ABSTRACT OF THE DISCUSSION OF PAPERS READ AT THE PREVIOUS MEETING.

A STUDY OF SCHEDULE RATING—ALBERT W. WHITNEY

VOL. VII, PAGE 225.

WRITTEN DISCUSSION

MR. W. W. GREENE:

The gist of Mr. Whitney's mathematical analysis of schedule rating is contained in the formula for the schedule rate for the individual risk. This rate we find to be made up of two quantities, first the rate charged for hazards which cannot conveniently be measured by the schedule $(\epsilon'/\epsilon \cdot R)$, and secondly that charged for measurable hazards

$$\left(\epsilon'/\epsilon \cdot \frac{N}{N'} \cdot \sum_{i=1}^{i=m} \frac{N_i' D_i'}{N_i D_i} \pi_i \right)$$

In a given classification the rate for the measurable hazards varies only in proportion to the morale factor of the risk, $i.\ e.$, the "susceptibility factor" (ϵ'/ϵ), which depends upon the condition of the risk as to "safety organization", "welfare and health", "first aid and hospital," etc. This morale factor is also applied to the rate charged for those measurable hazards which are specifically treated by the schedule.

The rate charged for the measurable hazards is found to be the sum of several items which respectively correspond to particular hazards.

The hazard due to floor openings is regarded as measurable, so there would be a specific premium charge for it under Mr. Whitney's formula. It follows from the principle we have just outlined that this charge would be the product of the morale factor and a rate of premium proportional to the exposure to floor openings in the particular risk (as compared with the exposure which is standard for the classification).

Under a schedule constructed as outlined in this paper, then, to determine the "schedule rate" you add the rate charged for accident causes whose potency cannot be measured in the individual risk to another rate reflective of the extent to which the management of the risk has adopted physical safe guards against measurable hazards, and apply to the sum of these partial rates the morale factor.

The basic formula for the schedule is, then, very compact. Moreover, it justifies itself to common sense in the light of at least one comparison with an existing schedule.

The present coal mine schedules have in their favor the fact that they are based largely upon statistics. However, the maximum charge for a given hazard under these schedules is proportional to the importance of that hazard in all coal mines as reflected in the accident cost for the industry.

For coal mining as a whole the pure premium for underground fires is small. Nevertheless in the individual mine the potency of the fire hazard may at a given time be very great.

The charge in the coal mining schedule for underground fire hazard is relatively small, since it is based on that proportion of all coal mine accidents which are due to underground fires. If the coal mine schedules were based on Mr. Whitney's formula, in a mine where exposure to fire hazard is fifty times as great as normal the charge would be approximately fifty times the normal pure premium for accidents due to the fire hazard, which seems to be the logical procedure.

Professor Whitney says, "the especial province of the schedule is to carry the classification process beyond the manual." Mr. Joseph H. Woodward said very much the same thing in these pages, as did the writer. Nevertheless, I think the time is opportune to clarify, perhaps to modify this statement.

There are at least two ways in which a "schedule" may be employed in compensation rating. One way is typified by the respective rewards and penalties in the Industrial Compensation Rating Schedule for guarding and for failure to guard. Another quite different way is exemplified in the present scheme for rating chemical risks.

This last is truly an extension of the classification system, being a "two way" analysis of those features of the risk which are the fundamental criteria of classification, i. e., raw material, process, and product. It is not "schedule rating" in the original sense.

It seems to me that the term "schedule rating" should be reserved for the former type of schedule, whose function is "merit rating" as opposed to classification.

Mr. Whitney's formula, in fact, assumes a classification system already built up, with each classification covering risks which differ in "merit" rather than in the character of the several loss producing causes.

MR. J. D. MADDRILL:

The opportunities afforded by these proceedings for the profitable exchange of ideas are especially appreciated by those of us who, through calls to government or other more or less unrelated fields, have lost some of the threads of development of problems that have interested us.

When we were last in touch with the rating schedule we were decrying its shortcomings, one of them being its literal coming short of manual. As we return to it we find that it has been so developed that there has now been secured to it the requisite quality that by relating inspection value *differentially* to the normal value (previously determined statistically) the normal is now more highly probable of approximate reproduction. Moreover, we find that without essential structural change the schedule now stands so modified as to define more truly the quality of individual risks within their manual classifications. If the same schedule is to be retained, however, and is to be trained more satisfactorily on its mark, it must next be dimensioned by the statistical valuation of its various items.

The magnitude of this necessary impending task—indeed its well-nigh impossibility with the present schedule—has evidently spurred the Actuarial and Engineering Committees of the National Council to aggressive effort to discover if possible, and statistically value before its application, a schedule plan founded on more natural and simple principles.

Whether the Committee has succeeded, or to what extent, it itself feels cannot with complete assurance be stated in advance of the stages of engineering definition and statistical test which must follow the actuarial analysis of structure. Professor Whitney expresses the gratification of the Committee at the degree to which the problem as conceived has submitted to mathematical analysis; and the formulae established at the close of his paper promise that it will yield no less satisfactorily to statistical control, once the component items have been appropriately defined in the engineering stage. It is believed that a schedule of the form proposed will avoid the pronounced incongruities of its predecessors without creating new ones, and will possess the properties demanded of a satisfactory schedule.

The conception of the product and the abstract demonstration of its soundness reflect the wizardry with which Professor Whitney and members of the Committee are endowed. Genius is not always easy to follow. But it is out of the most obscure reasoning that some of the simplest verities have sprung. Conversely, the "obvious" is often the most difficult of proof; yet we feel we understand it perfectly. We have reason to hope that it will so prove to be with the projected schedule that such pains are being required to discover and establish. It would indeed be fatal to its successful use if those who have it to apply and explain, and those who have to abide by its indicia, did not feel that they understood it.

My only extended experience with the development of a schedule happens to have been with the coal mine schedule of the Associated Companies, which was essentially a charge

schedule—my particular duties in connection with it having been to value its principal statistical coefficients and to aid in giving the schedule and working formulae simple form for application in the field. I refer to it here for the reason that though the statistical workout of the schedule and plan has been more than gratifying to all its sponsors, it of course met criticism in the field for the reason just implied—that it assigned charges only.

The Committee's projected plan is based on partial pure premiums, each, for any item subject to inspection, being that which measures the hazard from a recognized and specified cause of accidents. I am impressed most, I think, with the fact that the Committee has succeeded in relating each elemental pure premium multiplicatively to the corresponding normal elemental pure premium, so that both charges and credits are permitted to result and the principles of chance have due opportunity to operate to tend to equalize them and reproduce the normal, a vital property secured to the whole plan by virtue of this truth in regard to each of the elements.

There is for the physically observable hazards of the risk, aside from morale, a certain accident frequency and severity expectation that is measured more or less approximately by manual and schedule. We may consider departure of the actual experience of a given risk from that predicted by manual and schedule to result from five elemental sources: manual error, aggregate schedule error, chance variation from manual and schedule expectation irrespective of outstanding morale, departure of outstanding morale from that of the risk of normal morale, and finally chance variation from what the plant's own morale would of itself produce. As chance variation I refer to that type of deviation from the pure expected which is itself expected in very accordance with the theory of chance. In the single throw of one hundred coins, for example, the pure expectation would be fifty heads and fifty tails, but we just as certainly *expect* a departure of several either way. No one would think of deducing from this latter simple chance deviation that the coins were lacking in homogeneity. For exactly the same reason the obvious fluctuations of experience should be restricted by limits in experience rating formulae set up to measure quality of morale.

This is not altogether a digression from the subject under discussion, for so far as I am aware, no one yet presumes to have unraveled the intereffect of welfare, safety organization, first aid and hospital upon schedule and experience. Rather it is an argument in support of the view that while the schedule should very properly rate the average salutary effect of such safety organization and welfare measures as have been intro-

duced by the assured, it must not invade the domain of the intangible. It must be confined to the measurement of the physically discernible.

I do not overlook the fact that schedule and even manual will not for a long time to come perform their own part, and that meanwhile experience rating must be depended upon automatically to take up the slack. The fact will not excuse us, however, from keeping our eyes on the mark, and improving our marksmanship as our "aim" improves. Once the schedule is trued up, a perfected experience plan would just complete the rate measure, with definite independent jurisdiction beginning where manual and schedule should stop. Until then, the experience of a risk, rationally employed as indicative of its non-physical character in comparison with that of the average physically equivalent risk, may well absorb the deviations of uncertain standards while steadfastly applied in the *form* we believe it should ultimately take to measure within the limits of reason the probable outstanding moral conditions after all that is physcially observable has been rated by manual and schedule.

In conclusion, and as a consequence of the point of view I take that the pure function of experience rating is the measurement of the altogether intangible pure residue of plant morale after manual and schedule have taken full account of the physical (the schedule refining the manual), I am led to state that to my mind, though I know the contrary view is held by some, it would be quite illogical to apply experience rating before measuring the risk by schedule.

AUTHOR'S REVIEW OF DISCUSSIONS
MR. ALBERT W. WHITNEY:

The most important thing that I can say in closing this discussion is to call attention to the fact that a very large piece of statistical work on the Schedule has not only been undertaken but is now beginning to show results. In a general way the results indicate a very great difference in importance, far greater than has been generally supposed, between the different accident causes. These results work out very happily with the general plan of reconstruction. In complete accordance with the general plan it will yet be possible greatly to simplify the Schedule for particular groups of classifications. Such simplifications, however, will vary considerably from group to group. These statistics are throwing so much light on the subject that it seems astonishing that we have not had such data before. In a general way it can be said that our faith in the soundness and practicability of the proposed plan of Schedule revision are much increased by the statistical results that have been secured.

THE DISTRIBUTION OF "SHOCK" LOSSES IN WORKMEN'S COMPEN-
SATION AND LIABILITY INSURANCE—G. F. MICHELBACHER

VOL. VII.   PAGE 235.

WRITTEN DISCUSSION

MR. S. H. WOLFE:

We are all greatly indebted to Mr. Michelbacher for his
interesting and instructive analysis of the important problem
of reinsurance. I know of no other compilation on this subject
to which the student can refer with so much benefit. There
is no phase of the business so vital to its safety as a proper
distribution of risks. For the benefit of its agency force and its
insured a company must be prepared to write policies for a larger
coverage than it can safely assume itself; to relieve this con-
dition reinsurance must be resorted to.

Mr. Michelbacher's reference to the reinsurance pools which
are maintained by the stock companies and mutual companies,
would seem to indicate that catastrophes do not occur with
sufficient frequency to enable us to establish a satisfactory loss
ratio for them without extending our observation over a great
number of years. As he very properly points out, the losses
sustained by the stock companies reinsurance pool for work-
men's compensation have been almost negligible. I had hoped
to be able to give you the exact figures today, but they have
not arrived. In the case of the mutual reinsurance pool all
of the contributions up to the year 1920 have been returned to
the contributing carriers, all of the 1920 contributions are about
to be returned, all of the interest, less the very moderate cost of
administration, has been returned and the pool still has $200,000
with which to pay any catastrophe. This is a phase of reinsur-
ance which may well attract the attention of the student.

When the stock companies' pool was first organized the ques-
tion naturally arose with supervising officials of Insurance De-
partments as to the admissibility of the deposit with the Bureau
as an asset. It may interest the members of the Society to
know that each quarter the receipts and disbursements are
analyzed and apportioned so that each company's share in the
total amount on hand is definitely known. A certificate is
then issued to each company and this certificate forms the basis
of the claim for the asset. The matter was discussed with
several of the important Departments, briefed, and as a result
the admissibility of the asset was allowed.

There is one phase of the reinsurance business which is un-
known to this country, but which is followed in some cases
in Europe. Companies sell participations to banks, other finan-
cial institutions and even to individuals. The profit from sell-

ing reinsurance in this way has been large and has been independent of any gains or losses sustained on the reinsurance itself. I am not prepared to say that this plan could be legally adopted in this country, but it is a fact which should be known.

MR. A. L. KIRKPATRICK:

This paper covers the field of reinsurance very completely in a descriptive way and leaves little to be added. There is one form of treaty which is not covered, however, probably because it is one which is not commonly used. There is only one treaty of this nature, of which the writer has knowledge. It provides for the pro-rata division of premiums and losses between the ceding company and the reinsurer, on all the Workmen's Compensation business of the former. This means that instead of receiving notice of each individual policy, and each claim, the reinsuring company is notified periodically of the total premiums written and losses paid and from these figures are computed its premiums and losses as a direct percentage.

There are two sets of circumstances under which such a treaty might be desirable. The first is the case of a rapidly growing company which is receiving from its agents a larger volume of business than its capital and surplus will permit it to retain. It may find that the legal reserves for unearned premiums and for outstanding claims cause its liabilities to be heavier than it can stand. By reinsuring on a pro-rata basis over the entire line it is able to accept all business offered without endangering its surplus by heavy reserves.

The second reason which might cause a company to adopt this method, and the reason which led to the treaty previously mentioned, is to prevent one line of business growing too rapidly, in proportion to the other lines. It is merely an application of the old principle not to "put too many eggs in one basket." During the early years of Workmen's Compensation insurance, before adequate experience had been accumulated upon which to base rates, it was not at all certain that the rates adopted would prove adequate. If the line should prove it be unprofitable, it would be advisable to have a loss on a small percentage of the total business of the company. By ceding a part of the premium volume as reinsurance, the possible profit or loss was scaled down in the same proportion.