

# NATIONAL CONFERENCE ON WORK ZONE SAFETY

December 5-7, 1994

## PROCEEDINGS

*Sponsored by the*

**FEDERAL HIGHWAY ADMINISTRATION**

**AND THE**

**AMERICAN ROAD & TRANSPORTATION BUILDERS ASSOCIATION**

*Cosponsored by the*

**AMERICAN ASSOCIATION OF STATE HIGHWAY & TRANSPORTATION OFFICIALS**

**AND THE**

**AMERICAN TRAFFIC SAFETY SERVICES ASSOCIATION**

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# EXECUTIVE SUMMARY

On December 5-7, 1994, the American Road and Transportation Builders Association (ARTBA) and the Federal Highway Administration (FHWA) hosted the National Conference on Work Zone Safety. Cosponsors of the event were the American Association of State Highway & Transportation Officials (AASHTO) and the American Traffic Safety Services Association (ATSSA). The Conference, held in Washington, D.C., was designed to explore ways in which the highway construction industry and Federal, State and local governments can reduce accidents and fatalities in work zones. In 1993, following a healthy two-year decline in work zone fatalities, deaths rose from 647 in 1992 to 762. This trend underscores the need to identify the causes of these accidents and develop means to counter them.

Attending the Conference were more than 200 people representing diverse safety areas, including educators, engineers, corporate and Government officials. The two-and-a-half-day agenda was designed to offer a broad perspective from several disciplines as to the contributing factors causing accidents in work zones and possible remedies. Dr. Nicholas J. Garber, Professor of Civil Engineering at the University of Virginia served as moderator for the Conference, which began with an official welcome and introductory remarks by officials of the sponsoring organizations: Anthony R. Kane, Acting Executive Director, FHWA; Kenneth R. Rezendes, Chairman, ARTBA; Francis B. Francois, Executive Director, AASHTO; and Robert M. Garrett, Executive Director, ATSSA.

To give participants a foundation for their discussions in their respective workshops, the first day of the Conference featured an address by Dr. Garber, who presented an overview of existing problems related to work zone safety.

Consultant Douglas J. Mace, President of Last Resource, Inc., then provided an overview of new arrow panel technology based on information obtained from an ongoing NCHRP study. Arrow panels are widely used in street and road construction zones to warn motorists of potential hazards and redirect traffic. Manufacturers have been working to resolve problems related to visibility, which has sometimes been adversely affected by the use of solar power and a lack of sufficient quality control in the manufacturing process. Recently, researchers have sought to identify optimum visibility standards (light intensity) and distances with specific goals in mind—e.g., to alert drivers or to provide recognition.

The final morning speaker, Michael Robinson, Highway Engineer, Office of Highway Safety at the Federal Highway Administration, described changes in the *Manual on Uniform Traffic Control Devices (MUTCD)*, specifically those which apply to Part VI, which deals with work zone issues. Part VI took effect in January 1994, with the States being allowed two years to implement the final rule. In addition to changes in nomenclature which appear in the revised Part VI (namely the use of “temporary traffic control zone” in place of “work zone” and “road work” to replace “road construction”), the MUTCD now contains provisions which did not appear previously. These apply to the following areas:

- Identification of the four components of a temporary traffic control zone (i.e., Advance Warning Area, Transition Area, Activity Area, and Termination Area).
- Specifications for sign placement, colors, and content to reduce risk to motorists, pedestrians, and workers in temporary traffic control zones.
- Requirements related to training, worker clothing, barriers, speed controls, enforcement personnel, lighting, special devices, public information, and road closure.
- Selection of proper traffic control devices and methods.

The luncheon address was presented by The Honorable Nick J. Rahall II (D-WV), former Chairman of the Surface Transportation Subcommittee of the House Transportation and Public Works Committee. Congressman Rahall offered his predictions of how the new Republican Majority in Congress will view special transportation projects that are often included in highway bills. Despite the possible shift in priorities and focus expected to emerge under the Republican leadership, the Congressman indicated that he expects “relatively smooth sailing” in the House for the National Highway System bill in 1995 and is hopeful that the Senate will follow suit.

During the afternoon, the participants separated into workshop groups that focused on five topics. The sessions were led by facilitators who guided the discussions. Each group spent the afternoon exploring specific issues related to work zone safety and concluded their session by listing their concerns and recommendations for enhancing the safety of those who drive through or work in temporary traffic control zones.

On the second day of the Conference, Joseph J. Lasek, Chief, Technical Development Branch Safety Office, FHWA, opened the morning session with a discussion of the National Work Zone Safety Program. Section 1051 of the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) requires the Secretary of Transportation to develop and implement a work zone safety program that will improve work zone safety at construction sites. Mr. Lasek explained that the three-year high for work zone fatalities between 1988 and 1990 and the spike in 1993 was a clear indication that development of such a program is vital if the number of accidents and deaths are to be reduced. Ultimately, a draft National Work Zone Program was developed, and it addresses issues related to (1) standardization and uniformity; (2) ensuring compliance (3) evaluation (information/feedback/direction); and (4) implementation of innovative technologies.

Comments on the draft program reflected widespread support for the FHWA effort to improve work zone safety. However, it was evident that the States' ability to follow the recommendations set forth by FHWA would be limited by the available resources. This underscores the need for cooperation among the Federal, State and local agencies to strengthen safety programs.

Attorney Douglas D. Wilson, of the firm Parvin, Wilson, Barnett and Guynn, PC, then addressed the Conference, noting recent developments in work zone safety as they relate to liability, litigation, and insurance issues. His report focused on four types of regulations and laws that impose liability on employers for work zone hazards that either harm, or have a potential to harm, persons on the work site: (1) Occupational Safety and Health Act; (2) workers compensation laws; (3) common law negligence; and (4) State safety statutes. Mr. Wilson explained that employers are subject to numerous Federal and State laws regarding the safety of their workers on construction sites, and courts have continued to expand upon potential liability for employers in this area. This makes it more important than ever for employers to comply with existing statutes and regulations to avoid injury and liability for injuries and/or unintentional violation of paperwork rules.

The morning session concluded with a discussion of Work Zone Accident Data Collection by James E. Bryden, P.E., Construction Safety Coordinator, New York Department of Transportation. Mr. Bryden underscored the necessity of agency commitment to the health and safety of employees, contractors, and the public. New York's management of this area is centered around three integrated components: engineering, enforcement, and public awareness. By refining its data collection mechanisms and requiring accurate reporting, the State has achieved a better understanding of the causes of accidents and how they might be prevented. This has enabled State officials to implement more effective traffic control measures and enforcement activities, although improvements are still needed.

During the afternoon, participants again separated into different workshop groups which focused on the same five topics addressed in the first afternoon sessions. At the plenary session on day three of the Conference, the workshop facilitators had an opportunity to report on the discussions in their groups over the previous two days.

## **PHILOSOPHY OF TRAFFIC CONTROL**

Dr. Russell M. Lewis, a consulting engineer, and John B. Moran, Director of Occupational Safety and Health, Laborers Health and Safety Fund of North America, reported that their groups had explored several issues related to this topic: (1) The proper application of traffic control devices to guide motorists through work zones; (2) creative and flexible use of traffic control devices to attract motorists' attention; (3) dissemination of highway information to the motoring public; and (4) appropriate use of enforcement personnel to achieve greater safety of both motorists and work zone personnel.

Dr. Lewis noted that in work zones, where normally available safety factors are reduced, it is essential to communicate effectively with most drivers. Many accidents tend to be predictable, given the characteristics of the highway and the limitations of drivers. Driver behavior can be adversely impacted if motorists are annoyed, late,

lost, or otherwise surprised or inconvenienced; impatience and anger can affect judgment and performance, and variable traffic patterns can cause congestion, distraction, and confusion.

Driver performance, therefore, may be enhanced to a degree by minimizing delays, distractions, and inconvenience. Among the temporary traffic control principles and recommendations which emerged from the discussions in Dr. Lewis's and Mr. Moran's groups were the following:

1. Traffic control procedures should be based on road users' needs and characteristics. Reduced speed zoning should be avoided as much as practical.
2. Roadway occupancy and work completion time should be minimized to reduce exposure to potential hazards.
3. The results of a systems failure should be analyzed. The justification for using higher types of traffic control increases with the greater potential for catastrophic incidents.
4. Traffic control devices are effective only to the degree that (1) they are consistent with people's desires; (2) they are believed to be unduly hazardous if ignored; or (3) there is fear of enforcement. Consistency is needed with respect to uniform traffic control devices and standard procedures.
5. While Part VI of the MUTCD is generally regarded as "good," the Manual is primarily focused on the protection of the public rather than workers in work zones. Changes that reduce risks to one group must not increase risks to the other.
6. There is a need to reassess construction methods and designs from a safety perspective. Designs should address methods to provide construction vehicle access on other than the traffic-disturbed roadway. Physical separation between traffic and the work zone should be employed where possible, and work vehicles and equipment should look like work vehicles.
7. A shift in attitudes (on the part of both the public and governments) is needed as to how resources are allocated to work zone safety. Too often, it is only when a fatal event occurs that appropriate resources are provided to enhance safety.
8. Also needed is an understanding of measures that have been successfully applied to improve safety and a means for disseminating this information. It is recommended that a national clearinghouse be established for this purpose.
9. Credibility is seen as a major problem in traffic control. Therefore, signs and warnings must accurately reflect the situation in the work zone if driver performance is to be managed effectively. Drivers are most likely to utilize traffic control information when it appears to be reasonable, useful, and consistent with their expectations and experience.
10. Systems of communicating with drivers must be improved. The news media can be engaged as partners in apprising motorists of work zone activities and potential delays. Innovative approaches to provide real time information to motorists is needed to minimize frustration and delays.
12. Adequate enforcement measures should be employed, including the allocation of police and highway patrol personnel as appropriate.
13. Double points imposed on a driver's record for violations may have more impact on motorist behavior than double fines.
14. Education is key to improving safety for motorists and workers. Almost no State driver handbooks contain any information related to safe travel through work zones. The appropriate time to begin training drivers is in elementary school, to instill a safety mindset from childhood.
15. Training of workers is essential in any safety improvement effort. Accidents and fatalities involving workers in work zones are very high during the first year of employment and drop dramatically for several years thereafter. Early training, properly administered, can significantly reduce the number of accidents among the most vulnerable group.

16. Contract provisions should be reexamined and modified and incentives / disincentives considered as means of enhancing the safety of workers and motorists.
17. Relative risks should be evaluated, including risks of daytime vs. nighttime work, particularly in light of the increasing trend toward night work.

## **WORK ZONE SAFETY IMPLEMENTATION**

The purpose of these workshops, conducted by Jon V. Jackels, Work Zone Safety Coordinator of the State of Minnesota Department of Transportation, and ATSSA Director of Education and Training Victor H. Liebe, was to identify for public and private agencies good practices that ensure quality work zone traffic controls are applied in all work zones. Mr. Jackels and Mr. Liebe reported the following recommendations from their sessions:

1. Key elements of all work zone traffic control and safety programs include appropriate standards and guidelines; technical training; state-of-the-art work zone traffic controls; and quality control.
2. Successful implementation of work zone traffic controls involves both operations (Traffic Control Plans, public awareness) and monitoring (accident data collection, law enforcement) components.
3. Maintaining quality work zone traffic control devices requires the commitment of all levels of management; qualified field personnel; and up-to-date project manager tools.
4. Categories of good practices to improve the application of quality work zone traffic controls include surveillance by the owners, project personnel, workers and inspectors; quality tools and procedures; law enforcement personnel with traffic control and safety awareness training; positive and negative incentives; development of a safety culture among both workers and the motoring public; improved quality assurance procedures, to including training and certification as well as formalized procedures; and a traffic management scheme with some flexibility built in.
5. More joint participation should be encouraged among Government agencies and jurisdictions, contractors, and associations.
6. A central clearinghouse of information has great potential as a resource for agencies, contractors, and planners.
7. Pre-qualification of contractors should be encouraged.
8. More frequent inspections and better follow-up mechanisms could enhance work zone safety.
9. Future revisions of the MUTCD should be more user-friendly and more understandable, and cover areas not now included. More input from municipalities to supplement information provided by State and Federal agencies could make the Manual more balanced.
10. The MUCTD (or an organization such as AASHTO) should provide more guidance on how to develop a good Traffic Control Plan in an easily understood form. Current design handbooks are written for engineers and are not user-friendly for other principals involved in planning.
11. Greater public awareness of work zone safety issues can be achieved through education programs and media involvement.

## **CONTRACTORS CONSTRUCTION MANAGEMENT**

The co-facilitators of this workshop were Robert Attaway, Highway Program Director, Institute for Transportation Research and Education, North Carolina State University, and Joseph R. Julian, President of James Julian, Inc. Their groups addressed the need for proper safety training of work zone personnel. Partnering was seen by both groups they led as the other key to achieving effective construction management. During the two sessions, the recommendations that emerged fell into four broad categories:

1. **Training.** The groups agreed that training should be a universal requirement for those who work in temporary traffic control zones. Moreover, training should be uniform from State to State, project to project (especially for flaggers) and readily available. It is less certain whether certification in particular areas (such as flaggers) is desirable, but it could be used to designate completion of training, rather than level of competence achieved.
2. **Partnering.** Partnering is a concept which, when approached properly, results in a level of flexibility necessary to make course adjustments during a project without violating the terms of the contract. In some States, the process has been quite successful; in others, it has had mixed reviews. However, most participants believe it has great potential for improving conditions in work zones that have an impact on the safety of both the motorist and the worker, and therefore should be encouraged.
3. **Lump Sum vs. Unit Pricing.** Each of these two methods for paying for traffic control items and personnel has proponents. The general consensus was that each is appropriate in certain circumstances. Innovation is called for in lump sum situations, particularly in the event of resequencing, where the lump sum would have to be renegotiated to reflect the resequencing. On the other hand, pre-set items, such as flaggers, can be very hard to plan and could exceed the anticipated quantity. In such cases, unit pricing could be the best option. The group recommended that planners take into account such issues, as well as the legal nuances in given jurisdictions, to achieve the appropriate balance between the two.
4. **Incentives and Disincentives.** The workshop groups concluded that there are too few incentives under the current system. One area in which they have proved effective is lane or interchange rentals, wherein the contractor is charged a specific amount for shutting down an interchange or lane if he exceeds the time allotted for completion of his project. Incentives can also be useful where it is important that a project be completed quickly or as a means of rewarding superior performance. It is suggested that criteria be developed for assigning value to superior performance on traffic zone safety, to be used as a measure to evaluate appropriate rewards.

## INTERACTION WITH PUBLIC HIGHWAY USERS

These workshops, chaired by Maj. Thomas H. Milldebrandt, Criminal Justice/Traffic Law Enforcement Consultant, and Jerry E. Graham, P.E., President, Graham-Migletz Enterprises, Inc., addressed enforcement and speed control issues, and the need for public education programs to better inform motorists of the hazards of work zones. The recommendations that emerged from their discussions included the following:

1. The appropriate enforcement agencies should be involved in the formulation of the Traffic Control Plan rather than merely instructed in how they are expected to participate.
2. Police administrators must be sold on the importance of work zone traffic control and sufficient manpower to their total police mission.
3. Off-duty officers should be used where appropriate to provide a police presence and encourage motorists' compliance with work zone speed limits and controls. Funding through legislation should be considered for this purpose if necessary.
4. Enforcement personnel should be trained in the provisions of Chapter VI of the MUTCD in general and the current Traffic Control Plan in particular.
5. Law enforcement agencies should have the authority to cite those responsible for implementing and maintaining the Traffic Control Plan when they do not comply.
6. Public education programs should be developed and geared for various segments of society, including older drivers, children, contractors, construction workers, highway officials, police and others.
7. Driver awareness of work zone safety issues could be enhanced with greater exposure through driver handbooks and licensing tests.

8. The press and other media, including direct mail, should be used as tools to disseminate information and enhance public awareness of safety issues and concerns. Again, appropriate funding through legislation should be considered for this purpose.

The participants noted that enforcement is not, however, a panacea for poor traffic control practices. Rather, it should be planned for and accommodated under Traffic Control Plans.

## **ADVANCED TECHNOLOGIES**

These workshops were conducted by Dr. Ray Benekohal, Associate Professor of Civil Engineering, University of Illinois at Urbana-Champaign, and Dr. H. Gene Hawkins, Jr., who is an Associate Research Engineer and Program Manager with the Texas Transportation Institute of the Texas A&M University System. Their groups addressed means by which recent developments and emerging technologies can improve work zone safety for both motorists and workers. This subject is especially important at a time when night work is preferred for the convenience of motorists and to minimize workers' exposure to hazards posed by drivers. Recommendations from the discussions included the following:

1. Technological advances should be aimed at protecting both workers and drivers.
2. New products and technologies are needed to facilitate:
  - more accurate information to travelers (e.g., rerouting, etc.)
  - real-time information (e.g., travel times, delays)
  - credible messages
  - more active traffic control devices rather than the current passive TCDs
  - reduction of the duration of work zones.
3. Future traffic safety devices should enhance visibility and lighting, improve delineation of work space, and reduce distraction to drivers.
4. Guidelines for reflectance standards should be developed, and the development and evaluation of new retroreflective materials should be encouraged.
5. The development of computerized work zone data collection devices, including hardware and software that could track comprehensive accident data, should be encouraged. In addition, the procedures by which new technologies and devices are brought into practice should be streamlined.
6. A new category of funding for testing or development of new TCDs should be established. The ISTE program should be revised to require a work zone safety management system.
7. Industry should develop and improve driver information technologies, using heads-up displays, radio, and changeable message signs.
8. There is a need for implementation procedures that can respond to advancing technologies, perhaps through specific user services (e.g., work alarms, vehicle positioning, driver information, and incident and congestion management).
9. Uniformity of systems is desirable, and may be achieved through the establishment of a national clearing-house.
10. Automated vehicle control technologies for work zones have potential for ensuring speed compliance in work zones of the future. Such technologies could also be used to provide advance information of which the driver should be aware.
11. Economic incentives should be provided to encourage contractors to adopt technologies that can improve safety and to comply with existing standards.

## CONCLUDING REMARKS

The Conference moderator, Dr. Nicholas J. Garber, noted that while numerous recommendations were developed in the workshops, they could be condensed into a few major themes:

1. **User characteristics.** Research in this area is needed to identify the characteristics of the people who are involved in problem areas, both drivers and pedestrians. Both groups must be educated as to the hazards of negotiating work zones and how to successfully get through these areas.
2. **Incentives.** Both positive and negative incentives can be useful tools in achieving the desired performance on the part of the contractor.
3. **Reducing exposure.** To the extent possible, the length of time motorists spend in work zones should be minimized.
4. **Speed management.** Rather than setting arbitrary speed limits that drivers often ignore, we should identify the correct speeds for work zones and the means of bringing the drivers to comply with reduced speed limits established in those zones.
5. **Partnering.** This concept has numerous applications, particularly in arriving at the appropriate means of paying for work zone traffic control and in reducing exposure by reducing the length of contractor activities.
6. **Separating traffic.** Current systems do not allow the separation of traffic in terms of speed and volume, but means of doing so should be explored.
7. **Advanced technologies.** Real time traffic control devices can offer motorists up-to-the-minute information and limit the frustration, delays, and unwelcome surprises that cause accidents. Advanced technologies also should be used to facilitate data collection in work zones.
8. **National clearinghouse.** Cooperative efforts among the Conference's sponsoring organizations and others are needed, particularly in the development of a national clearinghouse, whereby information can be disseminated more efficiently to interested jurisdictions and agencies.
9. **Regional conferences,** similar to this one, could be very useful in addressing these and other issues and in developing workable solutions.