COMMONWEALTH OF PENNSYLVANIA

State Employees' Retirement System

16th Investigation of Actuarial Experience

January 1, 2001 to December 31, 2005

March 15, 2006

HayGroup

SIXTEENTH INVESTIGATION OF ACTUARIAL EXPERIENCE OF
THE STATE EMPLOYEES' RETIREMENT SYSTEM OF THE
COMMONWEALTH OF PENNSYLVANIA

EXPERIENCE FROM JANUARY 1, 2001 TO DECEMBER 31, 2005

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I. INTRODUCTION

This is the sixteenth in a series of investigations of actuarial experience for the State Employees' Retirement System (SERS) for the Commonwealth of Pennsylvania. This report is based upon economic and demographic experience from January 1, 2001 through December 31, 2005. A periodic review of actuarial experience is essential if a retirement system is to be financed on a sound basis. The Commonwealth has formally recognized this need in Section 5902(j) of the State Employees' Retirement Code:

> "The board shall have the actuary make an annual valuation of the various accounts within six months of the close of each calendar year. In the year 1975 and in every fifth year thereafter the board shall have the actuary conduct an actuarial investigation and evaluation of the system based on data including the mortality, service, and compensation experience provided by the board annually during the preceding five years concerning the members and beneficiaries. The board shall by resolution adopt such tables as are necessary for the actuarial valuation of the fund and calculation of contributions, annuities and other benefits based on the reports and recommendations of the actuary."

If a retirement system is to operate on a sound actuarial basis, the funds on hand together with the expected future contributions must be adequate to cover the value of future promised benefit payments. Each year the actuary projects the expected value of future benefits and the stream of contributions needed to meet the benefit payments. The projection serves as a basis for the determination of the needed employer contributions to the retirement fund. The projection is based on a wide variety of economic assumptions, such as assumed investment returns, and demographic assumptions, such as rates of mortality. Since both the economic and demographic experience change over time, it is essential to conduct a periodic review of the experience and to adjust the assumptions in the valuation to reflect the most recent experience.

Economic assumptions include the rates of investment return and salary growth. These relatively few rates, compared to the large number of demographic assumptions, have the most significant effect on the estimate of future contributions. General economic forces, instead of the specific experience of the retirement system, are often given more consideration when setting an investment return, or salary growth assumption. For instance, the salary increase and investment return typically rise or fall with changes in the rate of general inflation.

Demographic assumptions include the set of rates that predict certain events occurring to a group of employees or annuitants. Events of significance to a retirement system are those that result in a commencement or termination of a benefit payment. The events affecting active employees include

reasons for leaving the system such as retirement, becoming disabled, terminating service, or death. The events affecting annuitants include death. If an annuitant would return to service, or if a disabled annuitant were to recover, the benefit payments to the annuitant would stop. However, these events are not included in the analysis because the occurrences of these events are rare, and would not materially affect the calculation of the decrement rates.

It is general practice to introduce some degree of conservatism in setting actuarial assumptions. However, the degree of conservatism varies widely among pension plans. Some plans set assumptions so that the pension plan contributions will be at least as great as the contributions needed in the most adverse foreseeable circumstances. Other systems set assumptions that are close to the actual experience but conservative enough to protect against small deviations from past experience. The latter, a moderately conservative approach, has been used by the SERS Board and the proposed rates in this evaluation were developed on that basis.

Milliman recently completed an actuarial audit of the retirement system. The Milliman audit "…found the actuarial procedures and practices [of Hay Group] to be of a high quality and in compliance with all major aspects of the applicable actuarial standards." The Milliman audit included a review of the last (1996 to 2000) experience study and found that "…the statistical analysis undertaken…and the resulting recommendations of Hay are reasonable." Milliman's audit report also included a number of constructive suggestions for consideration by SERS and the Board for future experience studies. These suggestions are all considered in this report and discussed at the appropriate place.

Section II of this report describes the methodology that was used to develop the demographic rates and economic assumptions. Section III presents the results of the review of the economic experience and discusses the basis for the recommended economic assumptions. Section IV presents the results of the analysis of the demographic experience, and the basis for the recommended demographic assumptions. Section V presents the results of other experience analyses we have performed and our conclusions regarding the related actuarial assumptions. Section VI provides an overview and final commentary on Hay Group's recommendations. Section VII defines certain terms used in this report. The proposed demographic rates are contained in the Appendix.

II. METHODOLOGY

The specific objective of this actuarial investigation is the development of the following assumptions as to the expected experience of the fund:

- the investment return of the fund;
- the rates of salary increase among active members;
- the rates of disability among active members;
- the rates of superannuation retirement among active members;
- the rates of mortality among active members and annuitants;
- the rates of separation for other reasons among active members.

The analysis was performed separately for each category of membership expected to have unique patterns of termination experience:

- Class AA and Class A general employees eligible for full benefits at age 60 or with 35 years of service;
- State Police;
- members of the General Assembly;
- members of the judiciary;
- other members eligible to retire at age 50.

As mentioned above, the specific objective of this analysis is to develop economic and demographic assumptions as to the expected experience of the fund. In general, it is good actuarial practice to create the assumptions based on the actual experience. Development of the assumptions begins with the analysis of actual experience to expected experience, and the calculation of the actual-to-expected ratio. The actual-to-expected ratio gives a measure of how close the assumption predicted what actually happened. If the actual-to-expected ratio is greater than 1.0, then the actuarial assumption under-predicted; if the actual-to-expected ratio is less than 1.0, then the assumption over-predicted the number of occurrences. The product of the analysis is a set of proposed actuarial assumptions that produce an actual-to-expected ratio of 1.0, based on actual experience, unless circumstances warrant a deviation.

The economic part of the study was conducted through a review of fund performance and general salary changes in the last twenty years. The SERS Investment Office provided the historical fund investment return rates, either SERS or the Office of Administration provided the actual general salary increases through 2001 and Hay calculated salary increases after 2001 based upon compensation data used each year for the actuarial valuation.

The demographic assumptions were developed by analyzing the actual experience of the participants in the fund and comparing that experience to what was expected based on the demographic assumptions created in the previous experience study. A description of the individual member data provided by SERS follows.

SERS provided data on all employees and annuitants who were on the rolls during the study period. This data included date of birth for all members and the date of hire, salaries and other relevant information for employees. The data included the date and cause of termination for those who left

the active or annuitant roll during the study period. The data collection and analysis process was modified substantially for this experience study. In the past we received data on the number and demographics of annuitants and employees at the end of each year and at the end of the study period. We also received data on those terminating from annuitant and employee status for each calendar year. These files were matched to produce a continuous history for the study period.

Improvements in computer systems permitted a more direct approach for this study. SERS provided us with a record for each employee and annuitant who had been on the rolls at any time during the study period. This information included date of birth, date of hire and date of termination if the person left the rolls during the study period. This removed the need to match termination files against annuitant and employee files, as done in prior studies. The analysis in this study was performed by extracting the number of individuals eligible for a benefit each year and the number of those individuals who changed status during the year. For instance, the number exposed to disability during each year was the number of employees with over five years of service at the beginning of each year. The number of actual disability terminations was then the count of such terminations during the year. This approach is called the seriatim method.

Because of the need to provide this report to the Board in early 2006, it was not possible to include complete data for 2005. As in prior studies we requested data in the fall of the last year of the study so that we could produce the report and recommendations early in 2006. The data were cut off as of August 31, 2005. Our report is largely based on the full calendar year experience for 2001 through 2004. Economic and demographic experience in 2005 has been considered where it is valid and provides insight into the recommendations.

We have provided interim reports on the annual experience since 2001 for two purposes. One was to determine if there were any developing trends that would lead to recommended changes before the experience study. The other was to make sure that the data in the files were reasonable and consistent with reports prepared for the Board. The reports showed that the data were reasonable and consistent and that there was no need to introduce changes in the assumptions between 2001 and 2005.

We made several adjustments to the data received from SERS before conducting the experience study to determine demographic rates that were consistent with the definition of the rates as used in our valuation. The primary adjustment was to redesignate some of the terminations to be consistent with the valuation. For example, the valuation combines the disability retirements over age 60 with the superannuation retirements to develop an overall "superannuation" retirement rate. So any disability retirements that were over age 60 were combined with the superannuation retirees to produce one superannuation experience rate. We also moved the terminations of employees with reduced immediate benefits from the retirement category to the "other" category.

After the redesignations, we made several minor adjustments such as excluding employees who were hired and terminated in the same year since our study is based on full year rates of decrement. Table II-1 shows the number of terminations that were redesignated or otherwise adjusted.

TABLE II-1
Adjustments to Decrement Data from SERS for 2001 through 2004

	Disability	Retirement	Deceased	Other	Total
Data Received	2120	19,674	799	11,182	33,775
Reassignments	(360)	(7,907)	0	8,267	0
Other Adjustments	0	(741)	(4)	(2,212)	(2,957)
Data Used for Study	1,760	11,026	795	17,237	30,818

III. ANALYSIS OF ECONOMIC EXPERIENCE AND PROPOSED ECONOMIC ASSUMPTIONS

The most important set of rates in the valuation is the set of economic assumptions that include the prediction of future general salary increases and rates of investment return. The assumed rates of investment return and general salary increases are both driven by the underlying rate of inflation.

Salary growth and investment return are also linked in their effect on the valuation results. The cost impact of an increase in the investment return rate will be partially offset by a similar increase in the salary scale. For instance, if the salary increases are greater than expected, the benefits will grow in direct proportion because they are based on the final three-years' average salary. Conversely, an increase in investment earnings will directly reduce the employer contributions needed to pay the benefits. For SERS, an equal change in the two assumptions will change the actuarial liabilities and normal cost. For instance, decreasing both the salary growth and the investment return assumptions by 0.5 percent will increase the normal cost and unfunded liability.

The current assumptions are shown in Table III-1. The assumed general salary growth does not include individual career and longevity increases. (These increases are covered in a later section.) The real rate of salary growth and the real rate of investment return are derived by dividing the nominal rates by the rate of inflation. (e.g., real investment return is [1.085 / 1.030] – 1.0)

TABLE III-1
Current Economic Assumptions

Annual Inflation	Investment Return		Salary Growth	
	Nominal	Real	Nominal	Real
3.0%	8.5%	5.3%	3.3%	0.3%

Based upon Milliman's review, they agreed that the current assumptions shown in Table III-1 were reasonable given the economic conditions that existed at the time of adoption of the recommendations from the last study in 2001. Looking to the future, Milliman made a number of suggestions for possible change with regard to the economic assumptions, which are discussed further below.

Table III-2 below shows the rate of inflation, the nominal and real investment return based on the market value of assets and the nominal and real salary growth for the past twenty years. The rate of inflation is based upon the Consumer Price Index for all Urban Consumers (CPI-U), the U.S. City Average. The annual rate of inflation is calculated as the change in the index from December of the previous year to December of the current year. For example, the CPI-U for December of 2004 was 190.3 and the CPI-U for December of 2005 was 196.8, which resulted in an annual inflation for 2005 of 3.4 percent [(196.8/190.3) – 1 = 3.4%].

TABLE III-2
Annual Rates of Growth

Year	Inflation	Investment Return		Salary Growth	
		Nominal	**Real**	**Nominal**	**Real**
1986	1.1	15.2	13.9	3.5	2.4
1987	4.4	3.3	(1.1)	3.4	(1.0)
1988	4.4	12.8	8.0	5.0	0.6
1989	4.6	17.8	12.6	6.0	1.3
1990	6.1	1.0	(4.8)	5.0	(1.0)
1991	3.1	22.6	19.0	1.0	(2.0)
1992	2.9	7.4	4.4	2.1	(0.8)
1993	2.7	13.2	10.2	5.1	2.3
1994	2.7	(1.1)	(3.7)	3.9	1.2
1995	2.5	25.2	22.1	3.8	1.2
1996	3.3	15.9	12.2	2.0	(1.3)
1997	1.7	18.0	16.0	3.0	1.3
1998	1.6	16.3	14.5	3.0	1.4
1999	2.7	19.9	16.8	3.0	0.3
2000	3.4	2.2	(1.1)	3.0	(0.4)
2001	1.6	(7.9)	(9.3)	3.3	1.7
2002	2.4	(10.9)	(13.0)	3.5	1.1
2003	1.9	24.3	22.0	2.0	0.1
2004	3.3	15.1	11.4	1.9	(1.4)
2005	3.4	14.5	10.7	3.0	(0.4)
20 Yr Avg 1986 – 2005	**3.0%**	**10.8%**	**7.6%**	**3.3%**	**0.3%**
5 Yr Avg 2001 – 2005	**2.5%**	**6.1%**	**3.5%**	**2.7%**	**0.2%**
10 Yr Avgs:					
1986 – 1995	**3.4%**	**11.4%**	**7.7%**	**3.9%**	**0.5%**
1991 – 2000	**2.7%**	**13.7%**	**10.7%**	**3.0%**	**0.3%**
1996 – 2005	**2.5%**	**10.1%**	**7.4%**	**2.8%**	**0.3%**

Inflation

While inflation does not directly affect SERS liabilities or assets (as it would if automatic COLAs applied under SERS), it is an important consideration in our review of both the investment return and general salary increase assumptions. We believe, based upon historical inflation rates (as shown in Table III-2) and our current expectations for the future (giving appropriate consideration to the supportive points covered in the next paragraph) that it is reasonable and appropriate to continue with the current annual inflation assumption of 3.0 percent. Milliman, on the other hand, suggested in their audit report that the annual inflation component of the investment return (and general salary scale) assumption be reduced from the current 3.0 percent per year to at least 2.5 percent per year (and possibly to 2.0 percent per year). Although we acknowledge, and concur with Milliman, that there has been some decrease in inflation levels since our 2001 experience study, we see that change as relatively small. In fact, small enough that the 3.0 percent annual inflation assumption continues to fall within our best estimate range of actuarial reasonableness.

This conclusion is supported by the current inflation projection assumption utilized by actuaries of the Social Security Administration (SSA). SSA, for purposes of cost projections included in their most recent annual Trustees' Reports (based upon their "intermediate assumptions"), projects that future annual inflation will be at a rate of 2.8 percent. A five-year actuarial experience study was completed in late 2005 for the Commonwealth of Pennsylvania's other major retirement system, the Public School Employees' Retirement System (PSERS). The PSERS actuary (Buck Consultants) recommended that the Board change from the current 3.5 percent inflation to 3.25 percent inflation. Although SERS and PSERS are largely independent systems, and they independently arrive at their actuarial assumptions, Hay views the PSERS Board's adoption of Buck's recommendation as being consistent with and supportive of Hay's recommendation that the Board retain the 3.0 percent inflation assumption.

While we have given serious consideration to Milliman's suggestion that the assumed rate of future inflation be lowered to 2.5 percent (or possibly lower), we nevertheless have a different actuarial opinion regarding this assumption, as explained above and discussed further below in our discussion on the Investment Return assumption.

Investment Return

As shown in Table III-2, from 2001 through 2005, the nominal rate of return was 6.1 percent and the real rate (after discounting for inflation) was 3.5 percent per year. These numbers are lower than those of the whole 20-year period, which had a nominal rate of 10.8 percent, and a real rate of 7.6 percent.

We believe that the analysis and investment projection support the continuation of an investment return assumption of 8.5 percent. In fact, given the higher investment returns during the past 20 years, an 8.5 percent assumption remains somewhat conservative.

Although the investment return experience over the three-year period 2000 through 2002 was the least favorable experience of any consecutive three years in recent history (an average investment **loss** of almost 6 percent per year), a significant rebound began in 2003 and the returns for the most recent three years averaged an impressive 17.9 percent per year. Therefore, despite the shortfall in actual versus assumed returns (6.1 percent versus 8.5 percent) over the most recent five-year period,

the higher investment returns of the past three years, we believe, offer strong evidence that annual returns of 8.5 percent can be sustained.

This conclusion is supported by SERS' investment advisors, Rocaton Investment Advisors, who currently project that future investment returns on SERS assets will be 8.5 percent per year. Also, the PSERS actuary recently recommended, as part of their five-year experience study, that the PSERS Board retain their 8.5 percent annual investment return assumption. Although SERS and PSERS are largely independent systems and they independently arrive at their actuarial assumptions, they have generally had similar experience with regard to historical investment returns, and this similarity is likely to continue for the foreseeable future.

Milliman suggested in their audit report that the overall annual investment return assumption be reduced from the current 8.5 percent per year to at most 8.0 percent per year (and possibly to 7.5 percent per year). While we understand Milliman's suggestion, and we do not view the idea as inappropriate, we nevertheless have a different actuarial opinion regarding this assumption. In summary, it is Hay Group's view that SERS' current 8.5 percent annual investment return assumption and the underlying 3.0 percent annual inflation assumption continue to fall within our best estimate ranges for each of these assumptions. Furthermore, for reasons explained in the following paragraph, we view these assumptions as still having an element of conservatism consistent with that applied by the Board in their past selection of actuarial assumptions.

We believe that continuation of the 8.5 percent investment return assumption still affords SERS and the Board a sufficient and appropriate margin of conservatism considering that returns over the past twenty years and over the past ten years have averaged more than 8.5 percent (namely 10.8 percent over twenty years and 10.1 percent over the past ten years). Although the investment return experience over the three-year period 2000 through 2002 was clearly very unfavorable, with an average annual loss of approximately 6 percent, this was substantially offset by the very favorable 17.9 percent per year average returns earned over the three-year period since then. Given this rebound in SERS' investment experience over the 2003 through 2005 period, in combination with the outlook of SERS' investment advisors (who currently project that future investment returns on SERS assets will be 8.5 percent per year), we consider the continuation of the 8.5 percent investment return assumption to be reasonable and appropriate.

General Salary Scale

There are two components to the projected salary increases for members of SERS. The first is the rate by which the salary scales are expected to increase each year. The general increase was initially set at the current 3.3 percent a year in 1996. The assumption consisted of an assumed inflation rate of 3.0 percent and an assumed real salary growth rate of 0.3 percent. In 2001, based primarily upon the 1996-2000 experience of (i) real salary growth continuing at 0.3 percent on average and (ii) inflation remaining close to 3.0 percent (at 2.8 percent), the 3.3 percent general salary increase assumption was retained, as were its two component parts.

Now we consider what has occurred in 2001 through 2005, along with expectations for 2006 and beyond. The annual general increases from 2001 through 2005, ranged from a low of 1.9 percent to a high of 3.5 percent fluctuating in accordance with newly negotiated increases beginning in 2003. Average annual increases were 2.7 percent over the five-year period and 3.3 percent over the twenty-year period (1986-2005). The real rate of salary growth during the same period ranged between a 1.4 percent drop in 2004 to a 1.7 percent increase in 2001. The average real salary growth during the past 20 years was 0.3 percent a year and during the past five years was 0.2 percent per year.

With one more general increase remaining under the current contract (3.5 percent effective at the beginning of 2007) and much uncertainty regarding negotiations to occur after the November 2006 gubernatorial election, the outlook for future general increases is uncertain. We discussed the outlook for salary adjustments in the future with the Office of Administration and they do not have any projections of increases beyond the current contracts. Our current expectation is that general increases will continue to be set at levels which, on average, will be slightly in excess of inflation.

As discussed above, after considering Milliman's suggestion that the future inflation assumption be decreased by at least 0.5 percent (and that the general salary scale assumption be correspondingly reduced), Hay Group has deemed it reasonable and appropriate to continue with the current annual inflation assumption of 3.0 percent. Therefore, consistent with the recommendation Hay initially put forth in 1996, and revalidated in 2001, we recommend continuation of the general salary increase assumption of 3.3 percent, and its two component parts (an assumed inflation rate of 3.0 percent and an assumed real salary growth rate of 0.3 percent).

Our recommendations are shown in Table III-3 and are compared to the current assumptions and experience over the last 5 and last 20 years. As noted above, we are recommending that the Board continue with the current set of economic assumptions.

TABLE III-3
Recommended Economic Assumptions

	Inflation	Investment Return		Salary Growth	
		Nominal	Real	Nominal	Real
Current	3.0%	8.5%	5.3%	3.3%	0.3%
Experience 1986 – 2005	3.0%	10.8%	7.6%	3.3%	0.3%
Experience 2001 – 2005	2.5%	6.1%	3.5%	2.7%	0.2%
Proposed	3.0%	8.5%	5.3%	3.3%	0.3%

Career Salary Growth Assumption

The second component to the projected salary increases for members of SERS takes into account expected salary growth resulting from actions that affect an individual's career. These are increases from promotion to a higher range and/or through longevity to a higher step. That is, a career salary increase is a member's total salary increase less the general salary scale increase applicable to the member.

We analyzed the career salary scale for the years 2001 through 2004 by year of increase and age of the employee. Our analysis showed that the average increase was close to the expected increases except at the youngest age group. Table III-4 shows the comparison of actual and expected career salary increases by age.

TABLE III-4
Comparison of Actual to Expected Salary Increases

Age	Actual Average Increase	Expected Average Increase
20 – 24	10.6%	5.5%
25 – 29	5.3	5.5
30 – 34	4.2	5.0
35 – 39	3.6	4.4
40 – 44	3.0	3.8
45 – 49	2.6	3.2
50 – 54	2.2	2.5
55 – 59	2.3	1.9
60 – 64	2.1	1.8
65 – 69	2.1	1.8

Milliman recommended that the Board consider a career salary scale that varies by service rather than by age. While salary increases are somewhat correlated to age, service might provide a better correlation. Table III-5 shows the increase in salary by service and is a better fit than the age distribution shown in Table III-4. The service-based table more clearly reflects the large increases in the first year of employment and the small increases in the later years. We recommend that the Board adopt rates based on service as shown in Table III-5.

TABLE III-5
Proposed Salary Increases

Completed Years of Service	Actual Average Increase in Following Year
1	16.9%
2	8.3
3	5.9
4	4.6
5	4.2
6-10	3.2
11-15	2.8
16-20	2.4
21-25	1.8
26+	1.6

IV. ANALYSIS OF DEMOGRAPHIC EXPERIENCE AND PROPOSED DEMOGRAPHIC ASSUMPTIONS

The terminations from active employment for SERS participants are analyzed by four categories depending on the eligibility for SERS benefits:

- Deaths
- Disabilities
- Superannuation retirements
- Other separations from active employment

The terminations are split by the categories above to calculate the long-term rates to be used for the valuation.

The following sections describe the analysis of the demographic experience and show the results of the actual-to-expected experience analysis. The first section discusses the analysis and results for active Class AA and Class A general employees subject to age 60 superannuation, and the second section discusses the results for employees subject to different retirement provisions. The different eligibility rules for retirement do not affect the probability of death or disability, so these rates are the same for all classes. The final section describes the actual-to-expected analysis for retirees and survivors.

Tables IV-1 through IV-5 below compare the actual terminations that have occurred in the period to the expected results based on the current set of actuarial demographic assumptions used in the 2004 actuarial valuation. These actuarial demographic assumptions were based on the previous experience study. The actual-to-expected ratio is the actual terminations as a percent of the expected terminations. Total deaths among female employees, for instance, were 235 or 83 percent of the 285 female employee deaths that would have been expected using the current valuation tables.

In general, we are recommending that the assumptions for the valuation for active employees be revised to reflect the actual experience of the evaluation period.

Analysis of Deaths

Members who die while on active duty are eligible for a death benefit. If the member had less than 5 years of credited service, the member's accumulated contributions are returned. If the member was eligible to receive a retirement benefit, an eligible beneficiary or survivor will receive a benefit from SERS.

During the study period, there were 795 deaths. Based on the current assumptions, we would have expected 1,004 deaths during the 4-year period. The resulting actual-to-expected ratio was 0.79. The long-term rates for death are calculated separately for males and females. Table IV-1 shows the actual deaths, expected deaths based on the current rates, and expected deaths based on the proposed rates. Mortality continues to improve so it is not surprising that the actual deaths during the most recent period are lower than expected.

We propose to adjust the current rates to produce a 1.00 actual-to-expected ratio.   Later in the report we recommend going to the RP-2000 tables to predict mortality after retirement.   We compared the actual experience for actives to the RP-2000 table and found that it was not a good fit for the actives.   So we do not propose using the RP-2000 table for the active mortality.

Unlike post-retirement mortality, lower mortality (fewer deaths) among active participants would reduce benefits. Therefore, the assumptions we are proposing are somewhat conservative.

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TABLE IV-1
Employees Leaving Active Employment Because of Death

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	Actual Deaths	**Expected Deaths**	**Ratio Actual-to-Expected**	**Ratio with Proposed Rates**
	2001-2004	2001-2004	2001-2004	2006-2010
Female Deaths	235	285	0.83	1.00
Male Deaths	560	719	0.78	1.00
Total Deaths	795	1,004	0.79	1.00

Analysis of Disability Retirements

A member is eligible for disability retirement if the member is unable to perform his or her current job and has at least 5 years of service. A State Police or enforcement officer does not have a service requirement.

The data on terminations included 2,120 disability retirements. However, 360 of those members were eligible for superannuation retirement based on their age and credited service at termination. Since there is no difference in benefit, we combined the disabled and non-disabled members who retire after superannuation into the superannuation rates. Therefore, the disability rates are based on the 1,760 members who became disabled before superannuation age.

The total number of disability retirement terminations included in this analysis was 1,760. We would have expected 1,582 disability retirements during the same period, based on the current assumptions. The actual disabilities were 11 percent greater than expected. This continues a trend observed in the last study of an increase in the number of approved disability retirements. We propose disability retirement rates that are based on the actual experience of the disability retirements calculated separately for males and females. Table IV-2 shows the number of disability retirements, the expected disability retirements based on the current assumptions, and the expected number of disability retirements based on the proposed rates.

TABLE IV-2
Employees Leaving Active Employment for Disability Retirement

	Actual Disability Retirements	Expected Disability Retirements	Ratio Actual-to-Expected	Ratio with Proposed Rates
	2001-2004	2001-2004	2001-2004	2006-2010
Female Disability Retirements	912	785	1.16	1.00
Male Disability Retirements	848	796	1.07	1.00
Total Disability Retirements	1,760	1,582	1.11	1.00

Analysis of Superannuation Retirements – Class AA & Class A General Employees

Class AA and Class A general employees can retire and receive full formula benefits after attaining superannuation age. Superannuation age is defined as age 60 with three years of service. Members of Class AA and Class A with 35 or more years of credited service are entitled to full formula benefits regardless of age. As mentioned under the disability retirement analysis, members who terminated on a disability retirement, but were eligible for unreduced benefits at the time of disability were treated as superannuation retirements and included in this part of the analysis.

Table IV-3 below shows the actual superannuation retirements compared to the expected superannuation retirements based on the current assumptions. Although the current superannuation rates are the same for males and females, actual superannuation retirements have been tracked separately for males and females during the 4-year period.

TABLE IV-3
Employees Leaving Active Employment for Superannuation Retirement

	Actual Superannuation Retirements	Expected Superannuation Retirements	Ratio Actual-to-Expected	Expected with Proposed Rates
	2001-2004	2001-2004	2001-2004	2006-2010
Female Superannuation Retirements	3,725	3,165	1.18	1.11
Male Superannuation Retirements	5,051	4,410	1.15	1.08
Total Superannuation Retirements	8,776	7,575	1.16	1.09

The overall experience was much higher than expected. The retirement rates in the last five years have tended to group around certain key events. The events leading to a surge in retirements were:

> Enactment of Act 9 effective July 1, 2001 with increased benefits for employees who retired after that date

> Anticipation of potential changes in the collectively-bargained agreement which became effective on July 1, 2003

> Elimination of one of the health plan options for employees who retired on or after July 1, 2004

We propose that the retirement rates be adjusted toward actual experience but not as high as the full actual experience. This discounts some of the surge retirements but not entirely. Many of those who retire during a surge month would have retired in the following year and, therefore, should be in our annual rate. We also propose that any expected future surges be reflected in ad hoc increases in the rates when the events are known. One known upcoming event is that, effective July 1, 2008, employees retiring on full benefits will need 20 years of service to qualify for subsidized health benefits, as compared to 15 years of service required prior to that date. We would increase the retirement rates in the first half of 2008 for employees retiring after age 60 with 15 to 20 years of service to anticipate that surge.

Another possible effect is a surge in retirements as a result of anticipation of changes in the collective bargaining agreements as the agreements expire on June 30, 2007. We do not propose an

increase for the current valuation but will reexamine that possibility for the December 31, 2006 valuation.

Our analysis of superannuation retirements during the study period and the assumption changes we have proposed reflect, consistent with Milliman's expectation, that some acceleration of retirements has begun to occur, and is likely to continue, as a consequence of the Act 9 increases in active participant benefits. Table IV-4 shows our recommended rates.

TABLE IV-4
Comparison of Current and Proposed Superannuation Retirement Rates

Age	Current Superannuation Rates	Proposed Superannuation Rates
	Males and Females	**Males and Females**
Under 60	0.22	0.30
60-61	0.22	0.25
62	0.33	0.33
63-64	0.22	0.22
65	0.34	0.33
66	0.27	0.22
67-79	0.20	0.22
80	1.00	1.00

Analysis of Other Separations from Active Employment – Class AA & Class A General Employees

Table IV-5 shows the ratio of actual to expected terminations for reasons other than death, disability or superannuation retirement. These rates would be expected to vary somewhat according to the economic cycle. Employees are more likely to continue with an employer in a tight job market. We had set rates that were 12 percent below the actual experience in the last experience study since it appeared to be a favorable job market during that experience period and the experience study for 1990 to 1995 had shown lower rates in a tighter job market. However, this study is close to the actual experience from the last study so we recommend setting rates that equal 100 percent of this year's experience. The recommended rates will produce expected terminations close to the experience of the last five years.

Our valuation splits the other separations into three categories. These are (1) non-vested separations, (2) vested separations who take immediate early retirement benefits and (3) vested separations who defer their benefits until superannuation age. Non-vested separations are those who do not have five years of service upon separation. We examined those with more than five years of service and found that 60 percent of those with 5 to 14 years of service elected an immediate annuity and 98 percent of those with 15 or more years of service elected an immediate annuity. We propose to assume that 60 percent of those with 5 to 14 years of service and all of those with 15 or more years of service will elect an immediate annuity.

TABLE IV-5
Other Separations From Active Employment

	Actual Separations	**Expected Separations**	**Ratio Actual-to-Expected**	**Ratio with Proposed Rates**
	2001-2004	2001-2004	2001-2004	2006-2010
Female Separations	7,902	6,711	1.18	1.00
Male Separations	7,689	6,231	1.23	1.00
Total Separations	15,591	12,941	1.20	1.00

Table IV-6 summarizes the total actual terminations, expected terminations based on the current rates, the actual-to-expected ratio, and the actual-to-expected ratio based upon the proposed rates.

TABLE IV-6
Total Employees Leaving Active Employment

	Actual Terminations	Expected In Valuation	Ratio Actual-to- Expected	Ratio with Proposed Rates
	2001-2004	2001-2004	2001-2004	2006-2010
Deaths	795	1,004	0.79	1.00
Disabilities	1,760	1,582	1.11	1.00
Superannuation Retirements	8,776	7,575	1.16	1.09
Other Separations	15,591	12,941	1.20	1.00
TOTAL	26,922	23,102	1.17	1.03

Analysis of Experience for Special Benefit Classes

Members who are in the General Assembly, members of the Judiciary, State Police and other members of law enforcement (categorized as Hazardous Duty employees) have different patterns of termination than do Class AA and Class A members eligible to retire at age 60 or with 35 years of service. Some of the differences, such as retirement at ages before 60, are attributable to different retirement eligibility conditions; and other differences, such as terminations without eligibility for a benefit before five years, are attributable to the characteristics of the group. Table IV-7 compares the actual terminations, expected terminations based on the current rates, the actual-to-expected ratio, and the actual-to-expected ratio based upon the proposed rates for each of the employee groups.

The rates of decrement for special classes tend to fluctuate more than for general employees because there are fewer employees in special classes and, therefore, more of a statistical variation from one study to the next. We reviewed the superannuation and other separation rates and believe that it would be reasonable to set rates that project the same proportion of future retirements as the actual experience in the four year study period.

The one exception is the expected terminations for legislators. Since there were two elections in the four year study period and there will be three in the next five years, the expected experience during the next five years should be 150 percent of the actual.

As suggested by Milliman, we extended our past analysis to consider the relative number of deaths and disabilities for hazardous duty employees and the State Police. The ratio of actual-to-expected deaths for these employees of 86 percent is close to the 79 percent observed for all employees. The disability actual-to-expected ratio of 95 percent is also fairly close to the overall ratio of 1.11. These ratios are close enough to suggest that we use the overall tables for the subset of hazardous duty and State Police members.

We recommend that the Board adopt termination assumptions for superannuation and other terminations that reproduce the actual experience of the study period with the exception of the adjustment referred to above for legislators.

TABLE IV-7
Special Benefit Classes Leaving Active Employment

	Actual Terminations	Expected Terminations	Ratio Actual-to-Expected	Ratio with Proposed Rates
	2001-2004	2001-2004	2001-2004	2006-2010
Superannuation				
State Police With More Than 20 Years of Service	301	256	1.18	1.00
Other Hazardous Duty	1,829	1,274	1.44	1.00
Legislators	37	59	.62	1.50
Members of the Judiciary	83	73	1.14	1.00
Separated Before Superannuation				
State Police	140	391	.36	1.00
Hazardous Duty	1,467	1,332	1.10	1.00
Legislators	27	21	1.27	1.50
Members of the Judiciary	12	51	.24	1.00
Death				
Hazardous Duty and State Police	130	150	.86	1.10
Disability				
Hazardous Duty and State Police	256	271	.95	1.11

Analysis of Annuitant Mortality

The actual and expected numbers of deaths among annuitants are shown in Table IV-8 through Table IV-10. The annuitants are categorized as non-disabled retirees, disabled retirees, and survivors. The survivor category also includes alternate payees.

The current assumptions expected 6,879 deaths for male annuitants compared to the actual deaths of 6,983 or an actual-to-expected ratio of 1.02. For females, the expected deaths were 5,392 compared to actual deaths of 6,511 or an actual-to-expected ratio of 1.21.

Mortality has generally improved throughout the last 100 years so we had set rates that allowed for that improvement in the future. The mortality assumption for annuitants is one of the most important factors in the valuation. As a result, we recommended mortality rates that would expect a continuing improvement in mortality.

The number of deaths among non-disabled annuitants was 8 percent greater than expected and the number of deaths among disabled annuitants was 14 percent greater than expected. Overall, the total number of deaths was 10 percent greater than expected. In the context of a pension plan, adverse mortality experience occurs if retirees live longer and, therefore, draw more benefits than predicted by the table (i.e., adverse experience is when a smaller number of deaths occur than expected). Since life expectancies nationally and among SERS members have continually increased, and that in turn increases the cost of the pension plan, it would be prudent to set mortality rates that have a margin reflecting that improvement. In other words, the mortality rates should be set to project fewer deaths than shown by recent experience.

Milliman agreed that improvements in mortality should be reflected in setting the assumptions, although this is not typically done, and commended us for including such an improvement. Milliman also recommended that SERS consider mortality tables that had roughly similar margins for males and females.

We determined that the RP-2000 tables projected to 2008 would produce mortality rates that provide a margin of 15 percent and that result in a closer balance in the margin between males and females. We also found that the projected 2008 rates produced results with a reasonable margin for disabled employees and for survivors.

Mortality tables are also used to establish the early retirement and other actuarial equivalence factors used to determine benefits payable to retirees who make optional elections. The two sets of mortality assumptions, those used for the valuation and those used for the actuarial equivalence factors, should be kept in step over the long run to avoid significant additional losses or gains resulting from the exercise of optional elections at retirement. The optional elections do result in overall losses, in any event, because they are, by law, based on 4 percent interest rather than the 8.5 percent interest assumption used for actuarial funding.

However, we believe that it is not necessary to change the actuarial equivalence factors every time there is a change in the valuation mortality assumptions. The change in equivalence factors is a very costly and time-consuming process. SERS staff has determined that the SERS Code does not

require that the actuarial equivalence factors be changed every time the actuarial assumptions are changed. The current set of actuarial equivalence factors were reasonable given life expectancies at the time of their adoption and they continue to reflect life expectancies fairly closely. As shown in Table IV-10 the current experience is only 108 percent of that expected during the study period. Therefore, we recommend that the actuarial equivalence factors remain unchanged but that the issue be reconsidered at the time of the next experience study.

TABLE IV-8
Deaths of Male Annuitants

	Actual Deaths	Expected Deaths	Ratio Actual-to-Expected	Expected with Proposed Rates	Ratio Actual-to-Expected
	2001-2004	2001-2004	2001-2004	2006-2010	2006-2010
Non-disabled Retirees	6,297	6,279	1.00	5,328	1.18
Disabled Retirees	565	485	1.17	507	1.11
Survivors	121	115	1.06	98	1.23
TOTAL	6,983	6,879	1.02	5,933	1.18

TABLE IV-9
Deaths of Female Annuitants

	Actual Deaths	Expected Deaths	Ratio Actual-to-Expected	Expected with Proposed Rates	Ratio Actual-to-Expected
	2001-2004	2001-2004	2001-2004	2006-2010	2006-2010
Non-disabled Retirees	4,395	3,625	1.21	3,995	1.10
Disabled Retirees	404	364	1.11	327	1.24
Survivors	1,712	1,403	1.22	1,515	1.13
TOTAL	6,511	5,392	1.21	5,837	1.12

TABLE IV-10
Total Deaths of Annuitants

	Actual Deaths	**Expected Deaths**	**Ratio Actual-to-Expected**	**Expected with Proposed Rates**	**Ratio Actual-to-Expected**
	2001-2004	2001-2004	2001-2004	2006-2010	2006-2010
Non-disabled Retirees	10,692	9,904	1.08	9,323	1.15
Disabled Retirees	969	849	1.14	834	1.16
Survivors	1,833	1,518	1.21	1,612	1.14
TOTAL	13,494	12,271	1.10	11,769	1.15

V. OTHER EXPERIENCE ANALYSES

Optional Retirement Elections

The valuation includes a prediction of the number of new retirees who will select each of the options. Prediction of the proportion that will elect Option 4 is particularly important because of the adverse effect on the fund of each such election. Table V-1 compares the current assumptions to the selection by new retirees during the experience period. Option 4, the return of the present value of all or part of the employee contributions, can be selected along with any other available option. An increasingly popular option is to combine an Option 1 type of guarantee with a percentage to a survivor.

TABLE V-1
Assumed Elections of Options at Retirement

Election	Current Assumption	Experience
No election	33%	32%
Option 1	38%	28%
Option 2 or 3 or other percentage survivor	29%	27%
Option 1 combined with 2, 3 or other	N/A	13%
Total	100%	100%
Election Including Option 4	83%	84%

We recommend adopting the experience percentages shown above as assumptions for the future election of options. Ten percent of the Option 4 withdrawals were partial, but we recommend assuming the maximum permitted withdrawals for Option 4 elections. That will be slightly conservative since partial withdrawals are less costly.

Purchases of Service

Employees can purchase certain past service by agreeing to pay the cost of that service. The most common purchases are for past SERS service and for military service. Before Act 9 in 2001 employees had to agree to pay the cost in a lump sum or in installment payments over no more than three years. Act 9 permits payments over as long as six years, or the employee can defer payment until retirement. The deferred payments, plus interest, are used to reduce the benefits at retirement.

We have developed new purchase of service assumptions based upon experience during the five-year study, and we propose to use those assumptions for valuation purposes.

Handling of Future Service Credits for Part-Time Employees

As recommended by Milliman we will modify our methods and procedures, as needed, to accurately project the cost for part-time employees.

VI. CONCLUSION

Our recommended changes, in total, would continue the Board policy of establishing moderately conservative assumptions. The assumptions, as a set, are conservative in that they produce a somewhat higher employer cost than would be produced without including the conservatism. Use of the recommended set of assumptions would allow some margin for adverse experience without significantly overstating the current cost of the system.

Most of the demographic assumptions were set to be the same as experience in the last five years. We propose two significant deviations from that approach that, we believe, are justified by the analysis of those particular rates. First, we assume that superannuation retirements will increase in line with experience but not to the full level resulting from the surges in retirements in the last five years. Second, as in the past, we are recommending adding a margin to the annuitant mortality rates to anticipate continued improvement in mortality.

Some of the changes in assumptions will increase the projected cost of the retirement system and some will decrease the cost. Overall, we expect that adoption of the recommended assumptions will be cost neutral. In other words, the cost of the retirement system with the recommended changes will be about the same as the cost using the current assumptions.

VII. GLOSSARY

Actual-to-Expected Ratio – The actual number of members leaving for a specific cause (such as retirement) divided by the number the actuary expected to leave.

Actuarial Assumptions – Predicted probability of future events including economic and demographic assumptions.

Demographic Assumptions – Predictions about the rate at which employees will leave the retirement plan and the rate at which annuitants will die. These include rates of retirement and disability.

Economic Assumptions – Predictions about the future earnings of the retirement fund, salary growth and inflation.

APPENDIX – DEMOGRAPHIC ASSUMPTIONS

Schedule A
Assumptions for Active Female General Employees

Age	Rate of Death	Rate of Disability	Rate of Early Retirement Employees with 5 - 14 Years of Service	Employees with 15 or More Years of Service	Rate of Superannuation Retirement
17	0.0001				
18	0.0001				
19	0.0002				
20	0.0002				
21	0.0002				
22	0.0002		0.0405		
23	0.0002	0.0007	0.0398		
24	0.0002	0.0007	0.0399		
25	0.0002	0.0007	0.0388		
26	0.0002	0.0008	0.0371		
27	0.0002	0.0010	0.0354		
28	0.0002	0.0010	0.0345		
29	0.0002	0.0014	0.0352		
30	0.0002	0.0017	0.0353		
31	0.0002	0.0020	0.0352	0.0506	
32	0.0002	0.0022	0.0350	0.0506	
33	0.0003	0.0026	0.0281	0.0271	
34	0.0003	0.0028	0.0282	0.0271	
35	0.0003	0.0029	0.0284	0.0271	
36	0.0003	0.0030	0.0283	0.0271	
37	0.0004	0.0031	0.0281	0.0271	
38	0.0004	0.0034	0.0229	0.0271	
39	0.0004	0.0036	0.0227	0.0271	
40	0.0005	0.0038	0.0172	0.0271	
41	0.0005	0.0042	0.0166	0.0271	
42	0.0006	0.0046	0.0164	0.0271	
43	0.0006	0.0051	0.0168	0.0271	
44	0.0007	0.0053	0.0164	0.0271	
45	0.0007	0.0060	0.0164	0.0271	0.3000
46	0.0007	0.0067	0.0147	0.0271	0.3000
47	0.0009	0.0072	0.0148	0.0271	0.3000
48	0.0010	0.0080	0.0131	0.0271	0.3000
49	0.0011	0.0086	0.0130	0.0271	0.3000
50	0.0012	0.0091	0.0130	0.0271	0.3000
51	0.0012	0.0095	0.0125	0.0271	0.3000
52	0.0014	0.0100	0.0124	0.0271	0.3000
53	0.0015	0.0106	0.0121	0.0271	0.3000
54	0.0016	0.0110	0.0120	0.0271	0.3000
55	0.0018	0.0115	0.0233	0.0389	0.3000
56	0.0020	0.0120	0.0233	0.0389	0.3000
57	0.0021	0.0125	0.0233	0.0389	0.3000
58	0.0024	0.0130	0.0233	0.0389	0.3000
59	0.0026	0.0135	0.0937	0.1566	0.3000

Schedule A
Assumptions for Active Female General Employees

Age	Rate of Death	Rate of Disability	Rate of Early Retirement Employees with 5 - 14 Years of Service	Rate of Early Retirement Employees with 15 or More Years of Service	Rate of Superannuation Retirement
60	0.0030				0.2500
61	0.0033				0.2500
62	0.0036				0.3300
63	0.0040				0.2200
64	0.0045				0.2200
65	0.0049				0.3300
66	0.0054				0.2200
67	0.0061				0.2200
68	0.0068				0.2200
69	0.0077				0.2200
70	0.0087				0.2200
71	0.0099				0.2200
72	0.0113				0.2200
73	0.0129				0.2200
74	0.0148				0.2200
75	0.0168				0.2200
76	0.0190				0.2200
77	0.0215				0.2200
78	0.0242				0.2200
79	0.0270				0.2200
80	n/a				1.0000

NOTE: Superannuation rates over age 59 include disability retirements

Schedule B
Assumptions for Active Male General Employees

Age	Rate of Death	Rate of Disability	Rate of Early Retirement Employees with 5 - 14 Years of Service	Employees with 15 or More Years of Service	Rate of Superannuation Retirement
17	0.0002				
18	0.0002				
19	0.0002				
20	0.0002				
21	0.0002				
22	0.0002				
23	0.0002	0.0003	0.0296		
24	0.0002	0.0003	0.0296		
25	0.0002	0.0003	0.0296		
26	0.0002	0.0005	0.0296		
27	0.0002	0.0005	0.0296		
28	0.0003	0.0010	0.0255		
29	0.0003	0.0009	0.0251		
30	0.0003	0.0009	0.0249		
31	0.0003	0.0010	0.0246	0.0386	
32	0.0004	0.0011	0.0246	0.0386	
33	0.0004	0.0012	0.0195	0.0263	
34	0.0004	0.0015	0.0191	0.0263	
35	0.0005	0.0016	0.0189	0.0263	
36	0.0005	0.0017	0.0189	0.0263	
37	0.0005	0.0017	0.0188	0.0263	
38	0.0005	0.0018	0.0187	0.0263	
39	0.0006	0.0019	0.0188	0.0263	
40	0.0006	0.0025	0.0169	0.0263	
41	0.0007	0.0028	0.0169	0.0263	
42	0.0008	0.0032	0.0168	0.0263	
43	0.0009	0.0035	0.0169	0.0263	
44	0.0010	0.0039	0.0169	0.0263	
45	0.0012	0.0044	0.0112	0.0263	0.3000
46	0.0013	0.0047	0.0111	0.0263	0.3000
47	0.0015	0.0051	0.0110	0.0263	0.3000
48	0.0016	0.0052	0.0108	0.0263	0.3000
49	0.0019	0.0058	0.0109	0.0263	0.3000
50	0.0021	0.0061	0.0095	0.0263	0.3000
51	0.0023	0.0065	0.0096	0.0263	0.3000
52	0.0025	0.0068	0.0095	0.0263	0.3000
53	0.0027	0.0074	0.0095	0.0263	0.3000
54	0.0030	0.0077	0.0097	0.0263	0.3000
55	0.0033	0.0080	0.0233	0.0386	0.3000
56	0.0035	0.0082	0.0233	0.0386	0.3000
57	0.0038	0.0086	0.0233	0.0386	0.3000
58	0.0041	0.0088	0.0233	0.0386	0.3000
59	0.0044	0.0092	0.0825	0.1373	0.3000

Schedule B
Assumptions for Active Male General Employees

Age	Rate of Death	Rate of Disability	Rate of Early Retirement Employees with 5 - 14 Years of Service	Employees with 15 or More Years of Service	Rate of Superannuation Retirement
60	0.0048				0.2500
61	0.0053				0.2500
62	0.0059				0.3300
63	0.0065				0.2200
64	0.0073				0.2200
65	0.0083				0.3300
66	0.0093				0.2200
67	0.0105				0.2200
68	0.0118				0.2200
69	0.0132				0.2200
70	0.0146				0.2200
71	0.0160				0.2200
72	0.0177				0.2200
73	0.0194				0.2200
74	0.0214				0.2200
75	0.0236				0.2200
76	0.0262				0.2200
77	0.0290				0.2200
78	0.0322				0.2200
79	0.0355				0.2200
80	n/a				1.0000

NOTE: Superannuation rates over age 59 include disability retirements

Schedule C
Assumptions for Active General Employees
Withdrawal Rates for Female Employees

Years of Service

Age	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
17	0.1119	0.1071													
18	0.1119	0.1071	0.1048												
19	0.1119	0.1071	0.1048	0.0918											
20	0.1119	0.1071	0.1048	0.0918	0.0824										
21	0.1119	0.1071	0.1048	0.0918	0.0824	0.0292									
22	0.1119	0.1071	0.1048	0.0918	0.0824	0.0292	0.0259								
23	0.1024	0.1024	0.0954	0.0918	0.0824	0.0268	0.0259	0.0235							
24	0.1024	0.1024	0.0930	0.0918	0.0824	0.0268	0.0259	0.0235	0.0212						
25	0.1024	0.1024	0.0930	0.0918	0.0824	0.0268	0.0259	0.0235	0.0212	0.0212					
26	0.1024	0.1024	0.0930	0.0918	0.0824	0.0268	0.0259	0.0235	0.0212	0.0212	0.0283				
27	0.1024	0.1024	0.0930	0.0918	0.0824	0.0268	0.0259	0.0212	0.0212	0.0212	0.0259	0.0259			
28	0.1024	0.1024	0.0930	0.0918	0.0824	0.0268	0.0235	0.0212	0.0212	0.0188	0.0259	0.0259	0.0259		
29	0.1024	0.1024	0.0930	0.0918	0.0824	0.0268	0.0235	0.0212	0.0212	0.0188	0.0259	0.0259	0.0259	0.0259	
30	0.1024	0.1024	0.0930	0.0918	0.0824	0.0268	0.0235	0.0212	0.0212	0.0188	0.0259	0.0259	0.0259	0.0259	0.0203
31	0.1024	0.1024	0.0930	0.0918	0.0824	0.0268	0.0235	0.0212	0.0212	0.0188	0.0259	0.0259	0.0259	0.0259	0.0203
32	0.1024	0.1024	0.0930	0.0918	0.0824	0.0268	0.0235	0.0212	0.0212	0.0188	0.0259	0.0259	0.0259	0.0259	0.0203
33	0.1024	0.1024	0.0930	0.0801	0.0706	0.0221	0.0207	0.0165	0.0141	0.0141	0.0212	0.0212	0.0212	0.0212	0.0155
34	0.1024	0.1024	0.0930	0.0801	0.0706	0.0221	0.0207	0.0165	0.0141	0.0141	0.0212	0.0212	0.0212	0.0212	0.0155
35	0.1024	0.1024	0.0930	0.0801	0.0706	0.0221	0.0207	0.0165	0.0141	0.0141	0.0212	0.0212	0.0212	0.0212	0.0155
36	0.1024	0.1024	0.0930	0.0801	0.0706	0.0221	0.0207	0.0165	0.0141	0.0141	0.0212	0.0212	0.0212	0.0212	0.0155
37	0.1024	0.1024	0.0930	0.0801	0.0706	0.0221	0.0207	0.0165	0.0141	0.0141	0.0212	0.0212	0.0212	0.0212	0.0155
38	0.1024	0.1024	0.0930	0.0801	0.0589	0.0221	0.0188	0.0165	0.0094	0.0094	0.0165	0.0165	0.0165	0.0165	0.0108
39	0.1024	0.1024	0.0930	0.0801	0.0589	0.0221	0.0188	0.0165	0.0094	0.0094	0.0165	0.0165	0.0165	0.0165	0.0108
40	0.1001	0.1001	0.0930	0.0801	0.0589	0.0221	0.0165	0.0165	0.0094	0.0085	0.0094	0.0094	0.0094	0.0094	0.0061
41	0.1001	0.1001	0.0930	0.0801	0.0589	0.0221	0.0165	0.0141	0.0094	0.0085	0.0094	0.0094	0.0094	0.0094	0.0061
42	0.1001	0.1001	0.0930	0.0801	0.0589	0.0221	0.0165	0.0141	0.0094	0.0085	0.0094	0.0094	0.0094	0.0094	0.0061
43	0.0977	0.0977	0.0883	0.0765	0.0589	0.0221	0.0165	0.0141	0.0094	0.0085	0.0094	0.0094	0.0094	0.0094	0.0061
44	0.0977	0.0977	0.0883	0.0765	0.0530	0.0198	0.0165	0.0141	0.0094	0.0085	0.0094	0.0094	0.0094	0.0094	0.0061
45	0.0977	0.0977	0.0883	0.0765	0.0530	0.0198	0.0165	0.0141	0.0094	0.0085	0.0094	0.0094	0.0094	0.0094	0.0061
46	0.0977	0.0977	0.0883	0.0765	0.0530	0.0198	0.0127	0.0141	0.0094	0.0085	0.0094	0.0071	0.0071	0.0071	0.0061
47	0.0977	0.0977	0.0883	0.0765	0.0530	0.0198	0.0127	0.0141	0.0094	0.0085	0.0094	0.0071	0.0071	0.0071	0.0061
48	0.0977	0.0977	0.0883	0.0765	0.0530	0.0198	0.0127	0.0094	0.0071	0.0047	0.0094	0.0071	0.0071	0.0071	0.0061
49	0.0977	0.0977	0.0883	0.0765	0.0530	0.0198	0.0127	0.0094	0.0071	0.0047	0.0094	0.0071	0.0071	0.0071	0.0061
50	0.0977	0.0977	0.0883	0.0765	0.0530	0.0198	0.0127	0.0094	0.0071	0.0047	0.0094	0.0071	0.0071	0.0071	0.0061
51	0.0977	0.0977	0.0883	0.0706	0.0436	0.0165	0.0127	0.0094	0.0071	0.0047	0.0094	0.0071	0.0071	0.0071	0.0061
52	0.0977	0.0977	0.0883	0.0706	0.0436	0.0165	0.0113	0.0094	0.0071	0.0047	0.0094	0.0071	0.0071	0.0071	0.0061
53	0.0977	0.0977	0.0883	0.0706	0.0436	0.0165	0.0113	0.0094	0.0071	0.0047	0.0071	0.0071	0.0071	0.0071	0.0061
54	0.0977	0.0977	0.0883	0.0706	0.0436	0.0165	0.0113	0.0094	0.0071	0.0047	0.0071	0.0071	0.0071	0.0071	0.0061
55	0.0977	0.0977	0.0883	0.0706	0.0436	0.0165	0.0141	0.0141	0.0141	0.0141	0.0165	0.0165	0.0165	0.0165	0.0155
56	0.0977	0.0977	0.0883	0.0706	0.0436	0.0165	0.0141	0.0141	0.0141	0.0141	0.0165	0.0165	0.0165	0.0165	0.0155
57	0.0977	0.0977	0.0883	0.0706	0.0436	0.0165	0.0141	0.0141	0.0141	0.0141	0.0165	0.0165	0.0165	0.0165	0.0155
58	0.0977	0.0977	0.0883	0.0706	0.0436	0.0165	0.0141	0.0141	0.0141	0.0141	0.0165	0.0165	0.0165	0.0165	0.0155
59	0.0977	0.0977	0.0883	0.0706	0.0436	0.0612	0.0612	0.0612	0.0612	0.0612	0.0636	0.0636	0.0636	0.0636	0.0626

Years of Service

Age	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
17	0.1185	0.1185													
18	0.1185	0.1185	0.1000												
19	0.1185	0.1185	0.1000	0.0753											
20	0.1185	0.1185	0.1000	0.0753	0.0703										
21	0.1185	0.1185	0.1000	0.0753	0.0703	0.0222									
22	0.1185	0.1185	0.1000	0.0753	0.0703	0.0222	0.0197								
23	0.1160	0.1160	0.0975	0.0691	0.0642	0.0197	0.0197	0.0197							
24	0.1160	0.1160	0.0975	0.0691	0.0642	0.0197	0.0197	0.0197	0.0197						
25	0.1160	0.1160	0.0975	0.0691	0.0642	0.0197	0.0197	0.0197	0.0197	0.0197					
26	0.1160	0.1160	0.0975	0.0691	0.0642	0.0197	0.0197	0.0197	0.0197	0.0197	0.0247				
27	0.1160	0.1160	0.0975	0.0691	0.0642	0.0197	0.0197	0.0197	0.0197	0.0197	0.0247	0.0220			
28	0.1160	0.1160	0.0975	0.0691	0.0642	0.0197	0.0158	0.0148	0.0148	0.0148	0.0193	0.0170	0.0168		
29	0.1160	0.1160	0.0975	0.0691	0.0642	0.0197	0.0158	0.0148	0.0148	0.0148	0.0193	0.0170	0.0168	0.0168	
30	0.1111	0.1111	0.0925	0.0691	0.0642	0.0197	0.0158	0.0148	0.0148	0.0148	0.0193	0.0170	0.0168	0.0168	0.0154
31	0.1111	0.1111	0.0925	0.0691	0.0642	0.0197	0.0158	0.0148	0.0148	0.0148	0.0193	0.0170	0.0168	0.0168	0.0154
32	0.1111	0.1111	0.0925	0.0691	0.0642	0.0197	0.0158	0.0148	0.0148	0.0148	0.0193	0.0170	0.0168	0.0168	0.0154
33	0.1111	0.1111	0.0925	0.0654	0.0605	0.0183	0.0143	0.0118	0.0118	0.0099	0.0143	0.0121	0.0118	0.0118	0.0105
34	0.1111	0.1111	0.0925	0.0654	0.0605	0.0183	0.0143	0.0118	0.0118	0.0099	0.0143	0.0121	0.0118	0.0118	0.0105
35	0.1086	0.1086	0.0901	0.0654	0.0605	0.0183	0.0143	0.0118	0.0118	0.0099	0.0143	0.0121	0.0118	0.0118	0.0105
36	0.1086	0.1086	0.0901	0.0654	0.0605	0.0183	0.0143	0.0118	0.0118	0.0099	0.0143	0.0121	0.0118	0.0118	0.0105
37	0.1086	0.1086	0.0901	0.0654	0.0605	0.0183	0.0143	0.0118	0.0118	0.0099	0.0143	0.0121	0.0118	0.0118	0.0105
38	0.1086	0.1086	0.0901	0.0654	0.0605	0.0183	0.0143	0.0118	0.0118	0.0099	0.0143	0.0121	0.0118	0.0118	0.0105
39	0.1086	0.1086	0.0901	0.0654	0.0605	0.0183	0.0143	0.0118	0.0118	0.0099	0.0143	0.0121	0.0118	0.0118	0.0105
40	0.1086	0.1086	0.0901	0.0654	0.0469	0.0128	0.0099	0.0099	0.0099	0.0099	0.0133	0.0121	0.0118	0.0118	0.0105
41	0.1086	0.1086	0.0901	0.0654	0.0469	0.0128	0.0099	0.0099	0.0099	0.0099	0.0133	0.0121	0.0118	0.0118	0.0105
42	0.1086	0.1086	0.0901	0.0654	0.0469	0.0128	0.0099	0.0099	0.0099	0.0099	0.0133	0.0121	0.0118	0.0118	0.0105
43	0.1086	0.1086	0.0901	0.0605	0.0469	0.0128	0.0099	0.0099	0.0099	0.0099	0.0133	0.0121	0.0118	0.0118	0.0105
44	0.1086	0.1086	0.0901	0.0605	0.0469	0.0128	0.0099	0.0099	0.0099	0.0099	0.0133	0.0121	0.0118	0.0118	0.0105
45	0.1049	0.1049	0.0864	0.0605	0.0469	0.0128	0.0089	0.0064	0.0064	0.0049	0.0084	0.0072	0.0069	0.0069	0.0056
46	0.1049	0.1049	0.0864	0.0605	0.0469	0.0128	0.0089	0.0064	0.0064	0.0049	0.0084	0.0072	0.0069	0.0069	0.0056
47	0.1049	0.1049	0.0864	0.0605	0.0469	0.0128	0.0089	0.0064	0.0064	0.0049	0.0079	0.0072	0.0069	0.0069	0.0056
48	0.1049	0.1049	0.0864	0.0605	0.0469	0.0128	0.0089	0.0064	0.0064	0.0049	0.0079	0.0072	0.0069	0.0069	0.0056
49	0.1049	0.1049	0.0864	0.0605	0.0469	0.0128	0.0089	0.0064	0.0064	0.0049	0.0079	0.0072	0.0069	0.0069	0.0056
50	0.1024	0.1024	0.0740	0.0605	0.0432	0.0114	0.0074	0.0049	0.0049	0.0049	0.0064	0.0064	0.0064	0.0064	0.0056
51	0.1024	0.1024	0.0740	0.0605	0.0432	0.0114	0.0074	0.0049	0.0049	0.0049	0.0064	0.0064	0.0064	0.0064	0.0056
52	0.1024	0.1024	0.0740	0.0605	0.0432	0.0114	0.0074	0.0049	0.0049	0.0049	0.0064	0.0064	0.0064	0.0064	0.0056
53	0.1024	0.1024	0.0740	0.0605	0.0432	0.0114	0.0074	0.0049	0.0049	0.0049	0.0064	0.0064	0.0064	0.0064	0.0056
54	0.1024	0.1024	0.0740	0.0605	0.0432	0.0114	0.0074	0.0049	0.0049	0.0049	0.0064	0.0064	0.0064	0.0064	0.0056
55	0.1024	0.1024	0.0740	0.0605	0.0432	0.0148	0.0148	0.0148	0.0148	0.0148	0.0163	0.0163	0.0163	0.0163	0.0154
56	0.1024	0.1024	0.0740	0.0605	0.0432	0.0148	0.0148	0.0148	0.0148	0.0148	0.0163	0.0163	0.0163	0.0163	0.0154
57	0.1024	0.1024	0.0740	0.0605	0.0432	0.0148	0.0148	0.0148	0.0148	0.0148	0.0163	0.0163	0.0163	0.0163	0.0154
58	0.1024	0.1024	0.0740	0.0605	0.0432	0.0148	0.0148	0.0148	0.0148	0.0148	0.0163	0.0163	0.0163	0.0163	0.0154
59	0.1024	0.1024	0.0740	0.0605	0.0432	0.0543	0.0543	0.0543	0.0543	0.0543	0.0558	0.0558	0.0558	0.0558	0.0549

Schedule E
Rates for Employees Subject to Different Retirement Provisions

Rate of Withdrawal and Early Retirement

Service	State Police / Hazardous Duty (withdrawal)	Legislators (withdrawal)	Judicial Officers (withdrawal)	Age	State Police / Hazardous Duty (early ret)	Legislators (early ret)	Judicial Officers (early ret)
0	0.0560	0.0000	0.0002	17 to 49	0.0093	0.0386	0.0024
1	0.0560	0.0386	0.0024	50 to 59	0.0000	0.0000	0.0024
2	0.0373	0.0386	0.0024				
3	0.0280	0.0386	0.0024				
4	0.0280	0.0386	0.0024				
5	0.0187	0.0386	0.0024				
6	0.0187	0.0386	0.0024				
7	0.0093	0.0386	0.0024				
8	0.0093	0.0386	0.0024				
9	0.0093	0.0386	0.0024				
10 +	0.0093	0.0386	0.0024				

The withdrawal rates for years of service 1 to 10+ are rounded to two decimals in our program.

Rate of Superannuation Retirement

Age	Hazardous Duty	Legislators	Judicial Officers		Service	State Police with 20 or More Years of Service
49	0.0718	0.0125	0.0227		20	0.0470
50	0.0718	0.0125	0.0227		21	0.0118
51	0.0718	0.0188	0.0227		22	0.0118
52	0.0718	0.0188	0.0227		23	0.0118
53	0.0718	0.0188	0.0227		24	0.0118
54	0.0718	0.0188	0.0227		25	0.3527
55	0.0718	0.0188	0.0227		26	0.1999
56	0.0718	0.0188	0.0227		27	0.1881
57	0.0718	0.0251	0.0227		28	0.1881
58	0.0718	0.0251	0.0227		29	0.1881
59	0.0718	0.0251	0.0227		30	0.1881
60	0.0718	0.0251	0.0227		31	0.1881
61	0.1436	0.0314	0.0227		32	0.1881
62	0.5743	0.0314	0.0227		33	0.1881
63	0.4450	0.0314	0.0227		34	0.3527
64	0.5025	0.0376	0.0227		35	0.4821
65	0.7178	0.0376	0.0227		36	0.4821
66	0.3446	0.0376	0.0227		37	0.4821
67	0.3446	0.0439	0.0227		38	0.4821
68	0.3446	0.0439	0.0227		39	0.4821
69	0.3446	0.0502	0.0227		40	1.0000
70	0.3446	0.0502	1.0000			
71	0.3446	0.0564				
72	0.3446	0.0564				
73	0.3446	0.0627				
74	0.3446	0.0627				
75	0.3446	0.0627				
76	0.3446	0.0627				
77	0.3446	0.0627				
78	0.3446	0.0627				
79	0.3446	0.0627				
80	1.0000	1.0000				

Schedule F
Annuitant Mortality Tables

| | Non-Disabled Annuitants and Survivors | | Disabled Annuitants | |
Age	Male	Female	Male	Female
30	0.001067	0.000341	0.021684	0.006874
31	0.001199	0.000403	0.021684	0.006986
32	0.001350	0.000459	0.021684	0.006986
33	0.001516	0.000513	0.021684	0.006930
34	0.001687	0.000561	0.021684	0.006874
35	0.001857	0.000608	0.021684	0.006819
36	0.002021	0.000653	0.021684	0.006764
37	0.002172	0.000698	0.021684	0.006710
38	0.002298	0.000747	0.021510	0.006655
39	0.002414	0.000803	0.021338	0.006602
40	0.002531	0.000875	0.021166	0.006602
41	0.002657	0.000959	0.020996	0.006602
42	0.002804	0.001056	0.020827	0.006602
43	0.002974	0.001161	0.020660	0.006602
44	0.003172	0.001275	0.020493	0.006602
45	0.003397	0.001382	0.020328	0.006548
46	0.003610	0.001491	0.021303	0.007135
47	0.003843	0.001604	0.022263	0.007747
48	0.004089	0.001734	0.023208	0.008453
49	0.004350	0.001875	0.024138	0.009196
50	0.004624	0.002044	0.025056	0.010056
51	0.004742	0.002161	0.025962	0.010967
52	0.004802	0.002365	0.026853	0.012021
53	0.004868	0.002628	0.027955	0.013133
54	0.004932	0.002944	0.029055	0.014300
55	0.005065	0.003311	0.030400	0.015514
56	0.005296	0.003741	0.031764	0.016771
57	0.005618	0.004213	0.033152	0.017921
58	0.006060	0.004728	0.034572	0.018935
59	0.006579	0.005314	0.035745	0.019952
60	0.007204	0.005956	0.036953	0.020981
61	0.007976	0.006647	0.038523	0.022034
62	0.008786	0.007387	0.039858	0.023133
63	0.009783	0.008175	0.041615	0.024299
64	0.010825	0.009026	0.043154	0.025554
65	0.011988	0.009957	0.044822	0.026924
66	0.013390	0.010964	0.047024	0.028431
67	0.014824	0.012047	0.049038	0.030094
68	0.016259	0.013230	0.050839	0.031928
69	0.017961	0.014557	0.053254	0.033946
70	0.019677	0.016084	0.055456	0.036156
71	0.021772	0.017706	0.058343	0.038253
72	0.024174	0.019694	0.061501	0.040837
73	0.026926	0.021715	0.064945	0.043268
74	0.030039	0.024067	0.068685	0.046223

Schedule F
Annuitant Mortality Tables

Age	Non-Disabled Annuitants and Survivors		Disabled Annuitants	
	Male	Female	Male	Female
75	0.033799	0.026357	0.073313	0.048979
76	0.037671	0.029039	0.077677	0.052306
77	0.042244	0.032241	0.082990	0.056291
78	0.047324	0.035541	0.088651	0.060072
79	0.053021	0.039238	0.094636	0.064088
80	0.059395	0.043372	0.100922	0.068360
81	0.067015	0.048005	0.107482	0.072920
82	0.075477	0.053218	0.114292	0.077801
83	0.084134	0.059090	0.120355	0.083038
84	0.094326	0.065718	0.127550	0.088668
85	0.104704	0.073806	0.133865	0.095493
86	0.116087	0.082981	0.140266	0.102889
87	0.129648	0.093297	0.147938	0.110899
88	0.144671	0.103917	0.155811	0.118600
89	0.159879	0.116324	0.162581	0.127861
90	0.177620	0.128555	0.177620	0.136723
91	0.193465	0.141170	0.193465	0.146143
92	0.211461	0.153875	0.211461	0.156126
93	0.228113	0.167725	0.228113	0.167725
94	0.244739	0.179895	0.244739	0.179895
95	0.263241	0.191419	0.263241	0.191419
96	0.279394	0.202116	0.279394	0.202116
97	0.295088	0.213524	0.295088	0.213524
98	0.312782	0.222162	0.312782	0.222162
99	0.327575	0.229542	0.327575	0.229542
100	0.341809	0.235574	0.341809	0.235574
101	0.358628	0.244834	0.358628	0.244834
102	0.371685	0.254498	0.371685	0.254498
103	0.383040	0.266044	0.383040	0.266044
104	0.392003	0.279055	0.392003	0.279055
105	0.397886	0.293116	0.397886	0.293116
106	0.400000	0.307811	0.400000	0.307811
107	0.400000	0.322725	0.400000	0.322725
108	0.400000	0.337441	0.400000	0.337441
109	0.400000	0.351544	0.400000	0.351544
110	0.400000	0.364617	0.400000	0.364617
111	0.400000	0.376246	0.400000	0.376246
112	0.400000	0.386015	0.400000	0.386015
113	0.400000	0.393507	0.400000	0.393507
114	0.400000	0.398308	0.400000	0.398308
115	0.400000	0.400000	0.400000	0.400000
116	0.400000	0.400000	0.400000	0.400000
117	0.400000	0.400000	0.400000	0.400000
118	0.400000	0.400000	0.400000	0.400000
119	0.400000	0.400000	0.400000	0.400000
120	1.000000	1.000000	1.000000	1.000000