Implications of Crash Data for Assessing Glare

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Acknowledgments

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Agenda

- Methods for isolating the effects of natural light in crash data
- Variables related to glare
- Conclusions

How is crash risk affected by natural light?

- Differences between night and day:
  - Ambient light
  - Alcohol
  - Fatigue
  - etc.
- Isolating light via seasonal and DST changes (assume exposure is linked to clock, not sun)

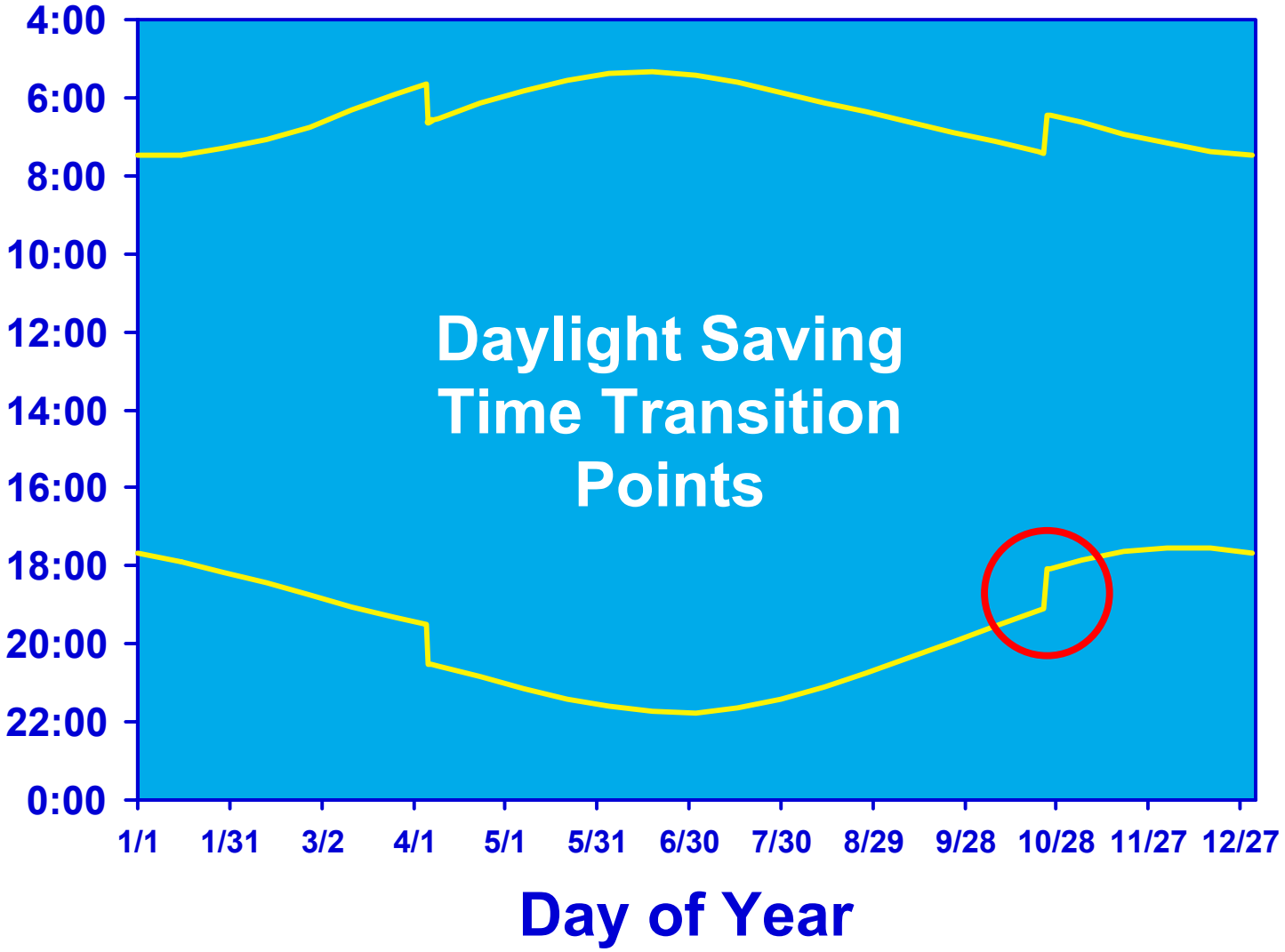
Some Background Reports:

- UMTRI-93-33
- UMTRI-95-44
- UMTRI-99-21
- UMTRI-2001-33

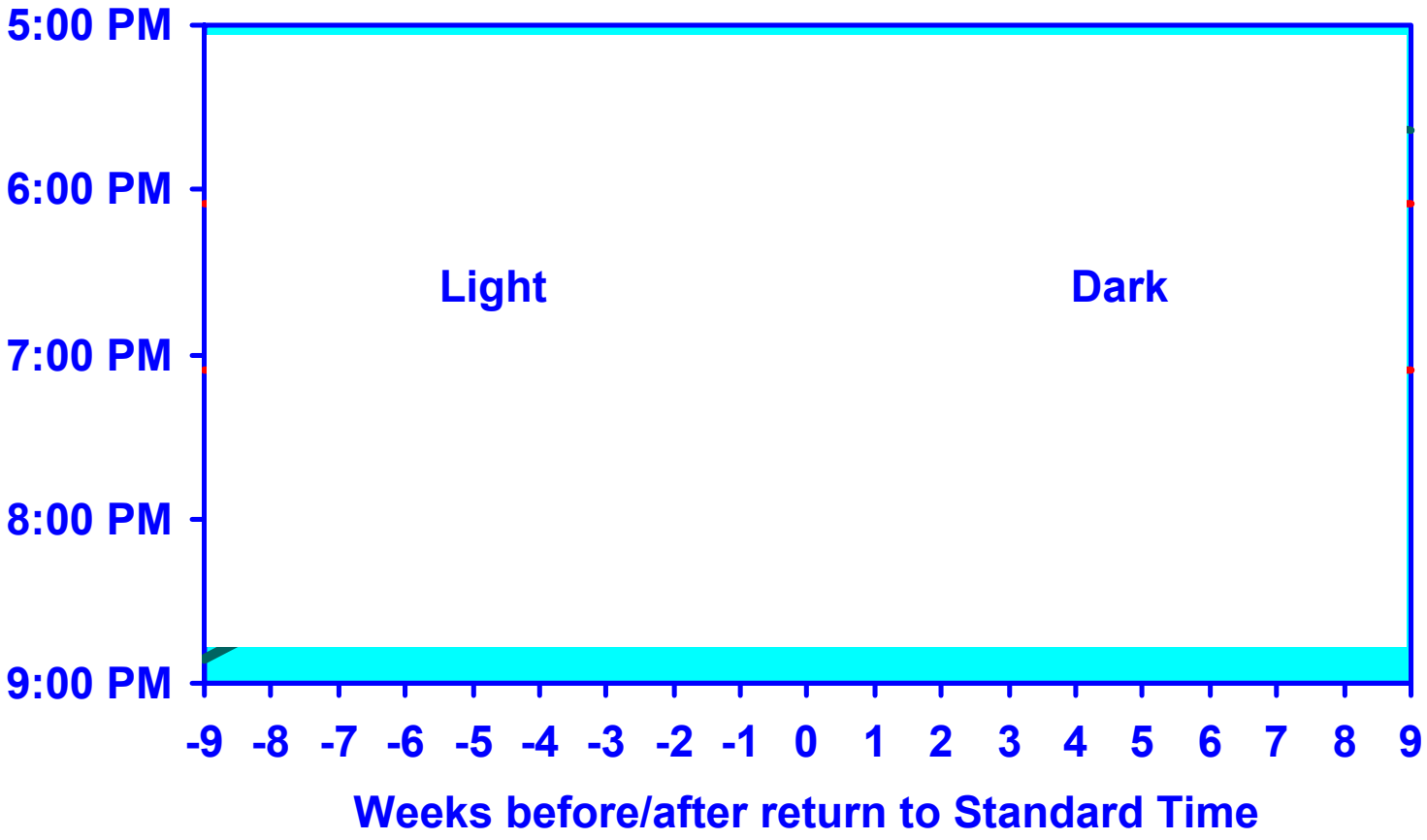
Crash ratios night/day (Burgett et al., 1989) versus dark/light (UMTRI-2001-33) for various single-vehicle crashes (FARS)

Accident Type	Night/Day	Dark/Light
Pedestrian	6.72	4.14
Run off road	6.75	n.s.
Overturn	4.83	0.73

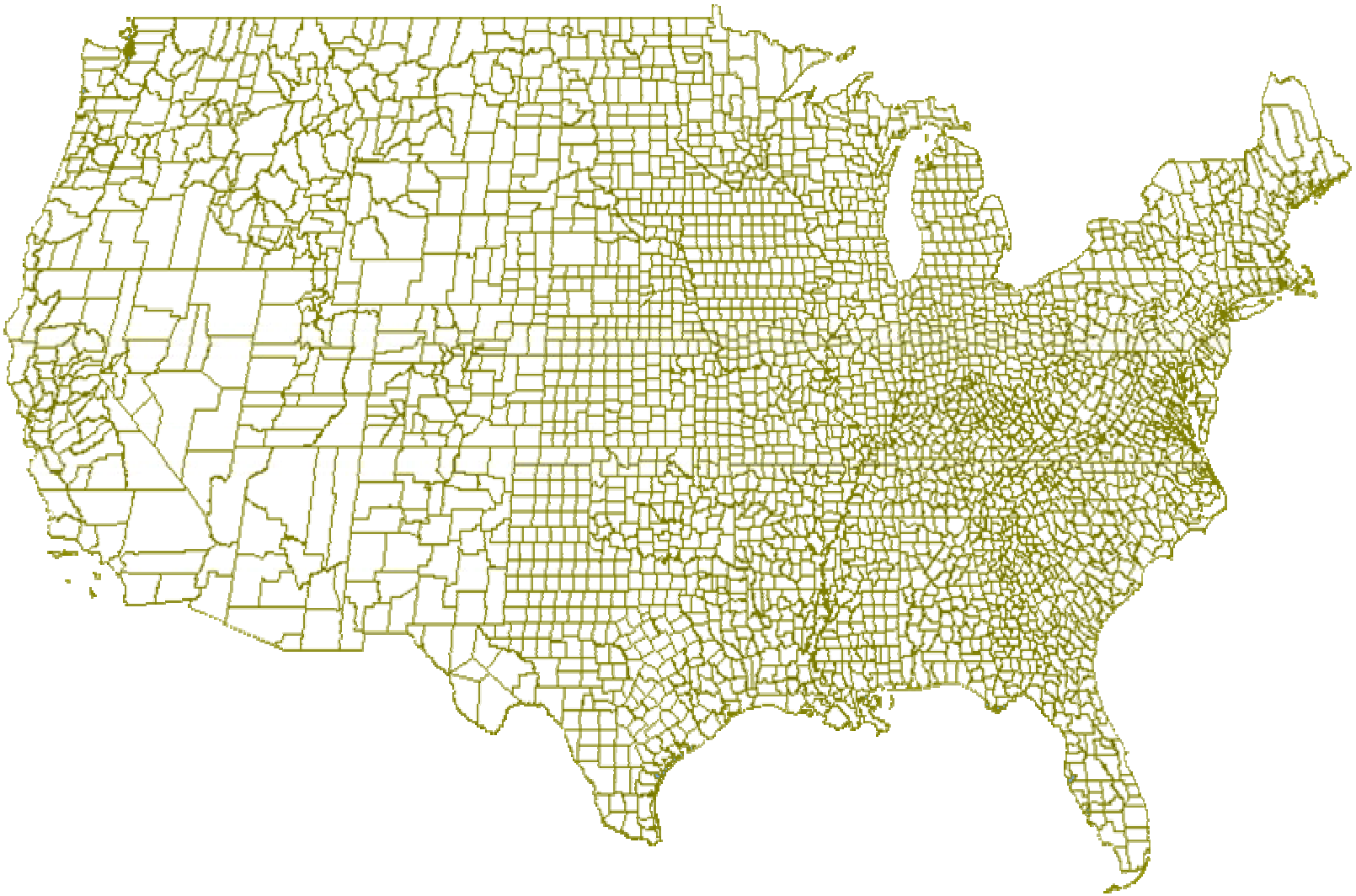
Annual Solar Cycle & DST



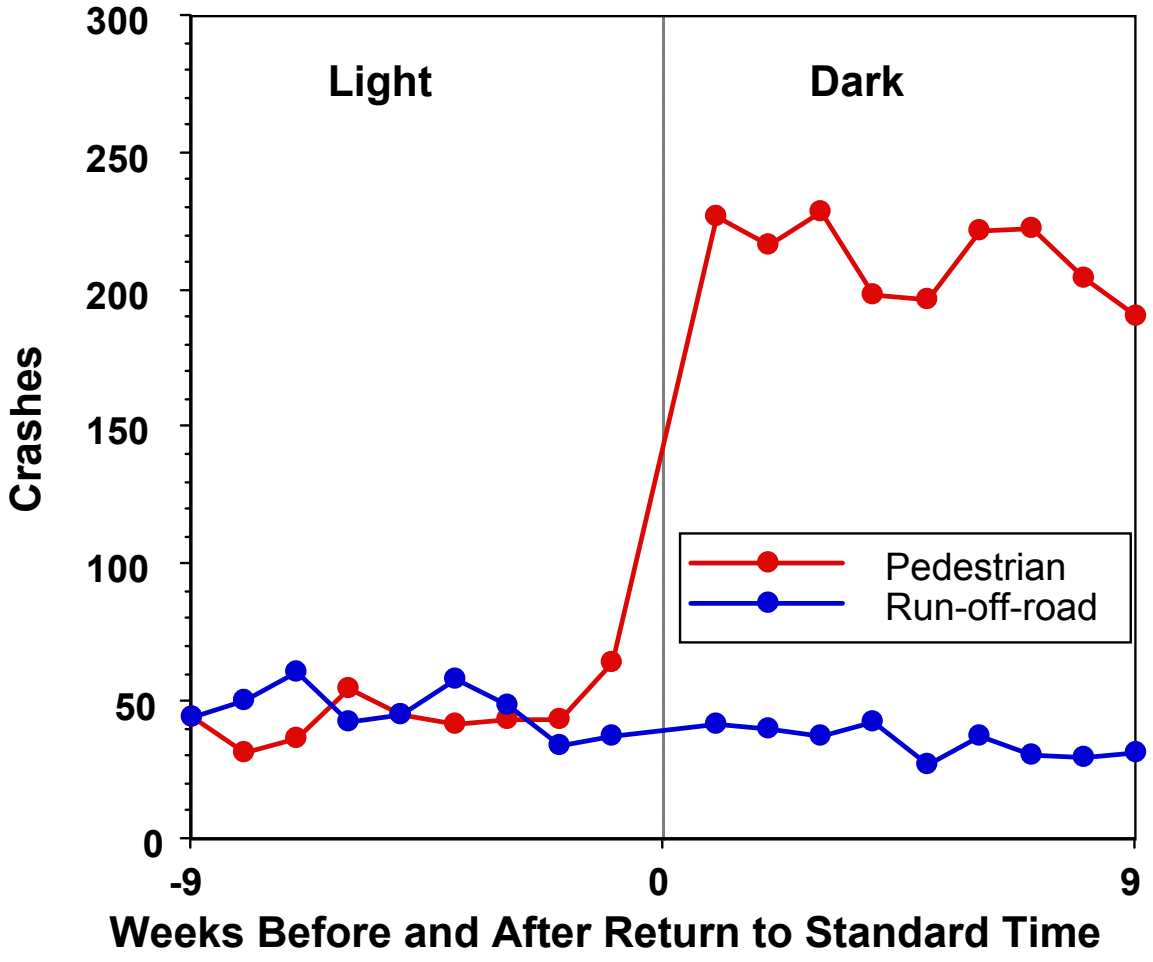
Civil Twilight (Fall PM)



United States Counties



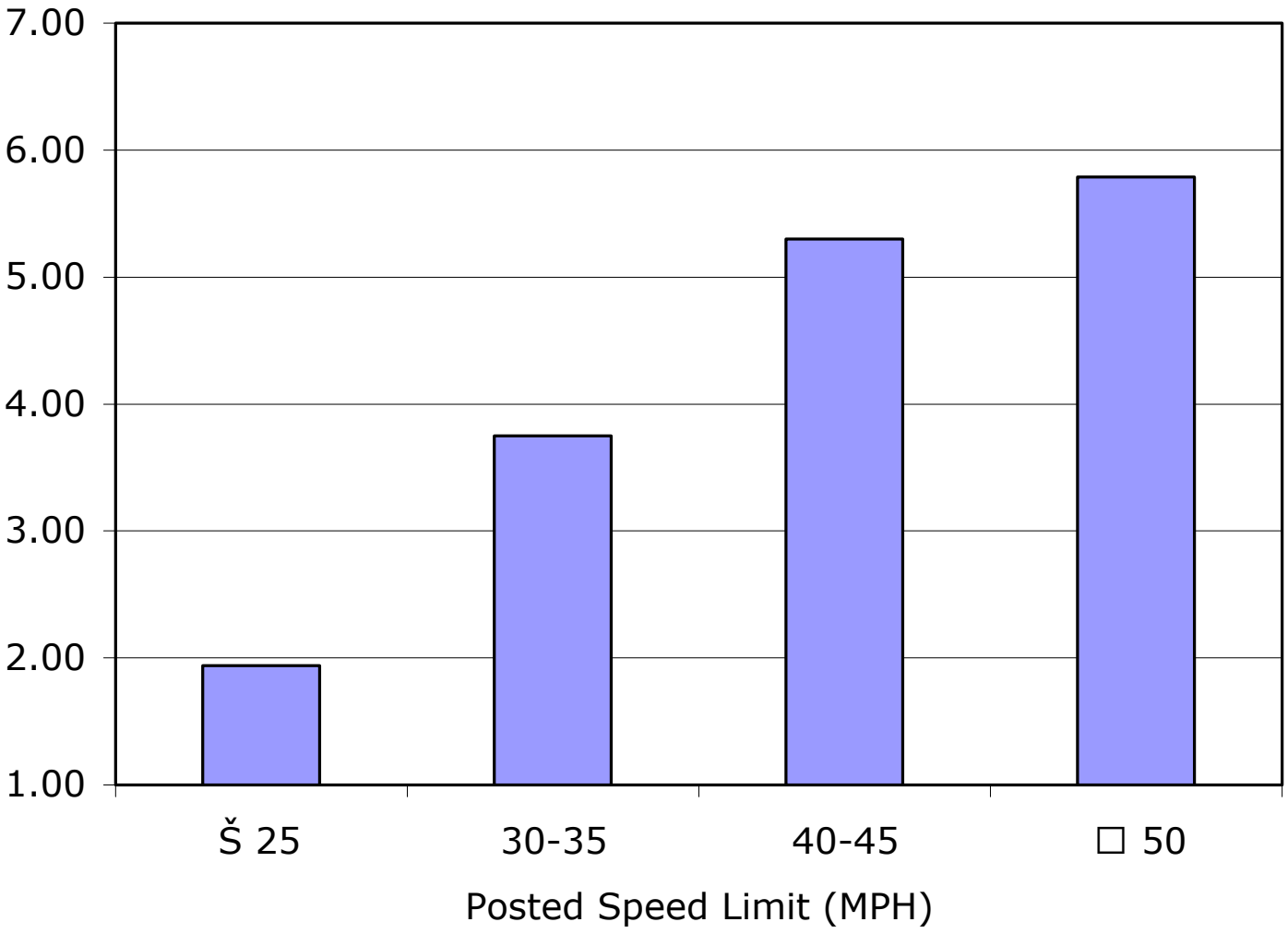
Crash counts around the fall, PM return to standard time



Event	Dark	Light	Total	Dark/Light Ratio	% Crashes in Darkness
Motor Vehicle in Transport	1454	1091	2545	**1.33**	57.1%
Pedestrian	1147	277	1424	**4.14**	80.5%
Overturn	174	239	413	0.73	42.1%
Tree	168	170	338	0.99	49.7%
Pedalcycle	77	86	163	0.90	47.2%
Utility Pole	45	58	103	0.78	43.7%
Ditch	43	51	94	0.84	45.7%
Guardrail	46	44	90	1.05	51.1%
Motor Vehicle in Transport in Other Roadway	36	40	76	0.90	47.4%
Culvert	27	37	64	0.73	42.2%
Curb	25	34	59	0.74	42.4%
Embankment - Material Type Unknown	26	32	58	0.81	44.8%
Parked Motor Vehicle	38	18	56	**2.11**	67.9%
Other Fixed Object	30	25	55	1.20	54.5%
Railway Train	35	18	53	**1.94**	66.0%
Embankment – Earth	23	22	45	1.05	51.1%
Highway/Traffic Sign Post	19	22	41	0.86	46.3%
Fence	20	20	40	1.00	50.0%
Fell from Vehicle	14	20	34	0.70	41.2%
Other Post, Other Pole, or Other Support	13	18	31	0.72	41.9%
Concrete Traffic Barrier	16	14	30	1.14	53.3%
Animal	23	5	28	**4.60**	82.1%
Bridge Pier or Abutment	11	11	22	1.00	50.0%
Bridge Rail	9	11	20	0.82	45.0%
Wall	7	11	18	0.64	38.9%
Other Non-Collision	5	12	17	0.42	29.4%
Other Type Non-Motorist	8	7	15	1.14	53.3%
Embankment - Rock, Stone, or Concrete	6	7	13	0.86	46.2%
Other Object(not fixed)	5	6	11	0.83	45.5%
Boulder	5	4	9	1.25	55.6%
Building	3	4	7	0.75	42.9%
Bridge Parapet End	2	4	6	0.50	33.3%
Fire Hydrant	1	3	4	0.33	25.0%
Immersion	2	2	4	1.00	50.0%
Pavement Surface Irregularity (1993 only)	1	3	4	0.33	25.0%
Luminary/Light Support		3	3	-	-
Other Longitudinal Barrier Type		3	3	-	-
Shrubbery	1	2	3	-	-
Impact Attenuator/Crash Cushion	1	1	2	-	-
Thrown or Falling Object	2		2	-	-
Transport Device Used as Equipment (Since 1993)	2		2	-	-
Unknown		2	2	-	-
Injured in Vehicle		1	1	-	-
Grand Total	1454	1091	6008	1.46	59.4%

Dark/light ratios in DST data from UMTRI-2001-33

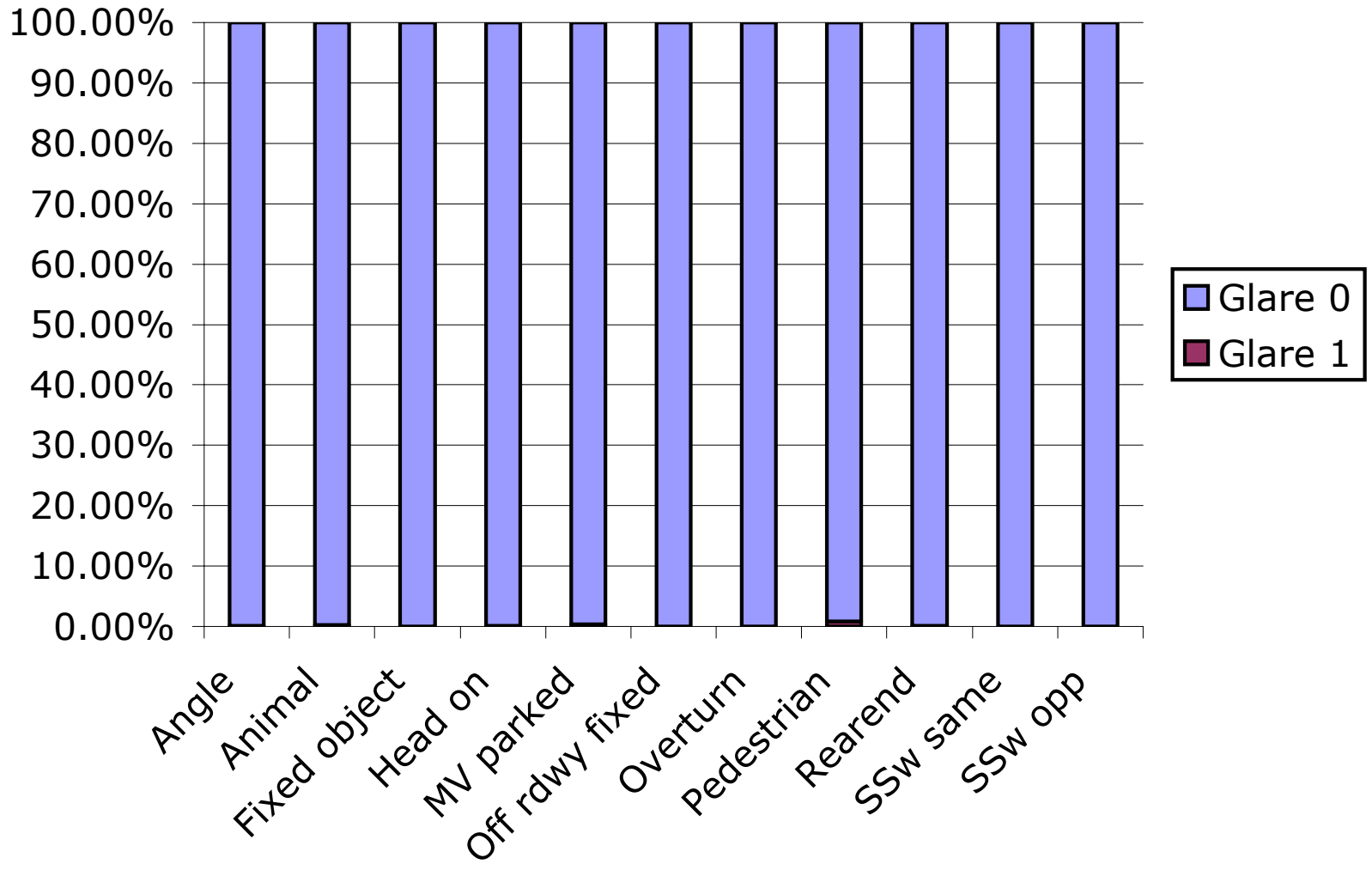
The Effect of Darkness on Pedestrian Fatal Crashes by Posted Speed Limit



Analyses of FARS data for glare

- Related factors, driver level, in the vehicle file (DR_CF1 etc.): Vision obscured by, (62) Reflected glare, bright sunlight, headlights
- Possible problems with coding: underuse, overuse, misuse
  - Probably doesn't tell us everything
  - But maybe more than nothing

Coding of "glare" for night, fatals by crash category (1987-2001)



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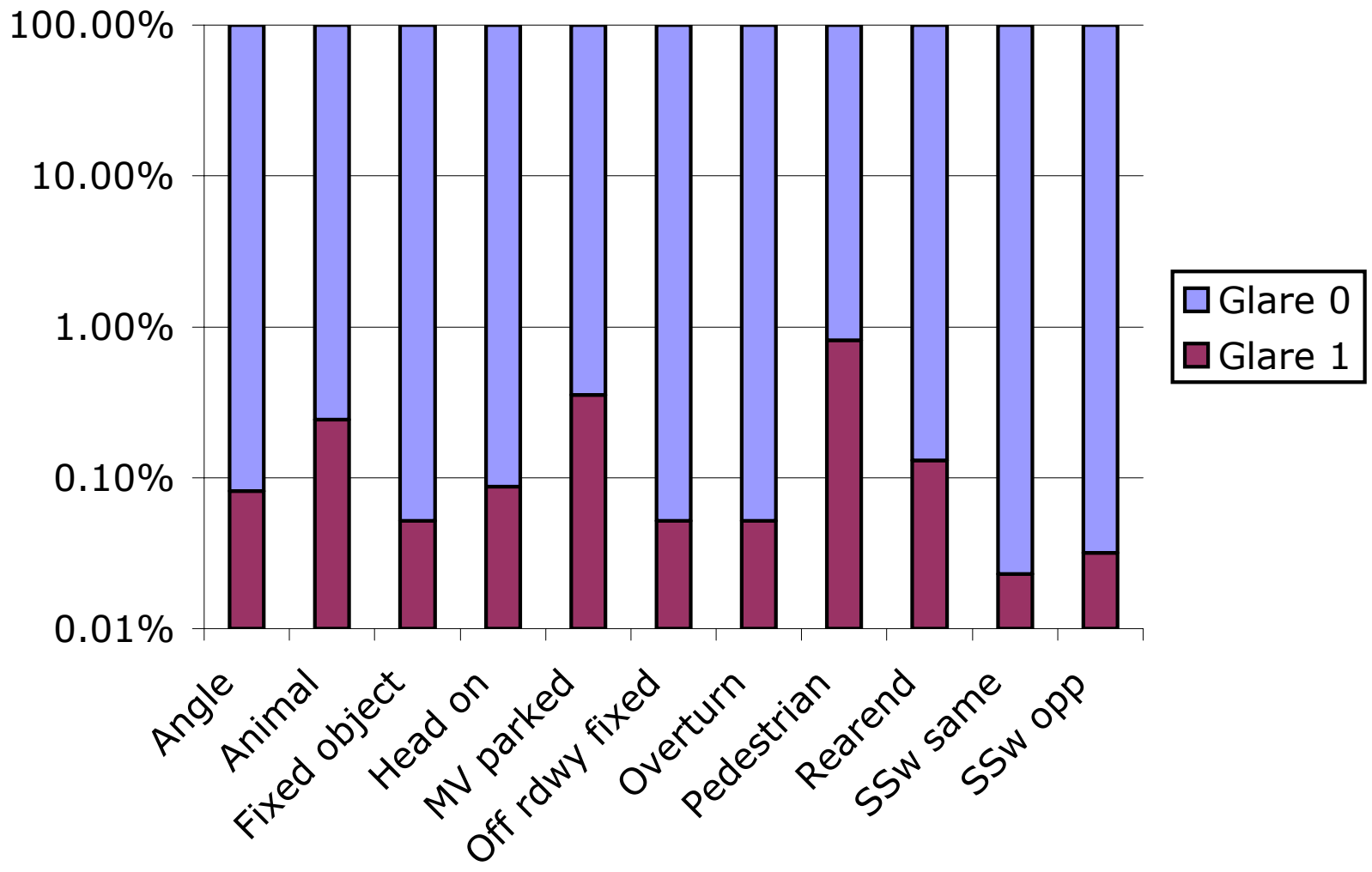
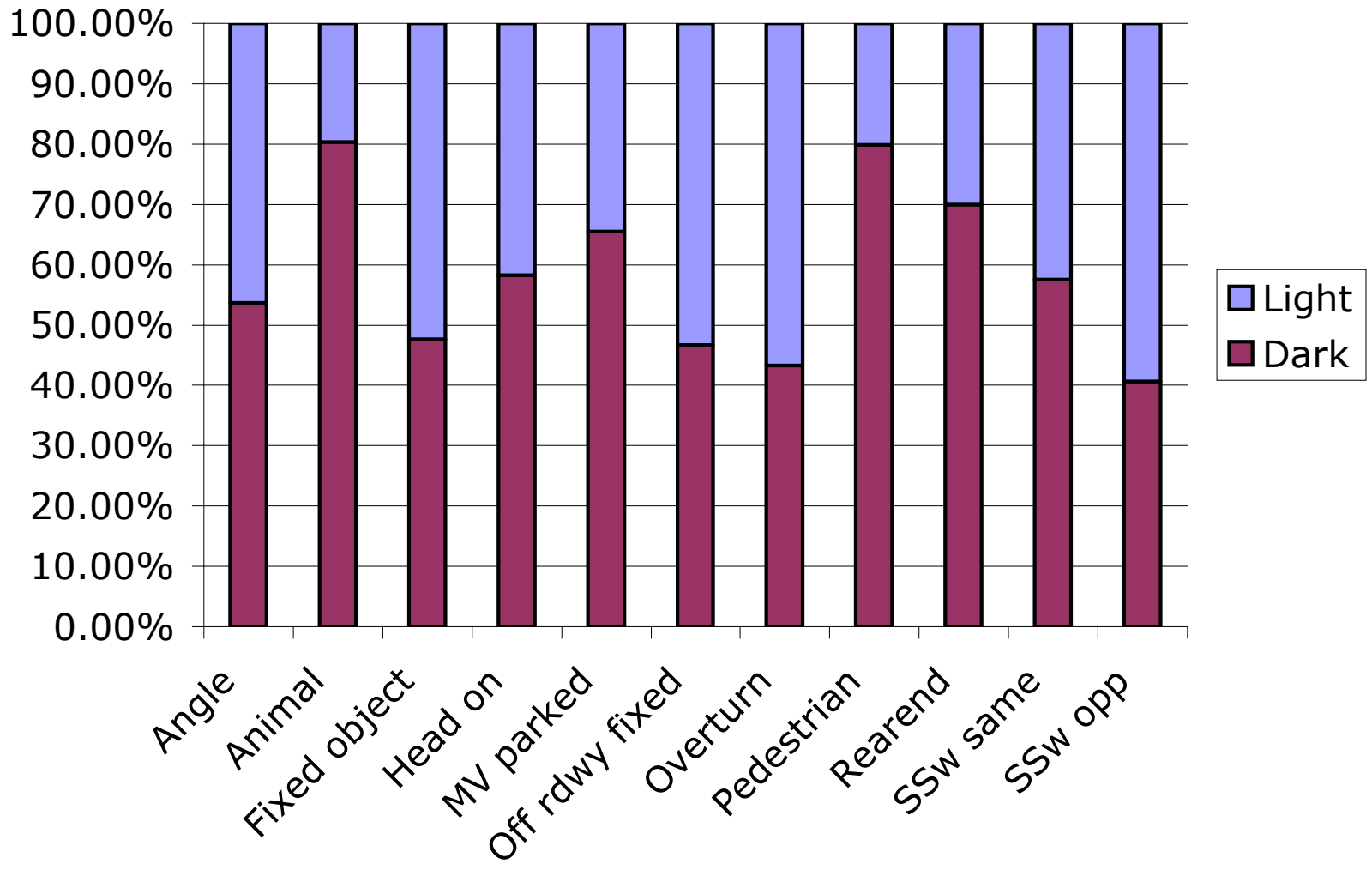
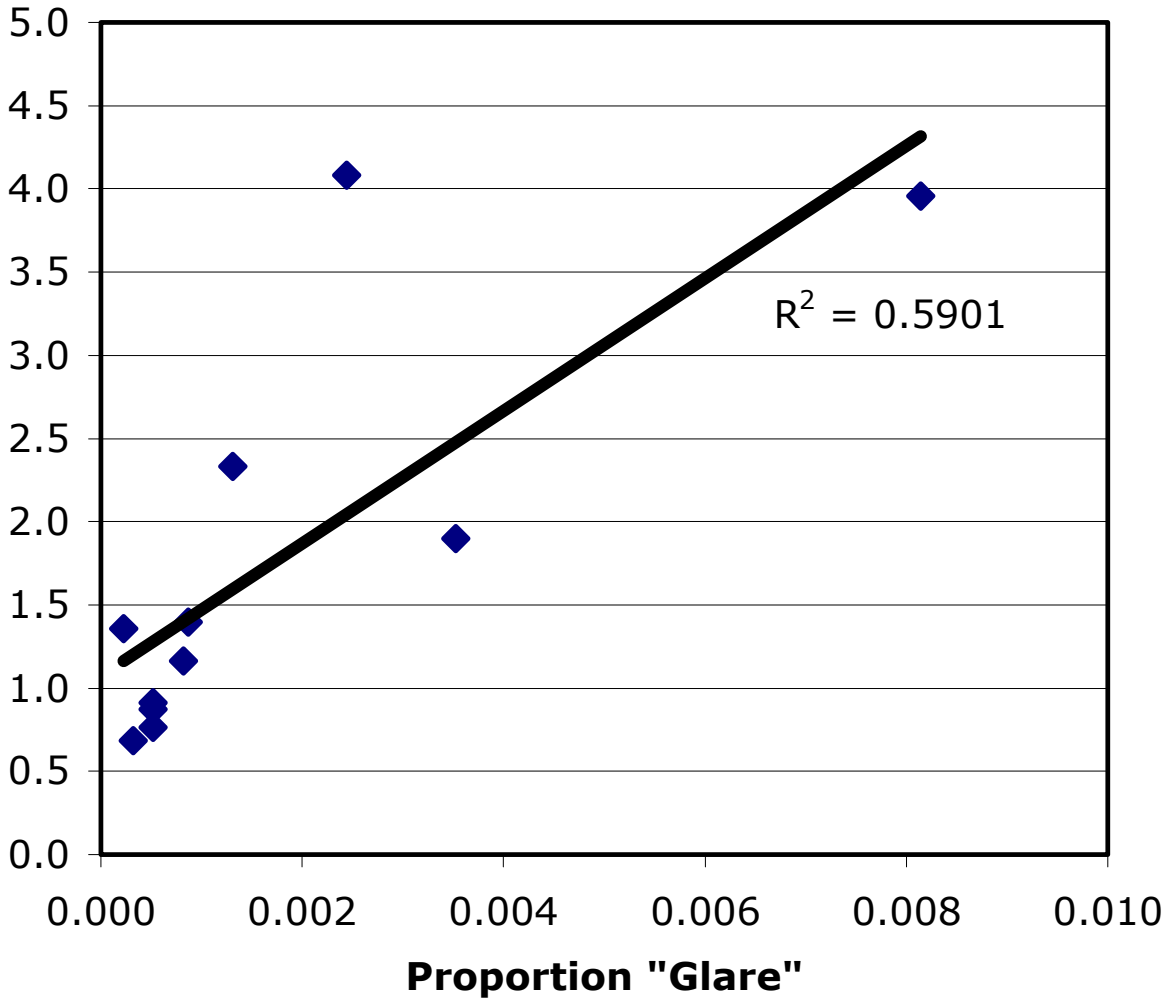


Dark/light for DST by crash category



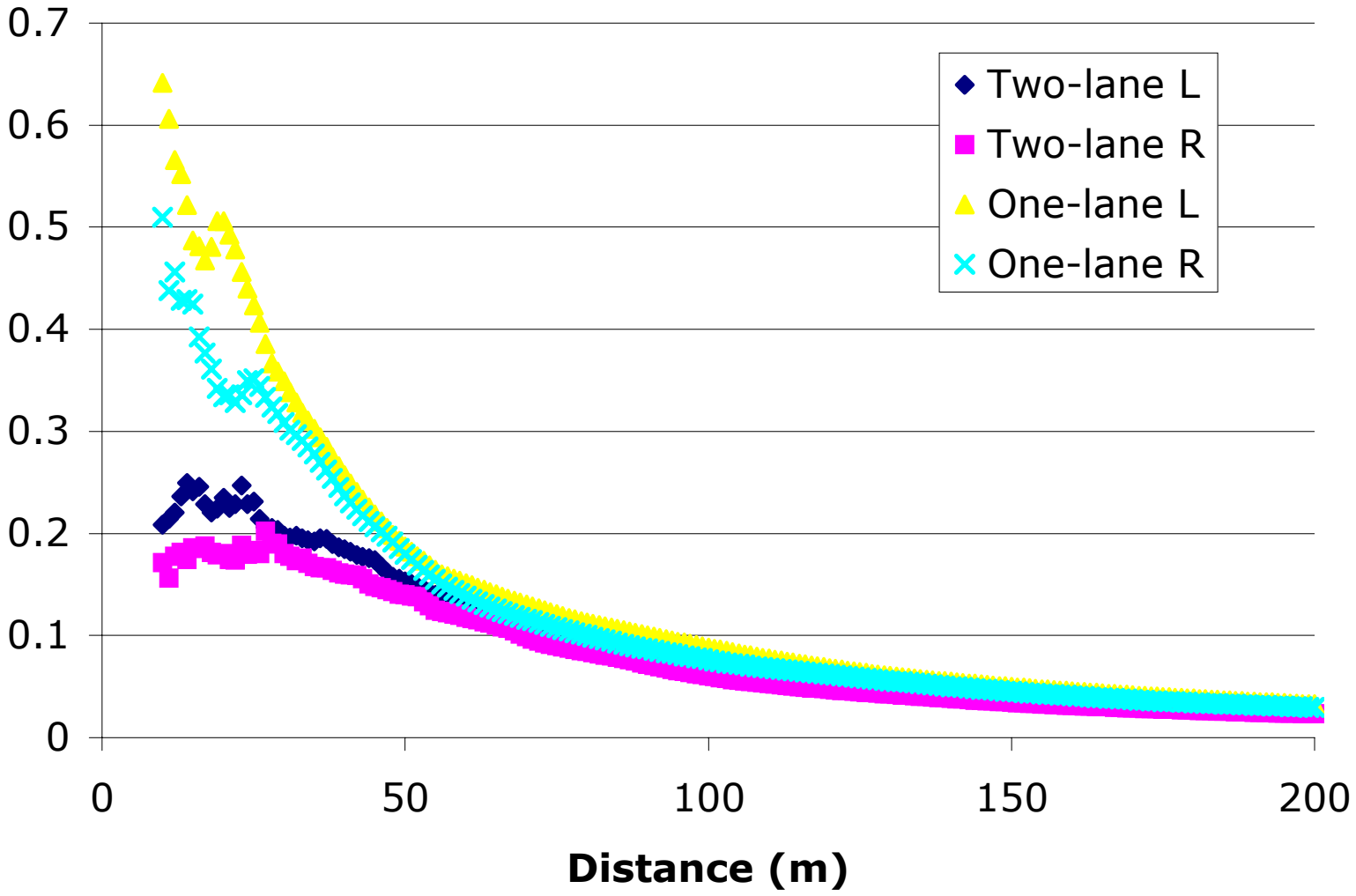
Dark/light and “glare” by crash type



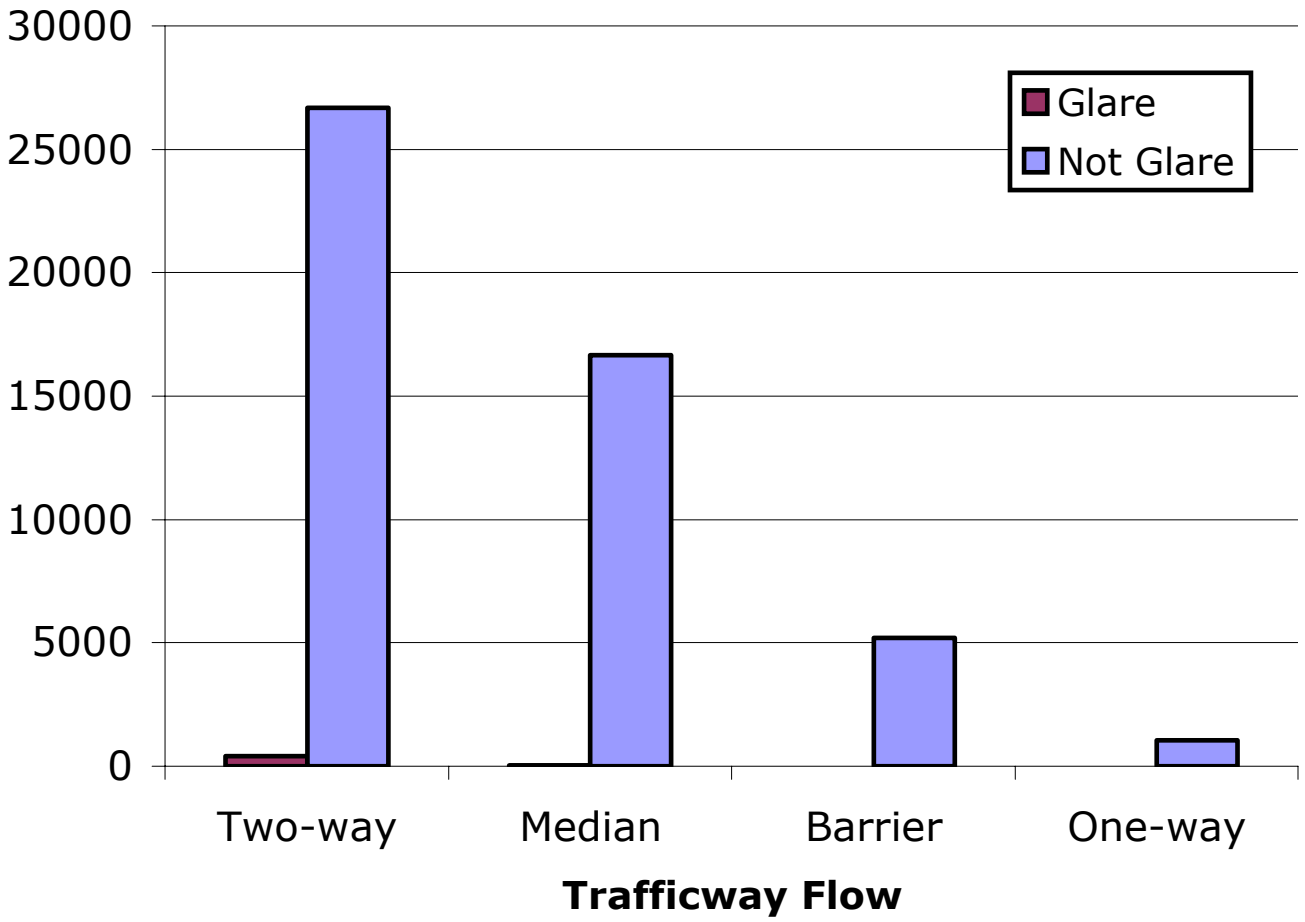
Trafficway Flow

- Levels:
  - 1 Not Physically Divided (Two Way Trafficway)
  - 2 Divided Highway, Median Strip (Without Traffic Barrier)
  - 3 Divided Highway, Median Strip (With Traffic Barrier)
  - 4 One Way Trafficway
- Relationship to glare

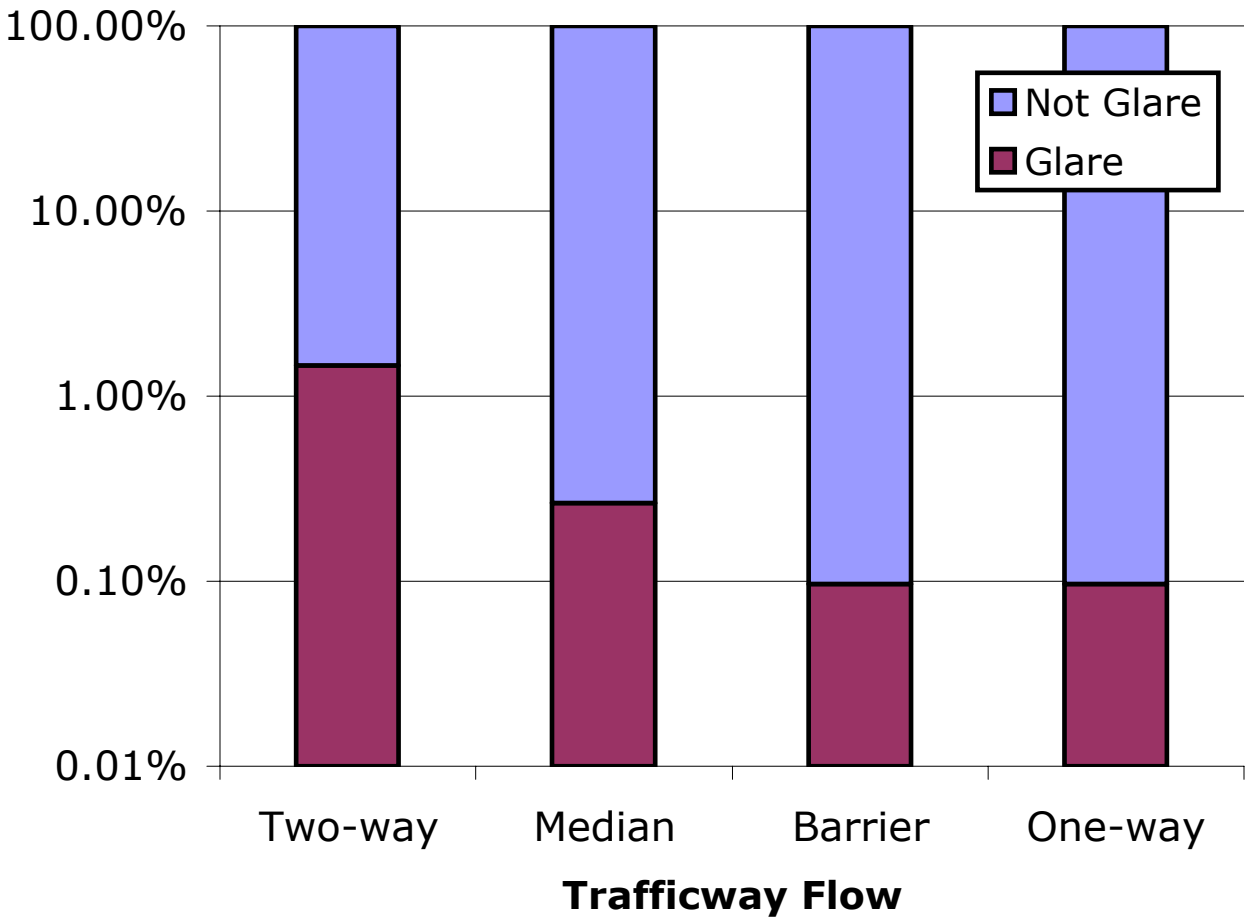
Glare light from median TH low beams for one- and two-lane lateral offsets



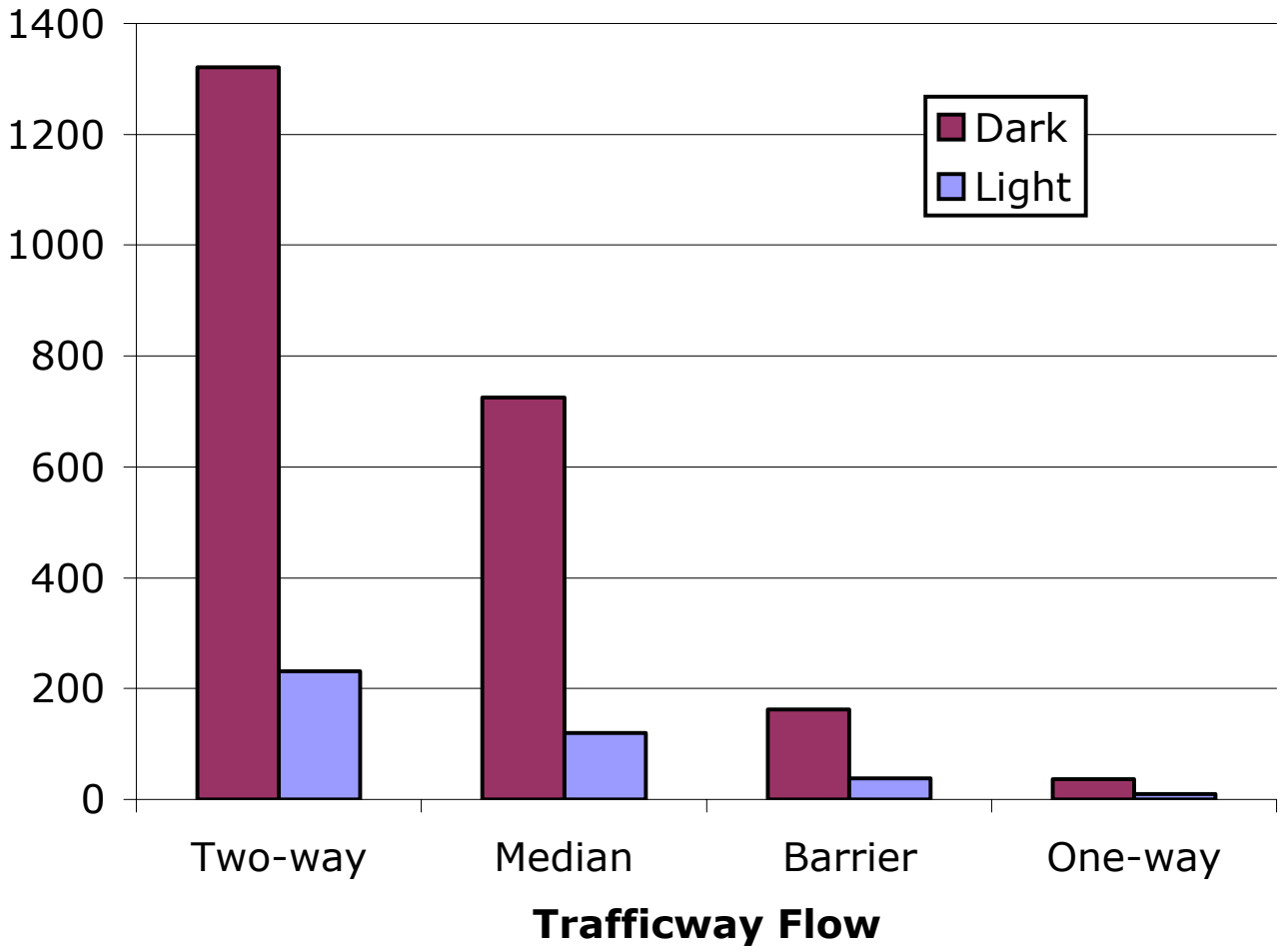
Glare coded for fatal pedestrian crashes at night by trafficway flow (counts)



Glare coded for fatal pedestrian crashes at night by trafficway flow (percentage)



Dark/Light Fatalities by Trafficway Flow (DST, age > 15) (counts)



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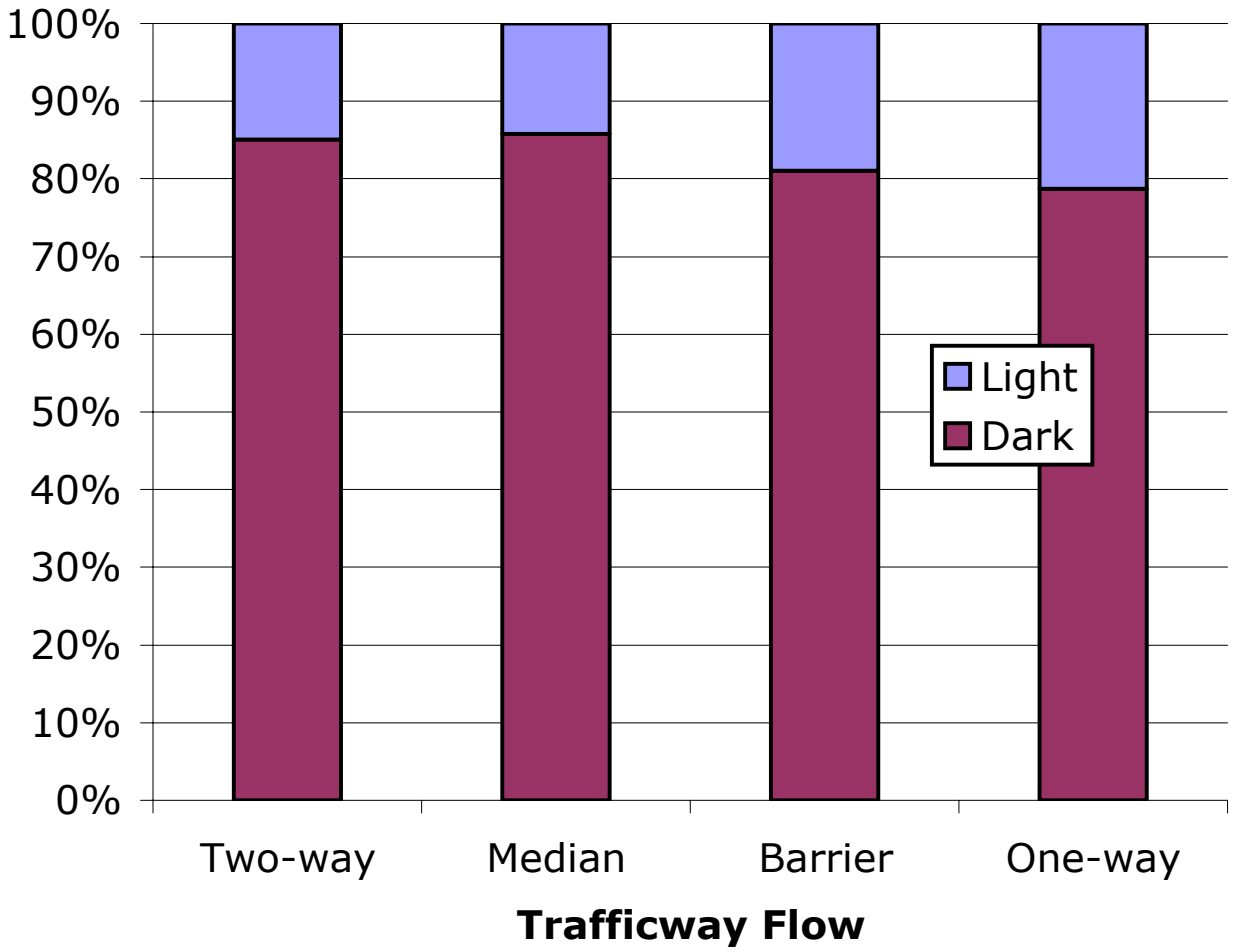
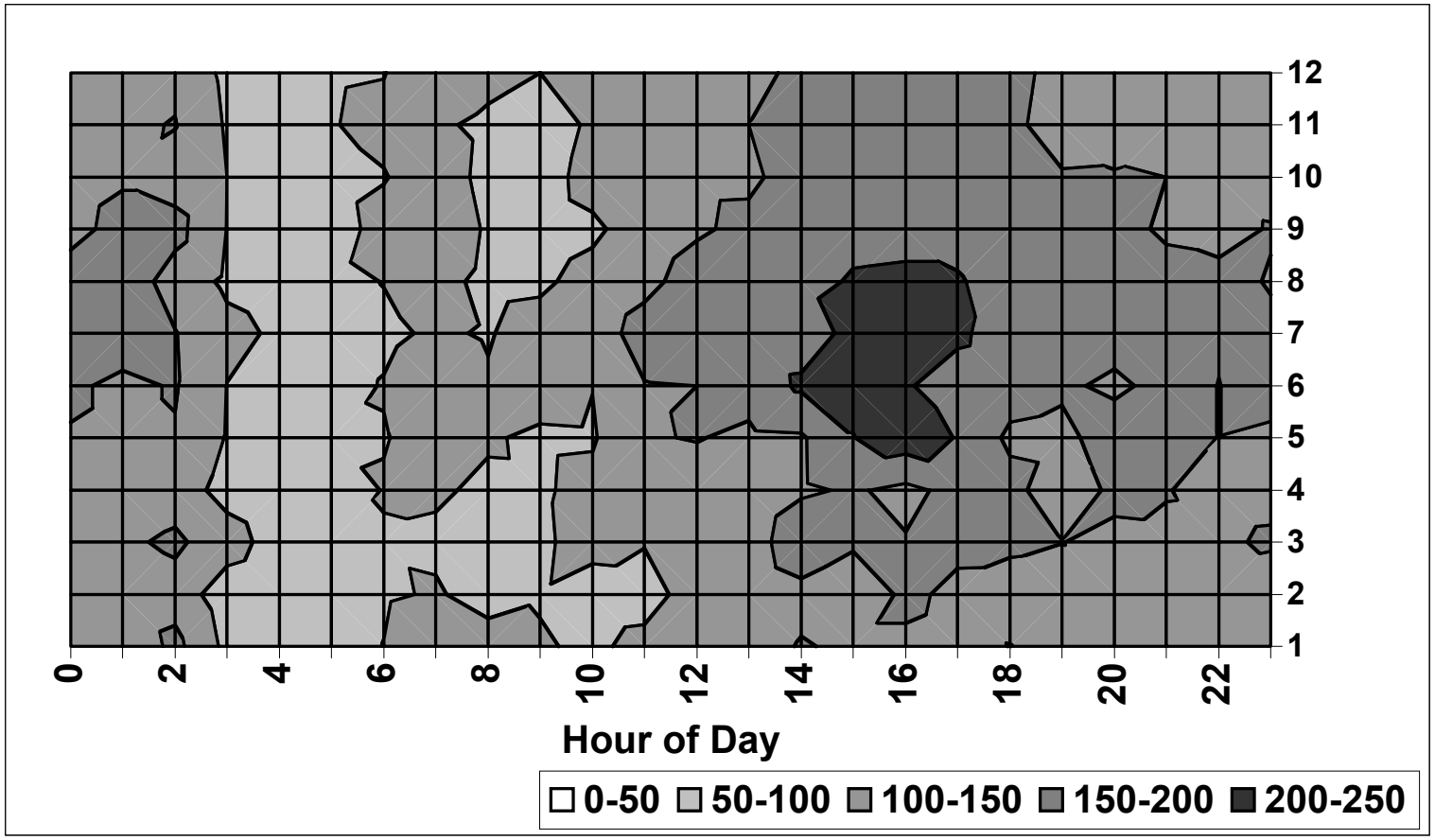
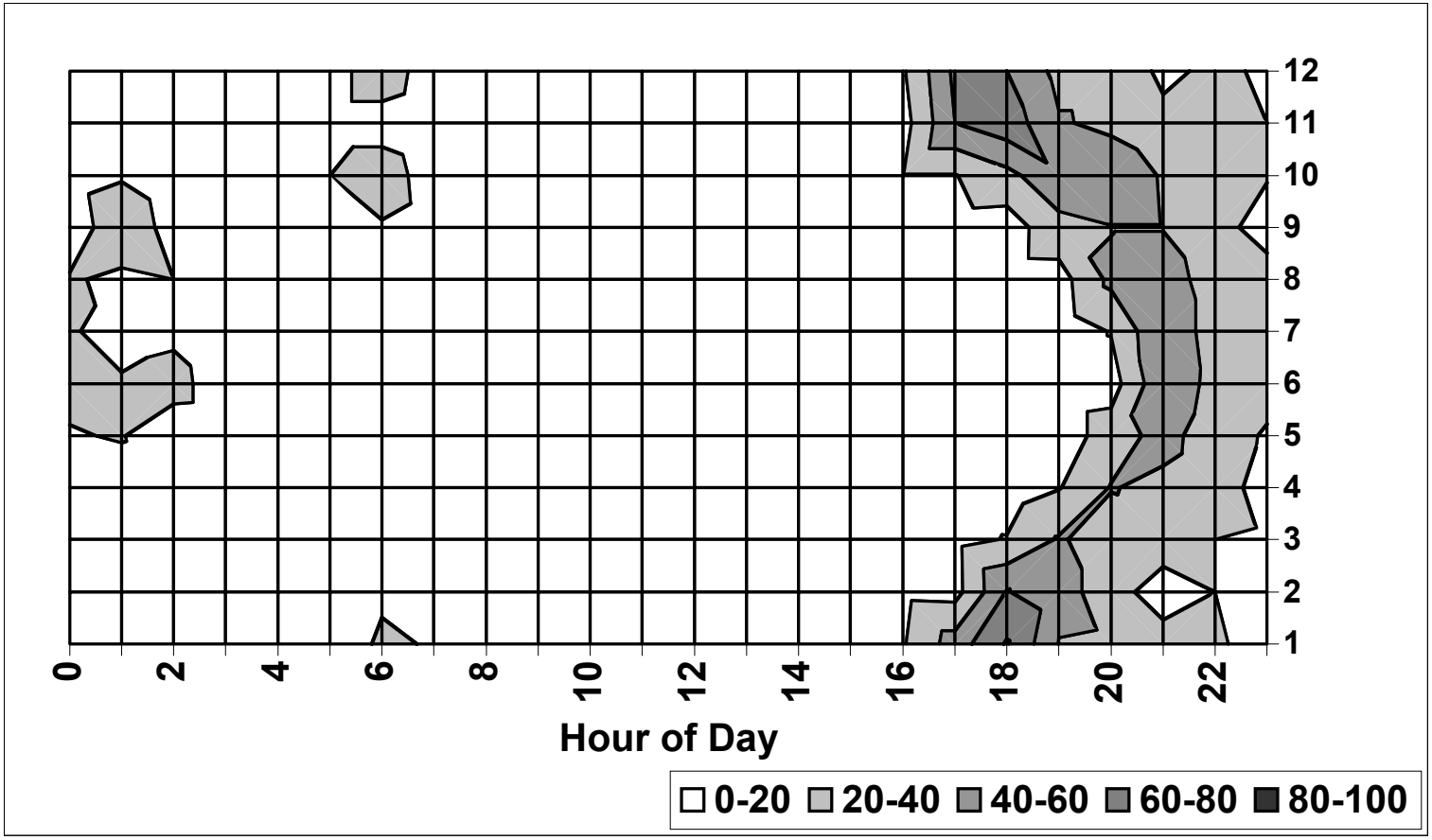


Nonpedestrian Fatalities by Month and Hour (1987-2002)



Pedestrian Fatalities by Month and Hour (1987-2002)



Conclusions:

- Pedestrian visibility is the key safety issue in the dark
- Coding of glare in crash databases may not be fully reliable, but it's probably rational
- Risk for pedestrians in the dark is reduced for roadways where glare maybe reduced, but risk is still substantial
- Fixed lighting may be partly responsible for reduced risk on those roadways

Thank you