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November 18, 2015

Mr. Jeffrey L. Ezell
Executive Director
Teachers Retirement System of Georgia
Suite 100, Two Northside 75
Atlanta, GA 30318

Dear Mr. Ezell:

Enclosed are 30 copies of the "Teachers Retirement System of Georgia Experience Investigation for the five-year period ending June 30, 2014". The investigation covers the economic and demographic experience for the System and makes recommendations for changes to assumptions and methods to better reflect future experience.

Please let us know if there are any questions concerning this report.

Sincerely,

Edward A. Macdonald, ASA, FCA, MAAA
President

Cathy Turcot
Principal and Managing Director

John Garrett, ASA, FCA, MAAA
Principal and Consulting Actuary

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Teachers Retirement System of Georgia

Experience Investigation for the

Five-Year Period Ending June 30, 2014

November 18, 2015

Board of Trustees
Teachers Retirement System of Georgia
Suite 100, Two Northside 75
Atlanta, GA 30318

Members of the Board:

We are pleased to submit the results of an investigation of the economic and demographic experience for the Teachers Retirement System of Georgia. The investigation has been made in accordance with Section 47-3-23(b) of the retirement law which provides that at least once in every five-year period, the actuary shall make an actuarial investigation into the mortality, service and compensation experience of the members and beneficiaries of the Retirement System. The purpose of the investigation is to assess the reasonability of the actuarial assumptions and methods currently used by the Retirement System. This investigation covers the five-year period from July 1, 2009 to June 30, 2014. As a result of this investigation, it is recommended that revised economic assumptions and demographic tables be adopted by the Board for future use.

The investigation of the demographic experience of members of the System includes all active and retired members as well as beneficiaries of deceased members. The experience was investigated separately for males and females since different tables are used for each of these groups.

The number of members expected to separate from active service, the expected rates of salary increase and the expected number of post-retirement deaths were obtained by use of the rates determined in the last experience investigation and adopted by the Board of Trustees. The results of the investigation indicate that the assumed rates of separation from active service due to withdrawal, disability, death and retirement, and rates of salary increase and post-retirement mortality do not accurately reflect the actual and anticipated experience of the Retirement System. As a result of the investigation, new withdrawal, salary, disability, retirement and mortality tables have been developed which reflect more closely the actual experience of the membership.

All new assumptions are shown in the attached tables in Appendix D of this report. In the actuary's judgment, the recommended assumptions are suitable for use until further experience indicates that modifications are desirable.

The experience investigation was performed by, and under the supervision of, independent actuaries who are members of the American Academy of Actuaries with experience in performing valuations for public retirement systems. The undersigned meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

Respectfully submitted,

Edward A. Macdonald, ASA, FCA, MAAA
President

Cathy Turcot
Principal and Managing Director

John Garrett, ASA, FCA, MAAA
Principal and Consulting Actuary

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Section I
Executive Summary

The following table summarizes the findings and recommendations with regard to the assumptions utilized for the Teachers Retirement System of Georgia. Detailed explanations for the recommendations are found in the sections that follow.

Recommended Economic Assumption Changes

The table below lists the three economic assumptions used in the actuarial valuations and the current and proposed rates.

Item	Current	Proposed
Price Inflation	3.00%	2.75%
Investment Return*	7.50%	7.50%
Wage Inflation	3.75%	3.25%

* net of investment expenses.

Recommended Demographic Assumption Changes

The table below lists the demographic assumptions that we recommend be changed based on the experience of the last five years.

Assumption Changes
Withdrawal, Pre-Retirement Mortality, Disability Retirement, Service Retirement, Post-Retirement Mortality, Salary Scale

Recommended Other Assumption Changes

The table below lists the other assumptions that are considered in our valuations that should be reviewed during the experience study.

Assumption	Assumption Changes
Administrative Expenses	Recommend no change to current assumption
Amortization Method	No change to current method of level percent of payroll amortization
Asset Smoothing	No change to current method of smoothing market gains and losses over 5 year period
Option Factors	Recommend change in current option factors to reflect change in mortality rate
Percent Married	Recommend change to current assumption
Unused Sick Leave	Recommend changes to our loads on service for allowing members to convert forfeited sick leave to service at retirement
Valuation Cost Method	No change in Entry Age Normal Cost Method
Vested Termination Benefit	Recommend change to current assumption

Section II
Financial Impact

The following table highlights the impact of the recommended changes on the principal valuation results. This table is for illustrative purposes only and not intended to modify the contribution rates set forth in the June 30, 2014 valuation report.

Impact on Principal Valuation Results ($1,000's)		
	Valuation Results 2014	**Recommended Assumptions**
Unfunded Accrued Liability	$13,710,395	$14,353,924
Funding Ratio	81.9%	81.2%
Employer Annual Required Contribution		
Normal Rate*	6.56%	6.27%
Unfunded Accrued Liability Rate	7.71%	8.17%
Total Rate	14.27%	14.44%
Amortization Period (in years)	29.0	29.3

***Includes administrative expenses

Section III
Economic Assumptions

There are three economic assumptions used in the actuarial valuations performed for the System. They are:

- Price Inflation
- Investment Return
- Wage Inflation

Actuarial Standard of Practice (ASOP) No. 27, *"Selection of Economic Assumptions for Measuring Pension Obligations"*, provides guidance to actuaries in selecting economic assumptions for measuring obligations under defined benefit plans and was revised in September 2013. The revised standard now requires that each economic assumption selected by the actuary should be reasonable which means it has the following characteristics:

- It is appropriate for the purpose of the measurement;
- It reflects the actuary's professional judgment;
- It takes into account historical and current economic data that is relevant as of the measurement date;
- It reflects the actuary's estimate of future experience, the actuary's observation of the estimates inherent in market data, or a combination thereof; and
- It has no significant bias (i.e., it is not significantly optimistic or pessimistic), except when provisions for adverse deviation or plan provisions that are difficult to measure are included and disclosed, or when alternative assumptions are used for the assessment of risk.

Each economic assumption should individually satisfy this standard. Furthermore, with respect to any particular valuation, each economic assumption should be consistent with every other economic assumption over the measurement period.

In our opinion, the economic assumptions recommended in this report have been developed in accordance with ASOP No. 27, as revised in September, 2013. The following table shows our recommendation followed by detailed discussions of each assumption.

Item	Current	Proposed
Price Inflation	3.00%	2.75%
Real Rate of Return	4.50	4.75
Investment Return	7.50%	7.50%
Price Inflation	3.00%	2.75%
Real Wage Growth	0.75%	0.50%
Wage Inflation	3.75%	3.25%

Price Inflation

Background: As can be seen from the table above, assumed price inflation is used as the basis for both the investment return assumption and the wage inflation assumption. These latter two assumptions will be discussed in detail in the following sections.

It is important that the price inflation assumption be consistently applied throughout the economic assumptions utilized in an actuarial valuation. This is called for in ASOP No. 27 and is also required to meet the parameters for determining pension liabilities and expenses under Governmental Accounting Standards Board (GASB) Statements No. 67 and 68.

The current price inflation assumption is 3.00% per year.

Past Experience: The Consumer Price Index, US City Average, All Urban Consumers, CPI (U), has been used as the basis for reviewing historical levels of price inflation. The level of that index in June of each of the last 50 years is provided in Appendix A.

In analyzing this data, annual rates of inflation have been determined by measuring the compound growth rate of the CPI (U) over various time periods. The results are as follows:

Period (Fiscal Years Ending)	Number of Years	Inflation	Annual Standard Deviation
2005-2014	10	2.31%	1.81%
1995-2004	10	2.51	0.83
1985-1994	10	3.62	1.06
1975-1984	10	7.78	3.39
1965-1974	10	4.68	2.63
1995-2014	20	2.41%	1.37%
1985-2014	30	2.81	1.39
1975-2014	40	4.03	2.99
1965-2014	50	4.16	2.90
1927-2014	88	2.98	4.15

The graph below shows the annual increases in the CPI (U) over the 50-year period (1965-2014) compared to the 3.00% currently assumed.
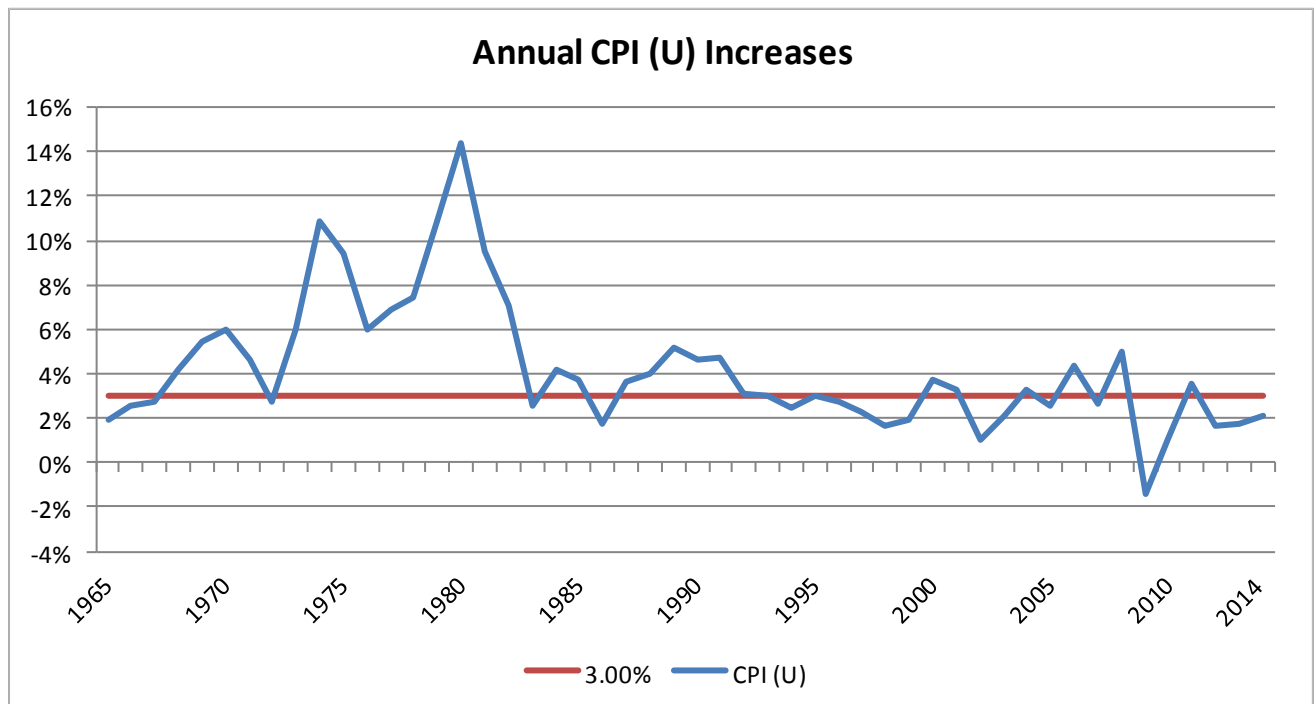
Over more recent historical periods, the average annual rate of increase in the CPI-U has been below 3.00%. The period of high inflation from 1973 to 1982 has a significant impact on the averages over periods which include these rates. Further, the average rate of 2.98% over the entire 88-year period is close to the average rate of 2.81% for the prior 30 years (1985 to 2014) but the volatility of the annual rates in the more recent years has been markedly lower as indicated by the significantly lower annual standard deviations. Many experts attribute the lower average annual rates and lower volatility to the increased efforts of the Federal Reserve since the early 1980's to stabilize price inflation. The severe recession of 2007-2009 resulted in a short period of deflation followed by low levels of inflation. The Federal Reserve has combated this weak environment with zero interest rates and quantitative easing. Although the quantitative easing program has ended, the Federal Reserve has disclosed an inflation target of at least 2.0% annually and will keep interest rates very low until they see progress toward the target.

Recommendation: It is difficult to accurately predict inflation. Inflation's short-term volatility is illustrated by comparing its average rate over the last 10, 30 and 50 years. Although the 10-year average of 2.31% is lower than the System's assumed rate of 3.00%, the longer 30, 40 and 50-year averages of 2.81%, 4.03% and 4.16% respectively, are at or slightly higher than the System's rate. The validity of the System's assumption is, therefore, dependent upon the emphasis one assigns to the short and long-terms.

Current economic forecasts suggest lower inflation but are generally looking at a shorter time period than appropriate for our purposes. In the 2014 OASDI Trustees Report, the Chief Actuary for Social Security bases the 75 year cost projections on an intermediate inflation assumption of 2.7% with a range of 1.7% to 3.7%. We consider that range reasonable and recommend that TRS lower the current price inflation assumption from 3.00 to 2.75%.

Price Inflation Assumption	
Current	3.00%
Recommended	2.75%

Investment Return

Background: The assumed investment return is one of the most significant assumptions in the annual actuarial valuation process as it is used to discount the expected benefit payments for all active, inactive and retired members of the System. Minor changes in this assumption can have a major impact on valuation results. The investment return assumption should reflect the asset allocation target for the funds set by the Board of Trustees.

The current assumption is 7.50%, consisting of a price inflation assumption of 3.00% and a real rate of return assumption of 4.50%. The return is net of investment expenses.

Past Experience: The assets for the System are valued using a widely accepted asset-smoothing methodology (5-year smoothing) that fully recognizes the expected investment income and also recognizes 20% of each year's investment gain or loss (the difference between actual and expected investment income). The asset smoothing methodology from 2010 to 2012 was based on 7-year smoothing and actuarial value was set equal to market value in 2013. The recent experience over the last five years is shown in the table below.

Year Ending 6/30	Actuarial Value	Market Value
2010	2.23	11.09
2011	4.34	21.27
2012	4.62	2.16
2013	7.52	13.28
2014	9.41	17.17
Average	5.59%	12.81%

The impact of the asset smoothing method can be observed in the table. Very poor asset returns during 2008 and 2009 are reflected in the actuarial value returns through 2013. While important to review and analyze, historical returns over such a short time period are not credible for the purpose of setting the long-term assumed future rate of return.

We next include in our analysis information concerning future expectations for the investment return assumption. Because of the significant variability in past year-to-year results and the inter-play of inflation on those results in the short term, we prefer to base our investment return assumption on the capital market assumptions utilized by the Board in setting investment policy and the asset allocation established by the Board as a result of that policy. This approach is referred to as the building block method in ASOP No. 27.

Analysis: The current capital market assumptions and asset allocation as provided by the System are shown in Appendix B. We further assumed that investment returns approximately follow a lognormal distribution with no correlation between years. The results below provide an expected range of real rates of return over a 50-year time horizon. Looking at one year results produces an expected real return of 6.30% but also has a high standard deviation or measurement of volatility. By expanding the time horizon, the average return does not change much but the volatility declines significantly. The following table provides a summary of results. The geometric real rates of return are net of investment expenses.

Time Span In Years	Mean Real Return	Standard Deviation	Real Returns by Percentile				
			5th	25th	50th	75th	95th
1	6.30%	14.40%	-15.61%	-3.82%	5.34%	15.37%	31.50%
5	5.53%	6.37%	-4.61%	1.14%	5.34%	9.71%	16.33%
10	5.44%	4.50%	-1.79%	2.35%	5.34%	8.42%	13.00%
20	5.39%	3.18%	0.24%	3.22%	5.34%	7.51%	10.70%
30	5.37%	2.60%	1.16%	3.61%	5.34%	7.11%	9.70%
40	5.37%	2.25%	1.71%	3.84%	5.34%	6.87%	9.10%
50	5.36%	2.01%	2.09%	4.00%	5.34%	6.71%	8.70%

Based on this analysis there is a 50% likelihood that the average real rate of return over a 50-year period will be 5.34%. It can also be inferred that for the 10-year time span, 5% of the resulting real rates of return were below -1.79% and 95% were above that. As the time span increases, the results begin to merge. Over a 50-year time span, the results indicate there is a 25% chance that real returns will be below 4.00% and a 25% chance they will be above 6.71%. In other words, there is a 50% chance the real returns will be between 4.00% and 6.71 %.

Recommendation: Using the building block approach of ASOP No. 27 and the projection results outlined above, we are recommending a range for the investment return assumption of the 25th to 75th percentile real returns over the 50-year time span plus the recommended inflation assumption less the recommended expense ratio. The following table details the range.

Item	25th Percentile	50th Percentile	75th Percentile
Real Rate of Return*	4.00%	5.34%	6.71%
Inflation	2.75	2.75	2.75
Net Investment Return	6.75%	8.09%	9.46%

* net of investment expenses

There is a 50% chance that the net return will be 8.09% or more over a 50-year period. A net return of 7.50% is at the 40th percentile. Although not in the center of the recommended range, in our opinion a return of 7.50% is conservative yet reasonable. In addition, the most recent Public Fund Survey indicates that the current median return assumptions for the approximately 126 large public plans in the summary is 7.75%. Further, the recent trend in the return assumption of these large plans is toward lower annual rates of return.

After review of past experience for TRS and future expectation analysis, we are recommending the real rate of return assumption can be increased from 4.50% to 4.75%. Combining this with our recommendation to lower the price inflation assumption, we recommend the long-term investment return assumption remain at 7.50%.

Investment Return Assumption		
	Current	**Recommended**
Real Rate of Return*	4.50%	4.75%
Inflation	3.00	2.75
Net Investment Return	7.50%	7.50%

* net of investment expenses

Wage Inflation

Background: The assumed future increases in salaries consist of a wage inflation component and a component for promotion and longevity, often called merit increases. Wage inflation normally consists of price inflation and a component for real wage growth which reflects the overall return on labor in the economy. Merit increases are generally age and or service related, and will be discussed in the demographic assumption section of the report.

The current wage inflation assumption is 3.75% and is composed of a 3.00% rate of inflation assumption and a 0.75% real rate of wage inflation.

Past Experience: The Social Security Administration publishes data on wage growth in the United States. Appendix C shows the last 50 calendar years' data. We provide the rates of wage inflation and a comparison with the rates of price inflation over various calendar year time periods in the table below. Currently this wage data is only available through 2013. We remove the rate of price inflation for each calendar year for the data to result in the historical real rate of wage inflation.

Period (Calendar Years Ending)	Number of Years	Wage Inflation	Price Inflation	Real Wage Growth
2004-2013	10	2.80%	2.37%	0.43%
1994-2003	10	3.95	2.37	1.58
1984-1993	10	4.26	3.71	0.55
1974-1983	10	7.23	8.17	(0.94)
1964-1973	10	5.60	4.10	1.50
1994-2013	20	3.37%	2.37%	1.00%
1984-2013	30	3.67	2.82	0.85
1974-2013	40	4.55	4.13	0.42
1964-2013	50	4.76	4.12	0.64

Thus over the last 50 years, annual real wage growth has averaged 0.64%.

Annual Real Rates of Wage Growth

As the analysis of the national wage growth data shows, the shorter-term historical average real rate (0.43% for latest 10 year period) is lower than the longer-term average real rates. The rate of real wage inflation over the prior 20 and 30 year periods is 1.00% and 0.85% respectively. Over the longer term, 50 years, the rate is 0.64%.

Recommendation: As with price inflation, we again look at the 2014 OASDI Trustees Report. The Chief Actuary for Social Security bases the 75 year cost projections on an ultimate national wage growth assumption 1.12% greater than the price inflation assumption of 2.80%. The apparent real wage growth experience of TRS during the experience study period was 0.0% annual rate of growth. This study period, however, included the effects of the largest economic downturn in recent history which reduces the usefulness of the data for anticipating future real wage increase. We recommend reducing the current assumed rate of real wage growth from 0.75% to 0.50% per year to anticipate an expected longer-term trend in lower wage inflation.

Wage Inflation Assumption		
	Current	Recommended
Price Inflation	3.00%	2.75%
Real Wage Growth	0.75%	0.50%
Wage Inflation	3.75%	3.25%

Payroll Growth Assumption: The current amortization method is level percent of payroll assuming that payroll grows at the 3.75% rate of wage inflation. We recommend continued use of this amortization method, changing the payroll growth assumption to the recommended wage inflation assumption of 3.25%.

Section IV
Demographic Assumptions

There are several demographic assumptions used in the actuarial valuations performed for the Teachers Retirement System of Georgia. They are:

- Rates of Withdrawal
- Rates of Disability Retirement
- Rates of Service Retirement
- Rate of Mortality
- Rates of Salary Increase

The Actuarial Standards Board has issued Actuarial Standard of Practice (ASOP) No. 35, *"Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations"*, which provides guidance to actuaries in selecting demographic assumptions for measuring obligations under defined benefit plans. In our opinion, the demographic assumptions recommended in this report have been developed in accordance with ASOP No. 35.

The purpose of a study of demographic experience is to compare what actually happened to the membership during the study period (July 1, 2009, through June 30, 2014) with what was expected to happen based on the assumptions used in the last five actuarial valuations.

Detailed tabulations by age, service and/or gender are performed over the entire study period. These tabulations look at all active and retired members during the period as well as separately annotating those who experience a demographic event, also referred to as a decrement. In addition the tabulation of all members together with the current assumptions permits the calculation of the number of expected decrements during the study period.

If the actual experience differs significantly from the overall expected results, or if the pattern of actual decrements, or rates of decrement, by age, gender, or service does not follow the expected pattern, new assumptions are recommended. Recommended changes usually do not follow the exact actual experience during the observation period. Judgment is required to extrapolate future experience from past trends and current member behavior.

The remainder of this section presents the results of the demographic study. We have prepared tables that show a comparison of the actual and expected decrements and the overall ratio of actual to expected results (A/E Ratios) under the current assumptions. If a change is being proposed, the revised A/E Ratios are shown as well. Salary adjustments, other than the economic assumption for wage inflation discussed in the previous section, are treated as demographic assumptions.

RATES OF WITHDRAWAL

COMPARISON OF ACTUAL AND EXPECTED WITHDRAWALS
FROM ACTIVE SERVICE

CENTRAL AGE OF GROUP	NUMBER OF WITHDRAWALS					
	MALE			FEMALE		
	Actual	Expected	Ratio of Actual to Expected	Actual	Expected	Ratio of Actual to Expected
Withdrawals with less than 5 years of service						
20	89	125.6	0.709	145	168.3	0.862
25	1,752	1,850.7	0.947	5,276	5,719.0	0.923
30	2,016	2,129.7	0.947	5,777	5,675.4	1.018
35	1,379	1,464.4	0.942	3,914	3,908.6	1.001
40	1,174	1,226.2	0.957	3,591	3,479.5	1.032
45	954	909.6	1.049	2,893	2,626.3	1.102
50	699	690.4	1.012	2,077	2,009.4	1.034
53 & Over	1,362	1,127.7	1.208	2,750	2,327.6	1.181
TOTAL	**9,425**	**9,524.3**	**0.990**	**26,423**	**25,914.1**	**1.020**
Withdrawals with at least 5 but less than 10 years of service						
25	48	77.3	0.621	167	401.0	0.416
30	705	833.5	0.846	3,332	4,076.2	0.817
35	773	790.8	0.977	2,735	2,879.5	0.950
40	644	595.1	1.082	2,237	2,336.6	0.957
45	526	445.2	1.181	1,961	1,814.2	1.081
50	375	365.4	1.026	1,608	1,450.8	1.108
53 & Over	861	647.9	1.329	2,458	1,912.3	1.285
TOTAL	**3,932**	**3,755.2**	**1.047**	**14,498**	**14,870.6**	**0.975**
Withdrawals with 10 or greater years of service						
30	13	26.0	0.500	38	99.7	0.381
35	223	268.3	0.831	1,120	1,191.5	0.940
40	459	418.9	1.096	1,572	1,542.3	1.019
45	443	387.8	1.142	1,568	1,301.5	1.205
50	349	362.2	0.964	1,658	1,287.8	1.287
53 & Over	537	470.6	1.141	2,315	2,298.5	1.007
TOTAL	**2,024**	**1,933.8**	**1.047**	**8,271**	**7,721.3**	**1.071**

The following graphs show a comparison of the current expected, actual, and proposed rates of withdrawal for actives.

Withdrawal Rates (SVC < 5) - Males

Withdrawal Rates (SVC < 5) - Females

Withdrawal Rates (SVC 5-9) - Males

Withdrawal Rates (SVC 5-9) - Females

Withdrawal Rates (SVC 10+) - Males

Withdrawal Rates (SVC 10+) - Females
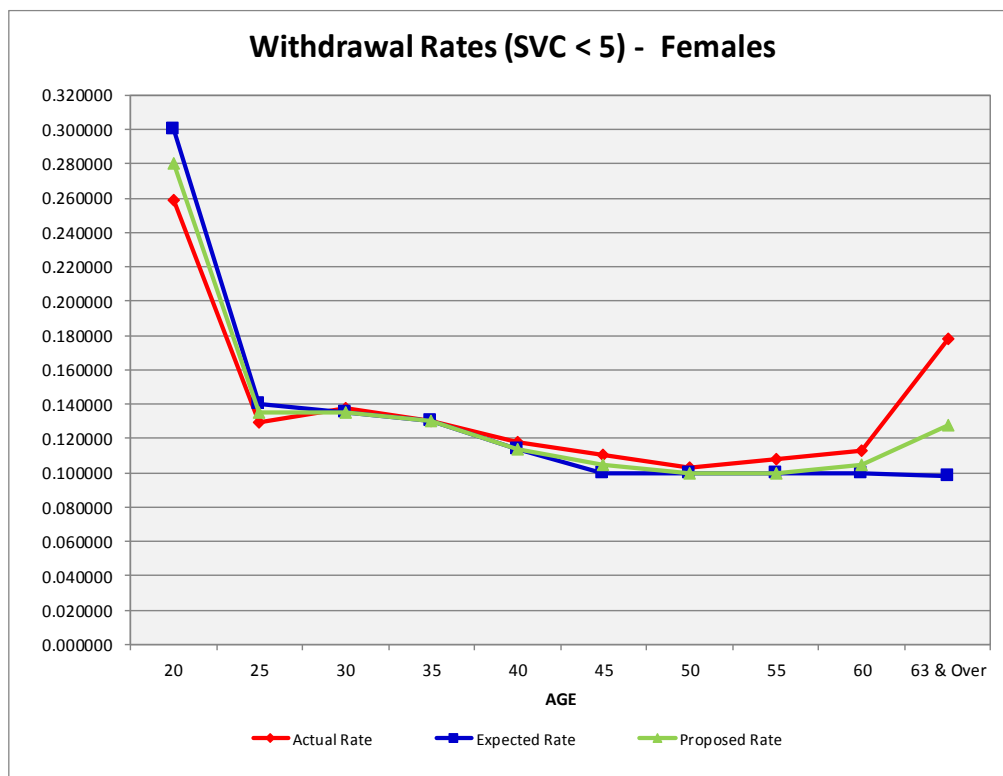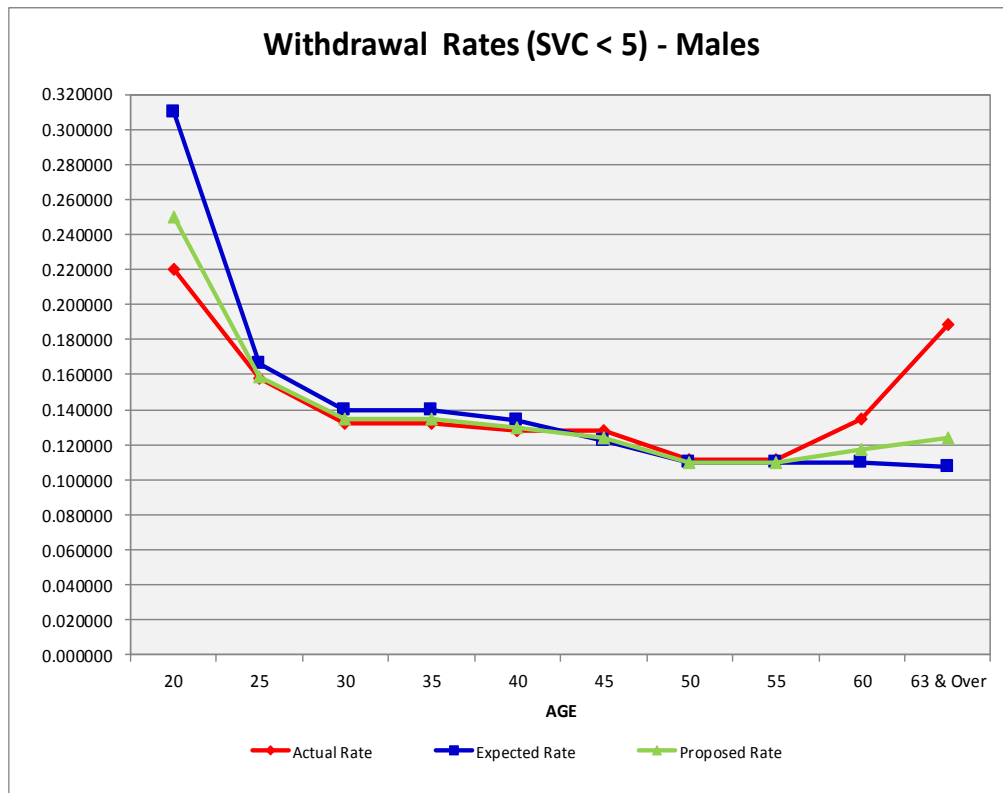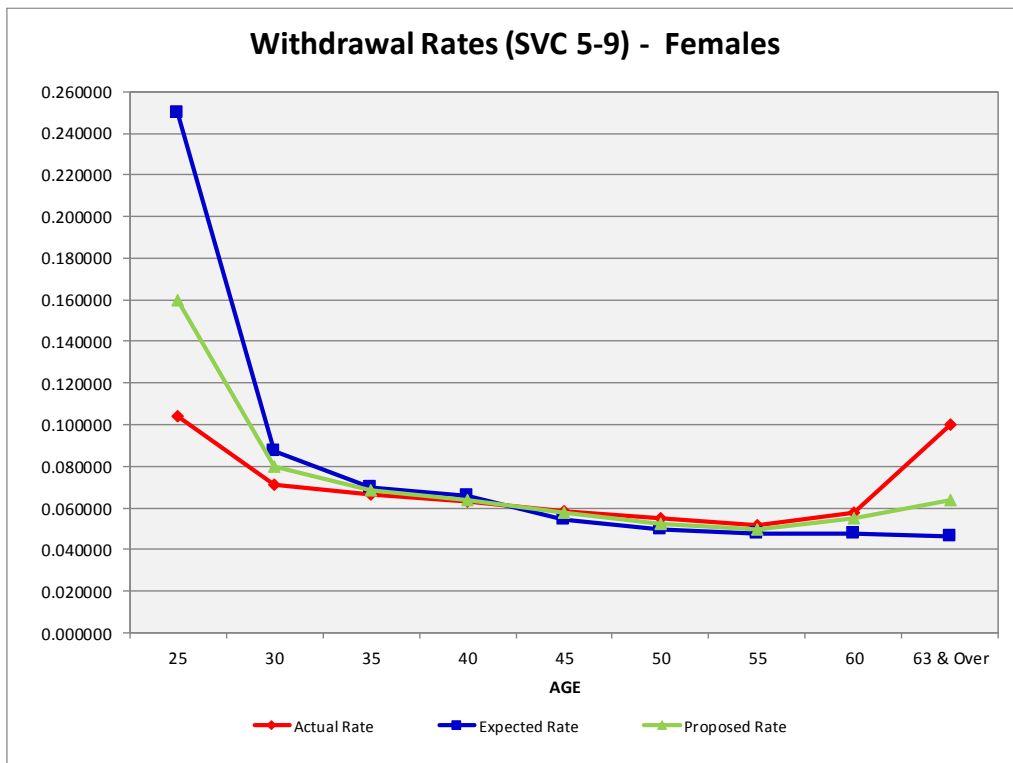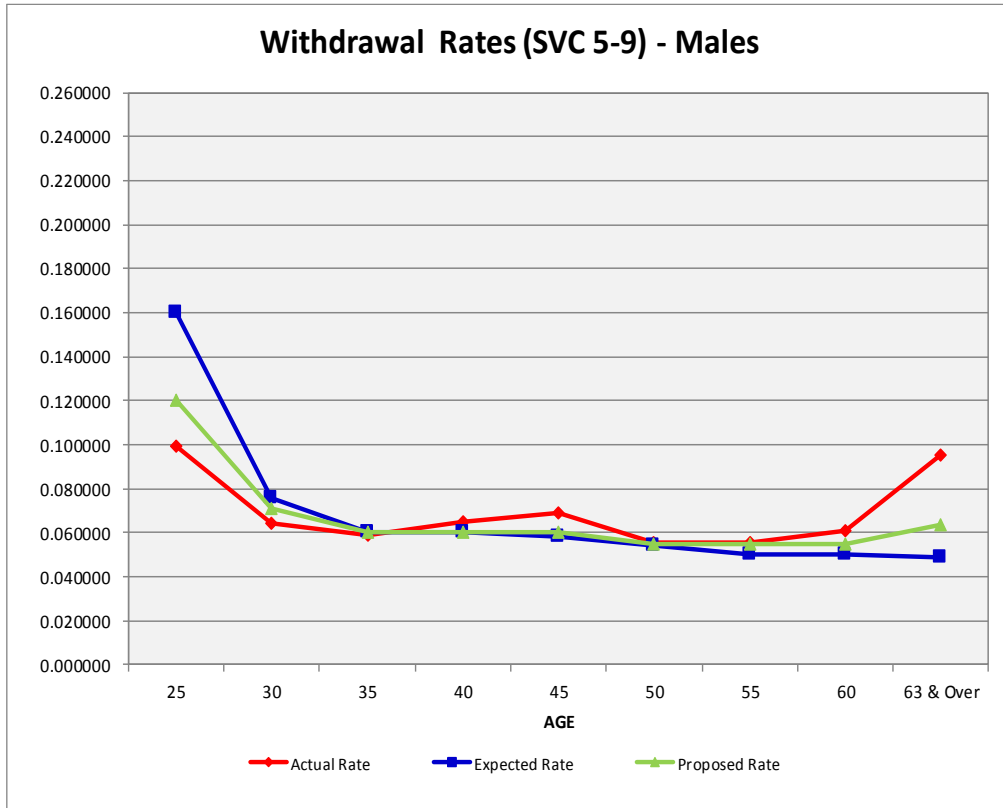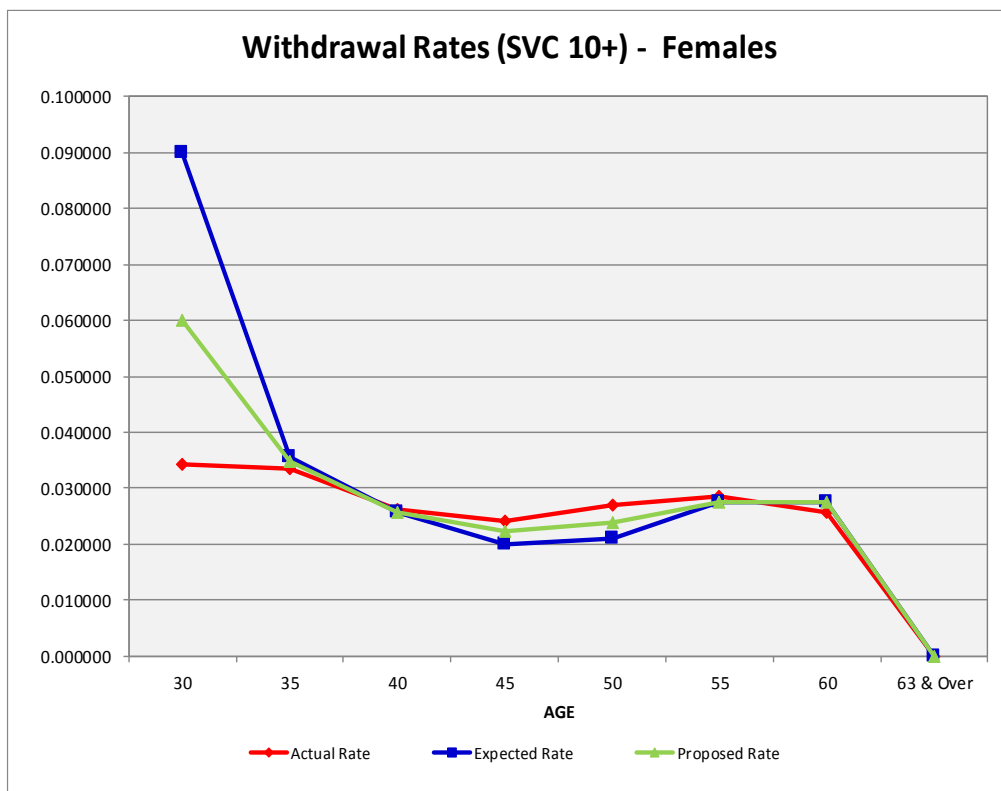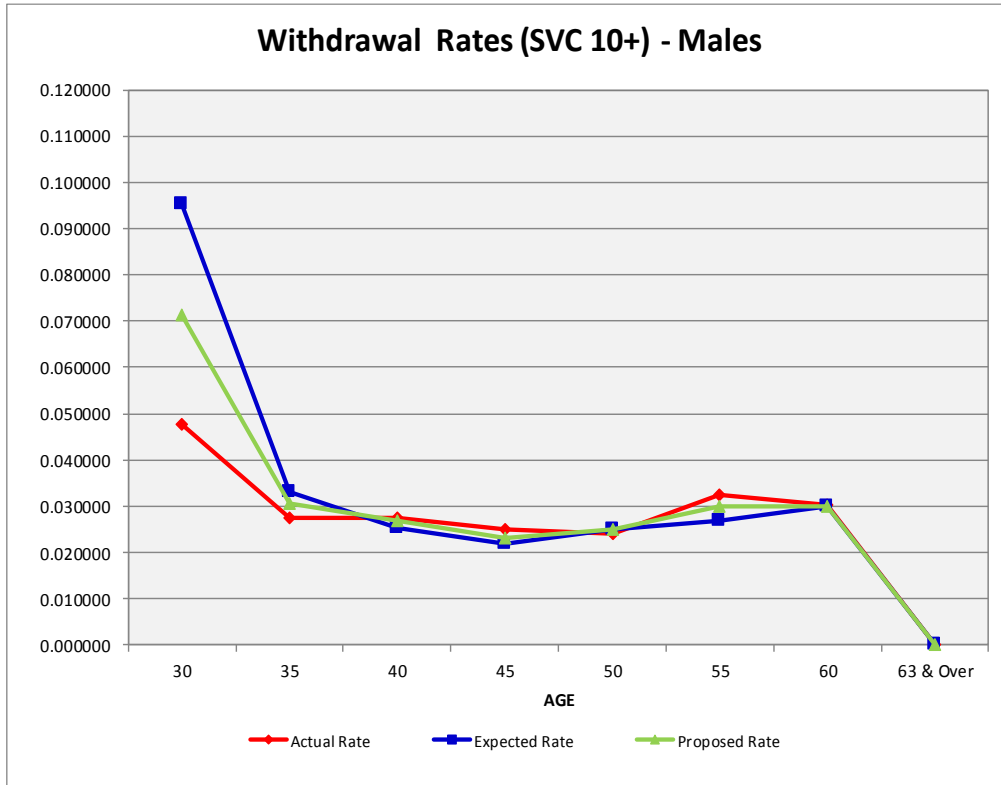
The rates of withdrawal adopted by the Board are used to determine the expected number of separations from active service which will occur as a result of resignation or dismissal. The preceding results indicate that during the study period fewer members than expected withdrew in all service categories for both males and females at the younger ages and slightly more members than expected withdrew at the older ages. We recommend that the rates of withdrawal be revised at this time to more closely reflect the experience of the System.

COMPARATIVE RATES OF WITHDRAWAL
FROM ACTIVE SERVICE

	RATES OF WITHDRAWAL					
	Present			Proposed		
AGE	Years Of Service			Years Of Service		
	0 - 4	5 - 9	10 +	0 - 4	5 - 9	10 +
	Male					
20	31.00%			25.00%		
25	18.00%	16.00%		17.00%	12.00%	
30	14.00%	8.00%	11.00%	13.50%	7.00%	8.00%
35	14.00%	6.00%	3.00%	13.50%	6.00%	3.00%
40	13.00%	6.00%	2.25%	13.00%	6.00%	2.50%
45	12.00%	6.00%	2.20%	12.00%	6.00%	2.30%
50	11.00%	5.50%	2.50%	11.00%	5.50%	2.50%
55	11.00%	5.00%	2.70%	11.00%	5.50%	3.00%
60	11.00%	5.00%	0.00%	12.00%	5.50%	0.00%
64	11.00%	5.00%	0.00%	13.00%	6.50%	0.00%
	Female					
20	30.00%			28.00%		
25	14.00%	25.00%		13.50%	16.00%	
30	13.00%	9.00%	9.00%	13.50%	8.00%	6.00%
35	13.00%	7.00%	3.50%	13.00%	7.00%	3.50%
40	11.00%	7.00%	3.00%	11.00%	6.50%	3.00%
45	10.00%	5.50%	2.00%	10.50%	6.00%	2.30%
50	10.00%	5.00%	2.00%	10.00%	5.00%	2.40%
55	10.00%	4.75%	2.75%	10.00%	5.00%	2.75%
60	10.00%	4.75%	0.00%	10.50%	5.50%	0.00%
64	10.00%	4.75%	0.00%	13.00%	6.50%	0.00%

COMPARISON OF ACTUAL AND EXPECTED WITHDRAWALS
BASED ON PROPOSED RATES

CENTRAL AGE OF GROUP	NUMBER OF WITHDRAWALS					
	MALE			FEMALE		
	Actual	Expected	Ratio of Actual to Expected	Actual	Expected	Ratio of Actual to Expected
Withdrawals with less than 5 years of service						
20	89	101.3	0.879	145	157.1	0.923
25	1,752	1,765.7	0.992	5,276	5,514.8	0.957
30	2,016	2,053.6	0.982	5,777	5,681.5	1.017
35	1,379	1,412.1	0.977	3,914	3,908.6	1.001
40	1,174	1,188.3	0.988	3,591	3,479.5	1.032
45	954	923.8	1.033	2,893	2,757.6	1.049
50	699	690.4	1.012	2,077	2,009.4	1.034
53 & Over	1,362	1,184.0	1.150	2,750	2,445.7	1.124
TOTAL	**9,425**	**9,319.2**	**1.011**	**26,423**	**25,954.2**	**1.018**
Withdrawals with at least 5 but less than 10 years of service						
25	48	58.0	0.828	167	256.6	0.651
30	705	777.6	0.907	3,332	3,728.7	0.894
35	773	790.8	0.977	2,735	2,808.2	0.974
40	644	595.1	1.082	2,237	2,266.2	0.987
45	526	459.0	1.146	1,961	1,947.0	1.007
50	375	371.9	1.008	1,608	1,527.1	1.053
53 & Over	861	740.7	1.162	2,458	2,167.6	1.134
TOTAL	**3,932**	**3,793.1**	**1.037**	**14,498**	**14,701.4**	**0.986**
Withdrawals with 10 or greater years of service						
30	13	19.5	0.667	38	66.5	0.571
35	223	250.1	0.892	1,120	1,158.9	0.966
40	459	445.5	1.030	1,572	1,542.3	1.019
45	443	405.4	1.093	1,568	1,457.3	1.076
50	349	362.2	0.964	1,658	1,472.0	1.126
53 & Over	537	507.5	1.058	2,315	2,298.5	1.007
TOTAL	**2,024**	**1,990.2**	**1.017**	**8,271**	**7,995.5**	**1.034**

RATES OF DISABILITY RETIREMENT

COMPARISON OF ACTUAL AND EXPECTED DISABILITY RETIREMENTS

CENTRAL AGE GROUP	NUMBER OF DISABILITY RETIREMENTS					
	MALE			FEMALE		
	Actual	Expected	Ratio of Actual to Expected	Actual	Expected	Ratio of Actual to Expected
27 & Under	0	3.2	0.000	0	7.8	0.000
30	0	10.2	0.000	1	19.3	0.052
35	2	14.7	0.136	13	29.6	0.439
40	9	20.3	0.443	54	49.3	1.095
45	30	29.5	1.017	77	83.9	0.918
50	58	56.5	1.027	199	190.0	1.047
53 & Over	115	134.9	0.852	529	648.6	0.816
TOTAL	**214**	**269.3**	**0.795**	**873**	**1,028.5**	**0.849**

The following graphs show a comparison of the current expected, actual, and proposed rates of disability retirement.

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Disability Rates - Males

Disability Rates - Females
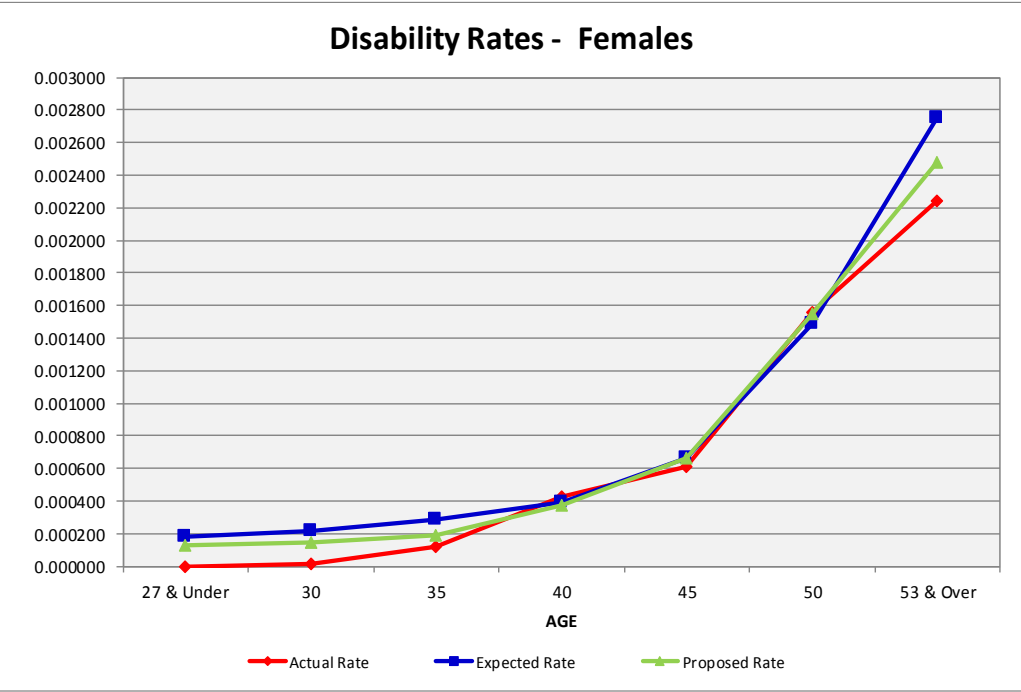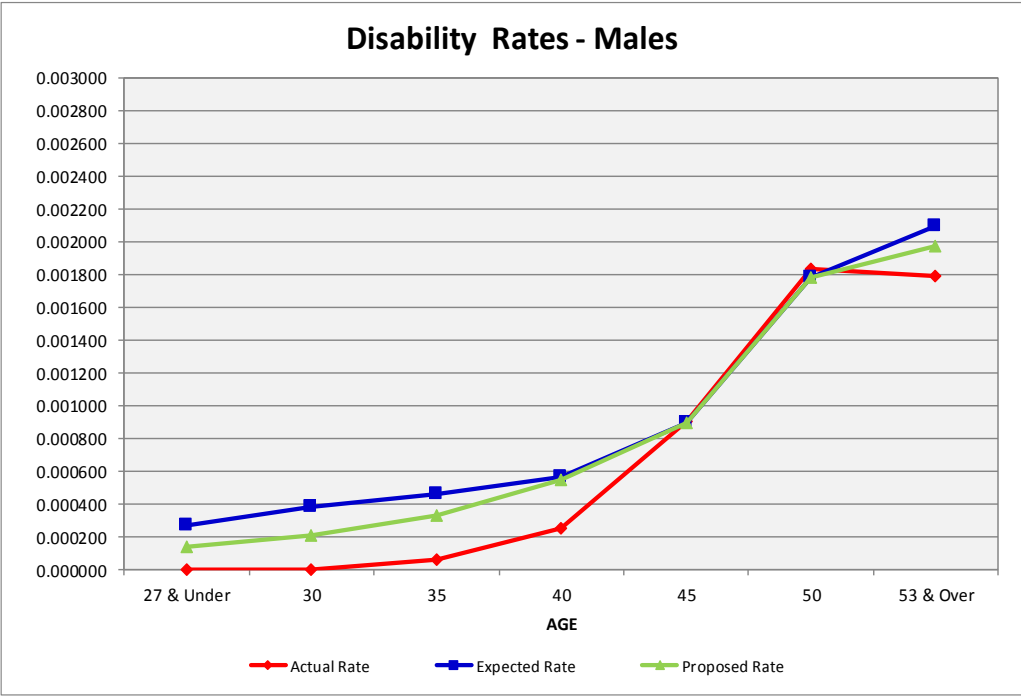
During the period under investigation, the actual rates of disability retirement were less than expected in some age groups and overall. We recommend the rates of disability retirement be revised to reflect the experience of the System. The following table shows a comparison between the present disability retirement rates and the proposed rates.

COMPARATIVE RATES OF DISABILITY RETIREMENTS

| AGE | RATES OF DISABILITY | | | |
| | MALE | | FEMALE | |
	Present	Proposed	Present	Proposed
25	0.0270%	0.0135%	0.0174%	0.0130%
30	0.0408%	0.0210%	0.0216%	0.0140%
35	0.0408%	0.0330%	0.0282%	0.0190%
40	0.0540%	0.0550%	0.0390%	0.0390%
45	0.0900%	0.0900%	0.0648%	0.0650%
50	0.1700%	0.1700%	0.1170%	0.1400%
55	0.3150%	0.3000%	0.3774%	0.3400%

COMPARISON OF ACTUAL AND EXPECTED DISABILITY RETIREMENTS BASED ON PROPOSED RATES

| CENTRAL AGE OF GROUP | NUMBER OF DISABILITY RETIREMENTS | | | | | |
| | MALE | | | FEMALE | | |
	Actual	Expected	Ratio of Actual to Expected	Actual	Expected	Ratio of Actual to Expected
27 & Under	0	1.6	0.000	0	5.6	0.000
30	0	5.6	0.000	1	13.0	0.077
35	2	10.5	0.190	13	19.9	0.653
40	9	19.7	0.457	54	47.3	1.142
45	30	29.5	1.017	77	83.9	0.918
50	58	56.5	1.027	199	197.4	1.008
53 & Over	115	127.1	0.905	529	584.5	0.905
TOTAL	**214**	**250.5**	**0.854**	**873**	**951.6**	**0.917**

RATES OF RETIREMENT

COMPARISON OF ACTUAL AND EXPECTED RETIREMENTS

CENTRAL AGE OF GROUP	NUMBER OF SERVICE RETIREMENTS					
	MALE			FEMALE		
	Actual	Expected	Ratio of Actual to Expected	Actual	Expected	Ratio of Actual to Expected
Less than 30 years of service or all ages 65 and over						
49 & Under	36	63.0	0.571	87	302.6	0.288
52	113	216.1	0.523	380	777.4	0.489
57	127	137.6	0.923	687	575.9	1.193
60	513	527.0	0.973	3,079	3,106.8	0.991
61	375	393.5	0.953	2,062	2,372.5	0.869
62	495	466.0	1.062	2,073	1,874.0	1.106
63	355	294.8	1.204	1,331	1,414.0	0.941
64	288	211.7	1.360	1,042	1,064.0	0.979
65	319	355.2	0.898	1,204	1,138.8	1.057
66	316	286.5	1.103	977	820.8	1.190
67	219	215.1	1.018	609	523.0	1.164
68	154	140.8	1.094	396	361.2	1.096
69	119	104.5	1.139	289	258.7	1.117
70 & Over	300	534.8	0.561	732	1,020.2	0.718
TOTAL	**3,729**	**3,946.6**	**0.945**	**14,948**	**15,609.9**	**0.958**
30 or more years of service and less than age 65						
50 & Under	73	52.5	1.390	168	158.5	1.060
51	78	58.0	1.345	299	239.0	1.251
52	114	101.5	1.123	578	537.0	1.076
53	172	142.0	1.211	649	588.7	1.102
54	182	177.2	1.027	770	704.9	1.092
55	194	185.4	1.046	781	716.8	1.090
56	213	183.8	1.159	780	708.4	1.101
57	212	185.9	1.140	795	687.4	1.157
58	186	182.0	1.022	768	644.0	1.193
59	181	183.1	0.989	773	709.2	1.090
60	199	185.5	1.073	775	692.0	1.120
61	155	138.3	1.121	653	588.8	1.109
62	151	143.5	1.052	615	501.2	1.227
63	114	111.9	1.019	448	387.6	1.156
64	89	82.5	1.079	328	290.4	1.129
TOTAL	**2,313**	**2,113.1**	**1.095**	**9,180**	**8,153.9**	**1.126**

The analysis of the experience reflects that the current assumed rates of retirement slightly over-anticipate retirements for members prior to 30 years of service but under-anticipate the rates for those meeting the 30 years of service requirements before age 65. We recommend adjustment to the rates to reflect the experience as well as maintain a reasonable degree of margin. The following graphs show a comparison of the present, actual, and proposed rates of service retirements.

Retirement Rates - Males
Less than 30 years of service or all ages 65 and over

Retirement Rates - Females
Less than 30 years of service or all ages 65 and over

Retirement Rates - Males
30 or more years of service and less than age 65

Retirement Rates - Females
30 or more years of service and less than age 65
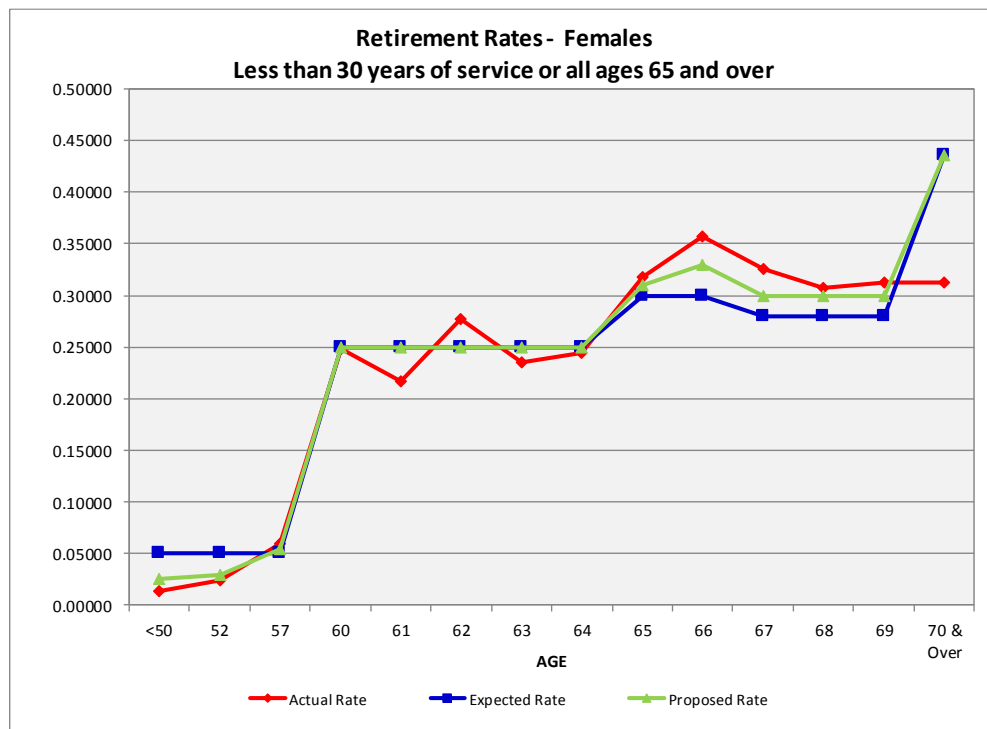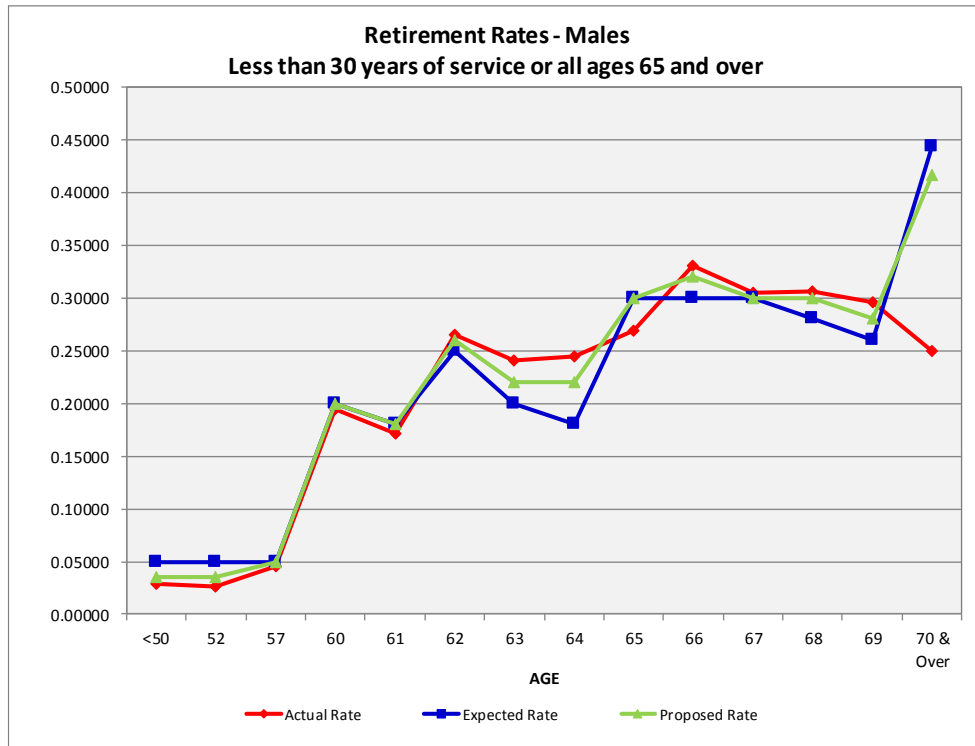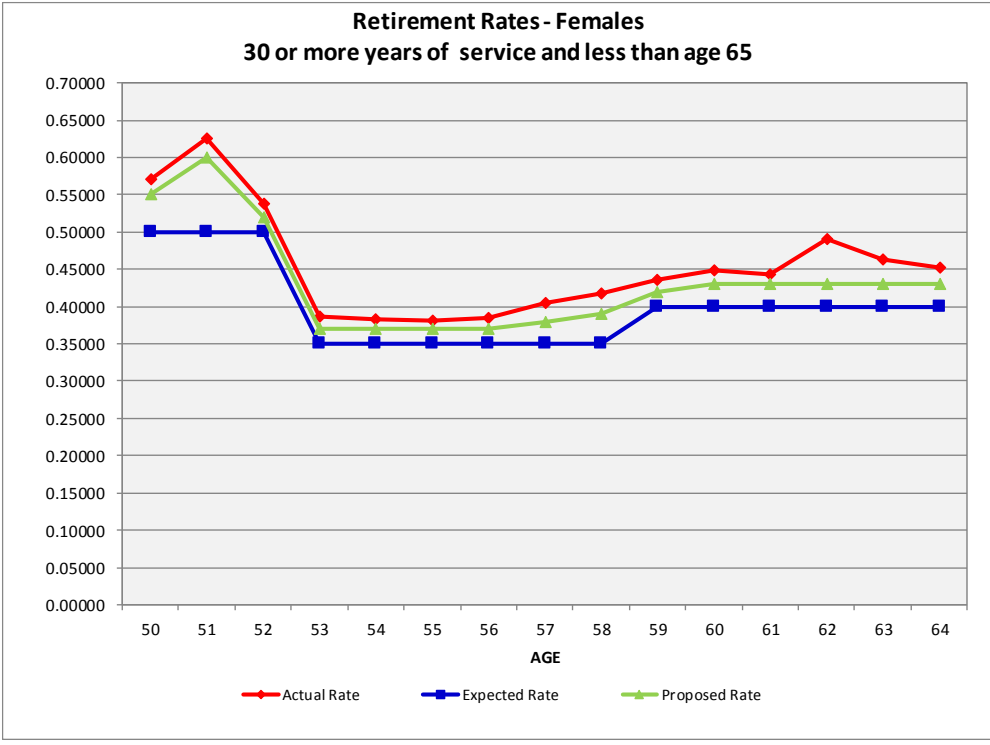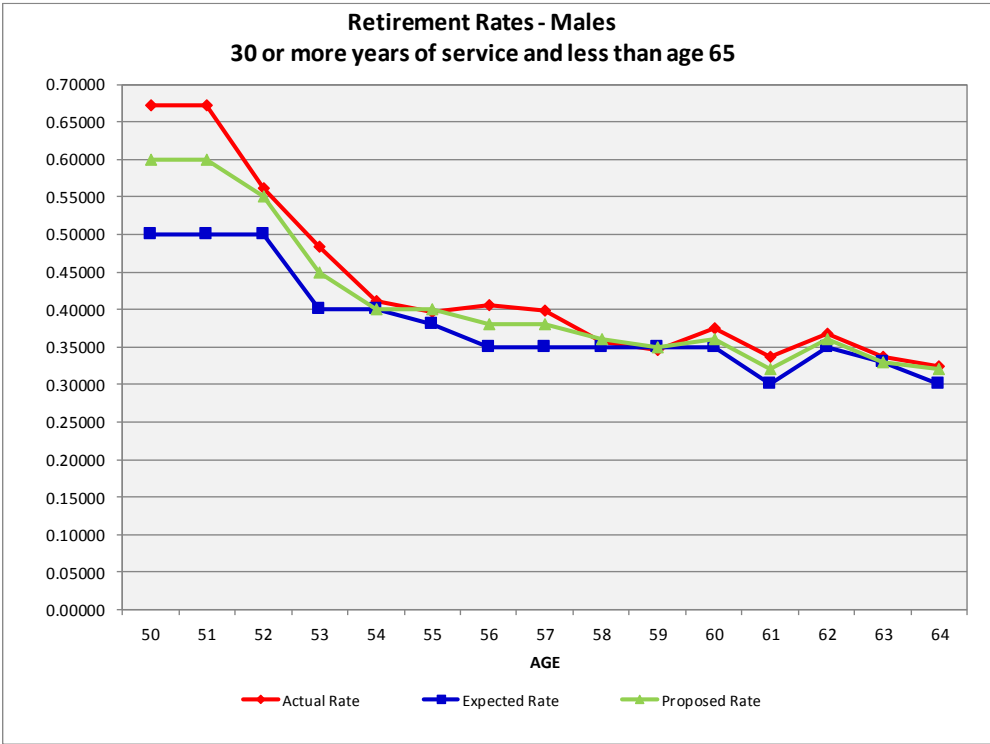
The following table shows a comparison of the present and proposed rates of service retirement.

COMPARATIVE RATES OF RETIREMENT

	RATES OF SERVICE RETIREMENT							
	MALE				FEMALE			
	Present		Proposed		Present		Proposed	
AGE	< 30 years of service	>= 30 years of service	< 30 years of service	>= 30 years of service	< 30 years of service	>= 30 years of service	< 30 years of service	>= 30 years of service
50	5.0%	50.0%	3.5%	60.0%	5.0%	50.0%	3.0%	55.0%
51	5.0%	50.0%	3.5%	60.0%	5.0%	50.0%	3.0%	60.0%
52	5.0%	50.0%	3.5%	55.0%	5.0%	50.0%	3.0%	52.0%
53	5.0%	40.0%	3.5%	45.0%	5.0%	35.0%	3.0%	37.0%
54	5.0%	40.0%	3.5%	40.0%	5.0%	35.0%	3.0%	37.0%
55	5.0%	38.0%	5.0%	40.0%	5.0%	35.0%	5.5%	37.0%
56	5.0%	35.0%	5.0%	38.0%	5.0%	35.0%	5.5%	37.0%
57	5.0%	35.0%	5.0%	38.0%	5.0%	35.0%	5.5%	38.0%
58	5.0%	35.0%	5.0%	36.0%	5.0%	35.0%	5.5%	39.0%
59	5.0%	35.0%	5.0%	35.0%	5.0%	40.0%	5.5%	42.0%
60	20.0%	35.0%	20.0%	36.0%	25.0%	40.0%	25.0%	43.0%
61	18.0%	30.0%	18.0%	32.0%	25.0%	40.0%	25.0%	43.0%
62	25.0%	35.0%	26.0%	36.0%	25.0%	40.0%	25.0%	43.0%
63	20.0%	33.0%	22.0%	33.0%	25.0%	40.0%	25.0%	43.0%
64	18.0%	30.0%	22.0%	32.0%	25.0%	40.0%	25.0%	43.0%
65	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	31.0%	31.0%
66	30.0%	30.0%	32.0%	32.0%	30.0%	30.0%	33.0%	33.0%
67	30.0%	30.0%	30.0%	30.0%	28.0%	28.0%	30.0%	30.0%
68	28.0%	28.0%	30.0%	30.0%	28.0%	28.0%	30.0%	30.0%
69	26.0%	26.0%	28.0%	28.0%	28.0%	28.0%	30.0%	30.0%
70	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%
71	30.0%	30.0%	25.0%	25.0%	30.0%	30.0%	30.0%	30.0%
72	30.0%	30.0%	25.0%	25.0%	30.0%	30.0%	30.0%	30.0%
73	30.0%	30.0%	25.0%	25.0%	30.0%	30.0%	30.0%	30.0%
74	30.0%	30.0%	25.0%	25.0%	30.0%	30.0%	30.0%	30.0%
75	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

COMPARISON OF ACTUAL AND EXPECTED RETIREMENTS
BASED ON PROPOSED RATES OF RETIREMENT

CENTRAL AGE OF GROUP	NUMBER OF SERVICE RETIREMENTS					
	MALE			FEMALE		
	Actual	Expected	Ratio of Actual to Expected	Actual	Expected	Ratio of Actual to Expected
Less than 30 years of service or all ages 65 and over						
49 & Under	36	44.1	0.816	87	151.3	0.575
52	113	151.2	0.747	380	466.4	0.815
57	127	137.6	0.923	687	633.5	1.084
60	513	527.0	0.973	3,079	3,106.8	0.991
61	375	393.5	0.953	2,062	2,372.5	0.869
62	495	484.6	1.021	2,073	1,874.0	1.106
63	355	324.3	1.095	1,331	1,414.0	0.941
64	288	258.7	1.113	1,042	1,064.0	0.979
65	319	355.2	0.898	1,204	1,176.8	1.023
66	316	305.6	1.034	977	902.9	1.082
67	219	215.1	1.018	609	560.4	1.087
68	154	150.9	1.021	396	387.0	1.023
69	119	112.6	1.057	289	277.2	1.043
70 & Over	300	502.2	0.597	732	1,020.2	0.718
TOTAL	**3,729**	**3,962.6**	**0.941**	**14,948**	**15,407.0**	**0.970**
30 or more years of servicce and less than age 65						
50 & Under	73	63.0	1.159	168	173.8	0.967
51	78	69.6	1.121	299	286.8	1.043
52	114	111.7	1.021	578	558.5	1.035
53	172	159.8	1.076	649	622.3	1.043
54	182	177.2	1.027	770	745.2	1.033
55	194	195.2	0.994	781	757.8	1.031
56	213	199.5	1.068	780	748.9	1.042
57	212	201.8	1.051	795	746.3	1.065
58	186	187.2	0.994	768	717.6	1.070
59	181	183.1	0.989	773	744.7	1.038
60	199	190.8	1.043	775	743.9	1.042
61	155	147.5	1.051	653	633.0	1.032
62	151	147.6	1.023	615	538.8	1.141
63	114	111.9	1.019	448	416.7	1.075
64	89	88.0	1.011	328	312.2	1.051
TOTAL	**2,313**	**2,233.9**	**1.035**	**9,180**	**8,746.5**	**1.050**

RATES OF PRE-RETIREMENT MORTALITY

COMPARISON OF ACTUAL AND EXPECTED PRE-RETIREMENT MORTALITY

CENTRAL AGE OF GROUP	NUMBER OF DEATHS					
	MALE			FEMALE		
	Actual	Expected	Ratio of Actual to Expected	Actual	Expected	Ratio of Actual to Expected
27 & Under	7	4.5	1.556	0	8.5	0.000
30	10	10.7	0.935	14	20.4	0.686
35	14	20.2	0.693	26	36.8	0.707
40	15	34.4	0.436	40	70.7	0.566
45	19	43.2	0.440	65	108.3	0.600
50	40	59.1	0.677	73	170.0	0.429
53 & Over	112	352.0	0.318	212	767.2	0.276
TOTAL	**217**	**524.1**	**0.414**	**430**	**1,181.9**	**0.364**

The experience indicates that the pre-retirement mortality rates were significantly lower than anticipated. We recommend that the rates of mortality in active service for both males and females be changed to the RP-2000 Employee Mortality Table with future mortality improvement projected to 2025 based on the Society of Actuaries' projection scale BB. The following table shows a comparison between the present death rates and the proposed rates.

COMPARATIVE RATES OF PRE-RETIREMENT MORTALITY

AGE	RATES OF MORTALITY			
	MALE		FEMALE	
	Present	Proposed	Present	Proposed
20	0.0316%	0.0320%	0.0184%	0.0177%
25	0.0373%	0.0349%	0.0194%	0.0192%
30	0.0393%	0.0412%	0.0223%	0.0245%
35	0.0631%	0.0717%	0.0350%	0.0441%
40	0.0964%	0.1001%	0.0554%	0.0655%
45	0.1299%	0.1399%	0.0852%	0.1043%
50	0.1860%	0.1983%	0.1326%	0.1555%
55	0.2916%	0.2810%	0.2018%	0.2228%
60	0.5273%	0.4092%	0.3478%	0.3058%
64	0.8757%	0.5330%	0.5814%	0.4015%

RATES OF POST-RETIREMENT MORTALITY

The current basis for rate of post-retirement mortality for service retirees and beneficiaries is the RP-2000 Combined Mortality Table set back two years for males and three years for females. The current basis for rate of post-retirement mortality for disability retirees is the RP-2000 Disabled Mortality Table set back two years for males.

COMPARISON OF ACTUAL AND EXPECTED CASES
OF POST-RETIREMENT DEATHS

CENTRAL AGE OF GROUP	NUMBER OF DEATHS AMONG SERVICE RETIREMENTS AND BENEFICIARIES					
	MALE			FEMALE		
	Actual	Expected	Ratio of Actual to Expected	Actual	Expected	Ratio of Actual to Expected
47 & Under	7	2.3	3.043	4	1.3	3.077
50	10	2.5	4.000	6	3.7	1.622
55	28	17.3	1.618	41	42.4	0.967
60	97	91.9	1.055	236	224.6	1.051
65	232	266.6	0.870	488	588.1	0.830
70	327	391.4	0.835	590	738.4	0.799
75	435	478.4	0.909	755	821.2	0.919
80	575	582.6	0.987	912	952.2	0.958
85	514	506.2	1.015	1,139	949.1	1.200
90	364	350.5	1.039	1,111	818.0	1.358
93 & Over	172	148.6	1.157	993	729.3	1.362
TOTAL	**2,761**	**2,838.3**	**0.973**	**6,275**	**5,868.3**	**1.069**

CENTRAL AGE OF GROUP	NUMBER OF DEATHS AMONG DISABILITY RETIREMENTS					
	MALE			FEMALE		
	Actual	Expected	Ratio of Actual to Expected	Actual	Expected	Ratio of Actual to Expected
47 & Under	6	3.9	1.538	26	5.2	5.000
50	10	7.4	1.351	25	12.8	1.953
55	24	19.8	1.212	66	43.6	1.514
60	38	32.9	1.155	82	86.5	0.948
65	33	34.2	0.965	77	85.7	0.898
70	18	24.8	0.726	51	60.9	0.837
75	11	17.5	0.629	28	40.3	0.695
80	8	10.7	0.748	36	36.2	0.994
85	7	7.1	0.986	31	33.8	0.917
90	5	3.9	1.282	31	21.4	1.449
93 & Over	5	2.3	2.174	8	9.6	0.833
TOTAL	**165**	**164.5**	**1.003**	**461**	**436.0**	**1.057**

For service retirements and beneficiaries we recommend use of the RP-2000 White Collar Mortality Table with future mortality improvement projected to 2025 with the Society of Actuaries' projection scale BB set forward one year for males. For disability retirements, we recommend the use of the RP-2000 Disabled Mortality Table with future mortality improvement projected to 2025 with Society of Actuaries' projection scale BB set forward two years for males and four years for females. The following graphs show a comparison of the present, actual and proposed rates of post-retirement mortality.

Healthy Mortality Rates - Males

Healthy Mortality Rates - Females
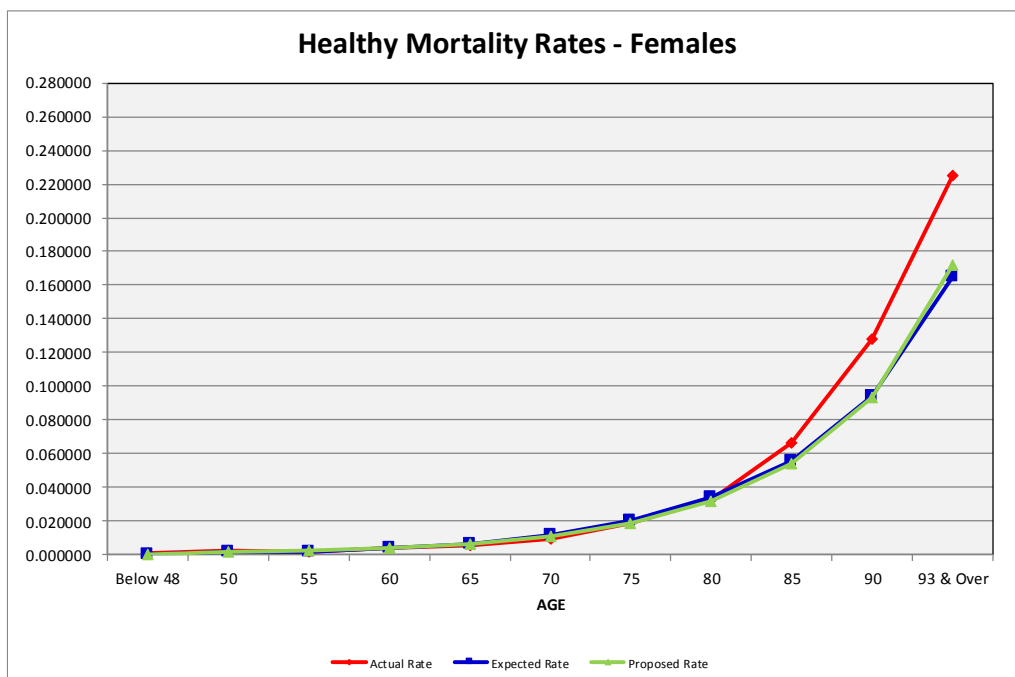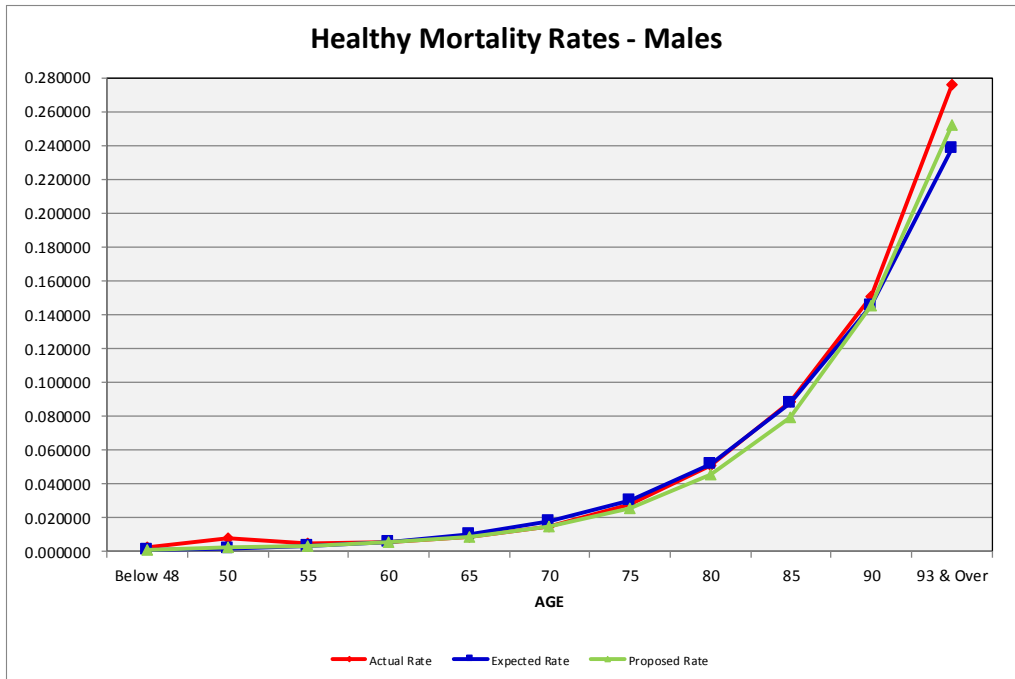
Disabled Mortality Rates - Males
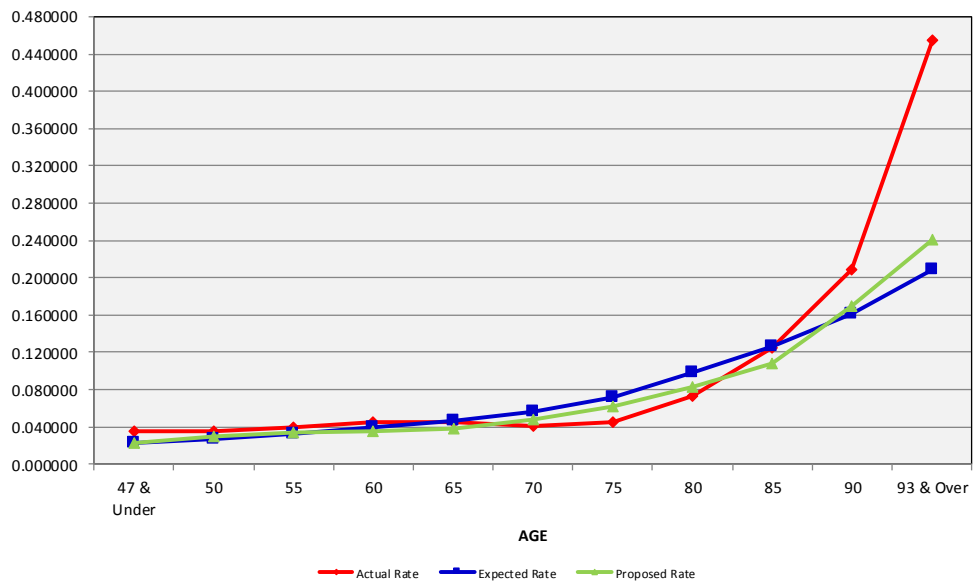
Disabled Mortality Rates - Females
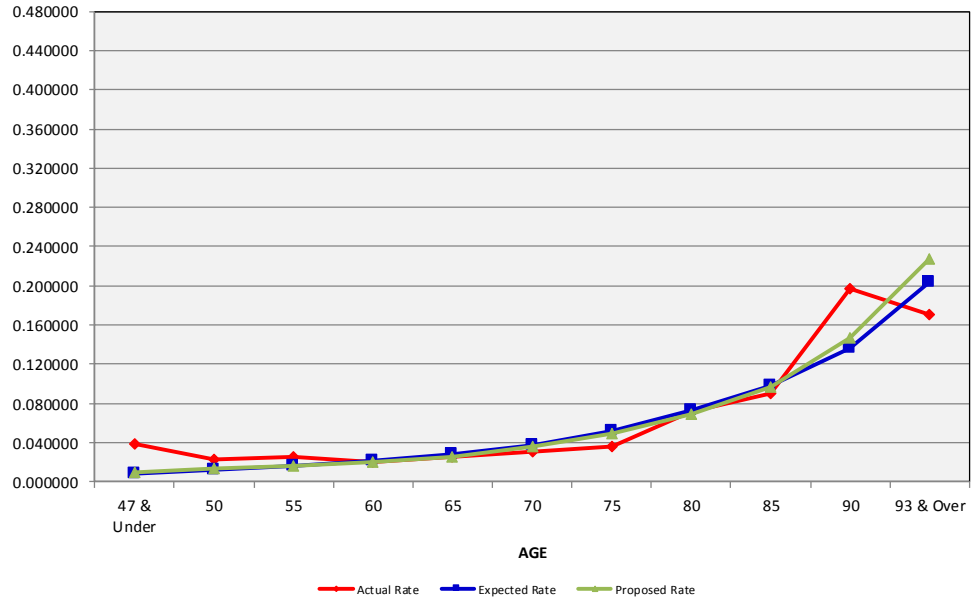
The following table shows a comparison of the present and proposed rates of post-retirement mortality.

COMPARATIVE RATES OF POST-RETIREMENT MORTALITY

| AGE | SERVICE RETIREMENTS AND BENEFICIARIES | | | |
| | MALE | | FEMALE | |
	Present	Proposed	Present	Proposed
35	0.0631%	0.0602%	0.0350%	0.0432%
40	0.0964%	0.0889%	0.0554%	0.0598%
45	0.1299%	0.1352%	0.0852%	0.0942%
50	0.1860%	0.2136%	0.1326%	0.1474%
55	0.2916%	0.3478%	0.2018%	0.2281%
60	0.5273%	0.5197%	0.3478%	0.3638%
65	1.0012%	0.9071%	0.6657%	0.6397%
70	1.7871%	1.4666%	1.2163%	1.1229%
75	3.0387%	2.5894%	2.0665%	1.9017%
80	5.2123%	4.5768%	3.4105%	3.1857%
85	8.9718%	8.0034%	5.6294%	5.4864%
90	15.0590%	15.1656%	9.6337%	9.5675%

| AGE | DISABILITY RETIREMENTS | | | |
| | MALE | | FEMALE | |
	Present	Proposed	Present	Proposed
35	2.2571%	2.0938%	0.7450%	0.6911%
40	2.2571%	2.0938%	0.7450%	0.6911%
45	2.2571%	2.3306%	0.7450%	0.9865%
50	2.6404%	2.9279%	1.1535%	1.4019%
55	3.2859%	3.4400%	1.6544%	1.6567%
60	3.9334%	3.5881%	2.1839%	1.9670%
65	4.6584%	3.8275%	2.8026%	2.6129%
70	5.6909%	4.7566%	3.7635%	3.6157%
75	7.3292%	6.3153%	5.2230%	5.0131%
80	9.7640%	8.3527%	7.2312%	6.9358%
85	12.8343%	10.9122%	10.0203%	9.6851%
90	16.2186%	17.2787%	14.0049%	15.3358%

COMPARISON OF ACTUAL AND EXPECTED CASES
OF POST-RETIREMENT DEATHS
BASED ON PROPOSED RATES OF MORTALITY

| CENTRAL AGE OF GROUP | NUMBER OF DEATHS AMONG SERVICE RETIREMENTS AND BENEFICIARIES | | | | | |
| | MALE | | | FEMALE | | |
	Actual	Expected	Ratio of Actual to Expected	Actual	Expected	Ratio of Actual to Expected
47 & Under	7	2.3	3.043	4	1.5	2.667
50	10	2.9	3.448	6	4.2	1.429
55	28	19.7	1.421	41	48.5	0.845
60	97	90.6	1.071	236	232.0	1.017
65	232	238.6	0.972	488	565.3	0.863
70	327	321.9	1.016	590	682.9	0.864
75	435	406.8	1.069	755	755.5	0.999
80	575	511.6	1.124	912	890.4	1.024
85	514	458.5	1.121	1,139	923.1	1.234
90	364	350.1	1.040	1,111	812.5	1.367
93 & Over	172	157.2	1.094	993	756.5	1.313
TOTAL	**2,761**	**2,560.2**	**1.078**	**6,275**	**5,672.4**	**1.106**

The use of the recommended post-retirement mortality assumption would result in an overall 9.75% margin in the current experience to recognize future mortality improvement.

| CENTRAL AGE OF GROUP | NUMBER OF DEATHS AMONG DISABILITY RETIREMENTS | | | | | |
| | MALE | | | FEMALE | | |
	Actual	Expected	Ratio of Actual to Expected	Actual	Expected	Ratio of Actual to Expected
47 & Under	6	4.0	1.500	26	6.1	4.262
50	10	8.2	1.220	25	15.2	1.645
55	24	20.5	1.171	66	43.2	1.528
60	38	30.0	1.267	82	78.2	1.049
65	33	28.3	1.166	77	79.8	0.965
70	18	20.7	0.870	51	58.4	0.873
75	11	15.0	0.733	28	38.7	0.724
80	8	9.1	0.879	36	34.7	1.037
85	7	6.0	1.167	31	33.1	0.937
90	5	4.1	1.220	31	23.1	1.342
93 & Over	5	2.7	1.852	8	10.7	0.748
TOTAL	**165**	**148.6**	**1.110**	**461**	**421.2**	**1.094**

RATES OF SALARY INCREASE

COMPARISON OF ACTUAL AND EXPECTED RATES OF SALARY INCREASE OF ACTIVE MEMBERS

| SERVICE | SALARIES AT END OF YEAR ($1,000's) | | | | | |
| | MALE | | | FEMALE | | |
	Actual	Expected	Ratio of Actual to Expected	Actual	Expected	Ratio of Actual to Expected
0	76,379	67,760	1.127	138,608	113,185	1.225
1	633,186	622,586	1.017	1,489,914	1,426,606	1.044
2	627,185	645,226	0.972	1,556,651	1,596,493	0.975
3	636,015	656,164	0.969	1,711,826	1,763,794	0.971
4	659,443	680,165	0.970	1,846,043	1,899,639	0.972
5	657,955	677,293	0.971	1,935,510	1,992,460	0.971
6	629,823	644,573	0.977	1,894,495	1,939,385	0.977
7	606,223	621,755	0.975	1,819,682	1,866,262	0.975
8	570,186	589,716	0.967	1,745,218	1,805,425	0.967
9	536,543	553,646	0.969	1,686,485	1,736,004	0.971
10	507,883	525,282	0.967	1,619,318	1,675,933	0.966
11	499,504	515,057	0.970	1,596,195	1,643,567	0.971
12	473,797	489,420	0.968	1,511,073	1,563,505	0.966
13	445,917	459,551	0.970	1,391,742	1,432,986	0.971
14	418,755	433,211	0.967	1,301,444	1,347,537	0.966
15	402,464	414,289	0.971	1,236,776	1,271,771	0.972
16	373,122	385,661	0.967	1,152,325	1,191,898	0.967
17	337,436	346,721	0.973	1,100,300	1,130,633	0.973
18	299,492	308,922	0.969	1,020,479	1,054,994	0.967
19	274,717	282,602	0.972	967,572	994,615	0.973
20 & Over	2,240,570	2,310,785	0.970	7,333,145	7,582,817	0.967
Total	**11,906,595**	**12,230,385**	**0.974**	**36,054,801**	**37,029,509**	**0.974**

The current assumed rates of salary increase were significantly greater than the actual rates of increase averaged over the study period in most service categories. We recommend a change to the current salary increase rates to partially reflect the experience.

Over the past five years, actual rates of salary increase have been less than expected at most service breakdowns. In the economic section of this experience study report, we are recommending the price inflation assumption be reduced from 3.00% to 2.75% (see page 5). The price inflation assumption is part of our building block approach to determining the salary scale. In addition to the price inflation component, there are components to the assumed rates of salary increase for real wage growth and merit/promotion increases.

The average annual actual rate of inflation over the period was 2.02% and the apparent real rate of wage growth for TRS members was determined to be 0.00%. These combined equal an apparent rate of wage inflation of 2.02%. The rates of salary increase assumption will use the proposed 3.25% rate of wage inflation (2.75% price inflation plus the 0.50% real rate of wage growth assumption) as the base rate of increase at all years of service and add the merit/promotion component which varies by years of service. The table below provides the analysis concerning the development of the merit component of this assumption.

Service	Actual Rate of Increase	Apparent Merit Increase (Actual Less Wage Inflation)	Proposed Assumed Merit Increase
1	8.57%	6.55%	5.75%
2	3.64%	1.62%	4.25%
3	3.23%	1.21%	2.75%
4	3.01%	0.99%	2.25%
5	2.97%	0.95%	2.00%
6	3.09%	1.07%	2.00%
7	2.62%	0.60%	2.00%
8	1.76%	-0.26%	1.25%
9	1.76%	-0.26%	0.75%
10	1.52%	-0.50%	0.75%
11	1.68%	-0.34%	0.50%
12	1.45%	-0.57%	0.50%
13	1.64%	-0.38%	0.50%
14	1.25%	-0.77%	0.25%
15	1.52%	-0.50%	0.25%
16	1.10%	-0.92%	0.00%
17	1.46%	-0.56%	0.00%
18	1.07%	-0.95%	0.00%
19	1.34%	-0.68%	0.00%
20 & Over	0.59%	-1.43%	0.00%

The proposed assumed rates of merit increases are added to the assumed rate of wage inflation (3.25%) for each year of service. The following graph shows the actual, expected proposal rate for salary increase.

Salary Increases

Legend: Actual Rate, Expected Rate, Proposed Rate

X-axis: SERVICE (1 to 20 & Over)

The following table shows a comparison between the current and proposed rates of salary increase.

COMPARATIVE ASSUMED RATES OF SALARY INCREASE

RATES OF SALARY INCREASE		
SERVICE	CURRENT	PROPOSED
0	7.00%	9.00%
1	6.75%	7.50%
2	6.63%	6.00%
3	6.50%	5.50%
4	6.25%	5.25%
5	6.00%	5.25%
6	5.50%	5.25%
7	5.25%	4.50%
8	5.25%	4.00%
9	5.00%	4.00%
10	5.00%	3.75%
11	4.85%	3.75%
12	4.80%	3.75%
13	4.75%	3.75%
14	4.75%	3.50%
15	4.50%	3.50%
16	4.50%	3.25%
17	4.25%	3.25%
18	4.25%	3.25%
19	4.25%	3.25%
20 & Over	3.75%	3.25%

ADMINISTRATIVE EXPENSES: This assumption is currently 0.25% of payroll (included in normal contribution). We recommend no change to this assumption.

ASSETS: Currently, the actuarial value of assets recognizes a portion of the difference between the market value of assets and the expected actuarial value of assets, based on the assumed valuation rate of return. The amount recognized each year is 20% of the difference between market value and expected actuarial value. We recommend maintaining the current smoothing method.

COST OF LIVING: Currently, we assume cost of living increases of 1.5% semi-annually. We recommend maintaining this assumption.

OPTION FACTORS: The option factors currently used by the Retirement System are based on the mortality tables and investment rate of return (discount rate) used in the valuation. We recommend that the factors be revised to be based on the mortality table recommended for the valuation.

PERCENT MARRIED: Currently, 85% of male active members and 60% of female active members are assumed to be married with the male four years older than his spouse. This assumption is used to determine who will receive death in active service benefits. The beneficiaries of unmarried members are assumed to receive a refund of member contributions. We recommend changing this assumption for death in service benefits to 100% for both males and females.

UNUSED SICK LEAVE: Currently, we assume a 1.75% load on liabilities for members who retire on early retirement, a 2.0% load for members who retire with unreduced retirement before 30 years of service and a 2.5% load for members who retire with 30 or more years of service. Based on data we received from the Retirement System on members who converted unused leave at retirement over the past five years, we recommend changing the loads on liabilities to 1.25% for members who retire on early retirement and for members who retire with unreduced retirement before 30 years of service and a 1.75% load for members who retire with 30 or more years of service.

VALUATION COST METHOD: Currently, the valuation uses the entry age actuarial cost method. This is the most widely used cost method of large public sector plans and has demonstrated the highest degree of stability as compared to alternative methods. We recommend no change to this assumption.

VALUATION INTEREST RATE SMOOTHING: Currently, the valuation liabilities are calculated using a smoothed interest rate method. The interest rate assumed during the look forward period (currently 23 years from the valuation date) is the investment rate of return expected to be earned during the look forward period based on the actual rate of return earned during the look back period (currently 7 years) such that the average assumed rate of return over

the combined 30-year period is equivalent to the assumed ultimate investment rate of return (currently 7.50%). The interest rate after the 23-year look forward period is the ultimate investment rate of return of 7.50%.

CORRIDOR LIMIT ON INTEREST RATE SMOOTHING: Currently, the smoothed interest rate used during the 23-year look forward period is subject to a corridor which is determined such that the long-term investment rate of return is between the 40th and 50th percentile of expected returns based on TRS capital market assumptions as of June 30, 2009.

VESTED TERMINATION BENEFIT: Currently, we assume that 50% of vested members under age 50 and 75% of members age 50 and over who terminate with 10 or more years of service before retirement eligibility will choose to receive a benefit payable at age 60. Other members are assumed to receive a refund of contribution. We recommend changing the percentage who will elect to receive a benefit to 60% for those who terminate before age 50 and 80% for members who terminate at age 50 and over.

APPENDIX A

Historical June CPI (U) Index

Fiscal Year Ending 6/30	CPI (U)	Fiscal Year Ending 6/30	CPI (U)
1964	31.0	1990	129.9
1965	31.6	1991	136.0
1966	32.4	1992	140.2
1967	33.3	1993	144.4
1968	34.7	1994	148.0
1969	36.6	1995	152.5
1970	38.8	1996	156.7
1971	40.6	1997	160.3
1972	41.7	1998	163.0
1973	44.2	1999	166.2
1974	49.0	2000	172.4
1975	53.6	2001	178.0
1976	56.8	2002	179.9
1977	60.7	2003	183.7
1978	65.2	2004	189.7
1979	72.3	2005	194.5
1980	82.7	2006	202.9
1981	90.6	2007	208.352
1982	97.0	2008	218.815
1983	99.5	2009	215.693
1984	103.7	2010	217.965
1985	107.6	2011	225.722
1986	109.5	2012	229.478
1987	113.5	2013	233.504
1988	118.0	2014	238.343
1989	124.1		

APPENDIX B

Capital Market Assumptions and Asset Allocation

Real Rates of Return and Standard Deviations by Asset Class

Asset Class	Expected Real Rate of Return*	Standard Deviation
Fixed Income	-0.5%	9.0%
US Large Stocks	9.0%	21.5%
US Mid Stocks	12.0%	24.5%
US Small Stocks	13.5%	34.0%
Int'l Developed Mkt Stocks	8.0%	19.0%
Int'l Emerging Mkt Stocks	12.0%	27.0%

Net of inflation

Asset Class Correlation Coefficients

Asset Class	Fixed Income	US Large Stocks	US Mid Stocks	US Small Stocks	Int'l Dev Mkt Stocks	Int'l EM Mkt Stocks
Fixed Income	1.00					
US Large Stocks	0.18	1.00				
US Mid Stocks	0.18	0.94	1.00			
US Small Stocks	0.14	0.83	0.90	1.00		
Int'l Developed Mkt Stocks	0.15	0.63	0.65	0.51	1.00	
Int'l Emerging Mkt Stocks	0.08	0.67	0.70	0.65	0.69	1.00

Asset Allocation Targets

Asset Class	Asset Allocation
Fixed Income	30.0%
US Large Stocks	39.8%
US Mid Stocks	3.7%
US Small Stocks	1.5%
Int'l Developed Mkt Stocks	19.4%
Int'l Emerging Mkt Stocks	5.6%

APPENDIX C

Social Security Administration Calendar Year Wage Index

Calendar Year	Wage Index	Annual Increase	Calendar Year	Wage Index	Annual Increase
1963	$4,396.64		1989	$20,099.55	3.96%
1964	4,576.32	4.09%	1990	21,027.98	4.62
1965	4,658.72	1.80	1991	21,811.60	3.73
1966	4,938.36	6.00	1992	22,935.42	5.15
1967	5,213.44	5.57	1993	23,132.67	0.86
1968	5,571.76	6.87	1994	23,753.53	2.68
1969	5,893.76	5.78	1995	24,705.66	4.01
1970	6,186.24	4.96	1996	25,913.90	4.89
1971	6,497.08	5.02	1997	27,426.00	5.84
1972	7,133.80	9.80	1998	28,861.44	5.23
1973	7,580.16	6.26	1999	30,469.84	5.57
1974	8,030.76	5.94	2000	32,154.82	5.53
1975	8,630.92	7.47	2001	32,921.92	2.39
1976	9,226.48	6.90	2002	33,252.09	1.00
1977	9,779.44	5.99	2003	34,064.95	2.44
1978	10,556.03	7.94	2004	35,648.55	4.65
1979	11,479.46	8.75	2005	36,952.94	3.66
1980	12,513.46	9.01	2006	38,651.41	4.60
1981	13,773.10	10.07	2007	40,405.48	4.54
1982	14,531.34	5.51	2008	41,334.97	2.30
1983	15,239.24	4.87	2009	40,711.61	(1.51)
1984	16,135.07	5.88	2010	41,673.83	2.36
1985	16,822.51	4.26	2011	42,979.61	3.13
1986	17,321.82	2.97	2012	44,321.67	3.12
1987	18,426.51	6.38	2013	44,888.16	1.28
1988	19,334.04	4.93			

APPENDIX D

TABLE 1
RATES OF SEPARATION FROM ACTIVE SERVICE - MALES

AGE	Rates of Withdrawal Service 0 - 4	Rates of Withdrawal Service 5 - 9	Rates of Withdrawal Service 10+	Death	Disability	Rates of Retirement < 30 years of service	Rates of Retirement >= 30 years of service
19	0.25000	0.00000	0.00000	0.000307	0.000135		
20	0.25000	0.00000	0.00000	0.000320	0.000135		
21	0.25000	0.00000	0.00000	0.000331	0.000135		
22	0.25000	0.00000	0.00000	0.000340	0.000135		
23	0.21000	0.12000	0.00000	0.000346	0.000135		
24	0.19000	0.12000	0.00000	0.000349	0.000135		
25	0.17000	0.12000	0.00000	0.000349	0.000135		
26	0.15000	0.12000	0.00000	0.000351	0.000135		
27	0.14000	0.12000	0.00000	0.000354	0.000135		
28	0.13500	0.10000	0.09000	0.000365	0.000210		
29	0.13500	0.08000	0.08000	0.000382	0.000210		
30	0.13500	0.07000	0.08000	0.000412	0.000210		
31	0.13500	0.07000	0.07000	0.000463	0.000210		
32	0.13500	0.06000	0.07000	0.000521	0.000210		
33	0.13500	0.06000	0.04000	0.000585	0.000250		
34	0.13500	0.06000	0.03000	0.000651	0.000290		
35	0.13500	0.06000	0.03000	0.000717	0.000330		
36	0.13500	0.06000	0.03000	0.000780	0.000370		
37	0.13500	0.06000	0.03000	0.000839	0.000410		
38	0.13000	0.06000	0.03000	0.000894	0.000450		
39	0.13000	0.06000	0.03000	0.000947	0.000500		
40	0.13000	0.06000	0.02500	0.001001	0.000550	0.03500	
41	0.13000	0.06000	0.02500	0.001059	0.000600	0.03500	
42	0.13000	0.06000	0.02500	0.001127	0.000650	0.03500	
43	0.13000	0.06000	0.02300	0.001205	0.000700	0.03500	
44	0.13000	0.06000	0.02300	0.001296	0.000800	0.03500	
45	0.12000	0.06000	0.02300	0.001399	0.000900	0.03500	
46	0.12000	0.06000	0.02300	0.001499	0.001000	0.03500	0.60000
47	0.12000	0.06000	0.02300	0.001609	0.001100	0.03500	0.60000
48	0.11000	0.05500	0.02500	0.001725	0.001200	0.03500	0.60000
49	0.11000	0.05500	0.02500	0.001851	0.001300	0.03500	0.60000
50	0.11000	0.05500	0.02500	0.001983	0.001700	0.03500	0.60000
51	0.11000	0.05500	0.02500	0.002122	0.002200	0.03500	0.60000
52	0.11000	0.05500	0.02500	0.002271	0.002700	0.03500	0.55000
53	0.11000	0.05500	0.03000	0.002431	0.002800	0.03500	0.45000
54	0.11000	0.05500	0.03000	0.002609	0.002900	0.03500	0.40000
55	0.11000	0.05500	0.03000	0.002810	0.003000	0.05000	0.40000
56	0.11000	0.05500	0.03000	0.003067	0.003200	0.05000	0.38000
57	0.11000	0.05500	0.03000	0.003282	0.003500	0.05000	0.38000
58	0.11000	0.05500	0.03000	0.003526	0.004500	0.05000	0.36000
59	0.12000	0.05500	0.03000	0.003797	0.005500	0.05000	0.35000
60	0.12000	0.05500		0.004092		0.20000	0.36000
61	0.12000	0.05500		0.004403		0.18000	0.32000
62	0.12000	0.05500		0.004721		0.26000	0.36000
63	0.12000	0.06500		0.005034		0.22000	0.33000
64	0.13000	0.06500		0.005330		0.22000	0.32000
65	0.13000	0.06500		0.005600		0.30000	0.30000
66	0.13000	0.06500		0.005839		0.32000	0.32000
67	0.13000	0.06500		0.006044		0.30000	0.30000
68	0.13000	0.06500		0.006215		0.30000	0.30000
69	0.13000	0.06500		0.006518		0.28000	0.28000
70	0.13000	0.06500		0.006800		0.30000	0.30000
71	0.13000	0.06500		0.016839		0.25000	0.25000
72	0.13000	0.06500		0.018697		0.25000	0.25000
73	0.13000	0.06500		0.020825		0.25000	0.25000
74	0.13000	0.06500		0.023233		0.25000	0.25000
75	0.00000	0.00000		0.025929		1.00000	1.00000

TABLE 2
RATES OF SEPARATION FROM ACTIVE SERVICE – FEMALES

| AGE | Rates of Withdrawal Service | | | Death | Disability | Rates of Retirement | |
	0 - 4	5 - 9	10+			< 30 years of service	>= 30 years of service
19	0.28000	0.00000	0.00000	0.000176	0.000100		
20	0.28000	0.00000	0.00000	0.000177	0.000100		
21	0.28000	0.00000	0.00000	0.000178	0.000100		
22	0.28000	0.00000	0.00000	0.000180	0.000100		
23	0.13500	0.16000	0.00000	0.000183	0.000130		
24	0.13500	0.16000	0.00000	0.000186	0.000130		
25	0.13500	0.16000	0.00000	0.000192	0.000130		
26	0.13500	0.16000	0.00000	0.000199	0.000130		
27	0.13500	0.16000	0.00000	0.000207	0.000130		
28	0.13500	0.11000	0.06000	0.000218	0.000130		
29	0.13500	0.09000	0.06000	0.000230	0.000140		
30	0.13500	0.08000	0.06000	0.000245	0.000140		
31	0.13500	0.07000	0.06000	0.000285	0.000150		
32	0.13500	0.07000	0.06000	0.000325	0.000160		
33	0.13000	0.07000	0.05000	0.000365	0.000170		
34	0.13000	0.07000	0.04000	0.000404	0.000180		
35	0.13000	0.07000	0.03500	0.000441	0.000190		
36	0.13000	0.06500	0.03000	0.000477	0.000200		
37	0.13000	0.06500	0.03000	0.000514	0.000210		
38	0.12000	0.06500	0.03000	0.000555	0.000270		
39	0.12000	0.06500	0.03000	0.000601	0.000330		
40	0.11000	0.06500	0.03000	0.000655	0.000390	0.02500	
41	0.11000	0.06500	0.02000	0.000718	0.000420	0.02500	
42	0.11000	0.06000	0.02000	0.000790	0.000450	0.02500	
43	0.10500	0.06000	0.02100	0.000869	0.000470	0.02500	
44	0.10500	0.06000	0.02200	0.000955	0.000560	0.02500	
45	0.10500	0.06000	0.02300	0.001043	0.000650	0.02500	
46	0.10500	0.05500	0.02300	0.001135	0.000750	0.02500	0.55000
47	0.10500	0.05500	0.02300	0.001230	0.000900	0.02500	0.55000
48	0.10000	0.05500	0.02300	0.001330	0.001000	0.02500	0.55000
49	0.10000	0.05500	0.02400	0.001438	0.001200	0.02500	0.55000
50	0.10000	0.05000	0.02400	0.001555	0.001400	0.03000	0.55000
51	0.10000	0.05000	0.02400	0.001683	0.001800	0.03000	0.60000
52	0.10000	0.05000	0.02500	0.001825	0.002500	0.03000	0.52000
53	0.10000	0.05000	0.02750	0.001981	0.002900	0.03000	0.37000
54	0.10000	0.05000	0.02750	0.002100	0.003000	0.03000	0.37000
55	0.10000	0.05000	0.02750	0.002228	0.003400	0.05500	0.37000
56	0.10000	0.05000	0.02750	0.002371	0.003900	0.05500	0.37000
57	0.10000	0.05000	0.02750	0.002525	0.004500	0.05500	0.38000
58	0.10500	0.05500	0.02750	0.002692	0.005200	0.05500	0.39000
59	0.10500	0.05500	0.02750	0.002871	0.006000	0.05500	0.42000
60	0.10500	0.05500		0.003058		0.25000	0.43000
61	0.10500	0.05500		0.003250		0.25000	0.43000
62	0.10500	0.05500		0.003443		0.25000	0.43000
63	0.13000	0.06500		0.003726		0.25000	0.43000
64	0.13000	0.06500		0.004015		0.25000	0.43000
65	0.13000	0.06500		0.004304		0.31000	0.31000
66	0.13000	0.06500		0.004590		0.33000	0.33000
67	0.13000	0.06500		0.004868		0.30000	0.30000
68	0.13000	0.06500		0.005136		0.30000	0.30000
69	0.13000	0.06500		0.005390		0.30000	0.30000
70	0.13000	0.06500		0.005630		0.30000	0.30000
71	0.13000	0.06500		0.013739		0.30000	0.30000
72	0.13000	0.06500		0.015281		0.30000	0.30000
73	0.13000	0.06500		0.016986		0.30000	0.30000
74	0.13000	0.06500		0.018826		0.30000	0.30000
75	0.00000	0.00000		0.020784		1.00000	1.00000

TABLE 3
RATES OF SALARY INCREASES

SERVICE	RATE
0	1.0900
1	1.0750
2	1.0600
3	1.0550
4	1.0525
5	1.0525
6	1.0525
7	1.0450
8	1.0400
9	1.0400
10	1.0375
11	1.0375
12	1.0375
13	1.0375
14	1.0350
15	1.0350
16	1.0325
17	1.0325
18	1.0325
19	1.0325
20 & Over	1.0325

TABLE 4
RATES OF MORTALITY FOR MEMBERS RETIRED ON ACCOUNT OF SERVICE
AND BENEFICIARIES OF DECEASED MEMBERS

AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.000320	0.000176	71	0.016360	0.012475
20	0.000331	0.000177	72	0.018305	0.013890
21	0.000340	0.000178	73	0.020538	0.015457
22	0.000346	0.000180	74	0.023051	0.017169
23	0.000349	0.000183	75	0.025894	0.019017
24	0.000349	0.000186	76	0.029028	0.021067
25	0.000351	0.000192	77	0.032543	0.023328
26	0.000354	0.000199	78	0.036444	0.025854
27	0.000365	0.000207	79	0.040717	0.028667
28	0.000382	0.000218	80	0.045768	0.031857
29	0.000327	0.000230	81	0.051354	0.035447
30	0.000360	0.000263	82	0.057552	0.039464
31	0.000400	0.000301	83	0.064279	0.044003
32	0.000446	0.000337	84	0.071731	0.049093
33	0.000495	0.000372	85	0.080034	0.054864
34	0.000548	0.000404	86	0.091519	0.061254
35	0.000602	0.000432	87	0.104448	0.068390
36	0.000656	0.000461	88	0.119126	0.076174
37	0.000711	0.000489	89	0.135205	0.084499
38	0.000767	0.000521	90	0.151656	0.095675
39	0.000826	0.000556	91	0.169158	0.107752
40	0.000889	0.000598	92	0.187712	0.120452
41	0.000960	0.000648	93	0.206741	0.133710
42	0.001043	0.000708	94	0.226445	0.147223
43	0.001136	0.000776	95	0.250467	0.160813
44	0.001245	0.000855	96	0.271263	0.181190
45	0.001352	0.000942	97	0.285234	0.194718
46	0.001468	0.001038	98	0.306313	0.202595
47	0.001587	0.001140	99	0.319624	0.214644
48	0.001710	0.001247	100	0.341120	0.220284
49	0.001835	0.001357	101	0.353540	0.232882
50	0.002136	0.001474	102	0.373578	0.242074
51	0.002317	0.001639	103	0.382320	0.259472
52	0.002519	0.001785	104	0.397886	0.272162
53	0.002735	0.001947	105	0.400000	0.293116
54	0.003063	0.002083	106	0.400000	0.307811
55	0.003478	0.002281	107	0.400000	0.322725
56	0.003700	0.002539	108	0.400000	0.337441
57	0.003959	0.002782	109	0.400000	0.351544
58	0.004273	0.003042	110	0.400000	0.364617
59	0.004684	0.003324	111	0.400000	0.376246
60	0.005197	0.003638	112	0.400000	0.386015
61	0.005834	0.004019	113	0.400000	0.393507
62	0.006594	0.004428	114	0.400000	0.398308
63	0.007349	0.005039	115	0.400000	0.400000
64	0.008179	0.005672	116	0.400000	0.400000
65	0.009071	0.006397	117	0.400000	0.400000
66	0.009867	0.007239	118	0.400000	0.400000
67	0.010671	0.008094	119	1.000000	0.400000
68	0.011784	0.008996	120	1.000000	1.000000
69	0.013210	0.009988			
70	0.014666	0.011229			

TABLE 5
RATES OF MORTALITY FOR MEMBERS RETIRED ON ACCOUNT OF DISABILITY

AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.020938	0.006911	71	0.050230	0.038623
20	0.020938	0.006911	72	0.053122	0.041246
21	0.020938	0.006911	73	0.056244	0.044032
22	0.020938	0.006911	74	0.059591	0.046990
23	0.020938	0.006911	75	0.063153	0.050131
24	0.020938	0.006911	76	0.066917	0.053473
25	0.020938	0.006911	77	0.070859	0.057039
26	0.020938	0.006911	78	0.074957	0.060857
27	0.020938	0.006911	79	0.079187	0.064954
28	0.020938	0.006911	80	0.083527	0.069358
29	0.020938	0.006911	81	0.087959	0.074098
30	0.020938	0.006911	82	0.092468	0.079197
31	0.020938	0.006911	83	0.097046	0.084679
32	0.020938	0.006911	84	0.101687	0.090559
33	0.020938	0.006911	85	0.109122	0.096851
34	0.020938	0.006911	86	0.116934	0.106215
35	0.020938	0.006911	87	0.125144	0.116438
36	0.020938	0.006911	88	0.139099	0.127572
37	0.020938	0.006911	89	0.155385	0.139427
38	0.020938	0.006911	90	0.172787	0.153358
39	0.020938	0.006911	91	0.191152	0.167340
40	0.020938	0.006911	92	0.210317	0.181190
41	0.020938	0.006911	93	0.230128	0.194718
42	0.020938	0.007592	94	0.250467	0.202595
43	0.020938	0.008311	95	0.271263	0.214644
44	0.022121	0.009068	96	0.285234	0.220284
45	0.023306	0.009865	97	0.306313	0.232882
46	0.024493	0.010700	98	0.319624	0.242074
47	0.025684	0.011574	99	0.341120	0.259472
48	0.026878	0.012482	100	0.353540	0.272162
49	0.028078	0.013418	101	0.373578	0.293116
50	0.029279	0.014019	102	0.382320	0.307811
51	0.030481	0.014595	103	0.397886	0.322725
52	0.031681	0.015140	104	0.400000	0.337441
53	0.032877	0.015650	105	0.400000	0.351544
54	0.034074	0.016124	106	0.400000	0.364617
55	0.034400	0.016567	107	0.400000	0.376246
56	0.034701	0.016987	108	0.400000	0.386015
57	0.034987	0.017395	109	0.400000	0.393507
58	0.035271	0.017807	110	0.400000	0.398308
59	0.035565	0.018704	111	0.400000	0.400000
60	0.035881	0.019670	112	0.400000	0.400000
61	0.036234	0.020725	113	0.400000	0.400000
62	0.036637	0.021884	114	0.400000	0.400000
63	0.037102	0.023164	115	0.400000	0.400000
64	0.037645	0.024576	116	0.400000	1.000000
65	0.038275	0.026129	117	0.400000	1.000000
66	0.039002	0.027830	118	1.000000	1.000000
67	0.040855	0.029683	119	1.000000	1.000000
68	0.042891	0.031687	120	1.000000	1.000000
69	0.045123	0.033845			
70	0.047566	0.036157			