trophe reinsurance. Therefore, the transfer of coverage of such off site property to the liability policies, thus bringing them in for protection under the Government Indemnity Bill, solved this problem for the insurers of the physical damage coverage.

Mr. Butler's paper will serve as an invaluable reference work on the complex, intriguing and highly important subject of liability insurance on the nuclear energy risk.

SOME FURTHER NOTES ON ESTIMATING ULTIMATE INCURRED LOSSES IN AUTO LIABILITY INSURANCE

FRANK HARWAYNE

VOLUME XLVI, PAGE 59

DISCUSSION BY F. J. HOPE

Mr. Harwayne has presented this paper as a supplement to his previous paper "Estimating Ultimate Incurred Losses in Auto Liability Insurance" (Volume XLV, 1958 *Proceedings* of C.A.S.). He here elaborates on the derivation of and the factors underlying a formula incorporated in his preceding paper; namely,

$$\log_{10}y = 2.0674t^{-.80599} \; 10^{-.24841t}$$

In the formula, a value for y expresses losses paid as of any evaluation date t as a percentage of total losses eventually to be incurred on a policy year of automobile insurance exposures.

In this elaboration, Mr. Harwayne examines the various forces that go into the accumulation of losses paid with the passage of time. On the first page, he draws upon Mr. Tapley's earlier paper to suggest two conclusions; namely, that (1) "easier claims are settled first", with which there can hardly be any quarrel, and (2) "that the number of claims paid during a particular time interval is functionally related to the number of claims outstanding at the beginning of that time interval." It would seem that this latter needs some elaboration with respect to relative number of car exposures immediately prior to the period, since that would affect the number of claims outstanding at the beginning of the period.

On Page 60, with respect to the distribution of number of claims paid (as % of total) according to average age of accident, there follows a statement to the effect that the values are "satisfied by a formula for paid increments comprised of 9% of the amount (presumably number) outstanding as of the beginning of each month." There is no elaboration as to how the value of 9% was established, so one must assume that it was derived from the same data as the distribution itself.

The formula for N, the cumulative number of claims paid (as a percent of total) according to time measured from date of accident is rel-

atively simple and fits the observed data quite well. However, it becomes extremely complex when combined with a third degree equation designed to reflect seasonal variations in number of claims created.

The reviewer made his way through a check of the algebra and calculus involved, and can only express doubts as to the practical value of this formula in the everyday business of revising rates. It could be expected that both company executives and insurance department authorities would insist upon observed data to substantiate the formula, to such degree that that formula itself would not be needed. It must be acknowledged that the comparison between calculated values and observed values for Policy Year 1956 is impressive.

With respect to Mr. Harwayne's summary, we can agree that the traditional method of developing earned premiums and earned exposures are suitable for approximating the occurrence of losses as well, subject to seasonal variations. In his summary, he also notes that, measured from time of occurrence, the average paid claim cost increases with time, and leaves it to the reader to speculate on what the result might be if a company made every effort to clear out its claims quickly. The inference seems to be that claims grow large because they are allowed to age; it is more likely in most instances that they age because they are of a serious nature and, therefore, destined to be large from the moment of occurrence. There is also an inference that the companies could reduce their losses by disposing of them more quickly; on the contrary, it is not only possible, but quite probable, that the haste to dispose of claims rather than resist them has been a major factor in the steady growth of average claim size, and thereby a disservice to both companies and the public in the long run.

It is this reviewer's conclusion that Mr. Harwayne's development of formulas to measure the various forces behind loss payments makes an excellent addition to the *Proceedings* of the Casualty Actuarial Society. For practical application, they require and should initiate more rigorous tests by substantial volumes of data.

NOTES ON SOME ACTUARIAL PROBLEMS OF PROPERTY INSURANCE

LAURENCE H. LONGLEY-COOK

VOLUME XLVI, PAGE 66

DISCUSSION BY F. W. DOREMUS

A careful review of Mr. Longley-Cook's paper must impress the reader with the extent of his research, the depth and clarity of his reasoning and the challenge of his conclusions.

He explores many facets with a precision that again draws to the attention of the Society those contributions that can be made by it to reducing the overall complexity of fire insurance rate making.