

produced between the locomotive and the cars in the train.

- 20. Almost all of the 43 large observation type windows which happened to be on the lower sides of the five overturned coaches were broken out either as a result of impact against the ground or by the weight of the passengers or luggage on the inside.
- 21. Six persons who fell or were thrown through the large window openings were injured fatally.
- 22. Although the basic structure of the passenger cars withstood well the stresses of collision, the cars displayed inadequate design crashworthiness. Sharp edges were raised, hard surfaces were present, and seats and furniture were secured inadequately. The large observation type windows constituted a critical weakness, destroying the crash integrity of the structure.
- 23. The use of propane as fuel in passenger cars created a serious fire hazard that could have resulted in a catastrophic accident.
- 24. The people of Salem provided an outstanding example of what can be accomplished by preplanning and practicing for emergencies.

V. PROBABLE CAUSE

The National Transportation Safety Board determines that the probable cause of this derailment was the displacement of the east stock rail of the southward main track by the false flange on the left-hand wheel on the leading axle of the rear truck of locomotive unit 4031. This wheel slid flat when the traction-motor armature bearings failed and locked the driving wheels. Failure to detect the sliding wheels was caused by the dispatch of the locomotive with an inoperative wheel-slip indicator.

The cause of six of the eleven fatalities was the ejection of passengers through the large side windows which broke when the cars overturned. The other fatalities were caused by passengers being ejected from the end of the car, or being

struck by a crosstie, or being hurled around the inside of the car. A total of 163 passengers and employees were injured when impacted against injury-producing surfaces inside the cars.

R-72-31-35

VI. RECOMMENDATIONS

The National Transportation Safety Board recommends that:

- 1. The Federal Railroad Administration review Part 230 of Title 49, CFR, and make necessary amendments and additions to:

R(72-31)

- (a) Clarify the intent of application and reconcile the conflict between sections 230.201(d) and 230.262.
- (b) Require a practical initial terminal test that will indicate whether the locomotive complies with the Federal regulations before use in train service.
- (c) Require use of warning systems other than the wheel-slip warning device that are needed to protect the operation of the locomotive, and require that means be provided for testing all warning systems.

- 2. The FRA in establishing near-future safety standards for railroad and rail rapid-transit passenger cars, give priority to the problem of ejection of passengers through large side windows. Regulations should be promulgated on realistic performance tests. This source of fatalities, even though small in number, is of such a large proportion among passenger fatalities as to warrant action prior to the issuance of the Mechanical Standards.

R(72-32)

- 3. The FRA promulgate regulations for railroad passenger cars to minimize the sources of direct impact injury such as described in this report.

R(72-33)

4. Amtrak, in the meantime, correct those injury - causing features pointed out in this report as passenger cars are renovated or rebuilt. Purchase specifications for future passenger cars should be established to insure against passenger ejection through windows in overturning accidents and to insure that interiors are designed to minimize impact-type injuries. These specifications should include provisions for the practical escape of nondisabled passengers from overturned cars when the exits at the ends of the cars are blocked.

P(72-34)

5. The Association of American Railroads evaluate the requirements for maintenance and overhaul of traction motors and other major component parts of locomotive units and establish standards and recommended practices for such maintenance.

P(72-35)

6. The Office of Civil Defense of the United States Army review the plans made by the town of Salem, Illinois, for such emergency situations and consider advising associated state and county Civil Defense Agencies of their contents and results in this instance.

P(72-34)

THE NATIONAL TRANSPORTATION SAFETY BOARD:

/s/ JOHN H. REED
Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ ISABEL A. BURGESS
Member

/s/ WILLIAM R. HALEY
Member

Louis M. Thayer, Member, was absent, not voting.

August 30, 1972