route 15 Bypass at Battlefield Parkway Intersection

The Route 15 Bypass at Battlefield Parkway signalized intersection has the second highest total intersection crashes with 45 crashes including 10 injury crashes, 28 rear end crashes, and 8 angle crashes. Of the 45 total crashes, 36 crashes (80 percent) were either angle or rear end crashes with 15 occurring on northbound Route 15 Bypass and 8 occurring on southbound Route 15 Bypass. Similar to the Edwards Ferry Road intersection, the high frequency of rear end crashes can be attributed to high congestion levels during peak periods. The high number of angle crashes can potentially be attributed to driver inattention but also aggressive driving behavior that is exacerbated by long delays and high congestion levels as motorists attempt to “beat the light” to avoid additional travel delays. Additionally, Battlefield Parkway is the first signalized intersection along southbound Route 15 Bypass beyond the Route 15 Bypass at Route 15 Business/Route 15 intersection and is 2 miles south of the next signalized intersection to the north at Route 15 and Raspberry Drive/Whites Ferry Road. No pedestrian or bicycle-related crashes were reported at the intersection.

Figure 8-6 depicts crashes at the Route 15 Bypass and Battlefield Parkway intersection by time of day. As shown, the highest number of crashes occur along the northbound Route 15 Bypass (40 percent) at the intersection. The second highest number of crashes occurs along the eastbound Battlefield Parkway (24 percent) with the southbound Route 15 Bypass (22 percent) having a similar number of crashes. There is a high frequency of crashes at the intersection between 4 PM and 5 PM and between 7 PM and 8 PM. The lower number of crashes between 5 PM and 7 PM compared to 4 PM to 5 PM and 7 PM to 8 PM may be attributed to the lower travel speeds at the intersection during this heavily congested time period. The crash frequency is similar throughout the rest of the day with the exception of the hours between 12 AM and 5 AM when no crashes were reported.

Figure 8-6: Route 15 Bypass at Battlefield Parkway Crashes by Time of Day



8.1.2.3 Route 15 Bypass at Fort Evans Road Intersection

The Route 15 Bypass at Fort Evans Road signalized Green-T intersection experiences the third highest total intersection crashes with 38 crashes reported including 6 injury crashes and 27 rear end crashes. Of the 38 total crashes, 29 crashes (76 percent) were either angle or rear end crashes. There was one reported pedestrian crash in the vicinity of the Route 15 Bypass and Fort Evans Road intersection that resulted in an injury. Similar to the Edwards Ferry Road intersection, the high frequency of rear end crashes can be attributed to high congestion levels during peak periods with 50 percent of the crashes occurring between 4 PM and 8 PM. As noted in Chapter 4, an interchange is planned at this signalized intersection in conjunction with the Route 15 Bypass at Edwards Ferry Road interchange which will significantly reduce the potential for both rear end and angle crashes.

8.1.2.4 Route 15 Bypass at Route 15 Business/Route 15

The Route 15 Bypass at Route 15 Business/Route 15 unsignalized intersection experienced seven total crashes including five that resulted in an injury. Three of the seven crashes were rear end crashes. The future Loudoun County project to widen Route 15 north of Leesburg will include reconstruction of this intersection to a signalized Green-T. This modification of the intersection is expected to change the frequency and types of crashes occurring there.

8.1.2.5 Battlefield Parkway at Catoclin Circle

A total of seven crashes occurred at the Battlefield Parkway/Catoclin Circle unsignalized intersection including one that resulted in an injury. Five of these crashes were angle crashes.

8.1.2.6 Battlefield Parkway at Plaza Street

A total of five crashes occurred at the Battlefield Parkway/Plaza Street signalized intersection including three that resulted in injury.

8.1.2.7 Route 15 Bypass at Old Balls Bluff Road/Dry Hollow Road

A total of five crashes occurred on Route 15 Bypass in the vicinity of the Old Balls Bluff Road/Dry Hollow Road unsignalized intersection. One of the crashes resulted in a visible injury. Four of the five crashes were rear end crashes. Based on a review of the crash descriptions, no crashes were specifically attributed to the intersection.

8.1.2.8 Battlefield Parkway at Fieldstone Drive

A total of five crashes occurred at the Battlefield Parkway/Fieldstone Drive unsignalized intersection including one that resulted in an injury. Of the five crashes, two were angle crashes, one was a rear end collision, one was a fixed object crash, and one was a sideswipe crash.

8.1.2.9 Battlefield Parkway at Balls Bluff Road

A total of four crashes occurred at the Battlefield Parkway/Balls Bluff Road unsignalized intersection including two that resulted in injury. All four crashes were angle crashes.

8.1.2.10 Battlefield Parkway at Smartts Lane

One sideswipe crash occurred at the Battlefield Parkway/Smartts Lane unsignalized intersection, with no injuries reported.

8.1.2.11 Battlefield Parkway at Shanks Evans Road

One fixed object crash occurred at the Battlefield Parkway/Shanks Evans Road signalized intersection with no injuries reported.

8.2 SAFETY ASSESSMENT OF THE PREFERRED ALTERNATIVE

Travel demand is projected to grow along the Route 15 Bypass and other roadways within the study area. With this forecasted increase in traffic, and without improvements to the roadway system (No Build Alternative), congestion will increase and correspondingly, crash frequency is anticipated to increase. The Preferred Build Alternative as discussed in Chapters 4 and 5 will provide a double roundabout interchange at the Route 15 Bypass and Battlefield Parkway intersection and will improve safety, reduce conflict points, and reduce the potential for crashes.

The Highway Safety Manual (HSM) presents a variety of quantitative methods for estimating crash frequency or severity for various facility types including the application of crash modification factors (CMF). The quantitative safety analysis focuses on the review of available CMFs contained in the Virginia State Preferred CMF List and the Crash Modification Factors Clearinghouse and their application to the Preferred Build Alternative. The Crash Modification Factors Clearinghouse is a web-based comprehensive listing of available CMFs including both those included and not included in the HSM. A CMF is a multiplicative factor used to compute the expected number of crashes after implementing a given

countermeasure at a specific location. Applicable CMFs were identified for each of the proposed design elements and applied to calculate the predicted change in crash frequency per year.

A summary of individual design elements associated with the Preferred Build Alternative that may contribute to safety within the study limits is provided below followed by an overall summary of conflict points and application of CMFs.

8.2.1 Route 15 Bypass at Battlefield Parkway Interchange

The Preferred Build Alternative includes the removal of the signalized intersection at Route 15 Bypass and Battlefield Parkway and the construction of a grade-separated interchange with two roundabouts along Battlefield Parkway. **Table 8-6** summarizes the number of merging, diverging, and crossing conflict points under No Build conditions and Build conditions within the limits of the proposed improvements. **Figure 8-7** displays conflict points for the existing/No Build intersection configuration and **Figure 8-8** shows the number of conflict points for the proposed interchange to replace the signalized intersection. As shown in **Figures 8-7 and 8-8**, the existing intersection has 32 conflict points and the proposed interchange has 16 conflict points. The proposed interchange to replace the signalized intersection will reduce the total number of conflict points from 32 conflict points to 4 merge/diverge conflict points along Route 15 Bypass and 12 merge/diverge conflict points along Battlefield Parkway at the roundabouts for a total reduction of 16 conflict points including all 16 of the crossing conflict points which typically result in the most severe types of crashes. Angle crashes, which are typically the most severe type of crash and occur at crossing conflict points, account for 18 percent of the reported crashes at the intersection. Additionally, converting the Route 15 Bypass at Battlefield Parkway intersection to an interchange will allow through traffic along the Route 15 Bypass to operate under free-flow conditions, reducing the frequency of rear end and congestion-related crashes along the Route 15 bypass. Sixty-two (62) percent of the crashes reported at the intersection were rear end crashes.

As noted above, two roundabouts are proposed along Battlefield Parkway to serve the proposed interchange that will result in 6 merging and 6 diverging conflict points. Although there will be 12 new conflict points created at the two roundabouts serving the interchange, the number of conflict points created at the roundabouts is less than the number of conflict points with a traditional signalized intersection (32 conflict points). Additionally, roundabouts, when compared to traditional stop-controlled or signal-controlled intersections, offer a reduction in travel speeds and eliminate crossing conflict points resulting in overall reduced crash frequency and severity demonstrating the proven safety benefits of roundabouts. **Chapter 4** contains a discussion of the conflict points associated with the other interchange alternatives under consideration.

The CMF for the conversion of an at-grade intersection to a grade-separated interchange is 0.43 for injury related crashes and 0.64 for property damage only crashes, indicating a 57 percent reduction in injury related crashes and a 36 percent reduction in property damage only crashes at the Route 15 Bypass at Battlefield Parkway intersection under Build conditions. **Section 8.2.5** summarizes the application of this CMF to reported crashes at the intersection. By applying this CMF, the crash frequency at the Route 15 Bypass and Battlefield Parkway intersection is predicted to decrease by approximately 3.66 crashes per year.

Figure 8-7: Existing Route 15 Bypass at Battlefield Parkway Conflict Points

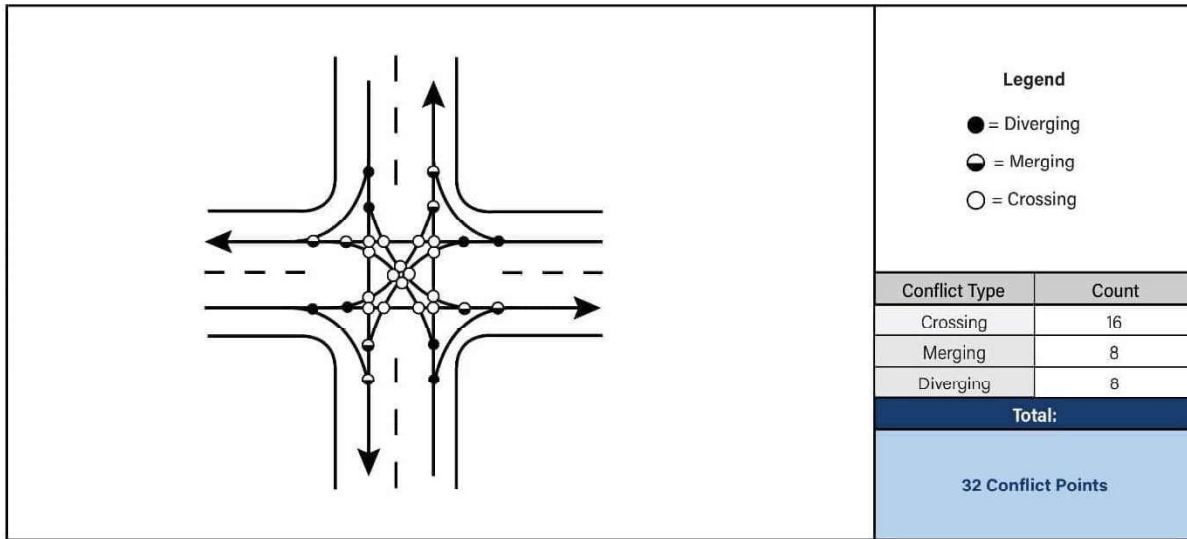
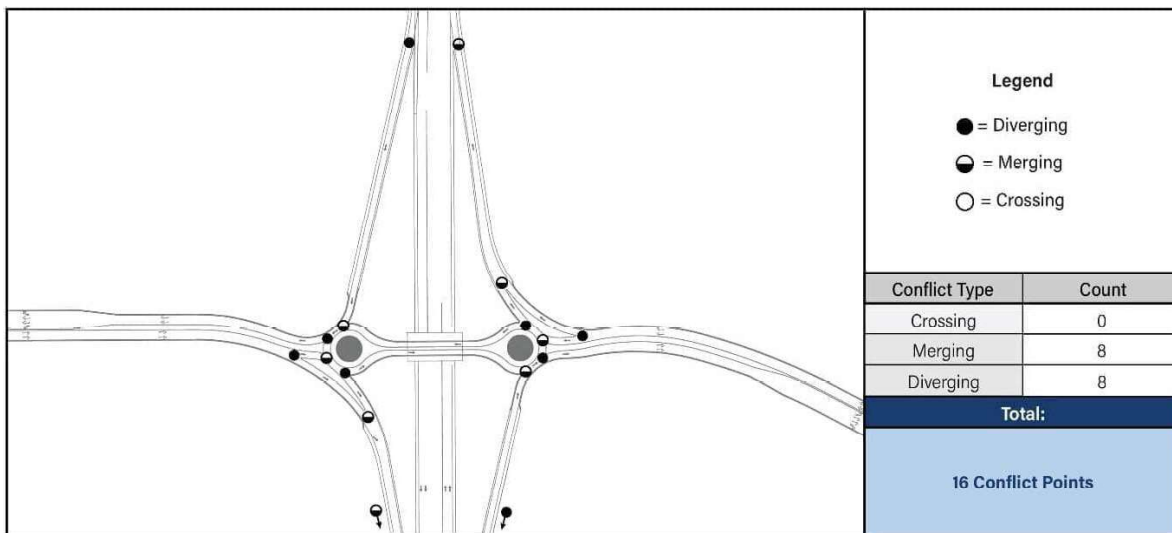


Figure 8-8: Preferred Route 15 Bypass at Battlefield Parkway Conflict Points



8.2.2 Route 15 Bypass at Old Balls Bluff Road/Dry Hollow Road Intersection Removal

The Preferred Build Alternative includes removal of the Old Balls Bluff Road and Dry Hollow Road access points along Route 15 Bypass. Under existing conditions, the four-legged intersection currently accommodates all turning movements. However, as part of the future Route 15 Widening project by Loudoun County, the existing 2-lane roadway will be widened to a 4-lane divided highway. The proposed improvements will not include a crossover at the intersection. **Table 8-6** summarizes the number of merging, diverging, and crossing conflict points under No Build conditions (with the Route 15 Widening Improvements) and Build conditions. The proposed removal of the access points to Route 15 Bypass will reduce the total number of conflict points from four conflict points including two merging and two diverging conflicts to no conflict points. Although five crashes were reported in the vicinity of the intersection, no crashes were directly attributed to the intersection.

While there is no available CMF that is directly applicable to the removal of these access points along Route 15 Bypass, the removal of the access points is consistent with the limited access designation of the Route 15 Bypass and is required in order to accommodate the ramps serving the proposed Route 15 Bypass at Battlefield Parkway interchange.

8.2.3 Route 15 Bypass at Battlefield Parkway Sidewalk/Shared-Use Path

The Preferred Build Alternative for the Route 15 Bypass at Battlefield Parkway intersection includes the construction of a sidewalk along the south side of Battlefield Parkway to provide safe pedestrian passage across the Route 15 Bypass. Additionally, the Preferred Build Alternative for the Route 15 Bypass at Battlefield Parkway intersection includes the construction of a shared-use path along the north side of Battlefield Parkway.

The CMF for the construction of a sidewalk and shared-use path is 0.12 for pedestrian-related crashes and 0.75 for bicyclist-related crashes, indicating an 88 percent and 25 percent reduction in pedestrian and bicyclist related crashes, respectively under Build conditions along the Battlefield Parkway corridor. **Section 8.2.5** summarizes the application of this CMF to reported crashes. Although there were no pedestrian or bicycle-related crashes reported along Battlefield Parkway within the study limits, the construction of a sidewalk and shared-use path will provide a safe and separated facility for pedestrians and bicyclists traveling along Battlefield Parkway and crossing Route 15 Bypass and remove vulnerable roadway users from the path of motorists.

8.2.4 Conflict Point Summary

Table 8-6 summarizes the conflict points under No Build and Build Alternative conditions for the study area intersections where improvements are proposed that will impact the number of conflict points. As shown, under No Build conditions, there are 36 conflict points at the Route 15 Bypass at Battlefield Parkway and Route 15 Bypass at Balls Bluff Road/Dry Hollow Road intersections including 16 crossing conflict points. The Preferred Build Alternative will reduce the total number of conflict points to 16 conflict points, a 56 percent reduction in conflict points and elimination of all 16 crossing conflict points typically resulting in the most severe types of crashes.

Table 8-6: Route 15 Bypass Conflict Point Summary

Location		Conflict Type											
		No Build Conditions				Build Conditions				Reduction of Conflict Points			
		Diverging	Merging	Crossing	Total	Diverging	Merging	Crossing	Total	Diverging	Merging	Crossing	Total
Route 15 Bypass at Balls Bluff Road/Dry Hollow Road		2	2	0	4	0	0	0	0	2	2	0	4
Route 15 Bypass at Battlefield Parkway	Existing Intersection	8	8	16	32	-	-	-	-	8	8	16	32
	Interchange Ramps	-	-	-	-	2	2	0	4	-2	-2	0	-4
	Interchange Roundabouts	-	-	-	-	6	6	0	12	-6	-6	0	-12
	Subtotal	8	8	16	32	8	8	0	16	0	0	16	16
Total		10	10	16	36	8	8	0	16	2	2	16	20

8.2.5 Summary of Crash Modification Factors

Table 8-7 summarizes the relevant CMFs discussed above. The CMFs were applied to calculate the predicted crash frequency per year for each location. As shown, the Preferred Build Alternative is predicted to reduce approximately four crashes per year.

Table 8-7: Crash Modification Factor Summary

Location	Design Element	Crash Type (Severity)	CMF	CMF Source	All Crashes		
					Historical Crash Frequency	Predicted Crash Frequency	Change in Crashes per Year
					Crashes per year		
Route 15 Bypass at Battlefield Parkway	Convert At-Grade Intersection to Grade-Separated Interchange	All Injury Crashes	0.43	VA State Preferred CMF List (Pg 10)	2.00	0.86	-1.14
		All PDO Crashes	0.64	VA State Preferred CMF List (Pg 10)	7.00	4.48	-2.52
South Side of Battlefield Parkway	Upgrade Sidewalk	Pedestrian Crashes	0.12	VA State Preferred CMF List (Pg 4)	0.00	0.00	0.00
		All Severities					
North Side of Battlefield Parkway	Install Shared-Use Path	Bike Injury Crashes	0.41	VA State Preferred CMF List (Pg 4)	0.00	0.00	0.00
		Bike PDO Crashes	1.00				
		All severities	0.75				
Total					9.00	5.34	-3.66

8.3 SAFETY AND CRASH ANALYSIS FINDINGS

Overall, it can be concluded that the Preferred Build Alternative will have a positive impact on safety along the Route 15 Bypass corridor.

- Recurring daily congestion due to heavy commuter traffic during both the morning and evening peak periods creates the potential for crashes along the Route 15 Bypass, specifically at the Route 15 Bypass at Battlefield Parkway intersection. The predominant crash type is rear end crashes, which account for 57 percent of all crashes and are frequently attributed to congestion. The Preferred Build Alternative will convert the signalized intersection at the Route 15 Bypass and Battlefield Parkway into a double roundabout interchange thereby reducing the potential for congestion-related crashes along the Route 15 Bypass and improving safety along the corridor compared to No Build conditions.
- The Preferred Build Alternative will reduce the total number of conflict points to 16 conflict points, a 56 percent reduction in conflict points. In addition, 16 crossing conflict points will be eliminated which typically result in the most severe types of crashes.
- A quantitative crash analysis using HSM methodologies was performed to document the safety impacts associated with the modifications to the Route 15 Bypass at Battlefield Parkway intersection. Based on a review of available CMFs, a reduction of 3.66 crashes per year (41 percent reduction) is predicted at the Route 15 Bypass at Battlefield Parkway intersection with the construction of an interchange.



VDOT

