

**DIGEST OF PRESENTATION AND DISCUSSION
OF REPORT ON THE NEED FOR A
NEW MORTALITY TABLE**

President Anderson announced that the report would be given in the form of a panel discussion conducted by the Chairman of the Special Committee on New Mortality Tables, Alfred N. Guertin, and would be followed by general discussion. The Chairman and members of the Committee present were invited to the rostrum, and the discussion proceeded.

MR. GUERTIN opened the discussion by setting out in brief form the background that led to the appointment of the Committee and how it functioned. He said other members would discuss various sections of the Committee's work. He stated that in advance of the meeting there had been distributed to all those present memoranda containing data to be discussed. (Appended is the Report of the Special Committee on New Mortality Tables of the Society of Actuaries, dated November 23, 1956, later submitted to the National Association of Insurance Commissioners. The tables attached to that report as Appendix A were included in the memoranda distributed to Society members before the meeting.)

Mr. Guertin stated that when the CSO table was adopted, it was not thought by many in the life insurance business that improvement in mortality would be so rapid that in less than ten years problems would arise, the solutions of which would indicate that a new table of mortality for ordinary insurance might be necessary. This need had not made itself felt as strongly in the field of participating insurance as in the case of non-participating insurance. Nonparticipating policies were being issued on many plans and at many ages where the gross premiums were less than the net premiums according to the CSO table and the rate of interest used in valuation. This had caused to come into operation the deficiency reserve requirements contained in the laws of many states.

While there was no time to review the extent of the improvement that had taken place in mortality over the twenty years elapsed since 1935, the midpoint of the experience that gave rise to the CSO table, he commended for study not only the reports of the Society Committee on Mortality but also census data covering the same period. Collaterally, similar data compiled in Great Britain and the report on the recent construction of the A 1949-52 table by a Joint Committee of the Institute and Faculty would help greatly in understanding the background of the Special Committee studies.

The Joint Legislative Committee of the American Life Convention and the Life Insurance Association of America had taken cognizance of the situation, and, with the approval of the Joint Committee, request had been made of the National Association of Insurance Commissioners at its meeting in June that a committee be appointed to look into the problem of deficiency reserves. Meanwhile, a subcommittee of the Joint Legislative Committee had reached the general conclusion that it would probably be impractical to attempt to meet the problem of deficiency reserves except through the medium of a new mortality table adopted by the various states on a permissive basis.

The Life Insurance Committee of the N.A.I.C. had acceded to the request of the company organizations, and a subcommittee of representatives of seven states had been appointed. Not only must this subcommittee make recommendations to the N.A.I.C. for the solution of the deficiency reserve problem, but it must also recognize the effect of a new table on the business generally, including companies which have no deficiency reserve problem. Above all, being composed of supervisory officials, it would be concerned with solvency as a basic criterion.

The Subcommittee of the Life Insurance Committee of the N.A.I.C. consisted of the following state representatives: W. Harold Bittel, New Jersey, Chairman; Charles C. Dubuar, New York; Henry G. Eggert, Nebraska; Ralph H. Keffer, Connecticut; George P. Lilly, Kansas; Maurice LeVita, Maryland; and Theodore Tubergen, Michigan.

At the meeting of the Board of Governors of the Society held in Chicago last June, the President had been authorized to appoint a committee to cooperate with the National Association of Insurance Commissioners in the construction of an up-to-date mortality table or tables, somewhat along the lines of the CSO table. The members of the Committee appointed by the President consisted of the Fellows listed in the report of the Special Committee, appended.

The Society Committee had held six meetings. Subcommittees on which Messrs. Rood, Hoskins, Winter and Phillips were serving had held many more meetings. This group had done the actual technical work of consolidating data, constructing the various tables defined by the Committee and making most of the other calculations needed. More than a dozen different tables had been constructed with necessary derived tables. All this would have been impossible without there being placed at the disposal of the Committee the New York Life's electronic computer and adequate personnel. Mr. Guertin acknowledged particularly the enormous amount of work done by Mr. Charles M. Sternhell and his staff at the New York Life, where the basic calculations were made for Mr.

Phillips and the subcommittee. In turn, Mr. Winter had the assistance at his office of Mr. Julius Vogel.

The N.A.I.C. Subcommittee on Deficiency Reserves had been kept fully apprised of the progress of the Special Committee. All studies made had been turned over to them, and, through Mr. Bittel, they had had the benefit of the discussions within the Special Committee. In addition, a joint meeting of the two committees had been held. It was through this meeting and subsequent informal discussions that Table X₁₇ was finally produced. Table X₁₇ was derived primarily from an average experience table derived from data collected by the Committee on Mortality but with a pattern of margins that followed suggestions of members of the Special Committee and also suggestions of Mr. Bittel and his group. The Special Committee felt that Table X₁₇ would be suitable for use as a permissive basis for the valuation of standard ordinary insurance.

The work of the Special Committee was not complete. It had agreed, at the request of the N.A.I.C. Subcommittee, to explore insurance mortality by sex, and a subcommittee of three consisting of Mr. Winter, Chairman, and Messrs. Phillips and Davis had agreed to make exploratory surveys.

MR. H. F. ROOD said the drain upon company earnings as a result of deficiency reserves under the existing law was very heavy—one prominent life insurance company would set up this year deficiency reserves equal to about 60% of last year's statement earnings. In his own company, the deficiency reserve required in connection with a special \$25,000 ordinary life policy averaged \$35 per \$1,000 over the net level reserve. Another company had abandoned the idea of issuing a special low cost nonparticipating ordinary life policy with a \$25,000 minimum because it could not set up the required deficiency reserves. Well-established nonparticipating companies had been able to withstand the depressing effect of deficiency reserves, but few of them are issuing policies requiring such reserves other than ordinary life. Some of the nonparticipating companies felt that they could afford to charge lower rates on other plans but were reluctant to accept the strain on earnings which would result. Many of the newer and smaller companies were not in a position to set up such deficiency reserves and found themselves in a serious situation. They could afford to issue nonparticipating policies at rates lower than those now charged but could not stand the loss in surplus which would result from the legally required deficiency reserve. This placed them in a difficult position in attempting to compete with companies issuing participating policies and with the older companies issuing low cost nonparticipating policies.

After a preliminary examination of the possibility of following the

approach of the 1941 CSO Table, the Subcommittee had abandoned that idea and had begun its study without any preconceived notions as to what an appropriate table would be. The Committee examined the mortality rates published each year by the Committee on Mortality under Ordinary Insurance and Annuities of the Society of Actuaries for the period 1946 to 1954 and for various combinations of years within this period. It was inappropriate to use earlier data, partly because the war years would be included and partly because of the tremendous changes which had taken place in mortality rates during the past few years. It had been found that there was a substantial reduction in mortality rates even during the 8 years studied. The effect of war deaths during this period had been considered and data both including and excluding insurance issued without medical examinations had been studied. The possibility of a select table with perhaps a select period varying by age at issue had been explored. The desirability of separate male and female mortality tables had also been considered.

After considerable study and discussion, it had been decided for ages 20 and over to use, as the basic data, the experience by amounts under standard ordinary insurance issues between 1950 and 1954 anniversaries, eliminating the first 5 policy years. Only policies issued subject to a medical examination had been included for durations 6 to 15 but both medical and nonmedical issues combined had been included for durations 16 and over. War deaths had been excluded from all data and no separation by sex had been made.

For ages 0 to 9 the Committee had computed mortality rates from data contributed by the Equitable, Metropolitan, New York Life and Prudential. This study had produced a mortality rate of 1.00 for the value of $1000q_x$ at age 1 and a mortality rate of 6.33 for the value of $1000q_x$ at age 0. In determining the mortality rate for age 0, it had been assumed that policies would be issued at age 1 day. The data from these four companies had been combined with the intercompany experience during the first 5 policy years on business issued at ages 10 to 14 to produce rates from ages 10 to 19.

The table thus produced was based on an exposure of about \$170 billion and actual claims of nearly \$2 billion. The exposure was more than three times that used for the 1941 CSO Table. It had been agreed that this formed a satisfactory basic table but that it should be adjusted to provide some safety margins. There had been several different suggestions as to the type of margin that might be appropriate. Such a margin might have been produced by using a longer period of exposure. A fairly heavy margin might have made the table more acceptable to those who thought it dan-

gerous to reduce mortality rates too far. A light margin might be appropriate because the new table would then be less likely to become obsolete because of further improvement in mortality.

There were several important reasons on which the Committee agreed that an adjusted table with a margin over average experience was necessary:

- (1) The period 1950-54 was extremely favorable. There had been no major wars, depressions or epidemics. Business was good, and excellent medical facilities had been available to nearly everyone. There was no guarantee that future death rates would remain low.
- (2) For many years following the depression of the 1930's, the companies had operated on a fairly conservative basis. The underwriting of impaired lives and those engaged in hazardous occupations had been fairly uniform and most such persons had been placed in substandard classifications. During the past few years the strong competitive situation which currently existed had forced companies to examine their underwriting practices very carefully, and many included in the standard classification some borderline cases that had formerly been treated as substandard. Also, there had been a tendency to treat as standard those lives which formerly had been charged only small extra premiums. Some companies felt that the cost of handling these small extras, the higher not-taken rates experienced and the general aggravation of policyholders and agents were not warranted by the small additional amounts collected. While these changes were sound, it had to be recognized that the level of mortality rates might increase as policies accepted under these more liberal underwriting standards formed a larger proportion of the business in force.
- (3) The 1955 Committee Reports published by the Society of Actuaries indicated that mortality rates were considerably higher for premium paying policies than for paid-up business. This had been confirmed by a recent mortality study of the Institute in England. With the trend toward lower premium plans of insurance, it seemed probable that a larger proportion of business in force in the future would be on a premium paying basis and that the average rates of mortality would be affected upward by this change.
- (4) Several companies had announced plans to issue life insurance to females on the basis of an age setback. If this trend continued, the new table might be used primarily as a male table. Consequently, mortality rates thereunder should be somewhat higher than a table representative of a mixture of male and female mortality.
- (5) The basic table was to be constructed from the average experience of 15 very large companies which operate widely throughout the country. There were deviations from the average for companies in this group, but there would be still wider fluctuations for smaller companies and particularly for those that operated only in certain areas or that specialized in certain classes of business.

- (6) Investigation of population data had indicated that there were material variations in the rates of mortality by sex, marital status, geographic areas and occupation. Medically examined and nonmedical risks produced different mortality rates. Companies issuing different proportions of these various classes of business would be likely to experience mortality rates which would deviate considerably from the average of the 15 large companies studied.

The conclusion was reached that basically the job of the Committee was to provide a mortality table for valuation that would be safe for all companies operating in the United States to use for policies issued at standard premium rates. This would include companies with strict underwriting rules and those with liberal underwriting rules, those operating nationwide and those limiting their operations to small areas, those issuing a large proportion to females and those selling almost entirely to males, those issuing primarily to business and professional men and those covering semi-industrial classes or other special occupational groups, such as military or aviation risks. With this decision made, the Committee had undertaken to adjust the mortality rates upward to cover for each age group the deviation from the average that might reasonably be expected for these various types of companies.

Seventeen mortality tables had been prepared to date. Most were experimental, as investigation was made of the characteristics of tables covering different periods of time, including war deaths, nonmedical business, various margins, etc. A preliminary table which had been distributed to members of the Society had seemed to be the first to satisfy the majority of the Committee. This table had been submitted to the Bittel Committee for discussion. Then the Committee had experimented further, and Table X₁₇ had been devised.

MR. C. M. STERNHELL (New York Life) read a discussion prepared by MR. J. T. PHILLIPS, stating that after constructing and analyzing about ten different mortality tables, it had been realized that it was desirable to obtain more specific information about variations in ultimate mortality rates by individual company.

Mortality data for each of the 15 large companies that contribute to both the mortality studies of the Society of Actuaries were obtained. These data consisted of exposures and actual claims for policy year durations 6 and over during the period between 1950 and 1954 policy anniversaries. War deaths were excluded. The experience at durations 6 to 15 covered medical issues only and was subdivided by quinquennial age group at issue and duration. These data were appropriately combined to produce data by quinquennial attained age groups. The experience at durations 16 and over covered both medical and nonmedical issues and

was already subdivided by quinquennial attained age groups. Those two experiences were then combined to produce mortality data at durations 6 and over for each of the 15 companies.

The data for all 15 companies were then combined and crude average mortality rates obtained at quinquennial attained ages 22 through 92. A minor adjustment was made in the mortality rates at ages 22 through 32 in order to avoid a dip in these mortality rates. No preliminary adjustment or graduation of the mortality rates at ages 37 and over was made because of the extremely large volume of data and the smooth progression of these mortality rates. At ages under 20, the crude mortality rates obtained from the juvenile mortality study described by Mr. Rood were used. The basic mortality rates obtained in this manner were considered to be representative of average company ultimate mortality experience during the 1950-1954 period.

The next step was to determine appropriate safety margins to cover individual company variations in mortality. The differences between the mortality rates of each of the 15 large companies and the basic mortality rates representing the combined experience of these 15 companies were examined. In order to take account of the mortality experience of companies that do not contribute to the annual mortality studies of the Society, a special questionnaire had been sent to the senior actuary of each of the companies that had an actuary who was a member of the Society. Appropriate mortality data had been submitted by 33 of these companies. While these data were generally not exactly homogeneous with the data submitted by the 15 large companies, the mortality rates of these 33 companies were compared with the basic average mortality rates to aid in determining appropriate safety margins.

This analysis of variations in individual company mortality rates had indicated that a U-shaped pattern of safety margins might be appropriate with a minimum margin of from 10% to 15% at age 52 and with higher percentage margins at younger and older ages. These margins had not been determined by attempting to clear the highest individual company mortality rate at each quinquennial age, but rather by attempting to draw a smooth curve that would clear, on the average, about 90% of the individual company mortality rates. In other words, the curve was drawn so that, on the average, only about 4 or 5 of the 48 companies would have higher mortality rates at a particular five-year age group than those produced by the curve.

In constructing the preliminary table, the minimum percentage margin had been 10% at age 52 grading up to 15% at age 72 and to 28% at age 92. The 10% margin at age 52 was equivalent to a margin of .82 per 1,000

over the basic mortality rate. This constant margin had been graded down to a value of .50 per 1,000 at age 12, and was then continued at that level down to age 0. Study of this table had produced suggestions for several further changes, namely:

- (1) The mortality rates at ages 3 to 15 were higher than U.S. White Males 1949-51 mortality rates and the margins at these ages should be reduced.
- (2) The margins in the important middle range of ages between 20 and 70 were rather light and should be increased so that the minimum percentage margin at age 52 would be about 15% instead of 10%.
- (3) The mortality rates at ages 78 and over were higher than U.S. White Males 1949-51 mortality rates and the margins at these ages should be reduced.

Taking account of these comments, Table X₁₇ had been constructed as follows:

- (1) A flat 15% margin was used at ages 52 to 92.
- (2) The 15% margin at age 52 was equivalent to a margin of 1.23 per 1,000 over the basic mortality rate and this constant margin was graded down to a value of .24 per 1,000 at age 12 and then up to a value of .65 per 1,000 at ages 1 and 0.

Graduation of Table X₁₇ had been along the following lines. Pivotal mortality rates had been obtained by adding the indicated margins to the basic mortality rates at quinquennial ages. These pivotal mortality rates had then been graduated by a 5th difference modified osculatory interpolation formula. The graduation had produced mortality rates at individual ages 0 to 92. Mortality rates per 1,000 at ages over 92 had been extrapolated to grade into a value of 1,000 at age 99.

One of the tests used in the development of the new mortality table was an analysis of ratios of actual to expected deaths. These mortality ratios were based on the experience during the 1950-54 period for attained ages 20 and over at durations 6 and over. The aggregate mortality ratio for the combined experience of the 15 large companies that contribute to the annual mortality studies of the Society of Actuaries was 63% on the basis of the CSO Table and 85% on the basis of Table X₁₇. Comparable individual mortality ratios for the 15 large companies on the basis of Table X₁₇ fell within a range of about 80% to 90%. Comparable individual company mortality ratios for the 33 smaller companies ranged from about 55% to 95%.

Net annual premiums for the Ordinary Life plan on the basis of Table X₁₇ ranged from about 80% to 90% of corresponding net annual premiums on the basis of the CSO Table. The Ordinary Life net annual premiums on the basis of Table X₁₇ were about \$1 to \$2 lower per \$1,000

than the corresponding lowest gross annual nonparticipating premiums currently charged.

Tests of aggregate mean reserves on the basis of several model offices indicated that Table X_{17} net level premium reserves are about $2\frac{1}{2}\%$ to 3% lower than CSO net level premium reserves and about 1% to 3% higher than CSO Commissioners Reserve Valuation Method reserves, when the same interest rate was used.

The periods of extended term insurance provided by 10th year terminal reserves were generally about 15% to 25% longer on the basis of Table X_{17} than on the basis of the CSO Table. If companies should be permitted to calculate values of extended term insurance on the basis of 130% mortality, the terms might not be too far out of line with those currently granted.

Before closing, Mr. Sternhell explained how the various monetary values for each of the new mortality tables had been calculated on the IBM 705 system of the New York Life. It generally took about 3 or 4 days of manual calculation to construct and graduate a new mortality table that would satisfy certain specified criteria. A copy of the new mortality rates would then be given to the Electronics Division at about 5 o'clock in the afternoon and a complete tabulation of all the required monetary values would be received at 9 o'clock the morning of the following day.

It took about 30 minutes to key punch the mortality rates on a set of punch cards and to verify and check these cards. These cards were then fed into the 705 system together with a program instructing the machine to calculate values of l_x , d_x , commutation columns, net premiums for four plans at individual ages 0 to 70, and terminal and mean reserves for these four plans at each individual age and duration. The time required for all of these calculations was only about 10 minutes, including about 4 minutes for setup time.

The results were produced on magnetic tapes. While reserves were calculated for all ages, only the reserves for quinquennial issue ages were produced on tape. The data on the tape were then put on punch cards in order to permit the printing of the results in the desired format without providing the additional programming necessary to edit the tape. It took about 30 minutes to convert from tape to punch cards, another 30 minutes to sort the punch cards into the required order for printing, and then about one hour to print out the results in appropriate form.

About 75 sheets listing commutation columns, net premiums for four plans at each age, and terminal and mean reserves for the four plans at quinquennial issue ages and individual durations were produced. The en-

tire job for one mortality table was completed in 2 hours and 40 minutes. Similar calculations had been completed for about 12 mortality tables and not a single error in any of the values has been found.

It should be mentioned that it took a team of two experienced programmers about 14 hours to prepare and "de-bug" the program for the foregoing calculations. The same program could, however, be used for each of the new mortality tables that was constructed.

After receiving the results of the 705 calculation, about two days were required to complete the required manual calculations and to type and reproduce a report for the Committee members.

MR. J. E. HOSKINS said that the table which has been proposed had the same general incidence of mortality as the aggregate of the intercompany experience on which it was based, excluding the first five durations; while its mortality rates did not materially exceed those of the United States White Males 1949-51 Table. Like the 1941 CSO Table and the α -1949 Table, it contained a planned element of conservatism, bearing in mind that less time had elapsed between the average time of the underlying exposure and the preparation of the table than had usually been the case.

Up to about age 65, the safety margin in Table X₁₇ as a percentage of the underlying experience mortality rates was very similar to the percentage margin of the 1941 CSO above its basic data, but probably higher than what the 1941 CSO margin would have been if its basic data had included experience beyond the 15th policy year. Above age 65, where the 1941 CSO basic data did include these longer durations, the percentage margin of Table X₁₇ above its basic data was greater than that of the 1941 CSO Table.

The nature of this provision for conservatism was such that, on reasonable model offices, aggregate reserves moderately exceeded those which would have been produced by the underlying data, the excess being somewhat greater than that of the aggregate reserves on the 1941 CSO Table over those produced by its underlying data. Since the primary use of the new table was expected to be for valuation, the fact that it produced aggregate reserves which were moderately conservative was a desirable quality. High mortality rates alone did not produce a table which was "safe" from the standpoint of valuation. It was important, to be sure, that the mortality rates be high enough so that the costs of insurance emerging in the development of the reserve would ordinarily be sufficient to pay claims; but in addition it was important that the incidence of mortality in the table be such as to produce reserves which would be adequate without being clearly superfluous.

If the table should be made an optional standard for minimum nonforfeiture values, it might at first thought appear that the fact of its producing greater aggregate reserves than the underlying data would be a disadvantage. It was generally agreed that the law should not require companies to pay cash values greater than natural reserves derived from the premium assumptions, so that the company would not be compelled to favor withdrawing policyholders at the expense of continuing policyholders. However, the "most probable" mortality assumption from which natural reserves would be derived was presumably not the aggregate mortality rate for all business more than five years old, but rather a series of select and ultimate rates in which the select period might run for as long as fifteen years. Reserves of any kind, including natural reserves, derived from such a mortality assumption would tend to be larger than the corresponding reserves derived from the aggregate experience of durations 6 and over. Consequently, even though the table discussed produced higher aggregate reserves than the underlying aggregate experience of durations 6 and over, it probably would not produce higher aggregate reserves than underlying experience analyzed by duration, with all policy years included. The table, therefore, appeared to be a satisfactory basis for minimum cash values.

When single premiums derived from the table were used to provide paid-up and extended term insurance, the provision for conservatism in the table had the effect of making some allowance for the administrative expenses attaching to those benefits.

The provision for conservatism in the mortality rates was believed to be great enough to make the table satisfactory for calculations of participating insurance, while at the same time it was small enough so that the problem of deficiency reserves on nonparticipating insurance was removed for the present.

MR. W. H. BITTEL stated that his comments might seem unusual in view of his connection with an Insurance Department because of the traditional concept that those responsible for the supervision of insurance companies should favor ultraconservatism in any statutory mortality table. He was vitally concerned about an insurer's ability to carry out all of its contracts and favored reasonable margins to assure this objective. He felt that these margins should not introduce inequities in nonforfeiture values and should not be excessive in any one area, such as mortality, since there were the equally important factors of interest and provision for expenses where conservatism was also needed. It was not possible to legislate solvency nor to guarantee contract performance by including large margins in statutory mortality tables. In his opinion, one of the

most important functions of an actuary was to predict future mortality as accurately as possible where sufficient data were available to justify such a projection.

Table X₁₇ had several features which seemed to him desirable in a statutory mortality table. The mortality rates did not exceed those shown by the U.S. White Males 1949-51 Mortality Table except at a few very old ages where the excess was negligible. Also, the rate for age 0 reflected the first year mortality rate on children aged 1 day. In these respects, the table was an improvement on the 1941 CSO Table and on many of the tables previously considered.

It seemed to him that when loadings were included in a statutory standard the purposes for which they are added should be individually set forth and the loadings scientifically designed to achieve these purposes. In the case of a general loading such as that included in Table X₁₇, this principle had not been complied with. These loadings on mortality rates which represented average experience after the first 5 years varied from 80% to 15%. This pattern was at variance with the loading concept in the 1941 CSO Table which was also of an arbitrary nature. It had been stated that these margins were needed to cover individual company variations in mortality. However, in his opinion, it was not the function of a statutory mortality table to produce net premiums which would be suitable for a company with high mortality rates. The preferable objective of such a table should be to produce reserves and nonforfeiture values appropriate for the majority of life insurance companies.

Another undesirable feature of Table X₁₇ was that it was based on unknown proportions of male and female experience and there was no way of determining the effect of the inclusion of female lives. It would have been preferable if the new table had been based only on male experience with some indication of the adjustment needed for female risks. The Abridged Life Tables 1954 for the United States indicated that for most ages the male expectation of life is about the same as that for a female 5 years older. It would thus appear that a provision should be added to existing statutes to permit the optional adjustment of reserves and nonforfeiture values for policies issued at lower premium rates for female risks. If the Commissioners' Subcommittee should accept Table X₁₇, it probably would recommend an optional rating down in age for females of not more than 3 years. The three-year age setback would take into consideration the fact that Table X₁₇ was a mixed and not a male table. The same considerations would apply to a similar recommendation in the case of the 1941 CSO Table.

Present indications were that the Commissioners' Subcommittee would

not recommend any changes in existing statutes relating to deficiency reserves. The report of that Subcommittee would probably recommend the adoption of a new mortality table at this time only in conjunction with a change in the Standard Valuation Law to authorize the use of such a table on a permissive basis combined with a change in the Standard Nonforfeiture Law to require the use of the new table for nonforfeiture values when used for reserves.

He recognized that practical considerations could not be ignored in a project of this kind and that Table X_{17} probably represents the best compromise that could be obtained at this time. However, it was his hope that actuaries would give more consideration in the future to the purposes of a loading added to a table to be used as a statutory mortality standard and to the limits which should be placed on such loadings. He also hoped that separate data on male and female mortality experience would be available for future studies of this kind.

The Commissioners' Subcommittee was especially indebted to the Company representatives on the Society's Special Committee who gave so much time to this study. That Committee had been most cooperative in preparing material to answer the various questions which the Commissioners' Subcommittee had raised. He also wished to thank the Society of Actuaries on behalf of the National Association of Insurance Commissioners for appointing this Special Committee to assist his Subcommittee in this project.

MR. A. L. MAYERSON (University of Michigan) deplored the fact that the Committee had not distributed the basic actual rates of mortality on which Table X_{17} had been developed. He had developed the percentages of the rates of mortality in Table X_{17} to those in the 1946-49 Basic Table published in Volume II of the *Transactions*. It seemed to him that at the younger ages there was some question as to whether the new table was not loaded perhaps a little too heavily. He pointed out that the differences in deaths per thousand would be very small, although percentage-wise they could be large. It would not be very long before the 1959-61 U.S. Life Tables would be published, and it might become somewhat embarrassing if this new table which was put together then turned out in just a few years to be substantially higher than the 1959-61 population tables at the early ages, which is where he thought mortality was still improving the fastest.

THE CHAIRMAN then read into the record the following table of mortality rates derived from the underlying data upon which Table X_{17} was based and which provided the information requested by Mr. Mayer-son:

Age	Mortality Rate	Age	Mortality Rate
2	.78	52	8.21
7	.43	57	13.22
12	.43	62	21.12
17	.67	67	33.08
22	.89	72	51.00
27	.98	77	74.52
32	1.18	82	112.32
37	1.68	87	160.98
42	2.95	92	231.24
47	4.92		

MR. E. F. ESTES (Bankers Life of Nebraska) stated that he had visited with local actuaries, principally actuaries of companies of \$100 million or less, most of whom indicated fears that the introduction of a new table would expose them to the cost of reprinting rate books and policies, which, with other items such as expense of policy approval, agents' educational meetings, and agency department printing, might run as high as \$50,000, an item of much importance to a small company. He thought the matter should be carefully considered.

He indicated that he thought that the problem of a new mortality table should be discussed on its merits without so much stress on the matter of deficiency reserves, since it was the function of the Society of Actuaries to discuss new mortality tables when the subject was timely and not for the purpose of solving the deficiency reserve problems of a few companies.

In discussing Table X₁₇, he stated that there should be provision for suitably modifying the mortality rates when applied to calculation of extended insurance. He thought that in Table X₁₇ the margins for expense and adverse experience under extended insurance might not be adequate.

It did not make much difference what mortality table was used as a legal yardstick since the table used in computation of premiums and natural reserves was the really important measure; and what basically keeps private insurance solvent is dollars of premium income. It would be unfortunate, therefore, if a valuation table were of such a nature as to encourage companies to reduce premiums below a safe level.

THE CHAIRMAN, in discussing the point raised by Mr. Estes about the desirability of the production of a new mortality table as a direct result of mortality trends rather than specific company problems, stated that, when he was Chairman of the N.A.I.C. Committee some fifteen years ago, the first draft of the legislation proposed by that Committee had contained a provision that mortality experience should be reviewed by supervisory authority at periodic intervals and, if a new table were needed, construction of a new table should be given consideration. This

had been a rather revolutionary step at the time and it had not been acceptable to the insurance business nor to the Commissioners. He stated, however, that the deficiency reserve problem, while it needed solution, was really a manifestation of the fact that the problem of mortality tables was upon us and should be recognized.

MR. HOSKINS stated that, with respect to the extended term problem discussed by Mr. Estes, the Committee did not feel that its responsibility was to work out legislation or proposed changes in the law. The Society's Committee was instructed solely to prepare a mortality table which would be suitable for such use as the Commissioners might choose to make of it. Any changes in the Standard Valuation and Nonforfeiture Laws, other than the insertion of a new table, he felt to be outside the scope of the Society and rather within that of the National Association of Insurance Commissioners, subject to discussion with representatives of the life insurance business, such as the Life Insurance Association and the American Life Convention. He stated that the points made by Mr. Estes as to necessity of having mortality rates high enough so that companies would not be induced to use unsafe premium rates was kept in mind and, as he had stated before, Table X₁₇ had a greater margin of conservatism relative to 1956 mortality than did the 1941 CSO Table relative to 1941 mortality.

MR. ROBERT MERRITT (Phoenix Mutual) stated that during the agitation for a new mortality table in the late 1930's and early 1940's considerable stress had been laid on the fact that a new mortality table exhibiting lower rates of mortality was not necessarily conservative for valuation purposes. Usually a newer table would produce very little change in the aggregate reserve of a well-established company. Any change would probably be a slight increase. There are probably quite a few persons who had become thoroughly inculcated with this notion. He himself had been somewhat confused to note in the statements just made that the two model office distributions had produced mean reserves that were lower on the new table than on the 1941 CSO Table. On the other hand, turning back to the report of the 1938 committee, he had found that in the model office there exhibited, the Table Z mean reserves were higher than those on the American Experience Table. Moreover, the model office of the 1938 report contained a sizable block of reserves on paid-up policies, which the present distributions apparently do not. With this block removed, the Table Z reserves on the remaining business were still in excess of American Experience. Examining more closely the three model offices by plan of insurance, he had found that the reserve ratios on the limited payment life and endowment policies are comparable

throughout. The disparity appeared to lie in the ordinary life business, X_{17} reserves being lower than CSO reserves, whereas Table Z reserves were higher than American Experience reserves. The criterion for comparison of reserves on Ordinary Life is, of course, well known (Jordan, *Life Contingencies*, p. 117):

$$V_x' \begin{matrix} > \\ \equiv \\ < \end{matrix} {}_tV_x$$

according as

$$\frac{\ddot{a}'_{x+t}}{\ddot{a}_{x+t}} \begin{matrix} < \\ \equiv \\ > \end{matrix} \frac{\ddot{a}'_x}{\ddot{a}_x}.$$

He had constructed a table of annuities-due on the basis of the various tables mentioned. In the comparisons of the situations in 1938 and 1956 the differences in the ratios of annuities on the comparative basis explained what had seemed an anomalous result.

MR. G. H. DAVIS (Life Insurance Association of America) stated that the adoption of Table X_{17} or a similar table as a permissive valuation standard would solve the deficiency reserve problem currently. There was a question, however, as to how long the new table would solve the deficiency reserve problem if improvement in mortality should continue. He thought a gross premium was really deficient only when judged against appropriate mortality, interest and expense assumptions. Such assumptions should be on the basis of currently reasonable standards and the net valuation premium complies with these criteria only by accident. He was not sure as to just how serious the basic problem of deficiency reserves might become. It seemed to him that, if there was a serious problem to be taken care of, there might be a better method than the present deficiency reserve requirement and that that was something that demanded the continued attention of actuaries and regulatory bodies.

THE CHAIRMAN stated that he had received a question asking why it was important that the new table should bear any particular relationship to the Table for White Males 1949-51.

MR. BITTEL stated that the white male table, contrary to expectation, produced higher rates of mortality at most of the higher ages than total males. Rates under the male tables were all considerably higher than under female tables. On the other hand, there was a general feeling that any mortality table which is supposed to represent the experience of insured lives should not show mortality rates exceeding those of the general population because it was generally known that insurance companies selected their risks and that they should have an experience more favorable than that of the general population.

MR. H. M. SARASON (Actuarial Consultant), in a written discussion submitted in his absence, pointed out that the adoption of a new table might solve the deficiency reserve problem only temporarily. Repeated discussions of differing solutions to continuing problems could result in incorrect decisions. He suggested that more companies consider the writing of participating insurance, not only as a means of avoiding the current deficiency reserve problem, but as a sound step in the interest of stability of the business.

MR. E. G. FASSEL (Northwestern Mutual) presented a written discussion with reference to the suggestion made to the Committee that the table should be modified so that the rates of mortality do not exceed those for the general population as shown in the Table for White Males 1949-51, stating that any inference that the new table would be wrong if it should show higher mortality in any age range than population mortality should be avoided.

There was not only the question of how accurately the latter was able to state the true population mortality rate. The more fundamental consideration was that population mortality, whatever it might be, was a side issue, and that it was mortality upon insured lives that was under consideration. Insurance companies are bound by contract to the mortality experience under their policies, for better or for worse, and it is not inconceivable that population mortality could be better than mortality on insured lives. Companies could ignore this possibility only at their peril.

Mortality tables giving experience under insured lives are reliable because derived from accurate records based upon a financial relationship—something that cannot be said about population mortality tables, which may suffer from systematic errors. For discussions of these limitations, reference was made to *Population Statistics and Their Compilation* by Hugh H. Wolfenden in 1954 and *Introduction to Demography* by Mortimer Spiegelman in 1955, both published by the Society. In connection with the lower rates of population mortality from age 78 to age 95, he quoted the following statement from Mr. Spiegelman, page 50:

In life table computations, it is usual to disregard population and death records at the extreme ages of life and to proceed by other means. . . . However, in the computation of death rates, these data are generally accepted without adjustment and used in some broad age grouping, as 75 and over, or 85 and over.

The task of the Committee was actually to forecast mortality to be experienced under insured lives, which in its judgment might possibly warrant some concession from past experience at the older ages. This might be justified on the basis of a secular trend toward lower mortality

evident in insurance statistics and corroborated by other sources—comparative annuity tables, comparative mortality census, etc. The outcome could well be rates at the high ages even lower than those in the suggested table. The point made was that rates adopted, in any case, must find their warrant in the mortality upon insured lives.

THE CHAIRMAN stated that he wished to express publicly his personal thanks to the members of his Committee for their industry and cooperation. Nowhere nor at any other time could a Chairman have been blessed with a committee personnel more objective in individual viewpoints and more dedicated to a sound solution of the project at hand. He was truly grateful.

PRESIDENT ANDERSON, on resuming the Chair, said that it had been a great source of pride and satisfaction to him during the course of his term in office that the Society had been able to assemble a talented Committee of this type and which had proceeded so expeditiously with its work. Regardless of the outcome of the work, he felt he spoke on behalf of all of those present in wishing to share in the pride and satisfaction connected with it.

REPORT OF THE SPECIAL COMMITTEE ON NEW MORTALITY TABLES OF THE SOCIETY OF ACTUARIES

In accordance with authorization of the Board of Governors, this Special Committee was appointed by the Society of Actuaries to cooperate with the National Association of Insurance Commissioners in the construction of an up-to-date mortality table or tables, somewhat along the form of the CSO Table, which might be used by companies on a permissive basis. The Committee, as appointed, consists of the following Fellows of the Society:

- ALFRED N. GUERTIN, Actuary, American Life Convention, Chicago, Ill., Chairman
 HENRY F. ROOD, Vice President and Actuary, Lincoln National Life Insurance Company, Fort Wayne, Ind., Vice Chairman
 W. HAROLD BITTEL, Chief Actuary, Department of Banking and Insurance, Trenton, N.J.
 ARTHUR COBURN, Vice President, Southwestern Life Insurance Company, Dallas, Tex.
 MALVIN E. DAVIS, Vice President and Chief Actuary, Metropolitan Life Insurance Company, New York, N.Y.
 WILLIAM V. HAUKE, Assistant Actuary, Continental Assurance Company, Chicago, Ill.
 JAMES E. HOSKINS, Actuary, Life Actuarial Department, The Travelers Insurance Company, Hartford, Conn.
 NORMAN M. HUGHES, Vice President and Chief Actuary, National Life and Accident Insurance Company, Nashville, Tenn.
 JAMES T. PHILLIPS, Senior Vice President and Chief Actuary, New York Life Insurance Company, New York, N.Y.
 BERT A. WINTER, Second Vice President and Associate Actuary, Prudential Insurance Company, Newark, N.J.

Appointment of the Special Committee followed the appointment by the N.A.I.C. in July, 1956, of a Subcommittee to deal with the problems of deficiency reserves and the possible construction of a new mortality table.

Appended is a new mortality table, temporarily designated as Table X₁₇, constructed by this Committee following consultation with the N.A.I.C. Subcommittee, and which in the opinion of this Committee would be suitable as a permissive basis for the valuation of standard ordinary insurance. This table is based primarily on the mortality experience, with adjustments, of life insurance companies which report their mortality experience year by year to a standing committee of the Society of Actuaries.

Mortality rates at quinquennial ages above age 20 were determined on the basis of standard ordinary insurance experience data so reported for the policy years beginning in 1950 and ending in 1954, excluding policies with durations of less than 6 years. War deaths were excluded. For durations 6 through 15 years, medically examined business only was included. For durations in excess of 15 years, both medical and nonmedical business were included. For ages 0-9, mortality rates were derived from data furnished by four large companies with age zero adjusted to age one day. These were combined with rates for ages 10 to 19 derived from Society data for issue ages 10 to 14, including all years of duration. The resulting table was based on exposures of about \$170 billions with claims of about \$2 billions, more than three times the data used in the construction of the CSO Table. It was recognized that the table was representative of average company experience.

In order to make the table suitable for general use, it was necessary to recognize the following: extremely favorable mortality during the period 1950-54 due in part to the absence of wars, epidemics and depression and the wide availability of medical facilities; a trend on the part of companies toward the liberalization of underwriting rules; the inclusion of a substantial amount of data upon paid-up policies in the underlying statistics; a possibility that the table might tend toward use as a male table in view of a trend toward age setback for females; and variations in mortality experience by company as a result of differing proportions of business as classified by sex, marital status, residence, occupation or medical and nonmedical. This recognition was given through modification of the average experience rates.

The table of average experience was modified by reference to the experiences of the individual companies submitting data to the Society and to the experience of a considerable number of other individual companies which submitted corresponding data to this Committee. These companies were widely representative of differing methods and situses of operations. Analysis of these data indicated that a U-shaped pattern of margins over average experience would be appropriate. Margins were fixed on a basis which, while not clearing the highest company mortality rate at each age group, would clear on the average about 90% of individual mortality rates in each quinquennial age group, about 10% being attributed to chance fluctuation. The resulting margin was then adjusted so that, in

general, the mortality rates would not exceed population mortality rates as represented by U.S. White Male 1949-51 mortality rates.

The above procedures developed additions to the average experience table, expressed in terms of deaths per 1,000, as follows:

1. Addition of a flat 15% at ages 52 to 92.
2. Addition of a graded constant of 0.24 at age 12 increasing to 1.23 at age 52.
3. Addition of a constant of 0.65 at ages 0 and 1.
4. Addition of a margin at ages 2 to 12 of amounts so that the final rates would conform with the U.S. White Male 1949-51 experience.
5. Addition of increasing grading from age 92 so as to merge with a mortality rate of 1,000 at age 99, thus providing a tabular limiting age of 100 years.

The table was then graduated by applying a fifth difference modified osculatory interpolation formula to pivotal mortality rates at quinquennial ages.

Application of tabular mortality rates according to Table X₁₇ indicated that for companies submitting data to the Society, the average mortality ratio would be 85% and for individual companies such ratios fell between 80% and 90%. For the other companies which submitted data directly to the Special Committee, the corresponding figures for individual companies were 55% to 95%.

Attached to the appended Table X₁₇ are comparisons of mortality rates, net premiums, reserves and other functions based on Table X₁₇ and the 1941 CSO Table, as well as other data deemed helpful to interested persons. All of the material contained in this report, as well as other preliminary data, has previously been submitted to the N.A.I.C. Subcommittee.

On behalf of the entire Committee, I wish to acknowledge the cooperation of actuaries and companies that submitted data on request, the helpful comments received from various sources, the important contributions of official and staff time, as well as the use of electronic and other equipment of companies whose actuaries served on the Committee and, most important of all, the cooperation received from the N.A.I.C. Subcommittee and their careful consideration of all the materials placed at their disposal.

ALFRED N. GUERTIN
Chairman

November 23, 1956

Appendix A

VALUES OF $1,000q_x$ ON MORTALITY TABLE X_{17}

Age	Mortality Rate	Age	Mortality Rate	Age	Mortality Rate
0	6.98	35	2.25	70	49.79
1	1.65	36	2.39	71	54.15
2	1.29	37	2.56	72	58.65
3	1.06	38	2.77	73	63.26
4	.90	39	3.02	74	68.12
5	.80	40	3.30	75	73.37
6	.73	41	3.60	76	79.18
7	.67	42	3.93	77	85.70
8	.63	43	4.28	78	93.06
9	.61	44	4.65	79	101.19
10	.60	45	5.06	80	109.98
11	.62	46	5.51	81	119.35
12	.67	47	6.00	82	129.17
13	.75	48	6.55	83	139.38
14	.87	49	7.16	84	150.01
15	1.00	50	7.84	85	161.14
16	1.13	51	8.60	86	172.82
17	1.25	52	9.44	87	185.13
18	1.34	53	10.37	88	198.25
19	1.41	54	11.41	89	212.46
20	1.46	55	12.55	90	228.14
21	1.49	56	13.81	91	245.77
22	1.52	57	15.20	92	265.93
23	1.54	58	16.73	93	289.30
24	1.57	59	18.39	94	316.66
25	1.59	60	20.20	95	351.24
26	1.62	61	22.17	96	400.56
27	1.66	62	24.28	97	488.42
28	1.70	63	26.56	98	668.15
29	1.76	64	29.04	99	1,000.00
30	1.82	65	31.75		
31	1.89	66	34.74		
32	1.96	67	38.04		
33	2.04	68	41.68		
34	2.14	69	45.61		

VALUES OF NUMBER LIVING AT EXACT AGE (l_x) AND NUMBER DYING (d_x) BASED ON MORTALITY TABLE X₁₇

Age	l_x	d_x	Age	l_x	d_x	Age	l_x	d_x
0...	10,000,000	69,800	35...	9,504,913	21,386	70...	5,720,146	284,806
1...	9,930,200	16,385	36...	9,483,527	22,666	71...	5,435,340	294,324
2...	9,913,815	12,789	37...	9,460,861	24,220	72...	5,141,016	301,521
3...	9,901,026	10,495	38...	9,436,641	26,139	73...	4,839,495	306,146
4...	9,890,531	8,901	39...	9,410,502	28,420	74...	4,533,349	308,812
5...	9,881,630	7,905	40...	9,382,082	30,961	75...	4,224,537	309,954
6...	9,873,725	7,208	41...	9,351,121	33,664	76...	3,914,583	309,957
7...	9,866,517	6,611	42...	9,317,457	36,618	77...	3,604,626	308,916
8...	9,859,906	6,212	43...	9,280,839	39,722	78...	3,295,710	306,699
9...	9,853,694	6,011	44...	9,241,117	42,971	79...	2,989,011	302,458
10...	9,847,683	5,909	45...	9,198,146	46,543	80...	2,686,553	295,467
11...	9,841,774	6,102	46...	9,151,603	50,425	81...	2,391,086	285,376
12...	9,835,672	6,590	47...	9,101,178	54,607	82...	2,105,710	271,995
13...	9,829,082	7,372	48...	9,046,571	59,255	83...	1,833,715	255,583
14...	9,821,710	8,545	49...	8,987,316	64,349	84...	1,578,132	236,736
15...	9,813,165	9,813	50...	8,922,967	69,956	85...	1,341,396	216,153
16...	9,803,352	11,078	51...	8,853,011	76,136	86...	1,125,243	194,464
17...	9,792,274	12,240	52...	8,776,875	82,854	87...	930,779	172,315
18...	9,780,034	13,105	53...	8,694,021	90,157	88...	758,464	150,365
19...	9,766,929	13,771	54...	8,603,864	98,170	89...	608,099	129,197
20...	9,753,158	14,240	55...	8,505,694	106,746	90...	478,902	109,257
21...	9,738,918	14,511	56...	8,398,948	115,989	91...	369,645	90,848
22...	9,724,407	14,781	57...	8,282,959	125,901	92...	278,797	74,140
23...	9,709,626	14,953	58...	8,157,058	136,468	93...	204,657	59,207
24...	9,694,673	15,221	59...	8,020,590	147,499	94...	145,450	46,058
25...	9,679,452	15,390	60...	7,873,091	159,036	95...	99,392	34,910
26...	9,664,062	15,656	61...	7,714,055	171,021	96...	64,482	25,829
27...	9,648,406	16,016	62...	7,543,034	183,145	97...	38,653	18,879
28...	9,632,390	16,375	63...	7,359,889	195,479	98...	19,774	13,212
29...	9,616,015	16,924	64...	7,164,410	208,054	99...	6,562	6,562
30...	9,599,091	17,470	65...	6,956,356	220,864			
31...	9,581,621	18,109	66...	6,735,492	233,991			
32...	9,563,512	18,744	67...	6,501,501	247,317			
33...	9,544,768	19,471	68...	6,254,184	260,674			
34...	9,525,297	20,384	69...	5,993,510	273,364			

MORTALITY TABLE X₁₇
COMMUTATION COLUMNS—INTEREST AT 2½%

Age	D _x	N _x	C _x	M _x
0	10000000.0000	327997038.1798	68097.5612	2000072.2488
1	9688000.0388	317997038.1798	15595.4789	1931974.6876
2	9436111.8759	308309038.1410	11875.8579	1916379.2087
3	9194086.9020	298872926.2651	9507.9520	1904503.3508
4	8960332.8894	289678839.3631	7867.1870	1894995.3988
5	8733921.0677	280718506.4737	6816.4568	1887128.2118
6	8514082.1627	271984585.4060	6063.8398	1880311.7550
7	8300357.7920	263470503.2433	5425.9556	1874247.9152
8	8092484.0300	255170145.4513	4974.1246	1868821.9596
9	7890132.2366	247077661.4213	4695.7836	1863847.8350
10	7692994.2033	239187529.1847	4503.5135	1859152.0514
11	7500856.6800	231494534.9814	4537.1780	1854648.5379
12	7313371.8477	223993678.3014	4780.5203	1850111.3599
13	7130216.3995	216680306.4537	5217.3649	1845330.8396
14	6951091.3175	209550090.0542	5900.0282	1840113.4747
15	6775652.4671	202598998.7367	6610.2814	1834213.4465
16	6603782.3048	195823346.2696	7280.4069	1827603.1651
17	6435434.0990	189219563.9648	7847.8707	1820322.7582
18	6270624.3994	182784129.8658	8197.5408	1812474.8875
19	6109484.8288	176513505.4664	8404.0411	1804277.3467
20	5952068.9006	170404020.6376	8478.3008	1795873.3056
21	5798418.2566	164451951.7370	8428.9272	1787395.0048
22	5648564.4630	158653533.4804	8376.3519	1778966.0776
23	5502418.2556	153004969.0174	8267.1451	1770589.7257
24	5359945.7280	147502550.7618	8210.0642	1762322.5806
25	5221005.3252	142142605.0338	8098.7523	1754112.5164
26	5085564.9606	136921599.7086	8037.7862	1746013.7641
27	4953489.0353	131836034.7480	8022.0585	1737975.9779
28	4824650.1193	126882545.7127	8001.8280	1729953.9194
29	4698973.9099	122057895.5934	8068.3933	1721952.0914
30	4576296.4649	117358921.6835	8125.5557	1713883.6981
31	4456553.8309	112782625.2186	8217.3309	1705758.1424
32	4339640.1002	108326071.3877	8298.0247	1697540.8115
33	4225497.2370	103986431.2875	8409.6289	1689242.7868
34	4114026.6394	99760934.0505	8589.2279	1680833.1579
35	4005095.3611	95646907.4111	8791.6503	1672243.9300
36	3898618.3932	91641812.0500	9090.5858	1663452.2797
37	3794439.6117	87743193.6568	9476.9208	1654361.6939
38	3692415.3188	83948754.0451	9978.3382	1644884.7731
39	3592378.1141	80256338.7263	10584.4782	1634906.4349
40	3494174.6162	76663960.6122	11249.5849	1624321.9567
41	3397701.2944	73169785.9960	11933.3773	1613072.3718
42	3302897.1607	69772084.7016	12663.9274	1601138.9945
43	3209674.7796	66469187.5409	13402.3522	1588475.0671
44	3117987.6224	63259512.7613	14144.9531	1575072.7149
45	3027794.1907	60141525.1389	14947.0871	1560927.7618
46	2938998.5007	57113730.9482	15798.8050	1545980.6747
47	2851516.8366	54174732.4475	16691.7850	1530181.8697
48	2765275.8516	51323215.6109	17670.7749	1513490.0847
49	2680159.2713	48557939.7593	18721.8403	1495819.3098

MORTALITY TABLE X₁₇—Continued
COMMUTATION COLUMNS—INTEREST AT 2½%

Age	D _x	N _x	C _x	M _x
50.	2596067.7387	45877780.4880	19856.7350	1477097.4695
51.	2512892.2915	43281712.7493	21083.8080	1457240.7345
52.	2430518.3801	40768820.4578	22384.5624	1436156.9265
53.	2348852.8730	38338302.0777	23763.5171	1413772.3641
54.	2267800.2783	35989449.2047	25244.4665	1390008.8470
55.	2187243.6351	33721648.9264	26780.2817	1364764.3805
56.	2107115.8958	31534405.2913	28389.4166	1337984.0988
57.	2027333.4003	29427289.3955	30063.8771	1309594.6822
58.	1947822.4115	27399955.9952	31792.3604	1279530.8051
59.	1868522.2034	25452133.5837	33524.1022	1247738.4447
60.	1789424.3869	23583611.3803	35264.6570	1214214.3425
61.	1710515.2500	21794186.9934	36997.2791	1178949.6855
62.	1631798.0473	20083671.7434	38653.7431	1141952.4064
63.	1553344.3904	18451873.6961	40250.6332	1103298.6633
64.	1475207.2566	16898529.3057	41795.0464	1063048.0301
65.	1397431.5402	15423322.0491	43286.2364	1021252.9837
66.	1320061.6636	14025890.5089	44740.4317	977966.7473
67.	1243124.5699	12705828.8453	46135.0647	933226.3156
68.	1166669.4302	11462704.2754	47440.6895	887091.2509
69.	1090773.3293	10296034.8452	48536.7568	839650.5614
70.	1015632.4004	9205261.5159	49334.9497	791113.8046
71.	941525.9008	8189629.1155	49740.1821	741778.8549
72.	868821.6790	7248103.2147	49713.6216	692038.6728
73.	797917.3035	6379281.5357	49245.0475	642325.0512
74.	729210.8561	5581364.2322	48462.3273	593080.0037
75.	662962.8860	4852153.3761	47455.1631	544617.6764
76.	599337.8850	4189190.4901	46298.1686	497162.5133
77.	538421.7240	3589852.6051	45017.2444	450864.3447
78.	480272.2504	3051430.8811	43604.0654	405847.1003
79.	424954.2099	2571158.6307	41952.3068	362243.0349
80.	372637.1786	2146204.4208	39983.0465	320290.7281
81.	323565.4159	1773567.2422	37675.6277	280307.6816
82.	277997.9610	1450001.8263	35033.2226	242632.0539
83.	236184.2890	1172003.8653	32116.4294	207598.8313
84.	198307.2623	935819.5763	29022.5623	175482.4019
85.	164447.9463	737512.3140	25852.8758	146459.8396
86.	134584.1489	573064.3677	22691.4849	120606.9638
87.	108610.1163	438480.2188	19616.5636	97915.4789
88.	86344.5278	329870.1025	16700.2406	78298.9153
89.	67538.3208	243525.5747	13999.2430	61598.6747
90.	51891.8045	175987.2539	11549.8809	47599.4317
91.	39076.2671	124095.4494	9369.5721	36049.5508
92.	28753.6171	85019.1823	7459.9016	26679.9787
93.	20592.4072	56265.5652	5812.0552	19220.0771
94.	14278.0993	35673.1580	4411.0083	13408.0219
95.	9518.8444	21395.0587	3261.8110	8997.0136
96.	6024.8666	11876.2143	2354.4673	5735.2026
97.	3523.4513	5851.3477	1678.9593	3380.7353
98.	1758.5540	2327.8964	1146.3200	1701.7760
99.	569.3424	569.3424	555.4560	555.4560

COMPARISON OF TABLE X₁₇ WITH 1941 CSO TABLE

Age	1,000 ₀₀		RATIO OF TABLE X ₁₇ TO 1941 CSO TABLE
	1941 CSO Table	Table X ₁₇	
5.....	2.76	.80	29.0%
20.....	2.43	1.46	60.1
35.....	4.59	2.25	49.0
50.....	12.32	7.84	63.6
65.....	39.64	31.75	80.1
80.....	131.85	109.98	83.4
95.....	396.21	351.24	88.6

EXTENDED TERM INSURANCE PROVIDED BY
10TH YEAR TERMINAL RESERVES

PLAN	ISSUE AGE	NET LEVEL BASIS—2½% INTEREST				INCREASE IN PERIOD OF EXTENDED TERM INSURANCE		
		1941 CSO Table		Table X ₁₇		Table X ₁₇ over 1941 CSO Table		
		Years	Days*	Years	Days*	Years	Days	Percent
Ordinary Life...	5	29	90	40	38	10	313	37.1%
	20	23	101	29	119	6	18	26.0
	35	15	251	19	101	3	215	22.9
	50	9	27	10	235	1	208	17.3
20 Payment Life.	5	48	63	54	123	6	60	12.8
	20	35	238	40	85	4	212	12.8
	35	23	70	26	208	3	138	14.6
	50	12	129	14	105	1	341	15.7
20 Year End....	5	10	\$541	10	\$553	.....	.....	.....
	20	10	\$529	10	\$545	.....	.....	.....
	35	10	\$479	10	\$513	.....	.....	.....
	50	10	\$260	10	\$343	.....	.....	.....

* Or amount of pure endowment.

NET PREMIUMS AND TERMINAL RESERVES—2½% INTEREST

END OF YEAR	ORDINARY LIFE			20 PAYMENT LIFE		
	Net Level Basis		Comm. Method*	Net Level Basis		Comm. Method*
	1941 CSO Table	Table X ₁₇	1941 CSO Table	1941 CSO Table	Table X ₁₇	1941 CSO Table
	ISSUE AGE 5					
Net Premium	\$ 8.28	\$ 6.72	\$ 8.47	\$ 16.18	\$ 13.62	\$ 17.10
Reserves						
1	\$ 5.74	\$ 6.10	\$ 0	\$ 13.86	\$ 13.17	\$ 0
5	31.90	32.66	26.30	74.75	69.88	63.24
10	70.92	69.70	65.55	162.69	149.20	154.52
20	162.10	152.95	157.26	374.46	335.97	374.46
	ISSUE AGE 20					
Net Premium	\$ 12.49	\$ 10.54	\$ 12.88	\$ 21.76	\$ 19.16	\$ 23.10
Reserves						
1	\$ 10.40	\$ 9.36	\$ 0	\$ 19.93	\$ 18.20	\$ 0
5	54.11	49.05	44.17	104.48	95.70	87.96
10	113.60	104.24	104.28	221.94	204.15	210.20
20	247.93	233.64	240.03	502.64	464.87	502.64
	ISSUE AGE 35					
Net Premium	\$ 20.50	\$ 17.48	\$ 21.25	\$ 30.30	\$ 27.00	\$ 32.14
Reserves						
1	\$ 16.49	\$ 15.71	\$ 0	\$ 26.59	\$ 25.49	\$ 0
5	84.70	81.27	69.35	138.43	132.99	116.37
10	174.39	168.26	160.54	291.43	279.90	275.68
20	362.44	354.41	351.75	653.56	623.97	653.56
	ISSUE AGE 50					
Net Premium	\$ 36.90	\$ 32.20	\$ 38.52	\$ 44.58	\$ 40.28	\$ 47.19
Reserves						
1	\$ 25.82	\$ 25.36	\$ 0	\$ 33.80	\$ 33.71	\$ 0
5	129.46	127.58	106.39	172.85	172.50	144.77
10	257.76	254.22	238.09	356.77	354.91	336.45
20	495.96	487.12	482.61	799.41	778.94	799.41

* Net premiums shown for Commissioners Method are renewal net premiums.

NET PREMIUMS AND TERMINAL RESERVES—2½% INTEREST

END OF YEAR	20 YEAR ENDOWMENT			20 YEAR TERM		
	Net Level Basis		Comm. Method*	Net Level Basis		Comm. Method*
	1941 CSO Table	Table X ₁₇	1941 CSO Table	1941 CSO Table	Table X ₁₇	1941 CSO Table
	ISSUE AGE 5					
Net Premium...	\$ 39.44	\$ 38.64	\$ 40.36	\$ 2.25	\$.96	\$ 2.22
Reserves						
1.....	\$ 37.77	\$ 38.83	\$ 23.91	\$-.45	\$.18	\$ 0
5.....	200.98	204.94	189.47	-.83	1.55	-.41
10.....	433.01	437.64	424.84	.84	3.26	1.15
20.....	1,000.00	1,000.00	1,000.00	0	0	0
	ISSUE AGE 20					
Net Premium...	\$ 39.87	\$ 39.11	\$ 41.21	\$ 3.46	\$ 1.83	\$ 3.54
Reserves						
1.....	\$ 38.53	\$ 38.68	\$ 18.61	\$ 1.12	\$.42	\$ 0
5.....	202.84	203.68	186.32	5.08	1.91	4.15
10.....	433.51	435.36	421.77	8.13	3.30	7.47
20.....	1,000.00	1,000.00	1,000.00	0	0	0
	ISSUE AGE 35					
Net Premium...	\$ 41.98	\$ 40.29	\$ 43.81	\$ 8.28	\$ 4.97	\$ 8.55
Reserves						
1.....	\$ 38.62	\$ 39.13	\$ 12.02	\$ 3.92	\$ 2.85	\$ 0
5.....	202.37	205.15	180.30	17.81	13.26	14.56
10.....	430.71	435.65	414.96	28.67	21.46	26.35
20.....	1,000.00	1,000.00	1,000.00	0	0	0
	ISSUE AGE 50					
Net Premium...	\$ 49.67	\$ 46.40	\$ 52.27	\$24.33	\$18.71	\$25.32
Reserves						
1.....	\$ 39.07	\$ 40.03	\$ 5.27	\$12.78	\$11.42	\$ 0
5.....	201.54	206.52	173.46	58.54	52.60	47.92
10.....	422.21	431.19	401.89	95.95	86.14	88.27
20.....	1,000.00	1,000.00	1,000.00	0	0	0

* Net premiums shown for Commissioners Method are renewal net premiums.

MEAN RESERVES—2½% INTEREST

YEAR	ORDINARY LIFE			20 PAYMENT LIFE		
	1941 CSO Table (N.L.P.)*	1941 CSO Table (C.R.M.)†	Table X ₁₇ (N.L.P.)*	1941 CSO Table (N.L.P.)*	1941 CSO Table (C.R.M.)†	Table X ₁₇ (N.L.P.)*
ISSUE AGE 5						
1.....	\$ 7.01	\$ 1.00	\$ 6.41	\$ 15.02	\$ 1.00	\$ 13.39
5.....	32.51	27.00	32.55	74.80	63.00	69.30
10.....	70.99	66.00	69.24	161.55	153.00	147.74
20.....	161.26	156.00	151.74	370.74	371.00	332.38
ISSUE AGE 20						
1.....	\$ 11.45	\$ 1.00	\$ 9.95	\$ 20.85	\$ 1.00	\$ 18.68
5.....	54.73	45.00	49.18	104.42	88.00	95.23
10.....	113.68	104.00	103.74	220.53	209.00	202.34
20.....	247.04	239.00	231.92	497.92	498.00	459.99
ISSUE AGE 35						
1.....	\$ 18.50	\$ 2.00	\$ 16.60	\$ 28.45	\$ 2.00	\$ 26.25
5.....	86.27	71.00	81.63	139.18	117.00	132.65
10.....	175.51	162.00	168.09	290.65	275.00	278.12
20.....	363.20	353.00	353.68	648.40	648.00	618.45
ISSUE AGE 50						
1.....	\$ 31.36	\$ 6.00	\$ 28.78	\$ 39.19	\$ 6.00	\$ 36.99
5.....	134.96	112.00	130.88	177.46	150.00	175.00
10.....	263.52	244.00	257.81	360.13	340.00	356.37
20.....	503.37	491.00	492.59	795.01	795.00	774.36

* Net Level Premium Method.

† Commissioners Reserve Method.

MEAN RESERVES—2½% INTEREST

YEAR	20 YEAR ENDOWMENT			20 YEAR TERM		
	1941 CSO Table (N.L.P.)*	1941 CSO Table (C.R.M.)†	Table X ₁₇ (N.L.P.)*	1941 CSO Table (N.L.P.)*	1941 CSO Table (C.R.M.)†	Table X ₁₇ (N.L.P.)*
ISSUE AGE 5						
1.....	\$ 38.61	\$ 25.00	\$ 38.73	\$.90	\$ 1.00	\$.57
5.....	199.36	188.00	202.68	.22	1.00	1.82
10.....	428.30	420.00	432.54	1.84	2.00	3.64
20.....	987.81	988.00	987.80	1.32	1.00	.76
ISSUE AGE 20						
1.....	\$ 39.20	\$ 20.00	\$ 38.89	\$ 2.29	\$ 1.00	\$ 1.13
5.....	201.45	185.00	201.81	6.36	5.00	2.65
10.....	429.16	418.00	430.54	9.68	9.00	4.12
20.....	987.81	988.00	987.80	2.83	3.00	1.48
ISSUE AGE 35						
1.....	\$ 40.30	\$ 14.00	\$ 39.71	\$ 6.10	\$ 2.00	\$ 3.91
5.....	202.16	180.00	203.82	20.38	17.00	14.55
10.....	427.69	412.00	431.62	32.13	30.00	23.42
20.....	987.81	988.00	987.80	8.12	8.00	5.57
ISSUE AGE 50						
1.....	\$ 44.37	\$ 11.00	\$ 43.22	\$ 18.56	\$ 6.00	\$15.06
5.....	205.57	178.00	208.42	65.47	55.00	57.23
10.....	423.99	404.00	431.03	105.62	98.00	93.29
20.....	987.81	988.00	987.81	26.68	27.00	22.25

* Net Level Premium Method.

† Commissioners Reserve Method.

**COMPARISON OF AGGREGATE MEAN RESERVES ON VARIOUS
MORTALITY TABLES AND 2½% INTEREST**

(Based on \$1,000,000,000 of Insurance Distributed on Basis of Model Office)

PLAN	COMPANY "A" DISTRIBUTION			COMPANY "B" DISTRIBUTION		
	1941 CSO Table (N.L.P.)*	1941 CSO Table (C.R.M.)†	Table X ₁₇ (N.L.P.)*	1941 CSO Table (N.L.P.)*	1941 CSO Table (C.R.M.)†	Table X ₁₇ (N.L.P.)*
AGGREGATE MEAN RESERVES (MILLIONS OF DOLLARS)						
Ordinary Life.....	\$ 92.5	\$ 87.4	\$ 89.9	\$140.9	\$133.1	\$136.4
20 Pay. Life.....	118.9	115.8	113.7			
25 Pay. Life.....				65.5	62.9	63.1
20 Year End.....	85.1	83.3	85.3			
25 Year End.....				63.8	60.7	64.3
20 Year Term.....	5.0	4.3	3.9			
Total.....	\$301.5	\$290.8	\$292.8	\$270.2	\$256.7	\$263.8
RATIOS TO 1941 CSO TABLE (N.L.P.)*						
Ordinary Life.....	100.0%	94.5%	97.2%	100.0%	94.5%	96.8%
20 Pay. Life.....	100.0	97.4	95.6			
25 Pay. Life.....				100.0	96.0	96.3
20 Year End.....	100.0	97.9	100.2			
25 Year End.....				100.0	95.1	100.8
20 Year Term.....	100.0	86.0	78.0			
Total.....	100.0%	96.5%	97.1%	100.0%	95.0%	97.6%
RATIOS TO 1941 CSO TABLE (C.R.M.)†						
Ordinary Life.....	105.8%	100.0%	102.9%	105.9%	100.0%	102.5%
20 Pay. Life.....	102.7	100.0	98.2			
25 Pay. Life.....				104.1	100.0	100.3
20 Year End.....	102.2	100.0	102.4			
25 Year End.....				105.1	100.0	105.9
20 Year Term.....	116.3	100.0	90.7			
Total.....	103.7%	100.0%	100.7%	105.3%	100.0%	102.8%

* Net Level Premium Method.

† Commissioners Reserve Method.

GRADUATED 1950-1954 EXPERIENCE TABLE (TABLE X₁₀)

Age	Mortality Rate	Age	Mortality Rate	Age	Mortality Rate
0.....	.00633	35.....	.00141	70.....	.04330
1.....	.00100	36.....	.00153	71.....	.04709
2.....	.00078	37.....	.00168	72.....	.05100
3.....	.00066	38.....	.00187	73.....	.05501
4.....	.00058	39.....	.00210	74.....	.05923
5.....	.00052	40.....	.00236	75.....	.06380
6.....	.00047	41.....	.00264	76.....	.06885
7.....	.00043	42.....	.00295	77.....	.07452
8.....	.00040	43.....	.00328	78.....	.08092
9.....	.00038	44.....	.00363	79.....	.08799
10.....	.00037	45.....	.00402	80.....	.09564
11.....	.00039	46.....	.00445	81.....	.10378
12.....	.00043	47.....	.00492	82.....	.11232
13.....	.00047	48.....	.00546	83.....	.12120
14.....	.00051	49.....	.00606	84.....	.13045
15.....	.00055	50.....	.00672	85.....	.14012
16.....	.00061	51.....	.00745	86.....	.15027
17.....	.00067	52.....	.00821	87.....	.16098
18.....	.00075	53.....	.00902	88.....	.17239
19.....	.00081	54.....	.00992	89.....	.18475
20.....	.00085	55.....	.01091	90.....	.19838
21.....	.00087	56.....	.01201	91.....	.21371
22.....	.00089	57.....	.01322	92.....	.23124
23.....	.00090	58.....	.01455	93.....	.25147
24.....	.00092	59.....	.01599	94.....	.27490
25.....	.00093	60.....	.01757	95.....	.30303
26.....	.00095	61.....	.01928	96.....	.34336
27.....	.00098	62.....	.02112	97.....	.40979
28.....	.00100	63.....	.02310	98.....	.52262
29.....	.00104	64.....	.02525	99.....	.70855
30.....	.00108	65.....	.02761	100.....	1.00000
31.....	.00113	66.....	.03021		
32.....	.00118	67.....	.03308		
33.....	.00124	68.....	.03624		
34.....	.00132	69.....	.03966		