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July 18, 2017

The Board of Trustees
District of Columbia Retirement Board
900 7th Street, NW, 2nd Floor
Washington, DC 20001

Dear Trustees:

Enclosed are 20 copies of the "District of Columbia Retirement Board Experience Investigation for the Five-Year Period Ending September 30, 2015". The investigation includes the economic and demographic experience for the District of Columbia Retirement Board. This report includes the financial impact of the proposed assumption measured as of the October 1, 2016 actuarial valuation.

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

Sincerely,

Edward J. Koebel, EA, FCA, MAAA
Principal and Consulting Actuary

Jonathan T. Craven, ASA, EA, FCA, MAAA
Consulting Actuary

EJK/JTC:dmw

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District of Columbia Retirement Board

Teachers' Retirement Plan and Police Officers' & Firefighters' Retirement Plan

Experience Investigation for the Five-Year Period Ending September 30, 2015

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July 18, 2017

The Board of Trustees
District of Columbia Retirement Board
900 7th Street, NW, 2nd Floor
Washington, DC 20001

Dear Trustees:

We are pleased to submit the results of an investigation of the economic and demographic experience for the District of Columbia Retirement Board. The purpose of the investigation was to assess the reasonability of the actuarial assumptions for the System. This investigation covers the five-year period from October 1, 2010 to September 30, 2015. As a result of the investigation, it is recommended that revised tables be adopted by the Board for future use.

The investigation of the experience of members of the System includes all active and retired members as well as beneficiaries of deceased members.

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, disability, retirement, salary increase and mortality tables have been developed which reflect more closely the actual experience of the membership.

This report shows a comparison of the actual and expected cases of separation from active service, actual and expected number of deaths, and actual and expected salary increases. These tables are shown based on current assumed expected rates and based on new proposed expected rates. A comparison between the rates of separation and mortality presently in use and the recommended revised rates are also shown in this report.

All rates of separation, mortality and salary increase at each age for each system are shown in the attached tables in Appendix D of this report. In the actuary's judgment, the rates recommended are suitable for use until further experience indicates that modifications are desirable.

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The Board of Trustees
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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 J. Koebel, EA, FCA, MAAA
Principal and Consulting Actuary

Jonathan T. Craven, ASA, EA, FCA, MAAA
Consulting Actuary

EJK/JTC:dmw

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The following summarizes the findings and recommendations with regard to the assumptions utilized for the District of Columbia Retirement Board. Detailed explanations for the recommendations are found in the sections that follow.

Economic Assumption Changes

The table below lists the three economic assumptions used in the actuarial valuation and the current and recommended rates.

Item	Current	Recommended
Price Inflation	3.50%	2.75%
Investment Return	6.50%	6.25%
Wage Inflation	4.25%	4.00%

Recommended Demographic Assumption Changes

The table below lists a summary of the demographic assumptions that are recommended to be changed based on the experience of the last five years.

Assumption	Recommendations
Withdrawal	Teachers – Split for males and females and increase rates Police Officers & Firefighters – Increase rates
Disability Retirement	Teachers & Firefighters – Lower rates Police Officers – No Change
Service Retirement	Teachers, Police Officers and Firefighters – Change rates at all ages and/or service levels to match experience
Mortality	Change to RPH 2014 Blue Collar Mortality Table projected with generational mortality for all Plans
Salary Scale	Teachers – No Change Police Officers and Firefighters – Refined merit scale to better match step, retention and longevity increases

Recommended Other Method Changes

The table below lists a summary of the actuarial method assumptions and our recommendations going forward for future valuations.

Method	Recommendations
Actuarial Cost Method	No Change to the Entry Age Normal (EAN) Cost Method
Amortization Method	Recommend a layered Unfunded Accrued Liability (UAL) amortization approach beginning with the 2017 valuation. New UAL layers composed of experience gains and losses will be amortized over a closed 20 year period from valuation date they were initially measured. Changes to assumptions and methods would also be captured in the same UAL layers.
Asset Smoothing	Recommend consideration for the Board to move to 5-year smoothing period to recognize investment gains and losses beginning with the 2016 valuation.

Financial Impact

The following tables highlight the impact of the recommended changes on the Unfunded Accrued Liability, Actuarially Determined Employer Contribution (ADEC) and the Funding Ratio on an Actuarial Value basis for each Plan of DCRB.

Teachers' Retirement Plan
($ in Thousands)

	Valuation Results 2016	Demographic Changes Only	Demographic and Economic Changes
Unfunded Accrued Liability	$184,164	$221,034	$237,508
ADEC Rate	11.51%	12.28%	12.85%
ADEC Amount	$59,046	$62,562	$64,884
Funding Ratio	90.9%	89.3%	88.6%

Police Officers' Retirement Plan
($ in Thousands)

	Valuation Results 2016	Demographic Changes Only	Demographic and Economic Changes
Unfunded Accrued Liability	$(419,961)	$(321,015)	$(301,051)
ADEC Rate	20.69%	21.33%	22.62%
ADEC Amount	$59,952	$61,943	$65,620
Funding Ratio	113.5%	110.0%	109.3%

Firefighters' Retirement Plan
($ in Thousands)

	Valuation Results 2016	Demographic Changes Only	Demographic and Economic Changes
Unfunded Accrued Liability	$(66,577)	$(85,487)	$(75,774)
ADEC Rate	34.26%	29.30%	30.59%
ADEC Amount	$45,644	$38,422	$40,087
Funding Ratio	104.8%	106.2%	105.5%

There are three economic assumptions used in the actuarial valuations performed for DCRB. 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	Recommended
Price Inflation	3.50%	2.75%
Investment Return	6.50%	6.25%
Wage Inflation	4.25%	4.00%

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.

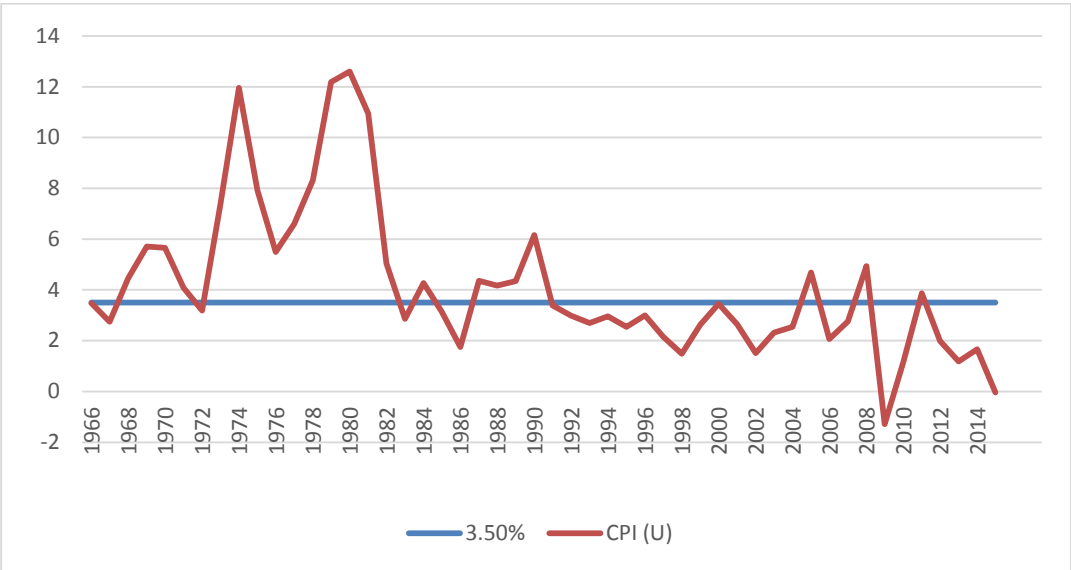
The current price inflation assumption is 3.50% per year.

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 September 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
2006-2015	10	1.81%	1.79%
1996-2005	10	2.64	1.45
1986-1995	10	3.53	1.50
1976-1985	10	7.09	3.39
1966-1975	10	5.62	2.63
1996-2015	20	2.23%	1.79%
1986-2015	30	2.66	1.45
1976-2015	40	3.75	2.94
1966-2015	50	4.12	2.98
1927-2015	88	2.93	3.98

The graph below shows the annual increases in the CPI (U) over the entire 50 year period.



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 1.81% is lower than the System's assumed rate of 3.50%, the longer 40 and 50-year averages of 3.75% and 4.12% respectively, are somewhat 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 2016 OASDI Trustees Report, the Chief Actuary for Social Security bases the 75 year cost projections on an intermediate inflation assumption of 2.6% with a range of 2.0% to 3.2%. We consider that range reasonable and recommend that DCRB lower the current price inflation assumption from 3.50 to 2.75%.

Price Inflation Assumption	
Current	3.50%
Reasonable Range	2.00% - 3.50%
Recommended	2.75%

The change in the price inflation assumption has an impact on the COLA assumption. For the first time, the proposed price inflation assumption is below the 3.0% cap for members hired after

November 1, 1996. We analyzed the variability of the CPI to determine the new proposed COLA assumptions. If the 2.75% price inflation assumption is adopted, we recommend changing the COLA assumptions as shown in the following table.

COLA	Current	Proposed
Hired < 11/1/1996	3.50%	3.35%
Hired >= 11/1/1996	3.00%	2.95%

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 divisions. 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 6.50%, consisting of a price inflation assumption of 3.50% and a real rate of return assumption of 3.00%. The return assumption is net of investment expenses.

Past Experience: The assets for DCRB are valued using a widely accepted asset-smoothing methodology that fully recognizes the expected investment income and also recognizes 1/7th of each year's investment gain or loss (the difference between actual and expected investment income). The experience over the last nine years is shown in the table below.

Year Ending 9/30	Actuarial Value	Market Value
2007	11.70%	16.40%
2008	(0.23)	(17.17)
2009	(5.86)	(2.64)
2010	1.60	10.38
2011	1.42	2.96
2012	2.72	14.08
2013	3.87	11.41
2014	4.72	8.10
2015	6.14	(4.05)
Average	2.80%	3.86%

The impact of the asset smoothing method can be observed in the table above. Poor asset returns during 2008 and 2009 are reflected in the actuarial value returns through 2015. 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 mean real return of 6.11% but also has a high standard deviation or measurement of volatility. By expanding the time horizon, the average return changes slightly but the volatility declines significantly. The following table provides a summary of results.

Time Span In Years	Mean Real Return	Standard Deviation	Real Returns by Percentile				
			5th	25th	50th	75th	95th
1	6.11%	13.70%	-14.77%	-3.44%	5.31%	14.85%	30.12%
5	5.41	6.07	-4.20	1.30	5.31	9.47	15.76
10	5.33	4.28	-1.50	2.46	5.31	8.24	12.59
20	5.28	3.03	0.44	3.29	5.31	7.37	10.41
30	5.27	2.47	1.32	3.65	5.31	6.99	9.46
40	5.26	2.14	1.85	3.87	5.31	6.76	8.89
50	5.26	1.91	2.21	4.03	5.31	6.61	8.51

Based on this analysis there is a 50% likelihood that the average real rate of return over a 50-year period will be 5.31%. It can also be inferred that for the 10-year time span, 5% of the resulting real rates of return will be below -1.50% 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 4.03% and a 25% chance they will be above 6.61%. In other words, there is a 50% chance the real returns will be between 4.03% and 6.61%.

Nominal Return Ranges: The returns shown above are gross real rates of return. To get nominal rates of return that are net of investment fees, the gross real returns must be adjusted by expected inflation and investment expenses. Using a building block approach that includes our proposed inflation assumption of 2.75% and the real return projection results outlined above, the following

table illustrates 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.

Item	25th Percentile	50th Percentile	75th Percentile
Real Rate of Return	4.03%	5.31%	6.61%
Proposed Inflation	2.75	2.75	2.75
Investment Expenses	(0.25)	(0.25)	(0.25)
Net Investment Return	6.53%	7.81%	9.11%

Using the same methodology with the inflation assumption used by the investment consultant yields the following results.

Item	25th Percentile	50th Percentile	75th Percentile
Real Rate of Return	4.03%	5.31%	6.61%
Assumed Inflation	2.40	2.40	2.40
Investment Expenses	(0.25)	(0.25)	(0.25)
Net Investment Return	6.18%	7.46%	8.76%

Using the same methodology with the targeted inflation rate of the Federal Reserve Board yields the following results.

Item	25th Percentile	50th Percentile	75th Percentile
Real Rate of Return	4.03%	5.31%	6.61%
FRB Targeted Inflation	2.00	2.00	2.00
Investment Expenses	(0.25)	(0.25)	(0.25)
Net Investment Return	5.78%	7.06%	8.36%

As can be seen by the tables above, nominal rates using this building block methodology are highly dependent on the inflation assumption. Our proposed inflation assumption is very long term in nature because the resulting nominal net investment return assumption is also used as the discount rate for all projected future benefit payments of the plan. These projected benefit payments can span up to 100 years. Investment consultants customarily rely more on available data in the long term bond markets which have a shorter duration. The Federal Reserve Board is trying to create an inflation rate which it deems desirable. The bottom line is that nobody knows what the inflation rate is going to be in the future.

Using our inflation assumption and the capital market assumptions of the investment consultant, there is 50% chance that the net nominal return will be between 6.53% and 9.11% over a 50-year period. Based on this type of analysis, the most likely nominal rate of return would be 7.81% and we would recommend 7.75% because it is close to the center of the distribution. This rate would indicate that future asset gains and losses should approximately offset each other if the assumption is realized. This is rate that ASOP 27 guides us as actuaries to recommend as the most likely outcome. Using the investment consultant's inflation assumption of the Federal Reserve Board's target rate of inflation, the nominal rate would be less. We do realize in the real world that actuarial gains are more desirable than actuarial losses and as such we recommend a lower investment return assumption to insure against adverse experience.

Investment Return Assumption	
Current	6.50%
Recommended	6.25%

Wage Inflation

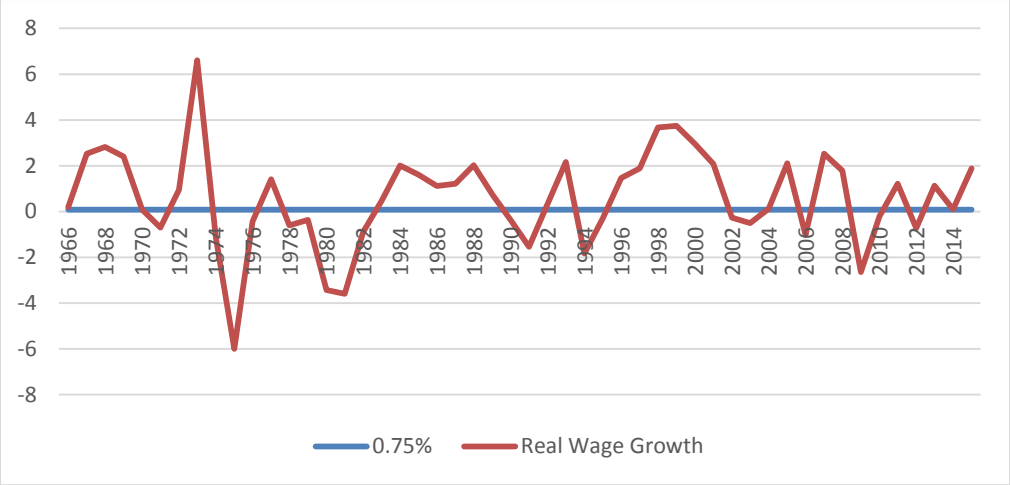
Background: The assumed future increases in salaries consist of an inflation component and a component for promotion and longevity, often called merit increases. The latter are generally age and or service related, and will be dealt with in the demographic assumption section of the report. Wage inflation normally is above price inflation as a reflection of the overall return on labor in the economy. The current wage inflation assumption is 4.25%, or 0.75% above current price 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. As with our analysis of inflation, we provide below wage inflation and a comparison with price inflation over various time periods. Since wage data is only available through 2014 we use that year as the starting point.

Period	Wage Inflation	Price Inflation	Real Wage Growth
2005-2014	2.69%	1.81%	0.88%
1995-2004	4.14	2.64	1.50
1985-1994	3.94	3.53	0.41
1975-1984	7.23	7.09	0.14
1965-1974	5.78	5.62	0.16
1995-2014	3.41	2.23	1.18
1985-2014	3.59	2.66	0.93
1975-2014	4.49	3.75	0.74
1965-2014	4.75	4.12	0.63

Thus over the last 50 years, annual real wage growth as measured by the Social Security Administration has averaged 0.63%.

Annual Real Wage Growth



Recommendation: As with price inflation, we again look at the 2016 OASDI Trustees Report. The Chief Actuary for Social Security bases the 75 year cost projections on a national wage growth assumption 1.20% greater than the price inflation assumption of 2.60%. We concur in general with a range of 0.50% to 1.80%, and recommend use of a 1.25% per year rate at the current time which, when added to the proposed Price Inflation rate, will make the recommended Wage Inflation Assumption rate equal to 4.00%.

Wage Inflation Assumption		
Current	4.25%	
	Reasonable Range	
Real Wage Growth	0.50%	1.80%
Proposed Inflation	2.75	2.75
Total	3.25%	4.55%
Recommended	4.00%	

SECTION III– ACTUARIAL METHODS

There are certain actuarial methods that are part of the Funding Policy and are used in the actuarial valuations performed for the District of Columbia. They are:

- Actuarial Cost Method
- Amortization Method
- Asset Smoothing Method

Actuarial Cost Method: The Actuarial Standard of Practice (ASOP) No. 4, *"Measuring Pension Obligations and Determining Pension Plan Costs or Contributions"*, provides guidance to actuaries in determining periodic costs or actuarially determined contributions. The Standard defines an Actuarial Cost Method as a procedure for allocating the actuarial present value of projected benefits to time periods, usually in the form of a normal cost and an actuarial accrued liability.

The current actuarial cost method is the Entry Age Normal Method under which the actuarial present value of the projected benefits of each individual included in an actuarial valuation is allocated on a level basis over the earnings of the individual between entry age and assumed exit age. The portion of this actuarial present value allocated to a valuation year is called the normal cost. The portion of this actuarial present value not provided for at a valuation date by the actuarial present value of future normal costs is called the Actuarial accrued liability.

The Entry Age Normal Cost Method is by far the most common actuarial cost method used for public sector pension plans. It is also the required actuarial cost method for measuring accounting costs under GASB Statements 67 and 68. **We believe this is the best method for your plans and recommend continued use of it.**

Amortization Method: The Actuarial Standard of Practice (ASOP) No. 4, *"Measuring Pension Obligations and Determining Pension Plan Costs or Contributions"* also defines an amortization method as a method under a contribution allocation procedure or cost allocation procedure for determining the amount, timing, and pattern of recognition of the unfunded actuarial accrued liability.

A funding policy was adopted by the Board in 2012 which included adopting a closed level dollar amortization of the Unfunded Actuarial Accrued Liability (UAAL) over 20 years. The period is to decrease by one year per year until a funded ratio of 100% is attained. The amortization period reached 17 years as of the October 1, 2015 actuarial valuation. The Police Officers' and Firefighters' Retirement Plan was over 100% funded as of October 1, 2015 while the Teachers' Retirement Plan was not.

Under the current method, all future changes in the UAAL will be amortized by a shrinking period. As amortization periods decrease, payments will become increasingly more volatile with certain experience. To avoid the volatility of short amortization periods, **we recommend new UAAL layers composed of experience gains and losses be amortized over a closed 20-year period from the valuation date they are initially measured**. Also, changes to assumptions and methods would also be captured in any UAAL layers.

Therefore, the UAAL as of October 1, 2017 ("Transitional UAAL") will be amortized over 15 years and each subsequent additional increase or decrease in UAAL will be amortized over a separate 20-year period from the valuation date it is measured. Under this methodology, after 20 years, there would be a minimum of 20 individual amortization bases.

Asset Smoothing Method: The Actuarial Standard of Practice (ASOP) No. 44, *"Selection and Use of Asset Valuation Methods for Pension Valuations"* provides guidance to actuaries when performing actuarial valuations for defined benefit plans.

Asset smoothing is used to dampen the impact of volatility of market value returns on the required contributions to the plan. The current seven year smoothing method was implemented in the October 1, 2008 actuarial valuation. Although some in the actuarial profession use asset smoothing periods longer than five years, it is somewhat uncommon and various actuarial organizations have expressed their opinions recently:

- The Conference of Consulting Actuaries (CCA) Public Plan Community White Paper endorses smoothing periods of 3 years to 10 years with market value corridors on smoothing periods of 5 to 10 years.

- The Report of the Blue Ribbon Panel of the Society of Actuaries on Public Pension Plan Funding recommends limiting smoothing periods to 5 years.

- The Government Finance Officers Association (GFOA) Best Practice recommends asset smoothing periods of ideally 5 years or less but no longer than 10 years with market value corridors for smoothing periods greater than 5 years.

We recommend the Board consider changing the asset smoothing to a five year smoothing method with a 20% corridor around the market value of assets.

There are several demographic assumptions used in the actuarial valuations performed for the District of Columbia Retirement Board. They are:

- Rates of Mortality
- Rates of Withdrawal
- Rates of Disability Retirement
- Rates of Service Retirement
- 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 (October 1, 2010 through September 30, 2015) with what was expected to happen based on the assumptions used in the most recent 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. In addition non-recurring events, such as early retirement windows, need to be taken into account in determining the weight to give to recent experience.

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.

The mortality assumption is one of the most important demographic assumptions because it predicts the length of time pension benefits will be paid to both current and future retirees and beneficiaries. If retirees and beneficiaries live longer than expected, actuarial losses are realized.

Rates of mortality continue to decline today mostly due to advancements in medicine and public health. The continued increases in life expectancies has prompted the actuarial profession to require actuaries to include assumptions of mortality improvement in the mortality tables used in the valuations and option factors.

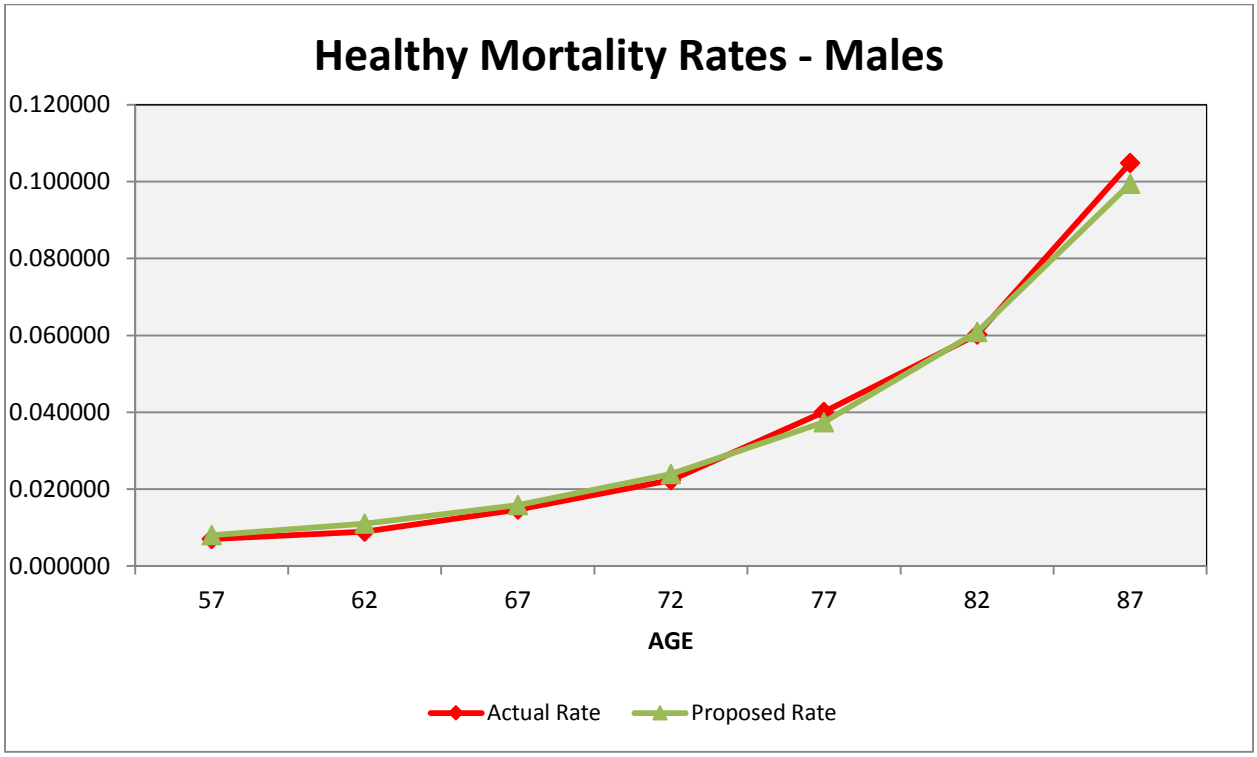
In order to develop an appropriate mortality table, we need as much data as possible. Therefore, we have combined the mortality experience of the Teachers, Police and Firefighters to analyze the mortality assumption. We also included mortality experience from the previous 2006-2010 study to increase the credibility of the data.

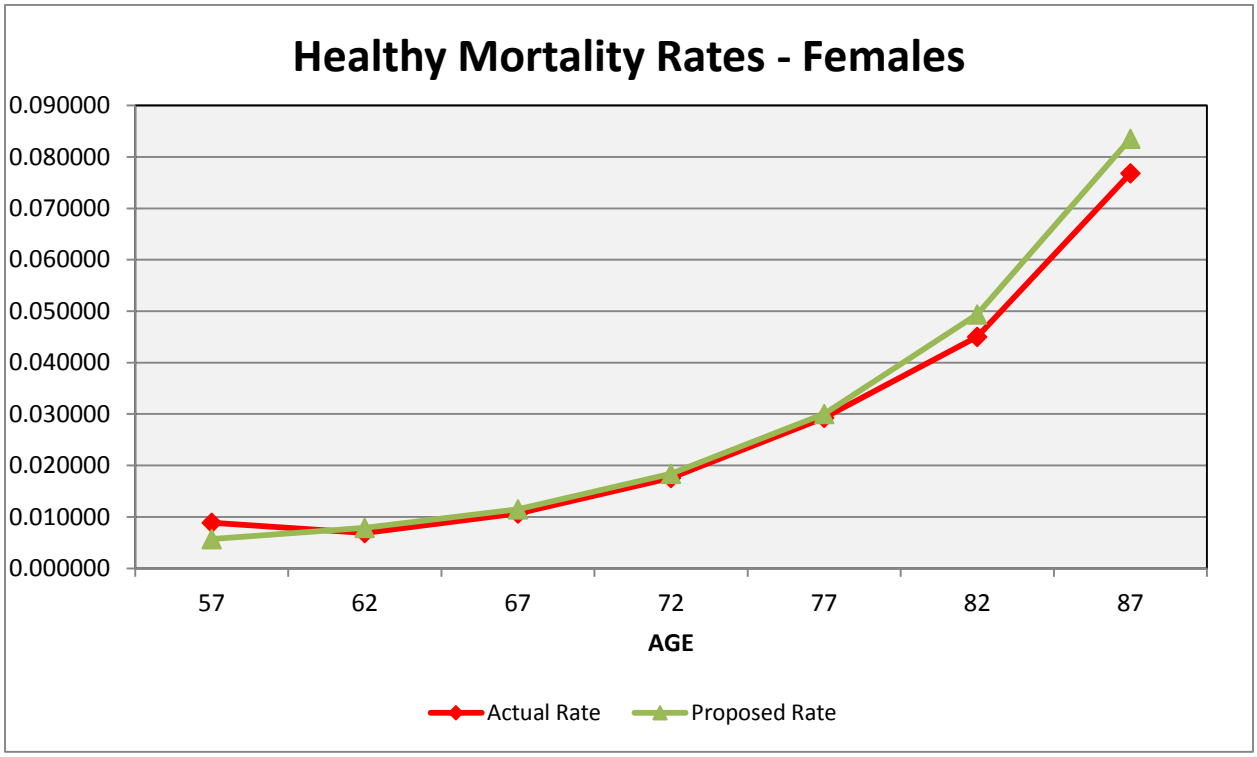
The health of disabled retirees is generally worse than healthy retirees and therefore we have a different mortality assumption for disabled retirees.

Healthy Lives Mortality

The first step of selecting a mortality table is to compare published mortality tables to the mortality experienced by the members of the plan. This is done by projecting the mortality table rates to the period of the experience. The actual mortality experience is from the July 1, 2006 – June 30, 2015 period so we will project the mortality rates to 2011 for comparison to the actual experience.

After testing many standard mortality tables against the mortality experience of the 2006-2015 study period, we selected the RPH 2014 Blue Collar Mortality Table with ages set back one year for males as the best fit table when projected back to 2011. The following graphs show the actual mortality rates during the study period and the mortality rates of the RPH 2014 Blue Collar Mortality Table with ages set back one year for males projected to 2011.





A comparison of actual deaths and expected deaths using the proposed mortality table with ratios of actual deaths to expected deaths is shown below:

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
Under 60	59	58	1.017	48	22	2.182
62	95	118	0.805	55	63	0.873
67	164	177	0.927	115	124	0.927
72	169	181	0.934	167	175	0.954
77	173	162	1.068	243	249	0.976
82	139	140	0.993	300	329	0.912
87	115	109	1.055	364	396	0.919
92	80	60	1.333	356	369	0.965
95 & Over	35	33	1.061	287	270	1.063
TOTAL	**1,029**	**1,038**	**0.991**	**1,935**	**1,997**	**0.969**

The next step is to project the mortality rates into the future in order to allow for future expected mortality improvement.

The Society of Actuaries strongly recommends projecting mortality improvement generationally. Generational projection creates a unique mortality table for each year of birth. For example, the mortality rate at age 65 for someone who is now 40 will be the current age 65 rate with 25 years of projection applied. For the same person, the mortality rate at age 70 will be the current age 70 rate with 30 years of projection applied.

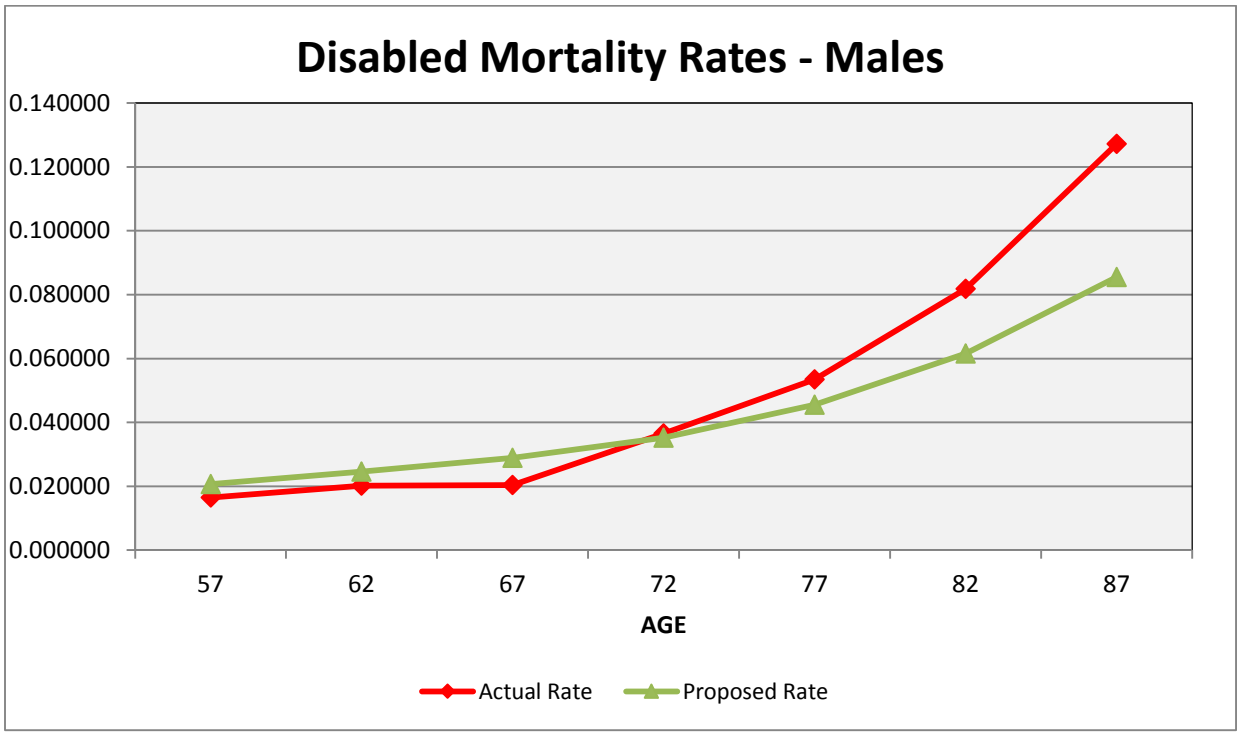
The other form of projection is called a static projection where the base rates of mortality are projected to a future date or for a specific number of years. The projection is independent from the member's year of birth. Generational projection is theoretically more accurate where a static projection will overstate liabilities for some and understate liabilities for others.

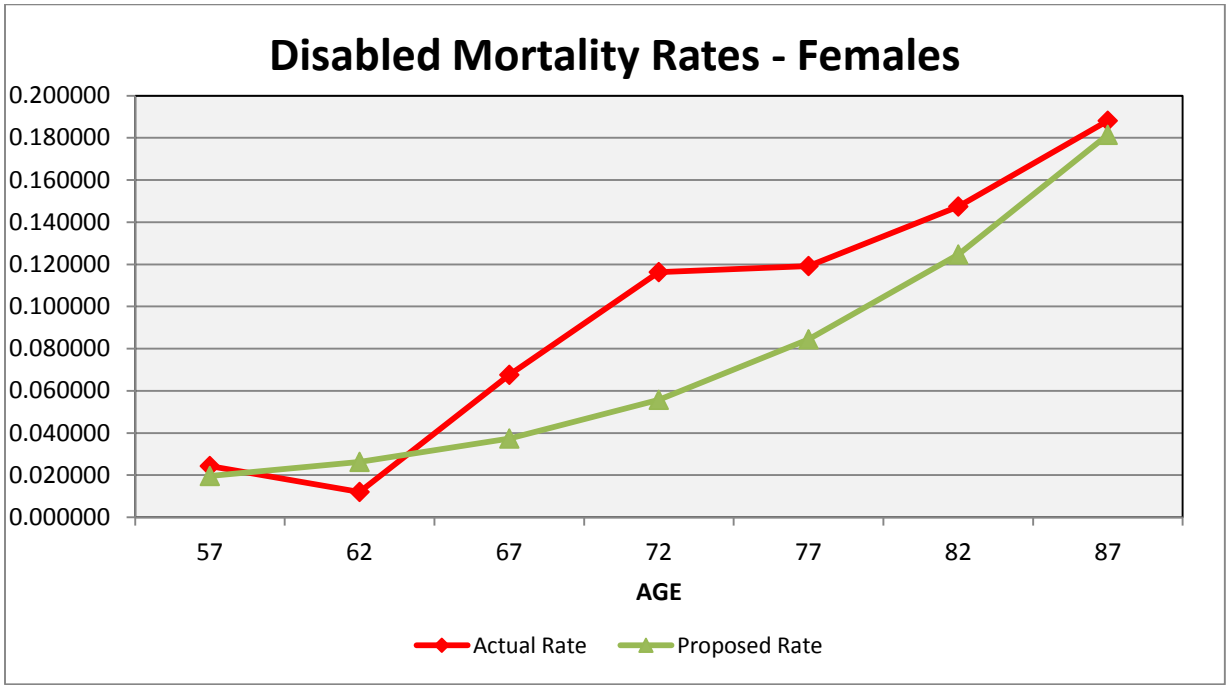
We recommend projecting the RPH Blue Collar Mortality Table with ages set back 1 year for males generationally using Scale BB for both active and retired members.

Disabled Lives Mortality

Disabled lives mortality is much harder to predict than healthy lives mortality since the many reasons for disability are numerous in nature with differing impacts on mortality. Another reason is the much smaller number of disabled retirees which make their data less credible.

We have selected the RPH 2014 Disabled Retiree Mortality Table with female rates set forward 7 years and male rates set back 6 years for the mortality table for disabled lives. Because of the smaller sample size, we picked the assumption so there is a margin for adverse selection instead of projecting the mortality table for future improvement. The following graphs show the mortality experience of the study period compared with what the proposed assumption would have predicted:





The following table show the actual disabled retiree deaths compared with what would have been predicted by our proposed assumption. Please note the margin for males is 17.4% and the margin for females is 18.6%. This margin allows for adverse deviation.

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
Under 50	20	10	2.000	7	9	0.778
52	5	11	0.455	10	7	1.429
57	20	25	0.800	14	11	1.273
62	39	47	0.830	8	18	0.444
67	44	62	0.710	39	22	1.773
72	72	69	1.043	48	23	2.087
77	84	72	1.167	44	31	1.419
82	118	89	1.326	55	46	1.196
87	114	77	1.481	60	58	1.034
92	81	47	1.723	37	44	0.841
95 & Over	25	20	1.250	23	22	1.045
TOTAL	**622**	**529**	**1.176**	**345**	**291**	**1.186**

RATES OF WITHDRAWAL

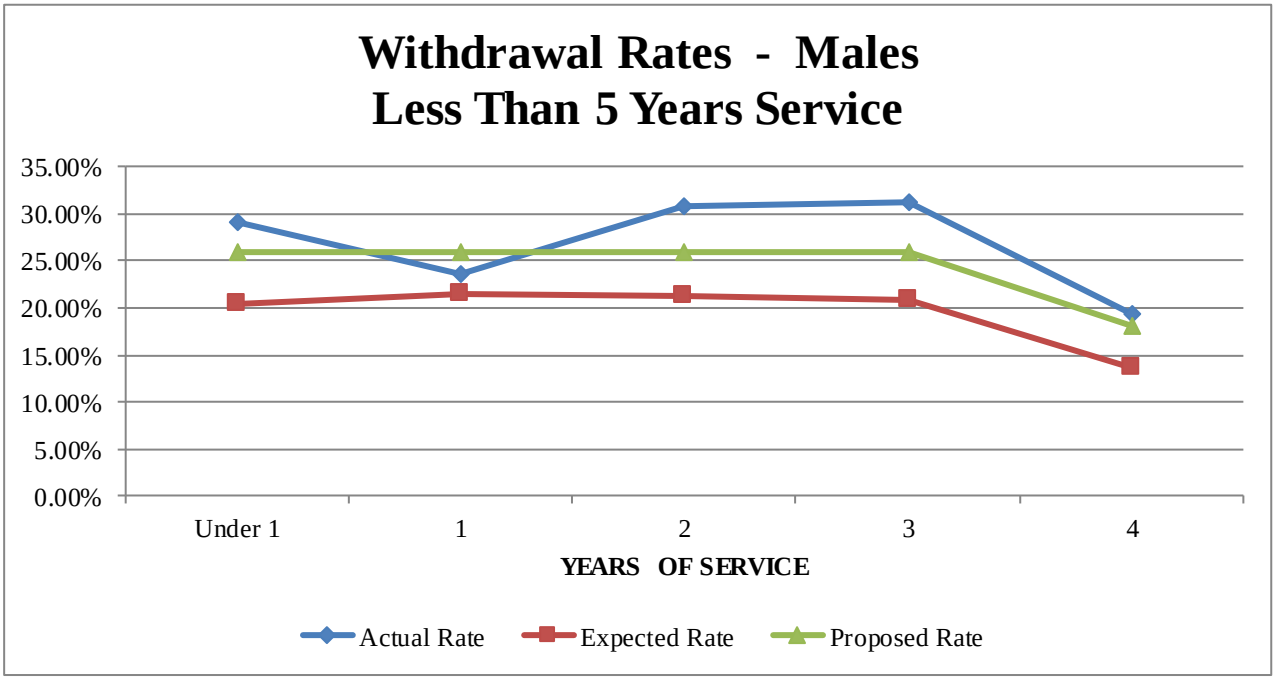
COMPARISON OF ACTUAL AND EXPECTED WITHDRAWALS FROM ACTIVE SERVICE

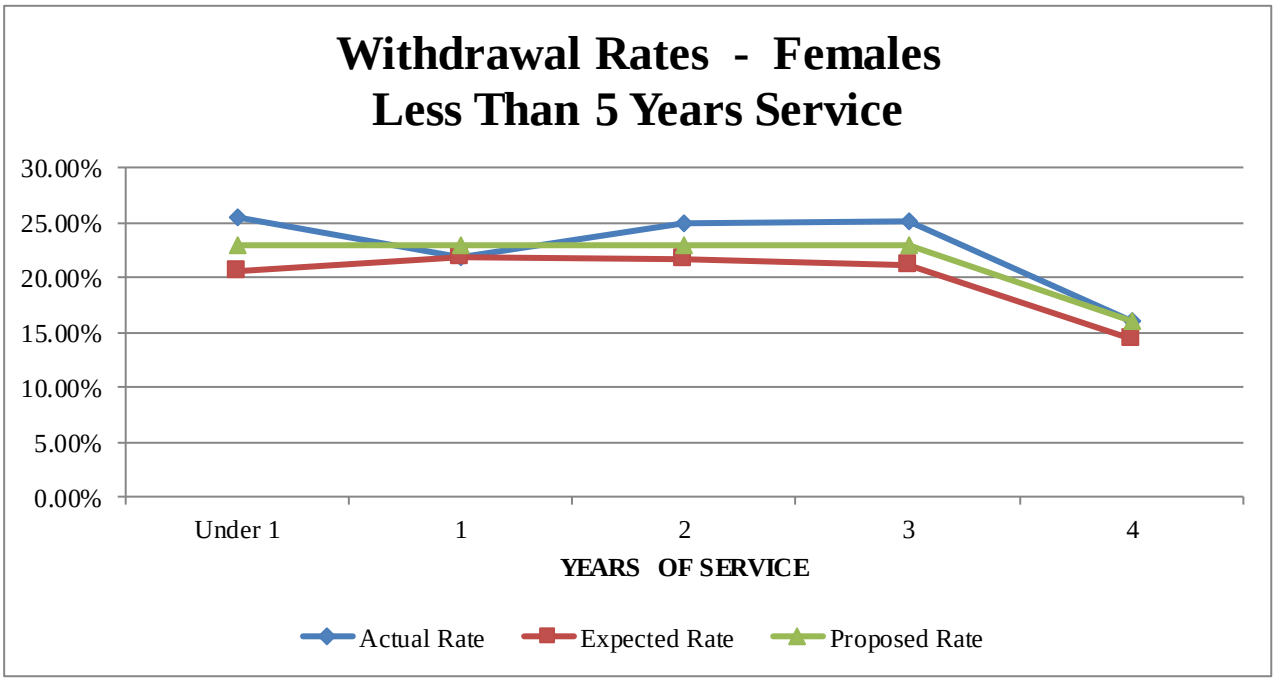
SERVICE	NUMBER OF WITHDRAWALS		
	Actual	Expected	Ratio of Actual to Expected
	Withdrawals with less than 5 years of service		
Under 1	54	42	1.286
1	743	729	1.019
2	750	609	1.232
3	506	399	1.268
4	236	200	1.180
TOTAL	**2,289**	**1,979**	**1.157**

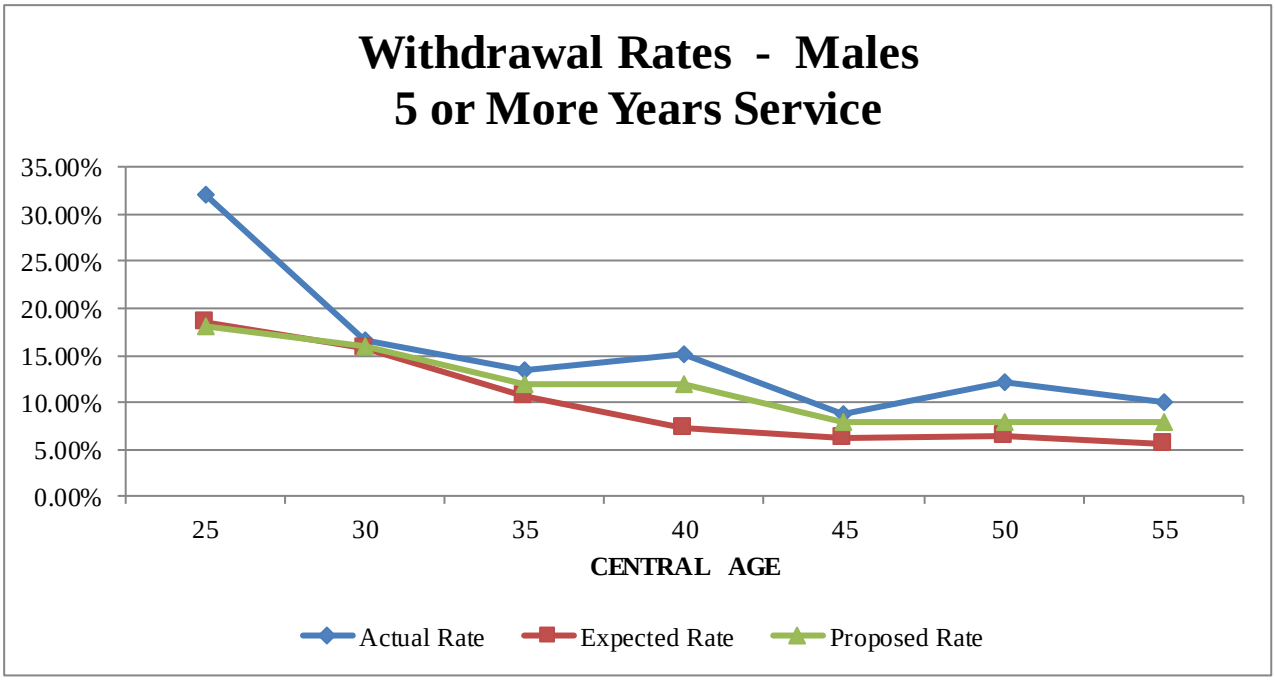
CENTRAL AGE OF GROUP	NUMBER OF WITHDRAWALS		
	Actual	Expected	Ratio of Actual to Expected
	Withdrawals with 5 or more years of service		
25	41	32	1.281
30	163	153	1.065
35	155	139	1.115
40	178	123	1.447
45	109	83	1.313
50	93	63	1.476
55	78	53	1.472
60	90	39	2.308
TOTAL	**907**	**685**	**1.324**

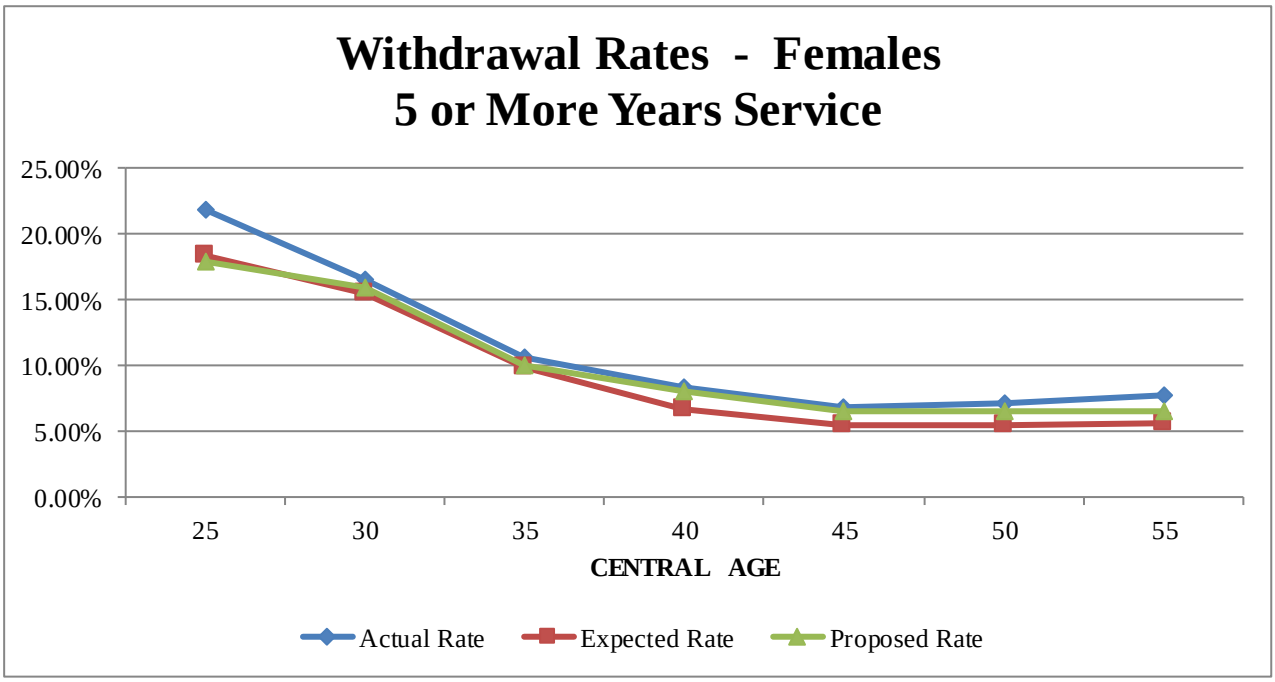
The following graph shows a comparison of the present, actual and proposed rates of withdrawal.

RATES OF WITHDRAWAL FOR ACTIVE MEMBERS









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 the actual number of withdrawals is somewhat more than expected at less than 5 years of service and even more so at 5 or more years of service. Actual withdrawals were also more than expected during the 2006-2010 period. In addition, we reviewed withdrawals

for males and females separately and found that males are withdrawing at approximately 3% higher rates than females.

Therefore, first, we are recommending withdrawal rates be split for males and females. And second, we are recommending changing the age and service parameters used in applying the rates. Currently, there are different age based withdrawal rates for less than 4 years of service, 5 to 10 years of service, and 10 or more years of service. We recommend simplifying the rate structure into a select and ultimate format with service based rates for all members with less than 5 years of service and age based rates for all members with 5 or more years of service. Last, we are recommending an increase in the withdrawal rates for ages above 30.

SERVICE	RATES OF WITHDRAWAL		
	Less than 5 years of service		
	Present	Proposed	
		MALES	FEMALES
< 1	NA	26.00%	23.00%
1	NA	26.00%	23.00%
2	NA	26.00%	23.00%
3	NA	26.00%	23.00%
4	NA	18.00%	16.00%

AGE	RATES OF WITHDRAWAL		
	5 or more years of service		
	Present	Proposed	
		MALES	FEMALES
25	20.00%	18.00%	18.00%
30	16.00%	16.00%	16.00%
35	14.00%	12.00%	10.00%
40	12.00%	12.00%	8.00%
45	10.00%	8.00%	6.50%
50	10.00%	8.00%	6.50%
55	10.00%	8.00%	6.50%

COMPARATIVE RATES OF WITHDRAWAL

COMPARISON OF ACTUAL AND EXPECTED WITHDRAWALS FROM ACTIVE SERVICE BASED ON PROPOSED RATES

SERVICE	NUMBER OF WITHDRAWALS - MALES		
	Actual	Expected	Ratio of Actual to Expected
	Withdrawals with less than 5 years of service		
Under 1	14	12	1.167
1	193	213	0.906
2	230	194	1.186
3	153	128	1.195
4	66	61	1.082
TOTAL	**656**	**608**	**1.079**

SERVICE	NUMBER OF WITHDRAWALS - FEMALES		
	Actual	Expected	Ratio of Actual to Expected
	Withdrawals with less than 5 years of service		
Under 1	40	36	1.111
1	550	581	0.947
2	520	479	1.086
3	353	324	1.090
4	170	169	1.006
TOTAL	**1,633**	**1,589**	**1.028**

CENTRAL AGE OF GROUP	NUMBER OF WITHDRAWALS - MALES		
	Actual	Expected	Ratio of Actual to Expected
	Withdrawals with 5 or more years of service		
25	8	5	1.600
30	33	32	1.031
35	47	42	1.119
40	63	50	1.260
45	33	30	1.100
50	36	24	1.500
55	22	18	1.222
60	27	15	1.800
TOTAL	**269**	**216**	**1.245**

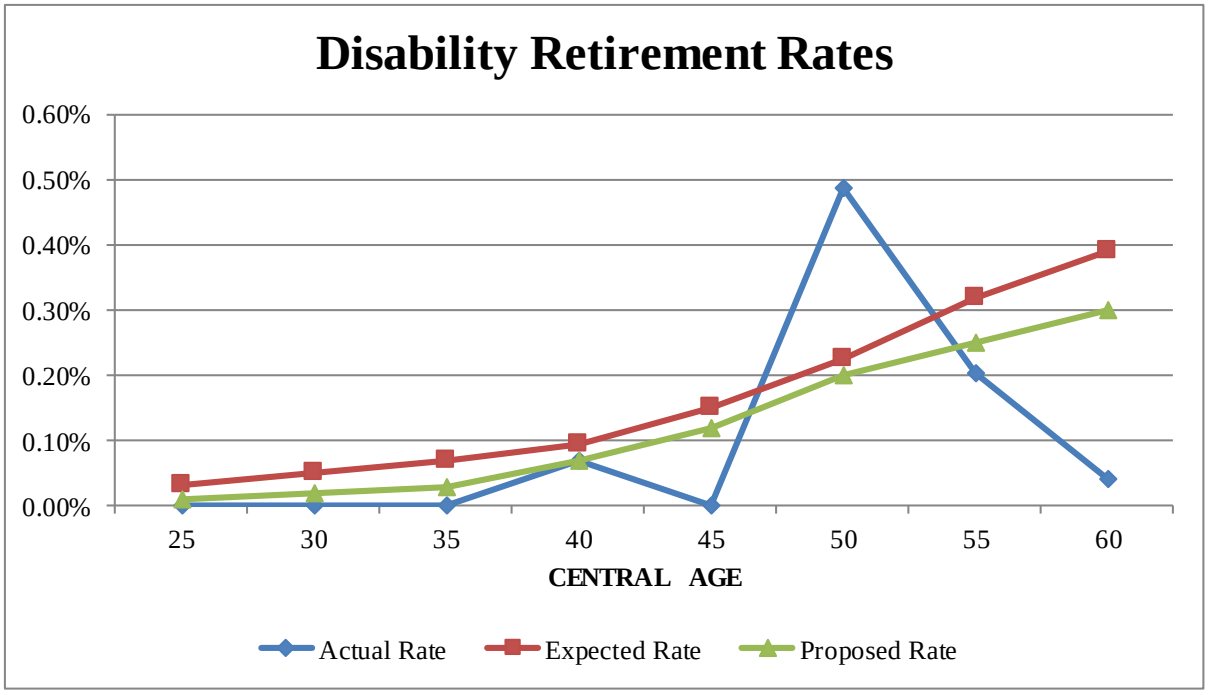
CENTRAL AGE OF GROUP	NUMBER OF WITHDRAWALS - FEMALES		
	Actual	Expected	Ratio of Actual to Expected
	Withdrawals with 5 or more years of service		
25	33	27	1.222
30	130	126	1.032
35	108	102	1.059
40	115	110	1.045
45	76	71	1.070
50	57	52	1.096
55	56	47	1.191
60	63	34	1.853
TOTAL	**638**	**569**	**1.121**

RATES OF DISABILITY RETIREMENT

COMPARISON OF ACTUAL AND EXPECTED DISABILITY RETIREMENTS

CENTRAL AGE OF GROUP	NUMBER OF DISABILITIES		
	Actual	Expected	Ratio of Actual to Expected
25	0	1	0.000
30	0	2	0.000
35	0	2	0.000
40	2	3	0.667
45	0	3	0.000
50	10	5	2.000
55	5	8	0.625
60+	1	12	0.083
TOTAL	**18**	**36**	**0.500**

The following graphs show a comparison of the present, actual, and proposed rates of disability retirements.



During the period under investigation, the actual rates of disability retirement were less than expected. A similar pattern of disability retirements was seen in the last experience investigation. Therefore, we recommend the rates of disability retirement be lowered again to more closely 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 RETIREMENT

AGE	RATES OF DISABILITY RETIREMENT	
	Present	Proposed
25	0.03%	0.01%
30	0.05%	0.02%
35	0.07%	0.03%
40	0.09%	0.07%
45	0.15%	0.12%
50	0.22%	0.20%
55	0.32%	0.25%
60	0.40%	0.30%

COMPARISON OF ACTUAL AND EXPECTED DISABILITY RETIREMENTS BASED ON PROPOSED RATES

CENTRAL AGE OF GROUP	NUMBER OF DISABILITIES		
	Actual	Expected	Ratio of Actual to Expected
25	0	0	0.000
30	0	1	0.000
35	0	1	0.000
40	2	2	1.000
45	0	3	0.000
50	10	4	2.500
55	5	6	0.833
60+	1	13	0.077
TOTAL	**18**	**30**	**0.600**

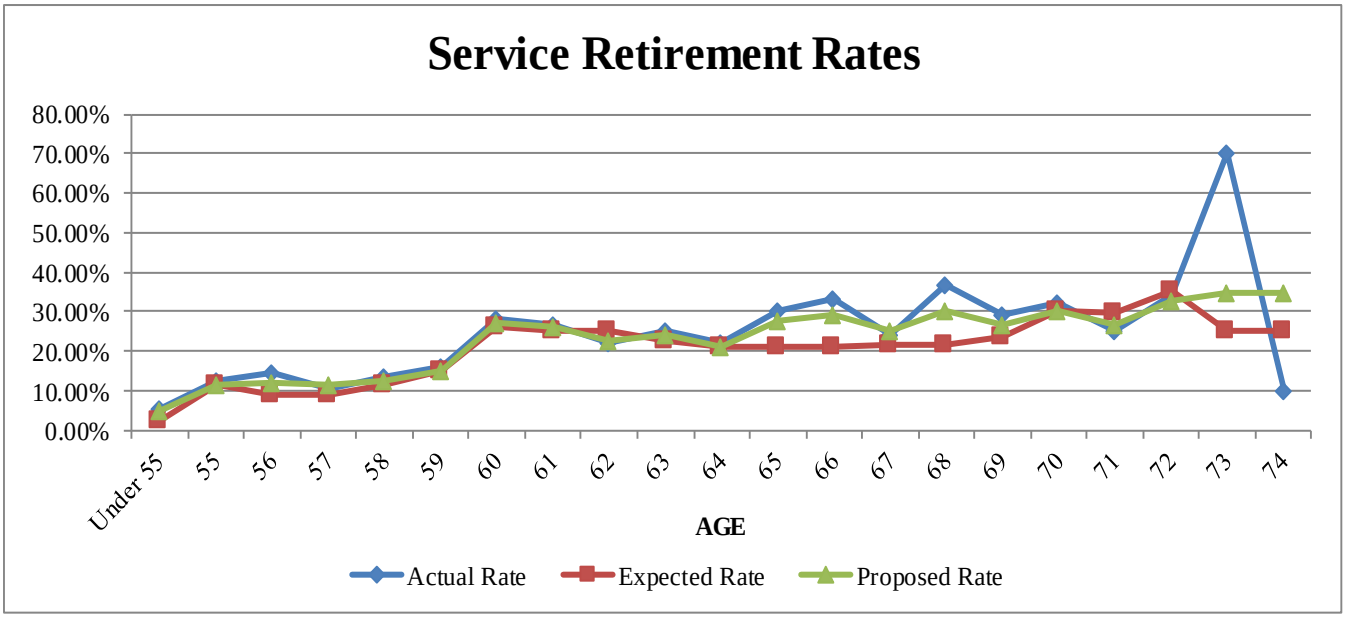
RATES OF SERVICE RETIREMENT

COMPARISON OF ACTUAL AND EXPECTED RETIREMENTS

AGE	NUMBER OF SERVICE RETIREMENTS Under 30 Years of Service		
	Actual	Expected	Ratio of Actual to Expected
Under 55	45	22	2.045
55	22	13	1.692
56	24	13	1.846
57	18	13	1.385
58	24	18	1.333
59	22	19	1.158
60	51	50	1.020
61	38	38	1.000
62	60	71	0.845
63	61	52	1.173
64	42	41	1.024
65	41	31	1.323
66	40	23	1.739
67	20	16	1.250
68	23	12	1.917
69	10	7	1.429
70	10	10	1.000
71	6	6	1.000
72	7	4	1.750
73	7	3	2.333
74	1	2	0.500
SUBTOTAL	**572**	**464**	**1.233**
75+	6	11	0.545
TOTAL	**578**	**475**	**1.217**

AGE	NUMBER OF SERVICE RETIREMENTS 30 or More Years of Service		
	Actual	Expected	Ratio of Actual to Expected
Under 55	0	1	0.000
55	11	17	0.647
56	16	12	1.333
57	11	12	0.917
58	14	13	1.077
59	24	23	1.043
60	28	23	1.217
61	25	22	1.136
62	20	19	1.053
63	13	15	0.867
64	16	14	1.143
65	20	12	1.667
66	8	8	1.000
67	8	8	1.000
68	9	7	1.286
69	7	6	1.167
70	6	5	1.200
71	2	4	0.500
72	3	6	0.500
73	7	2	3.500
74	0	0	0.000
SUBTOTAL	**248**	**229**	**1.083**
75+	3	8	0.375
TOTAL	**251**	**237**	**1.059**

The following graphs show a comparison of the present and actual rates of service retirements.



The preceding results indicate that for service retirements of members, the actual number of retirements was more than the expected number over this period. We recommend the rates of retirement be revised to more closely reflect the experience of the System.

The following table shows a comparison between the present service retirement rates and the proposed rates.

COMPARATIVE RATES OF SERVICE RETIREMENT

AGE	RATES OF SERVICE RETIREMENT			
	Less than 30 years of service		30 or more years of service	
	Present	Proposed	Present	Proposed
50	2.5%	5.0%	2.5%	5.0%
51	2.5%	5.0%	2.5%	5.0%
52	2.5%	5.0%	2.5%	5.0%
53	2.5%	5.0%	2.5%	5.0%
54	2.5%	5.0%	2.5%	5.0%
55	6.0%	9.0%	33.0%	22.0%
56	6.0%	9.0%	19.0%	22.0%
57	6.0%	9.0%	19.0%	20.0%
58	9.0%	10.0%	19.0%	20.0%
59	10.0%	10.0%	25.0%	25.0%
60	27.0%	27.0%	25.0%	28.0%
61	25.0%	25.0%	25.0%	28.0%
62	25.0%	22.0%	25.0%	25.0%
63	22.0%	25.0%	25.0%	22.0%
64	20.0%	20.0%	25.0%	25.0%
65	20.0%	25.0%	25.0%	35.0%
66	20.0%	30.0%	25.0%	25.0%
67	20.0%	25.0%	25.0%	25.0%
68	20.0%	30.0%	25.0%	30.0%
69	20.0%	25.0%	30.0%	30.0%
70	30.0%	30.0%	30.0%	30.0%
71	25.0%	25.0%	40.0%	30.0%
72	25.0%	35.0%	50.0%	30.0%
73	25.0%	35.0%	25.0%	35.0%
74	25.0%	35.0%	25.0%	35.0%
75	100.0%	100.0%	100.0%	100.0%

COMPARISON OF ACTUAL AND EXPECTED SERVICE RETIREMENTS BASED ON PROPOSED RATES

AGE	NUMBER OF SERVICE RETIREMENTS Under 30 Years of Service		
	Actual	Expected	Ratio of Actual to Expected
Under 55	45	48	0.938
55	22	19	1.158
56	24	19	1.263
57	18	19	0.947
58	24	21	1.143
59	22	19	1.158
60	51	50	1.020
61	38	38	1.000
62	60	63	0.952
63	61	59	1.034
64	42	41	1.024
65	41	38	1.079
66	40	35	1.143
67	20	21	0.952
68	23	18	1.278
69	10	9	1.111
70	10	10	1.000
71	6	6	1.000
72	7	6	1.167
73	7	4	1.750
74	1	3	0.333
SUBTOTAL	**572**	**546**	**1.048**
75+	6	11	0.545
TOTAL	**578**	**557**	**1.038**

AGE	NUMBER OF SERVICE RETIREMENTS 30 or More Years of Service		
	Actual	Expected	Ratio of Actual to Expected
Under 55	0	3	0.000
55	11	11	1.000
56	16	14	1.143
57	11	13	0.846
58	14	14	1.000
59	24	23	1.043
60	28	26	1.077
61	25	24	1.042
62	20	19	1.053
63	13	13	1.000
64	16	14	1.143
65	20	17	1.176
66	8	8	1.000
67	8	8	1.000
68	9	8	1.125
69	7	6	1.167
70	6	5	1.200
71	2	3	0.667
72	3	4	0.750
73	7	3	2.333
74	0	0	0.000
SUBTOTAL	**248**	**236**	**1.051**
75+	3	8	0.375
TOTAL	**251**	**244**	**1.029**

RATES OF SALARY INCREASE

COMPARISON OF ACTUAL AND EXPECTED SALARIES OF ACTIVE MEMBERS

SERVICE OF GROUP	SALARIES AT END OF YEAR (1000's)		
	MALES AND FEMALES		
	Actual	Expected	Ratio of Actual to Expected
0	181,453	182,020	0.997
1	144,091	143,520	1.004
2	102,572	104,429	0.982
3	88,722	88,805	0.999
4	75,492	75,147	1.005
5 - 9	263,125	263,622	0.998
10 - 14	239,311	240,012	0.997
15 - 19	138,841	137,383	1.011
20 - 24	152,836	150,964	1.012
25 - 29	122,351	123,527	0.990
30 +	61,082	60,679	1.007
TOTAL	**1,569,876**	**1,570,108**	**1.000**

The preceding results indicate that the actual rates of salary increases were very close to expected over this five-year period at almost all service group levels. Therefore, we recommend no change in the rates of salary increase at this time.

OTHER ASSUMPTIONS AND METHODS

PERCENT MARRIED: Currently, 64% of active members are assumed to be married with the male three years older than his spouse. Active members are assumed to have one child age ten. Since the data we currently have does not include spousal or family information, we will recommend no change to this assumption at this time, but will review closely during the next experience study if this data can be provided.

VALUATION COST METHOD: The Entry Age Normal (EAN) cost method is currently used to determine the annual cost of the plans. The EAN cost method is the most widely used cost method of large public sector plans and has demonstrated the highest degree of contribution stability as compared to alternative methods. Actuarial gains and losses under EAN are reflected in the unfunded actuarial accrued liability. We recommend no change at this time.

WITHDRAWAL ASSUMPTION: It is assumed that 35% of the vested members who terminate elect to withdraw their contributions while the remaining 65% elect to leave their contributions in the plan in order to be eligible for a benefit at their retirement date. After reviewing the refund logs provided over the past 6 years, we recommend changing this assumption to 15% of vested members withdrawing their contributions upon termination, and the remaining 85% leaving their contributions in the plan in order to receive a deferred benefit at their normal retirement date.

ADMINISTRATIVE EXPENSE ASSUMPTION: Starting with the 2012 actuarial valuation, it has been assumed that administrative expenses would be 1.20% of expected payroll for all active members and this assumption is weighted the same for all Plans. This is a common approach for allocating administrative expenses where there are multiple Plans with commingled assets. However, it appears actual administrative expenses as shown in the financial statements are being allocated based on asset values instead of payroll or headcount.

Over the experience period, total administrative expenses have actually been higher than expected during the experience period, with teacher administrative expenses slightly lower than expected and police officer and firefighter administrative expenses higher than expected. **We recommend keeping the administrative expense assumption for Teachers' Plan at 1.20% of payroll.**

RATES OF WITHDRAWAL

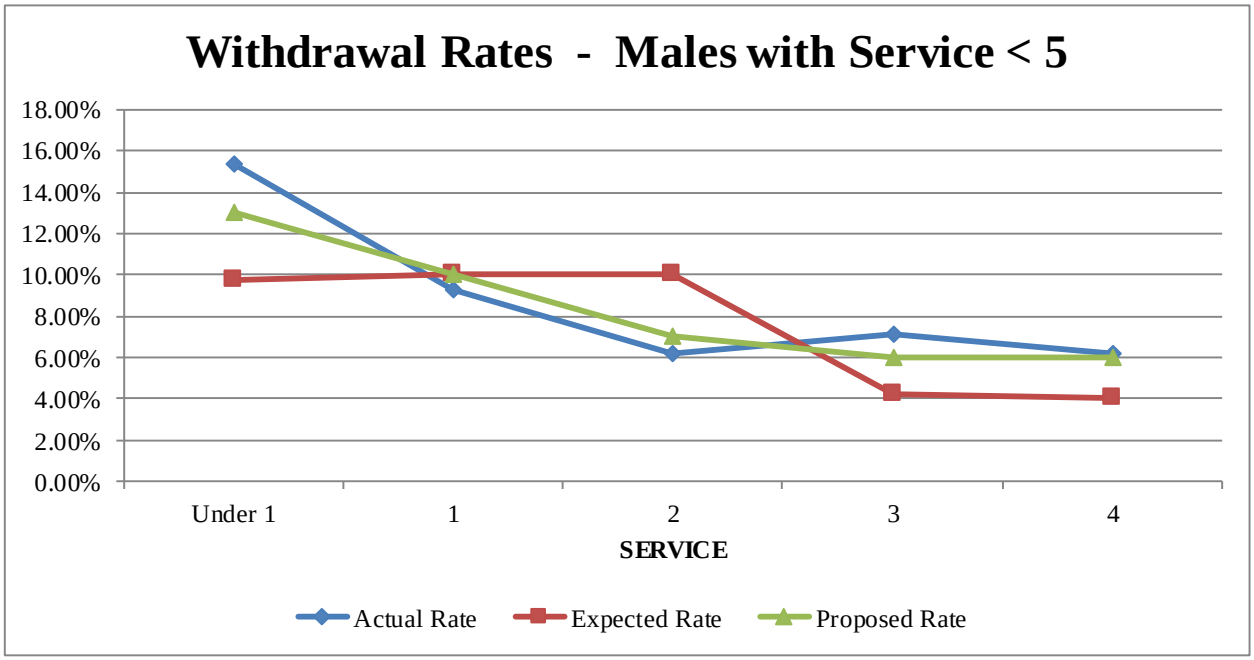
COMPARISON OF ACTUAL AND EXPECTED WITHDRAWALS FROM ACTIVE SERVICE

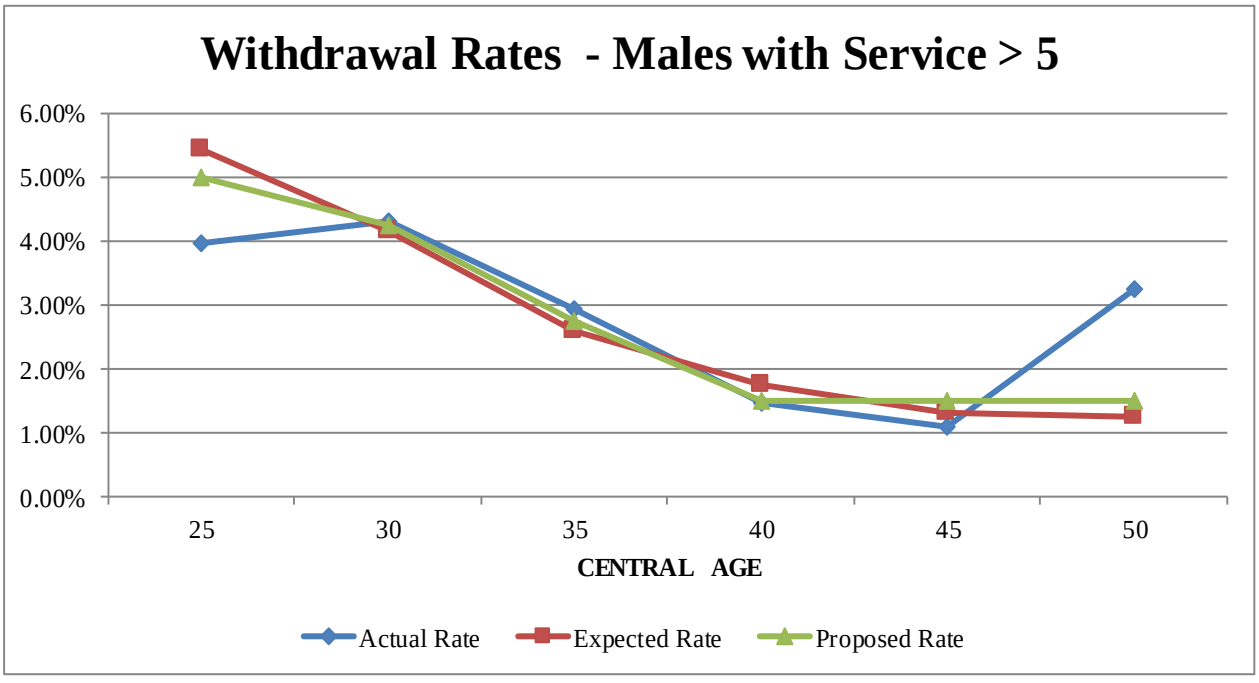
SERVICE	NUMBER OF WITHDRAWALS - LESS THAN 5 YEARS OF SERVICE					
	MALES			FEMALES		
	Actual	Expected	Ratio of Actual to Expected	Actual	Expected	Ratio of Actual to Expected
Under 1	14	9	1.556	3	3	1.000
1	55	59	0.932	20	15	1.333
2	30	49	0.612	9	12	0.750
3	32	19	1.684	5	3	1.667
4	29	19	1.526	7	3	2.333
TOTAL	**160**	**155**	**1.032**	**44**	**36**	**1.222**

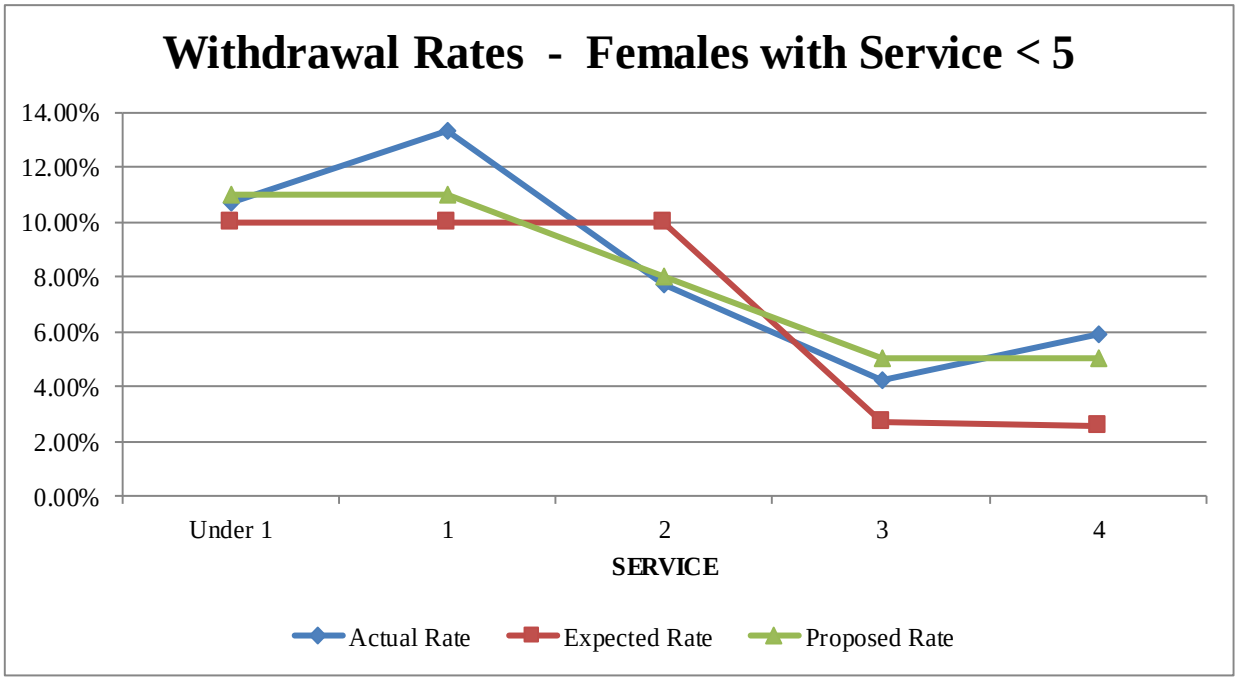
CENTRAL AGE OF GROUP	NUMBER OF WITHDRAWALS - 5 OR MORE YEARS OF SERVICE					
	MALES			FEMALES		
	Actual	Expected	Ratio of Actual to Expected	Actual	Expected	Ratio of Actual to Expected
25	6	8	0.750	2	2	1.000
30	60	58	1.034	23	13	1.769
35	52	46	1.130	17	9	1.889
40	33	39	0.846	10	11	0.909
45	39	46	0.848	13	14	0.929
50	68	26	2.615	26	8	3.250
55	17	4	4.250	4	1	4.000
60	2	0	0.000	0	0	0.000
TOTAL	**277**	**227**	**1.220**	**95**	**58**	**1.638**

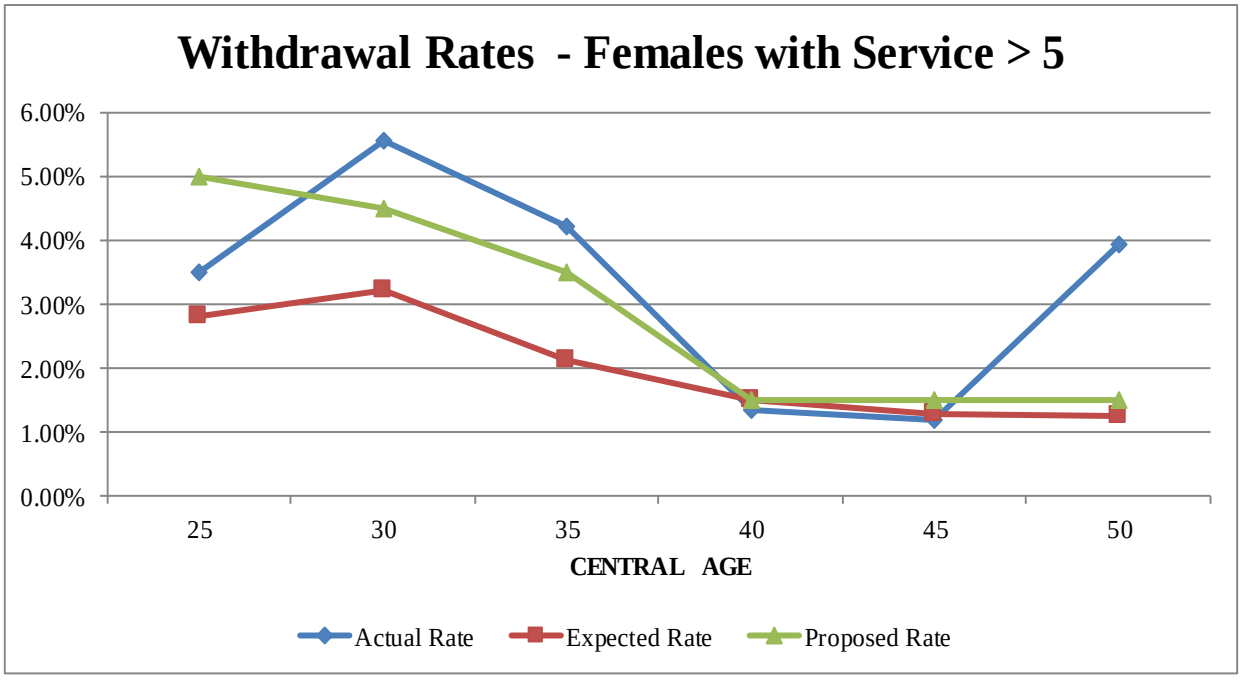
The following graphs show a comparison of the present, actual and proposed rates of withdrawal.

RATES OF WITHDRAWAL FOR ACTIVE MEMBERS









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 the actual number of withdrawals is more than expected for males

and females at both service breakdowns. We recommend that the rates of withdrawal be revised to more closely reflect the experience of the system.

The following table shows a comparison between the present withdrawal rates and the proposed withdrawal rates for members.

COMPARATIVE RATES OF WITHDRAWAL

SERVICE	RATES OF WITHDRAWAL - LESS THAN 5 YEARS OF SERVICE			
	MALES		FEMALES	
	Present	Proposed	Present	Proposed
< 1	10.0%	13.0%	10.0%	11.0%
1	10.0%	10.0%	10.0%	11.0%
2	10.0%	7.0%	10.0%	8.0%
3	NA	6.0%	NA	5.0%
4	NA	6.0%	NA	5.0%

AGE	RATES OF WITHDRAWAL - MORE THAN 5 YEARS OF SERVICE			
	MALES		FEMALES	
	Present	Proposed	Present	Proposed
25	6.00%	5.00%	2.50%	5.00%
30	4.25%	4.25%	3.50%	4.50%
35	2.50%	2.75%	2.00%	3.50%
40	1.75%	1.50%	1.50%	1.50%
45	1.25%	1.50%	1.25%	1.50%
50	1.25%	1.50%	1.25%	1.50%
55	1.25%	1.50%	1.25%	1.50%

COMPARISON OF ACTUAL AND EXPECTED WITHDRAWALS FROM ACTIVE SERVICE BASED ON PROPOSED RATES

SERVICE	NUMBER OF WITHDRAWALS - LESS THAN 5 YEARS OF SERVICE					
	MALES			FEMALES		
	Actual	Expected	Ratio of Actual to Expected	Actual	Expected	Ratio of Actual to Expected
Under 1	14	12	1.167	3	3	1.000
1	55	59	0.932	20	17	1.176
2	30	34	0.882	9	9	1.000
3	32	27	1.185	5	6	0.833
4	29	28	1.036	7	6	1.167
TOTAL	**160**	**160**	**1.000**	**44**	**41**	**1.073**

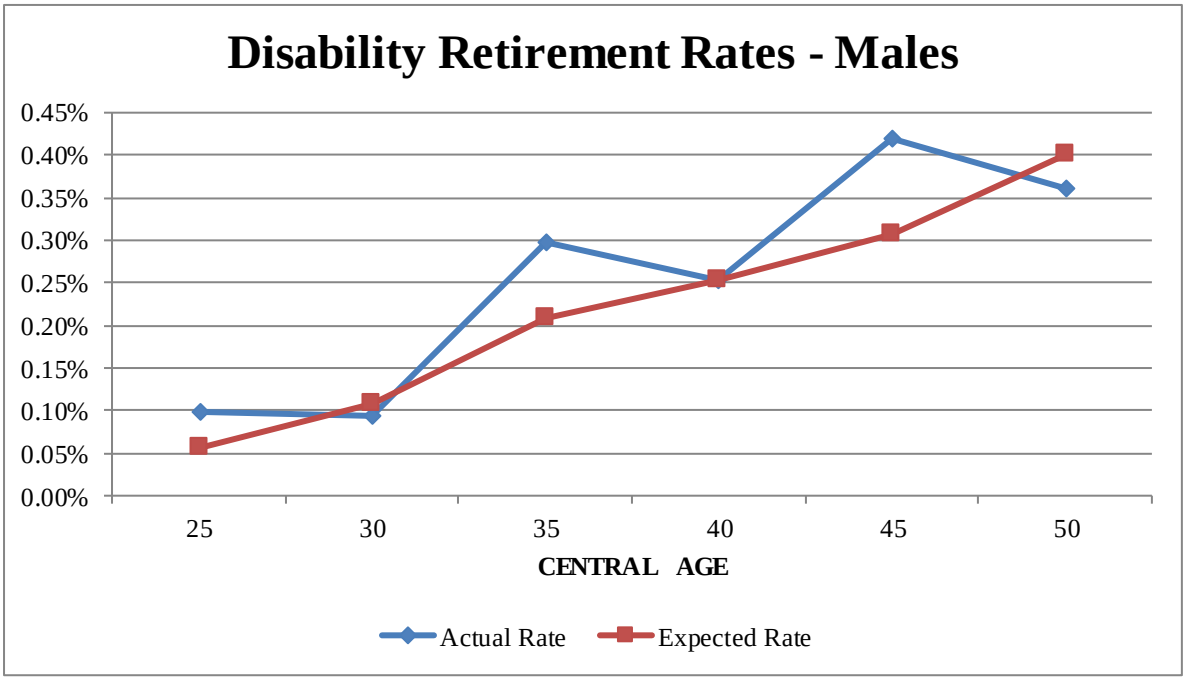
CENTRAL AGE OF GROUP	NUMBER OF WITHDRAWALS - 5 OR MORE YEARS OF SERVICE					
	MALES			FEMALES		
	Actual	Expected	Ratio of Actual to Expected	Actual	Expected	Ratio of Actual to Expected
25	6	8	0.750	2	3	0.667
30	60	59	1.017	23	19	1.211
35	52	49	1.061	17	14	1.214
40	33	34	0.971	10	11	0.909
45	39	53	0.736	13	16	0.813
50	68	31	2.194	26	10	2.600
55	17	5	3.400	4	1	4.000
60	2	0	0.000	0	0	0.000
TOTAL	**277**	**239**	**1.159**	**95**	**74**	**1.284**

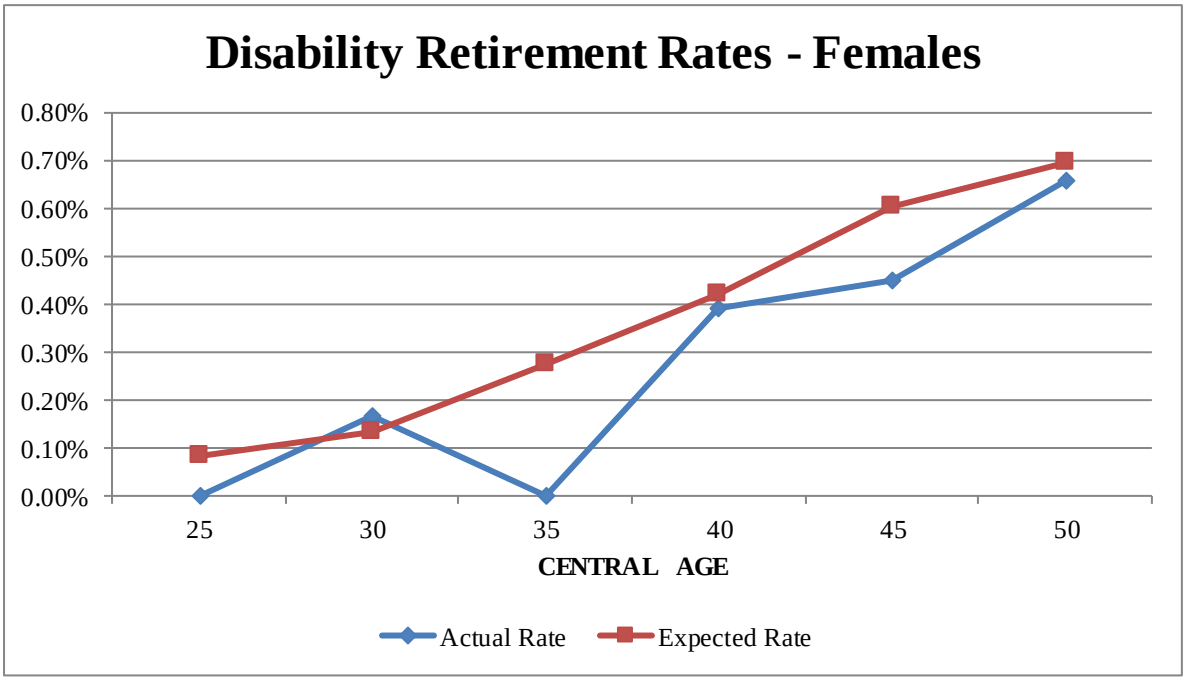
RATES OF DISABILITY RETIREMENT

COMPARISON OF ACTUAL AND EXPECTED DISABILITY RETIREMENTS

CENTRAL AGE OF GROUP	NUMBER OF DISABILITY RETIREMENTS					
	MALES			FEMALES		
	Actual	Expected	Ratio of Actual to Expected	Actual	Expected	Ratio of Actual to Expected
25	1	1	0.000	0	0	0.000
30	2	2	1.000	1	1	1.000
35	6	4	1.500	0	1	0.000
40	6	6	1.000	3	3	1.000
45	15	11	1.364	5	7	0.714
50	10	11	0.909	6	6	1.000
55+	0	4	0.000	3	2	1.500
TOTAL	**40**	**39**	**1.026**	**18**	**20**	**0.900**

The following graphs show a comparison of the present and actual rates of disability retirements.





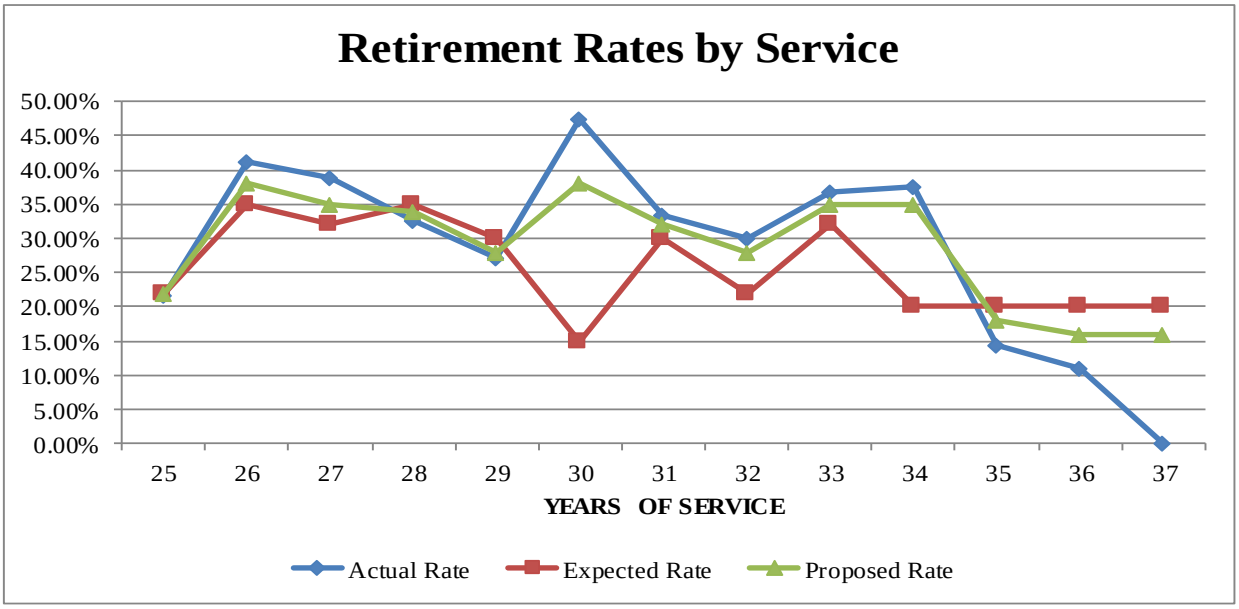
During the period under investigation, the actual rates of disability retirement matched the expected amounts for males overall and were just slightly less than expected for females. Therefore, we recommend keeping the current rates of disability.

RATES OF SERVICE RETIREMENT

COMPARISON OF ACTUAL AND EXPECTED RETIREMENTS

SERVICE	NUMBER OF SERVICE RETIREMENTS		
	Actual	Expected	Ratio of Actual to Expected
Under 25	5	3	1.667
25	100	101	0.990
26	123	105	1.171
27	76	63	1.206
28	53	57	0.930
29	43	48	0.896
30	53	17	3.118
31	17	15	1.133
32	9	7	1.286
33	7	6	1.167
34	3	2	1.500
35	1	1	1.000
36	1	2	0.500
37	0	1	0.000
38	0	1	0.000
39	1	1	1.000
SUBTOTAL	492	430	1.144
40 and Over	16	48	0.333
TOTAL	**508**	**478**	**1.063**

The following graphs show a comparison of the present and actual rates of service retirements.



The preceding results indicate that overall, the actual number of retirements was slightly more than expected. Therefore, we recommend revising the rates of retirement to match the experience more closely.

The following table shows a comparison between the present and the proposed retirement rates.

COMPARATIVE RATES OF SERVICE RETIREMENT

RATES OF SERVICE RETIREMENT		
SERVICE	Present*	Proposed*
Under 25	12.5%	15.0%
25	22.0%	22.0%
26	35.0%	38.0%
27	32.0%	35.0%
28	35.0%	34.0%
29	30.0%	28.0%
30	15.0%	38.0%
31	30.0%	32.0%
32	22.0%	28.0%
33	32.0%	35.0%
34	20.0%	35.0%
35	20.0%	18.0%
36	20.0%	16.0%
37	20.0%	16.0%
38	20.0%	16.0%
39	20.0%	16.0%
40 and Over	20.0%	16.0%

* 100% assumed rate at age 65.

COMPARISON OF ACTUAL AND EXPECTED SERVICE RETIREMENTS BASED ON PROPOSED RATES

SERVICE	NUMBER OF SERVICE RETIREMENTS		
	Actual	Expected	Ratio of Actual to Expected
Under 25	5	5	1.000
25	100	101	0.990
26	123	114	1.079
27	76	69	1.101
28	53	55	0.964
29	43	45	0.956
30	53	43	1.233
31	17	16	1.063
32	9	8	1.125
33	7	7	1.000
34	3	3	1.000
35	1	1	1.000
36	1	1	1.000
37	0	1	0.000
38	0	1	0.000
39	1	1	1.000
SUBTOTAL	492	471	1.045
40 and Over	16	46	0.348
TOTAL	**508**	**517**	**0.983**

RATES OF SALARY INCREASE

COMPARISON OF ACTUAL AND EXPECTED SALARIES OF ACTIVE MEMBERS

SERVICE OF GROUP	SALARIES AT END OF YEAR (1000's)		
	MALES AND FEMALES		
	Actual	Expected	Ratio of Actual to Expected
0	41,937	42,121	0.996
1	33,336	33,166	1.005
2	32,126	33,230	0.967
3	33,048	35,451	0.932
4	41,335	42,688	0.968
5 - 9	243,204	252,055	0.965
10 - 14	220,009	227,779	0.966
15 - 19	149,156	154,839	0.963
20 - 24	467,797	495,944	0.943
25 - 29	95,795	103,390	0.927
30 +	14,216	15,018	0.947
TOTAL	**1,371,959**	**1,435,681**	**0.956**

The preceding results indicate that salary increases were less than expected over this five-year period as was the case over the previous four-year study period. These results indicate a need to reduce the rate of assumed salary increases. This will automatically take place due to the proposed reduction in the price inflation assumption. In addition to the change in the price inflation assumption, we have also refined the merit scale portion of the assumption to match the step, retention, and longevity increases included in the most recent collective bargaining agreement.

SERVICE OF GROUP	SALARY INCREASE RATES	
	Present	Proposed
< 1	9.46%	9.46%
1	9.46%	8.94%
2	9.46%	7.38%
3	9.46%	6.86%
4	7.96%	6.34%
5	7.96%	5.83%
6	7.96%	5.83%
7-18	7.12%	5.83%
19	6.86%	12.47%
20	14.15%	5.57%
21	6.86%	5.31%
22	6.86%	5.05%
23	6.86%	4.79%
24	6.86%	7.07%
25	16.34%	4.53%
26 +	5.29%	4.27%

The following table shows a comparison of actual salary increases to the proposed increases over the 5 year study period.

SERVICE OF GROUP	SALARIES AT END OF YEAR (1000's)		
	MALES AND FEMALES		
	Actual	Expected	Ratio of Actual to Expected
0	41,937	42,119	0.996
1	33,336	33,007	1.010
2	32,126	32,598	0.986
3	33,048	34,609	0.955
4	41,335	42,048	0.983
5 - 9	243,204	248,284	0.980
10 - 14	220,009	226,172	0.973
15 - 19	149,156	154,796	0.964
20 - 24	467,797	484,049	0.966
25 - 29	95,795	98,282	0.975
30 +	14,216	14,465	0.983
TOTAL	**1,371,959**	**1,410,430**	**0.973**

OTHER ASSUMPTIONS AND METHODS

PERCENT MARRIED: Currently 80% of active members are assumed to be married with the male three years older than his spouse. Active members are assumed to have one child age ten. Since the data we currently have does not include spousal or family information, we will recommend no change to this assumption at this time, but will review closely during the next experience study if this data can be provided.

VALUATION COST METHOD: The Entry Age Normal (EAN) cost method is currently used to determine the annual cost of the plans. The EAN cost method is the most widely used cost method of large public sector plans and has demonstrated the highest degree of contribution stability as compared to alternative methods. Actuarial gains and losses under EAN are reflected in the unfunded actuarial accrued liability. We recommend no change at this time.

WITHDRAWAL ASSUMPTION: It is assumed that 80% of the vested members who terminate elect to withdraw their contributions while the remaining 20% elect to leave their contributions in the plan in order to be eligible for a benefit at their retirement date. After reviewing the refund logs provided over the past 6 years, we recommend changing this assumption to 25% of vested members withdrawing their contributions upon termination, and the remaining 75% leaving their contributions in the plan in order to receive a deferred benefit at their normal retirement date.

ADMINISTRATIVE EXPENSE ASSUMPTION: Starting with the 2012 actuarial valuation, it has been assumed that administrative expenses would be 1.20% of expected payroll for all active members and this assumption is weighted the same for all Plans. This is a common approach for allocating administrative expenses where there are multiple Plans with commingled assets. However, it appears actual administrative expenses as shown in the financial statements are being allocated based on asset values instead of payroll or headcount.

Over the experience period, total administrative expenses have actually been higher than expected during the experience period, with teacher administrative expenses slightly lower than expected and police officer and firefighter administrative expenses higher than expected. **We recommend increasing the administrative expense assumption for the Police Officers' Plan and Firefighters' Plan to 2.10% of payroll.**

PRE-RETIREMENT DEATH BENEFITS: To value the pre-retirement death benefit, the benefit form for all retirements (normal or disabled) is assumed to be a 67.8% Joint and Survivor annuity for all participants (based on 40% of average pay survivor benefits). One-fourth of all active deaths are assumed to occur in the line of duty. We recommend maintaining this assumption.

PERCENT OF DISABILITY: Three-fourths of all disabilities are assumed to occur in the line of duty. For all disability retirements occurring in the line of duty, the percent of disability is assumed to be 100%. We recommend no change to these assumptions.

RATES OF WITHDRAWAL

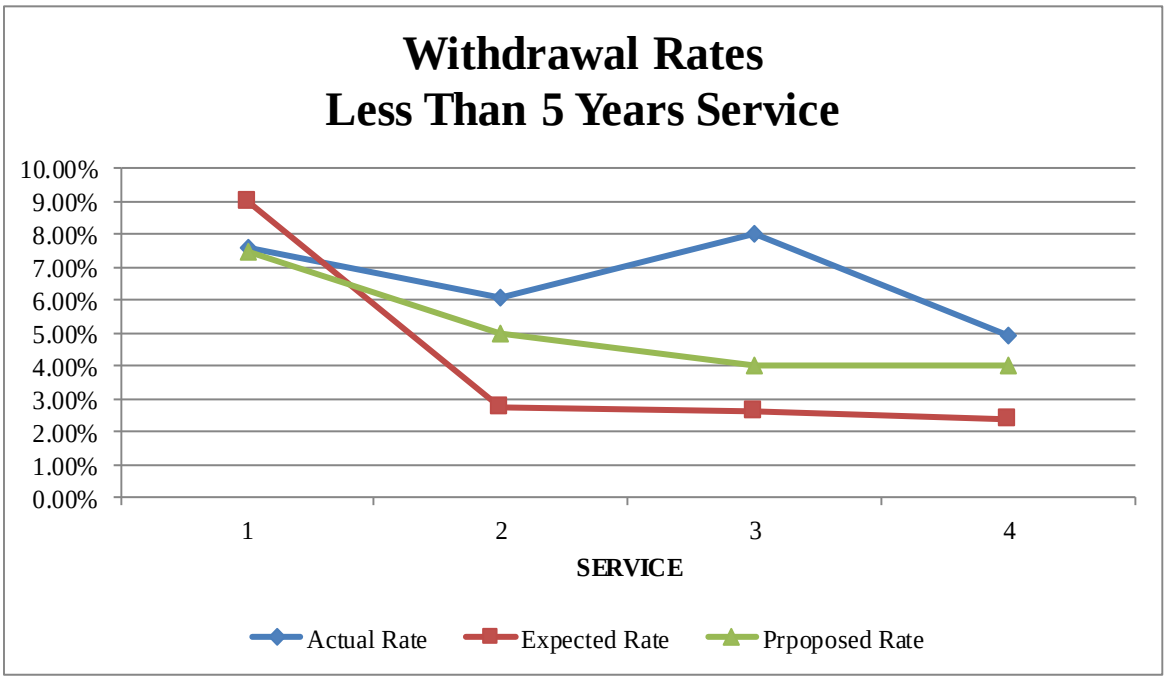
COMPARISON OF ACTUAL AND EXPECTED WITHDRAWALS FROM ACTIVE SERVICE

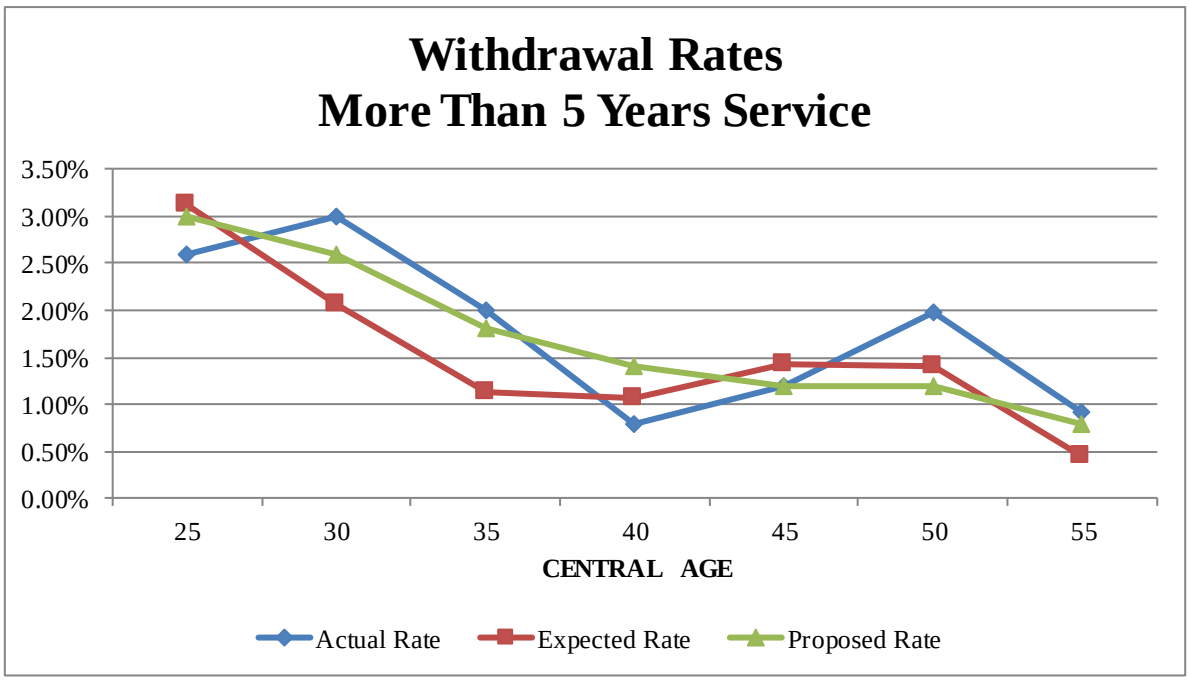
SERVICE	NUMBER OF WITHDRAWALS LESS THAN 5 YEARS OF SERVICE		
	Actual	Expected	Ratio of Actual to Expected
Under 1	0	0	0.000
1	13	15	0.845
2	14	6	2.219
3	21	7	3.061
4	21	10	2.057
TOTAL	**69**	**39**	**1.780**

CENTRAL AGE OF GROUP	NUMBER OF WITHDRAWALS 5 OR MORE YEARS OF SERVICE		
	Actual	Expected	Ratio of Actual to Expected
25	11	13	0.828
30	35	24	1.455
35	24	13	1.783
40	11	15	0.744
45	17	21	0.829
50	16	11	1.411
55	1	0	2.083
60	0	0	0.000
TOTAL	**115**	**98**	**1.175**

The following graph shows a comparison of the present, actual and proposed rates of withdrawal.

RATES OF WITHDRAWAL FOR ACTIVE MEMBERS





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 the actual number of withdrawals for members with less than 5 years of service is significantly more than expected. For members with 5 more years of service, the actual number of withdrawals is somewhat more than expected. Therefore, we recommend that the rates of withdrawal be revised to more closely reflect the experience of the system.

The following table shows a comparison between the present withdrawal rates and the proposed withdrawal rates for members with five or more years of service.

COMPARATIVE RATES OF WITHDRAWAL

SERVICE	RATES OF WITHDRAWAL	
	Less than 5 years of service	
	Present	Proposed
< 1	9.00%	7.50%
1	9.00%	7.50%
2	NA	5.00%
3	NA	4.00%
4	NA	4.00%

AGE	RATES OF WITHDRAWAL	
	5 or more years of service	
	Present	Proposed
25	3.50%	3.00%
30	2.00%	2.60%
35	1.00%	1.80%
40	1.00%	1.40%
45	1.50%	1.20%
50	1.50%	1.20%
55	0.00%	0.80%

COMPARISON OF ACTUAL AND EXPECTED WITHDRAWALS FROM ACTIVE SERVICE BASED ON PROPOSED RATES

SERVICE	NUMBER OF WITHDRAWALS LESS THAN 5 YEARS OF SERVICE		
	Actual	Expected	Ratio of Actual to Expected
Under 1	0	0	0.000
1	13	13	1.014
2	14	12	1.217
3	21	10	2.004
4	21	17	1.232
TOTAL	**69**	**52**	**1.331**

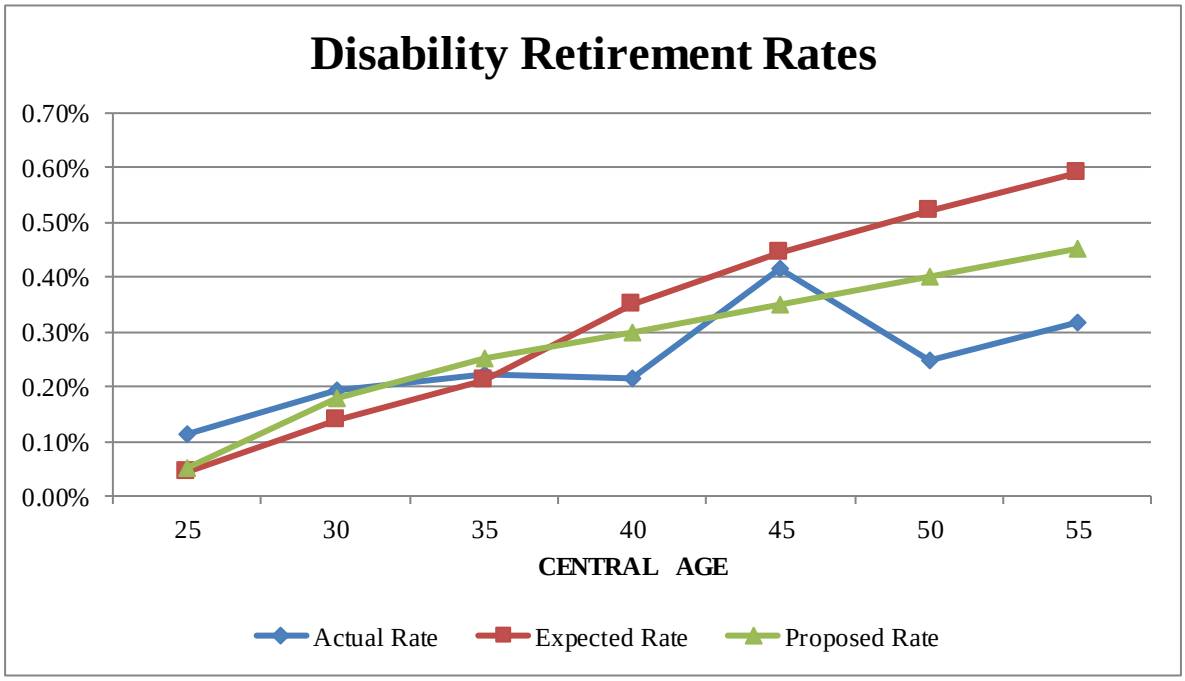
CENTRAL AGE OF GROUP	NUMBER OF WITHDRAWALS 5 OR MORE YEARS OF SERVICE		
	Actual	Expected	Ratio of Actual to Expected
25	11	13	0.863
30	35	30	1.155
35	24	22	1.110
40	11	19	0.569
45	17	17	0.989
50	16	10	1.656
55	1	1	1.147
60	0	0	0.000
TOTAL	**115**	**112**	**1.029**

RATES OF DISABILITY RETIREMENT

COMPARISON OF ACTUAL AND EXPECTED DISABILITY RETIREMENTS

CENTRAL AGE OF GROUP	NUMBER OF DISABILITY RETIREMENTS		
	Actual	Expected	Ratio of Actual to Expected
30	4	3	1.556
35	3	3	1.060
40	3	5	0.619
45	6	6	0.939
50	3	6	0.480
55	2	4	0.535
60	1	0	3.571
TOTAL	**22**	**27**	**0.818**

The following graphs show a comparison of the present, actual, and proposed rates of disability retirements.



During the period under investigation, the actual rates of disability retirement were less than expected. Therefore, we recommend the rates of disability retirement be revised to more closely 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 RETIREMENT

AGE	RATES OF DISABILITY RETIREMENT	
	Present	Proposed
25	0.02%	0.05%
30	0.15%	0.18%
35	0.20%	0.25%
40	0.35%	0.30%
45	0.45%	0.35%
50	0.52%	0.40%
55	0.60%	0.45%
60	0.70%	0.50%

COMPARISON OF ACTUAL AND EXPECTED DISABILITY RETIREMENTS BASED ON PROPOSED RATES

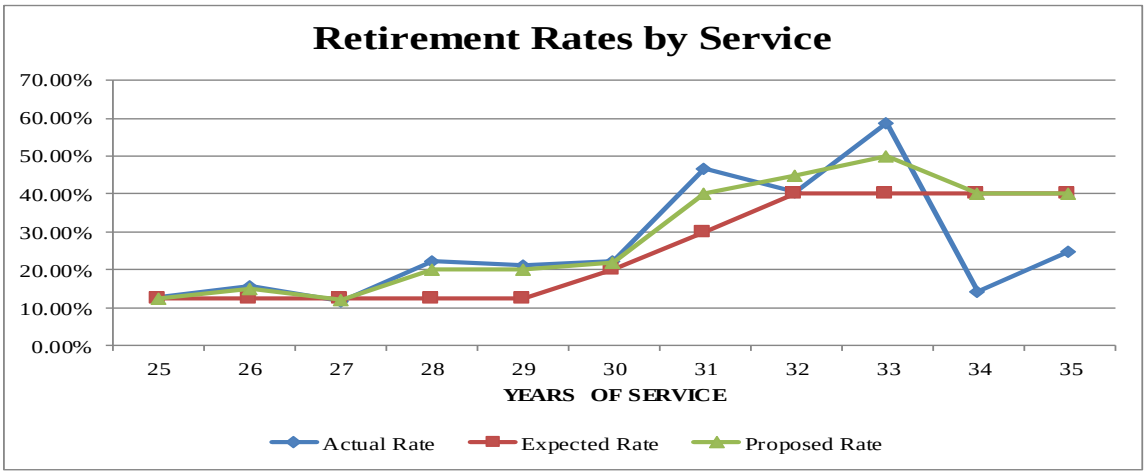
CENTRAL AGE OF GROUP	NUMBER OF DISABILITY RETIREMENTS		
	Actual	Expected	Ratio of Actual to Expected
30	4	3	1.228
35	3	3	0.894
40	3	4	0.719
45	6	5	1.190
50	3	5	0.624
55	2	3	0.703
60	1	0	2.941
TOTAL	**22**	**24**	**0.924**

RATES OF SERVICE RETIREMENT

COMPARISON OF ACTUAL AND EXPECTED RETIREMENTS

YEARS OF SERVICE	NUMBER OF SERVICE RETIREMENTS		
	Actual	Expected	Ratio of Actual to Expected
Under 25	3	11	0.282
25	16	16	1.032
26	25	20	1.249
27	15	16	0.951
28	35	20	1.717
29	33	20	1.638
30	22	20	1.078
31	30	21	1.408
32	15	17	0.904
33	10	8	1.250
34	1	4	0.250
35	1	2	0.455
36	1	2	0.625
37	4	3	1.538
38	1	2	0.455
39	2	2	1.111
40 & Over	1	1	1.000
TOTAL	**215**	**184**	**1.167**

The following graphs show a comparison of the present and actual rates of service retirements.



RATES OF RETIREMENT FOR ACTIVE MEMBERS

The preceding results indicate that the actual number of retirements during this period of investigation is slightly more than expected. Therefore, we recommend adjusting the rates of retirement to more closely match the experience of the Plan. The following table shows a comparison between the present retirement rates and the proposed rates.

COMPARATIVE RATES OF SERVICE RETIREMENT

Years of Service	RATES OF SERVICE RETIREMENT*	
	Present	Proposed
25	12.5%	12.5%
26	12.5%	15.0%
27	12.5%	12.0%
28	12.5%	20.0%
29	12.5%	20.0%
30	20.0%	22.0%
31	30.0%	40.0%
32	40.0%	45.0%
33	40.0%	50.0%
34	40.0%	40.0%
35	40.0%	40.0%

*100% assumed rate at age 60

COMPARISON OF ACTUAL AND EXPECTED SERVICE RETIREMENTS BASED ON PROPOSED RATES

YEARS OF SERVICE	NUMBER OF SERVICE RETIREMENTS		
	Actual	Expected	Ratio of Actual to Expected
Under 25	3	2	1.600
25	16	16	1.032
26	25	24	1.042
27	15	15	0.992
28	35	31	1.122
29	33	31	1.071
30	22	22	1.020
31	30	26	1.172
32	15	17	0.901
33	10	9	1.176
34	1	3	0.357
35	1	2	0.625
36	1	2	0.625
37	4	2	2.000
38	1	2	0.625
39	2	1	1.667
40 & Over	1	0	2.500
TOTAL	**215**	**202**	**1.064**

RATES OF SALARY INCREASE

COMPARISON OF ACTUAL AND EXPECTED SALARIES OF ACTIVE MEMBERS

SERVICE OF GROUP	SALARIES AT END OF YEAR (1000's) MALES AND FEMALES		
	Actual	Expected	Ratio of Actual to Expected
0	7,783	7,803	0.997
1	10,924	10,990	0.994
2	12,777	12,732	1.004
3	22,067	21,963	1.005
4	23,909	24,707	0.968
5 - 9	145,292	146,342	0.993
10 - 14	95,594	96,701	0.989
15 - 19	74,580	77,175	0.966
20 - 24	121,082	125,097	0.968
25 - 29	76,879	81,785	0.940
30 +	8,321	8,787	0.947
TOTAL	**599,208**	**614,082**	**0.976**

The preceding results indicate that salary increases were less than expected over this five-year period, especially with service levels 15 years and over. This was also the case in the prior experience study. Therefore, we recommend modest decreases for the 15 years of service and over group in the rates of salary increase at this time. Most of the decrease is due to the decrease in the inflation assumption. The merit/seniority portion of the scale is based on the collective bargaining agreement pay scales.

SERVICE OF GROUP	SALARY INCREASE RATES	
	Present	Proposed
0	2.50%	3.00%
1	2.50%	3.00%
2	2.50%	3.00%
3	2.50%	3.00%
4	2.50%	3.00%
5 - 9	2.50%	3.00%
10 - 14	2.50%	3.00%
15 +	2.50%	1.25%

A comparison of actual pay increases to the proposed salary scale are seen in the following table.

SERVICE OF GROUP	SALARIES AT END OF YEAR (1000's)		
	MALES AND FEMALES		
	Actual	Expected	Ratio of Actual to Expected
0	7,783	7,822	0.995
1	10,924	11,017	0.992
2	12,777	12,764	1.001
3	22,067	22,017	1.002
4	23,909	24,768	0.965
5 - 9	145,292	146,704	0.990
10 - 14	95,594	96,940	0.986
15 - 19	74,580	76,085	0.980
20 - 24	121,082	122,642	0.987
25 - 29	76,879	79,079	0.972
30 +	8,321	9,087	0.916
TOTAL	**599,208**	**608,925**	**0.984**

OTHER ASSUMPTIONS AND METHODS

PERCENT MARRIED: Currently 80% of active members are assumed to be married with the male three years older than his spouse. Active members are assumed to have one child age ten. Since the data we currently have does not include spousal or family information, we will recommend no change to this assumption at this time, but will review closely during the next experience study if this data can be provided.

VALUATION COST METHOD: The Entry Age Normal (EAN) cost method is currently used to determine the annual cost of the plans. The EAN cost method is the most widely used cost method of large public sector plans and has demonstrated the highest degree of contribution stability as compared to alternative methods. Actuarial gains and losses under EAN are reflected in the unfunded actuarial accrued liability. We recommend no change at this time.

WITHDRAWAL ASSUMPTION: It is assumed that 80% of the vested members who terminate elect to withdraw their contributions while the remaining 20% elect to leave their contributions in the plan in order to be eligible for a benefit at their retirement date. After reviewing the refund logs provided over the past 6 years, we recommend changing this assumption to 15% of vested members withdrawing their contributions upon termination, and the remaining 85% leaving their contributions in the plan in order to receive a deferred benefit at their normal retirement date.

ADMINISTRATIVE EXPENSE ASSUMPTION: Starting with the 2012 actuarial valuation, it has been assumed that administrative expenses would be 1.20% of expected payroll for all active members and this assumption is weighted the same for all Plans. This is a common approach for allocating administrative expenses where there are multiple Plans with commingled assets. However, it appears actual administrative expenses as shown in the financial statements are being allocated based on asset values instead of payroll or headcount.

Over the experience period, total administrative expenses have actually been higher than expected during the experience period, with teacher administrative expenses slightly lower than expected and police officer and firefighter administrative expenses higher than expected. **We recommend increasing the administrative expense assumption for the Police Officers' Plan and Firefighters' Plan to 2.10% of payroll.**

PRE-RETIREMENT DEATH BENEFITS: To value the pre-retirement death benefit, the benefit form for all retirements (normal or disabled) is assumed to be a 67.8% Joint and Survivor annuity for all participants (based on 40% of average pay survivor benefits). One-fourth of all active deaths are assumed to occur in the line of duty. We recommend maintaining this assumption.

PERCENT OF DISABILITY: Three-fourths of all disabilities are assumed to occur in the line of duty. For all disability retirements occurring in the line of duty, the percent of disability is assumed to be 100%. We recommend no change to these assumptions.

Historical September CPI (U) Index

Year	CPI (U)	Year	CPI (U)
1965	31.6	1991	137.2
1966	32.7	1992	141.3
1967	33.6	1993	145.1
1968	35.1	1994	149.4
1969	37.1	1995	153.2
1970	39.2	1996	157.8
1971	40.8	1997	161.2
1972	42.1	1998	163.6
1973	45.2	1999	167.9
1974	50.6	2000	173.7
1975	54.6	2001	178.3
1976	57.6	2002	181.0
1977	61.4	2003	185.2
1978	66.5	2004	189.9
1979	74.6	2005	198.8
1980	84.0	2006	202.9
1981	93.2	2007	208.5
1982	97.9	2008	218.8
1983	100.7	2009	216.0
1984	105.0	2010	218.4
1985	108.3	2011	226.9
1986	110.2	2012	231.4
1987	115.0	2013	234.1
1988	119.8	2014	238.0
1989	125.0	2015	237.9
1990	132.7		

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
Domestic Equity	5.3%	18.0%
International Developed Equity	5.9%	20.0%
International Emerging Equity	8.6%	26.5%
Investment Grade Bonds	0.7%	4.5%
High Yield Bonds	3.5%	12.5%
TIPS	0.4%	7.5%
Emerging Market Debt	3.5%	14.0%
Foreign Developed Market Debt	(0.3)%	9.0%
Bank Loans	2.3%	10.0%
Absolute Return Assets	3.1%	10.5%
Private Equity	7.0%	24.0%
Real Estate	3.9%	29.0%
Infrastructure	3.6%	16.0%
Private Energy Assets	6.0%	22.0%

Asset Allocation Targets

Asset Class	Asset Allocation
Domestic Equity	20%
International Developed Equity	16%
International Emerging Equity	10%
Investment Grade Bonds	11%
High Yield Bonds	4%
TIPS	6%
Emerging Market Debt	4%
Foreign Developed Market Debt	2%
Bank Loans	3%
Absolute Return Assets	4%
Private Equity	9%
Real Estate	6%
Infrastructure	3%
Private Energy Assets	2%

Asset Correlation Matrix

ASSET CLASS	Domestic Equity	International Dev. Eq.	Emerging Markets Eq.	Invest Grade Bonds	High Yield Bonds	TIPS	Emerging Markets Debt	Foreign Dev. Debt	Bank Loans	Absolute Return	Private Equity	Real Estate	Infrastructure	Private Energy
Domestic Equity	1.00													
International Dev. Eq.	0.90	1.00												
Emerging Markets Eq.	0.80	0.90	1.00											
Invest Grade Bonds	0.05	0.05	0.05	1.00										
High Yield Bonds	0.70	0.70	0.70	0.20	1.00									
TIPS	0.15	0.15	0.15	0.80	0.30	1.00								
Emerging Markets Debt	0.65	0.75	0.80	0.35	0.65	0.40	1.00							
Foreign Dev. Debt	0.25	0.45	0.35	0.60	0.25	0.60	0.60	1.00						
Bank Loans	0.60	0.60	0.55	0.00	0.80	0.20	0.40	0.05	1.00					
Absolute Return	0.80	0.85	0.85	0.05	0.70	0.20	0.65	0.30	0.65	1.00				
Private Equity	0.85	0.80	0.75	0.05	0.65	0.05	0.55	0.20	0.65	0.50	1.00			
Real Estate	0.50	0.45	0.40	0.20	0.50	0.10	0.30	0.35	0.45	0.40	0.45	1.00		
Infrastructure	0.55	0.55	0.50	0.30	0.60	0.30	0.60	0.45	0.50	0.60	0.45	0.60	1.00	
Private Energy	0.65	0.00	0.60	0.10	0.45	0.10	0.60	0.30	0.40	0.00	0.55	0.45	0.55	1.00

Social Security Administration Wage Index

Year	Wage Index	Annual Increase	Year	Wage Index	Annual Increase
1963	4,396.64	2.45%	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	(1.50)
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	2014	46,481.52	3.55

TABLE 1
TEACHERS' RETIREMENT PLAN
RATES OF SEPARATION FROM ACTIVE SERVICE

Age	Rates of Withdrawal		Rates of Disability	Rates of Death		Rates of Retirement
	Males	Females		Males	Females	
19	18.00%	18.00%	0.010%	0.0559%	0.0222%	
20	18.00%	18.00%	0.010%	0.0615%	0.0214%	
21	18.00%	18.00%	0.010%	0.0671%	0.0218%	
22	18.00%	18.00%	0.010%	0.0730%	0.0222%	
23	18.00%	18.00%	0.010%	0.0760%	0.0226%	
24	18.00%	18.00%	0.010%	0.0770%	0.0231%	
25	18.00%	18.00%	0.010%	0.0752%	0.0236%	
26	17.60%	17.60%	0.012%	0.0733%	0.0244%	
27	17.20%	17.20%	0.014%	0.0720%	0.0255%	
28	16.80%	16.80%	0.016%	0.0712%	0.0268%	
29	16.40%	16.40%	0.018%	0.0709%	0.0283%	
30	16.00%	16.00%	0.020%	0.0711%	0.0299%	
31	15.20%	14.80%	0.022%	0.0717%	0.0317%	
32	14.40%	13.60%	0.024%	0.0726%	0.0336%	
33	13.60%	12.40%	0.026%	0.0739%	0.0356%	
34	12.80%	11.20%	0.028%	0.0756%	0.0376%	
35	12.00%	10.00%	0.030%	0.0775%	0.0397%	
36	12.00%	9.60%	0.038%	0.0797%	0.0417%	
37	12.00%	9.20%	0.046%	0.0820%	0.0441%	
38	12.00%	8.80%	0.054%	0.0846%	0.0470%	
39	12.00%	8.40%	0.062%	0.0875%	0.0505%	
40	12.00%	8.00%	0.070%	0.0912%	0.0547%	5.00%
41	11.20%	7.70%	0.080%	0.0958%	0.0598%	5.00%
42	10.40%	7.40%	0.090%	0.1019%	0.0658%	5.00%
43	9.60%	7.10%	0.100%	0.1096%	0.0730%	5.00%
44	8.80%	6.80%	0.110%	0.1194%	0.0812%	5.00%
45	8.00%	6.50%	0.120%	0.1313%	0.0907%	5.00%
46	8.00%	6.50%	0.136%	0.1455%	0.1013%	5.00%
47	8.00%	6.50%	0.152%	0.1619%	0.1130%	5.00%
48	8.00%	6.50%	0.168%	0.1806%	0.1258%	5.00%
49	8.00%	6.50%	0.184%	0.2015%	0.1394%	5.00%
50	8.00%	6.50%	0.200%	0.2243%	0.1537%	5.00%
51	8.00%	6.50%	0.210%	0.2490%	0.1685%	5.00%
52	8.00%	6.50%	0.220%	0.2757%	0.1839%	5.00%
53	8.00%	6.50%	0.230%	0.3045%	0.1997%	5.00%
54	8.00%	6.50%	0.240%	0.3357%	0.2162%	5.00%
55	8.00%	6.50%	0.250%	0.3697%	0.2332%	22.00%
56	8.00%	6.50%	0.260%	0.4071%	0.2510%	22.00%
57	8.00%	6.50%	0.270%	0.4485%	0.2697%	20.00%
58	8.00%	6.50%	0.280%	0.4950%	0.2896%	20.00%
59	8.00%	6.50%	0.290%	0.5475%	0.3111%	25.00%
60	8.00%	6.50%	0.300%	0.6069%	0.3347%	28.00%
61	8.00%	6.50%	0.300%	0.6743%	0.3606%	28.00%
62	8.00%	6.50%	0.300%	0.7504%	0.3892%	25.00%
63	8.00%	6.50%	0.300%	0.8362%	0.4209%	22.00%
64	8.00%	6.50%	0.300%	0.9326%	0.4561%	25.00%
65	8.00%	6.50%	0.300%	1.0406%	0.4950%	35.00%
66	8.00%	6.50%	0.300%	1.1612%	0.5456%	25.00%
67	8.00%	6.50%	0.300%	1.2739%	0.6013%	25.00%
68	8.00%	6.50%	0.300%	1.3974%	0.6627%	30.00%
69	8.00%	6.50%	0.300%	1.5330%	0.7303%	30.00%
70	8.00%	6.50%	0.300%	1.6816%	0.8049%	30.00%
71	8.00%	6.50%	0.300%	1.8447%	0.8871%	30.00%
72	8.00%	6.50%	0.300%	2.0237%	0.9777%	30.00%
73	8.00%	6.50%	0.300%	2.2199%	1.0775%	35.00%
74	8.00%	6.50%	0.300%	2.4353%	1.1875%	35.00%
75	8.00%	6.50%	0.300%	2.6715%	1.3088%	100.00%

TABLE 2

POLICE OFFICERS' RETIREMENT PLAN
RATES OF SEPARATION FROM ACTIVE SERVICE

Age	Rates of Withdrawal		Rates of Disability		Rates of Death	
	Males	Females	Males	Females	Males	Females
19	5.00%	5.00%	0.030%	0.020%	0.0559%	0.0222%
20	5.00%	5.00%	0.030%	0.020%	0.0615%	0.0214%
21	5.00%	5.00%	0.036%	0.026%	0.0671%	0.0218%
22	5.00%	5.00%	0.042%	0.032%	0.0730%	0.0222%
23	5.00%	5.00%	0.048%	0.038%	0.0760%	0.0226%
24	5.00%	5.00%	0.054%	0.044%	0.0770%	0.0231%
25	5.00%	5.00%	0.060%	0.050%	0.0752%	0.0236%
26	4.85%	4.90%	0.070%	0.060%	0.0733%	0.0244%
27	4.70%	4.80%	0.080%	0.070%	0.0720%	0.0255%
28	4.55%	4.70%	0.090%	0.080%	0.0712%	0.0268%
29	4.40%	4.60%	0.100%	0.090%	0.0709%	0.0283%
30	4.25%	4.50%	0.110%	0.100%	0.0711%	0.0299%
31	3.95%	4.30%	0.120%	0.110%	0.0717%	0.0317%
32	3.65%	4.10%	0.130%	0.120%	0.0726%	0.0336%
33	3.35%	3.90%	0.140%	0.130%	0.0739%	0.0356%
34	3.05%	3.70%	0.150%	0.140%	0.0756%	0.0376%
35	2.75%	3.50%	0.160%	0.150%	0.0775%	0.0397%
36	2.50%	3.10%	0.174%	0.180%	0.0797%	0.0417%
37	2.25%	2.70%	0.188%	0.210%	0.0820%	0.0441%
38	2.00%	2.30%	0.202%	0.240%	0.0846%	0.0470%
39	1.75%	1.90%	0.216%	0.270%	0.0875%	0.0505%
40	1.50%	1.50%	0.230%	0.300%	0.0912%	0.0547%
41	1.50%	1.50%	0.248%	0.320%	0.0958%	0.0598%
42	1.50%	1.50%	0.266%	0.340%	0.1019%	0.0658%
43	1.50%	1.50%	0.284%	0.360%	0.1096%	0.0730%
44	1.50%	1.50%	0.302%	0.380%	0.1194%	0.0812%
45	1.50%	1.50%	0.320%	0.400%	0.1313%	0.0907%
46	1.50%	1.50%	0.340%	0.440%	0.1455%	0.1013%
47	1.50%	1.50%	0.360%	0.480%	0.1619%	0.1130%
48	1.50%	1.50%	0.380%	0.520%	0.1806%	0.1258%
49	1.50%	1.50%	0.400%	0.560%	0.2015%	0.1394%
50	1.50%	1.50%	0.420%	0.600%	0.2243%	0.1537%
51	1.50%	1.50%	0.424%	0.620%	0.2490%	0.1685%
52	1.50%	1.50%	0.428%	0.640%	0.2757%	0.1839%
53	1.50%	1.50%	0.432%	0.660%	0.3045%	0.1997%
54	1.50%	1.50%	0.436%	0.680%	0.3357%	0.2162%
55	1.50%	1.50%	0.440%	0.700%	0.3697%	0.2332%
56	1.50%	1.50%	0.454%	0.760%	0.4071%	0.2510%
57	1.50%	1.50%	0.468%	0.820%	0.4485%	0.2697%
58	1.50%	1.50%	0.482%	0.880%	0.4950%	0.2896%
59	1.50%	1.50%	0.496%	0.940%	0.5475%	0.3111%
60	1.50%	1.50%	0.510%	1.000%	0.6069%	0.3347%
61	1.50%	1.50%	0.510%	1.000%	0.6743%	0.3606%
62	1.50%	1.50%	0.510%	1.000%	0.7504%	0.3892%
63	1.50%	1.50%	0.510%	1.000%	0.8362%	0.4209%
64	1.50%	1.50%	0.510%	1.000%	0.9326%	0.4561%
65	1.50%	1.50%	0.510%	1.000%	1.0406%	0.4950%
66	1.50%	1.50%	0.510%	1.000%	1.1612%	0.5456%
67	1.50%	1.50%	0.510%	1.000%	1.2739%	0.6013%
68	1.50%	1.50%	0.510%	1.000%	1.3974%	0.6627%
69	1.50%	1.50%	0.510%	1.000%	1.5330%	0.7303%
70	1.50%	1.50%	0.510%	1.000%	1.6816%	0.8049%
71	1.50%	1.50%	0.510%	1.000%	1.8447%	0.8871%
72	1.50%	1.50%	0.510%	1.000%	2.0237%	0.9777%
73	1.50%	1.50%	0.510%	1.000%	2.2199%	1.0775%
74	1.50%	1.50%	0.510%	1.000%	2.4353%	1.1875%
75	1.50%	1.50%	0.510%	1.000%	2.6715%	1.3088%

TABLE 3

FIREFIGHTERS' RETIREMENT PLAN
RATES OF SEPARATION FROM ACTIVE SERVICE

Age	Rates of Withdrawal	Rates of Disability	Rates of Death	
			Males	Females
19	3.00%	0.010%	0.0559%	0.0222%
20	3.00%	0.010%	0.0615%	0.0214%
21	3.00%	0.010%	0.0671%	0.0218%
22	3.00%	0.020%	0.0730%	0.0222%
23	3.00%	0.030%	0.0760%	0.0226%
24	3.00%	0.040%	0.0770%	0.0231%
25	3.00%	0.050%	0.0752%	0.0236%
26	2.92%	0.076%	0.0733%	0.0244%
27	2.84%	0.102%	0.0720%	0.0255%
28	2.76%	0.128%	0.0712%	0.0268%
29	2.68%	0.154%	0.0709%	0.0283%
30	2.60%	0.180%	0.0711%	0.0299%
31	2.44%	0.194%	0.0717%	0.0317%
32	2.28%	0.208%	0.0726%	0.0336%
33	2.12%	0.222%	0.0739%	0.0356%
34	1.96%	0.236%	0.0756%	0.0376%
35	1.80%	0.250%	0.0775%	0.0397%
36	1.72%	0.260%	0.0797%	0.0417%
37	1.64%	0.270%	0.0820%	0.0441%
38	1.56%	0.280%	0.0846%	0.0470%
39	1.48%	0.290%	0.0875%	0.0505%
40	1.40%	0.300%	0.0912%	0.0547%
41	1.36%	0.310%	0.0958%	0.0598%
42	1.32%	0.320%	0.1019%	0.0658%
43	1.28%	0.330%	0.1096%	0.0730%
44	1.24%	0.340%	0.1194%	0.0812%
45	1.20%	0.350%	0.1313%	0.0907%
46	1.20%	0.360%	0.1455%	0.1013%
47	1.20%	0.370%	0.1619%	0.1130%
48	1.20%	0.380%	0.1806%	0.1258%
49	1.20%	0.390%	0.2015%	0.1394%
50	1.20%	0.400%	0.2243%	0.1537%
51	1.12%	0.410%	0.2490%	0.1685%
52	1.04%	0.420%	0.2757%	0.1839%
53	0.96%	0.430%	0.3045%	0.1997%
54	0.88%	0.440%	0.3357%	0.2162%
55	0.80%	0.450%	0.3697%	0.2332%
56	0.76%	0.460%	0.4071%	0.2510%
57	0.72%	0.470%	0.4485%	0.2697%
58	0.68%	0.480%	0.4950%	0.2896%
59	0.64%	0.490%	0.5475%	0.3111%
60	0.60%	0.500%	0.6069%	0.3347%
61	0.60%		0.6743%	0.3606%
62	0.60%		0.7504%	0.3892%
63	0.60%		0.8362%	0.4209%
64	0.60%		0.9326%	0.4561%
65	0.60%		1.0406%	0.4950%
66	0.60%		1.1612%	0.5456%
67	0.60%		1.2739%	0.6013%
68	0.60%		1.3974%	0.6627%
69	0.60%		1.5330%	0.7303%
70	0.60%		1.6816%	0.8049%
71	0.60%		1.8447%	0.8871%
72	0.60%		2.0237%	0.9777%
73	0.60%		2.2199%	1.0775%
74	0.60%		2.4353%	1.1875%
75	0.60%		2.6715%	1.3088%

TABLE 4

POLICE OFFICERS' AND FIREFIGHTERS' RETIREMENT PLAN
RATES OF RETIREMENT FROM ACTIVE SERVICE

Years of Service	Police*	Fire**
20	15.0%	12.5%
21	15.0%	12.5%
22	15.0%	12.5%
23	15.0%	12.5%
24	15.0%	12.5%
25	22.0%	12.5%
26	38.0%	15.0%
27	35.0%	12.0%
28	34.0%	20.0%
29	28.0%	20.0%
30	38.0%	22.0%
31	32.0%	40.0%
32	28.0%	45.0%
33	35.0%	50.0%
34	35.0%	40.0%
35	18.0%	40.0%
36	16.0%	40.0%
37	16.0%	40.0%
38	16.0%	40.0%
39	16.0%	40.0%
40+	16.0%	40.0%

*Assumed rate of retirement is 100% at age 65 for Police Officers, regardless of service.
**Assumed rate of retirement is 100% at age 60 for Firefighters, regardless of service.

TABLE 5

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

Age	Males	Females	Age	Males	Females
19	0.0559%	0.0222%	70	1.9399%	1.4553%
20	0.0615%	0.0214%	71	2.1101%	1.6038%
21	0.0671%	0.0218%	72	2.2991%	1.7695%
22	0.0730%	0.0222%	73	2.5091%	1.9529%
23	0.0760%	0.0226%	74	2.7430%	2.1549%
24	0.0770%	0.0231%	75	3.0040%	2.3766%
25	0.0752%	0.0236%	76	3.2952%	2.6199%
26	0.0733%	0.0244%	77	3.6204%	2.8876%
27	0.0720%	0.0255%	78	3.9835%	3.1836%
28	0.0712%	0.0268%	79	4.3889%	3.5127%
29	0.0709%	0.0283%	80	4.8414%	3.8805%
30	0.0711%	0.0299%	81	5.3460%	4.2932%
31	0.0717%	0.0317%	82	5.9081%	4.7576%
32	0.0726%	0.0336%	83	6.5333%	5.2808%
33	0.0739%	0.0356%	84	7.2280%	5.8698%
34	0.0756%	0.0376%	85	7.9987%	6.5321%
35	0.0775%	0.0397%	86	8.8524%	7.2752%
36	0.0797%	0.0417%	87	9.7971%	8.1081%
37	0.0820%	0.0441%	88	10.8417%	9.0408%
38	0.0846%	0.0470%	89	11.9965%	10.0848%
39	0.0875%	0.0505%	90	13.2734%	11.2535%
40	0.0912%	0.0547%	91	14.6859%	12.5111%
41	0.0958%	0.0598%	92	16.1673%	13.8377%
42	0.1019%	0.0658%	93	17.6800%	15.2252%
43	0.1096%	0.0730%	94	19.2095%	16.6747%
44	0.1194%	0.0812%	95	20.7589%	18.1931%
45	0.1313%	0.0907%	96	22.3428%	19.7901%
46	0.1455%	0.1013%	97	23.9822%	21.4754%
47	0.1619%	0.1130%	98	25.6980%	23.2551%
48	0.1806%	0.1258%	99	27.5058%	25.1285%
49	0.2015%	0.1394%	100	29.4103%	27.0858%
50	0.2243%	0.4105%	101	31.3988%	29.1040%
51	0.5604%	0.4235%	102	33.4365%	31.1444%
52	0.5906%	0.4381%	103	35.4599%	33.1900%
53	0.6229%	0.4544%	104	37.4524%	35.2232%
54	0.6574%	0.4727%	105	39.3982%	37.2273%
55	0.6944%	0.4933%	106	41.2831%	39.1860%
56	0.7342%	0.5165%	107	43.0946%	41.0849%
57	0.7771%	0.5428%	108	44.8227%	42.9112%
58	0.8234%	0.5726%	109	46.4592%	44.6544%
59	0.8736%	0.6066%	110	47.9987%	46.3061%
60	0.9286%	0.6452%	111	49.4376%	47.8604%
61	0.9893%	0.6890%	112	50.0000%	49.3137%
62	1.0567%	0.7383%	113	50.0000%	50.0000%
63	1.1314%	0.7940%	114	50.0000%	50.0000%
64	1.2145%	0.8570%	115	50.0000%	50.0000%
65	1.3067%	0.9283%	116	50.0000%	50.0000%
66	1.4089%	1.0092%	117	50.0000%	50.0000%
67	1.5221%	1.1010%	118	50.0000%	50.0000%
68	1.6475%	1.2051%	119	50.0000%	50.0000%
69	1.7862%	1.3227%	120	100.0000%	100.0000%

TABLE 6

RATES OF MORTALITY FOR MEMBERS RETIRED ON ACCOUNT OF DISABILITY

Age	Males	Females	Age	Males	Females
19	0.0285%	0.2642%	70	3.2231%	4.7498%
20	0.0285%	0.2758%	71	3.3611%	5.1467%
21	0.0285%	0.2898%	72	3.5133%	5.5788%
22	0.0350%	0.3059%	73	3.6812%	6.0488%
23	0.0412%	0.3239%	74	3.8660%	6.5593%
24	0.5873%	0.3433%	75	4.0690%	7.1128%
25	0.6461%	0.3638%	76	4.2916%	7.7121%
26	0.7048%	0.3852%	77	4.5353%	8.3602%
27	0.7662%	0.4071%	78	4.8018%	9.0599%
28	0.7982%	0.4292%	79	5.0929%	9.8144%
29	0.8089%	0.4513%	80	5.4109%	10.6271%
30	0.7896%	0.4774%	81	5.7583%	11.5016%
31	0.7700%	0.5088%	82	6.1382%	12.4419%
32	0.7563%	0.5465%	83	6.5542%	13.4525%
33	0.7480%	0.5921%	84	7.0106%	14.5555%
34	0.7449%	0.6469%	85	7.5122%	15.7466%
35	0.7466%	0.7122%	86	8.0642%	17.0213%
36	0.7527%	0.7891%	87	8.6728%	18.3751%
37	0.7628%	0.8786%	88	9.3445%	19.8037%
38	0.7766%	0.9809%	89	10.0864%	21.3026%
39	0.7938%	1.0253%	90	10.9061%	22.8674%
40	0.8139%	1.0693%	91	11.8114%	24.4937%
41	0.8366%	1.1127%	92	12.8104%	26.1771%
42	0.8616%	1.1555%	93	13.9118%	27.9130%
43	0.8883%	1.1977%	94	15.1248%	29.6972%
44	0.9193%	1.2394%	95	16.4592%	31.5251%
45	0.9575%	1.2806%	96	17.9257%	33.3924%
46	1.0066%	1.3215%	97	19.3867%	35.2946%
47	1.0701%	1.3624%	98	20.8457%	37.2273%
48	1.1515%	1.4036%	99	22.3065%	39.1860%
49	1.2537%	1.4458%	100	23.7725%	41.0849%
50	1.3787%	1.4897%	101	25.2475%	42.9112%
51	1.5276%	1.5362%	102	26.7351%	44.6544%
52	1.6184%	1.5864%	103	28.2387%	46.3061%
53	1.7079%	1.6414%	104	29.7622%	47.8604%
54	1.7959%	1.7026%	105	31.3090%	49.3137%
55	1.8825%	1.7714%	106	32.8828%	50.0000%
56	1.9674%	1.8494%	107	34.4872%	50.0000%
57	2.0507%	1.9381%	108	36.1258%	50.0000%
58	2.1324%	2.0392%	109	37.8023%	50.0000%
59	2.2126%	2.1541%	110	39.5201%	50.0000%
60	2.2916%	2.2844%	111	41.2831%	50.0000%
61	2.3700%	2.4317%	112	43.0946%	50.0000%
62	2.4484%	2.5974%	113	44.8227%	100.0000%
63	2.5279%	2.7828%	114	46.4592%	50.0000%
64	2.6094%	2.9893%	115	47.9987%	100.0000%
65	2.6943%	3.2181%	116	49.4376%	50.0000%
66	2.7840%	3.4705%	117	50.0000%	50.0000%
67	2.8800%	3.7482%	118	50.0000%	50.0000%
68	2.9841%	4.0527%	119	50.0000%	50.0000%
69	3.0979%	4.3859%	120	100.0000%	100.0000%

TABLE 7

RATES OF ANTICIPATED SALARY INCREASES

Years of Service	Teachers	Police	Fire
<1	8.3680%	9.7200%	7.1200%
1	8.3680%	9.2000%	7.1200%
2	8.3680%	7.6400%	7.1200%
3	8.3680%	7.1200%	7.1200%
4	8.3680%	6.6000%	7.1200%
5	8.3680%	6.0800%	7.1200%
6	8.1600%	6.0800%	7.1200%
7	7.9520%	6.0800%	7.1200%
8	7.7440%	6.0800%	7.1200%
9	7.5360%	6.0800%	7.1200%
10	7.3280%	6.0800%	7.1200%
11	6.2880%	6.0800%	7.1200%
12	5.4560%	6.0800%	7.1200%
13	5.2480%	6.0800%	7.1200%
14	5.2480%	7.5360%	7.1200%
15	5.2480%	6.0800%	9.2000%
16	5.2480%	6.0800%	5.3000%
17	5.2480%	6.0800%	5.3000%
18	5.2480%	6.0800%	5.3000%
19	5.2480%	12.7360%	5.3000%
20	5.2480%	5.8200%	9.2000%
21	5.2480%	5.5600%	5.3000%
22	5.2480%	5.3000%	5.3000%
23	5.2480%	5.0400%	5.3000%
24	5.2480%	7.3280%	5.3000%
25	5.2480%	4.7800%	9.2000%
26	5.2480%	4.5200%	5.3000%
27	5.2480%	4.2600%	5.3000%
28	5.2480%	4.0000%	5.3000%
29	5.2480%	7.2240%	5.3000%
30	5.2480%	4.0000%	9.2000%
31+	5.2480%	4.0000%	5.3000%