Lessons Learned from 45+ Years of Traffic Engineering Research

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University of New Mexico

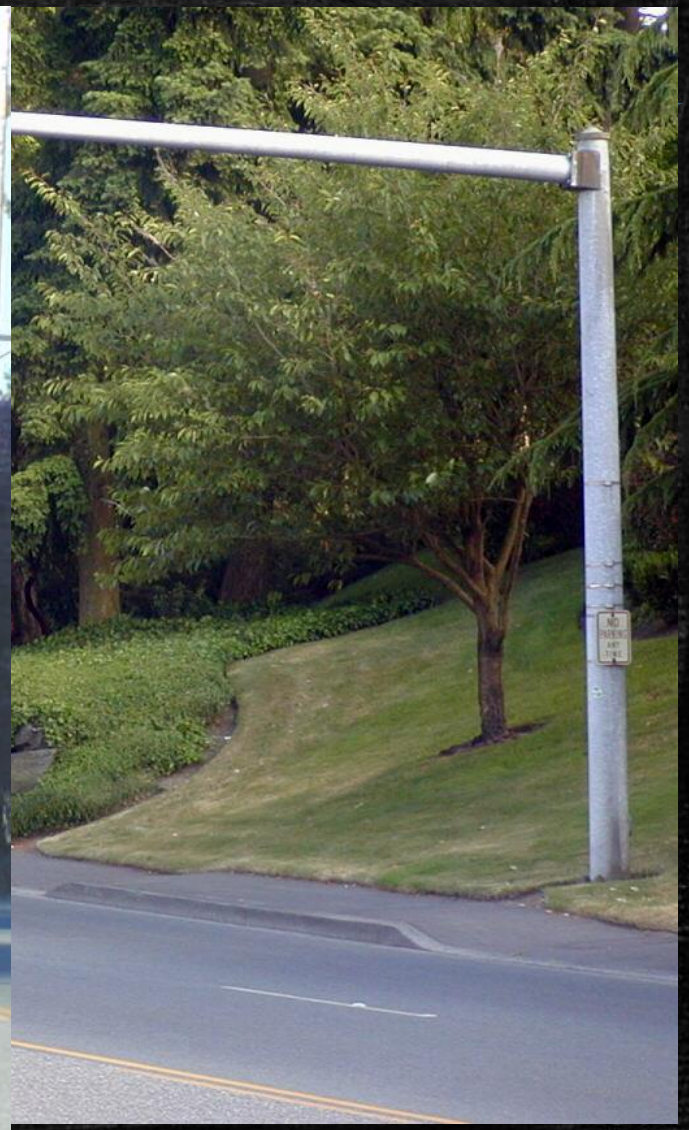

WELCOME
TO Fabulous
LAS VEGAS
NEVADA
YESCO

Background

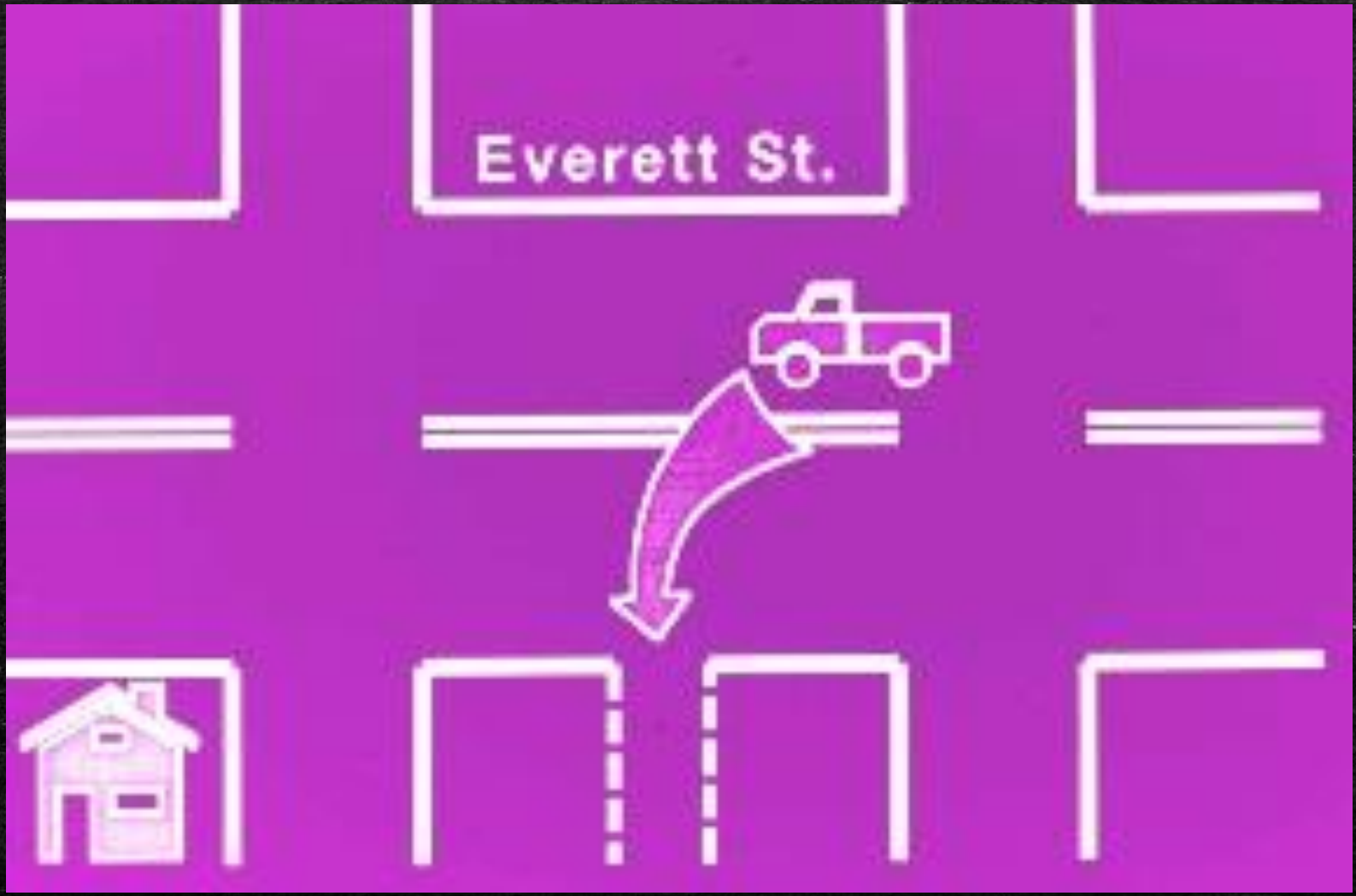
- Beginning June 1961, worked 4 summers for Oregon Highway Department
- BS degree, Physics, HMC
- MS Engineering, UW (1968)
- PhD Civil Engineering, UW (1969)
- University of Maryland (1970-77)
- FHWA, Summer 1971
- University of New Mexico (1977-2011)

1960's Two-Way Left-Turn Lanes

Expen$ive TWLTL



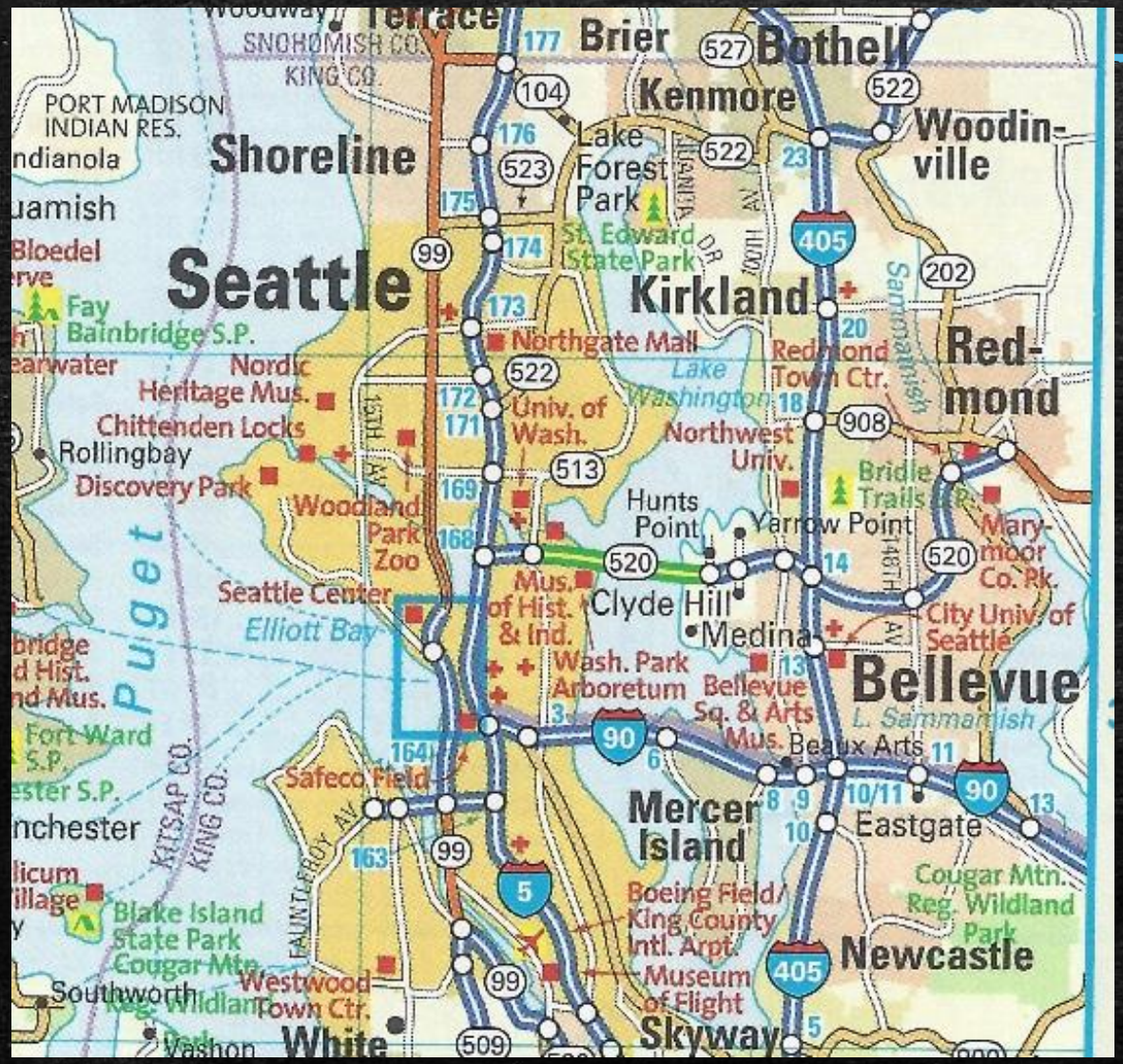
Make Sure that the Device is Legal

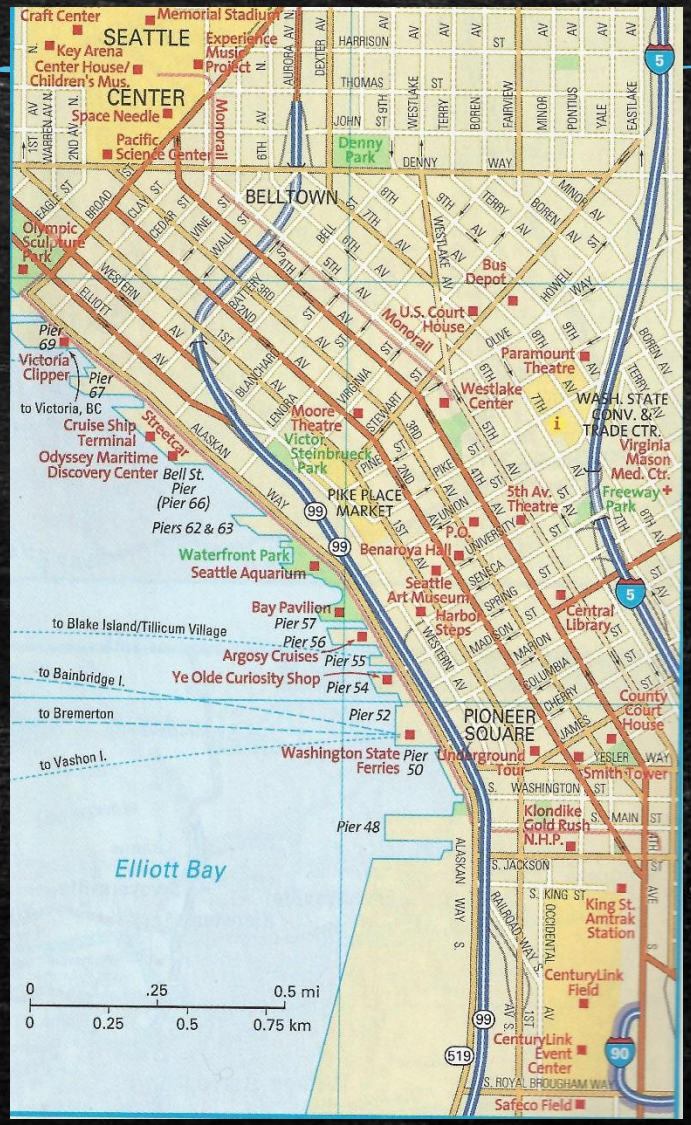


1960s Freeway Benefit Analyses

- Before-and-After study of
  - Travel time
  - Fuel consumption
  - Traffic accidents
- Select test routes through Seattle with intermediate checkpoints
- Five test vehicles, from small car to tractor-trailer

Test Routes


Brier
Bothell
Kenmore
Woodinville
Shoreline
Lake Forest Park
St. Edward State Park
Seattle
Kirkland
Northgate Mall
Redmond Town Ctr.
Redmond
Univ. of Wash.
Northwest Univ.
Bridle Trails
Hunts Point
Yarrow Point
Mary-moor Co. Pk.
Seattle Center
Elliott Bay
Clyde Hill
Medina
City Univ. of Seattle
Wash. Park Arboretum
Bellevue Sq. & Arts
Bellevue
Safeco Field
Mercer Island
Eastgate
Cougar Mtn. Reg. Wildland Park
Boeing Field/ King County Intl. Arpt.
Museum of Flight
Newcastle
Westwood Town Ctr.
Skyway
Southworth
Vashon
Blake Island State Park
Cougar Mtn.
Fay Bainbridge S.P.
Nordic Heritage Mus.
Chittenden Locks
Rollingbay
Discovery Park
Woodland Park Zoo
Fort Ward S.P.
Puget
Lake Washington
Lake Sammamish
PORT MADISON INDIAN RES.
SNOHOMISH CO.
KING CO.
KITSAP CO.


SEATTLE CENTER
Craft Center
Memorial Stadium
Key Arena
Center House/ Children's Mus.
Experience Music Project
Space Needle
Pacific Science Center
Monorail
Denny Park
BELLTOWN
Olympic Sculpture Park
Bus Depot
U.S. Court House
Paramount Theatre
Westlake Center
WASH. STATE CONV. & TRADE CTR.
Virginia Mason Med. Ctr.
Freeway Park
Pier 69
Victoria Clipper
Pier 67
to Victoria, BC
Cruise Ship Terminal
Odyssey Maritime Discovery Center
Streetcar
Bell St. Pier (Pier 66)
Piers 62 & 63
Moore Theatre
Victor Steinbrueck Park
PIKE PLACE MARKET
5th Av. Theatre
P.O.
Benaroya Hall
Waterfront Park
Seattle Aquarium
Seattle Art Museum
Harbor Steps
Central Library
Bay Pavilion
Pier 57
Pier 56
to Blake Island/Tillicum Village
Argosy Cruises
Pier 55
Ye Olde Curiosity Shop
Pier 54
to Bainbridge I.
to Bremerton
Pier 52
PIONEER SQUARE
County Courthouse
Washington State Ferries
Pier 50
Underground Tour
Smith Tower
to Vashon I.
Klondike Gold Rush N.H.P.
Pier 48
Elliott Bay
King St. Amtrak Station
CenturyLink Field
CenturyLink Event Center
Safeco Field
0 .25 0.5 mi
0 0.25 0.5 0.75 km

I-5 Through Seattle

Differential Truck Speed Limit

- Speed limits on MD Interstate Freeways
  - Passenger vehicles: 60, 65, and 70 mph
  - Trucks: 60 mph
- Rationale: large trucks require a longer stopping distance
- Problem: enforced differential increases the standard deviation of speeds
- Speeds monitored by vehicle type at 84 directional study sites

Field Data Collection

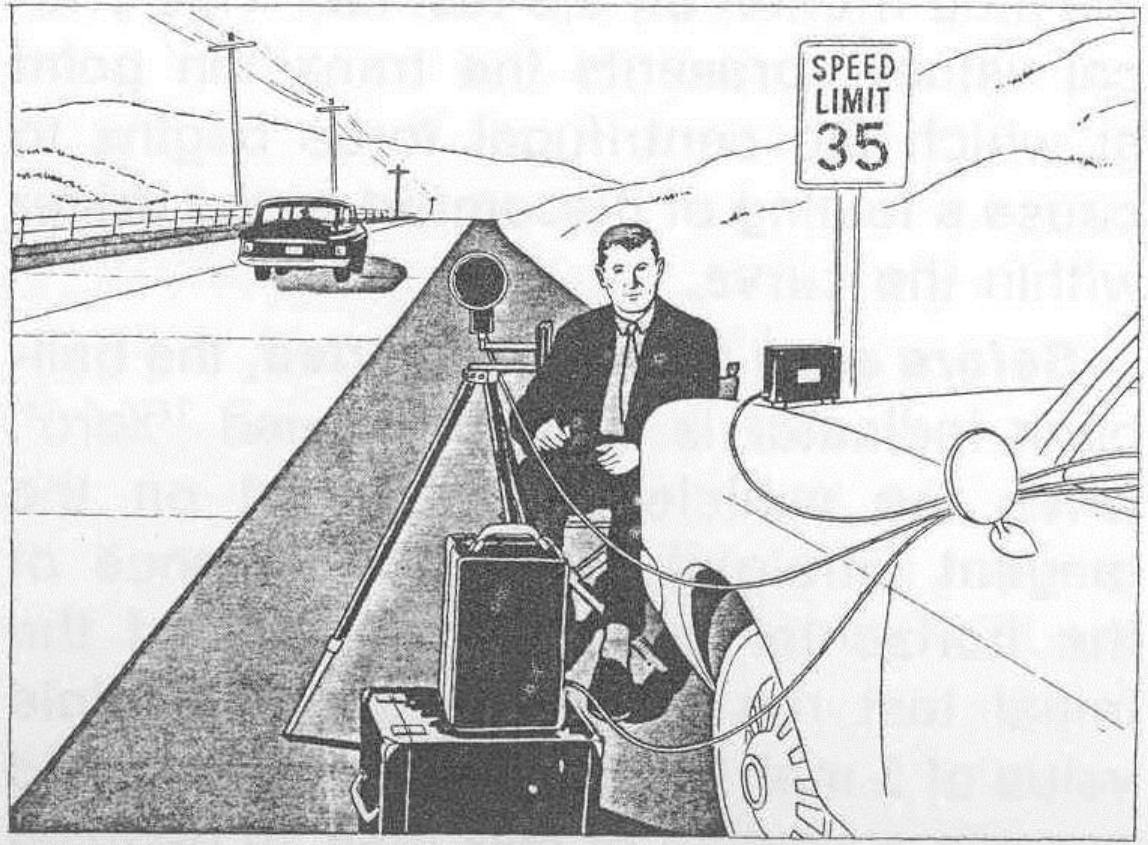
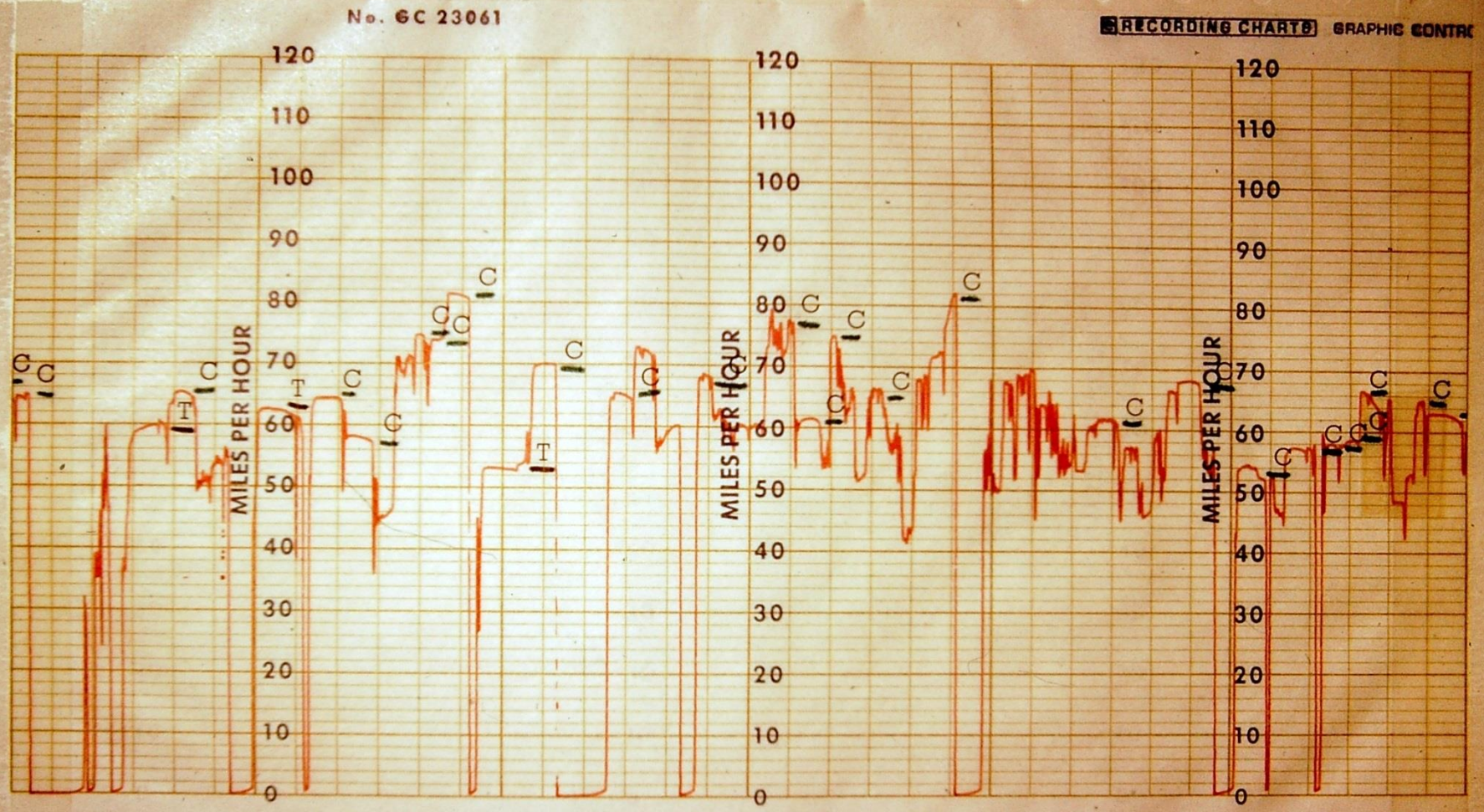


Fig. 6-4. Field setup with automatic speed measuring device.

1970s Era Radar

APPENDIX C

SAMPLE RECTI GRAPH RECORDER OUTPUT



Maryland Truck Size Limits

MD Roadside Hazards


The EM moment.
DISTRICT
MOVING & STORAGE


AMOCO

Signing for Real-Time Route Diversion

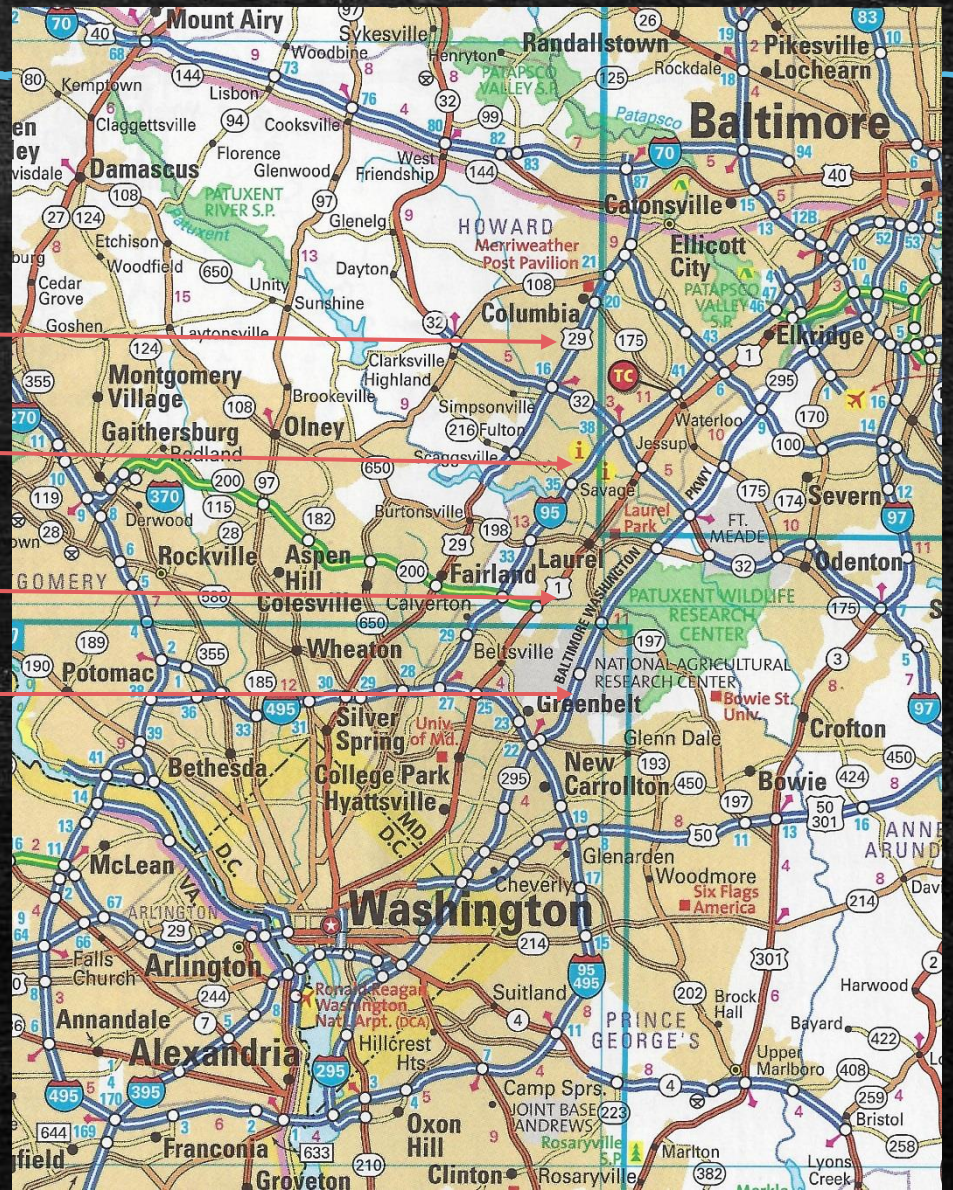
Four Routes

US 29

I95

US 1

BW Parkway



Five Candidate Signs

FREEWAY CONDITION

O Normal

O Congested

Next __2__ Miles

FREEWAY CONDITION

O Normal

O Congested

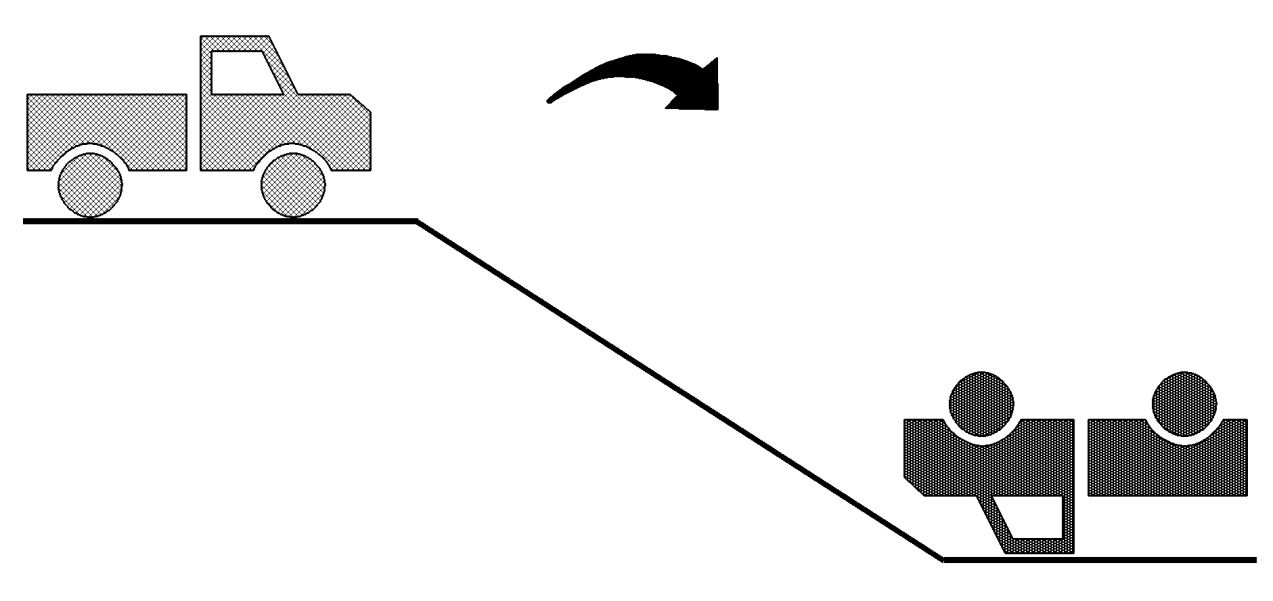
Use Alternate Route

Spring Avenue

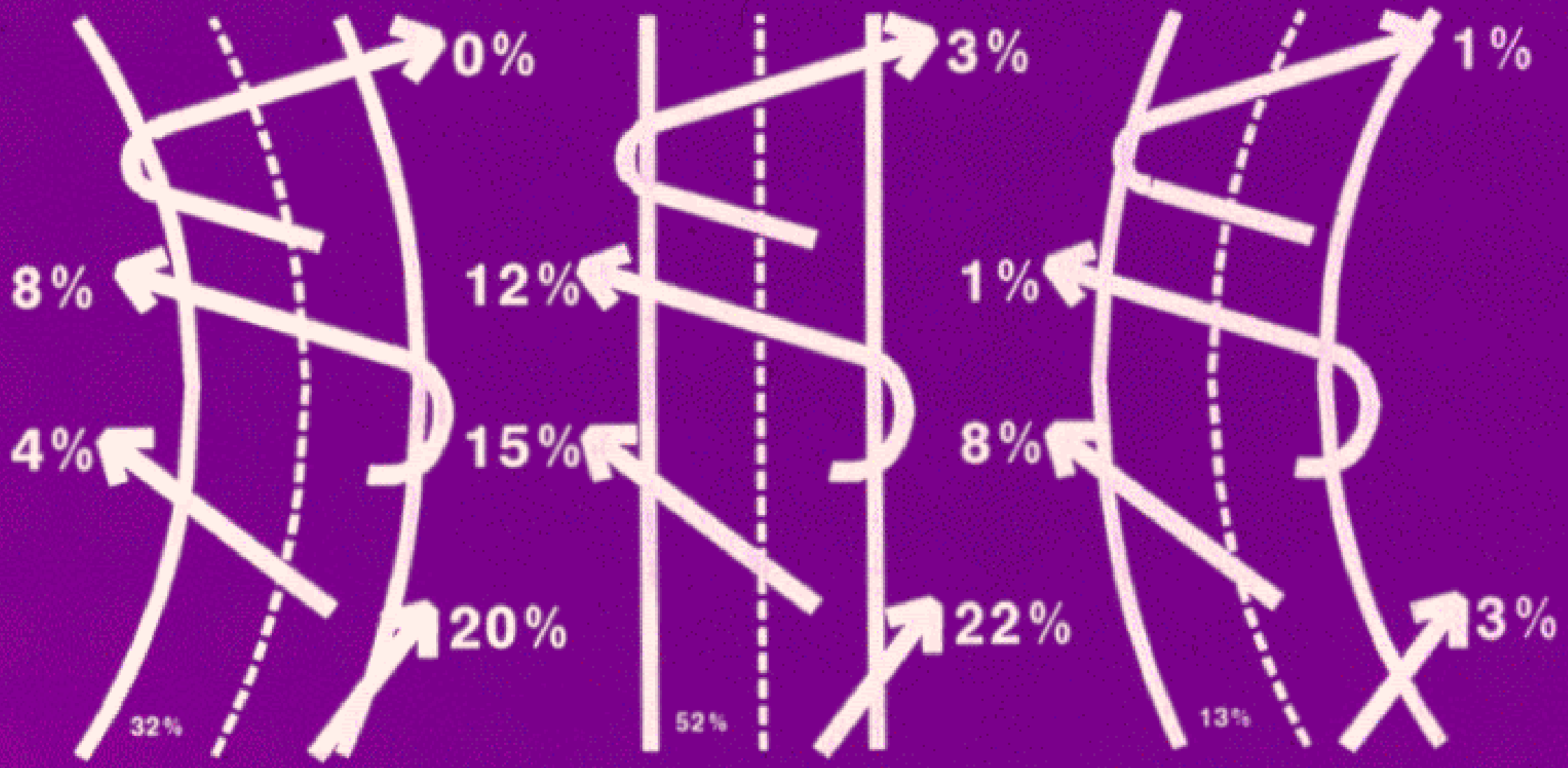
Distribute Survey on Interstate Ramp

NM Fatal Overturning Crashes

- IIHS-sponsored
- 151 sites
- Upstream comparison sites
- Steeper downgrades
- Sharper curvature
- Pickup trucks



151 Fatal Overturning Crashes



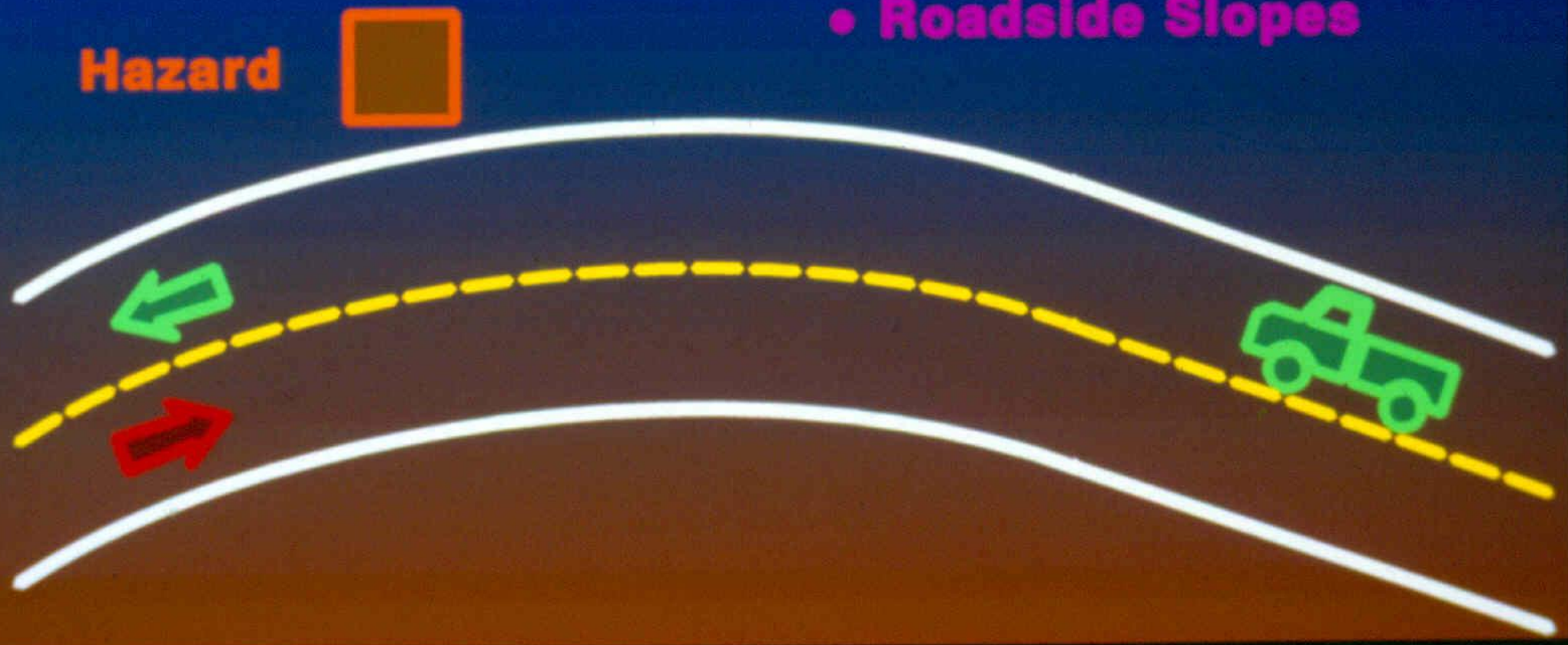
3% on Road

Guardrail Installation & Improvement

- Should priority be given to:
  - New installation where warranted
  - Bring existing guardrail to modern standards
- Field studies at guardrail and run-off-the-road crash sites
- Data collection similar to fatal OT study

Roadside Hazard Parameters

- Object Type
- Object Placement
- Roadway Alignment
- Shoulders
- Roadside Slopes



Rural Pedestrian Safety

Pedestrian Fatality Rates		
	US	NM
Per 100 mvm	0.37	0.77
Per 100 K Population	2.8	7.0
Per 100 K Drivers	4.2	10.0

San Juan – McKinley Counties, NM
12.5% of all NM accidents
20.9% of pedestrian accidents
35.0% of fatal pedestrian accidents

Pedestrian Accident Characteristics

	SJ/McK	NM
Non-Intersection	76%	68%
Fatal	26	13
Darkness	57	39
HBD	38	12

Possible Countermeasures

Shoulder Improvements	36%
Improved Lighting	29
Improved Signing	19
Visibility Improvements	12
Other	19

Rail-Highway Grade Crossings

- In 1982, NM had 845 public rail-highway grade crossings
- Field studies at 57 crossings with one or more accidents in 30-month period (23/yr)
- 35% had active control installed <u>after</u> the accident
- [By 2011, train crashes down to 6]

Typical Rail-highway Grade Crossings

What's Wrong Here?

Low-Cost Treatment for ROR Crashes

Engineering Factors in Alcohol-Involved Traffic Accidents

- 1984 study of 2528 fatal NM accidents
- Of 4105 drivers and pedestrians
  - 21.2% had been drinking (HBD), drunk
  - 11.3% HBD impaired
  - 9.6% HBD sobriety unknown
  - 57.9% not drinking/unknown
- Pedestrian: darkness and rural areas
- Horizontal curves more common

Wide Edgelines

- Use critical rate method to identify high ROR sections on NM's FAP and FAS
- Paint 8 inch wide edgelines on 19, keep other for comparison sites
- Treatment sites dropped 10%, from 1.59 to 1.43/mvm
- Comparison sites dropped 16%, from 1.59 to 1.34/mvm

Construction Zone Crashes

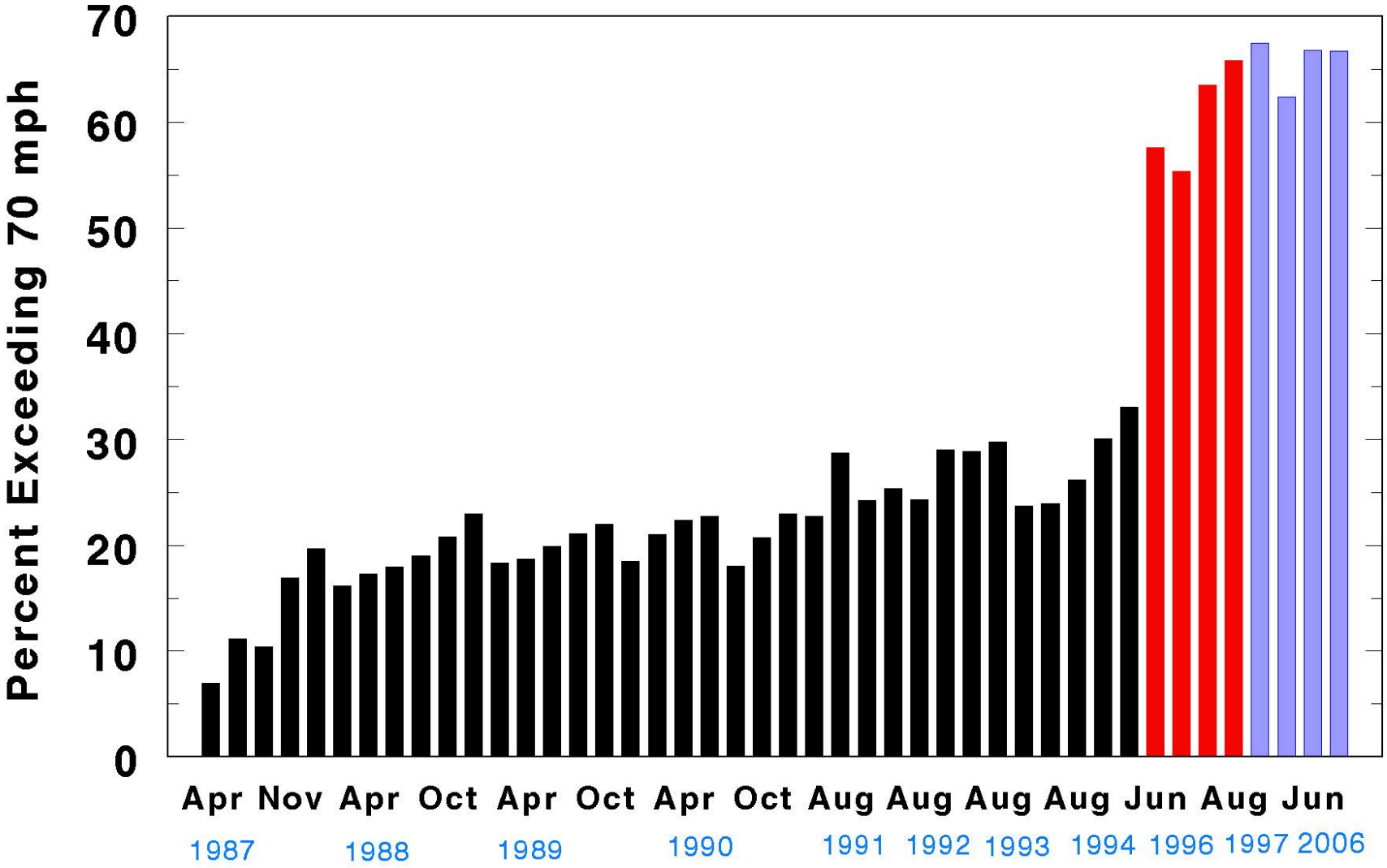
- Projects beginning between 1/83 and 12/85
- Drop *minor* projects
- 168 major projects on rural state highways
- Problem in identifying crashes
- Overall 26% accident increase during construction (33% on Interstate)
- *Following to close*, *improper lane change*, multiple-vehicle, rear end overrepresented

65 MPH Speed Limit

- April 2, 1987
- Installed 65 mph sign on I-25
- Contacted by IIHS
- Series of studies on urban and rural Interstates
- Initially, 7% > 70 mph
- By April 1995, 32% > 70 mph

NM Rural Interstate Speeds

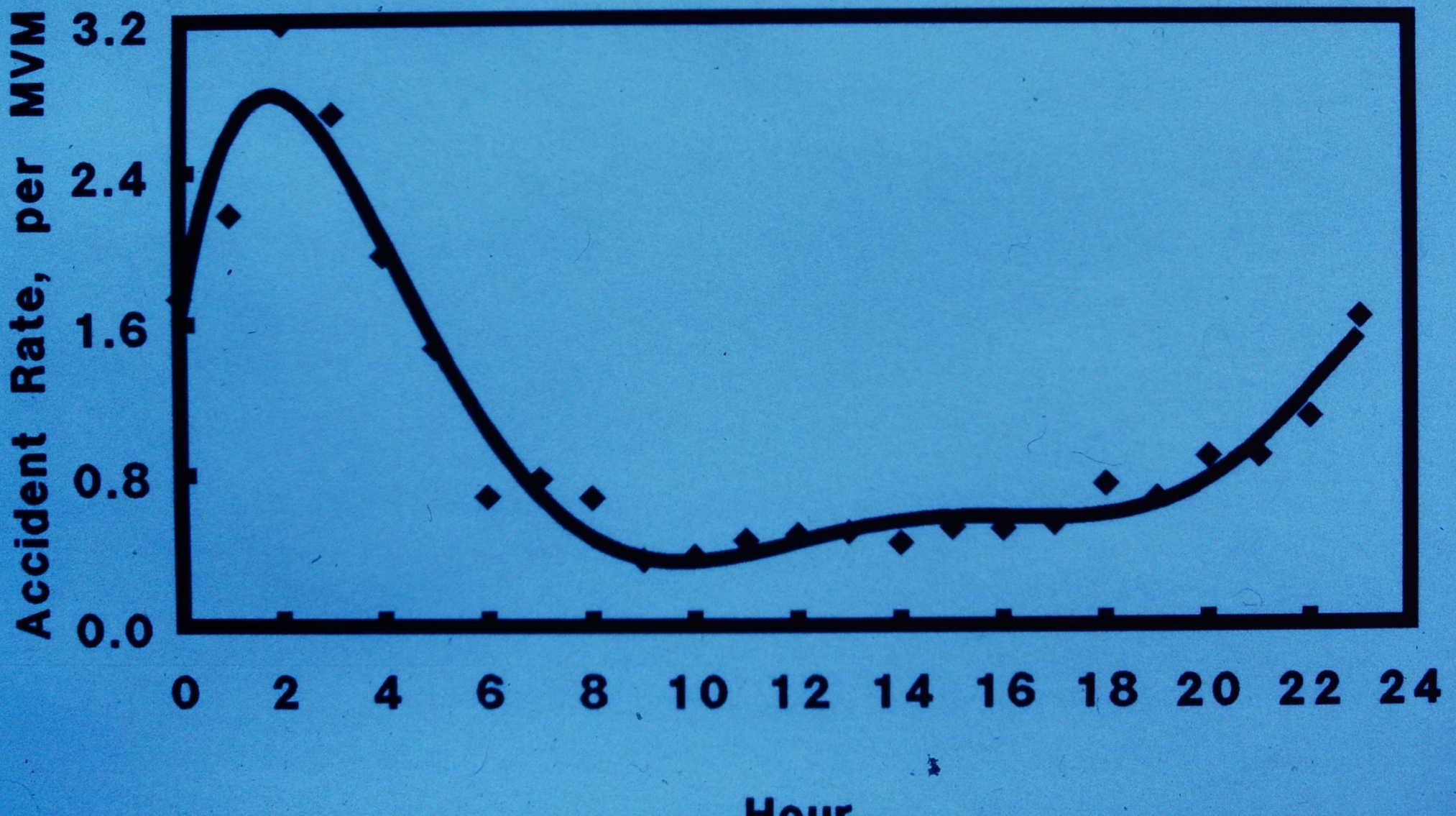
April 1987 - October 2007



Hourly Traffic Volumes and Accident Rates

- Hourly volumes from 44 rural permanent count stations
- 1985-87 accidents on a 10 mile segment surrounding these stations
- Peak hour for accidents is 6 pm with 6.3%, followed by 7 am and 5 pm with 5.6% each
- Minimum at 4 am with 2.7%
- Peak rate was 3.2/mvm at 2 am

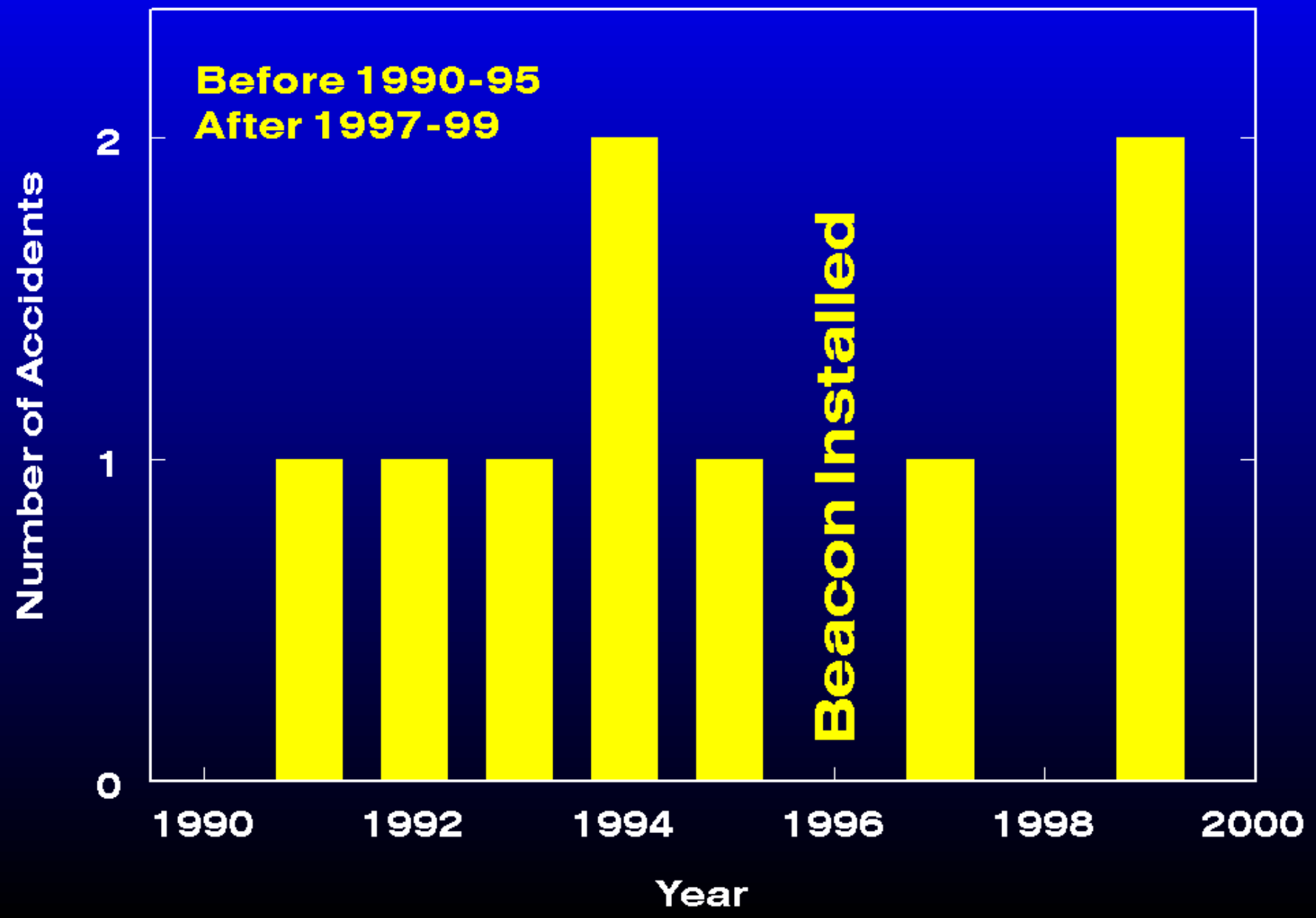
1985–87 Accident Rates
Near Permanent Count Stations



Guidelines for Beacon Installation

- Western state survey – most relied on MUTCD
- Consider speed, sight distance, crash experience, and roadway parameters
- Intersection beacons *may* reduce crashes by 20-30%
- Most NM beacons were in the southeast quadrant, adjacent to Texas

Accidents Before and After Beacon Installation



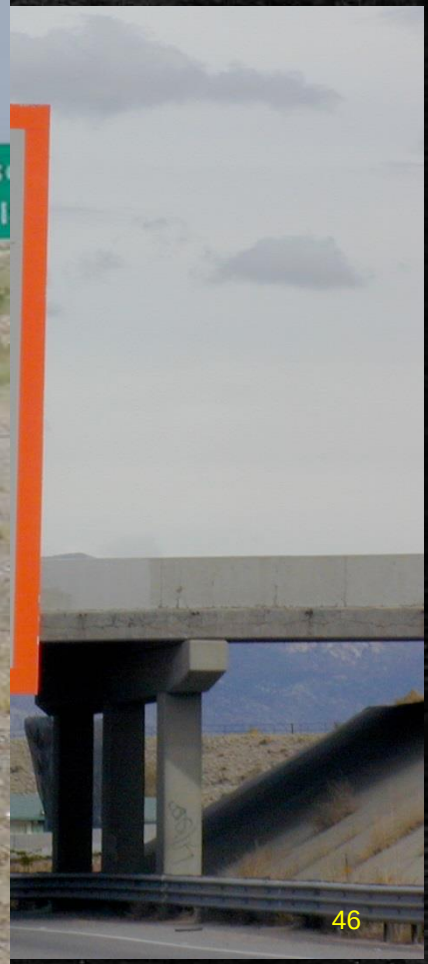
1990 Labor Day Edition of *USA Today*

- 1988-89 FARS data
- "You are more likely to die on the highways of New Mexico than in any other state in the USA. And if you do die in an accident, chances are someone was drinking."
- Analyzed 1345 counties with Interstates
- NM had 8 of the top 100 counties
- Reanalysis found numerous problems

Controlling Speeds in Work Zones

- City Streets

Freeway Work Zones



History of the Interstate Highway System

- Original paper at the 2006 District Meeting
- Series of 15 WesternITE articles, available at www.unm.edu/~jerome
- Western Highlights of Interstate, 2011 District Meeting


COMPLETE
STOP
PLEASE


Whoa!
3-WAY