INVESTMENTS OWNED - JUNE 30, 1958 - continued

| DESCRIPTION | PAR VALUE (BONDS) OR COST (STOCKS) |
|---|---|
| Forwarded | $28,469,841 |
| The Outlet Company - 500 shares | 42,915 |
| The Philadelphia National Bank - 1,000 shares | 38,250 |
| Plantations Bank of Rhode Island - 2,400 shares | 152,474 |
| The George Putnam Fund of Boston - 4,300 shares | 50,052 |
| Rhode Island Hospital Trust Company - 11,050 shares | 922,663 |
| Second Bank - State Street Trust Co.- 1,800 shares | 113,635 |
| Shawmut Association - 1,000 shares | 23,750 |
| Socony Mobil Oil Company, Inc. - 1,000 shares | 49,105 |
| Standard Oil Company of New Jersey - 1,900 shares | 108,811 |
| Transamerica Corp. - 500 shares | 20,750 |
| U.S. Trust Company of New York - 1,000 shares | 70,631 |
| Wellington Fund, Inc.- 18,500 shares | 252,086 |
| Western Massachusetts Companies - 1,000 shares | 40,500 |
| TOTAL INVESTMENTS | $30,355,463 |



# REPORT ON AN ACTUARIAL SURVEY AND VALUATION OF THE EMPLOYEES' RETIREMENT SYSTEM OF THE STATE OF RHODE ISLAND AS OF JUNE 30, 1958

There are presented herewith the results of an actuarial survey of the operating experience of the Employees' Retirement System of the State of Rhode Island covering the period of five years from July 1, 1953 to June 30, 1958, and an actuarial valuation of its assets and liabilities as of June 30, 1958.

This survey and valuation was made pursuant to the provisions of Section 3 of the Act governing the System prescribing the duties of the Actuary, which reads as follows:

> "In the five-year period, beginning with the year 1937, and in every 5-year period thereafter, the actuary shall make an actuarial investigation into the mortality, service and compensation experience of the members and beneficiaries of the retirement system, and shall make a valuation of the assets and liabilities of the system, and, taking into account the result of such investigation and valuation, the retirement board shall (a) adopt for the retirement system such mortality, service and other tables as shall be deemed necessary; and (b) certify the rates of contribution payable by the State of Rhode Island to carry out the provisions of this chapter."

The previous actuarial survey of the System, pursuant to this directive, was made as of June 30, 1953 and covered the period of seven years ending on that date.

## PURPOSE

The primary purpose of this study is to present basic actuarial information concerning the operations of the System reflecting its experience and on the basis thereof establish its true financial condition. Such information includes data on past and current financial and statistical experience, and actuarial normal and total costs.

From the most restricted point of view, a retirement system might be said to provide benefits only for service retirement. In a broad sense, however, the general usage of the term connotes other types of benefits, of a collateral character, such as provisions for disability and death.

## BASIS OF SURVEY

The provisions of the plan of operation forming the basis of this survey, including benefits for retirement, disability and death, and the method of financing these provisions, prescribed by the Act governing the System, are summarized in the appendix.

In any survey of the operating experience of a retirement system and in the establishment of its financial condition, it must be borne in mind that cost of benefits depends not only



upon the specific provisions themselves but also upon the constitution and characteristics of the particular group of members covered by the System. A given set of benefit provisions may involve higher or lower costs for one group of participants than for another.

The cost factor, however, is not the only one to be considered in maintaining a retirement system on an effective and practical basis. For example, the cost of a system which provides benefits only to those who remain continuously in service until retirement age may be lower for a group of persons having high rates of turn-over as compared with the cost for a group having low turn-over rates or whose participants entered service at the middle or older ages.

Hence, the basic assumptions to be used in the actuarial analysis of the System must reflect the peculiar characteristics of the group of participants comprising the system. To give full effect to those principles, a survey was made of the experience among the participants with respect to the several basic factors entering into cost calculations and other considerations. Thus, the actuarial functions used in computing costs of benefits and reserve requirements closely reflect the basic characteristics of the membership and the operating conditions of the service.

## Basic Factors

The financial condition of a retirement system is established by the valuation of its assets and liabilities. Such a valuation is predicated upon certain basic factors such as conditions for retirement, rates of death, rates of separation from service, rates of disability, rates of retirement and rates of mortality among annuitants. These factors are applied to determine the cost of the retirement allowances and other benefits provided under the plan of operation.

The factor of age has an important bearing upon cost considerations. For example, a young entrant into the service will require larger total contributions than an older entrant because the younger entrant will be able to earn a larger retirement benefit. On the other hand, an employee in service at the date of inception of the System who is of an advanced age may require an immediate outlay of moneys to provide for his retirement, as contrasted with a younger employee in service for whom no contributions may be necessary because of the possibility that this employee may withdraw from service or die while in the service before reaching retirement age.

The age of retirement must also be considered in cost calculations. A low retirement age results in larger costs not only because of longer life expectancy but also because by early re-



tirement such employees avoid the risk of health impairment that usually results from physical exertion at the advanced ages.

The factor of sex is also of importance because of the diverse physiological and economic conditions governing the two different sexes. Thus, marriage is a contributing factor in the rate of withdrawal from service of female employees. That women live longer than men is apparent from a study of mortality rates. Retirement annuities for women, therefore, require a larger outlay of moneys, not only because of their increased longevity but also because, on the average, women retire at earlier ages than men.

All of these factors are basic and interactive in a valuation of a retirement system. For example, a change in the death or withdrawal rates on active members will affect the present value of the retirement benefits unless the change is counterbalanced by the operation of other factors. Costs of retirement and other benefits, therefore, are dependent upon these forces.

## Mortality

The rate of mortality experienced among members of a retirement system affects its financial operations in two diverse ways. If the number of deaths is lower than contemplated by the mortality standard in use, certain gains to the system accrue

because a smaller amount of death benefits are payable. On the other hand, if more members survive at the age fixed for retirement than was anticipated, more pensions have to be paid and the result is higher pension cost. The increase in pension cost is greater than the saving in death benefit payments.

With respect to members already retired, if the rates of mortality are less than the expected according to the mortality table used to measure mortality among annuitants, a deficit results which must be met by larger contributions to the system. Conversely, if the rate of death among the annuitants is greater than the expected according to the assumed mortality table, a gain to the system occurs and a surplus is created. This surplus may be used as an additional reserve to meet future contingencies or applied as a credit on future contributions.

Turnover

Another important factor affecting current pension cost is employee turnover. While one of the objectives of a retirement system is to reduce employee turnover, and this is generally achieved in operations, there is usually a number of employees who leave the service with relatively short periods of employment and forfeit their accrued pension credits by accepting a refund of their contributions. On the other hand, the provision for the vesting of pension credit which has been provided in re-



tirement plans during recent years has made it possible for some employees to leave the service and retain their rights in a future pension expectance. The factor of turnover is basic in the calculation of costs and liabilities of a retirement system. Annual valuations and periodic actuarial investigations are prescribed in order that a continuous check of the factor of turnover may be maintained. Thus, changes in the basic assumptions can be made without too long a delay if it appears that the results of operating experience dictate such changes.

Disability

The operating experience of a retirement system with disability incidents is subject to wide variations depending upon the types of provisions made and the character and degree of administration of disability claims. The policies of the governmental agency have a considerable bearing upon the number of disability claims to be processed by a retirement system and the payments to be made. Members disabled for the particular duties of their previously assigned position are frequently able to perform useful service in another capacity. If they are given other employment, the burden on account of disability claims is reduced. As a general rule, however, this is not done and the members are forced to apply for disability benefits.

For these and other reasons, established disability tables cannot be applied to the operations of a particular system with any degree of dependability as a measure of the number of disability incidents and the amount of claims to be paid. Where such tables are applied, they must be carefully reviewed and checked periodically in order that the forecast of costs and obligations that they reflect takes into account all present and prospective factors of both internal and external character influencing the incidence of claims for disability benefits and their continued payment.

Employment

The policies maintained by the employer relative to the employment of personnel must be carefully studied and evaluated as to their effect on the current operations of the system. These policies frequently affect the number of persons entering its service, the age and salary distribution of the new entrants, the rates of separation from service or rates of disability. Any major revisions in employment or fiscal policies of the governmental agency, therefore, may have an immediate or future effect on the course of operations of the retirement system and its financial status.

In an actuarial investigation, these possibilities must be considered. If any of these factors are of sufficient scope



to warrant adjustments or revisions in the financing provisions of the retirement system or in the qualifying conditions relating to the several benefits comprising the benefit schedule or rates of benefit, the necessary changes must be made. Such changes are imperative if the underlying plan governing the retirement system is to be maintained on a basis that will meet most effectively, in accordance with technical requirements, the peculiar needs of the governmental agency.

Interest

The factor of interest is also basic in the operation of a retirement system. All calculations of costs and liabilities are predicated upon the theory that the reserves of the system will be continuously invested in income-bearing securities at an assumed rate. Mortality tables used in the computation of annuities and reserves reflect an interest factor. Interest income accounts for a substantial part of the revenue of the system. Without this income, contribution rates necessary to meet these costs would be considerably higher.

The effect on cost of the income from invested assets is quite pronounced. Earnings on investments have a direct bearing on the amounts to be contributed to the retirement system. The larger the earnings, the smaller are the contribution requirements from the employees or employer, or both. Earnings on

invested reserves result in large savings in cost. The amount of these earnings depends upon two factors, namely: (1) the rate of income on investments, and (2) the length of service rendered by those qualifying for pension benefits. Assuming a fixed return of 3% per year and regular monthly contributions to the system, the interest earnings after a period of 30 years would be equal to 38.2 per cent of the total accumulated sum consisting of principal and interest, and after 25 years, to 32.7 per cent of such sum.

To illustrate further, an investment made over a period of 25 years at 3 per cent will produce 28 per cent more income than one made at 2-1/2 per cent for the same period. Likewise, an investment made at 3-1/2 per cent for 25 years would produce 25 per cent more income than one made at 3 per cent for the same period of time.

Earnable compensation

Since the retirement annuities payable by the system are based upon the average rate of compensation for the five highest consecutive years within the last ten years of service, it is necessary for the correct calculation of costs and liabilities that future increases in compensation be taken into account. The accrued liabilities of the system at any given date, representing the present value of future pension expectancies, must reflect increases due to changes in compensation that will occur prior to the time when the annuities become payable. Generally a salary scale is prepared showing the rates of compensation that will be in effect at various ages until the prescribed minimum ages of retirement, on the assumption that as a member progresses in service towards retirement, his compensation will be continuously increased in accordance with the rates assumed in the salary scale.



In cost determinations, the salary scale is generally applied in terms of an average salary relationship between the present age of the member and the assumed average age of retirement. For example, if the salary scale rate at age 20 for a male member is $2,287 and at age 60 $4,518 , it is assumed that the member now 20 years of age will at age 60 be earning 4518/2287ths of his rate of salary at age 20.

The relationship between ages may be unaffected in a salary scale by an over-all increase in salary for the employees on a fixed percentage basis uniformly applied. However, the total pension cost for the system in terms of a dollar amount would be increased because pension cost generally follows the trend in salaries particularly if the retirement annuities are predicated upon salaries or if employer contributions are made upon the basis of employees' earnings. But under a fixed percentage rate of increase uniformly for all employees, salary scale relationships

between ages may remain at substantial parity and the salary scal may continue to be used effectively even though rates of salary have increased.

## FINANCING

### Retirement Costs

The cost of retirement system benefits should be allocated to the period in which these costs are incurred. This is in acco with principle. Pension cost is properly a part of personnel ser vice expense for the year in which it has accrued. It should, therefore, be allocated to the time within which the service cre- ating such cost is performed. This method of al locating to each year's service the deferred contingent retirement liability re- flects cost accounting practice. If an employer delays making contributions to the system until the employee retires, the cost of the benefits earned by the employee cannot be related to the retired employee's services.

To measure the cost of a retirement system by the current rate of pension payments, or to evaluate the effect of an increase in payments by the amount to be paid, misstates the real costs that will be incurred over a long period of years. The deferred character of the pension obligation, therefore, should be taken into account if the cost is to be properly allocated to the year



in which it is incurred. Failure to do this, understates the real costs and creates unwarranted claims for additional benefits or increases in payments.

The financing of a retirement system according to the ac- crual principle discussed above constitutes a method of budgeting for retirement costs. This method gives effect to the theory that contributions by an employer are a part of compensation for ser- vices rendered, the payment of which is deferred until the employ- ees fulfill the prescribed age and service conditions. Such method results in a continuous flow of revenues to the system, and places retirement costs on a current basis, in the salary budget where they properly belong. It makes it convenient for the employer to meet this cost and provide for it in his overall budget. It makes it necessary to take into account the additional cost to be in- curred on account of retirement benefits in the employment of new personnel. It establishes a rigid control over proposals for liberalizing amendments since the cost effect thereof, over the long term, must be made known at the time these proposals are ini- tiated. Finally, it results in greater stability for the retire- ment system under cyclical economic conditions and insures the continued operation of the retirement system on a sound financial basis.

## Contributions

Any discussion of financing a retirement system gives rise to the method by which funds are to be accumulated by the system to meet its accruing liabilities. Various methods exist for the accumulation of these funds.

In practically every retirement system, benefit payments are in a steady and persistent upward trend for a great many years. Several factors account for this condition, namely: (1) the continuing increase in the proportion of aged persons in the membership of the system; (2) an increase in membership due to the expansion of governmental functions and activities; (3) a larger proportion of younger individuals than older persons at the time the system was established; and (4) relating benefit payments in some situations to the length of time for which contributions are made, thus producing smaller benefit payments during the early years of the system.

If the method of financing the system and meeting these benefit payments is according to a level rate of contribution, distributed between the employees and employer in such proportions as may be agreed upon, income of the system from contributions during its early years of operations should exceed benefit payments. If the level rate of contribution has been correctly computed, the income from contributions in later years should fall



below benefit payments. The deficiency in income arising in future years would be made up by interest earnings on the accumulated reserve from excess income during the early years of operation. Thus the system would be considered in actuarial balance, with all benefit payments being covered by income from contributions and interest earnings.

Some methods of financing provide for a lower rate of contribution in the early years of operations with increases in future years according to a pre-determined rate schedule. Such a method is used in financing federal social security. Still another method is to fix the employee's rate of contribution at a level amount, with a graded contribution schedule for the employer's share of the cost of the system. The size of the accumulated reserve under such methods would depend upon the gradation of the contribution schedule. Any number of variations exist with respect to the method of financing a retirement system in order that it may become actuarially self-supporting.

## The Function of Reserves

A reserve established by an accepted method of financing is considered essential to the actuarial soundness of a retirement system. The maintenance of a reserve is a guarantee of the payment of accrued pension benefits.

Although a public employee retirement system is presumed to be permanent and solvent because the full faith and credit of the governmental unit maintaining the system is pledged to carry out the obligations of the system, the maintenance of reserves is not of itself a definite criterion of the ability of the system to fulfill its obligations. These reserves, however, serve a useful function and do have a real meaning to the estent that they represent an accumulation of income for the purpose of meeting future demands on the retirement system. Benefit payments by a system, as has been mentioned, increase steadily and persistently for a great many years. If effect is not given to the potential liabilities that are currently accruing, a deferment of costs to future years and future taxpayers occurs which may become of substantial proportions and may conceivably affect the ability of the retirement system to eventually meet its maturing obligations.

Reserves in a retirement system, therefore, are essential to its proper operation and for meeting future payments by the system. The maintenance of adequate reserves serves to establish financial stability for the system and results in confidence in the system on the part of its participants.

Actuarial Soundness

In any discussion of financing a retirement system, the terms "actuarially sound" or "actuarial soundness" are frequently



used. The terms relate to the ability of a retirement system to pay out the benefits that are promised. A proposal for a change in the amount of benefits or in the qualifying conditions therefor may be considered to be actuarially sound if the cost thereof is fully provided for according to a recognized method of actuarial funding.

Many definitions of actuarial soundness exist. One definition is that the retirement system is actuarially sound if sufficient assets are on hand to provide for all future benefits for those currently on the pension roll without consideration of the accrued pension credits of the participants in active service. Another definition is that a system is actuarially sound if the accumulated assets are sufficient to meet all accrued benefits, including those for retired members and active members. This latter definition contemplates full funding. Still another definition which is somewhat less stringent is that a system is actuarially sound if the accrued liabilities for both retired members and active members are balanced by the amount of the present and prospective assets of the system.

Irrespective of the concept of actuarial soundness that may be applied, a thorough actuarial analysis must be made of a retirement system periodically to establish its financial condition and its future cost burden, and to ascertain its progress and

operating experience. In this way, any unfavorable factors may be ascertained and remedial steps instituted for the purpose of insuring the proper operation of the system in fulfillment of its objectives.

## STATISTICAL DATA

Statistics were compiled for this study by Joseph B. Lewi Secretary, and supplied to us in proper form in accordance with our specifications. These statistics were classified and tabulated by us for purposes of this survey. Detailed tables reflecting this statistical data are presented in the appendix. The following is a summary of these statistics.

## STATE EMPLOYEES

| | Male | Female |
|---|---|---|
| Number at June 30, 1958 | 5,164 | 3,526 |
| Per cent of total | 59.4% | 40.6% |
| Aggregate salaries | $20,182,130.00 | $11,479,413. |
| Average salary | $3,908.00 | $3,256.00 |
| Average age | 46.6 | 42.6 |
| Average service | 8.4 | 7.7 |
| New entrants July 1, 1953 to June 30, 1958 | 3,377 | 2,944 |
| Per cent of total | 52.6% | 47.4% |
| Average age at entry | 36.4 | 26.0 |
| Membership at July 1, 1953 Number | 3,942 | 2,596 |
| Per cent of total | 60.3% | 39.7% |
| Average age | 48.0 | 40.9 |



## STATE EMPLOYEES - continued

| Terminations - July 1, 1953 to June 30, 1958 | Male | Female |
|---|---|---|
| By death | 238 | 64 |
| Per cent of total | 78.8% | 21.2% |
| Average age at death | 59.3 | 54.2 |

| Terminations - July 1, 1953 to June 30, 1958 | | |
|---|---|---|
| By retirement | 114 | 78 |
| Per cent of total | 59.4% | 40.6% |
| Average age at retirement | 69.7 | 68.1 |
| By withdrawal with refund | 1,803 | 1,872 |
| Per cent of total | 50.0% | 50.0% |
| Average age at withdrawal | 39.3 | 32.0 |

### Beneficiaries

#### Service retirements

| | | |
|---|---|---|
| Number at June 30, 1958 | 141 | 105 |
| Per cent of total | 57.3% | 42.7% |
| Annual payments | $184,500.00 | $118,916.00 |
| Average annual payment | $1,309.00 | $1,133.00 |
| Average age at June 30, 1958 | 73.5 | 71.2 |

#### Other Beneficiaries

| | Number | Annual Payments | Average Annuity | Average age June 30,1958 |
|---|---|---|---|---|
| (a) Ordinary Disability Annuity - | | | | |
| Male | 6 | $ 9,020.18 | $1,503.36 | 68.0 |
| Female | 7 | 4,954.98 | 707.85 | 63.3 |
| (b) Accidental Disability Annuity - | | | | |
| Male | 1 | $ 351.36 | $ 351.36 | 72.0 |
| Female | 2 | 2,524.44 | 1,262.22 | 65.0 |
| (c) Ordinary Disability Annuity - Option 1 - | | | | |
| Male | 1 | $ 643.97 | 643.97 | 63.0 |
| Female | 1 | 645.41 | 645.41 | 66.0 |
| (d) Accidental Death Benefit - Beneficiaries - | | | | |
| Female | 4 | $ 1,736.84 | $ 434.21 | 59.0 |

## STATE EMPLOYEES - Other Beneficiaries - continued

| | Number | Annual Payments | Average Annuity | Average Age June 30, |
|---|---|---|---|---|
| (e) Beneficiary Annuity - Option 2 - | | | | |
| Male | 10 | $18,980.30 | $1,898.03 | 70.4 |
| Female | 4 | 6,711.01 | 1,677.75 | 69.5 |
| (f) Cash Refund Annuity - Option 1 - | | | | |
| Male | 27 | $30,140.64 | $1,116.32 | 78.6 |
| Female | 12 | 14,160.98 | 1,180.08 | 75.9 |
| (g) Joint and Last Survivor Annuity - Option 2 - | | | | |
| Male | 8 | $12,505.91 | $1,563.24 | 76/75 |
| Female | 1 | 1,601.16 | 1,601.16 | 74/68 |
| (h) Joint and Last Survivor Annuity - Option 3 - | | | | |
| Male | 8 | $17,029.49 | $2,128.69 | 72/65 |

Terminations among service retirements - July 1, 1953 to June 30, 1958

| | Male | Female |
|---|---|---|
| By death | 49 | 31 |
| Per cent of total | 61.3% | 38.7% |
| Average age at death | 75.7 | 73.9 |

## TEACHERS

| | Male | Female |
|---|---|---|
| Number at June 30, 1958 | 1,655 | 4,242 |
| Per cent of total | 28.1% | 71.9% |
| Aggregate salaries | $8,156,058.00 | $20,403,297.00 |
| Average salary | $4,928.00 | $4,810.00 |
| Average age | 40.9 | 48.5 |
| Average service | 11.1 | 14.4 |
| New Entrants July 1, 1953 to June 30, 1958 | | |
| Per cent of total | 725 | 2,190 |
| | 26.2% | 73.8% |
| Average age at entry | 31.2 | 32.5 |
| Membership at July 1, 1953 | | |
| Number | 1,195 | 3,486 |
| Per cent of total | 25.5% | 74.5% |
| Average age | 42.6 | 45.3 |



## TEACHERS - continued

| | Male | Female |
|---|---|---|
| Terminations - July 1, 1953 to June 30, 1958 | | |
| By death | 16 | 60 |
| Per cent of total | 21.1% | 78.9% |
| Average age at death | 48.8 | 53.9 |
| Terminations - July 1, 1953 to June 30, 1958 | | |
| By retirement | 45 | 271 |
| Per cent of total | 14.2% | 85.8% |
| Average age at retirement | 66.7 | 66.9 |
| By withdrawal with refund | 204 | 1,103 |
| Per cent of total | 15.6% | 84.4% |
| Average age at withdrawal | 35.1 | 32.7 |

## Beneficiaries

### Service retirements

| | | |
|---|---|---|
| Number at June 30, 1958 | 67 | 457 |
| Per cent of total | 12.8% | 87.2% |
| Annual payments | $179,934.00 | $1,142,926.00 |
| Average annual payment | $2,686.00 | $2,501.00 |
| Average age at June 30, 1958 | 70.0 | 71.6 |

## Other Beneficiaries

| | Number | Annual Payments | Average Annuity | Average Age June 30,1958 |
|---|---|---|---|---|
| (a) Ordinary Disability Annuities - | | | | |
| Male | 6 | $ 9,205.62 | $1,534.27 | 56.2 |
| Female | 28 | 44,484.62 | 1,588.74 | 59.8 |
| (b) Accidental Disability Annuities - | | | | |
| Female | 1 | $2,666.67 | $2,666.67 | 43.0 |
| (c) Cash Refund Annuity - Option 1 - | | | | |
| Female | 5 | $11,680.15 | $2,336.03 | 73.0 |

Other Beneficiaries - continued

| | Number | Annual Payments | Average Annuity | Average June 30, |
|---|---|---|---|---|
| (d) Joint and Last Survivor Annuity - Option 2- | | | | |
| Male | 9 | $16,455.97 | $1,828.44 | 69/65 |
| Female | 3 | 3,900.93 | 1,300.31 | 68/57 |
| (e) Joint and Last Survivor Annuity - Option 3 - | | | | |
| Male | 9 | $25,753.52 | $2,861.50 | 71/65 |
| Female | 1 | 1,626.67 | 1,626.67 | 67/69 |

Terminations among service retirements - July 1, 1953 to June 30, 1958

| | Male | Female |
|---|---|---|
| By death | 13 | 66 |
| Per cent of total | 16.5% | 83.5% |
| Average age at death | 71.8 | 71.7 |

## ACTURIAL SURVEY

An actuarial survey was made of the mortality and service experience of the system covering the period from July 1, 1953 to June 30, 1958.

Life and service tables were prepared reflecting the operating experience for the aforesaid period. These are reproduced as a part of this report. A life and service table records the



operating experience with respect to such factors as death, separations from service without right to a retirement annuity, and retirements for service and disability. These factors are derived from the experience of the past and are adjusted to give effect to the probable operating experience in future years.

Thus, the actuarial functions produced by the life and service table reflect as closely as possible expected future trends and conditions. An actuarial valuation resulting from the application of these functions records the financial condition of the system at a given date giving effect as fully as possible to developments that may occur in future years in the operation of the system in respect to the several basic factors.

In the process of arriving at the final or refined rates of separation from service, graphic charts were prepared to which were transcribed the actual rates of separation caused by these factors as tabulated from the original statistical data relating to the experience among the group of employees covered by this survey. With the use of these graphs, the rates established in the original tabulations were adjusted and refined by the elimination of extreme fluctuations from the indicated primary trend. The graduated rates produced from a reading of these graphs were then used in the preparation of the life and service tables.

## TABLE A

STATE EMPLOYEES

LIFE AND SERVICE TABLE FOR AGES 16 TO 60

M A L E

| Age | Annual Rates of Withdrawal | Annual Rates of Death | Number in Service | Number of Withdrawals | Number of Deaths |
|---|---|---|---|---|---|
| 16 | .307637 | .000892 | 1,000,000 | 307,637 | 892 |
| 17 | .297297 | .000907 | 691,471 | 205,572 | 627 |
| 18 | .286957 | .000924 | 485,272 | 139,252 | 448 |
| 19 | .276482 | .000944 | 345,572 | 95,544 | 326 |
| 20 | .266008 | .000966 | 249,702 | 66,423 | 241 |
| 21 | .255533 | .000991 | 183,038 | 46,772 | 181 |
| 22 | .246385 | .001020 | 136,085 | 33,529 | 139 |
| 23 | .237238 | .001053 | 102,417 | 24,297 | 108 |
| 24 | .228090 | .001090 | 78,012 | 17,794 | 85 |
| 25 | .218942 | .001133 | 60,133 | 13,166 | 68 |
| 26 | .192135 | .001180 | 46,899 | 9,011 | 55 |
| 27 | .172340 | .001234 | 37,833 | 6,520 | 47 |
| 28 | .156047 | .001295 | 31,266 | 4,895 | 41 |
| 29 | .139754 | .001362 | 26,430 | 3,694 | 36 |
| 30 | .122431 | .001437 | 22,700 | 2,779 | 33 |
| 31 | .111592 | .001521 | 19,888 | 2,305 | 30 |
| 32 | .100221 | .001614 | 17,553 | 1,759 | 28 |
| 33 | .088850 | .001717 | 15,766 | 1,401 | 27 |
| 34 | .078767 | .001910 | 14,338 | 1,129 | 27 |
| 35 | .075156 | .002112 | 13,182 | 991 | 28 |
| 36 | .071544 | .002322 | 12,163 | 870 | 28 |
| 37 | .067933 | .002542 | 11,265 | 765 | 29 |
| 38 | .064322 | .002795 | 10,471 | 674 | 29 |
| 39 | .060710 | .003059 | 9,768 | 593 | 30 |
| 40 | .057099 | .003336 | 9,145 | 522 | 31 |
| 41 | .053558 | .003817 | 8,592 | 460 | 33 |
| 42 | .050765 | .004299 | 8,099 | 411 | 35 |
| 43 | .048564 | .004797 | 7,653 | 372 | 37 |
| 44 | .046364 | .005309 | 7,244 | 336 | 38 |
| 45 | .044163 | .005839 | 6,870 | 303 | 40 |
| 46 | .041962 | .006387 | 6,527 | 274 | 42 |
| 47 | .041638 | .007086 | 6,211 | 259 | 44 |
| 48 | .041313 | .007789 | 5,908 | 244 | 46 |
| 49 | .040989 | .008518 | 5,618 | 230 | 48 |



## TABLE A - continued

STATE EMPLOYEES

LIFE AND SERVICE TABLE FOR AGES 16 TO 60

M A L E

| Age | Annual Rates of Withdrawal | Annual Rates of Death | Number in Service | Number of Withdrawals | Number of Deaths |
|---|---|---|---|---|---|
| 50 | .040664 | .009269 | 5,340 | 217 | 49 |
| 51 | .040340 | .010077 | 5,074 | 205 | 51 |
| 52 | .040021 | .010905 | 4,818 | 193 | 53 |
| 53 | .039702 | .011732 | 4,572 | 182 | 54 |
| 54 | .039384 | .012637 | 4,336 | 171 | 55 |
| 55 | .039065 | .013548 | 4,110 | 161 | 56 |
| 56 | .038746 | .014530 | 3,894 | 151 | 57 |
| 57 | .038528 | .015556 | 3,686 | 142 | 57 |
| 58 | .038311 | .016624 | 3,487 | 134 | 58 |
| 59 | .038093 | .017741 | 3,295 | 126 | 58 |
| 60 | -- | -- | 3,111 | -- | -- |

## TABLE B

STATE EMPLOYEES

LIFE AND SERVICE TABLE FOR AGES 16 TO 60

F E M A L E

| Age | Annual Rates of Withdrawal | Annual Rates of Death | Number in Service | Number of Withdrawal | Number of Deaths |
|---|---|---|---|---|---|
| 16 | .286000 | .000879 | 1,000,000 | 286,000 | 879 |
| 17 | .282610 | .000891 | 713,121 | 201,535 | 635 |
| 18 | .279220 | .000904 | 510,951 | 142,668 | 462 |
| 19 | .275830 | .000955 | 367,821 | 101,456 | 351 |
| 20 | .272441 | .001031 | 266,014 | 72,473 | 274 |
| 21 | .269051 | .001115 | 193,267 | 51,999 | 215 |
| 22 | .265661 | .001210 | 141,053 | 37,472 | 171 |
| 23 | .262271 | .001321 | 103,410 | 27,121 | 137 |
| 24 | .258881 | .001500 | 76,152 | 19,714 | 114 |
| 25 | .254637 | .001679 | 56,324 | 14,342 | 95 |
| 26 | .241636 | .001859 | 41,887 | 10,121 | 78 |
| 27 | .205912 | .002039 | 31,688 | 6,525 | 65 |
| 28 | .177187 | .002215 | 25,098 | 4,447 | 56 |
| 29 | .151408 | .002220 | 20,595 | 3,118 | 46 |
| 30 | .137397 | .002226 | 17,431 | 2,395 | 39 |
| 31 | .123386 | .002231 | 14,997 | 1,850 | 33 |
| 32 | .109375 | .002236 | 13,115 | 1,434 | 29 |
| 33 | .104151 | .002241 | 11,652 | 1,214 | 26 |
| 34 | .098927 | .002247 | 10,412 | 1,030 | 23 |
| 35 | .092918 | .002252 | 9,359 | 870 | 21 |
| 36 | .086909 | .002257 | 8,468 | 736 | 19 |
| 37 | .080899 | .002504 | 7,713 | 624 | 19 |
| 38 | .074890 | .002750 | 7,070 | 529 | 19 |
| 39 | .067834 | .002997 | 6,522 | 442 | 20 |
| 40 | .066311 | .003243 | 6,060 | 402 | 20 |
| 41 | .064788 | .003327 | 5,638 | 365 | 19 |
| 42 | .063265 | .003441 | 5,254 | 332 | 18 |
| 43 | .061742 | .003619 | 4,904 | 303 | 18 |
| 44 | .060219 | .003808 | 4,583 | 276 | 17 |
| 45 | .058696 | .004010 | 4,290 | 252 | 17 |
| 46 | .058288 | .004223 | 4,021 | 234 | 17 |
| 47 | .057879 | .004450 | 3,770 | 218 | 17 |
| 48 | .057471 | .004692 | 3,535 | 203 | 17 |
| 49 | .057063 | .004949 | 3,315 | 189 | 16 |



## TABLE B - continued

STATE EMPLOYEES

LIFE AND SERVICE TABLE FOR AGES 16 TO 60

F E M A L E

| Age | Annual Rates of Withdrawal | Annual Rates of Death | Number in Service | Number of Withdrawal | Number of Deaths |
|---|---|---|---|---|---|
| 50 | .056654 | .005223 | 3,110 | 176 | 16 |
| 51 | .056246 | .005515 | 2,918 | 164 | 16 |
| 52 | .055837 | .006495 | 2,738 | 153 | 18 |
| 53 | .055429 | .007495 | 2,567 | 142 | 19 |
| 54 | .055021 | .008727 | 2,406 | 132 | 21 |
| 55 | .054612 | .010449 | 2,253 | 123 | 24 |
| 56 | .054204 | .010986 | 2,106 | 114 | 23 |
| 57 | .053431 | .011523 | 1,969 | 105 | 23 |
| 58 | .052657 | .012061 | 1,841 | 97 | 22 |
| 59 | .051884 | .012598 | 1,722 | 89 | 22 |
| 60 | -- | -- | 1,611 | -- | -- |

## TABLE C

### STATE EMPLOYEES

### LIFE AND RETIREMENT TABLE FOR AGES 60 TO 70

### M A L E

| Age | Annual Rates of Death | Annual Rates of Retirement | Number in Service | Number of Deaths | Number of Retirements |
|---|---|---|---|---|---|
| 60 | .038486 | .005245 | 1,000,000 | 38,486 | 5,245 |
| 61 | .040212 | .006799 | 956,269 | 38,453 | 6,502 |
| 62 | .041937 | .008169 | 911,314 | 38,218 | 7,445 |
| 63 | .043661 | .010026 | 865,651 | 37,795 | 8,679 |
| 64 | .045387 | .011883 | 819,177 | 37,180 | 9,734 |
| 65 | .047180 | .017667 | 772,263 | 36,435 | 13,644 |
| 66 | .048974 | .023451 | 722,184 | 35,368 | 16,936 |
| 67 | .050767 | .029232 | 669,880 | 34,008 | 19,582 |
| 68 | .052561 | .035019 | 616,290 | 32,393 | 21,582 |
| 69 | .054354 | .044121 | 562,315 | 30,564 | 24,810 |
| 70 | -- | 1.000000 | 506,941 | -- | 506,941 |

### F E M A L E

| Age | Annual Rates of Death | Annual Rates of Retirement | Number in Service | Number of Deaths | Number of Retirements |
|---|---|---|---|---|---|
| 60 | .031118 | .006757 | 1,000,000 | 31,118 | 6,757 |
| 61 | .032072 | .011713 | 962,125 | 30,857 | 11,269 |
| 62 | .033237 | .014634 | 919,999 | 30,578 | 13,463 |
| 63 | .034401 | .016544 | 875,958 | 30,134 | 14,492 |
| 64 | .035565 | .021834 | 831,332 | 29,566 | 18,151 |
| 65 | .036685 | .034121 | 783,615 | 28,747 | 26,738 |
| 66 | .037805 | .045307 | 728,130 | 27,527 | 32,989 |
| 67 | .040115 | .060836 | 667,614 | 26,781 | 40,615 |
| 68 | .041439 | .073024 | 600,218 | 24,872 | 43,830 |
| 69 | .042762 | .085213 | 531,516 | 22,729 | 45,292 |
| 70 | -- | 1.000000 | 463,395 | -- | 463,395 |



## TABLE D

### STATE EMPLOYEES

### M A L E

### LIFE TABLE FOR AGES 70 AND OVER

| Age | Rate of Death | Number of Retirants | Number of Deaths |
|---|---|---|---|
| 70 | .076577 | 1,000,000 | 76,577 |
| 71 | .078078 | 923,423 | 72,099 |
| 72 | .079580 | 851,324 | 67,748 |
| 73 | .081081 | 783,576 | 63,533 |
| 74 | .082512 | 720,043 | 59,412 |
| 75 | .083943 | 660,631 | 55,455 |
| 76 | .085373 | 605,176 | 51,666 |
| 77 | .086804 | 553,510 | 48,047 |
| 78 | .088235 | 505,463 | 44,600 |
| 79 | .089916 | 460,863 | 41,439 |
| 80 | .091596 | 419,424 | 38,418 |
| 81 | .093493 | 381,006 | 35,621 |
| 82 | .097841 | 345,385 | 33,793 |
| 83 | .102434 | 311,592 | 31,918 |
| 84 | .107288 | 279,674 | 30,006 |
| 85 | .112419 | 249,668 | 28,067 |
| 86 | .129500 | 221,601 | 28,697 |
| 87 | .153846 | 192,904 | 29,678 |
| 88 | .186813 | 163,226 | 30,493 |
| 89 | .219780 | 132,733 | 29,172 |
| 90 | .252747 | 103,561 | 26,175 |
| 91 | .285714 | 77,386 | 22,110 |
| 92 | .333333 | 55,276 | 18,425 |
| 93 | .379285 | 36,851 | 13,977 |
| 94 | .425236 | 22,874 | 9,727 |
| 95 | .471190 | 13,147 | 6,195 |
| 96 | .487276 | 6,952 | 3,388 |
| 97 | .542279 | 3,564 | 1,933 |
| 98 | .610442 | 1,631 | 996 |
| 99 | .690722 | 635 | 439 |
| 100 | .800000 | 196 | 157 |
| 101 | .833333 | 39 | 32 |
| 102 | 1.000000 | 7 | 7 |

## TABLE E

### STATE EMPLOYEES

### LIFE TABLE FOR AGES 70 AND OVER

### F E M A L E

| Age | Rate of Death | Number of Retirants | Number of Deaths |
|---|---|---|---|
| | | 1,000,000 | |
| 70 | .066593 | 933,407 | 66,593 |
| 71 | .068384 | 865,843 | 67,564 |
| 72 | .070175 | 805,082 | 60,761 |
| 73 | .077791 | 742,454 | 62,628 |
| 74 | .085407 | 679,043 | 63,411 |
| 75 | .093023 | 615,876 | 63,167 |
| 76 | .106395 | 550,350 | 65,526 |
| 77 | .119767 | 484,436 | 65,914 |
| 78 | .133139 | 419,939 | 64,497 |
| 79 | .146512 | 358,413 | 61,526 |
| 80 | .159884 | 301,108 | 57,305 |
| 81 | .173256 | 248,939 | 52,169 |
| 82 | .186628 | 202,480 | 46,459 |
| 83 | .200000 | 161,984 | 40,496 |
| 84 | .225000 | 125,538 | 36,446 |
| 85 | .250000 | 94,153 | 31,385 |
| 86 | .276000 | 68,167 | 25,986 |
| 87 | .302600 | 47,540 | 20,627 |
| 88 | .328900 | 31,904 | 15,636 |
| 89 | .355200 | 20,572 | 11,332 |
| 90 | .381500 | 12,724 | 7,848 |
| 91 | .407800 | 7,535 | 5,189 |
| 92 | .434100 | 4,264 | 3,271 |
| 93 | .460400 | 2,301 | 1,963 |
| 94 | .486700 | 1,181 | 1,120 |
| 95 | .513000 | 575 | 606 |
| 96 | .542279 | 263 | 312 |
| 97 | .610442 | 102 | 161 |
| 98 | .690722 | 32 | 70 |
| 99 | .800000 | 6 | 26 |
| 100 | .833333 | 1 | 5 |
| 101 | 1.000000 | | 1 |



## TABLE A

### TEACHERS

### LIFE AND SERVICE TABLE FOR AGES 21 TO 60

### M A L E

| Age | Annual Rates of Withdrawal | Annual Rates of Death | Number in Service | Number of Withdrawals | Number of Deaths |
|---|---|---|---|---|---|
| 21 | .096833 | .002454 | 1,000,000 | 96,833 | 2,454 |
| 22 | .093228 | .002539 | 900,713 | 83,972 | 2,287 |
| 23 | .089623 | .002625 | 814,454 | 72,994 | 2,138 |
| 24 | .086018 | .002710 | 739,322 | 63,595 | 2,004 |
| 25 | .082413 | .002796 | 673,727 | 55,524 | 1,884 |
| 26 | .078808 | .002881 | 616,319 | 48,571 | 1,776 |
| 27 | .075203 | .002967 | 565,972 | 42,563 | 1,679 |
| 28 | .071598 | .003052 | 521,730 | 37,355 | 1,592 |
| 29 | .067993 | .003138 | 482,783 | 32,826 | 1,515 |
| 30 | .064397 | .003223 | 448,442 | 28,878 | 1,445 |
| 31 | .060800 | .003309 | 418,119 | 25,422 | 1,384 |
| 32 | .053009 | .003394 | 392,313 | 20,796 | 1,332 |
| 33 | .045217 | .003480 | 370,185 | 16,739 | 1,288 |
| 34 | .039032 | .003565 | 352,158 | 13,745 | 1,255 |
| 35 | .032847 | .003651 | 337,158 | 11,075 | 1,231 |
| 36 | .031227 | .003736 | 324,852 | 10,144 | 1,214 |
| 37 | .029598 | .003822 | 313,494 | 9,279 | 1,198 |
| 38 | .028093 | .003907 | 303,017 | 8,513 | 1,184 |
| 39 | .026589 | .004015 | 293,320 | 7,799 | 1,178 |
| 40 | .025084 | .004217 | 284,343 | 7,132 | 1,199 |
| 41 | .023580 | .004432 | 276,012 | 6,508 | 1,223 |
| 42 | .022075 | .004659 | 268,281 | 5,922 | 1,250 |
| 43 | .020619 | .004902 | 261,109 | 5,384 | 1,280 |
| 44 | .018109 | .005159 | 254,445 | 4,608 | 1,313 |
| 45 | .014228 | .005429 | 248,524 | 3,536 | 1,349 |
| 46 | .014010 | .005727 | 243,639 | 3,413 | 1,395 |
| 47 | .013792 | .006040 | 237,831 | 3,280 | 1,436 |
| 48 | .013574 | .006373 | 233,115 | 3,164 | 1,486 |
| 49 | .013356 | .006745 | 228,465 | 3,051 | 1,541 |

## TABLE A - continued

### TEACHERS - M A L E

### LIFE AND SERVICE TABLE FOR AGES 21 TO 60

| Age | Annual Rates of Withdrawal | Annual Rates of Death | Number in Service | Number of Withdrawals | Number of Deaths |
|---|---|---|---|---|---|
| 50 | .013138 | .007140 | 223,873 | 2,941 | 1,598 |
| 51 | .012920 | .007563 | 219,334 | 2,834 | 1,659 |
| 52 | .012739 | .008014 | 214,841 | 2,737 | 1,722 |
| 53 | .012559 | .008522 | 210,382 | 2,642 | 1,793 |
| 54 | .012378 | .009233 | 205,947 | 2,549 | 1,902 |
| 55 | .012198 | .010168 | 201,496 | 2,458 | 2,049 |
| 56 | .012017 | .011140 | 196,989 | 2,367 | 2,194 |
| 57 | .011837 | .012154 | 192,428 | 2,278 | 2,339 |
| 58 | .011656 | .014012 | 187,811 | 2,189 | 2,632 |
| 59 | .011475 | .015918 | 182,990 | 2,100 | 2,913 |
| 60 | -- | -- | 177,977 | -- | -- |



## TABLE B

### TEACHERS

### LIFE AND SERVICE TABLE FOR AGES 20 TO 60

### F E M A L E

| Age | Annual Rates of Withdrawal | Annual Rates of Death | Number in Service | Number of Withdrawals | Number of Deaths |
|---|---|---|---|---|---|
| 20 | .200000 | .001795 | 1,000,000 | 200,000 | 1,795 |
| 21 | .198084 | .001862 | 798,205 | 158,112 | 1,486 |
| 22 | .196167 | .001929 | 638,607 | 125,274 | 1,232 |
| 23 | .194251 | .001996 | 512,101 | 99,476 | 1,022 |
| 24 | .192334 | .002064 | 411,613 | 79,165 | 850 |
| 25 | .190418 | .002131 | 331,588 | 63,140 | 708 |
| 26 | .184307 | .002198 | 267,741 | 49,347 | 588 |
| 27 | .178195 | .002265 | 217,806 | 38,812 | 493 |
| 28 | .171582 | .002332 | 178,501 | 30,628 | 416 |
| 29 | .164969 | .002399 | 147,457 | 24,326 | 354 |
| 30 | .140000 | .002464 | 122,777 | 17,189 | 303 |
| 31 | .124562 | .002533 | 105,285 | 13,115 | 267 |
| 32 | .109124 | .002600 | 91,903 | 10,029 | 239 |
| 33 | .093685 | .002667 | 81,635 | 7,648 | 218 |
| 34 | .078247 | .002734 | 73,769 | 5,772 | 202 |
| 35 | .062874 | .002801 | 67,795 | 4,263 | 190 |
| 36 | .048611 | .002868 | 63,342 | 3,079 | 182 |
| 37 | .035488 | .002935 | 60,081 | 2,132 | 176 |
| 38 | .029727 | .003003 | 57,773 | 1,717 | 173 |
| 39 | .027812 | .003070 | 55,883 | 1,554 | 172 |
| 40 | .025897 | .003137 | 54,157 | 1,403 | 170 |
| 41 | .023982 | .003210 | 52,584 | 1,261 | 169 |
| 42 | .022067 | .003371 | 51,154 | 1,129 | 172 |
| 43 | .020152 | .003540 | 49,853 | 1,005 | 176 |
| 44 | .018236 | .003721 | 48,672 | 888 | 181 |
| 45 | .016321 | .003914 | 47,603 | 777 | 186 |
| 46 | .014406 | .004165 | 46,640 | 672 | 194 |
| 47 | .012491 | .004428 | 45,774 | 572 | 203 |
| 48 | .010576 | .004707 | 44,999 | 476 | 212 |
| 49 | .008661 | .004901 | 44,311 | 384 | 217 |

TABLE B - continued

TEACHERS

LIFE AND SERVICE TABLE FOR AGES 20 TO 60

F E M A L E

| Age | Annual Rates of Withdrawal | Annual Rates of Death | Number in Service | Number of Withdrawals | Number of Deaths |
|---|---|---|---|---|---|
| 50 | .008326 | .005312 | 43,710 | 364 | 232 |
| 51 | .007992 | .005641 | 43,114 | 345 | 243 |
| 52 | .007657 | .005991 | 42,526 | 326 | 255 |
| 53 | .007323 | .006359 | 41,945 | 307 | 267 |
| 54 | .006988 | .006753 | 41,369 | 289 | 279 |
| 55 | .006606 | .007194 | 40,801 | 270 | 294 |
| 56 | .006277 | .007613 | 40,237 | 253 | 306 |
| 57 | .005948 | .008086 | 39,678 | 236 | 321 |
| 58 | .005619 | .008589 | 39,121 | 220 | 336 |
| 59 | .005290 | .009124 | 38,565 | 204 | 352 |
| 60 | -- | -- | 38,009 | -- | -- |



TABLE C

TEACHERS

LIFE AND RETIREMENT TABLE FOR AGES 60 TO 70

M A L E

| Age | Annual Rates of Death | Annual Rates of Retirement | Number in Service | Number of Deaths | Number of Retirements |
|---|---|---|---|---|---|
| 60 | .021249 | .040404 | 1,000,000 | 21,249 | 40,404 |
| 61 | .022697 | .049028 | 938,347 | 21,298 | 46,005 |
| 62 | .024146 | .057851 | 871,044 | 21,032 | 50,391 |
| 63 | .025595 | .070592 | 799,621 | 20,466 | 56,447 |
| 64 | .027043 | .083333 | 722,708 | 19,544 | 60,225 |
| 65 | .028578 | .090000 | 642,949 | 18,374 | 57,865 |
| 66 | .030327 | .096667 | 566,700 | 17,186 | 54,781 |
| 67 | .032132 | .103333 | 494,733 | 15,897 | 51,122 |
| 68 | .033999 | .110000 | 427,714 | 14,542 | 47,049 |
| 69 | .035931 | .116667 | 366,123 | 13,155 | 42,714 |
| 70 | -- | 1.000000 | 310,254 | -- | 310,254 |

F E M A L E

| Age | Annual Rates of Death | Annual Rates of Retirement | Number in Service | Number of Deaths | Number of Retirements |
|---|---|---|---|---|---|
| 60 | .010801 | .029891 | 1,000,000 | 10,801 | 29,891 |
| 61 | .011701 | .039801 | 959,308 | 11,225 | 38,181 |
| 62 | .012328 | .053512 | 909,902 | 11,217 | 48,691 |
| 63 | .012984 | .063651 | 849,994 | 10,363 | 54,103 |
| 64 | .013875 | .073790 | 785,528 | 10,899 | 57,964 |
| 65 | .014801 | .083930 | 716,665 | 10,607 | 60,150 |
| 66 | .015764 | .094069 | 645,908 | 10,176 | 60,760 |
| 67 | .016707 | .104208 | 574,972 | 9,606 | 59,917 |
| 68 | .017694 | .112745 | 505,449 | 8,943 | 56,987 |
| 69 | .018725 | .151976 | 439,519 | 8,230 | 66,796 |
| 70 | -- | 1.000000 | 364,493 | -- | 364,493 |

## TABLE D

TEACHERS

LIFE TABLE FOR AGES 70 AND OVER

M A L E

| Age | Rate of Death | Number of Retirants | Number of Deaths |
|---|---|---|---|
| | | 1,000,000 | |
| 70 | .036488 | 963,512 | 36,488 |
| 71 | .038363 | 926,549 | 36,963 |
| 72 | .040360 | 889,153 | 37,396 |
| 73 | .042486 | 851,376 | 37,777 |
| 74 | .044750 | 813,277 | 38,099 |
| 75 | .053565 | 769,714 | 43,563 |
| 76 | .062541 | 721,575 | 48,139 |
| 77 | .073333 | 668,660 | 52,915 |
| 78 | .086667 | 610,709 | 57,951 |
| 79 | .100000 | 549,638 | 61,071 |
| 80 | .113182 | 487,429 | 62,209 |
| 81 | .126364 | 425,836 | 61,593 |
| 82 | .139546 | 366,412 | 59,424 |
| 83 | .152727 | 310,451 | 55,961 |
| 84 | .165910 | 258,944 | 51,507 |
| 85 | .179092 | 212,569 | 46,375 |
| 86 | .192274 | 171,698 | 40,871 |
| 87 | .205456 | 136,422 | 35,276 |
| 88 | .218637 | 106,595 | 29,827 |
| 89 | .231819 | 81,884 | 24,711 |
| 90 | .245000 | 61,822 | 20,062 |
| 91 | .276000 | 44,759 | 17,063 |
| 92 | .307000 | 31,018 | 13,741 |
| 93 | .338000 | 20,534 | 10,484 |
| 94 | .369000 | 12,957 | 7,577 |
| 95 | .400000 | 7,774 | 5,183 |
| 96 | .430500 | 4,427 | 3,347 |
| 97 | .461000 | 2,386 | 2,041 |
| 98 | .491500 | 1,213 | 1,173 |
| 99 | .529000 | 571 | 642 |
| 100 | .566500 | 248 | 323 |
| 101 | .604000 | 98 | 150 |
| 102 | .641500 | 35 | 63 |
| 103 | .690000 | 11 | 24 |
| 104 | .800000 | 2 | 9 |
| 105 | 1.000000 | | 2 |



## TABLE E

TEACHERS

LIFE TABLE FOR AGES 70 AND OVER

F E M A L E

| Age | Rate of Death | Number of Retirants | Number of Deaths |
|---|---|---|---|
| 70 | .024216 | 1,000,000 | 24,216 |
| 71 | .025622 | 975,784 | 25,002 |
| 72 | .027112 | 950,782 | 25,778 |
| 73 | .028893 | 925,004 | 26,726 |
| 74 | .034176 | 898,278 | 30,700 |
| 75 | .039564 | 867,578 | 34,325 |
| 76 | .045150 | 833,253 | 37,621 |
| 77 | .052931 | 795,632 | 42,114 |
| 78 | .060712 | 753,518 | 45,748 |
| 79 | .068493 | 707,770 | 48,477 |
| 80 | .076565 | 659,293 | 50,479 |
| 81 | .084638 | 608,814 | 51,529 |
| 82 | .092710 | 557,285 | 51,666 |
| 83 | .100783 | 505,619 | 50,958 |
| 84 | .108855 | 454,661 | 49,492 |
| 85 | .116928 | 405,169 | 47,376 |
| 86 | .125000 | 357,793 | 44,724 |
| 87 | .133375 | 313,069 | 41,756 |
| 88 | .141750 | 271,313 | 38,459 |
| 89 | .150125 | 232,854 | 34,957 |
| 90 | .158500 | 197,897 | 31,367 |
| 91 | .186800 | 166,530 | 31,108 |
| 92 | .215100 | 135,422 | 29,129 |
| 93 | .243400 | 106,293 | 25,872 |
| 94 | .271700 | 80,421 | 21,850 |
| 95 | .300000 | 58,571 | 17,571 |
| 96 | .329000 | 41,000 | 13,489 |
| 97 | .358000 | 27,511 | 9,849 |
| 98 | .387000 | 17,662 | 6,835 |
| 99 | .416000 | 10,827 | 4,504 |
| 100 | .445000 | 6,323 | 2,814 |
| 101 | .520000 | 3,509 | 1,825 |
| 102 | .595000 | 1,684 | 1,002 |
| 103 | .690000 | 682 | 471 |
| 104 | .800000 | 211 | 169 |
| 105 | .833333 | 42 | 35 |
| 106 | 1.000000 | 7 | 7 |

## Separations from service without right to retirement benefit

The experience among the members of the system with respect to separations from the system by the acceptance of refunds was tabulated and analyzed. In the refinement of these statistics for the preparation of actuarial functions, effect was given to the conditions of the service prevailing at this time and to possible variations in future years.

The following are the rates for certain select ages that were used in the valuation of the assets and liabilities, the results of which are presented in this report.

Rates of separation with the acceptance of refund benefits per 1,000 members

| Age | State Employees | | Teacher Members | |
|---|---|---|---|---|
| | Male | Female | Male | Female |
| 20 | 177.0 | 181.6 | 83.3 | 174.6 |
| 25 | 145.9 | 169.7 | 73.7 | 88.6 |
| 30 | 80.2 | 91.6 | 33.4 | 33.8 |
| 35 | 50.1 | 61.9 | 16.6 | 30.7 |
| 40 | 38.1 | 40.4 | 0.9 | 20.0 |
| 45 | 29.5 | 39.1 | 0.5 | 8.4 |
| 50 | 27.1 | 37.8 | 0.3 | 0.3 |
| 55 | 26.1 | 36.4 | 0.2 | 0.1 |

The foregoing rates are below the rates developed in the preparation of the life and service tables based upon the operating experience of the system during the last five years. This adjustment was necessary for the purpose of providing for any possible decrease in rates of separation that may occur in the future.



## Mortality among active members

The following table illustrates the rates of death experienced among the members in active service in comparison with the rates shown by other mortality tables reflecting the most recent mortality compilations.

Rates of death per 1,000 members

| Age | State Employees Present Survey | | 1937 Standard Annuity Mortality Table | | United States Life Table 1949-1951 (Whites) | | Commissioners 1958 Standard Ordinary Mortality Table |
|---|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female | |
| 20 | 0.97 | 1.03 | 1.33 | 1.26 | 1.62 | 0.73 | 1.79 |
| 25 | 1.13 | 1.68 | 1.56 | 1.33 | 1.71 | 0.88 | 1.93 |
| 30 | 1.44 | 2.23 | 2.07 | 1.56 | 1.82 | 1.15 | 2.13 |
| 35 | 2.11 | 2.25 | 2.98 | 2.07 | 2.48 | 1.61 | 2.51 |
| 40 | 3.34 | 3.24 | 4.36 | 2.98 | 3.91 | 2.42 | 3.53 |
| 45 | 5.84 | 4.01 | 6.36 | 4.36 | 6.37 | 3.73 | 5.35 |
| 50 | 9.27 | 5.22 | 9.29 | 6.36 | 10.12 | 5.61 | 8.32 |
| 55 | 13.55 | 10.45 | 13.55 | 9.29 | 14.53 | 7.84 | 13.00 |

Rates of death per 1,000 members

Teachers

| Age | Present Survey Male | Present Survey Female | 1937 Standard Annuity Mortality Table Male | 1937 Standard Annuity Mortality Table Female | United States Life Table 1949-1951 (Whites) Male | United States Life Table 1949-1951 (Whites) Female | Commissioners 1958 Standard Ordinary Mortality Table |
|---|---|---|---|---|---|---|---|
| 20 | -- | 1.80 | 1.33 | 1.26 | 1.62 | 0.73 | 1.79 |
| 25 | 2.80 | 2.13 | 1.56 | 1.33 | 1.71 | 0.88 | 1.93 |
| 30 | 3.22 | 2.46 | 2.07 | 1.56 | 1.82 | 1.15 | 2.13 |
| 35 | 3.65 | 2.80 | 2.98 | 2.07 | 2.48 | 1.61 | 2.51 |
| 40 | 4.22 | 3.14 | 4.36 | 2.98 | 3.91 | 2.42 | 3.53 |
| 45 | 5.43 | 3.91 | 6.36 | 4.36 | 6.37 | 3.73 | 5.35 |
| 50 | 7.14 | 5.31 | 9.29 | 6.36 | 10.12 | 5.61 | 8.32 |
| 55 | 10.17 | 7.19 | 13.55 | 9.29 | 14.53 | 7.84 | 13.00 |

The mortality table used in measuring deaths among active members, for purposes of the actuarial valuation this year, was the 1937 Standard Annuity Mortality Table, and 3% interest, rated back five years for female lives.



Mortality among service retirants

Mortality experience among service retirants from July 1, 1953 to June 30, 1958 is illustrated by the following statistics:

Rates of death per 1,000 retired members

State Employees

| Age | Present Survey Male | Present Survey Female | Annuity Table for 1949 Ultimate Male | Annuity Table for 1949 Ultimate Female | 1937 Standard Annuity Mortality Table Male | 1937 Standard Annuity Mortality Table Female | 1955 American Annuity Table Male | 1955 American Annuity Table Female |
|---|---|---|---|---|---|---|---|---|
| 60 | 38.5 | 31.1 | 15.7 | 7.5 | 19.8 | 13.6 | 12.0 | 7.1 |
| 63 | 43.7 | 34.4 | 19.7 | 10.1 | 24.7 | 17.0 | 16.5 | 9.7 |
| 65 | 47.2 | 36.7 | 23.1 | 12.4 | 28.8 | 19.8 | 20.2 | 12.0 |
| 68 | 52.6 | 41.4 | 29.6 | 17.0 | 36.0 | 24.7 | 26.9 | 16.5 |
| 70 | 76.6 | 66.6 | 35.1 | 21.0 | 41.8 | 28.8 | 32.4 | 20.2 |
| 75 | 83.9 | 93.0 | 54.5 | 35.8 | 60.5 | 41.8 | 50.4 | 32.4 |
| 80 | 91.6 | 160.0 | 85.5 | 61.4 | 87.2 | 60.5 | 76.8 | 50.4 |

## Rates of death per 1,000 retired members

Teachers

| Age | Present Survey Male | Present Survey Female | Annuity Table for 1949 Ultimate Male | Annuity Table for 1949 Ultimate Female | 1937 Standard Annuity Mortality Table Male | 1937 Standard Annuity Mortality Table Female | 1955 American Annuity Table Male | 1955 American Annuity Table Female |
|---|---|---|---|---|---|---|---|---|
| 60 | 21.2 | 10.8 | 15.7 | 7.5 | 19.8 | 13.6 | 12.0 | 7.1 |
| 63 | 25.6 | 13.0 | 19.7 | 10.1 | 24.7 | 17.0 | 16.5 | 9.7 |
| 65 | 28.6 | 14.8 | 23.1 | 12.4 | 28.8 | 19.8 | 20.2 | 12.0 |
| 68 | 34.0 | 17.7 | 29.6 | 17.0 | 36.0 | 24.7 | 26.9 | 16.5 |
| 70 | 36.5 | 24.2 | 35.1 | 21.0 | 41.8 | 28.8 | 32.4 | 20.2 |
| 75 | 53.6 | 39.6 | 54.5 | 35.8 | 60.5 | 41.8 | 50.4 | 32.4 |
| 80 | 113.2 | 76.6 | 85.5 | 61.4 | 87.2 | 60.5 | 76.8 | 50.4 |

The mortality table used in measuring deaths among retired members was the 1937 Standard Annuity Mortality Table and 3% interest, rated back five years for female lives.



## Disability experience

The system provides a total and permanent disability benefit as a part of its benefit schedule. This benefit is payable to any member having at least ten years of total service who sustains a mental or physical disability due to causes other than disability incurred while in the performance of duty.

### Ordinary Disability Claims

| Year Ended June 30 | State Employees | Teachers |
|---|---|---|
| 1954 | 1 | 5 |
| 1955 | 1 | 7 |
| 1956 | 1 | 2 |
| 1957 | 2 | -- |
| 1958 | 2 | 4 |
| | 7 | 18 |

Approximately 32% of the State employees and 43% of teachers have 10 years of service or more and are eligible for this benefit. On the basis of the number of members exposed to this risk, the expectancy of disability incidents for State employees should be about 19 claims and in the case of teachers 22 claims. It will be noted that the number of ordinary disability claims has been below the expectancy, with the greatest variation in the case of the State employees.

## Accidental disability benefit

The experience with the accidental disability benefit has been exceedingly favorable. Only a few claims have been incurred and the rate of incidence is considerably below the expected according to the standards used in measuring these risks.

## Ordinary death benefit

The ordinary death benefit provided by the system is analogous to group life insurance, except that there is no conversion privilege for the continuance of insurance coverage in the case of employees leaving the service. The benefit is equal to: (1) the member's total contributions; and (2) an amount from State contributions equal to $200.00 per year of credited service subject to a minimum payment under item (2) of $500.00 and a maximum payment of $5,000.00.

Upon death while in receipt of a service retirement allowance, if no optional benefit has been elected, a death benefit is payable consisting of the excess of the member's total contributions, as of the date of retirement, over the total amounts received in the form of retirement allowance payments. The minimum payment in such a case is equal to five monthly annuity payments or $300.00, whichever is greater.



The amount of insurance in force in connection with the death benefit is as follows:

| | |
|---|---|
| State Employees - | |
| Male | $9,107,900.00 |
| Female | 5,735,600.00 |
| Teachers - | |
| Male | 3,793,000.00 |
| Female | 11,542,500.00 |
| Total | $30,179,000.00 |

## Accidental death benefit

The number of accidental death benefit claims has been few. The experience of the system with respect to this benefit has been very favorable. In fact, the total number of such claims now in force is only four, involving only former State employees.

## Interest earnings

The trend in the rate of interest earnings on investments has been persistently upward during recent years and has been considerably above the rate of 3% per annum applied in our valuation of the system. The following table presents figures which are illustrative of this experience:

| Fiscal Year Ended June 30th | Average rate of interest income |
|---|---|
| 1954 | 2.71% |
| 1955 | 2.77 |
| 1956 | 2.93 |
| 1957 | 3.20 |
| 1958 | 3.45 |

The rate of interest to be applied to the computation of reserves and liabilities should reflect the average that may be expected to be realized over a long period of years under the established investment authority. Any rate higher than such anticipated level will effect a deficiency in the reserves and liabilities which cumulatively may prove burdensome at some future time. Conversely, any rate which is lower than such anticipated average rate of earnings will result in the maintenance of liabilities and reserves above a reasonable valuation.

In a public retirement system, such a condition is unwarranted and unnecessary. The operating experience of past years and the prospective earnings during the foreseeable future on investments of the type to which the system is restricted support the use of a 3% rate of interest. Additional experience during the next several years may dictate an increase in this rate.



## ACTUARIAL VALUATION

A retirement system represents a long term operation which involves a steady and persistent increase in benefit payments. The system experiences a small outlay during its early years but the expenditures increase steadily until considerably higher levels of disbursements are reached as the system expands its operations. An actuarial valuation is made for the purpose of computing the liabilities under the prescribed benefit schedule and ascertaining how these liabilities will be met by the expected revenues under the prescribed method of financing.

As previously stated, this valuation is made with the use of the actuarial functions produced in the survey of the operating experience of the system in prior years. In establishing these functions, it is assumed that the operations of the system in respect to such factors as rates of mortality among active and retired members, rates of separation with refunds, salary increments and investment earnings, will be duplicated in future years. It is the responsibility of the actuary to properly evaluate the results of the past and possibly modify his findings with the view of establishing functions for future valuations which will realistically reflect the assumed experience under conditions that may be expected to exist in future years.

Long range valuations or cost estimates, regardless how determined, cannot be precise no matter how accurately they may

have been calculated. There are bound to be differences between actual experience in operations over the long term and in the assumptions made with respect to the several actuarial factors used as a basis in such determinations. Nevertheless, valuations and cost determinations must be made in order that an indication may be had regarding the accrued and accruing financial obligations under the retirement system and to illustrate cost trends. This is especially important in retirement systems where, either because of the character of the membership or the types of benefit provisions, costs will increase materially in future years as compared with the small expenditures incurred during the early years of the system's existence.

Types of valuations

Two different methods are used in making an actuarial valuation. One consists of projecting the income and disbursements for a period of years taking into account in such projection membership trends, separations, mortality and other relevant factors bearing upon the future course of operations of the retirement system. The second method is to set up the assets and liabilities of the system as of a given date, both accrued and prospective. From the latter method future contribution. rates are computed which may prove sufficient to discharge the benefit liabilities over the expected working lifetime of the members.



Each of these two methods has certain advantages and disadvantages. The principal feature of the projection method is that a graphic and more understandable presentation of what may happen in the future is possible. The second method involves the preparation of a balance sheet and is easier to apply because of the fewer assumptions made as to the probable future experience.

Under either method, costs are figured into perpetuity because of the assumption of a continuous flow of new members into the system to replace those who have retired, died or have otherwise become separated from service, and of probable increases in total membership. The balance sheet method is probably more difficult to understand because it includes the presentation of a technical financial statement reflecting actuarial techniques. That method generally provokes the comment that the figures embodied therein are only actuarial costs and do not represent real costs. This viewpoint is erroneous because the figures constitute actual costs and liabilities, actuarially determined.

It must be assumed that the system will continue in existence at least until it has discharged in full its obligations to all members thereof, both retired and active, disregarding for the moment prospective future entrants. The incorrect interpretation of the actuarial balance sheet probably arises from the fact that the ultimate cost figures and the accumulated assets of the system, as compared to current benefit payments, are so much larger than the amounts of benefits currently being paid.

An actuarial valuation of the system has been completed as of June 30, 1958, according to the balance sheet method and the results are presented in the succeeding pages.

## VALUATION BALANCE SHEET

A valuation balance sheet, embodying the results of the computation of reserves and liabilities, is presented in the succeeding pages. The technique used in the preparation of this statement is similar to that followed by accountants in the preparation of a financial balance sheet, except that a valuation balance sheet is broader in scope. It includes, in addition to the current liabilities, the actuary's evaluation of the accrued and prospective liabilities, and the present and prospective assets, actuarially determined.

A sound financial condition exists from the actuarial standpoint when assets are on hand equal to the difference between (1) the total of all accrued and prospective liabilities, and (2) the present value of future contributions to be received by the system. This is known as the actuarial reserve.

The valuation balance sheet, showing the financial condition of the system at June 30, 1958, is presented in the following pages.



## VALUATION BALANCE SHEET - JUNE 30, 1958

### A S S E T S

| | | |
|---|---|---|
| **PRESENT ASSETS** | | |
| Net present assets | $30,484,647.00 | |
| Less, releases of member contributions on account of refunds and death benefits | 9,104,529.00 | $ 21,380,118.00 |
| **DEFERRED ASSETS** | | |
| Obligation of the members and the employer for retirement and disability annuities covering service of members for the remainder of their active working lifetime subsequent to June 30, 1958 - | | |
| State Employees - | | |
| Members | $ 5,781,255.00 | |
| State | 11,397,758.00 | 17,179,013.00 |
| Teachers - | | |
| Members | $ 5,645,724.00 | |
| State | 5,417,568.00 | |
| Cities and towns | 5,417,567.00 | 16,480,859.00 |
| **DEFERRED OBLIGATION OF THE STATE OF RHODE ISLAND AND CITIES AND TOWNS** | | |
| Accrued Unfunded Liability - Present value of annuities and benefits in force, and accrued liabilities for retirement annuities and disability annuities on account of service prior to July 1, 1958, after credit for available present assets | | 52,833,480.00 |
| TOTAL ASSETS | | $107,873,470.00 |

## VALUATION BALANCE SHEET - JUNE 30, 1958

## L I A B I L I T I E S

### ACCRUED LIABILITIES

| | | |
|---|---|---|
| Reserve requirements for annuities and benefits in force - | | |
| State Employees | $ 3,901,544.00 | |
| Teachers | 14,885,097.00 | $ 18,786,641.00 |
| Present value of accrued requirements for retirement annuities, disability annuities and death benefits at June 30, 1958 - | | |
| State Employees - | | |
| Male | $14,384,780.00 | |
| Female | 6,881,455.00 | 21,266,235.00 |
| Teachers - | | |
| Male | $ 6,463,662.00 | |
| Female | 27,697,060.00 | 34,160,722.00 |

### PROSPECTIVE LIABILITIES

| | | |
|---|---|---|
| Present value of retirement annuities and disability annuities on account of service to be rendered after June 30, 1958 - | | |
| State Employees | $17,179,013.00 | |
| Teachers | 16,480,859.00 | 33,659,872.00 |
| TOTAL LIABILITIES | | $107,873,470.00 |



### Interpretation of Valuation Balance Sheet

The foregoing statement sets forth the financial condition of the system from a technical standpoint. The accrued unfunded liability of $52,833,480.00 constitutes an indebtedness of the State and the cities and towns to the pensioners and active members which is to be met by future contributions under the prescribed method of financing.

The retirement law provides for the employer to make a contribution each year at a rate per cent of payroll fixed by the retirement board upon the basis of a ten-year projection of expenditures and member contributions. This method of financing is essentially partial funding and has resulted in the gradual building up of the reserves of the system. A new projection was made last year and upon the basis of that projection new rates were fixed for the ensuing 10-year period. These rates should result in continued accretions to the reserves.

This method of partial funding should serve to cushion in future years the effect of increasingly larger payments by the system as the pension roll attains materially higher levels with the expansion of the system's operations.

## CONCLUDING COMMENTS

An interest rate of 3% per annum has been assumed in our valuation. This may tend towards a slight overstatement of the calculated reserves and liabilities in relation to the present rate of interest earnings on invested assets and the rate to be expected during the foreseeable future. An interest rate for valuation purposes must reflect the expected income over a long period of years under the established investment authority. Until it is demonstrated over a considerable period of time that interest income will average a higher rate than 3%, the use of that rate is justified.

The system is developing satisfactorily and is fulfilling its objectives in an adequate measure. Its benefit schedule is well suited to the needs of the employees comprising its membership. Rates of benefit and qualifying conditions compare most favorably with similar provisions in effect for State government employees and teachers of other States.

By the recent addition for State employees of the old-age and survivors' insurance provisions of the Federal Social Security Act, on an elective basis, the benefit schedule was extended to include survivors' benefits and other protections afforded by that program. This new addition to the benefit schedule will mean increasing obligations for the State under the graduated



schedule of contributions prescribed by social security. Further obligations may be imposed in future years on the participants in the social security system, meaning the employees and the State, if proposals for the expansion of that program to include other phases of employee welfare are adopted. We may look forward, therefore, to considerably higher costs for pensions and benefits in the future.

On a funded basis, which is the only correct method of expressing pension cost, the obligation of the State under the system exceeds 11% of payroll which includes amortization requirements on the unfunded accrued liability. Adding the cost of social security results in a total cost figure which is of fairly large proportion. Under the circumstances, therefore, proposals for increased benefits or more liberal qualifying conditions should be resisted if costs are to be kept within reasonable limitations.

The administration of the system, under the directives and policies of the Retirement Board, is maintaining a high standard of efficiency. The procedures in force reflect a conscientious and constructive approach to all problems arising in operations.

Respectfully submitted,

A. A. Weinberg
Actuary