Effect of Traffic Signal Placement on Driver Behavior

Traffic Safety Summit

March 13, 2008

Marc Start, PE PTOE

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Traffic Signal Display Location Change

- One approach monitored at three intersections

Before – Diagonal Span

After – Box Span

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Signal Display Location

- Traffic signal improvement from a ‘diagonal’ to ‘box span’ traffic signal configuration
- Motorists are likely to be uncomfortable with viewing a red indication
- Hypothesis: Traffic signal displays located further from the stop bar reduce vehicle entry surrounding the beginning of the red interval

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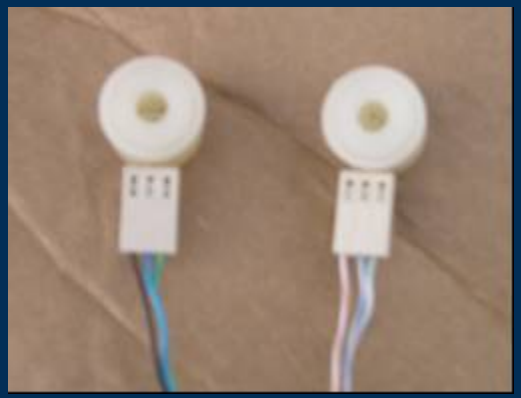
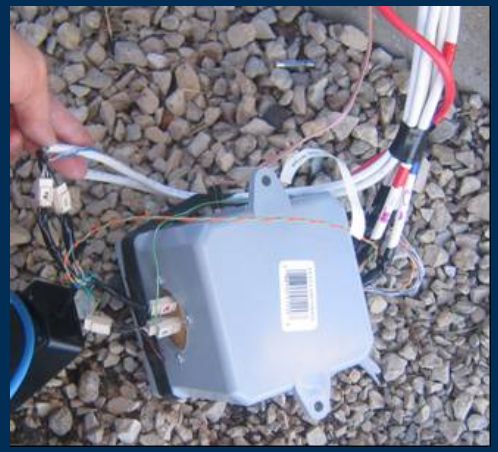
Project Tool

Sonic Sensor



Photocell



Logic Box

Data Logger

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Project Process

- Study driver behavior instead of crash statistics
  - ➡ Electronic measurement (accurate and inexpensive)
  - ➡ Representative sample in a short amount of time
- Re-measure to evaluate countermeasures
  - ➡ Study can take place in a matter of weeks/months
  - ➡ Isolate countermeasures, control variables

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Data Collection – Before & After

- Measure red light violation rate during first 3 seconds of the red interval
- Measure late yellow entry rate during last second of the yellow interval
- Data collected for three weeks (before & after)
- Measure volume, speed, "depth of red"

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Study Location Characteristics

Location	Yellow Interval & Speed	Major/ Cross Street	Approach Volume
Wyoming	4.7 s 35 mph	Cross	Low
Lansing	3.5 s 40 mph	Major	Medium
Southfield	4.3 s 40 mph	Major	High

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Study Results – Raw Data

Location		Red Light Violations	Late Yellow Entries	% Red Light Violations
Wyoming	Before	76	411	15.6%
	After	4	51	7.3%
Lansing	Before	18	304	5.6%
	After	9	166	5.1%
Southfield	Before	10	172	5.5%
	After	28	111	20.1%

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Study Results – Rate Change

Location	Red Light Violation Reduction	Late Yellow Reduction	Combination Reduction
Wyoming	94%	85%	86%
Lansing	56%	52%	52%
Southfield	-175%	36%	25%
Overall*			**54%**

***Numeric average of all three sites**

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Study Results – Distances to Signal Display

Location	Distance to Signal Displays (Before)	Distance to Signal Displays (After)	Combination Reduction
Wyoming	30-40’	105’	86%
Lansing	45-55’	80’	52%
Southfield	50-60’	135’	25%
Overall*			**54%**

***Numeric average of all three sites**

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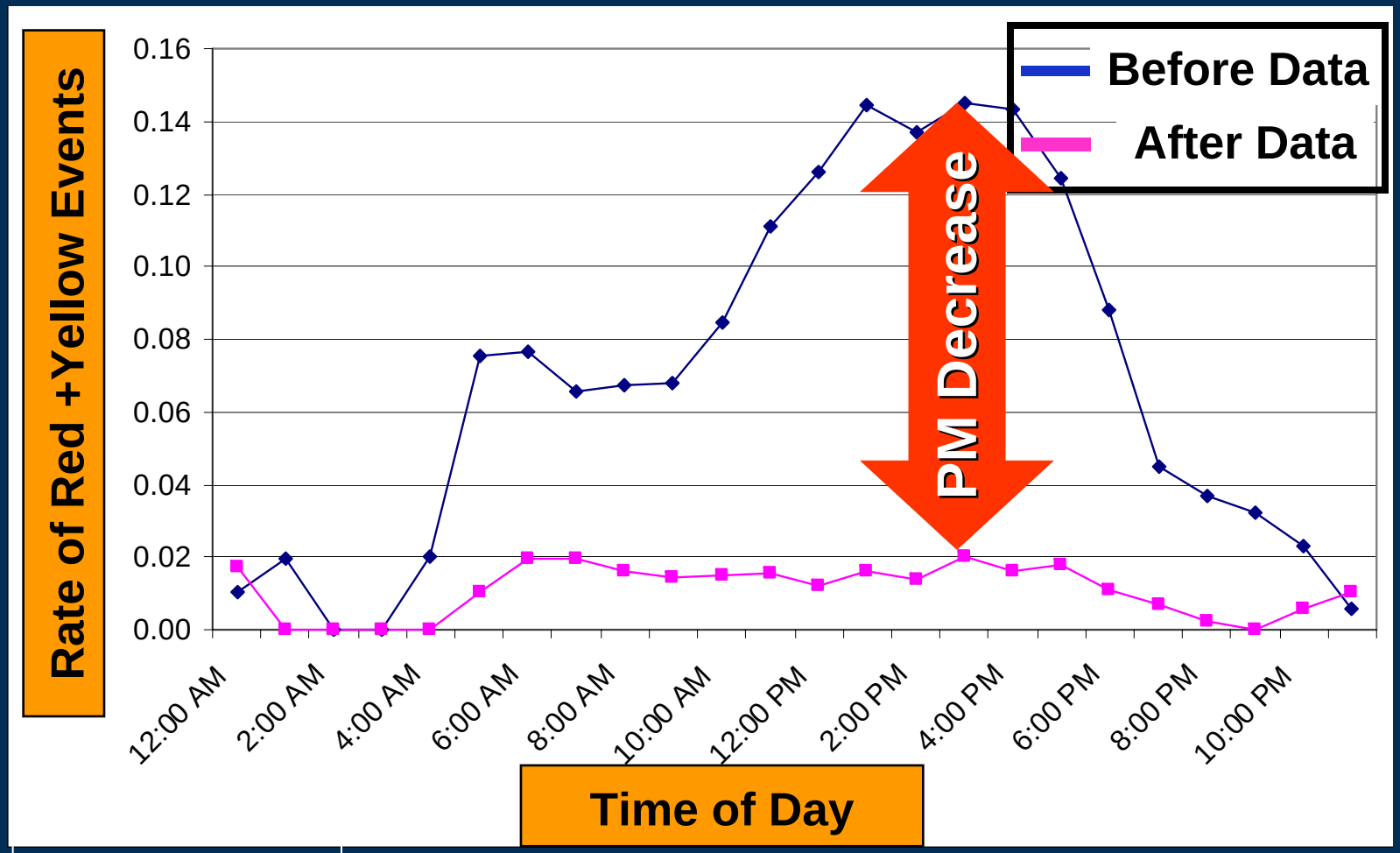
Combination Rate Results - Wyoming



Note: 3-hour averages shown

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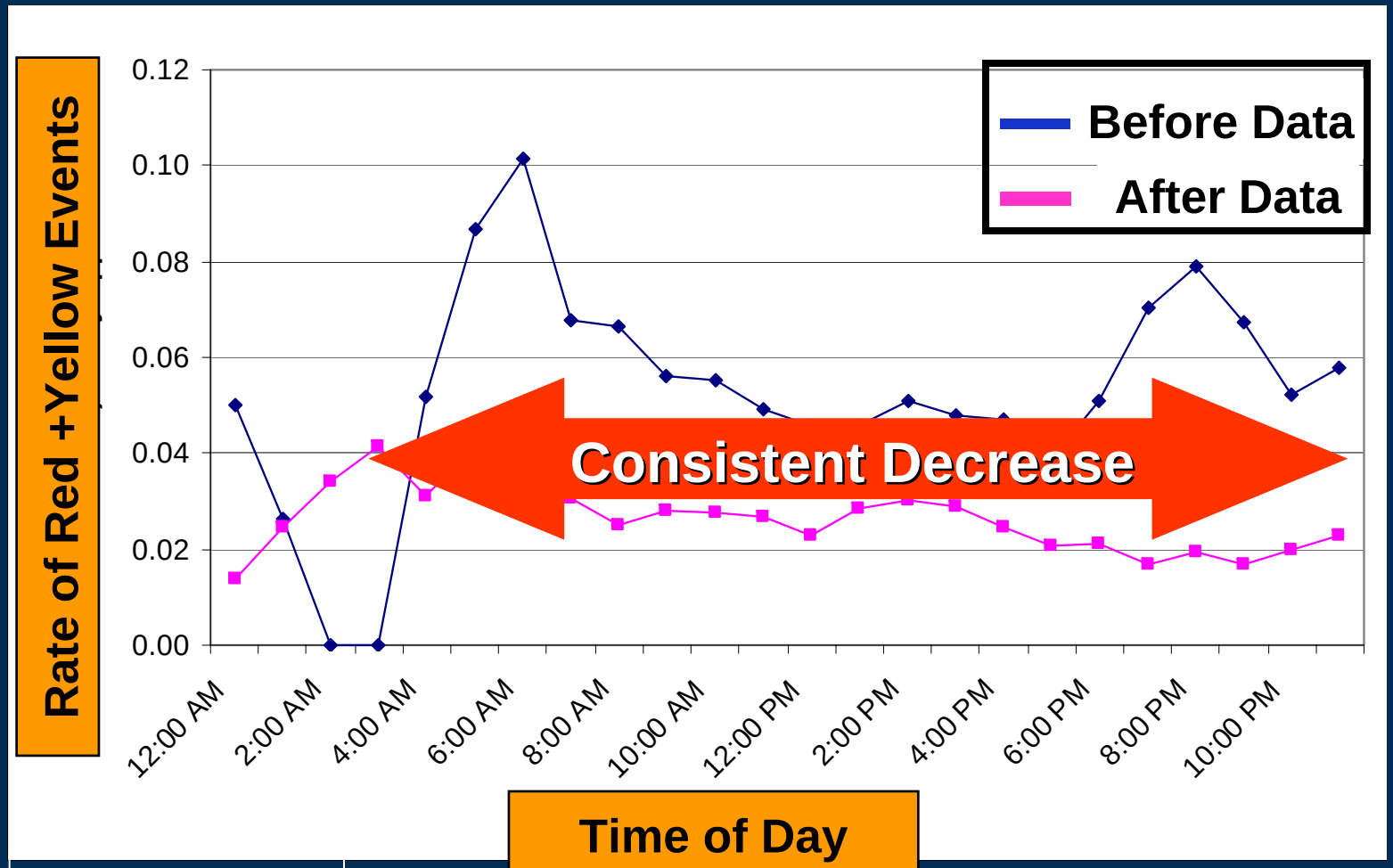
Combination Rate Results - Lansing



Note: 3-hour averages shown

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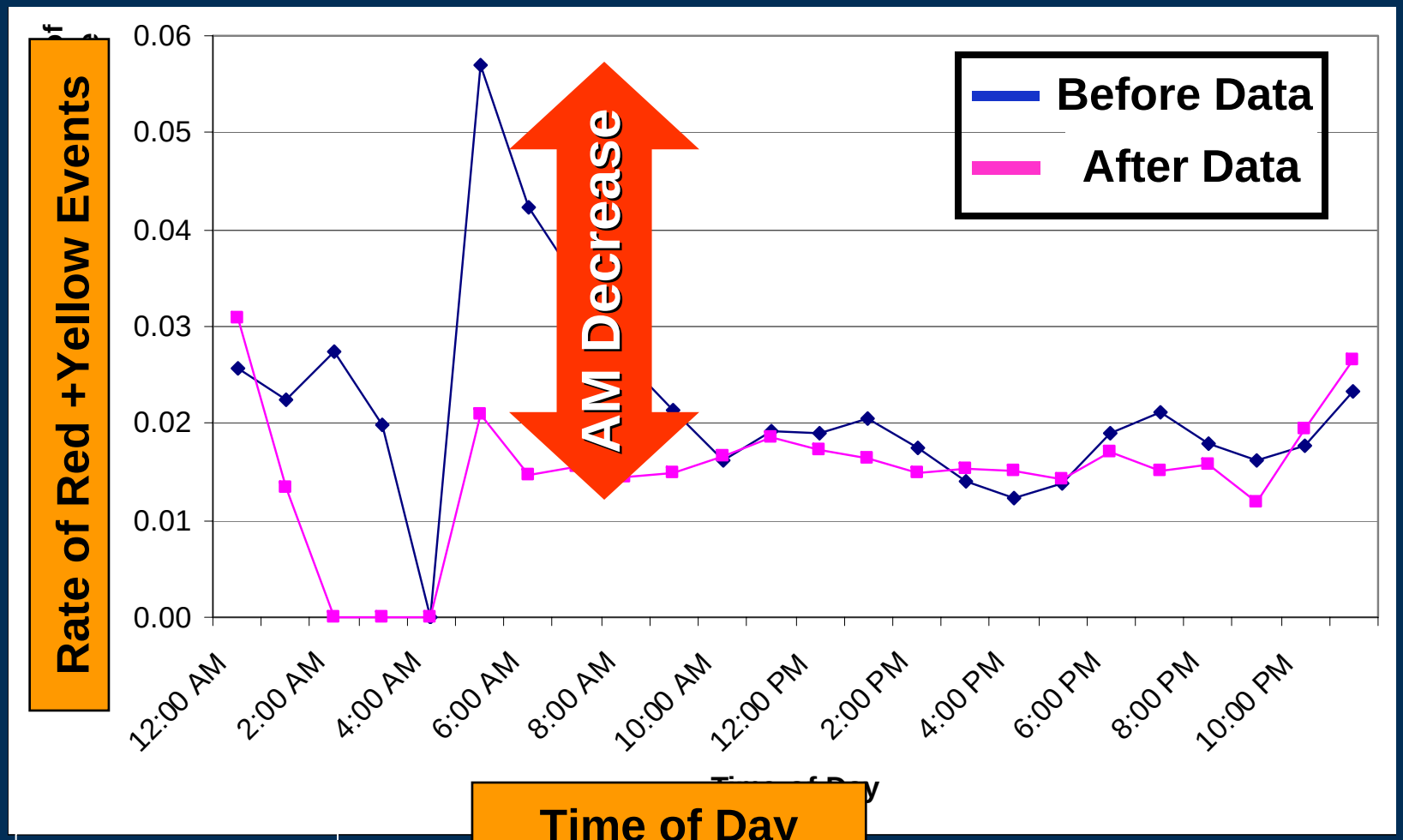
Combination Rate Results - Southfield



Note: 3-hour averages shown

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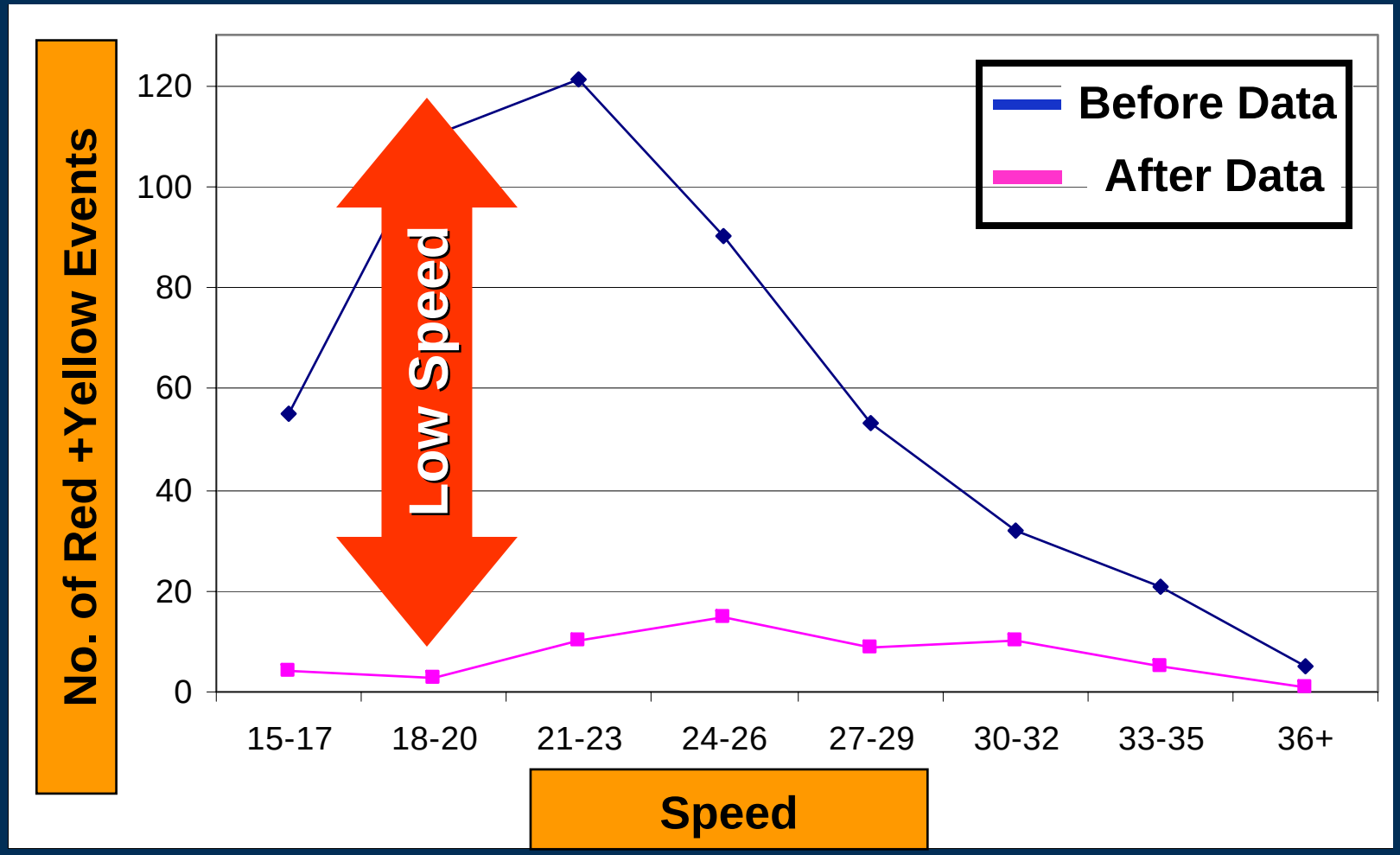
Combination Speed Results - Wyoming



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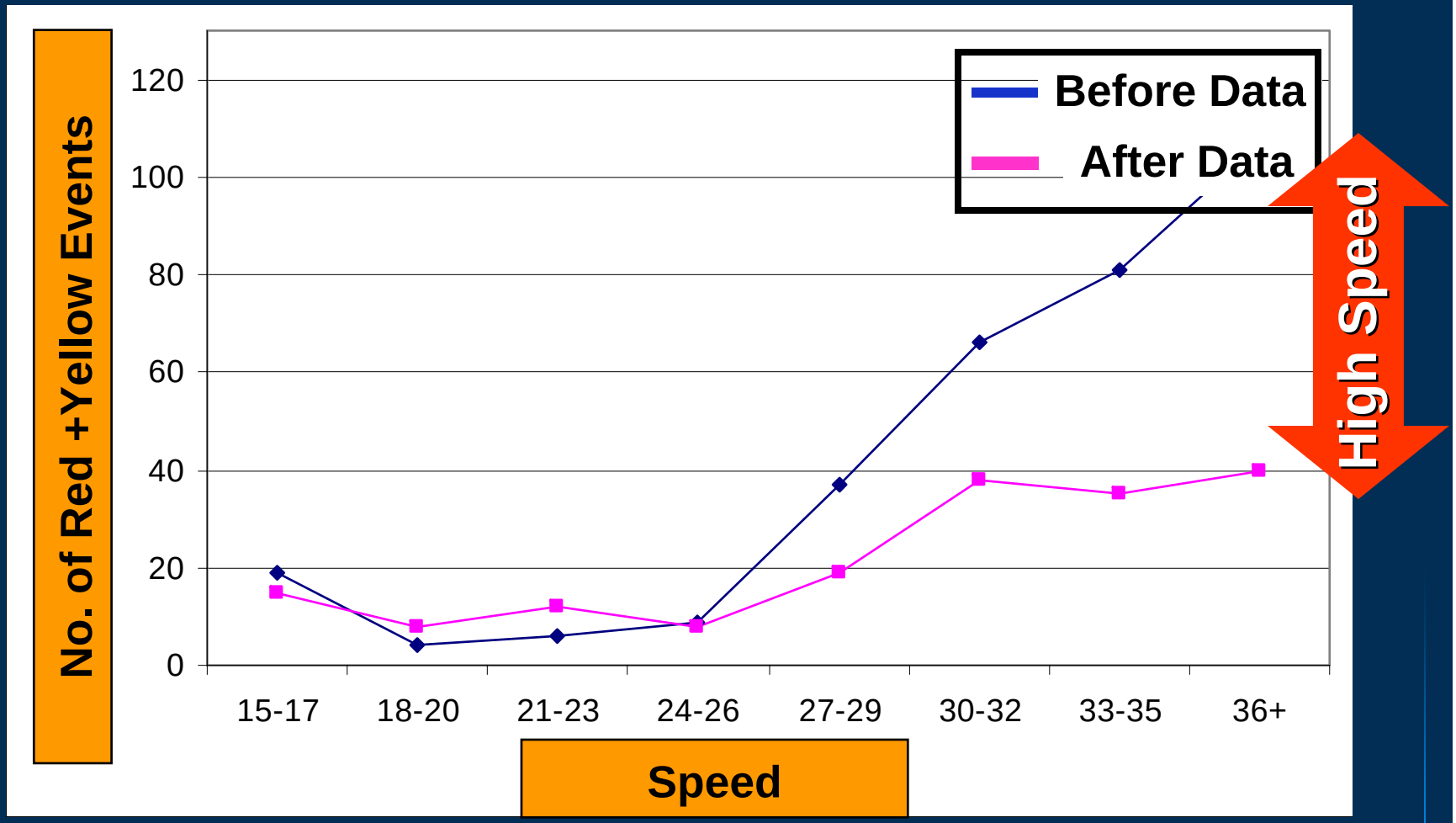
Combination Speed Results - Lansing



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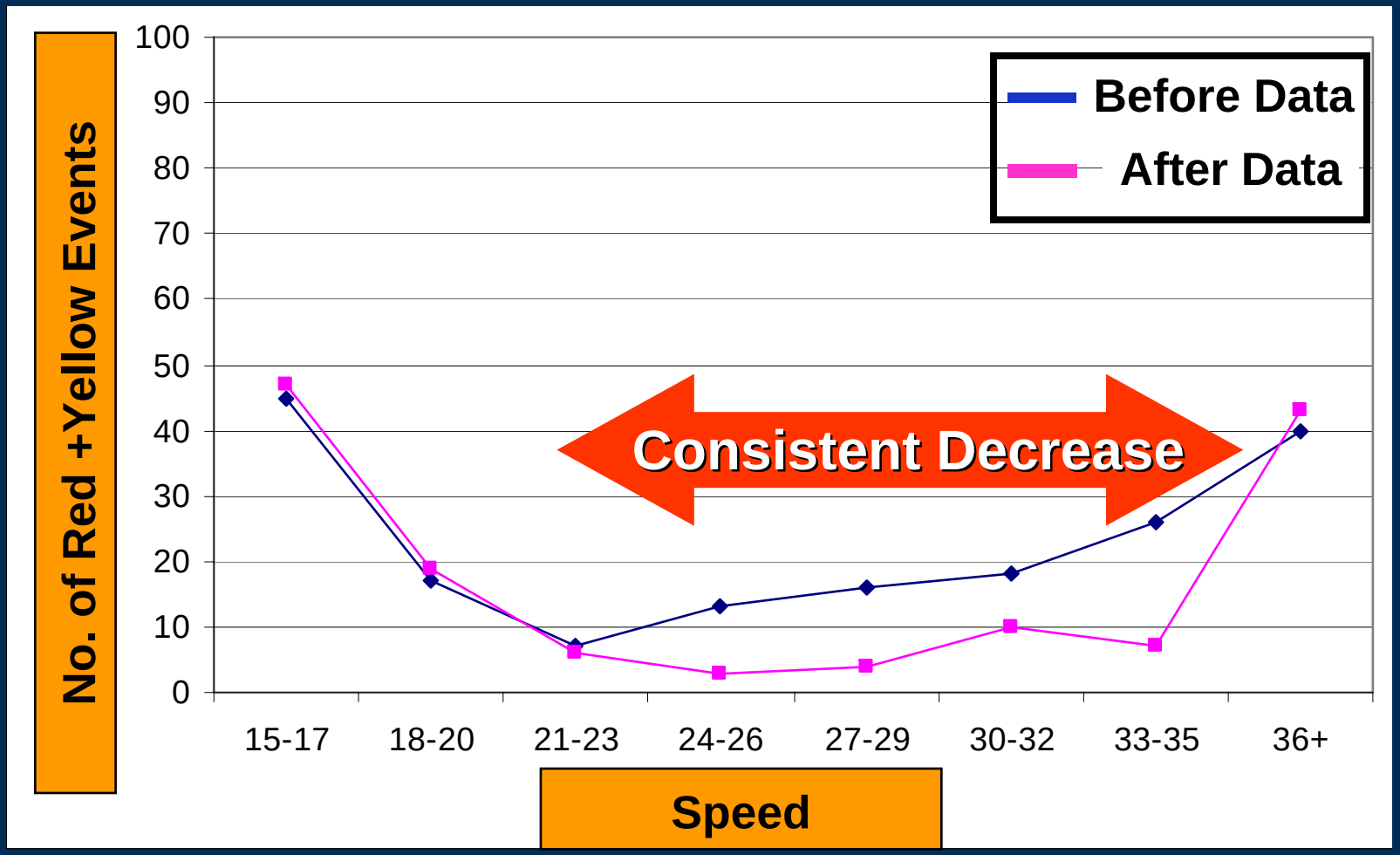
Combination Speed Results - Southfield



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Results Summary

- Rate reduction varied based on proximity of the existing traffic signal displays
- Rate reduction was higher for the side street location than the main street locations
- Side street location had low speed reduction, main street location had high speed reduction
- Far-side signal displays is a legitimate red light running countermeasure

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RLR Countermeasure – Clearance Intervals

- Lengthen the clearance intervals
- Intersection with highest crash rate in St. Paul, MN
- Westbound all red extended 1 sec, yellow extended ½ sec

Snelling Avenue at St. Anthony Avenue

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RLR Countermeasure – Clearance Intervals

- Red light violation rate immediately reduced by 10%
- Rate reduction remained through subsequent weeks
- Solution-specific approach

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RLR Countermeasure – Enforcement

- Covert enforcement, conspicuous enforcement in St. Paul, MN
- High right-angle crash rate

Arcade Street at Minnehaha Avenue

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RLR Countermeasure – Enforcement

- Hourly violation data provided to law enforcement
- Covert – no change in red light violation rate
- Conspicuous – 39% reduction
- Short term effect

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When Can It Be Called "Bad"?

- Indianapolis, IN intersection in "top 5" for angle crashes
- 3,300 ADT on the monitored approach
- 3% are violators
- Average of 100 red light violations per day
- Average of 125 late yellow entries per day

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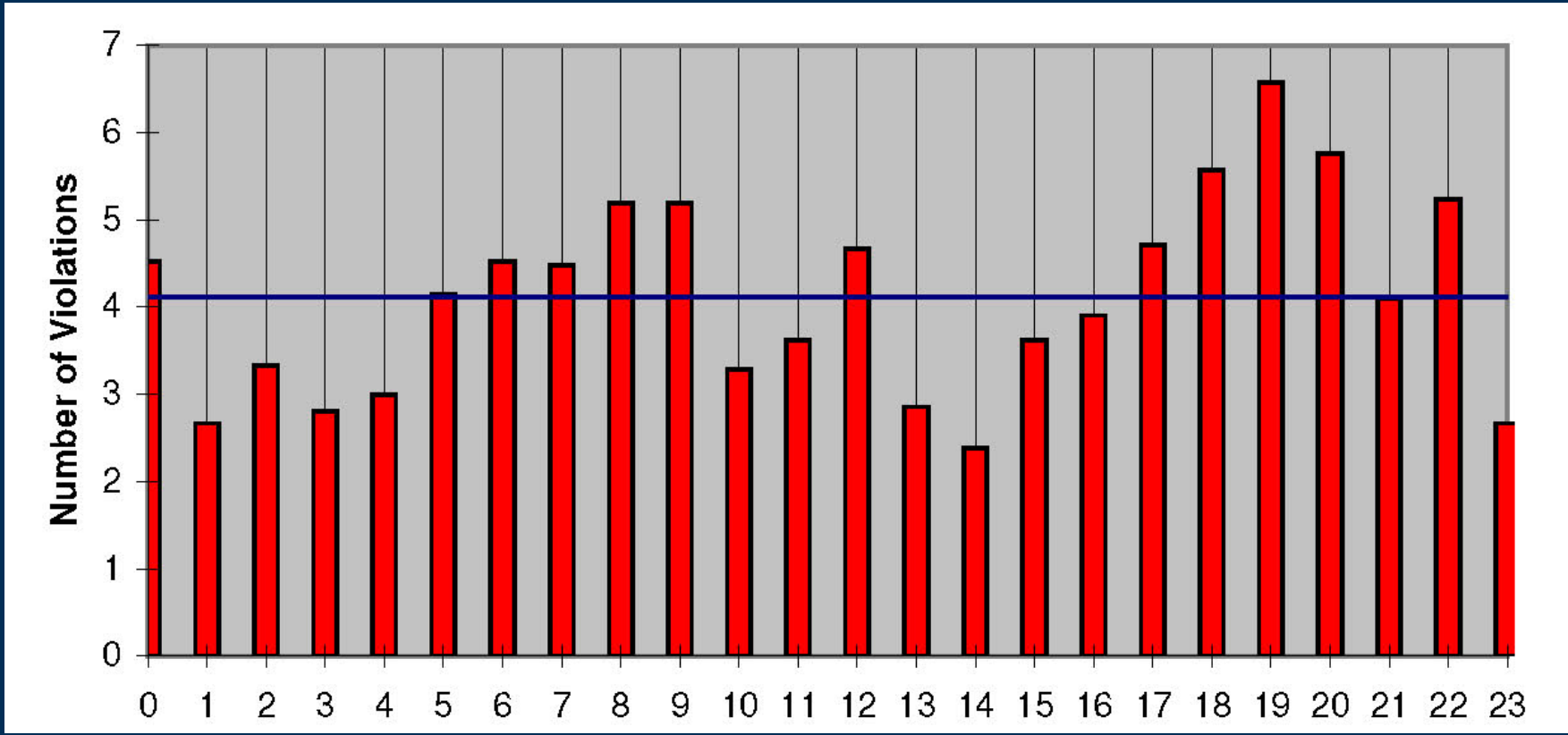
When Can It Be Called “Bad”?



Average Hourly Red Light Violations

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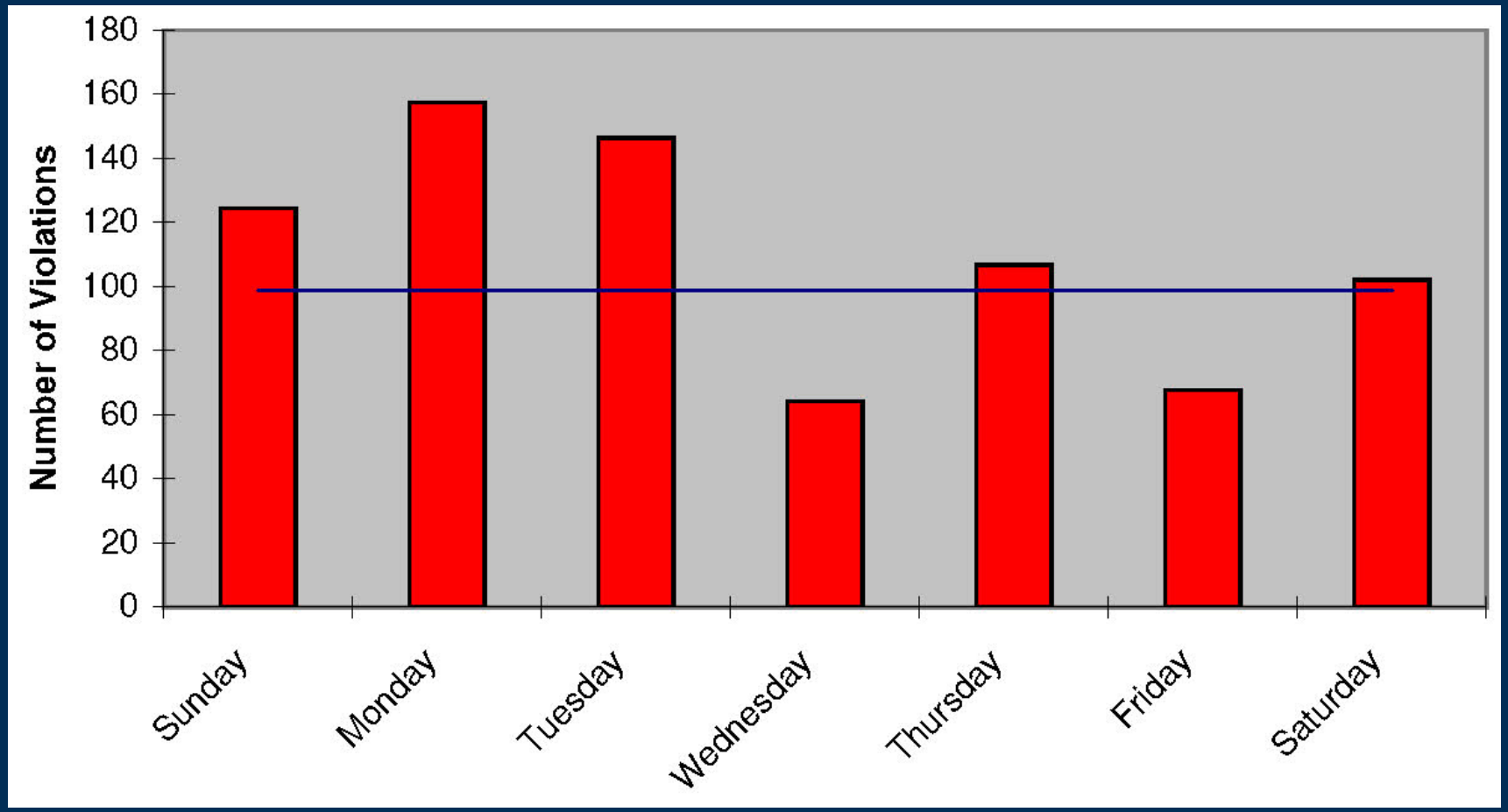
When Can It Be Called "Bad"?



Average Red Light Violations By Day of Week

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Conclusions

- The traffic signal display location affects driver behavior
- RLR engineering countermeasures need further evaluation
- Is there a driver “learning curve?” Optimal distance? Congestion effect? Typical rate?
- Need greater understanding of enforcement countermeasure (“halo” effect)

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Questions?

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