CE 509 – Spring 2011
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Assignment 2 – Identifying Hazardous Sites

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Problem 1

To find the top ten most hazardous sites from the data given, I used numerous methods across a system of spreadsheets. Table A shows my choices for the top ten most hazardous sites from the given database. These sites coincidentally happen to be identical to the sites in the Rate Quality Control table (Table 1-B-4) in the Appendix.

Table A: Top Ten Most Hazardous Sites

RANK	ROADON	REFERENCE ROAD	Sum ADT	Collisions	Spot Rate/MEV	Rc	Spot Rate > Rc?	Spot Rate - Rc
1	EAST	EDENTON	10200	11	0.98	0.64	Yes	0.34
2	DAWSON	MORGAN	30300	23	0.69	0.47	Yes	0.22
3	BLOUNT	EDENTON	20000	16	0.73	0.54	Yes	0.19
4	EDENTON	MCDOWELL	25800	19	0.67	0.49	Yes	0.18
5	GLENWOOD	HILLSBORO	27200	18	0.6	0.48	Yes	0.12
6	GLENWOOD	PEACE	34800	21	0.55	0.46	Yes	0.09
7	CORPORATION	NEW BERN	62500	32	0.47	0.38	Yes	0.08
8	BRENTWOOD	CAPITAL	69300	34	0.45	0.38	Yes	0.07
9	BUCK JONES	WESTERN	27400	16	0.53	0.48	Yes	0.05
10	CALVARY	CAPITAL	37300	20	0.49	0.45	Yes	0.03

To find these sites, I ranked the top ten sites using four different methods: the Frequency/Rate method (Appendix Table 1-A), the Rate Quality Control method (Appendix Tables 1-B-1 through 1-B-4), the Severity Method (Appendix Table 1-C), and Bayesian method (Appendix Tables 1-D-1 through 1-D-3).

I then compared the data in Tables 1-A, 1-B-4, and 1-C-1, and noted sites that showed up in at least two of the tables. The top ten show up in at least two tables.

It's worth noting that the most hazardous intersection of all is EAST and EDENTON which shows up in all three tables. Not only does it have the highest spot rate and critical rate, but it also has a significant EPDO from the Severity method.

Unfortunately, the Bayesian method did not prove helpful. The formed groups, which all have a high group variance and a low weighing factor, did not give many expected values that corresponded with collisions higher than my frequency lower-limit of ten collisions.

Assumptions and Methods

I did a few checks for gross data errors. All ADT values were within similar significant digit lengths, and a quick logic check showed number values in number fields and text in text fields.

I assumed intersections with swapped "ROADON" and "REFERENCEROAD" values were the same site. Additionally, I picked one ADT value for each site. While NCDOT policy is to average ADT values for the years in question, not all sites had counts for each year. I see this being a smaller margin of error among much larger ones. This also made data analysis easier.

For methods involving grouping sites, sites were grouped into families of combined ADT size (approximately 10-20k, 20k-40k, and 40k-80k). These values were chosen because the highest volume in each category was no more than twice the volume of the lower category.

I first tried to group by control type. Unfortunately, insufficient information made assumptions very difficult to make. Without significantly more research than the data at hand, it would be impossible to tell the difference between an intersection that received a brand new signal in 2008 from an intersection that had a signal in 2007 but was unresponsive due to power loss during collisions in 2006 and 2007. Additionally, all types of controls were well distributed regardless of ranking by collision frequency or combined ADT size. Investigations of collisions caused by control loss (signal outage) could be investigated at a later analysis.

Problem 2

To calculate the efficiency of the recommended sieve in problem two, integration was performed in a spreadsheet for numerous X values. A sample of an integration table can be seen in the Appendix, Table 2-A-3. When examining intersections with 10 or more collisions over three years using a limiting long-term collision frequency of 20 (**λ***), values for correct positives, false positives, and false negatives can be seen in Table B.

When the 49 sites are checked, we have a very commendable number of false positives (nearly zero). However, there is a tremendous amount of wasted effort in terms of engineering time and resources because 33 sites (more than half) are not hazardous.

Table B: Positives and Negatives at λ*=20, x=10 collisions.

Lambda*			λ=	20					
x Collisions	Sites n(x)	S(x*)	F(1|x)	False +'s	Cumulative False +'s	Correct +'s	False -'s	%Wasted Effort	%Missed Sites
10	5	49	0.9957	4.98	33.39	15.61	0.01	68.14%	0.01%

A better level to set **λ*** is 12 and is my recommendation for this problem. Simply changing this long term frequency limit greatly reduces the wasted effort by more than half, at an expense of one false negative site, as seen in Table C.

Table C: Positives and Negatives at λ*=20, x=10 collisions.

Lambda*			λ=	12					
x Collisions	Sites n(x)	S(x*)	F(1|x)	False +'s	Cumulative False +'s	Correct +'s	False -'s	%Wasted Effort	%Missed Sites
10	5	49	0.7558	3.78	13.68	35.32	1.17	27.92%	2.33%

Different combinations can be found when changing both X* and **λ*.** Unfortunately, it is very difficult to judge the value of effort against false negatives without budgetary constraints or acceptable losses. To help see the data in a more meaningful way, I inserted ***%Wasted Effort*** and ***%Missed Sites*** columns. Is a 1% difference in wasted effort worth an additional .5% of missed sites? These are difficult questions to ask.

Larger tables can be seen in the Appendix, Tables 2-A-1 and 2-A-2. It should be noted that further calculations could easily be done with these existing tables. For a tighter budget, use a larger X* value and adjust **λ*** accordingly to an acceptable tradeoff of effort for false negatives. With an unlimited budget, all sites could be checked.

Problem 3

I analyzed the given data for Problem 3 according to the Sites With Promise method, and have chose sites 1, 7, and 12 as seen in Table D.

Table D: Top 3 Most Hazardous, Sites With Promise Method								
Site#	Sitetype	2001-2009 Collision Avg	(C) 2010 Collisions	Total Average Collisions per year	Rate per MVM (D)	ΔF/σF (B)	ΔR/σR (E)	Criterion Notes
1	Freeway	Not Open	43	43	2.58	0.27	4.75	E, Not very promising for B
7	Freeway	13	24	14.1	1.43			C
12	Two-lane	8	19	9.1	2.44			C, High rate for D

There were no choices related to criterion A because no countermeasure was prepared. Only Site 1 was applicable for criterion B, but while it had a positive ΔF/σF value, at 0.27 it was no where near the frequency standard deviation of 27.83, which was not very promising in terms of a deficiency.

Both sites 7 and 12 were chosen for their exceptional match to criterion C. Both had collisions in 2010 that were higher than their 2001-2009 averages. In fact, Site 7 nearly doubled, and Site 12 more than doubled. These represent the top two results because Hauer placed a higher emphasis on criteria B and C over D and E. Additionally, Site 12 also had one of the highest rates per million vehicle miles (criterion D).

Site 9 had the highest value for criterion D, but for a third hazardous site I recommend Site 1 over Site 9. Site 1 has a high rate per million vehicle miles, but also has a tremendous ΔR/σR value, much higher than the rate standard deviation, which is why I chose Site 1 as a hazardous site.

A full table of values and calculations for the Sites With Promise method can be seen in Appendix Table 3-1.

Appendix

Table 1-A: Frequency/Rate Method. Only top values shown. Darker rows indicate rows not chosen due to 11-collision minimum.

Frequency/Rate Method					
RANK	ROADON	REFERENCE ROAD	Sum ADT	Collisions	Spot Rate per MEV
1	EAST	EDENTON	10200	11	0.98
2	BLOUNT	EDENTON	20000	16	0.73
3	DAWSON	MORGAN	30300	23	0.69
4	EDENTON	MCDOWELL	25800	19	0.67
5	GLENWOOD	HILLSBORO	27200	18	0.6
	BOYLAN	MORGAN	16000	10	0.57
6	GLENWOOD	PEACE	34800	21	0.55
7	BUCK JONES	WESTERN	27400	16	0.53
	CALVARY	LOUISBURG	12700	7	0.5
8	MAYNARD	WALNUT	29500	16	0.5
9	HARRISON	MAYNARD	20500	11	0.49
10	CALVARY	CAPITAL	37300	20	0.49
	MCDOWELL	MORGAN	27300	14	0.47
	CORPORATION	NEW BERN	62500	32	0.47

Table 1-B-1: Rate Quality Control for up to 20k Entering Vehicles. Only top values shown.

Rate Quality Control for up to 20k Entering Vehicles						
ROADON	REFERENCE ROAD	Sum ADT	Collisions	Spot Rate/MEV	Rc	Spot Rate > Rc?
EAST	EDENTON	10200	11	0.98	0.64	Yes
BLOUNT	EDENTON	20000	16	0.73	0.54	Yes
BOYLAN	MORGAN	16000	10	0.57	0.57	No
CALVARY	LOUISBURG	12700	7	0.5	0.61	No

Table 1-B-2: Rate Quality Control for between 20k-40k Entering Vehicles. Only top values shown.

Rate Quality Control for between 20k-40k Entering Vehicles						
ROADON	REFERENCE ROAD	Sum ADT	Collisions	Spot Rate/MEV	Rc	Spot Rate > Rc?
DAWSON	MORGAN	30300	23	0.69	0.47	Yes
EDENTON	MCDOWELL	25800	19	0.67	0.49	Yes
GLENWOOD	HILLSBORO	27200	18	0.6	0.48	Yes
GLENWOOD	PEACE	34800	21	0.55	0.46	Yes
BUCK JONES	WESTERN	27400	16	0.53	0.48	Yes
CALVARY	CAPITAL	37300	20	0.49	0.45	Yes
MAYNARD	WALNUT	29500	16	0.5	0.48	Yes
DAN ALLEN	HILLSBORO	37200	19	0.47	0.46	Yes
LEAD MINE	NORTH HILLS	33300	17	0.47	0.46	Yes
HARRISON	MAYNARD	20500	11	0.49	0.51	No
MCDOWELL	MORGAN	27300	14	0.47	0.48	No

Table 1-B-3: Rate Quality Control for Greater Than 40k Entering Vehicles. Only top values shown.

Rate Quality Control for Greater Than 40k Entering Vehicles						
ROADON	**REFERENCE ROAD**	**Sum ADT**	**Collisions**	**Spot Rate/MEV**	**Rc**	**Spot Rate > Rc?**
CORPORATION	NEW BERN	62500	32	0.47	0.38	Yes
BRENTWOOD	CAPITAL	69300	34	0.45	0.38	Yes
FALLS OF NEUSE	MILLBROOK	53000	24	0.41	0.39	Yes
MILLBROOK	SIX FORKS	59700	27	0.41	0.39	Yes
CREEDMOOR	GLENWOOD	69300	30	0.4	0.38	Yes
CREEDMOOR	MILLBROOK	47900	20	0.38	0.4	No
KILDAIRE FARM	MAYNARD	41400	17	0.38	0.41	No

Table 1-B-4: Rate Quality Control, Ranked by the difference in Rc from the Spot Rate. Only top values shown.

Rate Quality Control - Spot Rates > Rc								
RANK	**ROADON**	**REFERENCE ROAD**	**Sum ADT**	**Collisions**	**Spot Rate/MEV**	**Rc**	**Spot Rate > Rc?**	**Spot Rate - Rc**
1	EAST	EDENTON	10200	11	0.98	0.64	Yes	0.34
2	DAWSON	MORGAN	30300	23	0.69	0.47	Yes	0.22
3	BLOUNT	EDENTON	20000	16	0.73	0.54	Yes	0.19
4	EDENTON	MCDOWELL	25800	19	0.67	0.49	Yes	0.18
5	GLENWOOD	HILLSBORO	27200	18	0.6	0.48	Yes	0.12
6	GLENWOOD	PEACE	34800	21	0.55	0.46	Yes	0.09
7	CORPORATION	NEW BERN	62500	32	0.47	0.38	Yes	0.08
8	BRENTWOOD	CAPITAL	69300	34	0.45	0.38	Yes	0.07
9	BUCK JONES	WESTERN	27400	16	0.53	0.48	Yes	0.05
10	CALVARY	CAPITAL	37300	20	0.49	0.45	Yes	0.03
	MILLBROOK	SIX FORKS	59700	27	0.41	0.39	Yes	0.03
	FALLS OF NEUSE	MILLBROOK	53000	24	0.41	0.39	Yes	0.02

Table 1-C-1: Severity Method, ranked by EPDO. Only top values shown.

Severity Method								
RANK	**ROADON**	**REFERENCE ROAD**	**Collisions**	**A-INJs**	**B-INJs**	**C-INJs**	**Fatalities**	**EPDO**
1	BRENTWOOD	CAPITAL	34	1	1	25	0	100.5
2	GLENWOOD	PEACE	21	2	2	17	0	85.5
3	GLENWOOD	PLEASENT VALLEY	18	2	0	17	0	78.5
4	FALLS OF NEUSE	MILLBROOK	24	0	3	18	0	73.5
5	CORPORATION	NEW BERN	32	0	1	19	0	70
6	CREEDMOOR	GLENWOOD	30	0	2	18	0	70
7	CAPITAL	NEW HOPE CHURCH	11	4	1	7	0	66
8	EAST	EDENTON	11	3	0	10	0	63.5
9	DAN ALLEN	WESTERN	18	1	3	9	0	51.5
10	GORMAN	WESTERN	18	1	6	6	0	51.5
	HILLSBORO	BERYL	14	1	2	10	0	51.5
	GLENWOOD	MILLBROOK	13	2	0	9	0	50.5

Table 1-D-1: Bayesian for less than 20k Entering Vehicles. Shaded regions show area of interest (Mi greater than x collisions, collisions greater than 10). Notice the areas do share common rows.

Bayesian for up to 20k Entering Vehicles					
x Collisions	Sites n(x)	E(m)	s^2	a	mi
1	2	4.95	39.9103	0.12	1.49
2	5				2.37
3	2				3.24
4	2				4.12
5	2				4.99
6	2				5.87
7	2				6.75
8	0				7.62
9	0				8.5
10	1				9.37
11	1				10.25
12	0				11.13
13	0				12
14	0				12.88
15	0				13.75
16	1				14.63
17	0				15.51
18	0				16.38
19	0				17.26
20	0				18.13
21	0				19.01
22	0				19.89
23	0				20.76
24	0				21.64
25	0				22.51
26	0				23.39
27	0				24.27
28	0				25.14
29	0				26.02
30	0				26.89
31	0				27.77
32	0				28.65
33	0				29.52
34	0				30.4

Table 1-D-2: Bayesian for between 20k and 40k Entering Vehicles. Shaded regions show area of interest (Mi greater than x collisions, collisions greater than 10). Notice the areas do not share common rows.

Bayesian for between 20k-40k Entering Vehicles					
x Collisions	Sites n(x)	E(m)	s^2	a	mi
1	2	9.9	137.9459	0.07	1.64
2	4				2.57
3	3				3.49
4	2				4.42
5	4				5.35
6	1				6.28
7	5				7.21
8	4				8.14
9	1				9.06
10	1				9.99
11	4				10.92
12	1				11.85
13	2				12.78
14	3				13.71
15	0				14.63
16	2				15.56
17	2				16.49
18	3				17.42
19	2				18.35
20	1				19.28
21	1				20.2
22	0				21.13
23	1				22.06
24	0				22.99
25	0				23.92
26	0				24.84
27	0				25.77
28	0				26.7
29	0				27.63
30	0				28.56
31	0				29.49
32	0				30.41
33	0				31.34
34	0				32.27

Table 1-D-3: Bayesian for Greater Than 40k Entering Vehicles. Shaded regions show area of interest (Mi greater than x collisions, collisions greater than 10). Dark region shows rows of interest due to a convergence of these areas.

Bayesian for Greater than 40k Entering Vehicles					
x Collisions	Sites n(x)	E(m)	s^2	a	mi
1	0	16.54	342.8214	0.05	1.75
2	1				2.7
3	0				3.65
4	0				4.6
5	1				5.56
6	1				6.51
7	2				7.46
8	0				8.41
9	0				9.36
10	3				10.32
11	1				11.27
12	1				12.22
13	3				13.17
14	0				14.12
15	1				15.07
16	1				16.03
17	1				16.98
18	1				17.93
19	0				18.88
20	2				19.83
21	1				20.78
22	2				21.74
23	0				22.69
24	1				23.64
25	0				24.59
26	1				25.54
27	1				26.5
28	0				27.45
29	0				28.4
30	1				29.35
31	0				30.3
32	1				31.25
33	0				32.21
34	1				33.16

Table 2-A-1: Sieve Efficiency Method: λ=20. X* value of 10 is highlighted.

Lambda*			λ=	20					
x Collisions	**Sites n(x)**	**S(x*)**	**F(1|x)**	**False +'s**	**Cumulative False +'s**	**Correct +'s**	**False -'s**	**%Wasted Effort**	**%Missed Sites**
1	4	97	1	4	81.38	15.62	0	83.90%	0.00%
2	10	93	1	10	77.38	15.62	0	83.21%	0.00%
3	5	83	1	5	67.38	15.62	0	81.18%	0.00%
4	4	78	1	4	62.38	15.62	0	79.98%	0.00%
5	7	74	1	7	58.38	15.62	0	78.90%	0.00%
6	4	67	0.9999	4	51.38	15.62	0	76.69%	0.00%
7	9	63	0.9998	9	47.38	15.62	0	75.21%	0.00%
8	4	54	0.9993	4	38.39	15.61	0	71.08%	0.00%
9	1	50	0.9982	1	34.39	15.61	0.01	68.78%	0.01%
10	5	49	0.9957	4.98	33.39	15.61	0.01	68.14%	0.01%
11	6	44	0.9908	5.94	28.41	15.59	0.03	64.57%	0.07%
12	2	38	0.982	1.96	22.47	15.53	0.08	59.12%	0.22%
13	5	36	0.9672	4.84	20.5	15.5	0.12	56.95%	0.33%
14	3	31	0.9442	2.83	15.67	15.33	0.28	50.54%	0.91%
15	1	28	0.9111	0.91	12.83	15.17	0.45	45.84%	1.59%
16	4	27	0.8664	3.47	11.92	15.08	0.54	44.16%	1.96%
17	3	23	0.8094	2.43	8.46	14.54	1.07	36.77%	4.46%
18	4	20	0.7411	2.96	6.03	13.97	1.65	30.15%	7.61%
19	2	16	0.6633	1.33	3.06	12.94	2.68	19.16%	14.36%
20	3	14	0.5794	1.74	1.74	12.26	3.36	12.42%	19.33%
21	2	11			0	11	4.62		
22	2	9			0	9	6.62		
23	1	7			0	7	8.62		
24	1	6			0	6	9.62		
25	0	5			0	5	10.62		
26	1	5			0	5	10.62		
27	1	4			0	4	11.62		
28	0	3			0	3	12.62		
29	0	3			0	3	12.62		
30	1	3			0	3	12.62		
31	0	2			0	2	13.62		
32	1	2			0	2	13.62		
33	0	1			0	1	14.62		
34	1	1			0	1	14.62		

Table 2-A-2: Sieve Efficiency Method: λ=12. X* value of 10 is highlighted.

Lambda*			λ=	12					
x Collisions	Sites n(x)	S(x*)	F(1|x)	False +'s	Cumulative False +'s	Correct +'s	False -'s	%Wasted Effort	%Missed Sites
1	4	97	1	4	60.51	36.49	0	62.38%	0.00%
2	10	93	0.9998	10	56.51	36.49	0	60.77%	0.00%
3	5	83	0.9991	5	46.52	36.48	0	56.04%	0.00%
4	4	78	0.9991	4	41.52	36.48	0.01	53.23%	0.01%
5	7	74	0.9904	6.93	37.52	36.48	0.01	50.71%	0.01%
6	4	67	0.9762	3.9	30.59	36.41	0.08	45.66%	0.11%
7	9	63	0.9494	8.54	26.69	36.31	0.17	42.36%	0.27%
8	4	54	0.9051	3.62	18.14	35.86	0.63	33.60%	1.15%
9	1	50	0.8405	0.84	14.52	35.48	1.01	29.04%	1.98%
10	5	49	0.7558	3.78	13.68	35.32	1.17	27.92%	2.33%
11	6	44	0.6549	3.93	9.9	34.1	2.39	22.50%	5.15%
12	2	38	0.545	1.09	5.97	32.03	4.46	15.72%	10.50%
13	5	36	0.4346	2.17	4.88	31.12	5.37	13.56%	12.98%
14	3	31	0.3317	1	2.71	28.29	8.2	8.74%	20.91%
15	1	28	0.2421	0.24	1.71	26.29	10.2	6.12%	26.70%
16	4	27	0.1691	0.68	1.47	25.53	10.96	5.45%	28.87%
17	3	23	0.113	0.34	0.8	22.2	14.28	3.46%	38.31%
18	4	20	0.0723	0.29	0.46	19.54	16.94	2.28%	45.86%
19	2	16	0.0444	0.09	0.17	15.83	20.65	1.04%	56.35%
20	3	14	0.0261	0.08	0.08	13.92	22.56	0.56%	61.71%
21	2	11			0	11	25.49		
22	2	9			0	9	27.49		
23	1	7			0	7	29.49		
24	1	6			0	6	30.49		
25	0	5			0	5	31.49		
26	1	5			0	5	31.49		
27	1	4			0	4	32.49		
28	0	3			0	3	33.49		
29	0	3			0	3	33.49		
30	1	3			0	3	33.49		
31	0	2			0	2	34.49		
32	1	2			0	2	34.49		
33	0	1			0	1	35.49		
34	1	1			0	1	35.49		

Table 2-A-3: Sample Integration Table for x=1, shown to λ=13

Integral Table			For x=	1		
λ	λ^(x+B-1)	e^(-λ(1+a))	f(λ|x)	Area	Cumulative Area	Eq17
0.001	0.0083	0.9989	0.0083	0	0	0
0.01	0.0411	0.9894	0.0406	0.0002	0.0002	0.0003
0.02	0.0664	0.9789	0.065	0.0005	0.0007	0.0009
0.03	0.088	0.9686	0.0852	0.0008	0.0015	0.0018
0.04	0.1074	0.9583	0.1029	0.0009	0.0024	0.0029
0.05	0.1254	0.9482	0.1189	0.0011	0.0035	0.0043
0.06	0.1423	0.9381	0.1335	0.0013	0.0048	0.0058
0.07	0.1583	0.9282	0.1469	0.0014	0.0062	0.0075
0.08	0.1736	0.9184	0.1595	0.0015	0.0077	0.0094
0.09	0.1884	0.9087	0.1712	0.0017	0.0094	0.0114
0.1	0.2027	0.899	0.1822	0.0018	0.0112	0.0135
0.12	0.23	0.8801	0.2024	0.0038	0.015	0.0181
0.14	0.2559	0.8616	0.2205	0.0042	0.0192	0.0232
0.16	0.2808	0.8434	0.2368	0.0046	0.0238	0.0288
0.18	0.3046	0.8257	0.2515	0.0049	0.0287	0.0347
0.2	0.3277	0.8083	0.2649	0.0052	0.0339	0.0409
0.23	0.3611	0.7829	0.2827	0.0082	0.0421	0.0508
0.26	0.3931	0.7583	0.2981	0.0087	0.0508	0.0614
0.3	0.4341	0.7267	0.3154	0.0123	0.0631	0.0762
0.35	0.483	0.689	0.3328	0.0162	0.0793	0.0958
0.4	0.5299	0.6533	0.3462	0.017	0.0962	0.1163
0.5	0.6185	0.5874	0.3633	0.0355	0.1317	0.1591
0.6	0.7018	0.5281	0.3706	0.0367	0.1684	0.2034
0.7	0.781	0.4748	0.3708	0.0371	0.2055	0.2482
0.8	0.8567	0.4268	0.3657	0.0368	0.2423	0.2927
0.9	0.9296	0.3837	0.3567	0.0361	0.2784	0.3363
1	1	0.345	0.345	0.0351	0.3135	0.3787
2	1.6168	0.119	0.1924	0.2687	0.5822	0.7034
3	2.1415	0.0411	0.0879	0.1402	0.7224	0.8727
4	2.6141	0.0142	0.037	0.0625	0.7849	0.9482
5	3.0514	0.0049	0.0149	0.026	0.8109	0.9796
6	3.4625	0.0017	0.0058	0.0104	0.8212	0.9921
7	3.8529	0.0006	0.0022	0.004	0.8253	0.997
8	4.2266	0.0002	0.0008	0.0015	0.8268	0.9989
9	4.5861	0.0001	0.0003	0.0006	0.8274	0.9996
10	4.9336	0	0.0001	0.0002	0.8276	0.9998
11	5.2706	0	0	0.0001	0.8277	0.9999
12	5.5982	0	0	0	0.8277	1
13	5.9176	0	0	0	0.8277	1

Table 3-1: Sites With Promise Method. Shaded regions show areas that look promising for different criteria.

Sites With Promise Method										
Site#	**Sitetype**	**Length (miles)**	**AADT**	**2001-2009 Collision Avg**	**(C) 2010 Collisions**	**Total Average Collisions per year**	**Rate per MVM (D)**	**ΔF/σF (B)**	**ΔR/σR (E)**	**Criterion Notes**
1	Freeway	2.4	19000	Not Open	43	43	2.58	0.27	4.75	E, Not very promising for B
2	Freeway	1.4	23000	Not Open	21	21	1.79	-0.52	0.8	Not very promising for E
3	Freeway	0.8	28000	14	9	13.5	1.65			
4	Freeway	1.6	17000	19	13	18.4	1.85			
5	Freeway	3.4	32000	72	61	70.9	1.79			
6	Freeway	2.6	45000	60	62	60.2	1.41			
7	Freeway	1	27000	13	24	14.1	1.43			C
8	Two-lane	1.8	5000	7	0	6.3	1.92			
9	Two-lane	0.9	7000	7	5	6.8	2.96			High rate for D
10	Two-lane	3.2	8000	12	10	11.8	1.26			
11	Two-lane	2.4	11000	10	14	10.4	1.08			
12	Two-lane	1.7	6000	8	19	9.1	2.44			C, High rate for D
Freeway										
	Freq. Mean	Freq. St. Dev	Rate Mean	Rate St. Dev.						
	35.42	27.83	1.63	0.2						