

**TRANSACTIONS OF SOCIETY OF ACTUARIES  
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**PENSIONS**

*Actuarial Assumptions*

**A. Interest**

1. What interest assumptions are being used for cost estimates and valuations for:
  - a) Trusteed retirement plans?
  - b) Deposit administration plans?
2. To what extent is possible appreciation of the funds invested in equities being anticipated in the rates assumed for trustee retirement plans?

**B. Mortality**

1. What has been the recent trend in mortality among pensioners?
2. Are the 1951 Group Annuity Tables, with or without setback or projection, proving satisfactory for cost estimates and valuations of pension plan liabilities?

**C. Disability**

1. What experience with respect to rates of disablement and disabled life mortality, appropriate for pension plan calculations, is available?

**MR. AUBREY WHITE:** I feel that section A leaves the unfortunate impression that a different interest rate will be used if a client intends to adopt a trustee pension plan than would be used if a deposit administration plan has been selected. The real differences between these two ways of funding a pension plan are largely in the areas of flexibility and overhead charges (as distinguished from overhead costs).

Generally speaking, at the Osteimer Company we have used an interest rate for both trustee and deposit administration plans that is close to the rate available on government bonds. If, however, the client decides not to anticipate dividends which may be paid by the insurance company, the interest rate would be limited to the rate guaranteed by the insurance company under the group annuity contract.

In my opinion, possible appreciation in equity investments should not be taken into account when the valuation interest rate is selected. Any capital gains which eventually emerge will, to a considerable extent, reflect inflationary influences. These inflationary trends will in turn produce pressures for increased benefits. The pool of unrealized capital gains can then be used to absorb the cost of these increases.

**MR. CLARK T. FOSTER:** At Johnson & Higgins we have been recommending the use of  $3\frac{1}{2}\%$  interest in combination with the 1951 Group Annuity Table, set back one year. The same assumptions have been recommended for both trusts and deposit administration contracts.

Until a year ago we had been using 3% interest and the 1951 Group Annuity Table without setback.

There are indications that the Internal Revenue Service will require that interest rates reflect the higher current yields, but thus far we have had no demands for use of a rate higher than 3%. We have heard that the government would require an increase in the assumed interest rate if actual earnings were more than 1% higher than the assumed rate; however, we understand that the Internal Revenue Service would not insist on a rate higher than 3%. We also understand that quite a few agents feel strongly that the required interest rates should be above 3% when yields have been consistently at the 4% or 4½% level.

We do not take any specific account of possible capital appreciation when we select the valuation interest rate, but we do advise clients to consider the market value of trust assets when they schedule their amortization of past service liability and determine current contributions.

**MR. HOWARD H. HENNINGTON:** At the Equitable we encourage clients to use 3¼% interest in cost calculations; this is the rate guaranteed under our deposit administration contract. Cases that wish to anticipate dividends may, quite properly, use a higher rate and we will agree to a 3½% interest in appropriate situations. In general, these situations would be larger groups using a strong funding method such as the entry age normal cost method.

We feel that the selection of an interest rate is closely connected with the other actuarial assumptions; in a final salary plan the salary scale is particularly important. A salary scale which has not been constructed on a basis of comparing actual salaries in successive years among a group of employees may seriously understate the value of future benefits.<sup>1</sup>

**MR. ROBERT A. WISHART:** In the office of George Buck we make no recommendation about interest rates, but refer clients to their investment advisers. It seems to me that for new plans 3½% is probably the most common rate used today by our clients. While many of the plans set up during the last twenty years are changing to higher interest rates, the tendency is to make gradual increases so that, generally speaking, the older plans use lower rates of interest.

<sup>1</sup> In response to a remark by **MR. PRESTON C. BASSETT** that a salary scale reflecting inflationary increases had occasionally been rejected by the Internal Revenue Service, **MR. ROBERT F. LINK** responded by saying that he and Mr. Hennington had eliminated general increases in their studies and thereby attempted to minimize the effect of inflation. Even so, there was a significant difference between, for example, the ratio of the salaries of people aged 35 in 1960 to their salaries in 1959 and the ratio of the salaries of people aged 35 in 1960 to the salaries of people aged 34 in 1960.

We do not anticipate capital appreciation in our cost estimates but prefer to wait until it actually develops. Unrealized appreciation in the market value of equities is today receiving considerable attention and many methods have been developed for the application of part of it. Treasury Department representatives have indicated their preference for a method that results in uniform treatment from year to year. Since a pension plan inevitably develops into a final average plan, even though it may be formally a career salary plan, some of the capital appreciation can be used to absorb the cost of benefit increases when they occur.

MR. PRESTON C. BASSETT: At Towers, Perrin, Foster & Crosby we have been recommending  $3\frac{1}{2}\%$  interest on new plans, whether they are trustee or deposit administration.

DR. ALAN A. GROTH: Despite current high interest yields, we at Arthur Stedry Hansen prefer to use the  $3\%$  interest rate for contribution requirements (we prefer this term to "cost estimates") and valuations of trustee and deposit administration retirement plans. We reason that the present high rates cannot be used for long range estimates, while the  $3\%$  interest will give valuation results that are unlikely to increase in the future.

We have found that some insurance companies are now using a  $4\%$  interest assumption to evaluate cost requirements under deposit administration contracts while, at the same time, their annuity purchase rates are based on lower interest rates after the first five years. These high interest assumptions are especially unwarranted if the plan gives disability benefits or is of the excess, offset or stepped-up rate type and other assumptions, such as rate of disability or salary scale, are not taken into consideration.

In 1955 our actuarial committee decided to gradually change the mortality basis of trustee pension plans and deposit administration contracts to the 1951 Group Annuity Table. We also decided to project future mortality improvements on the basis of Projection Scale C, but concluded that it would be satisfactory to project future improvement of mortality only for the next 30 years. Even if this assumption proves untrue, 30 years is a sufficiently long period to allow us to change methods without any abrupt change in cost requirements. We also decided that the basic 1951 Group Annuity Table, with its built-in loading, makes adequate provisions for future mortality improvement among employees over age 65 in 1955.

We looked for a very simple way of introducing this allowance for

mortality improvement. From tables published by Ray Peterson, we knew that the value of a life annuity for a man aged 65 in 1982 is 11% higher than the value of an annuity for a man aged 65 in 1952, both calculated at  $2\frac{1}{2}\%$  interest. We assumed that the same relationship exists for all interest rates; this, of course, is not strictly accurate, but Projection C might not be 100% accurate either.

Based on this simple relationship, we adjust life annuity values by a factor varying between 1.00 for birth years 1890 or earlier and 1.11 for birth years 1920 or later. To assure consistent values for the other benefits, we had to extend the method of simple adjustments to the evaluation of disability and death benefits.

During the last six years we have found that our method gives conservative cost estimates. We also believe that this method, although somewhat arbitrary, is superior to the age setback technique and to the technique of projecting improvement for a number of years and then using a static table and that it is easily understood by our clients.

MR. RAY M. PETERSON: I want to emphasize the limited significance of the *Ga*-1951 Table without projection. As noted by the late Charles D. Rutherford in his criticism of my paper, "Group Annuity Mortality," "if the table being presented is the *Ga*-1951 Table with Projection C, these figures [*i.e.*, those based on the *Ga*-1951 Table without projection] have no real existence."

Intercompany group annuity mortality experience with respect to retirements on or after normal retirement date which has recently become available shows the trend of experience since 1946. Based on the data for moving five-year periods, the aggregate ratios for males, measured by the *Ga*-1951 Table without projection and weighted by amount of annual income, are:

Period	Ratio
1946-50 . . . . .	112%
1951-55 . . . . .	108
1952-56 . . . . .	106
1953-57 . . . . .	105
1954-58 . . . . .	103
1955-59 . . . . .	101

In 1959 the aggregate ratio for males, on the same basis, was 99%.

The annual rates of improvement for the nine-year period running from 1946-50 to 1955-59 (using a weighted average expected rate of mortality improvement for ages 76 to 90) are:

ANNUAL RATES OF MORTALITY  
IMPROVEMENT—MALES  
(by Annual Income)

Ages	1946-50 to 1955-59	Projection Scale C
61-65.....	1.02%	1.25%
66-70.....	1.44	1.25
71-75.....	.93	1.10
76-90.....	.54	.65

In my opinion these figures give great support to the appropriateness of Projection Scale C.

In constructing the *Ga*-1951 Table (without projection) we decided to modify the experience mortality rates by discounting those for males by 10% and for females 12½% in order to provide a basic safety margin and to allow for groups that have an inherently lighter mortality experience than the average. We considered this a vital matter since the self-supporting principle is very prominent in the operation of insured pension plans and should be considered even more important in the case of a trust fund pension plan, since each group is clearly on its own.

James Hamilton and Dorrance Bronson, in their book, *Pensions*, criticize these margins as "of questionable merit when used for a trust fund pension plan." They then present a table derived by removing the safety margins in the *Ga*-1951 Table and then projecting mortality rates for 14 years, *i.e.*, to 1965, according to Scale C. The 1959 intercompany experience is 103% of the expected according to this table, which might be called the Hamilton-Bronson Table. If mortality continues to improve in the future at the rates experienced during the last ten years, it is obvious that this table will soon be inadequate for average groups and is already inadequate for groups with inherently lighter mortality characteristics.

I have noted that some actuaries are using the *a*-49 Table without projection for pension valuations; in reports I have seen, this table is spoken of as a "mortality table well regarded by consulting actuaries and others concerned with pension funding practices." Again referring to the 1959 intercompany experience, the aggregate ratio based on expected mortality according to this table is 111%. I will leave it to the judgment of actuaries as to whether this may really be considered a conservative basis in the light of probable future mortality improvement.

An actuarial note which appeared in *TSA XII* presented monetary

functions on *Ga*-1951 Table projected to 1960. The aggregate mortality ratio for 1959 intercompany experience was 108% in terms of this table. It is evident that the projection from 1951 to 1960 has not even served to maintain the margin in the original table for groups with inherent mortality lighter than the average. This table, in my opinion, has no adequate provision for future mortality improvement and should not be used for pension valuation purposes or for group annuity rates. I would say the same about the *Ga*-1951 Table with one-year age setback, since that table is greatly similar to the *Ga*-1960 Table.

A quick comparison of these different tables may be made in terms of the expectation of life at age 65 for a male.

Mortality Basis	Expectation of Life
1959 actual experience . . . . .	14.2 years
<i>Ga</i> -1951 Table . . . . .	14.21
Hamilton-Bronson Table . . . . .	14.34
<i>Ga</i> -1960 Table . . . . .	14.83
<i>Ga</i> -1951 Table, one-year setback . . . . .	14.86
<i>a</i> -49 Table . . . . .	15.01
<i>Ga</i> -1951, Equitable 1955 Projection . . . . .	15.64
<i>Ga</i> -1951, Equitable 1960 Projection . . . . .	15.96

In the light of recent experience trends, I believe that a number of the mortality tables in current use for pension purposes should be carefully re-examined.

**MR. JOSEPH B. CRIMMINS:** At the Metropolitan we have been using the 1951 Group Annuity Table with Projection C for the past five years. Initially we used it for dividends, then later on for rates and for annual statement reserves.

We regularly study our group annuity mortality on an aggregate basis, without distinction between males and females or between deferred and matured annuities. For the four years ending 1958, our mortality has been a little over 111% of that expected by the 1951 Group Annuity Table with Projection C. We see no evidence that this table is overly conservative, and we feel that for the first time in our 30 years we have, in that mortality standard, a tool that gives an adequate appraisal of liabilities under group annuity contracts.

**MR. WILLIAM A. DREHER:** At The Terriberry Company we have recently finished a mortality investigation for a large pension fund. This study is a continuation of a series which includes all experience under this pension fund since 1940. The trend of mortality results is not par-

ticularly clear, but it would seem reasonable to conclude that mortality among male employees beginning service retirement at age 65 and over has improved at the rate of 1% a year between 1940 and 1959.

The volume of exposure on female annuitants was small (19 deaths and 1,481 years of exposure), but indicated that the 1951 Group Annuity Female Table, without projection, is still a conservative mortality standard. Actual mortality was 105.3% of expected.

The 1951 Group Annuity Male Table, without projection, is not nearly so satisfactory. After eliminating a group of executives with substantially higher mortality—this group retired after World War II and appears to include a number of men who would otherwise have been disability retirements—the mortality ratios were 122.4% for male wage employees with service retirements and 110.6% for male salaried employees with service retirements.

The experience of the wage employees was compared with a modification of the 1944 Railroad Retirement Board Table developed in our office. This modification is intended to offset the effect of disabled life experience that was included in the exposure underlying that table. The actual mortality of wage employees was 100.5% of the expected according to this modified table.

The experience of salaried employees was compared with a modification of the 1951 Group Annuity Male Table which removed the 10% loading in the mortality rates and then projected the rates according to Mr. Peterson's Scale C. The actual mortality was 107.9% of the expected by this standard and suggests that this table, which might be termed the 1951 Group Annuity Male Experience Table with Projection C, is a conservative standard of mortality among salaried employees with service retirements.

There was one paradoxical result of the study. The mortality ratios reached a peak in the third and fourth years after service retirement. This peak occurred among both wage and salaried employees and at all ages of retirement. Does it suggest a psychological impact of retirement that expresses itself in additional mortality three or four years later?

Experience among medical retirements was measured by the 1956 Railroad Retirement Disability Table. Our client administers the disability provisions of its retirement plan liberally and one would expect mortality results similar to experience of the Railroad Retirement Board, but the 1956 RRB Table does not fit the data particularly well. It appears that the select period is closer to ten than five years; also, the mortality rates in the first five years were 25% to 35% higher than RRB rates and grade down to about 90% of RRB ultimate rates.

MR. JOSEPH MUSHER: Very scanty experience data with respect to disability benefits under pension plans are available to the pension actuary. Furthermore, such experience data are rarely presented in sufficient detail to adapt them for cost estimates, and their appropriateness for a particular pension plan is open to serious question.

There is a wide range of opinions about the method of determining total and permanent disability in an actual case under a particular plan. The rate of total disability and its apparent permanence are importantly influenced by the following factors: (1) the distribution of covered

TABLE 1  
RATES OF TOTAL AND PERMANENT DISABILITY BY  
SELECTED AGES (PER 1,000 EXPOSED)

AGE	(a) UAW 1955		(b) 200% OF HUNTER'S DIS- ABILITY	(c) RAILROAD RETIREMENT BOARD 1956		(d) USWA 1954
	Males	Females		All Occu- pations	Regular Occu- pations	
30....	0.4	0.6	1.1	.....	.....	0.9
35....	0.5	0.8	1.3	0.4	.....	1.1
40....	0.7	1.0	1.7	0.9	1.6	1.7
45....	1.0	1.5	2.3	1.9	3.8	3.0
50....	1.8	2.6	3.4	3.4	7.2	5.0
55....	3.6	4.9	5.5	6.2	13.9	8.8

employees by sex and occupation, (2) the strictness or liberality in the interpretation of and the administration of the disability provisions, (3) the amount of disability pension, as related to the employee's regular earnings, and (4) the phase of the economic cycle. Needless to say, the mortality experience after disability retirement is affected in no small measure by the types of disability pensioners which emerge in the interplay of these forces. While this suggests wide swings in the cost of disability provisions, the actuary can take solace from the fact that disability benefits usually represent a minor element in the over-all cost picture.

You may be interested in a display of total and permanent disability rates presently being used by some pension actuaries (see Table 1).

*a) UAW 1955 rates of disablement*

They are based on the combined experience of several large automobile manufacturers.

b) 200 percent of Hunter's Table

c) RRB 1956 rates

These rates, based on actual experience, have been adopted by the Railroad Retirement Board for the seventh valuation of the Railroad Retirement system as of December 31, 1956. A pair of rates was developed; one set reflects a completely restrictive work-clause test and the other relates to individuals who are incapable of returning to their regular occupation.

d) USWA 1954

These rates have been found appropriate for the fully restrictive type of disability provision found in negotiated pension plans of moderate sized companies in the steel industry. The complete schedule of such rates can be found on page 204, Volume VI, of the *Proceedings* of the Conference of Actuaries in Public Practice.

I am also listing a table of temporary annuities to age 65 and the life annuities (at 3% interest) that have been used to evaluate the cost of disability benefits (see Table 2). The sources are:

TABLE 2  
VALUE OF DISABILITY ANNUITIES TO AGE 65 AND FOR LIFE

AGE	(a) HUNTER'S TABLE* AGGREGATE BASIS	(b) 1944 RAILWAY EMPLOYEES †		(c) RRB 1956 SELECT*
		Select	Ultimate	
$\ddot{a}_{x:65-x}^{h(12)}$ at 3% interest				
30 . . . .	7.836	10.546	.....	13.053
35 . . . .	8.046	10.227	.....	12.187
40 . . . .	7.845	9.504	12.703	11.180
45 . . . .	7.335	8.134	11.040	9.983
50 . . . .	6.563	6.729	8.938	8.491
55 . . . .	5.395	5.329	6.481	6.583
$\ddot{a}_x^{h(12)}$ at 3% interest				
30 . . . .	7.902	11.053	.....	13.800
35 . . . .	8.174	10.920	.....	13.169
40 . . . .	8.078	10.439	14.015	12.490
45 . . . .	7.759	9.330	12.779	11.761
50 . . . .	7.342	8.352	11.265	10.950
55 . . . .	6.879	7.831	9.728	10.078

\* On age nearest birthday basis.

† On age last birthday basis.

a) *Hunter's Aggregate Annuity Table*b) *1944 Railway Employees Table*

This table, based on experience among disability annuitants through 1944, was originally developed for the third valuation of the Railroad Retirement System and relates to a definition of disability for gainful employment in any occupation. The UAW actuaries have used the select and ultimate rates of mortality from this table for male disability pensioners, "modified somewhat to allow for lighter mortality among disabled female lives." On the other hand, at Murray W. Latimer and Associates, we have used annuity values based on the ultimate rates of mortality for Steelworker contracts involving moderate size companies in that industry.

c) *RRB 1956 Select*

This is the table developed by the Railroad Retirement Board for the seventh actuarial valuation of that System. This table differs from the 1944 table referred to above in two important respects. First, it is based on combined experience among both types of disabilities recognized under the Railroad Retirement Act—referred to in the valuation report as "total and permanent disabilities and occupational disabilities combined." Second, the 1956 table contains a five-year select period; the 1944 table had a select period of eight years.