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**The Safety Effect of Improved Nighttime Visibility via Fixed Lighting**

LITES

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1. Presentation only
2. No, I do not intend to expend this into a paper

In today's environment with more than 43 states in financial crisis, the approach of turning off lighting is being proposed. What will be the effect of this action?

This presentation examines the safety effect of improved nighttime visibility by using fixed lighting. A number of studies and their conclusions are cited.

Additionally, recent information from Great Britton shows the effect of street lighting on crime with benefit/ cost ratios as high as 4.45/ 1 and a payback period of less than 3 months.

Country	Total no. of fatalities (absolute) <sup>1</sup>			Fatalities per 1bn kilometres		
	1980	1990	1999	1980	1990	1999
Austria	2 003	1 558	1 079	56	28	15
Australia	3 274	2 331	1 759	...	...	10
Belgium	2 396	1 976	1 397	50	28	16
Canada	5 461	3 960	2 696	...	...	...
Switzerland	1 209	925	583	31	19	11
Czech Republic	1 261	1 291	1 455	59	52	36
Germany	15 050	11 046	7 772	37	20	12
Denmark	690	634	514	25	17	11 <sup>a)</sup>
Spain	6 522	9 032	5 738	...	...	...
European Union	...	...	42 356	...	...	...
France	13 672	11 215	8 487	44	26	15
Finland	551	649	431	21	16	9
Great Britain	6 010	5 217	3 423	22	13	7
Greece	1 446	2 050	2 116	...	...	27 <sup>a)</sup>
Hungary	1 630	2 432	1 306	...	...	...
Italy	9 220	7 151	6326 <sup>a)</sup>	...	...	...
Ireland	564	478	413	28	19	13 <sup>c)</sup>
Iceland	25	24	21	21	14	10
Japan	11 388	14 595	10 372	29	23	14
Luxembourg	98	70	58	...	...	...
Norway	362	332	304	19	12	10
Northern Ireland	229	185	141	...	...	...
Netherlands	1 996	1 376	1 090	27	14	9 <sup>a)</sup>
New Zealand	597	729	509	...	...	...
Portugal	2 579	2 646	1 995	...	...	...
Poland	6 002	7 333	6 730	...	...	...
Korea	6 449	14 174	10 756	...	...	...
Sweden	848	772	580	16	12	8
Turkey	4 839	8 212	5 975	...	...	120
United States	51 091	44 529	41 611	21	13	10
<sup>a)</sup> 1998	<sup>b)</sup> 1997	<sup>c)</sup> 1996				

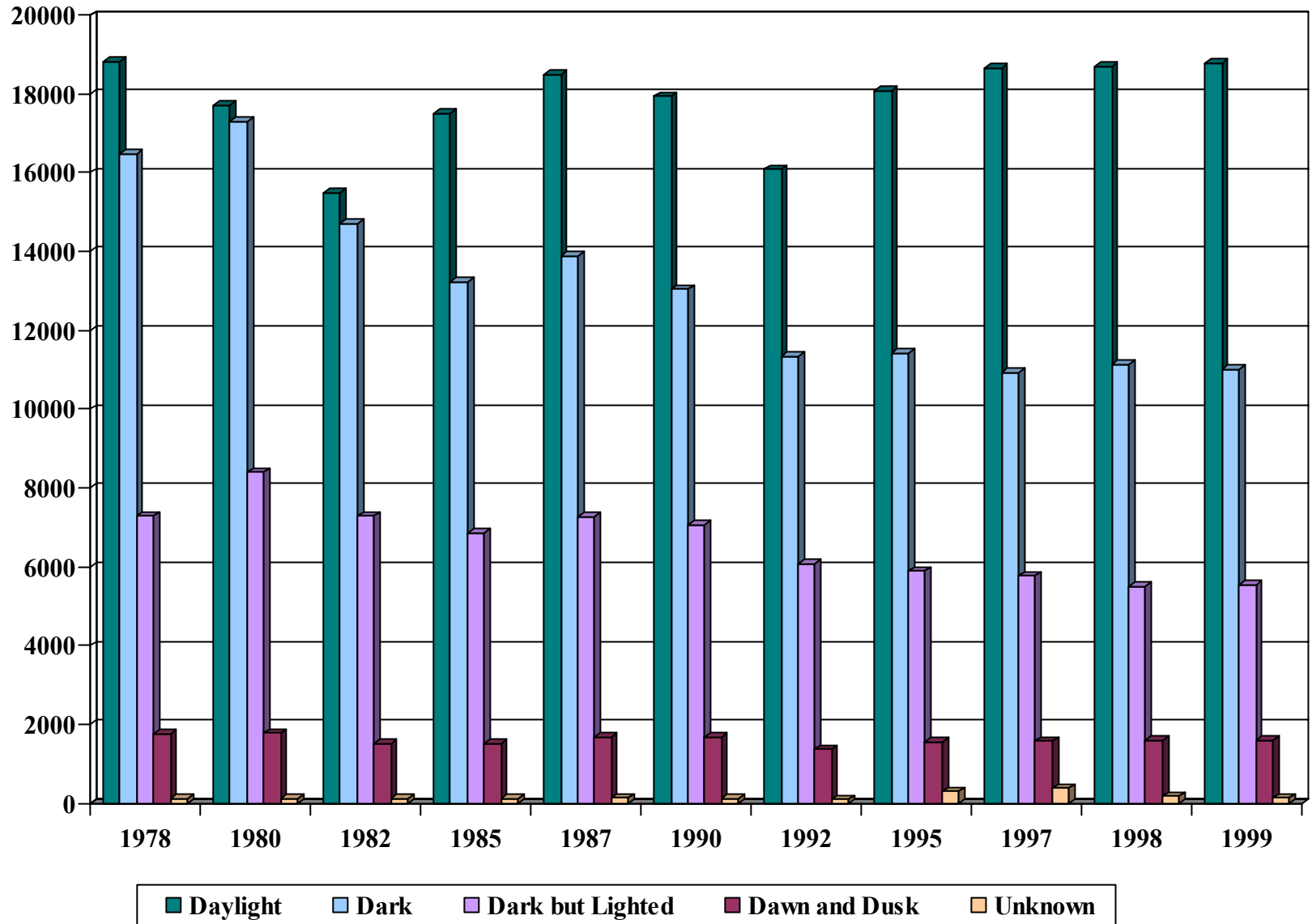
# What Is The Effect of Roadway Lighting?

- FHWA-TS-90-028, The Relationship of Fixed and Vehicular Lighting to Accidents
  - “Fixed lighting installations are intended to reduce the blinding glare of approaching headlights, to reveal objects and markings on the roadway beyond the range of the vehicle headlights, and to provide light on objects that are off the roadway or around the corner of an intersection”.

# What Does Roadway Lighting Do?

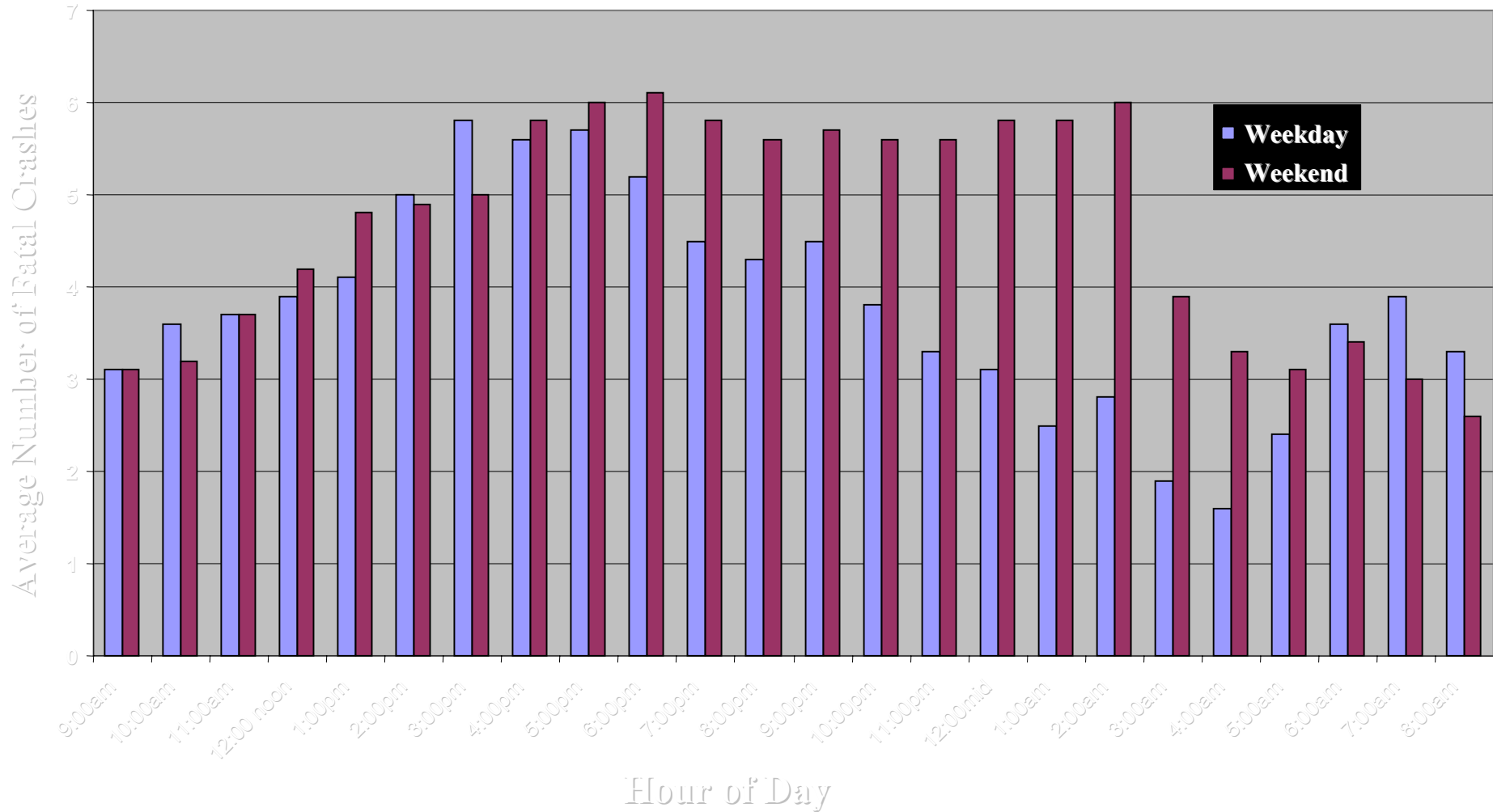
- “On major urban streets the greatest benefit is in the saving of pedestrian lives. Reductions of 45% - 80% have been found in various cities.” (excerpt from CP-31)
- In Switzerland a change in Right-of-Way law increased the number of pedestrian fatalities. They changed their method of lighting crosswalks and lowered the number of fatalities by 2/3's.

## Profile By Lighting Conditions (All Crashes)



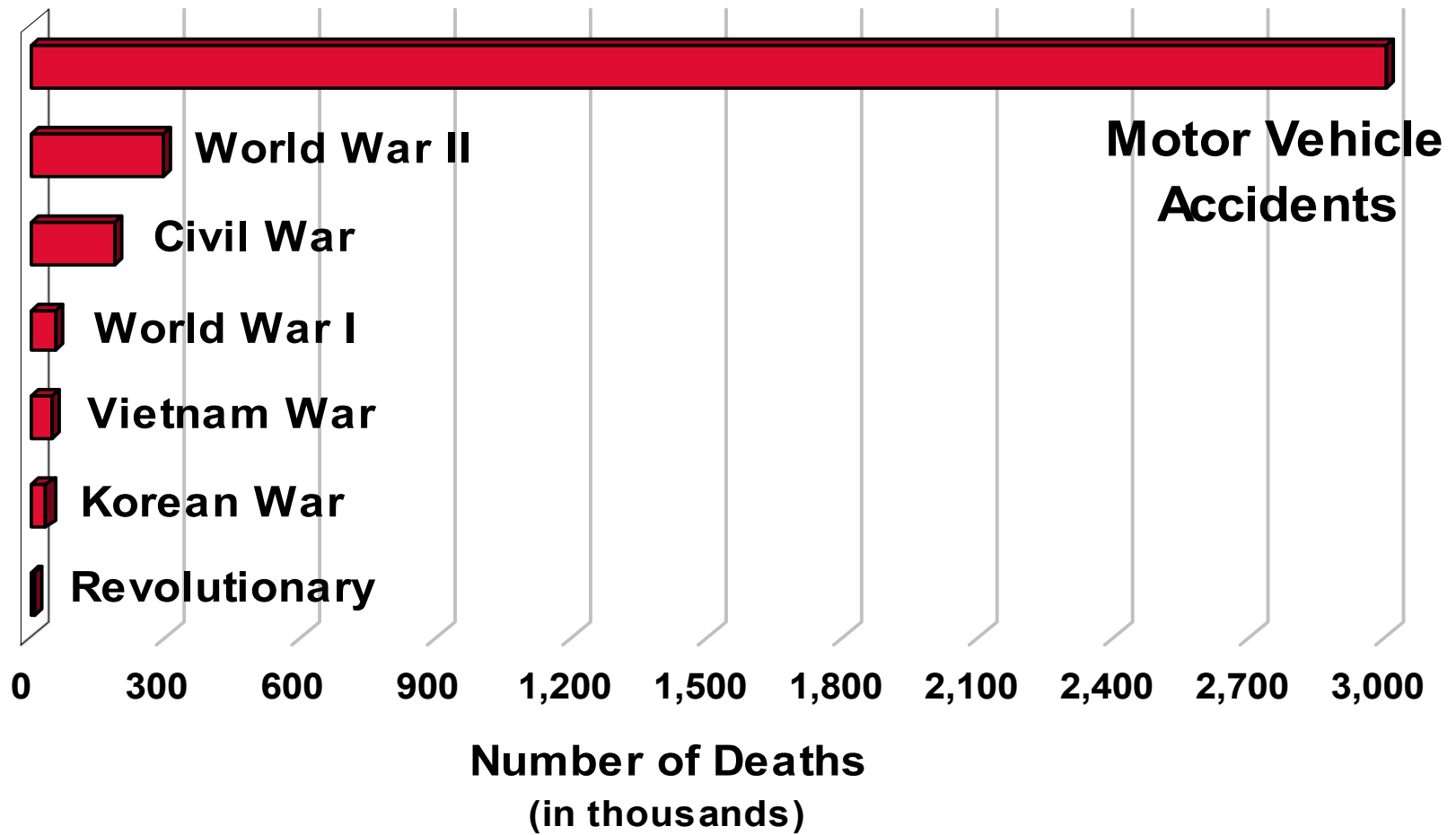
Data from Fatality Analysis Reporting System (FARS)

# Average Number of Fatal Crashes by Hour



Data from Fatality Analysis Reporting System (FARS)

# Americans Killed in Combat vs. Motor Vehicle Accidents\*



\*Combat Deaths 1775-1999; Motor Vehicle Accidents 1900-1999.

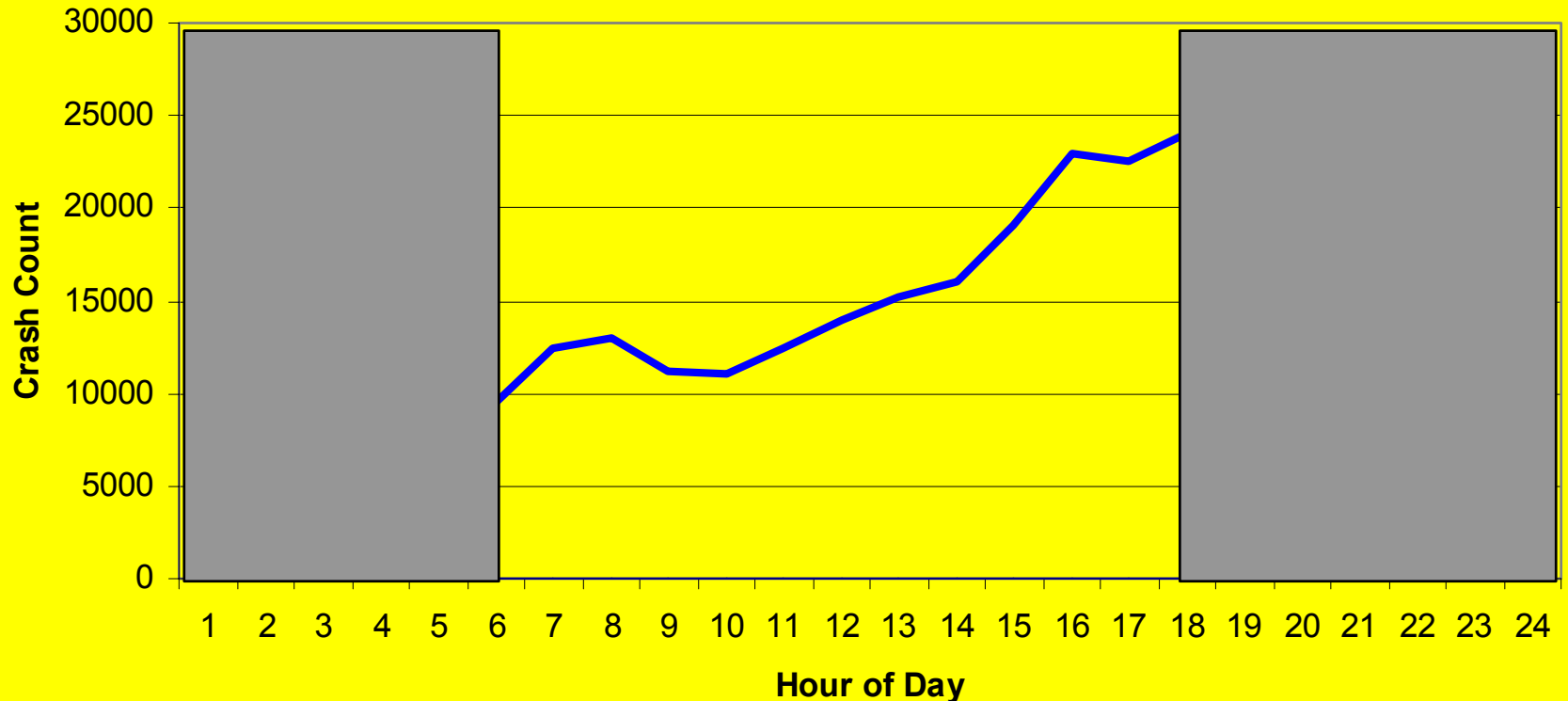
# USA Pedestrian Safety in 2000

- Injuries:
  - 78,000 Injured – on average one every 7 minutes
  - Equals 2 % of all Traffic Accidents Injuries
- Fatalities:
  - 4,739 Killed; on average one every 111 minutes
  - Equals 11 % of all Traffic Accident Fatalities
  - Alcohol involved in 47% of fatalities
    - Pedestrians 31%
    - Drivers 13%
    - Both 5%
  - Effect of Lighting?

“Assessing the Potential Benefit of Adaptive Headlighting Using Crash Databases” by Sullivan and Flannagan, Sept. 1999

- Used 11 years of FARS data to investigate 3 crash scenarios for sensitivity to light level:
  - Fatal pedestrian crashes @ intersections
  - Fatal pedestrian crashes on dark roads
  - Single vehicle run-off-road crashes on dark, curved roads
- Two Methods used
  - Seasonal pattern of crashes through out the year vs. seasonal light level pattern of twilight, daylight and nighttime.
  - Number of fatal crashes compared across abrupt changes due to daylight savings time changes

## Overall Number of Fatal Crashes by Time of Day (FARS, 1987 - 1997)



**About the same number of Fatalities Night vs. Day with  
much less Traffic!!**

Excerpted from University of Michigan – Transportation Research Institute  
“Assessing the Potential Benefit of Adaptive Headlighting Using Crash Databases” by  
Sullivan and Flannagan, Sept.’99

# University of Michigan – Transportation Research Institute

## “Assessing the Potential Benefit of Adaptive Headlighting

Using Crash Databases” by Sullivan and Flannagan, Sept. 1999

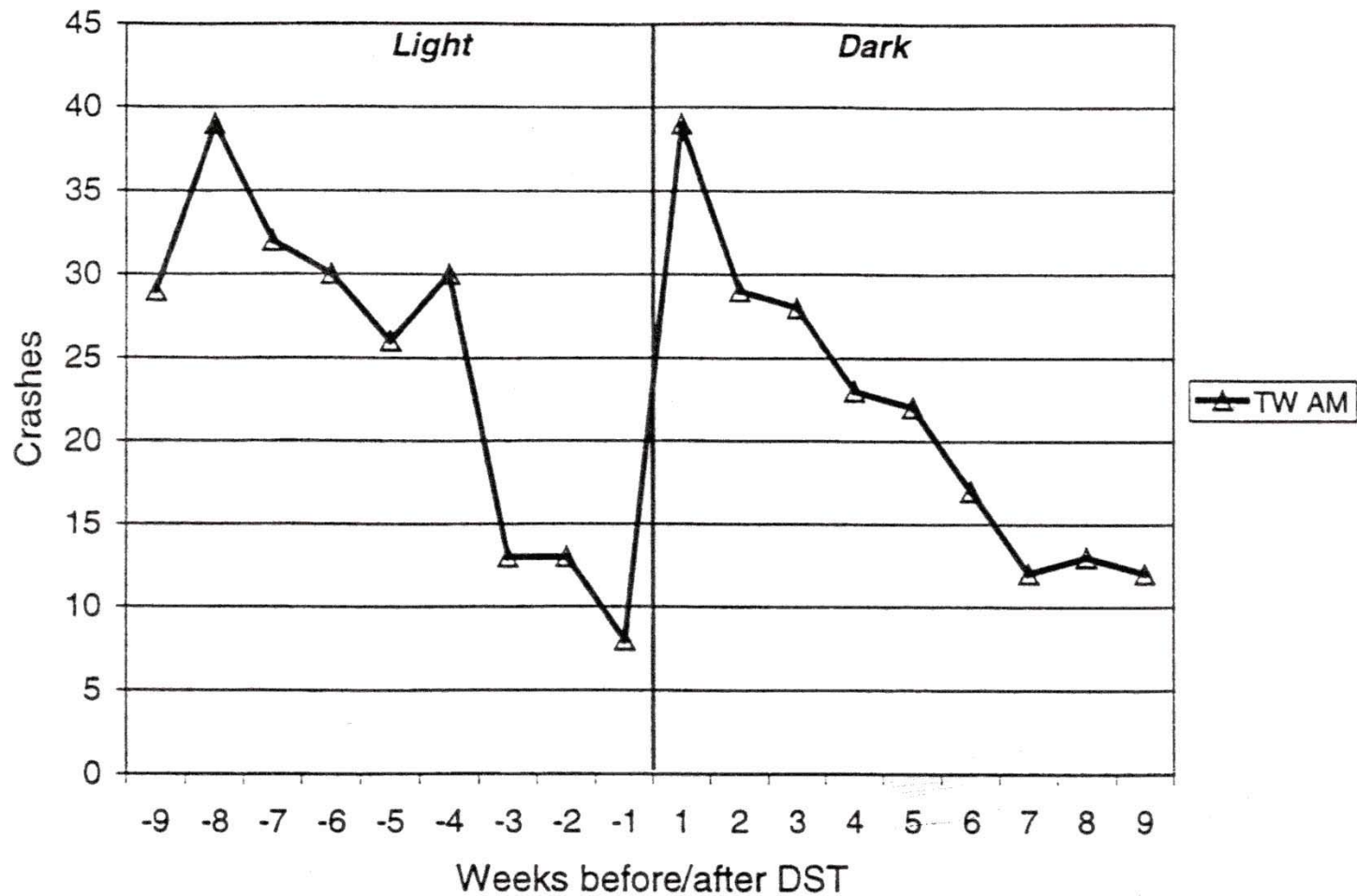


Figure 26. Cumulative spring A.M. crashes before and after DST changeover during the morning TW time interval. Data span 11-years, 1987 to 1997.

# University of Michigan – Transportation Research Institute

## “Assessing the Potential Benefit of Adaptive Headlighting

### Using Crash Databases” by Sullivan and Flannagan, Sept.1999

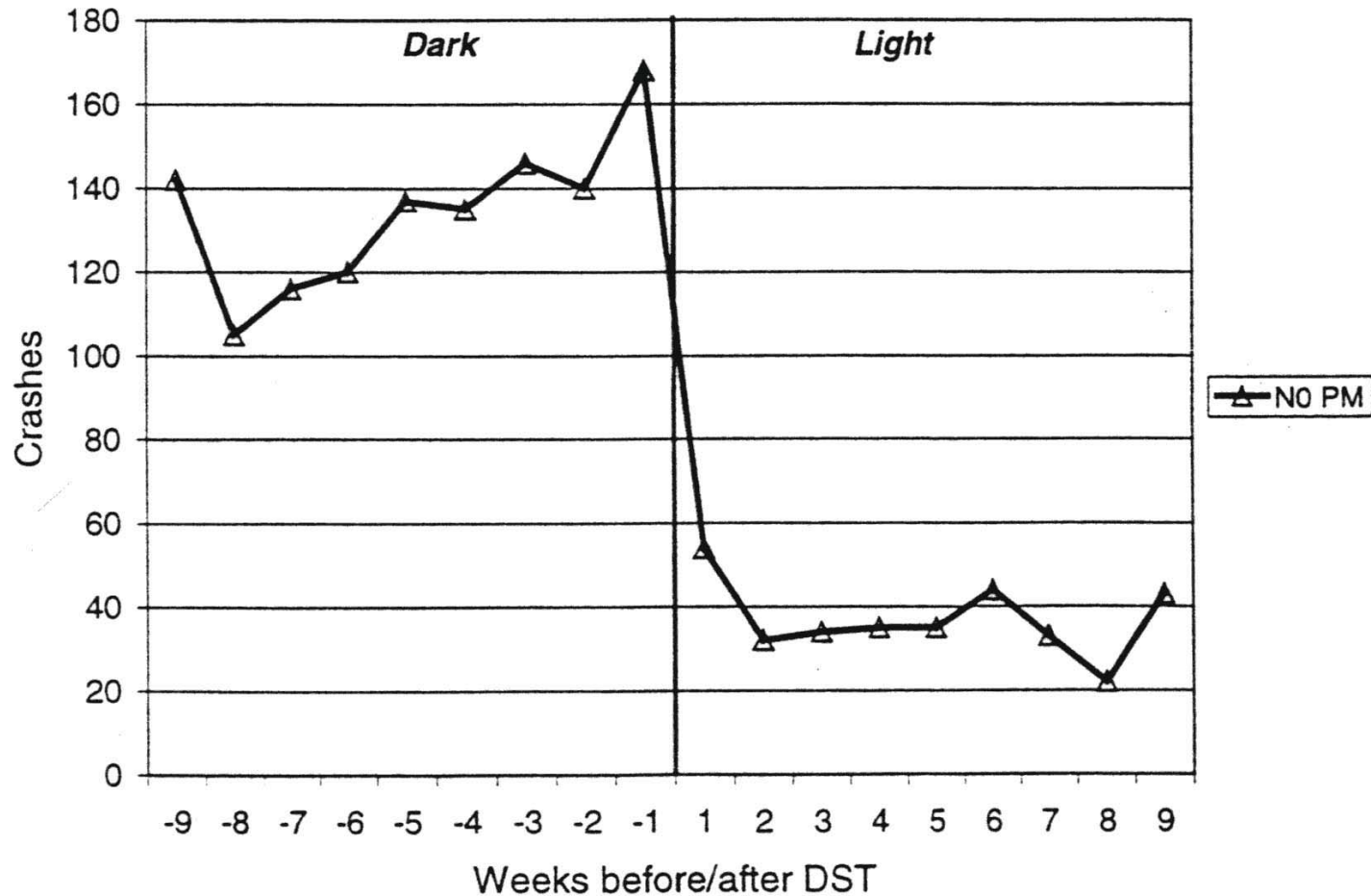


Figure 28. Cumulative spring P.M. crashes before and after the DST changeover in the evening for the N0 time interval. Data span 11 years, 1987 to 1997.

University of Michigan – Transportation Research Institute  
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•Chapter 2 Previous Research:

“One clear conclusion from the fixed-illumination research is that lighting reduces crash rates – in particular, pedestrian crash rates”.

•Chapter 7 Conclusions:

“Pedestrians maybe 3 to 6.75 times more vulnerable in the dark than in daylight, depending on circumstances”.

“At the moment the most practical means to extend the available time to avoid a pedestrian collision seems to be to improve lighting to illuminate objects farther ahead of the vehicle to extend the available time to react”.

# What's the Effect on Crime?(cont'd)

- Recent work, in 1996, by Criminologist Dr. Kate Painter of Cambridge University investigated the effect of lighting on crime in two towns; **Dudley** in West Midlands and **Stoke** on Trent in Staffordshire
- Mercury @ 1 lux avg. replaced by HPS @ 6 lux avg. coupled with a 2.5 lux minimum
- Measured changes in crime, public attitudes, fear and pedestrian street use at night.
- Exactly same comparisons were made in adjacent and control areas where lighting remained unchanged.

# What's the Effect on Crime? (cont'd)

- In both the re-lighted areas of **Stoke** and **Dudley**:
  - Crime reduced significantly
  - Fear of crime lessened
  - Quality of life measures increased
  - Night street use increased dramatically
- **There was no clear evidence of crime displacement**
- In **Stoke** there was positive evidence that the benefits of street lighting extended to immediate adjacent areas

# What's the Effect on Crime? (cont'd)

Area	Lights Cost	1 <sup>st</sup> Yr. Maint. Cost	Total Cost	Crime Prevented	Savings	Months Payback	B/C Ratio
Dudley	L55k	2611	L57611	641	L256,181	2.7	4.45
Stoke	L77k	2323	L79323	266	L107,620	8.8	1.36