

Safety Comparison of New Jersey Jughandle Intersections (NJJI) and Conventional Intersections

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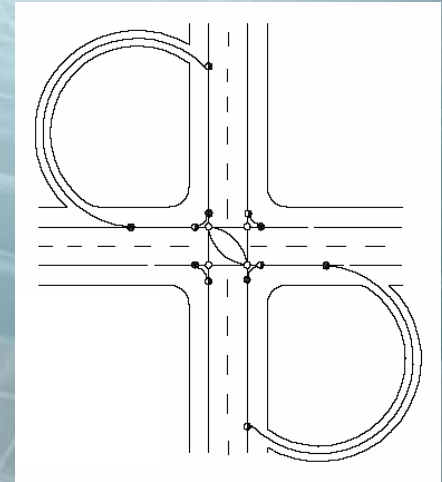
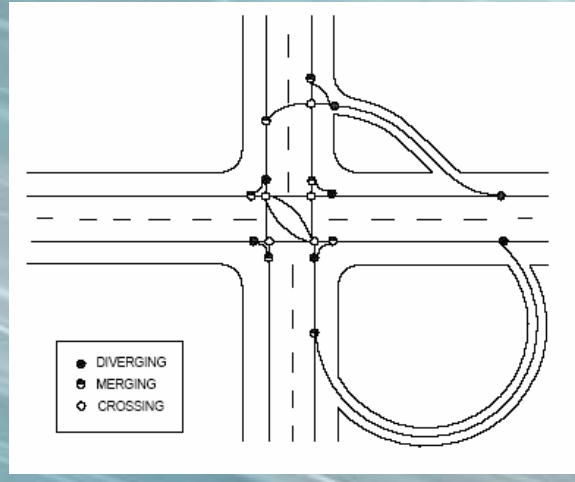
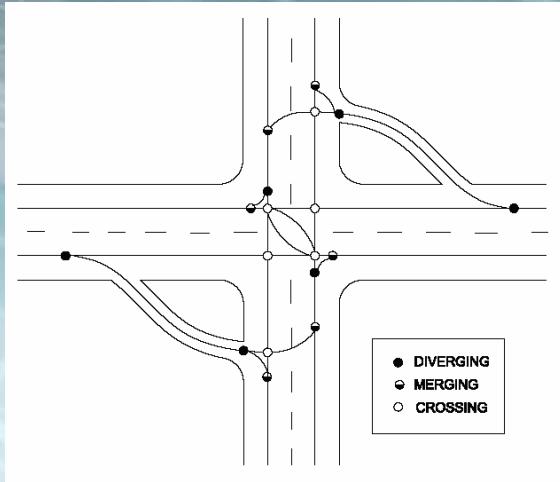
STUDY OBJECTIVE

To investigate the differences and similarities in the safety performance of NJJIs vs. Conventional intersections based on statistical analyses of intersection crash data

BACKGROUND

- NJJIs have been around for the past few decades
- NJJIs are expected to improve traffic operations by eliminating the left-turn phase on the major road
- NJJIs are expected to improve traffic safety by reducing the total number of potential conflict points and specific conflicting maneuvers at the intersection

CONFLICT POINTS

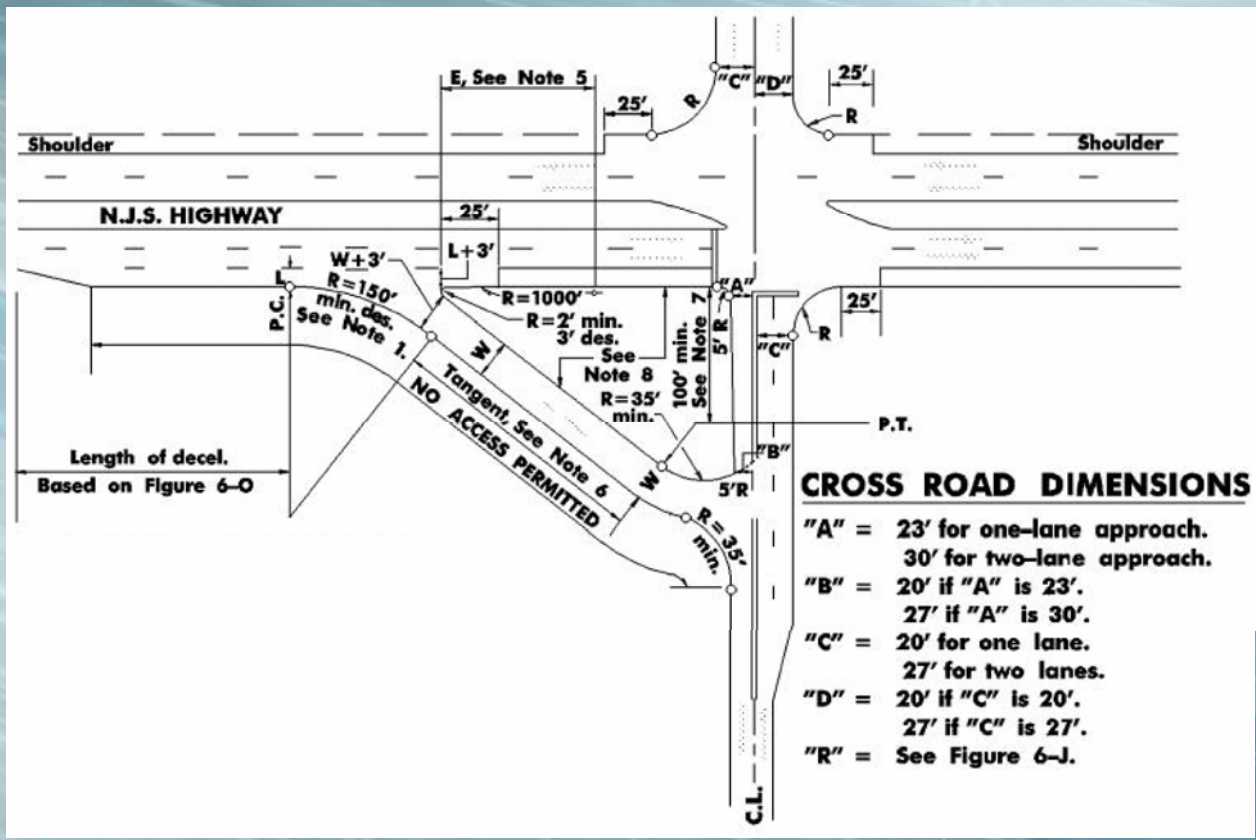


Conflict type	Four-Leg Signalized Intersection	Four-Leg Signalized Intersection with 2 Forward Jughandle Ramps	Four-Leg Signalized Intersection with 1 Forward and 1 Reverse Jughandle Ramp	Four-Leg Signalized Intersection with 2 Reverse Jughandle Ramps
Merging/diverging	16	16	16	16
Crossing (left turn)	12	6	5	4
Crossing (angle)	4	4	4	4
Total	32	26	25	24

BACKGROUND (cont'd.)

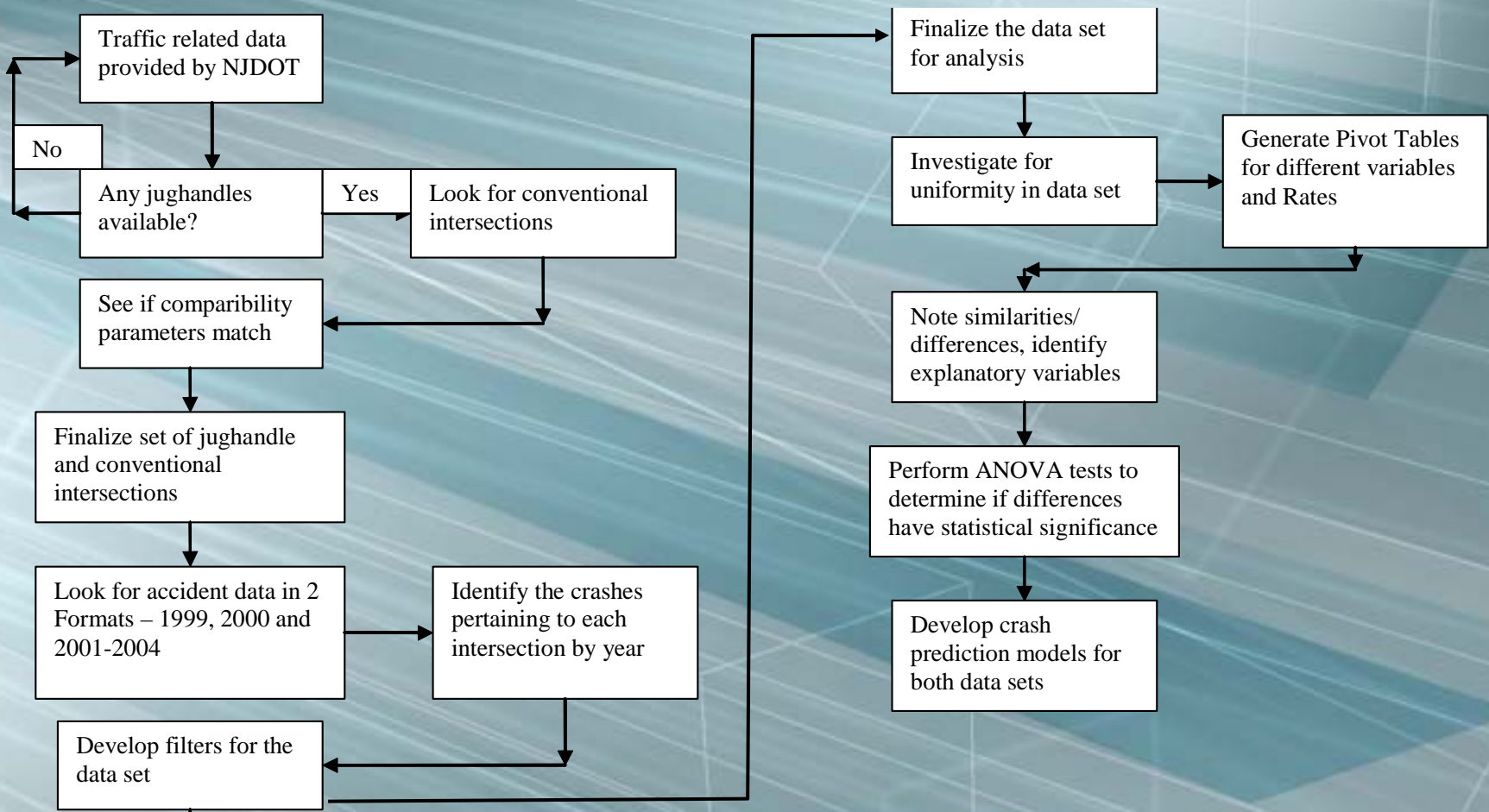
- FHWA Priority Area is Intersection Safety
- FHWA efforts to reduce fatalities, personal injuries and crashes at intersections
- FHWA Research Program on Non-Traditional Intersections and Intersection Treatments

TYPES OF NJJI RAMPS



“FORWARD” JUGHANDLE RAMP

ANALYSIS METHODOLOGY



PRIMARY "COMPARABILITY" PARAMETERS

- Similar Area Type – Rural / Urban
- Four-legged signalized intersections with no traffic signal control at the termini of the jughandle ramps on the minor road approaches
- Similar number of Lanes on major & minor road
- Similar AADTs for major & minor road
- Similar posted Speed Limit on major & minor road

SECONDARY "COMPARABILITY" PARAMETERS

- Similar Turn Movement Distributions
- Similar Median type and width
- Similar Proximity to nearby signalized intersections on both the major and minor roadways

SOURCES OF INFORMATION

- Straight Line Diagrams (SLDs)
- Crash Data on NJDOT website (1999-2004)
- Intersection traffic counts from NJDOT
- Aerial maps from NJGIN

CRASH DATA SET

- Animal Crashes (approx 1%) EXCLUDED
- Intersection Footprint of NJJIs (0.11 mile)
- Period of study – 5.5 years (1999-mid 2004)
- Total number of accidents - 11,326
- Total number of vehicles involved - 22,546
- Total number of people involved - 30,463
- 44 NJJIs and 50 Conventional Intersections

VARIABLES CHECKED FOR UNIFORMITY/DIFFERENCES

- Accident Severity by Year
- Road System
- Traffic Controls
- Road Character
- Surface Condition
- Weather
- DUI %
- Truck Involvement
- Road Division
- Road Under Construction
- Safety Equipment Used
- Driver License State (% of familiar drivers)
- Light Condition
- Apparent Contributing Circumstances
- Sequence of Events
- Age Distribution of Drivers
- Time of Day
- Day of Week

RESULTS

Severity (Column)	Collision Code (Row)	Same Dir. Rear End	Same Dir. Sideswipe	Angle	Head-On	Left Turn	Other	Total
Conventional Intersections								
Fatality	Count	3		1		3	8	15
	Column %	0.1%		0.1%		0.5%	1.2%	03%
	Row %	20.0%		6.7%		20.0%	53.3%	100.0%
	Per MEV/year	1.62		0.54		1.62	4.33	8.11
	Per MVT/year	1.84	0.00	0.61	0.00	1.84	4.92	9.22
Injury	Count	762	49	415	47	288	207	1768
	Column %	33.9%	8.3%	39.5%	42.3%	46.4%	32.0%	33.6%
	Row %	43.1%	2.8%	23.5%	2.7%	16.3%	11.7%	100.0%
	Per MEV/year	412.01	26.49	224.39	25.41	155.72	111.93	955.96
	Per MVT/year	468.20	30.11	254.99	28.88	176.96	127.19	1086.32
Property Damage Only	Count	1483	544	635	64	330	431	3487
	Column %	66.0%	91.7%	60.4%	57.7%	53.1%	66.7%	66.2%
	Row %	42.5%	15.6%	18.2%	1.8%	9.5%	12.4%	100.0%
	Per MEV/year	801.86	294.14	343.35	34.60	178.43	233.04	1885.43
	Per MVT/year	911.21	334.25	390.17	39.32	202.76	264.82	2142.53
Total	Count	2248	593	1051	111	621	646	5270
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	Row %	42.7%	11.3%	19.9%	2.1%	11.8%	12.3%	100.0%
	Per MEV/year	1215.50	320.64	568.28	60.02	335.78	349.29	2849.50
	Per MVT/year	1381.25	364.36	645.77	68.20	381.56	396.92	3238.07

RESULTS (cont'd.)

Severity (Column)	Collision Code (Row)	Same Dir. Rear End	Same Dir. Sideswipe	Angle	Head-On	Left Turn	Other	Total
Jughandle Intersections								
Fatality	Count	1					7	8
	Column %	0.03%					1.1%	0.1%
	Row %	12.5%					87.5%	100.0%
	Per MEV/year	0.39					2.75	3.14
	Per MVT/year	0.45					3.13	3.57
Injury	Count	1169	74	305	26	70	174	1818
	Column %	34.1%	10.8%	30.0%	36.6%	31.4%	27.5%	30.0%
	Row %	64.3%	4.1%	16.8%	1.4%	3.9%	9.6%	100.0%
	Per MEV/year	459.29	29.07	119.83	10.22	27.50	68.36	714.28
	Per MVT/year	521.92	33.04	136.17	11.61	31.25	77.69	811.68
Property Damage Only	Count	2257	613	711	45	153	451	4230
	Column %	65.9%	89.2%	70.0%	63.4%	68.6%	71.4%	69.9%
	Row %	53.4%	14.5%	16.8%	1.1%	3.6%	10.7%	100.0%
	Per MEV/year	886.76	240.84	279.35	17.68	60.11	177.19	1661.94
	Per MVT/year	1007.68	273.69	317.44	20.09	68.31	201.36	1888.57
Total	Count	3427	687	1016	71	223	632	6056
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	Row %	56.6%	11.3%	16.8%	1.2%	3.7%	10.4%	100.0%
	Per MEV/year	1346.44	269.92	399.18	27.90	87.62	248.31	2379.36
	Per MVT/year	1530.05	306.72	453.61	31.70	99.56	282.17	2703.82

RESULTS (cont'd.)

Parameter	Jughandle Intersections	Conventional Intersections	Difference	2-tailed Significance
Rear End Collisions Percentage	56.6%	42.7%	+ 13.9%	<0.000
Rear End Collisions per Million Entering Vehicles	1346	1215	+ 131	0.688
Rear End Collisions per Million Vehicle Miles	1530	1381	+ 149	0.886
Head-On Collisions Percentage	1.2%	2.1%	- 0.9%	0.013
Head On Collisions per Million Entering Vehicles	28	60	- 32	0.010
Head On Collisions per Million Vehicle Miles	32	68	- 36	0.008
Left Turn Collisions Percentage	3.7%	11.8%	- 8.1%	<0.000
Left Turn Collisions per Million Entering Vehicles	88	336	- 248	<0.000
Left Turn Collisions per Million Vehicle Miles	100	382	- 282	<0.000
Fatalities & Injuries Percentage	30.2%	33.8%	- 3.7%	0.141
Fatalities & Injuries per Million Entering Vehicles	717	964	- 247	0.085
Fatalities & Injuries per Million Vehicle Miles	815	1096	- 281	0.018
Property Damage Only Percentage	69.9%	66.2%	+ 4.8%	0.141
Property Damage Only per Million Entering Vehicles	1662	1885	- 223	0.166
Property Damage Only per Million Vehicle Miles	1889	2143	- 254	0.059

RESULTS (cont'd.)

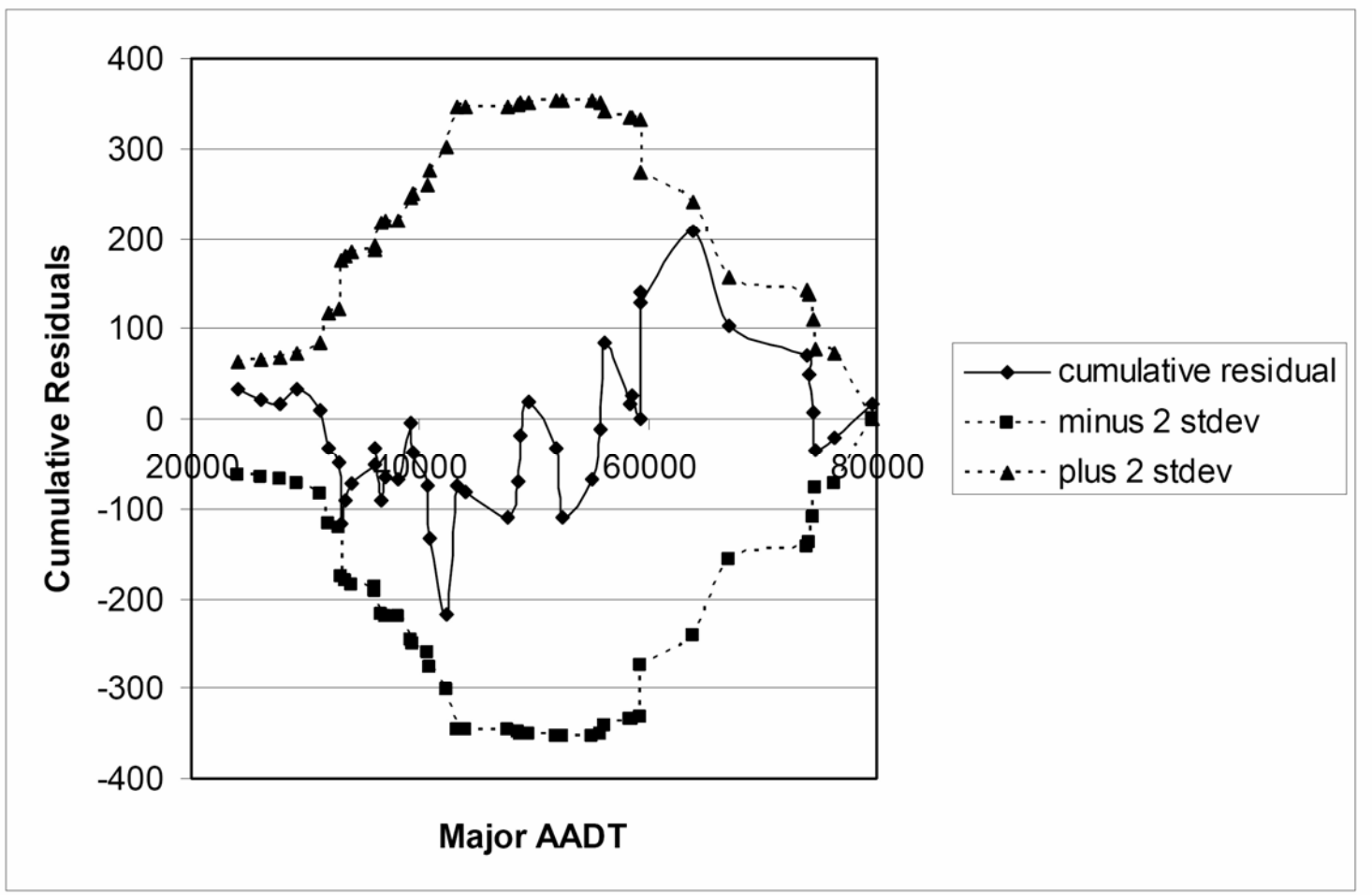
- NJJIs have lower PDO, fatal+injury and head-on accident rates (relative to exposure) than conventional intersections
- NJJIs have a higher proportions of rear-end and PDO accidents and a lower proportion of left turn accidents than conventional intersections
- Forward jughandles have the highest rate of accidents per million vehicle miles traveled overall, close to 1.3-1.4 times as many as the other two jughandle intersection types
- Reverse jughandles have the lowest rate of angle and left turn crashes per million vehicle miles traveled because the ramps lessen the opportunities for crossing conflicts

DEVELOPMENT OF NEGATIVE BINOMIAL CRASH MODELS

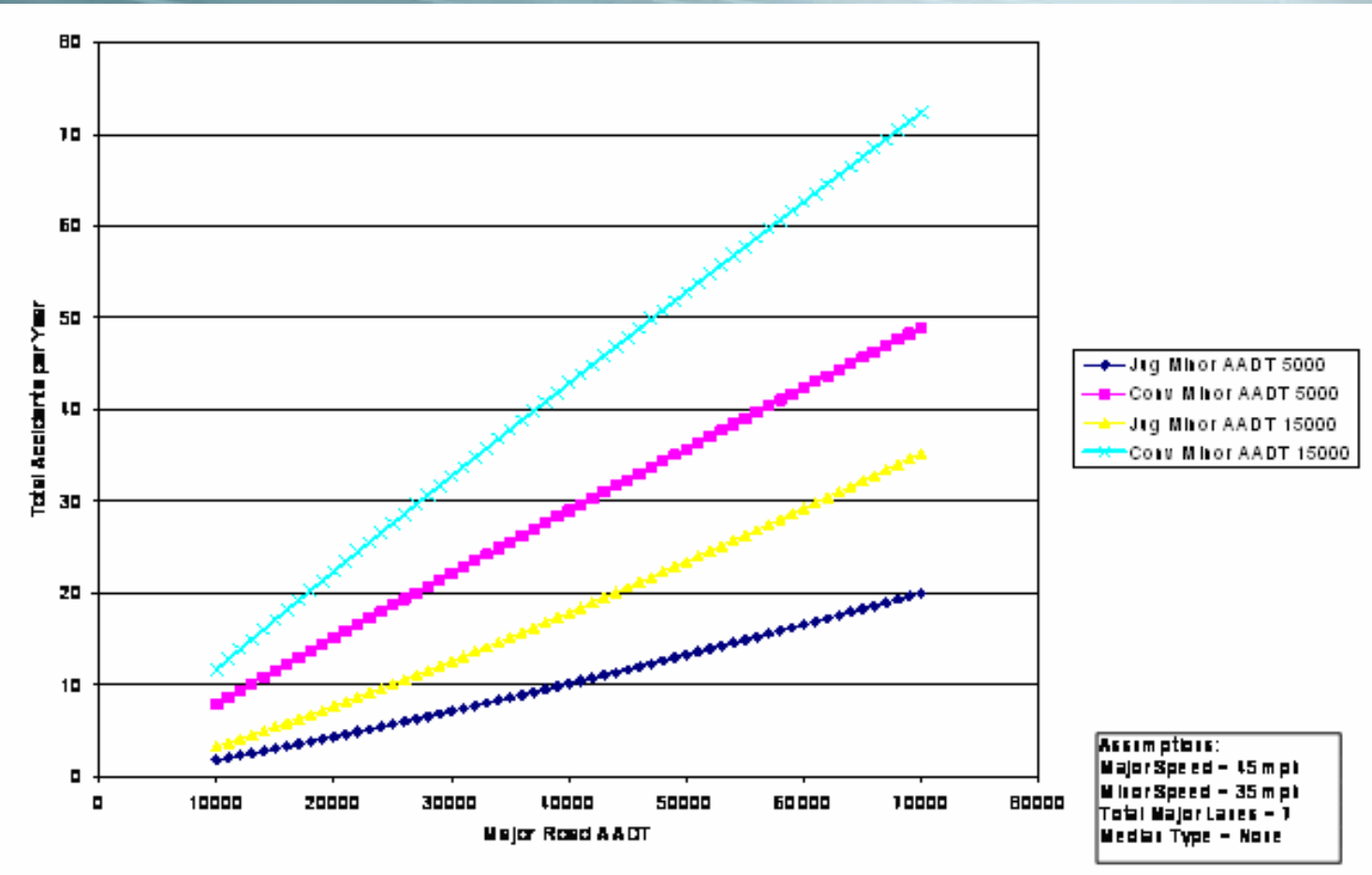
Variables	Cases									
	Jughandle Total Accidents	Conventional Total Accidents	Jughandle Fatal and Injury Accidents	Conventional Fatal and Injury Accidents	Jughandle Rear End Accidents	Conventional Rear End Accidents	Jughandle Left Turn and Angle Accidents	Conventional Angle Accidents	Jughandle Sideswipe Accidents	Conventional Sideswipe Accidents
Intercept	-20.6466 (-4.3899)	-13.7703 (-2.8479)	-10.5293 (-2.8646)	-15.8975 (-2.9576)	-24.1424 (-4.6215)	-13.9115 (-2.2211)	-10.3393 (-3.2349)	-7.9629 (-2.8532)	-16.6179 (-3.4799)	-6.7149 (-2.9927)
Major AADT	1.2148 (0.2828)	0.9361 (0.1939)	0.8234 (-0.2354)	0.9998 (0.2000)	1.2386 (0.2998)	1.0325 (0.1702)	0.7378 (0.2894)	0.3103 (0.2275)	1.2231 (0.2816)	0.9169 (0.2031)
Minor AADT	0.5168 (0.1073)	0.3561 (0.0712)	0.4078 (0.1109)	0.3493 (0.0760)	0.6316 (0.1112)	0.2746 (0.0782)	0.8181 (0.1388)	0.2520 (0.0990)	0.4945 (0.1309)	0.3708 (0.1066)
Major Speed	2.2461 (1.0538)				2.8913 (1.1041)					-2.6425 (0.7389)
Minor Speed						0.8385 (0.3044)		1.0804 (0.4093)		1.3250 (0.4665)
Major & Minor Speed		0.5684 (0.2068)		0.6369 (0.2166)						
Total Major Lanes	-1.4708 (0.6771)									
Total Lanes					-1.5261 (0.7022)		-1.4126 (0.7081)			
Median Type*		-0.4957 (0.1756)		-0.6114 (0.1825)						
Dispersion	0.1718 (0.0382)	0.2075 (0.0427)	0.1993 (0.0481)	0.2075 (0.0475)	0.1976 (0.0426)	0.2195 (0.0503)	0.2623 (0.0685)	0.3961 (0.0858)	0.2357 (0.0661)	0.2573 (0.0715)
Pseudo R ²	0.56	0.47	0.35	0.49	0.57	0.54	0.51	0.28	0.44	0.58
Calculated R ²	0.60	0.58	0.24	0.45	0.52	0.55	0.32	0.27	0.27	0.56
Log Likelihood/DF	635.6311	448.4788	126.3926	108.6552	283.5037	145.9082	78.1759	48.4454	31.6572	22.9496
Scaled Chi-Sq/DF	1.0354	1.0651	1.0283	1.2575	1.1121	0.9536	1.1798	1.2165	1.0898	1.2176
Scaled Deviance/DF	1.1735	1.1487	1.1207	1.1447	1.0959	1.1618	1.2590	1.0884	1.1059	1.1170

Type Variable : Present -1, None - 0
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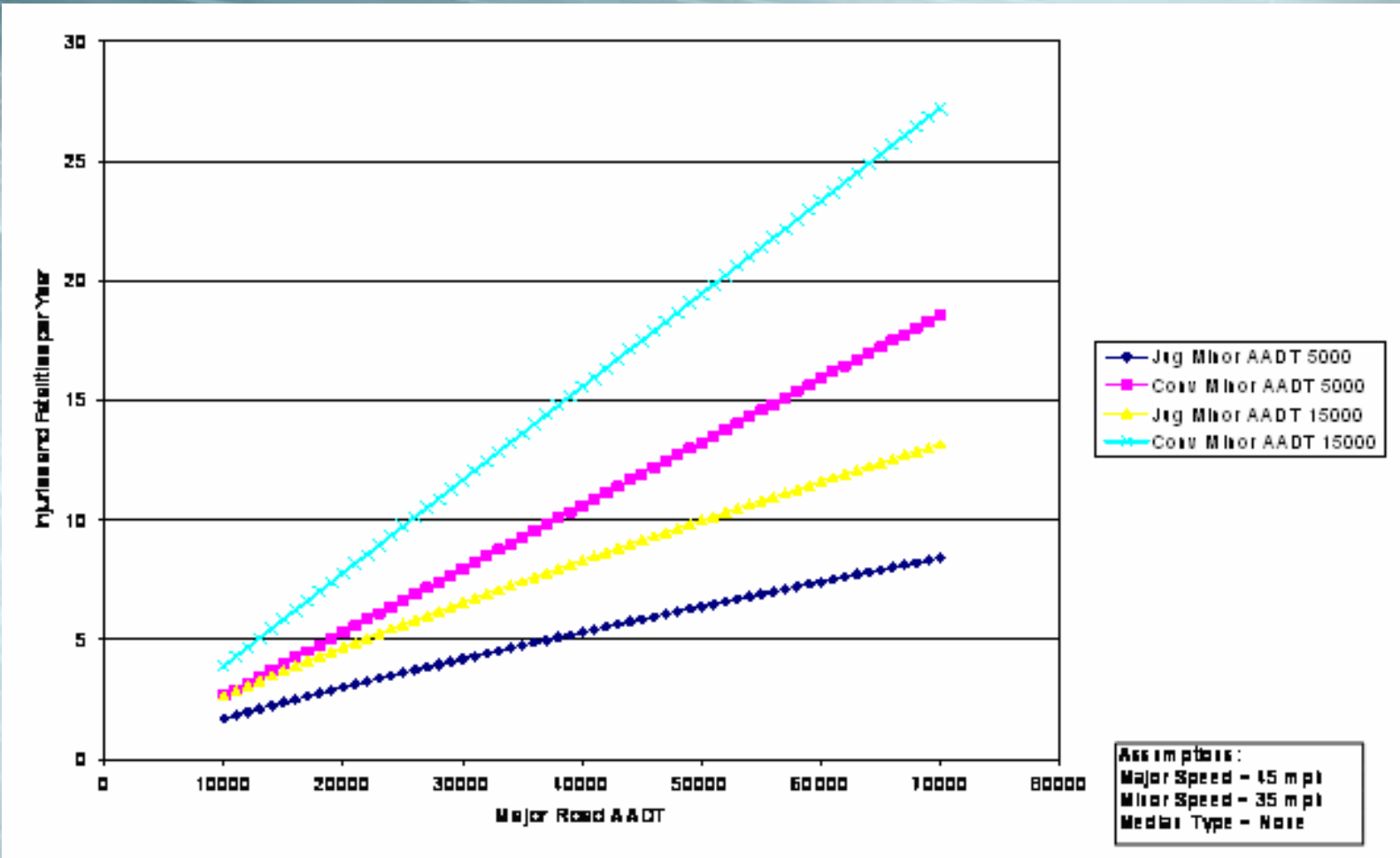
CURE PLOTS



COMPARISON PLOTS



COMPARISON PLOTS



QUESTIONS ?

COMMENTS !