

# RESEARCH PAYS OFF



ASSOCIATION  
OF AMERICAN  
RAILROADS

## Preventing Back Injuries

### AAR Program Adopted at Union Pacific

Back injuries are a continuing cause of lost time, medical cost, disability, and suffering in many industries. They have been the most prevalent and costly (in dollars and productivity) form of on-the-job injury in the U.S. railroad industry.

#### Problem

In the early 1980s, the Palestine Car Shop near Dallas, Texas, had the worst safety statistics of the Union Pacific (UP) Railroad's shop operations. In 1985, 9 out of 13 lost-time injuries were back injuries. As a result, 579 lost and 194 restricted, or limited work, days accumulated. Only 1,564 cars were repaired that year, and absenteeism was 4.0 percent. This problem had become common in the rail industry and attracted the attention of the Association of American Railroads (AAR).

#### Solution

After analyzing railroad accident data, the AAR Safety Research Division established a project designed to reduce back injury. Over the past 10 years extensive research had been performed by many organizations, culminating in the issue of guidelines on back compression (pressure on the spinal column) by the National Institute of Occupational Safety and Health. However, the guidelines were numerical, and using them in an

applied setting, that is, measuring back compression while a worker lifts on the job, was extremely difficult, time consuming, and expensive.

At the University of Michigan Center for Ergonomics, extensive ergonomic and biomechanical research led to the development of a computer model that calculated back compression from data on body position and the weight and position of the object being lifted. AAR modified and expanded the model for easy application to the railroad environ-

ment. The computer model was packaged by AAR for use on a microcomputer and made available to AAR member railroads. Figure 1 is an example of the model output.

Another line of research addressed the biomechanics and ergonomics of lifting. From this work, specific guidance on lifting to minimize the risk of back injury was developed and marketed through commercially available training and risk-management programs.

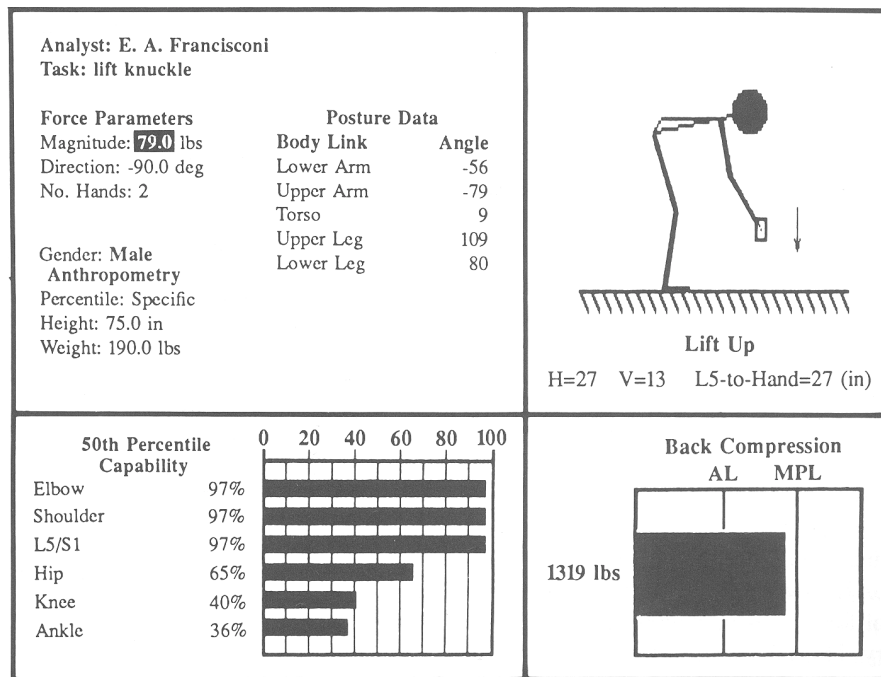


FIGURE 1 Sample from AAR-Back Model computer program.

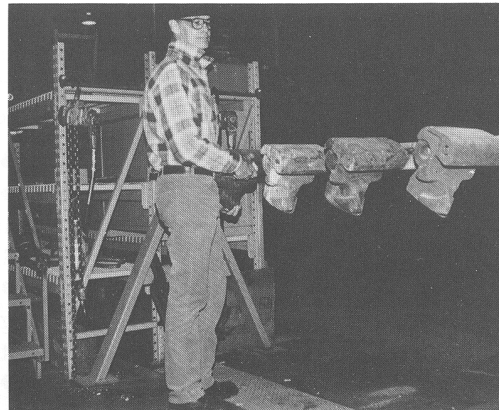
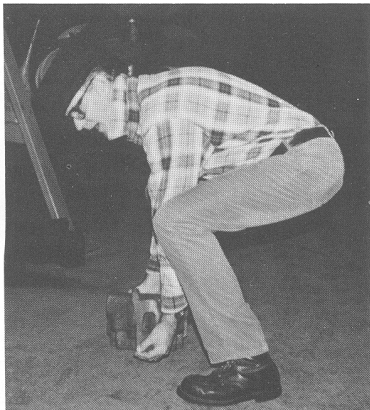
## Application

The director of shop operations at the Palestine Car Shop, working with a UP manager safety specialist, introduced the AAR-Back Model program to Palestine. They soon found several job tasks that routinely exceeded acceptable back compression values. On the basis of this analysis, the equipment supporting various jobs requiring lifting was redesigned. A system for loading knuckles onto racks was devised to eliminate bending and lifting (see photographs of before-and-after examples of coupler knuckle storage). Racks for other supplies and tools were devised to eliminate or modify many lifting and bending tasks.

Not all bending and lifting can be eliminated, however, even in an office setting. The ergonomics research showed that lifting even light objects can lead to back injury if done incorrectly. A commercial back injury management-training program (Pro-Back) was adopted, and every employee was taught how to bend and lift safely.

Finally, management attitude and priorities about safety were conveyed through weekly meetings with safety captains from each work area and quarterly "town hall" meetings with all shop employees.

Thus a systematic application of research findings and management led to improved equipment design, worker training, and management-employee attention to safety.



Coupler knuckles lifted onto racks for storage (left). Redesigned equipment (right) eliminated bending and lifting.

**TABLE 1 Results of Implementing Back-Injury Reduction Program**

	1985 <sup>a</sup>	1986	1987	1988
Total incidents	33	23	10	12
Reportable incidents	29	10	2	7
Lost-time incidents	13	1	0	0
Back injuries	9	0	0	0
Lost days	579	11	0	0
Restricted days	194	15	2	40 <sup>b</sup>

<sup>a</sup>1985 data are typical of data for previous 4 years.

<sup>b</sup>Increase is in non-back-related minor injury incidents.

## Benefits

The AAR-Back Model and Pro-Back programs were installed at the Palestine Car Shop in late 1985. In Table 1, 1985 data are compared with those from 1986 through August 1988. The last lost-time back injury was in October 1985, and 560,000 man-hours have been worked since. Because of the reduced number of lost-time injuries, particularly back injuries, productivity, with no change in staff size, increased from 1,564 cars repaired in 1985 to 1,835 cars repaired in 1986, 2,280 in 1987, and 2,900 projected in 1988. Consequently, the value of car repairs at the shop increased from \$8.935 million in 1985 to \$10.691 million in 1986, \$11.038 million in 1987, and \$12.000 million projected in 1988. Based on the cost to implement the back injury reduction program, the UP railroad calculates a cost-benefit ratio of approximately 1 to 10.

Another reflection of the productivity gain is seen in employee absenteeism. In 1985, absenteeism was 4.0 percent. This decreased to 1.7 percent in 1986 and to 1.1 percent in 1987 and is headed for 1.0 percent in 1988. The dollar savings in reduced lost-time days alone, from 579 to 11 to 0, has more than paid for the back-injury reduction program. The productivity gains were additional benefits.

The reduction in human suffering and disability, however, though difficult to quantify, is one of the most satisfying benefits to emerge from this successful application of research results.

For more information contact B. R. Tatum, Director, Shop Operations, Union Pacific Railroad, P.O. Box 316, Palestine, Texas 75801 (telephone 214-723-7761); E. A. Francisconi, Manager Safety Specialist, Union Pacific Railroad, 1416 Dodge St., Omaha, Nebraska 68179 (telephone 402-271-3243); or Paul McMahan, Manager, Safety Research Division, Association of American Railroads, 50 F St., N.W., Washington, D.C. 20001 (telephone 202-639-2281). For further information on the latest version of the Back Model contact Dr. D. B. Chaffin, University of Michigan, 1205 Beal IOE Building, Ann Arbor, Michigan 48109 (telephone 313-763-2245).

Suggestions for "Research Pays Off" articles are welcome.

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