ITS and Work Zones

ARTBA Work Zone Conference
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Work Zone Team

Presentation Outline

- What is Work Zone ITS?
- Why Use It?
- Examples of Applications
- FHWA WZ ITS Activities

What is *Work Zone* ITS?

- Use of technology to support effective work zone management and operations
- Used both in and around work zones
- Can have a safety or mobility main focus, but often supports ***both***
- Portable and temporary in ***most*** cases

What is *Work Zone* ITS?

Includes some combination of:

- Input devices: Sensors, cameras
- Output to: VMS, websites, highway advisory radio, pagers, 511, a TMC
- Via a local PC, a virtual TMC, or a TMC

What is *Work Zone* ITS?

Users of information may include:

- DOTs
- Public and road users
- Media outlets
- Contractors
- Trucking companies
- Emergency services providers
- Motorist assistance patrols
- Third party traveler information providers

Why Use Work Zone ITS?

- The effects of road work on road users and workers are increasing.
- We are seeing:
  - More congestion on our roads
  - More work zones
  - More lost lives
  - Growing exposure
  - Growing public frustration

Why Use Work Zone ITS?

Because it can help:

- Improve safety, mobility, traveler satisfaction, incident response, relationship with emergency responders
- Reduce congestion, crashes, secondary crashes, complaints from the public

Work Zone Mobility and Safety are Linked

As congestion builds in and approaching work zones, crash rates increase.

One state found that the largest single fatality cause over the last 10 years in its work zones has been end of queue crashes.

Most frequent type of crashes in work zones are rear-end crashes

ITS Applications in Work Zones

- Traffic monitoring and management
- Traveler information
- Incident management
- Tracking and evaluation of contract incentive/disincentives
- Worker safety/protection
- Speed management and enforcement

Example ITS Work Zone Applications

- Traffic monitoring and management
  - Sensors, queue detectors, counters, cameras and VMS
  - Dynamic “no passing zone” at taper based on traffic conditions
- Traveler information
  - Alternate route information
  - Estimated delay (time, distance)
  - Notification of stopped/slowed traffic

I-95 Outside of Fayetteville, NC

- Deployed May 2002
- 6 sensors to monitor real-time traffic conditions
- Data used to calculate delay
- Delay info automatically displayed on CMSs and website (map, CMS messages)
- 6 cameras to gather additional condition info, verify system CMS messages

I-95 Outside of Fayetteville, NC

- When delay > threshold, alternate route info also given on CMS
- Traffic signal added to alternate route to handle increased flow during diversions
- Results:
  - Before: NB Queues of 3.5 to 4 mi and SB Queues of 2.5 to 3 mi during lane closures
  - **After: Queues 1 mi or less**
  - ITS considered major contributing factor

Dynamic Lane Merge

Creates a dynamic no-passing zone based on detected traffic volume and back-ups

- Sensors detect traffic conditions
- Next upstream sign activated when traffic threshold met
- “Do Not Pass When Flashing”
- Signs are regulatory and enforceable

Interstate North of Detroit, Michigan

- Used to improve traffic flow, prevent dangerous merging
- System reduced travel time delays, number of crashes, aggressive driving during AM and PM peak periods
- Study found the system effective for roads with moderate traffic volumes

$120,000 cost for system

Work Zone Incident Management

Albuquerque Big I

- Cameras, some detectors
- Temporary TMC co-located with police substation
- HELP trucks patrolling, wrecker on call

Used to:

- Quickly detect incidents, call for appropriate, efficient response
- Guide drivers through work zone and detours

Big "I" Construction Intelligent Transportation System

Coordination with Emergency Services

Smart Work Stations

ITS Control Center

H.E.L.P. Patrols

Benefits of Using ITS at the Big I

- **Mobility**
  - Incident clear time reduced from 45 minutes in past to 25 minutes in work zone
- **Safety**
  - Less incidents than expected (7% increase during WZ)
- **Cost savings**
  - Help ensure response is commensurate with incident to save costs and avoid clogging roadway
  - Automation
- **Improved relations** with incident response community
- **Better public relations**/better informed public

Tracking and Evaluation of Contract Incentive/Disincentives

Arizona SR 68 travel time system

Rural corridor: Major route for commuting casino workers, recreational users, trucks

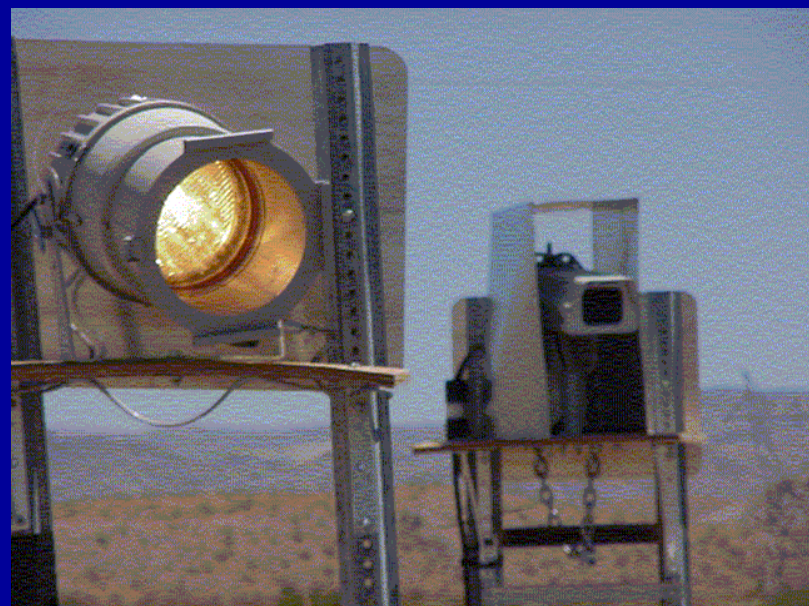
Arizona State Route 68

Why use ITS?

- Lengthy delays during past projects significantly impacted the public
- No viable alternate routes, so ADOT focused on reducing travel time in WZ
- To assess contractor compliance with travel time incentive/disincentive

Arizona State Route 68

- Avg travel time before WZ = 17 minutes
- Contractor required to keep average travel time to < 27 minutes
  - Otherwise $400k incentive pool reduced
- License plate reader system used to measure travel times



Arizona State Route 68 - Results

- Greater contractor participation in and commitment to keeping traffic moving
  - Limited number of flagging stations
  - Scheduled work to reduce impacts to travelers
- Incentive pool only charged about $15,000
  - System helped keep traffic moving
  - Contractor received most of the possible $400k incentive

Worker Safety/Protection

Work space intrusion alarms

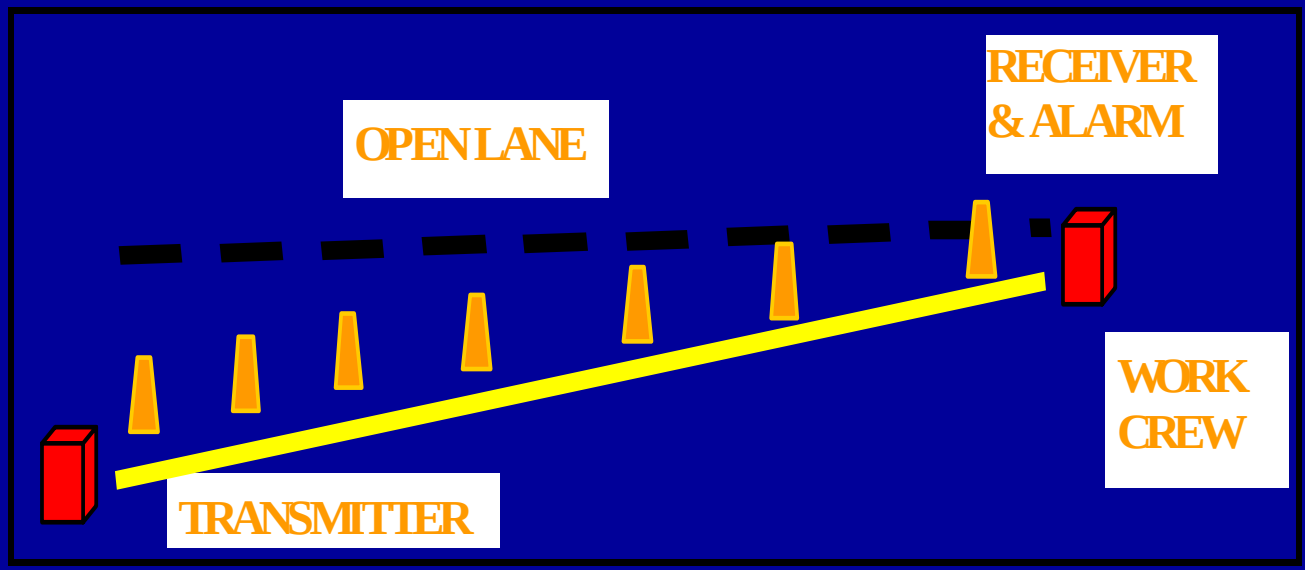
- Detect vehicles entering buffer area between work crews and passing vehicles
- Sound a warning alarm to alert workers and drivers
- Not extensively used to date
- Some deployments:
  - During rehab of 8 miles of U.S. Rte 22 in Pennsylvania
  - Some projects on I-64 in West Virginia

Example of One Type of Intrusion Alarm

Transmitter

Receiver

Intrusion Alarm Layout



Sensors need to be carefully aligned

For More Information:

http://www.ops.fhwa.dot.gov/wz/workshops/author-index.htm

Example of Another Type of Intrusion Alarm

Activates and sounds alarm:

- Upon direct vehicle impact. (shock)
- When tilted 90 degrees from vertical. (tilt)

Can be used on cones, drums, barricades…

Speed Management and Enforcement

- Variable speed limits
- Automated enforcement

Technology-assisted speed enforcement with VSL (NCHRP project in PA)

Automated Enforcement

- Help address limited space in WZs
- Move enforcement activity outside the WZ
- May require changes to law
- Need to overcome public/political opposition

Variable Speed Limits in Work Zones

- Enables an agency to automatically adjust speed limit based on changing conditions
  - Whether workers are present
  - As traffic flow changes
  - Weather (fog, rain, ice)
- May result in
  - More credibility of speed limits
  - Increased compliance
  - Improved safety
  - Improved traffic flow

Work Zones and ITS Architectures

National ITS Architecture: Framework for electronic exchange of information

- Maintenance and Construction Operations (MCO) User Service
  - Work Zone Management & Safety is 1 of 4 areas covered by MCO
  - Published in Federal Register in 2001
  - Anticipated WZ ITS use can be included in Regional Architectures to facilitate design, integration

Work Zones and Regional ITS Architectures

Considerations for including WZ ITS:

- Length of deployment: How temporary is it?
- Connectivity: Will the WZ ITS tie into something or be standalone?
  - TMC
  - Existing Website
  - 511 Traveler Info
  - 911 Call Center
  - Transit Center

FHWA ITS in WZ Activities

- Cross-Cutting Study
- Case Studies
- Implementation Guide
- VSL Field Operational Test
- Assessment of Effectiveness
- Evaluation Criteria
- Training Needs

WZ ITS Cross-Cutting Study

- 4 sites
  - Albuquerque, NM Big I (I-40 & I-25)
  - Lansing, MI I-496
  - Springfield, IL I-55
  - West Memphis, AR I-40 near I-55
- Additional research/information gathering on other applications
- Brochure and Report developed

FHWA-OP-01-043 and FHWA-OP-02-025

Challenges/Lessons Learned

- Communications must be reliable
- Allow start-up time
- Need to develop public awareness
- Information must be accurate (public credibility)
- Involve partners early
- Carefully gauge amount of information delivered
- Portability can be key
- Systems must be maintained
- Lack of data analysis done to quantify benefits

Benefits

- Improved mobility and traffic management
- More informed public
- Quicker incident response
- Greater safety of workers and travelers
- Better PR and relationships with other stakeholders
- Enhanced speed management
- Potential for cost savings
- Better understanding of traffic conditions

WZ ITS Case Studies

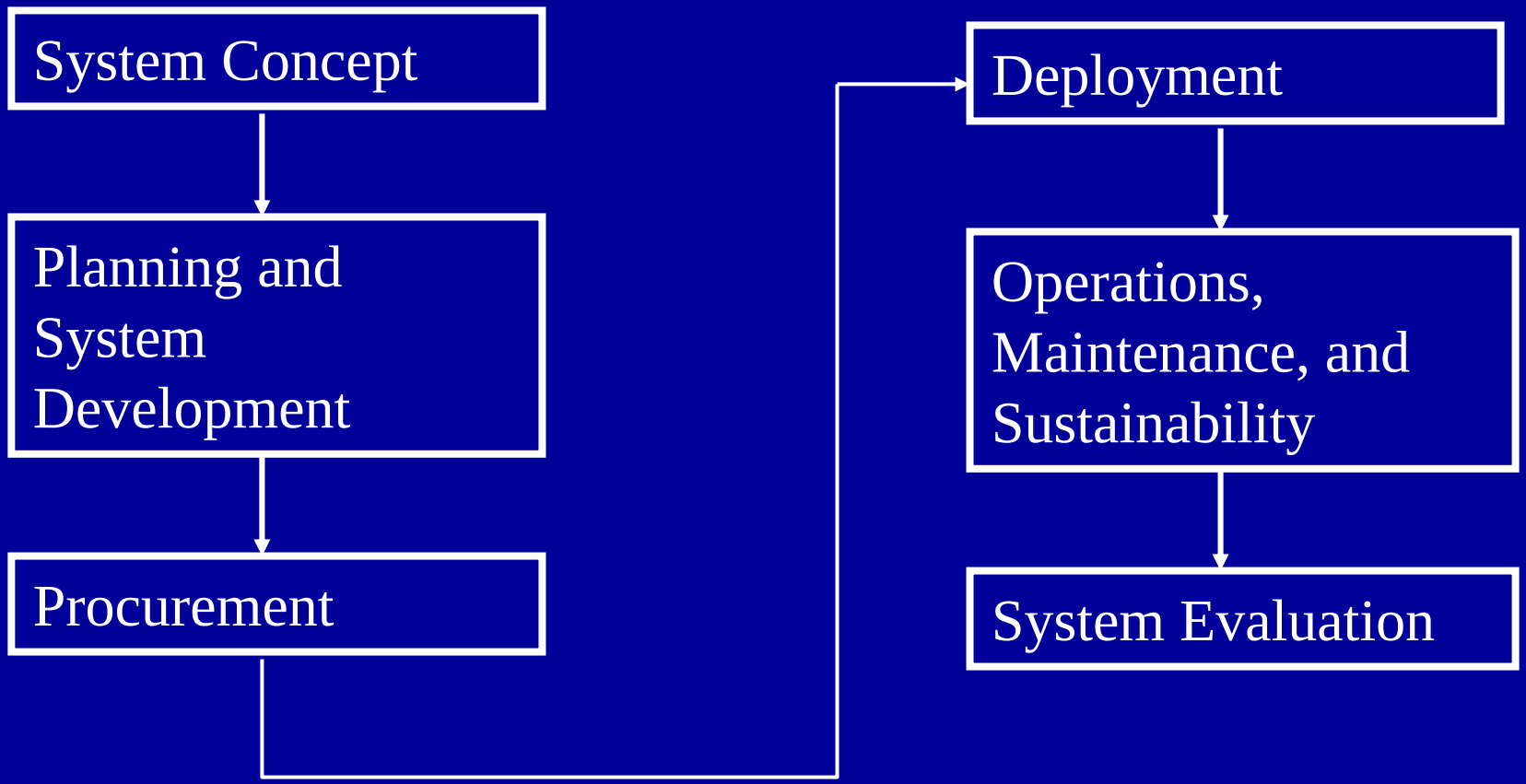
- Highlight 4 successful applications
  - Incident Mgmt System, Albuquerque
  - Traffic Mgmt & Traveler Info System, Springfield, IL
  - Contract Incentive Monitoring, Arizona
  - Dynamic Lane Merge, Detroit
- Provide more detailed information
- 4 individual reports, about 15 pages each
- 1 available now, others later in Nov 2004

FHWA-OP-04-072

Implementation Guide

- Provide guidance for implementing ITS in work zones
- Share knowledge and lessons learned from those experienced with ITS in work zones
- Available in early 2005

Implementation Guide



VSL Field Operational Test

- State self-evaluations, independent national evaluation
- Evaluate effectiveness and benefits
- Locations
  - Michigan
  - Maryland
  - Possibly a 3rd site

VSL Field Operational Test - Michigan

Assessment of Effectiveness

- Gather quantifiable results on effectiveness of ITS in work zones
- Look at mobility (delay, queue length) and safety measures, delivery of traveler info
- 6 sites where ITS is deployed in a work zone
  - NC site (I-40 in Winston-Salem)
  - AR site (I-30 between Benton and Little Rock)
  - MI site (US 131 in Kalamazoo)
  - Selection of other sites in process

For further Information/Resources:

www.fhwa.dot.gov/workzones

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Goal of FHWA Work Zone Program

Reduce congestion and crashes due to work zones

Additional Background Information

What We've Learned

Snapshot of work zone activity

(State DOT web sites)

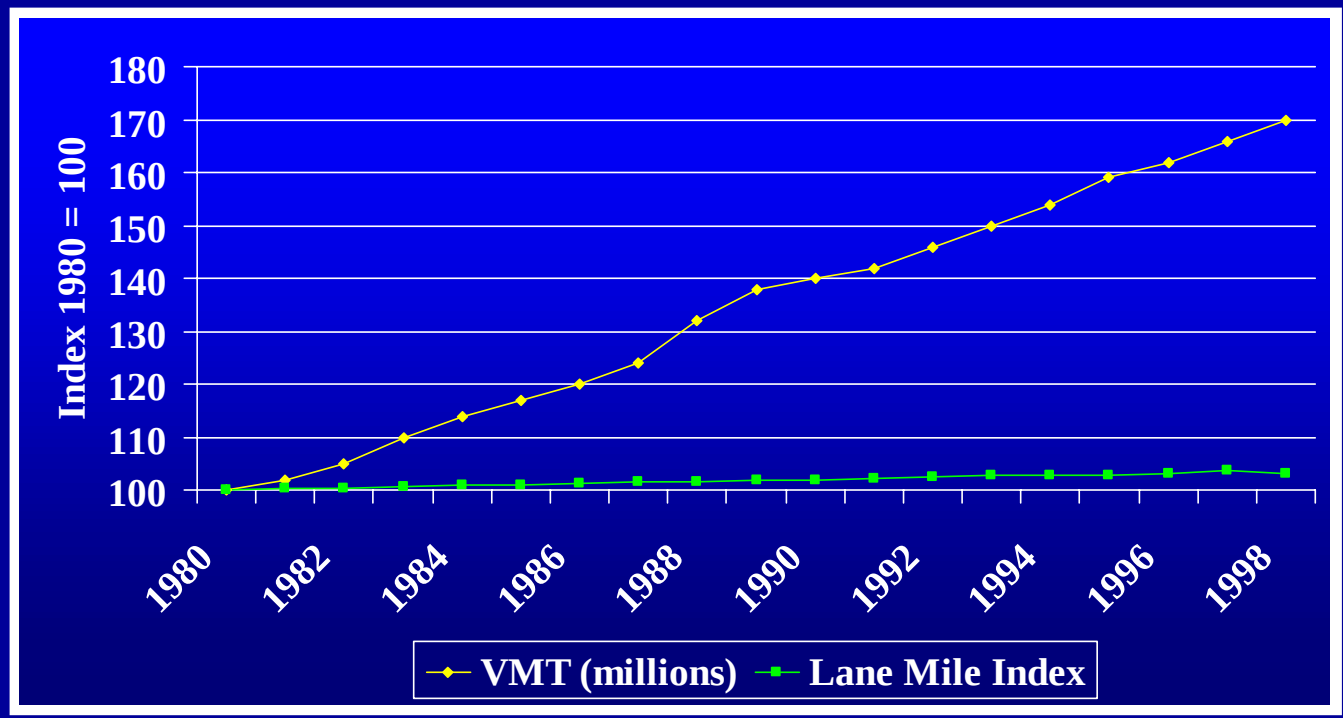
Attribute	Winter	Summer
Paving Work	13%	26%
Lane Closures	9 hours	11.8 hours
Impact on NHS	6.9%	20.9%
# of Work Zones	3,312	6,472
Lost Capacity (freeway lane miles)	3,357	6,157

More Congestion on our Roads

1980-1998

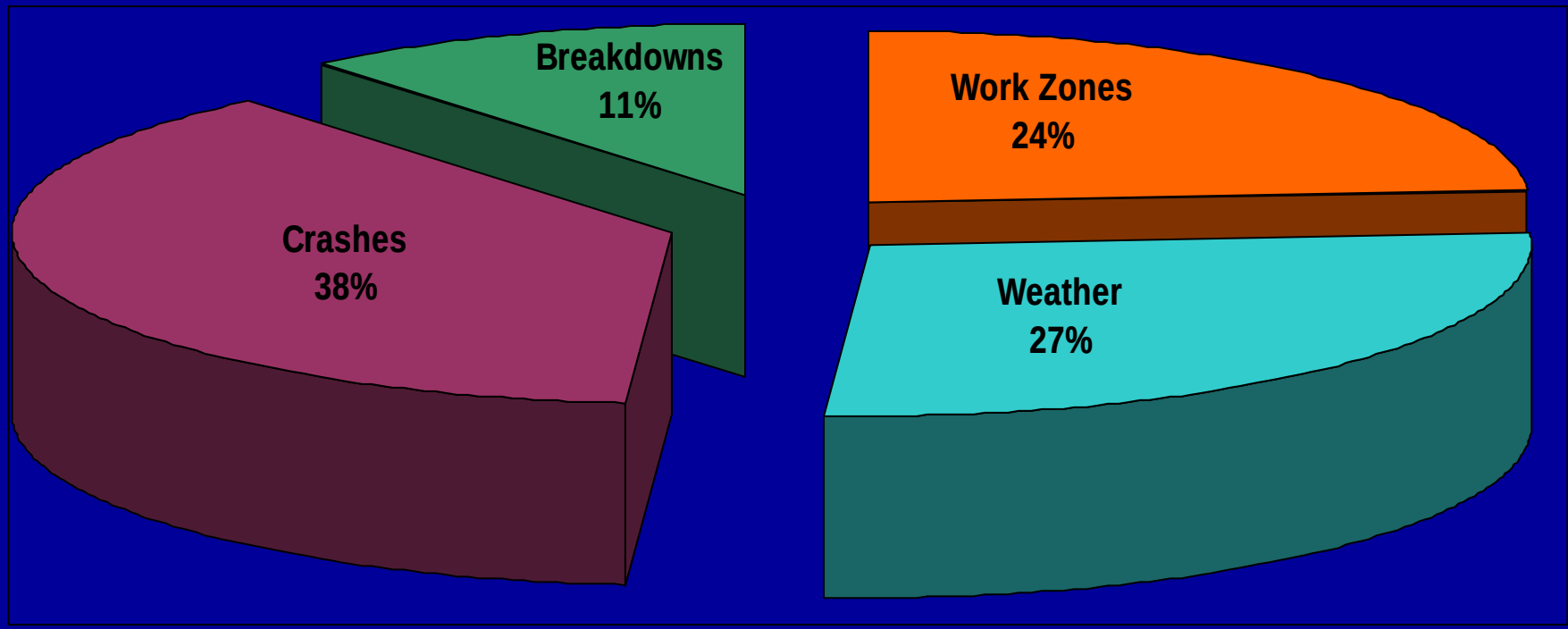
Vehicle Travel up 72%, Road Miles up 1%

- We're traveling more miles without increasing highway capacity significantly.



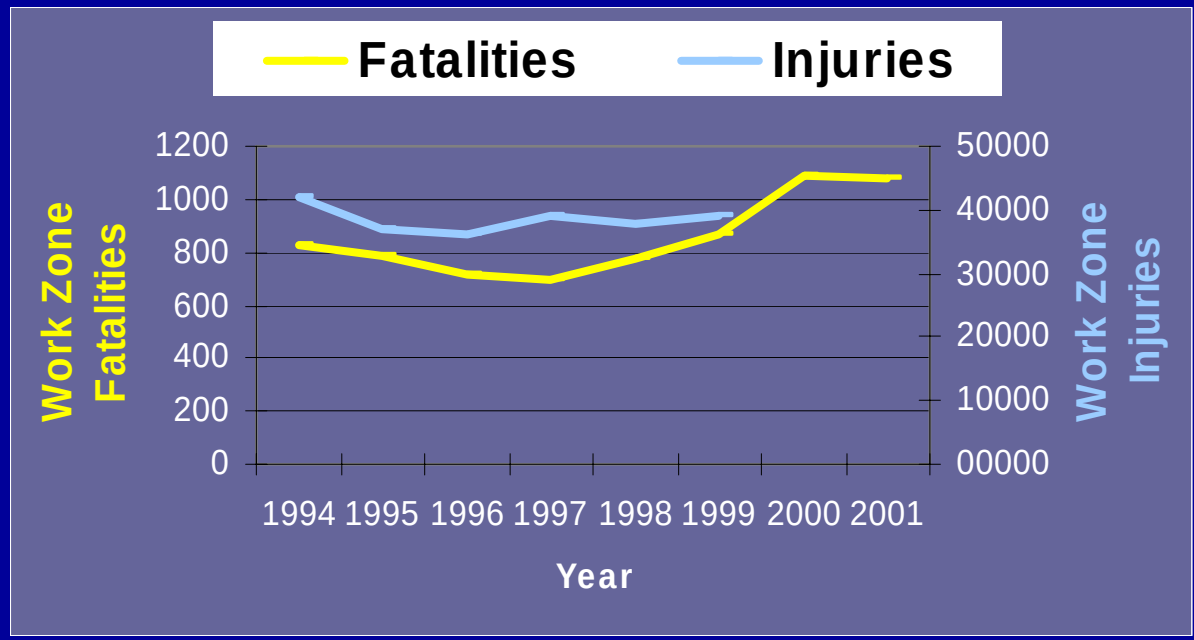
What We've Learned

Work zones are 24% of non-recurring congestion



Work Zone Fatalities Have Increased

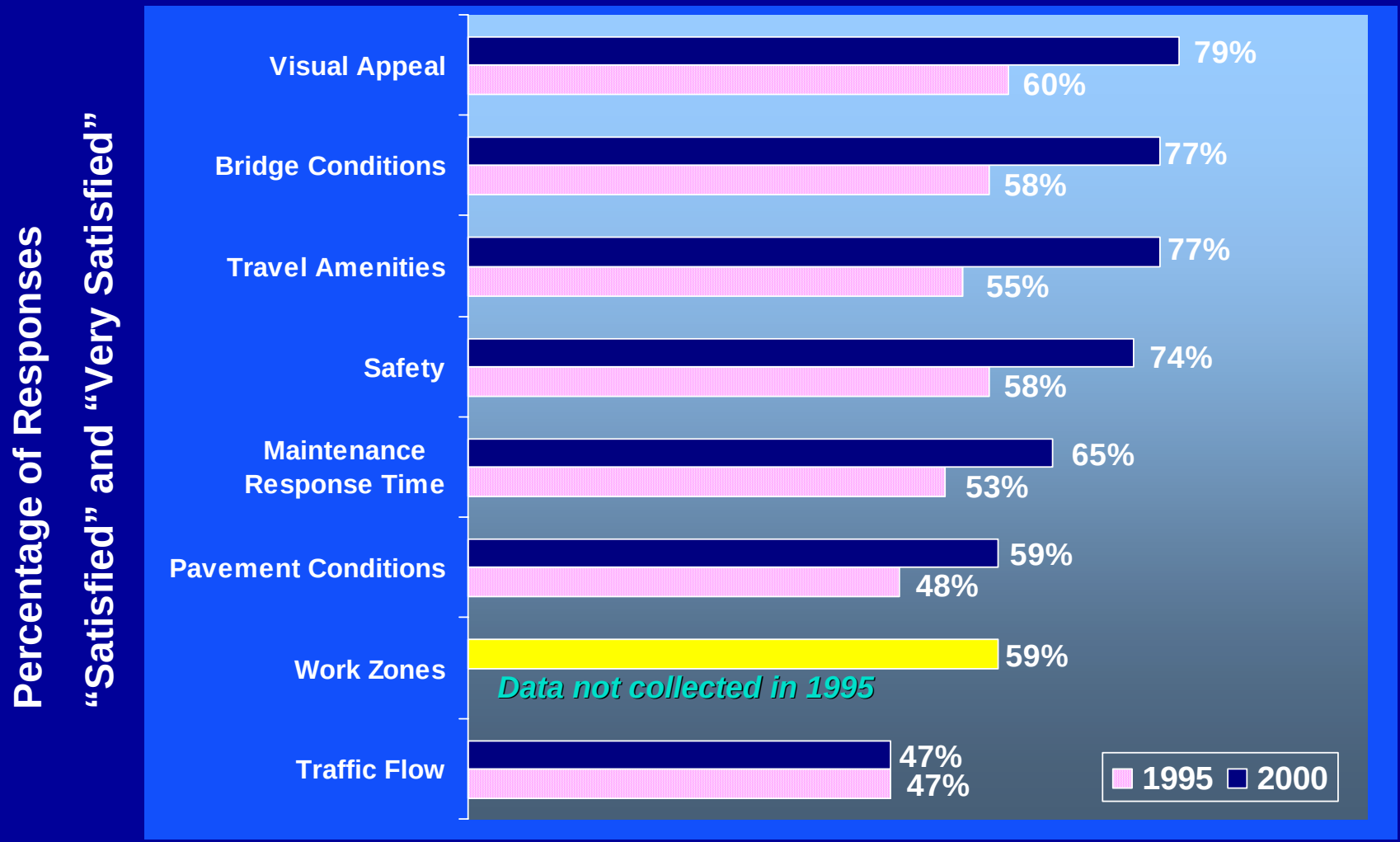
- Average more than 800 fatalities per year, with a high of 1,079 in 2001.
- In 1999, approximately 39,000 people were injured in work zones crashes.
- 120 to 130 workers die per year in road construction activities.



Growing Exposure

- Growing portion of roadwork is done under traffic
  - Share of highway capital outlay spent on system preservation rose from 47.6% in 1997 to 52% in 2000
- Working under traffic means more exposure of workers and road users

Increased Public Concern
Second Lowest Level of Satisfaction



Source: *Moving Ahead: The American Public Speaks on Roadways and Transportation in Communities* (which can be found on the FHWA web page at http://www.fhwa.dot.gov/reports/movingahead.htm)

What We've Learned

Attributes Reported on the Web

(Sample of 20 State DOT websites - Summer 2001)

Purpose	77%
Project start/end dates	71%
Length (miles)	18%
Lane closures or work activity by time of day	22%
Expected Delay	26% say whether or not to expect any delay 7% gave quantitative estimate