B2.2 Probability of Death During a Farm Tractor Overturn—Cole HP, McKnight RH, Reed DB, Browning SR, Struttmann TW, Piercy LR

Objective

Estimates of probability of operator death from all types of overturns range from .40 to .75 per event for farm tractors not protected by Rollover Protective Structures (ROPS). Because the total number of tractor overturns (the denominator) for a given population of farmers for a given time period is unknown these estimated fatality probabilities may be inaccurate. This study estimated the probability of death during a tractor overturn by using (a) tractor overturn fatality surveillance data, (b) surveillance data of farmers' non-fatal tractor overturns, and (c) Census of Agriculture farm population data. Method A state-wide death certificate analysis for the 1982-92 period found 164 Kentucky farmers died in tractor overturns (14.9 deaths/ year). A second study monitored all farm fatalities during the 1994-98 period and found 71 farmers died in tractor overturns (14.2 deaths/year). A third study sampled 998 farmers from 60 Kentucky counties and found that 1 in 9 age 55-years or older reported having overturned a tractor in their lifetime. One-third of this group survived two or more overturns. Data from these three studies and Census of Agriculture data for were used to estimate the total number of tractor overturn events (the denominator) for Kentucky farmers for a 20-year period.

Results

We estimated the denominator as 2,680 farm tractor overturns during the 1982 to 2002 year period. Assuming 14-tractor overturn deaths/year, the estimated numerator is 280 fatalities. The probability of death during a tractor overturn is .104, much smaller than previous estimates. These estimates apply to Kentucky farm tractors not protected by ROPS and seat belts and pooled across all types of overturns, tractors, and operators.

Conclusion

Accurate estimates of the probability of death are important for credibility of intervention programs that promote ROPS and seat belts, and for cost-analysis and cost-effectiveness studies of these programs.

B2.3 Performance of the NIOSH AutoROPS—Powers JR, Harris JR, Snyder KA, Ronaghi M, Etherton JR, Newbraugh BH

Approximately 132 agricultural tractor overturn fatalities occur per year (Myers and Snyder, 1993). The use of rollover protective structures (ROPS), along with seat belts, is the best known method for preventing these fatalities. One impediment to ROPS use, however, is low clearance situations, such as orchards and animal confinement buildings.

To address the need for ROPS that are easily adapted to low clearance situations, the Division of Safety Research, National Institute for Occupational Safety and Health, developed an automatically deploying, telescoping ROPS (AutoROPS). The NIOSH AutoROPS consists of two subsystems. The first is a retractable ROPS that is normally latched in its lowered position for day-to-day use. The second subsystem is a sensor that monitors the operating angle of the tractor. If a rollover condition is detected by the sensor, the retracted ROPS will deploy and lock in the full upright position before ground contact.

Static load testing and field upset tests of the NIOSH AutoROPS have been conducted in accordance with SAE standard J2194. Additionally, timed trials of the AutoROPS deployment mechanism were completed. The design of the retractable ROPS and sensor, as well as the results of the different testing phases will be discussed.

B2.4 Analyzing the Effectiveness of Composite Materials for an Automatically Deployable ROPS Application—Glaessgen EH, Raju IS, Ronaghi M, Etherton JR

Composite materials are used extensively in the aerospace community because of their structural characteristics such as high stiffness and strength-to-weight ratios. However, laminated composites are difficult and expensive to manufacture and often exhibit low resistance to impact, notches and other forms of damage. These deficiencies prevented the use of composites in critical or primary structure. Recently, the development of textile-based composites has significantly increased the damage tolerance characteristics of the material while improving manufacturability and reducing cost.

As cost, manufacturability and damage tolerance have improved, composites are being applied to automotive, infrastructure and other non-aerospace applications. The National Institute for Occupational Safety and Health (NIOSH) is conducting research to develop an automatically deployable roll over protection system (AutoROPS) for use on farm equipment. The AutoROPS system is designed to work in applications where overhead clearance limits the use of a fixed roll over protection system (ROPS). In the AutoROPS application, a lightweight and damage tolerant ROPS structure is critical for rapid deployment from the stowed configuration and for reduction of the weight of the deployment system while maintaining the integrity of the structure during roll-over. Composite materials offer the potential to satisfy this requirement.

In this presentation, recent advancements related to composite materials are briefly reviewed and important considerations for the application of composite materials to the AutoROPS are discussed including the cost, manufacturability and performance of composites under the

Pittsburgh, Pennsylvania
October 17-19, 2000

ABSTRACTS

National Occupational Injury Research Symposium

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