Preventing Derailments at

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Turnouts, where rail vehicles are physically moved from one track to another, and other special-trackwork areas are geometrically complex and pose a relatively high risk of train derailment. At these locations, the direction of a train's momentum differs from the direction of the track. The high forces created between the vehicle's wheels and the track can lead to derailments. Factors related to switch geometry, track maintenance, vehicle characteristics, and operating conditions can increase these forces.

PROBLEM

From 1984 to 1996, approximately 200 derailments occurred at turnouts and other special-trackwork areas of rail-transit systems in the United States. These derailments can have serious consequences. The derailment on the Bay Area Rapid Transit system that occurred on a main-line interlocking in December 1992 resulted in injuries to riders and substantial track damage. About $2.2 million was expended to repair track and rolling-stock damage. Fortunately, most derailments occur in yards and not on main tracks, where the consequences could be catastrophic. Nevertheless, derailments, wherever they occur, are costly and can result in serious injuries to transit patrons and employees.

SOLUTION

Under the Transit Cooperative Research Program, sponsored by the Federal Transit Administration and administered by the Transportation Research Board, a study was conducted to identify techniques that can be used to effectively reduce the potential for derailments on special trackwork. Objectives of this study were to determine the location, frequency, and mechanisms of such derailments; to evaluate, through both field testing and computer model simulation, devices currently in use to reduce the risk of derailments; to identify the inspection and maintenance practices now in use; and to recommend new and modified derailment-mitigation techniques.

To better understand derailment mechanisms, several types of turnouts on two transit systems were instrumented and monitored under a range of operating conditions. The measurements obtained from the tracks and from vehicles traversing them were correlated. A variety of devices and maintenance practices intended to reduce derailment risk were examined at the test locations, and their effectiveness in reducing the levels of detrimental forces was measured. A computer-simulation model was used to determine the potential effectiveness of proposed mitigation devices that had not yet been manufactured and thus could not be physically tested. The model was calibrated using data obtained from the two field studies.

The adoption of comprehensive maintenance and inspection standards were found to be highly effective means for reducing derailment potential. Rail lubrication and the use of several devices, such as extended guard rails and switch-point protectors, were also found to be highly effective. Other findings are noted in the report on Project D-2, "Derailment of Transit Vehicles in Special Trackwork," which is available through the Transit Cooperative Research Program, Transportation

Turnouts

Research Board, 2101 Constitution Avenue, N.W., Washington, D.C. 20418. Some of these findings are relevant to efforts to reduce the risk of derailments on railroads.

BENEFITS

Use of the recommended devices and procedures would greatly reduce the incidence of derailments both on main lines and in yards, increasing the safety of passengers and workers. In addition, economic benefits would accrue through the decrease in maintenance costs and downtime and the increase in the service life of trackwork components. A significant cost savings would be realized through avoidance of a derailment at a turnout, which can result in repair costs of several hundreds of thousands of dollars.

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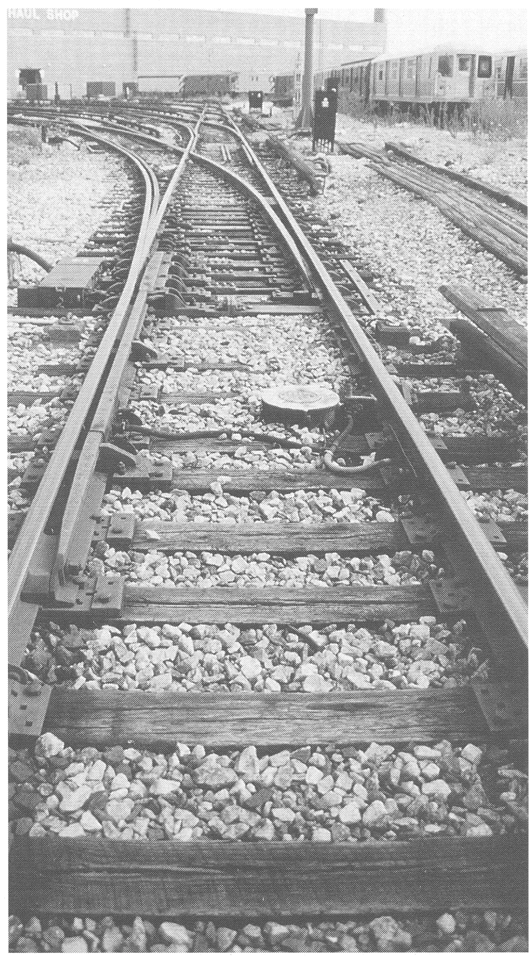
Suggestions for "Research Pays Off" topics are welcome. Contact G. P. Jayaprakash, Transportation Research Board, 2101 Constitution Avenue, N.W., Washington, D.C. 20418 (telephone 202-334-2952; e-mail giayapra@nas.edu.).



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Turnout at New York City Transit Authority's Coney Island Yard.