

# TUNNEL SAFETY

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## STATE OF THE ART

Construction, the nature of which involves assembling people, equipment, and materials to accomplish a purpose within a specified period of time, imposes many types of risks and hazards. Concern about employment risks and hazards has led to concentrated efforts by government and industry to minimize those damages and thus to reduce accidents and injuries to workers.

Within the construction industry, attitudes regarding safety have varied widely in the past. Safety practices were derived mostly from ideas of employers and employees as to what constitutes a safe job. Thus, uniform practices throughout the construction industry are not prevalent. Present trends, however, are to eliminate much of this variation.

Tunneling has its own peculiar risks as well as some that are common to other types of construction. In some instances, the safety aspects of tunneling are not recognized as being unique but are thought to be similar to those of mining. Most states, through their bureau of mines, have long-established safety regulations and assume that safety regulations pertinent to mining can be readily applied to tunneling. To do so, however, is not always appropriate. Tunneling must be recognized as a specialized underground construction effort. But federal and state mine bureau personnel, because they are familiar with underground construction, do represent a highly qualified group available to monitor tunnel safety.

The general public becomes aware of safety problems in tunneling through the news media, frequently from dramatic reports that do not contain facts or findings by qualified personnel. The public may not differentiate among specialized types of underground work and will conclude that any underground work is dangerous.

The tunneling industry must ensure that the public is well informed by the orderly, centralized dissemination of factual information concerning a tunnel project. To fully augment this concept, it should see that the safety aspects of the work are diligently monitored, documented, and reported by qualified project safety personnel. This factual information should be available to news media reporters during the course of the work and, subsequently, compiled into usable national safety statistics that provide a basis for monitoring tunnel work. At the present time, there are no established safety norms for tunnel work.

The U.S. Occupational Safety and Health Administration is responsible for improving the safety record of all industry. But in the safety field along with OSHA are local, state, and other federal agencies, all charged with the promotion of safety. The multiplicity of safety agencies and regulations tends to cloud the issues and create confusion in industries such as tunneling. Some of the problems are

1. Cross jurisdiction or unknown jurisdiction among federal, state, and local agencies, all claiming responsibility for inspection and enforcement of project safety;

2. Safety inspection personnel who lack training and experience necessary to evaluate and interpret safety situations; and

3. Complex and repetitive reporting requirements by multiple agencies.

Under present types of contracts, the practice of safety during construction is usually assigned to the contractor. Frequently, a contractor discovers that the design creates serious safety problems and must be modified to facilitate the work or enhance the safety of the work. The engineering attitude toward such design modification is often inflexible and unfavorable and becomes the source of dispute and delay.

Safety during construction, therefore, must be a prime consideration of the designer. Preliminary designs should be thoroughly reviewed by qualified safety and construction personnel before the final design is prepared. Designers and contractors should exhibit flexibility to meet and solve unanticipated safety problems that may arise during construction. Designers and owners can further contribute to the safety aspect of tunnel construction by establishing realistic time periods for project advertisement and construction. Realistic construction time would facilitate safety by minimizing the number of construction activities now commonly scheduled simultaneously for a given work area. Realistic construction time would reduce congestion commonly found within the close confines of a tunnel.

Because tunnel safety is so multifaceted, it cannot be the sole responsibility of the owner or contractor. Safety must be equally pursued by owner, contractor, and labor. Labor can contribute by providing competent workers trained to accomplish the work in a safe manner. Employees and supervisors that have poor safety records should be mandatorily retrained. Contractors and owners can materially contribute by providing additional project supervision on all work shifts, particularly swing and graveyard shifts.

## FUTURE RESEARCH

### Uniform Safety Rules and Regulations

The establishment of a single set of rules and regulations would substantially contribute to tunnel safety. Owners, labor, contractors, equipment manufacturers, and all local, state, and federal agencies should work under a common set of rules.

### Jurisdiction

Jurisdictions should be established that clearly delineate safety inspection and enforcement responsibilities of local, state, and federal agencies. Cross jurisdiction often leads to squabbling and bickering among agencies.

### **Safety Records and Reporting**

Requirements for safety records and reporting should be reviewed in an effort to reduce the number of reporting documents and to eliminate needless repetition. Coordination and standardization of reporting procedure could be more readily achieved if uniform safety rules and regulations were adopted.

### **National Statistical Tunneling Norms**

National statistical tunneling norms should be developed from job safety statistics by using data processing techniques. This information would be readily available and would serve as a means of evaluating project safety. Such data would be useful for reporting to the public the safety achievements on tunneling projects.

### **Safety Input Into Design**

Safety should be incorporated during the design stages of a tunnel project. Safety reviews of preliminary designs could be obtained from safety and construction personnel before the design is completed.

### **Safety Training**

Qualified tunnel safety personnel must be provided by

owners, contractors, and enforcement agencies, and stringent requirements should be established to ensure that this is done. Mandatory training programs should be set up and used to further the safety education of all those concerned with tunneling (designers, engineers, supervision, and trade personnel). Training education must be associated with incentives that ensure results. Safety personnel must have the necessary support of labor and management to adequately execute their duties.

### **Methods for Changing Attitudes Toward Safety**

Owners, employers, and employees who are not receptive to programs for tunnel safety should be impressed with the need for changing their safety attitudes. Means of changing these attitudes, whether through education, fines, or other methods, should be derived.

### **Safety Considerations in Tunnel Contracts**

Tunnel contracts should be written to emphasize safety and promote the sharing of responsibilities and costs for safety programs. Assignment of safety responsibilities and costs to only one participant in the tunnel project does little to contribute to the overall goals aimed at achieving work safety.