

# Bridge Construction-Related Deaths in West Virginia, 1990-1999:

## *Recognition of a Problem and Resulting Corrective Actions*

By **JAMES C. HELMKAMP** and **WAYNE J. LUNDSTROM**

**A** historical review of West Virginia's occupational fatality data by the Fatality Assessment and Control Evaluation (FACE) Program, a NIOSH-funded cooperative agreement research program, identified five bridge-construction-related deaths (SIC 1622 - bridge, tunnel and elevated highway) that had occurred in the state during the 15-month period of October 1996 through December 1997.

Further investigation revealed that 51 work-related deaths in the state had occurred in the construction industry (SIC major groups 15, 16 and 17) during the five-year period 1994-1998, resulting in a fatality rate of 29.9 per 100,000, which is more than twice the country's 14.4 rate. Nearly 14 percent (seven of 51) of these deaths were in SIC 1622, compared to only two percent (113 of 5,400) of the national construction-related deaths. The resulting state fatality rate for this construction subgroup was more than seven times the national rate, 349.3 per 100,000 and 44.9, respectively (WVBEP; BLS 2000 a,b,c).

### CONSTRUCTION ACTIVITY

Figure 1 shows that an average of nearly \$330 million in construction contracts were entered into annually by the WV Div. of Highways (WVDOH) during the 1990s, with those related to bridges

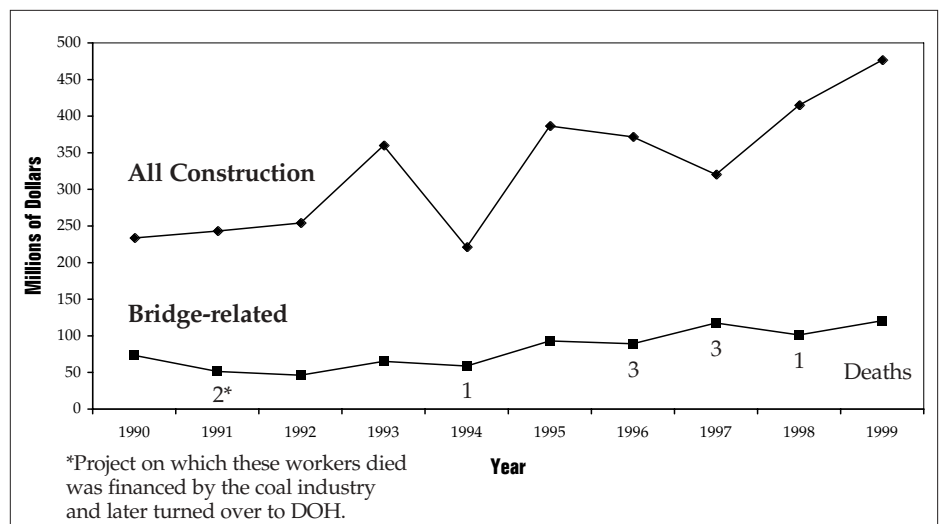
accounting for about one-quarter of those contracts in any one year. Bridge work includes new and temporary bridge construction; cleaning, painting and renovation of existing bridges; and demolition and dismantling of old bridges.

Overall, the total amount of construction contracts has shown a steady growth of about 10 percent (\$24M) per year. Bridge-related contracts have also steadily increased despite several fluctuations,

which WVDOH attributes to factors such as special funding initiatives from Congress, shifting priorities, delays in letting contracts, federal fiscal year and budget negotiations, and carry over from previous years (WVDOH).

About 34,000 people are employed annually in West Virginia in construction, with 350 to 400 employed in the state's bridge, tunnel and elevated highway industry sector (WVBEP).

**FIGURE 1 Construction & Bridge-Related WVDOH Contracts**



Source: Contract Administration Div., Div. of Highways, WV Dept. of Transportation.



**About 34,000 people are employed annually in West Virginia in construction, with 350 to 400 employed in the state's bridge, tunnel and elevated highway industry sector.**

This surveillance net was expanded to identify all bridge-construction-related deaths that occurred in WV during the 1990s and to describe the circumstances of those fatal incidents. This review encompassed an examination of corrective actions and preventive measures taken by state agencies, labor groups, contractors and the federal government to improve safety at bridge construction sites. This article is a synopsis of the findings.

#### **RESEARCH METHODS**

To identify potential bridge-construction-related deaths, a keyword search [i.e., *bridge* for items 30d (describe how injury occurred), 30e (place of injury) and 30f (location), and *construction* for item 12b (kind of business/industry)] was conducted on the death certificate file by the WV Vital Registration Office. [Note: *injury at work* (item 30c) had already been established.]

Case summaries for each verified death were developed based on information from several additional sources, including medical examiner, FACE and police reports, newspaper clippings, and OSHA inspection and investigation reports. Basic demographic, safety program, protective equipment and training

information, incident narrative and OSHA violations were reviewed for each fatality as well.

Information on corrective and preventive strategies were obtained from several sources including OSHA, the Laborers' Health and Safety Fund of North America (LHSFNA) (Lapping), Laborers' District Council of West Virginia (LDCWV), Mid-Atlantic Laborers' Employers Cooperation Education Trust (LECET), WV DOH and WV state legislature (WVSL).

#### **RESULTS**

##### ***Fatality Incidents***

A total of 10 bridge-construction-related deaths that occurred during the 10-year period 1990 to 1999 were identified through death certificate review. Nine of these cases involved employees in SIC 1622; the remaining case was SIC 1791 (structural steel erection). A total of eight fatal incidents occurred, with two incidents producing double fatalities.

The OSHA office in Charleston, WV, investigated all eight incidents. Five were related to new bridge construction; two to bridge demolition or dismantling; and one to temporary bridge construction. All victims were male with an aver-

age age of 41 years. Table 1 summarizes the safety-related factors that contributed to each fatality. This information is intended to provide a broad overview of each incident, not the specific narrative account, temporal sequence or causality of each fatality.

Investigations found that the sites where seven of the eight incidents occurred had significant safety and health program problems, most notably related to management and leadership issues and safety training. Typically, these problems arose because no qualified or competent person was available to perform assigned tasks or identify existing and predictable hazards.

In the authors' opinion, regular safety inspections of all operations by a company-appointed competent person who can identify hazards and has the authority to take prompt corrective action will help ensure that established safety procedures are followed. In addition, such inspections clearly demonstrate the employer's commitment to the safety program and injury prevention. Furthermore, frequent inspections will increase the likelihood that hazards will be recognized.

Another prevalent problem was lack of or inadequate site- and task-specific

safety training. Written safety programs should include task- and equipment-specific safety procedures, work rules, and worker training in hazard identification, avoidance and control. Evaluation of tasks to be performed at a worksite form the basis for the development, implementation and enforcement of a safety program as well as task-specific safety training and procedures. A key element of any safety program is the communication of these task-specific practices and rules.

These types of problems were cited as violations under OSHA 29 CFR 1926.20(b) and 21(b). The violations listed in Table 1 for cases 1, 2, 4 and 6 did not contribute directly to the fatal incident, but identified other safety issues that impacted the overall safety and well-being of workers.

#### Corrective Strategies

As a result of the deaths in 1996 and 1997, various prevention actions and proactive interventions were undertaken to refocus attention on the importance of job site and worker safety. These efforts included an OSHA-based federal directive applicable for all industries; state-oriented safety initiatives; a contractor-specific remedial safety program to satisfy state OSHA investigative findings; equipment-specific operating requirements; and safety training for the construction industry.

#### OSHA-Based: All Industries

OSHA's Directorate of Federal-State Operations approved a directive in November 1998 that established OSHA Strategic Partnerships for Worker Safety and Health (OSP). Available to all industries, OSP is a process whereby OSHA enters into an extended, voluntary, cooperative relationship with groups of employers, employees, employee representatives and other stakeholders in order to encourage, facilitate and recognize efforts to eliminate serious hazards and achieve a high level of worker safety and health (OSHA). Table 2 lists the core elements of OSP. In September 2000, the Kanawha County (WV) Contractor's Assn. and the area OSHA office entered into an OSP.

**TABLE 1 Contributing Factors for Bridge-Construction-Related Deaths\***

Contributing Factors	1	2	3	4	5	6	7	8	9	10
<b>Incident Type</b>										
Crushed	•	•	•	•						
Fall from height					•	•	•	•	•	•
<b>Safety and Health Program</b>										
None or inadequate	•	•		•						•
Management/leadership problems	•	•	•	•	•		•	•	•	•
Inadequate safety training	•	•		•	•	•	•	•	•	•
<b>Incident-Related Safety Equipment</b>										
Not available	•	•		•	•				•	•
Available but defective			•							
<b>Unsafe Condition(s)</b>										
Overloaded crane	•	•								
Workers without fall protection	•	•								
Dump truck back-up alarm inoperable			•							
Safety zone for excavator swing radius not established				•						
Inadequate number of lifelines and lack of safety nets					•					
Defective concrete post-tensioning rod failed during tensioning operation						•				
Free-standing girder over-stressed during demolition							•	•		
Structural member over-stressed from non-standard dismantling sequences									•	
Improperly designed, supported and welded temporary work platform										•
<b>OSHA Violations Contributing to Fatality 29 CFR 1926.Section (Paragraph)</b>										
20(b) accident prevention responsibilities	•	•	•	•	•					
21(b) safety training and education	•	•			•		•	•		•
50(c) and (f) medical service and first aid										•
100(a) head protection									•	
105(a) safety nets	•	•			•					
106(a) working over or near water									•	
451(a) and (g) scaffold capacity and fall protection										•
454(a) and (b) scaffold safety training										•
501(b) fall protection for sides and edges									•	
503(a) training for fall protection										•
550(a) requirements for cranes/derricks	•	•							•	
550(b) crawler, locomotive, truck cranes	•	•								
850(a) demolition preparatory operations										•
858(d) over-stressing of structural members during dismantling							•	•	•	
<b>OSHA Act - 1970</b>										
5(a)(1) general duty clause; excavator swing radius				•						
<b>OSHA Violations Not Contributing to Fatality</b>										
501(b) fall protection for sides and edges						•				
550(g) suspended personnel platforms	•	•								
652(a) protective systems for excavation sites				•						

\*1) and 2) workers crushed after crane collapse; 3) worker backed over by dump truck; 4) worker crushed between swinging excavator and object; 5) worker falls from steel truss bridge; 6) worker falls from bridge when tensioning rod fails; 7) and 8) workers fall due to premature demolition collapse; 9) worker falls due to over-stressed structural member that fails during temporary bridge dismantling; 10) worker falls after temporary work platform collapse.

#### Industry-Specific: Highway & Bridge Construction in West Virginia

In March 1999, Mid-Atlantic LECET and OSHA Region III established a partnership to eliminate serious injuries and deaths in the construction industry, with an emphasis on highway and bridge-con-

struction-related activities. The underlying principles of this partnership are recognition of the need to provide a safe, healthful work environment for all employees in the WV construction industry, and the value of bringing employer, employee and government skills to bear in

a cooperative, focused, voluntary effort to ensure worker safety and health (LECET).

Through this partnership, the Mid-Atlantic (LECET) Safe Sites Program was founded; it is a recognition process for highway/bridge contractors working in WV who have implemented effective safety and health programs and site-specific safety plans that ensure compliance with OSHA standards, policies and procedures. The program was developed specifically for WV because of the poor safety performance exhibited by construction employers during 1997. Table 2 lists key components of the program's safety and health requirements.

This program is another example of an OSHA OSP. To date, no specific site has been selected to pilot test the program. Expansion to other states within the Laborers' International Union of North America (LIUNA) Mid-Atlantic Region (Pennsylvania, Maryland and North Carolina) will be based on results achieved in WV and approval from OSHA (LECET).

#### **Contractor-Specific (Cases 7 & 8)**

In addition to the official OSHA investigation, LHSFNA investigated the causes and contributing factors associated with a July 2, 1997, bridge collapse. Although no direct cause for the collapse of the steel girders was identified, the investigators noted several issues related to the employer's (contractor's) safety program and its implementation on the job site (Lapping). These included effectiveness of on-the-job employee training, specifically that provided before high-hazard activities were performed; lack of a site-specific safety plan that described work activities, anticipated hazards and control measures; formal site inspections; and a communication system to identify and control project hazards.

Based on these findings, the Laborers' District Council of WV (on behalf of LIUNA members) and the contractor on the job where the two fatalities occurred signed a memorandum of understanding (MOU) in August 1997 (LDCWV). The comprehensive MOU applied to all construction projects of the contractor that fell within the council's jurisdiction. The purpose of the MOU was to identify deficiencies in the contractor's corporate safety and health program, and establish a proactive effort to reduce the frequency and severity of accidents and illnesses at each of the contractor's sites. The MOU contained the components listed in Table 2 (LDCWV).

OSHA Region III and the contractor signed an informal settlement agreement on Jan. 2, 1998, whereby the fatality site inspection citations and proposed penalties would be settled and not contested and the MOU adopted (OSHA).

#### **Equipment-Specific**

Cranes were directly involved in half of the deaths, with four of them resulting from two incidents in 1991 and 1997. A crane was also indirectly involved in a 1996 incident. As a result of the deaths in 1997, construction industry leaders and WVDOH officials called for some type of certification or licensing mechanism for crane operators as a means to prevent such tragedies (Myers). While contractors are certified by the state's Contractors Licensing Board, a similar requirement did not exist for crane operators.

The WV Crane Operator Certification Act, signed into law in 1998, required all crane operators to pass a written exam in order to be certified to operate cranes at construction sites throughout the state (WVSL). However, when many experienced operators could not pass the written test by the required deadline, substantial changes were recommended and a revised bill was enacted in 2000; this version allowed training and experience in lieu of testing for crane operator certification (WVSL). The deadline for these expanded certification guidelines was extended to Sept. 1, 2001.

#### **Training**

The National Resource Center for OSHA Training, established in 1994, is a consortium of the Building and Construction Trades Dept. of the AFL/CIO, Center to Protect Workers' Rights, George Meany Center for Labor Studies, and West Virginia University (WVU) Safety and Health Extension.

Various courses are available, with three (500, 502 and 510) devoted to the construction industry. The 500 course is designed to enable students to teach the 10- and 30-hour hazard awareness programs. Students must have completed the 510 course, or have equivalent training and five years' construction experience, to take the course.

The Meany Center in Silver Spring, MD, and WVU are the only training sites in OSHA Region III. During 1998 and 1999, the WVU site taught 12,500 courses to 305 students. Of these students, 11 were employed by WVDOH; nine were regional safety inspectors; one was the state safety officer; and one was the state safety training officer. Employing the "train-the-trainer" concept, these trainees, in turn, taught an additional 600 personnel who served as construction inspectors (dealing with new projects and job specifications) and bridge inspectors (dealing with existing bridges).

#### **DISCUSSION**

The five deaths that occurred between October 1996 and December 1997 brought immediate and reactive attention to construction industry safety problems—many of which had likely existed long before

these high-profile incidents. Officials with the Affiliated Construction Trades Foundation and the Constructor's Labor Council of WV suggested that the state's competitive market (for construction) had driven down prices, perhaps leading to unsafe practices such as cuts to safety training (Myers; Ward).

Historically, WVDOH has not routinely checked a firm's safety record before awarding construction contracts. Instead, it asks for financial data and basic information on whether the contractor has job-related experience (e.g., bridge demolition). These practices continue today (WVDOH).

Since no bridge-construction-related deaths have occurred in the state since September 1998, it would be shortsighted to think that this is coincidence or that preventive efforts initiated are the sole reason for the turnaround. The authors believe a combination of factors contributed to the change.

For example, the downward turn in the number of bridge-construction-related deaths at the end of the decade may be a reflection of the same trend experienced in the construction industry as a whole in the state. As the number of construction deaths decreased from 16 in 1994 to five in 1999, the death rate dropped nearly 70 percent from 46.9 to 14.5 deaths per 100,000. The U.S. rate was steady at 14.4 over that same period. One must remember that the state's rate is subject to much greater variability than the national rate, because a small increase or decrease in the number of deaths would cause a greater degree of change.

#### **Impact on Industry**

The preventive strategies developed at the national, state and company levels share common elements that collectively have contributed to a safer work environment for the state's construction industry as a whole and bridge-construction-related projects in particular. These include safety programs with full-time safety personnel; continuous and timely general and hazard-specific training; and the availability and use of personal protective equipment.

Safety training has also increased, providing both supervisors and workers with better hazard recognition, avoidance and abatement skills. The partnerships forged between OSHA, WVDOH, labor unions and contractors have provided strong foundations that have facilitated the establishment and revitalization of viable company safety programs, fostered employee involvement and increased safety awareness at the job sites. ■

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**TABLE 2**

## Components of Federal, State, Labor Union & Contractor Partnerships

### OSHA Strategic Partnerships for Worker Safety & Health (OSPS)

- Problem explanation and definition
- Identification of partners
- Goals
- Data collection and analysis
- Safety and health program
- Employee involvement
- Stakeholder involvement
- OSHA incentives
- On-site verification of a healthful working commitment and management commitment
- OSHA inspections
- Partnership evaluation
- Leveraging strategy (ways in which partnership expects to maximize the return on OSHA's investment of resources)
- Termination of partnership

### Laborers' District Council of West Virginia/Contractor Memorandum of Understanding

- Comprehensive audit of the contractor's existing accident prevention program
- Establishment of a labor-management safety committee
- Employment of a full-time safety director
- Implementation of a corporate safety and health program with site-specific plans
- Training
  - employee indoctrination
  - OSHA 10-hour course
  - site-specific
  - construction skills
- Management education and training
  - leadership
  - annual meetings
  - OSHA 30-hour course
  - site safety plan
- Safety and health indoctrination on the timing and requirement of the MOU and its implementation
- Jobsite inspections

### Mid-Atlantic Laborers' Employers Cooperation Education Trust Safe Sites Program

- Top-level management commitment
  - written safety and health program
  - management leadership
  - assignment of responsibility
  - safety incentives
  - program evaluation
- Employee involvement
  - composition of project-specific safety and health committees
  - functions and powers of committee
- Project safety analysis
  - safety and health surveys
  - analysis of new materials and procedures
  - routine examination and analysis of job hazards
  - routine self-inspections
  - system for management notification
  - investigation of incidents and near-hits
  - trend analysis of injury and illness data

- Hazard prevention and control
  - elimination and control of identified hazards using engineering and administrative controls
  - personal protective equipment
  - safety and health rules
  - equipment to prevent or detect hazardous conditions
  - system for correcting hazardous conditions
  - medical program
  - emergency response procedures

- Indoctrination and training
  - orientation for all project employees
  - safety and health training
    - OSHA 10-hour course for foremen
    - OSHA 30-hour course for contract supervisory personnel
    - employees

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