Teachers' Retirement System of the State of Illinois

Actuarial Experience Review

July 1, 2014 to June 30, 2017

September 18, 2018

At the August 16-17, 2018 Board of Trustees meeting, the Board adopted all recommended assumption changes contained herein, with the exception of the investment return assumption, which remained unchanged at 7%.

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September 18, 2018

Board of Trustees
Teachers' Retirement System of the State of Illinois
2815 West Washington Street
Springfield, IL 62702

Ladies and Gentlemen:

This report presents the results of the actuarial review of the demographic and economic experience of the Teachers' Retirement System of the State of Illinois (TRS) for the period July 1, 2014 through June 30, 2017. This experience review was prepared in accordance with Article 16, Section 176 of the Illinois Pension Code governing the System, which requires the actuary for TRS to make an actuarial investigation into the mortality, service, and other experience of the members, retirees and beneficiaries covered under the System at least once every three years. As recommended by the State Actuary, the economic assumptions for TRS have been reviewed on an annual basis since 2014.

All current actuarial assumptions were reviewed as part of this study. This review is the basis for our recommendation of the assumptions to be used for the June 30, 2018 actuarial valuation.

In preparing the results presented in this report, we have relied upon data that TRS provided to us regarding the membership census data and financial information. While the scope of our engagement did not call for us to perform an audit or independent verification of this information, we have reviewed it for reasonableness. The accuracy of the results presented in this report is dependent upon the accuracy and completeness of the underlying information.

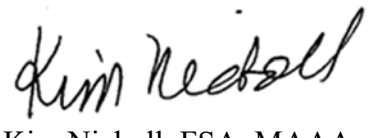
This review recommends assumptions to be used in the valuation to measure the System's financial condition as of a single date. Future actuarial measurements may differ significantly from the current measurements presented in this report due to other assumption sets. This report does not include an analysis of the potential range of such future measurements.

Our analysis was conducted in accordance with generally accepted actuarial principles as prescribed by the Actuarial Standards Board (ASB) and the American Academy of Actuaries. Additionally, the development of all assumptions contained herein is in accordance with ASB Actuarial Standard of Practice (ASOP) No. 27 (*Selection of Economic Assumptions for Measuring Pension Obligations*) and ASOP No. 35 (*Selection of Demographic and Other Non-Economic Assumptions for Measuring Pension Obligations*).

The undersigned actuaries are independent. They are Fellows of the Society of Actuaries, Enrolled Actuaries, and Members of the American Academy of Actuaries, and are experienced in performing experience studies for large public retirement systems. They meet the Qualification Standards of the American Academy of Actuaries.

Respectfully submitted,

Segal Consulting, a Member of the Segal Group



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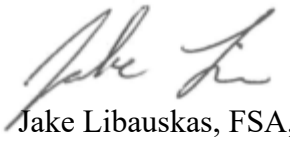

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Teachers' Retirement System of the State of Illinois

Experience Review for the Period July 1, 2014 through June 30, 2017

I. Executive Summary

A. Introduction

Actuarial valuations are prepared annually to determine whether the contributions being made by members and employers are sufficient to fund the Teachers' Retirement System of the State of Illinois (TRS). Each actuarial valuation is highly dependent on the assumptions that the actuary uses to project the benefits expected to be paid in the future to all members of TRS. The projection of expected future benefit payments is based on the characteristics of members as of the valuation date, the benefit provisions in effect on that date, and assumptions of future events and conditions.

The assumptions used in actuarial valuations can be grouped into two categories: (1) economic assumptions - the assumed long-term rate of investment return, inflation, salary increases, and severance pay, and (2) non-economic or demographic assumptions - the assumed rates of termination, disability, retirement, mortality, sick leave credit, and optional service purchase. Demographic assumptions are primarily selected on the basis of recent experience (although a change in plan design or the employment environment may suggest otherwise), while economic assumptions rely more on a long-term perspective of expected future trends.

In order to determine the probability of an event occurring, we examine the "decrements" and "exposures" of that event. Using termination from active employment, for example, we compare the number of employees who actually terminate in a certain age and/or service category (i.e., the number of "decrements") with those "who could have terminated" (i.e., the number of "exposures"). For example, if there were 5,000 active employees in the 20-24 age group at the beginning of the year and 500 of them terminate during the year, we would say the probability of termination in that age group is 500 ÷ 5,000 or 10%.

If actual experience exactly matches the expected experience, the actual annual cost of TRS will equal the annual cost determined by the actuarial valuation. However, this result is virtually never achieved, due to the long-term nature of the benefit projections and the numerous assumptions used in actuarial valuations. TRS recognizes actuarial gains and losses each year, reflecting the net difference between actual experience and anticipated experience. A pattern of gains or losses with respect to one or more assumptions is the basis for recommended changes to the assumptions. Each valuation measures the effectiveness of each assumption and allows for the monitoring of the assumptions.

Actuarial experience studies are undertaken periodically and serve as the basis for recommended changes in actuarial assumptions and methods. A change in assumptions is recommended when it is demonstrated that the current assumptions do not accurately reflect the current trend determined from analysis of the data or anticipated future trends based upon reasonable expectations. The data analyzed include actual experience for demographic assumptions and economic forecasts for economic assumptions. The Actuarial Standards Board (ASB) provides actuaries with standards of practice that provide guidance and recommendations on acceptable methods and techniques to be used in developing both economic and demographic assumptions. Specifically, these are the ASB Actuarial Standard of Practice (ASOP) No. 27 (*Selection of Economic Assumptions for Measuring Pension Obligations*) and ASOP No. 35 (*Selection of Demographic and Other Non-Economic Assumptions for Measuring Pension Obligations*).

I. Executive Summary

This study reviews the actuarial experience of TRS for the three-year period beginning July 1, 2014 and ending June 30, 2017, compares this experience to the current actuarial assumptions, and recommends changes to the assumptions as necessary. Economic assumption recommendations were primarily developed based on inputs related to economic forecasts and capital market expectations.

A summary of the key points of our review and our recommendations follows.

B. Recommendations

The experience review provides an opportunity for the Board, TRS staff, and actuary to consider how specific assumptions or methods affect the funding of the System, including the funded ratio and the adequacy of contributions made by members and employers (as compared to the Actuarially Determined Employer Contribution). We have reviewed both economic and demographic experience of the System as it relates to the expected actuarial experience based on the current plan assumptions. Included are recommendations for changes in assumptions that we believe will more accurately reflect the future experience of TRS.

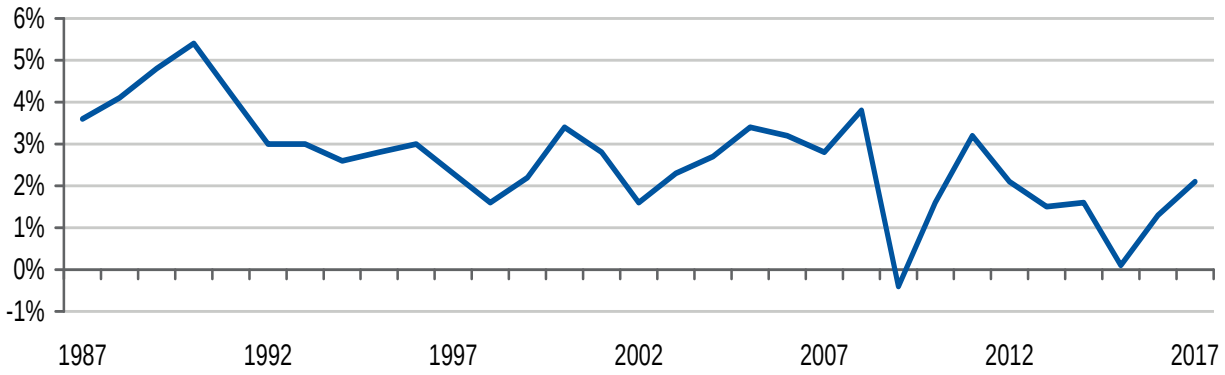
The detailed analysis of each individual assumption is discussed later in this report.

Economic Assumptions

Economic assumptions include inflation, rate of investment return (or discount rate), rate of individual salary increases, Tier II cost-of-living adjustments (COLA), Tier II pensionable salary cap, and rate of severance pay.

Inflation

Inflation continues at relatively low levels from a historical perspective, as shown in the graph below.



The current inflation assumption is 2.50% per annum. The outlook for inflation remains slightly less than 2.50% over a 20-year time horizon according to the Horizon Survey of Capital Market Assumptions (2017 Edition) and other professional forecasters. In light of all sources of inflation expectations reviewed in our study, we recommend maintaining the current assumption of 2.50%.

Most other economic assumptions have an underlying inflation component. The investment return assumption is comprised of inflation and the real rate of return for each asset class. The assumed rates of individual salary increases are comprised of inflation and merit and seniority increases. Finally, cost-of-living adjustments and the pensionable salary cap for Tier II members are functions of inflation (lesser of 3% and ½ of CPI-U).

I. Executive Summary

Rate of Investment Return

The System has averaged investment returns of 4.7% and 6.9% over the last 10 years and 20 years, respectively. The current assumption is 7.00%. Thus, on average the System has underperformed the assumption, but less-so as more years are included in the experience period.

Based on the System's target allocation and the 20-year Capital Market Assumptions (CMA) provided in the Horizon Survey of Capital Market Assumptions (2017 Edition), the net expected real rate of investment return (net of investment expenses and adjusted for negative cash flow) is 4.51%, compared to the current assumption of 4.50%. Since we recommend that the inflation assumption remain at 2.50%, and the investment return assumption is the combination of expected inflation plus expected real rate of return, the 50th percentile expected return over the next 20 years is 7.01%. Since last year's investment return analysis showed a 53% likelihood of achieving 7% and this year's analysis shows a 50% likelihood of achieving 7%, we recommend lowering the investment return assumption from 7% to 6.75% to maintain a similar confidence level as last year. However, we can support an investment return assumption of 7% because the likelihood of achieving this rate over the next 20 years is 50%. We would also support an investment return assumption less than 6.75% because the likelihood of achieving such an assumption over the next 20 years is greater than 50%.

Rate of Individual Salary Increases

We study the merit and seniority increases separately from inflation. Analysis of the distribution of merit and seniority increases by years of service during the study period shows that these increases were greater than expected.

Based on experience, we recommend increasing the merit and seniority portion of individual salary increases (full rates in the appendix).

Tier II COLA and Pay Cap

The COLA and pensionable salary cap increases for Tier II members are based on annual inflation, as annual increases are the lesser of 3% and ½ of CPI-U.

Based on maintaining the 2.50% inflation assumption, we recommend that the average COLA and rate of increase in the pensionable salary cap remain at 1.25%.

Severance Pay

Analysis of the severance pay assumption during the study period shows that actual severance payments have been greater than assumed, while the percent of retirees receiving severance pay has been consistent with expectations.

Based on experience, we recommend no changes to the percent of retirees assumed to receive severance pay, but recommend increasing the average severance payment rate from 2.5% to 10.0% of other pensionable earnings in the last year of employment. Note that this change is the result of fixing an apparent calculation error from the last experience review performed by the prior actuary and does not represent an actual increase in average severance pay during the study period.

I. Executive Summary

Demographic Assumptions

The demographic assumptions include mortality, retirement, termination (or withdrawal), disability incidence, sick leave service credits, and optional service purchase.

Mortality

The current post-retirement mortality table for healthy annuitant lives is the RP-2014 White Collar Mortality Table, with adjustments for the System's experience, projected generationally using Scale MP-2014. The actual rate of mortality was consistent with the current assumption for healthy female annuitants and was slightly less than expected for healthy male annuitants over the study period. We recommend adjusting the base table rates to match the System's experience and applying the latest generational mortality improvement scale ("MP-2017") from 2015, the midpoint of the study period, forward to account for future mortality improvement.

The current mortality table for disabled lives is the RP-2014 Disabled Retirees Table, projected generationally with Scale MP-2014. Experience for disabled annuitants has been greater than expected based on the current assumptions. We recommend adjusting the base table rates to better match plan experience and apply a generational projection using Scale MP-2017 from 2015 forward.

The current mortality table for beneficiary lives is the RP-2014 White Collar Mortality Table, with adjustments for plan experience, projected generationally with Scale MP-2014. The actual rate of mortality among beneficiaries during the study period was greater than expected for male beneficiaries and less than expected for female beneficiaries. We recommend adjusting the base table rates to better match plan experience and apply a generational projection using Scale MP-2017 from 2015 forward.

The current mortality table for active members is the RP-2014 White Collar Employee Mortality Table, with no adjustments to the base rates. The actual rate of mortality among active members during the study period was slightly greater than expected for males and females. We recommend adjusting the base table rates to better match plan experience and apply a generational projection using Scale MP-2017 from 2015 forward.

Retirement

The current retirement rates for active members are based on members' age and years of service at retirement. There are different retirement rates depending on Tier. As the Early Retirement Option (ERO) expired during the experience study period, members that retired under ERO were excluded from the analysis in order to prevent these retirements from impacting results. Tier 1 revealed slightly more retirements than expected retirements. Therefore, we recommend modifying rates to be consistent with actual experience, subject to the aforementioned ERO adjustment described above. We recommend no changes to the Tier II retirement rates as there is no actual retirement experience to analyze at this point.

Termination

The current turnover rates are based on gender, age, and years of service. Separate rates apply to members with less than five years of service and members with five or more years of service. Termination rates for members with 5 or more years of service are offset by rehires to reflect Tier 1 members being replaced by rehired Tier 1 members. The experience shows that actual turnover was less than expected. Therefore, we recommend decreasing termination rates for all members.

Note that our analysis excludes hourly/substitute teachers because their high turnover rate would overstate the probability of turnover for full-time teachers.

Disability Retirement

The current disability retirement rates are based on members' age and gender. During the experience study period, the number of disabilities was lower than expected. Therefore, we recommend lowering the disability rates to better match plan experience.

Other Demographic Assumptions

Other demographic assumptions that impact the valuation are the sick leave service credits and optional service purchases.

The current sick leave service credit assumption is based on service at retirement. On average, experience is fairly consistent with the current assumption, although inconsistent for individual service levels. We recommend slightly adjusting rates to better reflect plan experience.

The current optional service purchase assumption is based on service at retirement. On average, experience shows fewer optional service purchases than currently assumed. We recommend lowering rates to better reflect plan experience.

I. Executive Summary

Summary of Actuarial Experience

For the three-year period under review, the System has experienced actuarial gains and actuarial losses. Investment returns on the market value of assets has averaged 4.7% and 6.9% over the last 10 and 20 years, respectively. Despite a general underperformance relative to expected, the imputed return on the actuarial value of assets has produced gains during the study period. Experience for non-investment assumptions has produced losses in two of the three years of the study period and a small gain in the third. A summary of the historical gains and losses is shown below.

Valuation Date	Actuarial Accrued Liability (AAL) ($ in millions)	Total Actuarial Gain/(Loss)		Actuarial Asset Investment Gain/(Loss)		Non-Investment Gain/(Loss)	
		Amount ($ in millions)	% of AAL	Amount ($ in millions)	% of AAL	Amount ($ in millions)	% of AAL
June 30, 2017	$122,904	-$219	-0.2%	$384	0.3%	-$604	-0.5%
June 30, 2016	118,630	-1,431	-1.2%	-467	-0.4%	-964	-0.8%
June 30, 2015	108,122	1,482	1.4%	1,355	1.3%	127	0.1%

I. Executive Summary

Summary of Assumptions and Recommended Changes

The following table summarizes the actuarial assumptions and methods used in the valuation and the changes recommended in this report.

Description	Current	Proposed
Economic Assumptions		
Inflation	2.50%	No Change
Real Wage Growth	0.75%	No Change
Rate of Individual Salary Increases	Merit/seniority rates based on years of service, plus inflation and real wage growth	Minor changes to merit/seniority rates, based on plan experience
Investment Return	7.00%	6.75%, but can support 7%
Severance Pay	20% assumed to receive severance pay, average of 2.5% of earnings in final year of employment	Update assumed earnings percentage from 2.5% to 10%
Tier 2 Pay Cap Increase	1.25% per annum	No Change
Tier 2 COLA Increase	1.25% per annum	No Change
Demographic Assumptions		
Turnover	Gender distinct rates based on age and years of service	Adjust rates based on plan experience
Disability	Age based rates	Adjust rates based on plan experience
Active Retirement	Rates based on age and service that range from 0% to 100% from age 54 to age 70, grouped for members with less than 19, 19 to 30, 31, 32 to 33, and 34 or more years of service	Slight adjustment for rates based on plan experience. Updated service grouping 19 to 29 and 30 to 31 years of service
Healthy Post-Retirement Mortality	RP-2014 White Collar Healthy Annuitant Table, female rates multiplied by 76% for ages under 77 and 106% for ages 78-114 and male rates multiplied by 115% for ages 78-114	RP-2014 White Collar Healthy Annuitant Table, female rates multiplied by 70% for ages under 77 and 110% for ages 78-114 and male rates multiplied by 94% for ages under 80 and 110% for ages 81-114
Disabled Post-Retirement Mortality	RP-2014 Disabled Mortality Table	RP-2014 Disabled Mortality Table, male and female rates multiplied by 117% for ages 45-99
Beneficiary Post-Retirement Mortality	RP-2014 Healthy Annuitant Table, male and female rates multiplied by 112% for ages 50-114	RP-2014 Healthy Annuitant Table, male and female rates multiplied by 116% and 96%, respectively, for ages 50-114
Pre-Retirement Mortality	RP-2014 White Collar Employee Table	RP-2014 White Collar Employee Table, male and female rates multiplied by 104% for all ages
Mortality Improvement	Generational projection using Scale MP-2014	Generational projection using Scale MP-2017
Sick Leave Service Credit	Rates based on service	Adjusted rates based on plan experience
Optional Service Purchase	Rates based on service	Adjusted rates based on plan experience

I. Executive Summary

Impact of Assumption and Method Changes on Valuation Results

The following tables detail the impact of the recommended assumption changes, using the June 30, 2017 actuarial valuation results for illustrative purposes.

($ in Millions) Description	Current Assumptions	Proposed Economic Assumptions, Including 6.75%	Proposed Economic and Demographic Assumptions	Total Change
Actuarial Accrued Liability	$122,904	$127,846 +4,942	$126,459 -1,387	+$3,555
Actuarial Value of Assets	49,468	49,468	49,468	
Unfunded Actuarial Accrued Liability	73,436	78,378 +4,942	76,991 -1,387	+3,555
Funded Ratio	40.2%	38.7% -1.5%	39.1% +0.4%	-1.1%
Normal Cost	$1,980	$2,196 +216	$2,197 +1	+$217
FY 2019 Actuarially Determined Contribution*	7,371	7,923 +552	7,824 -99	+453
FY 2020 State Contribution**	4,791	N/A	4,826 +35	+35

($ in Millions) Description	Proposed Assumptions and 7.00%***	Proposed Assumptions, Including 6.75%***	Proposed Assumptions and 6.50%***	Proposed Assumptions and 6.00%***
Actuarial Accrued Liability	$122,329 -575	$126,459 +3,555	$130,900 +7,996	$140,472 +17,568
Actuarial Value of Assets	49,468	49,468	49,468	49,468
Unfunded Actuarial Accrued Liability	72,861 -575	76,991 +3,555	81,432 +7,996	91,004 +17,568
Funded Ratio	40.4% +0.2%	39.1% -1.1%	37.8% -2.4%	35.2% -5.0%
Normal Cost	$2,073 +93	$2,197 +217	$2,331 +351	$2,633 +653
FY 2019 Actuarially Determined Contribution*	7,473 +102	7,824 +453	8,197 +826	8,985 +1,614
FY 2020 State Contribution**	4,784 -7	4,826 +35	4,871 +80	4,964 +173

* State's portion
** Reflects five-year phase-in of effect of assumption changes
*** The deltas shown are compared to the current assumptions

I. Executive Summary

The net impact of the recommended economic assumption changes, using the 2017 valuation for illustrative purposes, would have increased the actuarial accrued liability by approximately $4,942 million, or 4.0%. The primary driver of the increase in the actuarial accrued liability is the lowering of the investment return assumption from 7.00% to 6.75%.

The net impact of the recommended demographic assumption changes would have decreased the actuarial accrued liability by approximately $1,387 million, or 1.1%. The primary driver of the decrease in the actuarial accrued liability is updating to the most recent mortality improvement scale, which generally projects less improvement in future mortality rates than MP-2014.

Overall, the recommended economic and demographic changes would increase the actuarial accrued liability by $3,555 million, or 2.9%, increase the normal cost by $217 million, or 11.0%, increase the FY 2019 Actuarial Determined Contribution by $453 million, or 6.1%, and increase the FY 2020 State Contribution by $35 million, or 0.7%.

The net impact of the recommended assumption changes and maintaining the 7% investment return assumption would decrease the actuarial accrued liability by $575 million, or 0.5%, increase the normal cost by $93 million, or 4.5%, increase the FY 2019 Actuarially Determined Contribution by $102 million, or 1.4%, and decrease the FY 2020 State Contribution by $7 million, or 0.1%.

II. Economic Assumptions

The economic assumptions have a significant impact on the development of plan liabilities. Changes to these assumptions can substantially alter the actuarial valuation results. The goal of an experience study is to produce a consistent set of economic assumptions that appropriately reflect expected future economic trends.

The primary economic assumptions that affect TRS' valuation results are:

- Inflation
- Rate of Investment Return
- Rate of Individual Salary Increases
- Tier II COLA / Pay Cap
- Rate of Severance Pay

The Actuarial Standards Board (ASB) has adopted Actuarial Standard of Practice No. 27 (ASOP 27 - *Selection of Economic Assumptions for Measuring Pension Obligations*) to provide actuaries guidance in developing economic assumptions.

The inflation component is included in all economic assumptions (except for severance pay), and therefore is key to developing a consistent set of actuarial assumptions. The rate of investment return assumption includes an inflation component and a real rate of return component. The components of the salary increase assumption are inflation, real wage growth, and merit and seniority increases. The Tier II COLA and pensionable salary cap increases are directly tied to actual inflation during the year.

II. Economic Assumptions

A. Inflation

In developing the recommendation for the assumed inflation component, actuarial standards of practice suggest the actuary review appropriate inflation data. This data may include consumer price indexes, the implicit price deflator, forecasts of inflation, and yields on government securities of various maturities. For this study, we referred to commonly referenced historical measures of inflation, the National Consumer Price Index for all urban consumers (CPI-U).

The table below shows that recent inflation experience is well below the longer-term average rate.

Average Annual Change as of March 31, 2018	CPI-U
Past 5 Years	1.40%
Past 10 Years	1.57%
Past 20 Years	2.18%
Past 30 Years	2.57%
Past 50 Years	4.05%

The average annual rate of increase in the CPI-U in the past 10 years has been at its lowest levels since the early 1960s. Historical trend is a less important consideration for the assumed rate of inflation, but assists in determining the reasonable bounds of expected inflation.

Horizon's 2017 Survey of Capital Market Assumptions[1] indicates that the average median inflation assumption is 2.44% over the next 20 years. The future expectations of the 12 investment advisors who provided 20-year assumptions in the survey range from 2.20% to 2.80%.

Next, we considered the measure of future inflation expectation by observing market-based forecasts. Treasury Inflation Protection Securities (TIPS) are government bonds, which, in addition to a fixed yield, add the actual percentage change in CPI to the principal value. Therefore, the spread between the TIPS and the Conventional Treasury note/bond of the same maturity is an indication of the market's forecast for inflation.

Because of the inflation protection, TIPS yields are almost always considerably lower than those of regular Treasury securities of similar maturities. As of the last week of April 2018, the yields on 30-year Treasury Bonds were as follows:

- Inflation indexed: 0.93%
- Non-inflation indexed: 3.13%

[1] This survey, prepared by Horizon Actuarial Services, LLC, compiles and averages the capital market assumptions of 35 investment advisors, including Segal Marco Advisors and RVK.

The difference of 2.20% means that for 30-year TIPS to match the return of the conventional 30-year Treasury for a buy-and-hold income investor, inflation would have to measure 2.20% per year over the next 30 years. The financial market's current expectations of inflation over the next 30 years is one indicator of future trend. However, additional risk premiums and investor preferences can be factored into the bond yields that is unrelated to market expectations of inflation, possibly distorting the reliability of this indicator.

As a check of the validity of this assumption, we reference the *2017 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Disability Insurance Trust Funds (2017 OASDI Trustees Report).* Three inflation assumptions used in this report were 2.00% for the low-cost projection, 2.60% for the intermediate projection, and 3.20% for the high-cost projection.

Considering the level indicated by financial market data (2.20%), investment consultants' future expectations (2.44%), and the OASDI intermediate cost assumption (2.60%), we recommend that the inflation assumption remain at 2.50%.

II. Economic Assumptions

B. Rate of Investment Return

The rate of investment return is used to determine the present value of expected future plan payments. The selection of an investment return assumption considers capital market outlook, the Systems' portfolio mix, and, to a lesser extent, historical returns.

The current assumption is 7.00%, which is composed of the following components:

- Inflation: 2.50%; and,
- Real Rate of Return: 4.50%, net of 0.70% for investment expenses

The table below shows the System's actual investment returns on a market value basis as well as an actuarial value basis.

Average Annual Return as of June 30, 2017	Market Value of Assets Basis	Actuarial Value of Assets Basis
Past 10 Years	4.7%	4.6%
Past 15 Years	7.2%	7.2%
Past 20 Years	6.9%	6.8%

The average annual rate of return over the past 10 and 20 years has been lower than the current assumption of 7.00% on both a market value of assets as well as an actuarial value of assets basis, while the average return over the past 15 years has been above the current assumption. Historical trend is a less important consideration for the assumed rate of investment return, but assists in determining the reasonable bounds of expected investment return.

In developing the real rate of return, we examined the capital market assumptions (CMA) per the Horizon Survey of Capital Market Assumptions (2017 Edition). The real return assumptions for the asset classes and the portfolio's expected real return are shown below.

Horizon Study Asset Classes	Horizon Study 20-Year Annual Arithmetic Real Return	Target Allocation	Weighted Real Return
US Equities Large Cap	6.68%	15.0%	1.00%
US Equities Small/Mid Cap	7.89%	2.0%	0.16%
Intl Equities Developed	6.98%	13.6%	0.95%
Emerging Markets Equities	9.39%	3.4%	0.32%
US Bonds Core	2.15%	8.0%	0.17%
US Bonds High Yield	4.36%	4.2%	0.18%
Intl Debt Developed	1.30%	2.2%	0.03%
Intl Debt Emerging	4.52%	2.6%	0.12%
TIPS	1.78%	4.0%	0.07%
Real Estate	5.38%	16.0%	0.86%
Hedge Funds (Absolute Return)	3.89%	14.0%	0.54%
Private Equity	10.15%	15.0%	1.52%
Total		**100.0%**	**5.92%**
Adjustment to Geometric			(0.56%)
Geometric Real Rate of Return			**5.36%**

II. Economic Assumptions

Using the System's target asset allocation and the CMA provided in the 2017 Horizon Survey, the expected real rate of return is 5.36%.

The real rate of return for the portfolio must be reduced to account for investment expenses. The investment expenses as a percent of the average market value of assets for the past five years are shown on the following table:

Year Ended June 30	Average Market Value of Assets ($ in Millions)	Investment Expense	
		Amount ($ in Millions)	Percent
2017	$44,553	$350	0.78%
2016	45,851	331	0.72%
2015	45,230	329	0.73%
2014	39,451	300	0.76%
2013	35,907	280	0.78%
Total	**$ 210,992**	**$1,590**	**0.75%**

Accounting for investment expenses, the expected net real rate of return can be determined as follows:

Gross Real Rate of Return	5.36%
Less Expenses	(0.75%)
Net Real Rate of Return	**4.61%**

In other words, there is a 50% likelihood of earning an annual real rate of return, net of expenses, of at least 4.61% using Horizon's CMA, which are based on a 20-year horizon.

An additional adjustment was added to take into account negative cash flow (average projected negative cash flow of 2.2% of assets, resulting in 10 basis point reduction).

The following table summarizes the components of the current and proposed investment return assumption.

Assumption Component	Current Assumption	Proposed Assumption
Inflation	2.50%	2.50%
Net Real Rate of Return	4.61%	4.61%
Adjustment for Negative Cash Flow	(0.10%)	(0.10%)
Total Expected Rate of Return	**7.01%**	**7.01%**
Adjustment*	(0.01%)	(0.26%)
Total Return Assumption	**7.00%**	**6.75%**
Confidence Level	**50%**	**54%**

*Adjusting the rate downward to the nearest 25 basis point interval increases the likelihood of meeting the expectation over a 20-year period. For example, the 26 basis point reduction in the recommended assumption increases the likelihood of meeting the expectation from 50% to 54%.

In order to maintain a similar confidence level as in the past, we recommend lowering the investment return assumption from 7.00% to 6.75%.

II. Economic Assumptions

C. Rate of Individual Salary Increase

The rate of individual salary increase is used to determine members' benefits provided by the System. Generally, a member's salary will change over the long term in accordance with inflation and merit and seniority scale. The actuary should review available compensation data when selecting this assumption, including the school districts' current compensation practices and any anticipated changes, historical compensation increases and practices of the school districts and other employers in the same industry or geographic area, and historical national wage increases and productivity growth.

The estimated rate of individual salary increases consists of two components:

- Inflation; and
- Merit and seniority increases

The inflation component represents the "across the board" average annual increase in salaries shown in the experience data. The merit and seniority component includes the additional increases in salary due to performance, seniority, promotions, etc.

Since merit and seniority increases are unique to each retirement system, it is appropriate to base this assumption on recent experience. We study the merit and seniority increases separately from inflation.

The current salary increase assumption (including inflation) uses service-based rates that range from 9.25% at one year of service to 3.25% at 20 or more years of service. The historical compensation data, adjusted by approximately 1.00% to account for actual inflation during the study period, was evaluated based on age and service. The strongest relationship continues to be based on members' service.

The following tables and graph compares the actual, expected and proposed individual salary increases during the period of the experience study, adjusted to remove inflation.

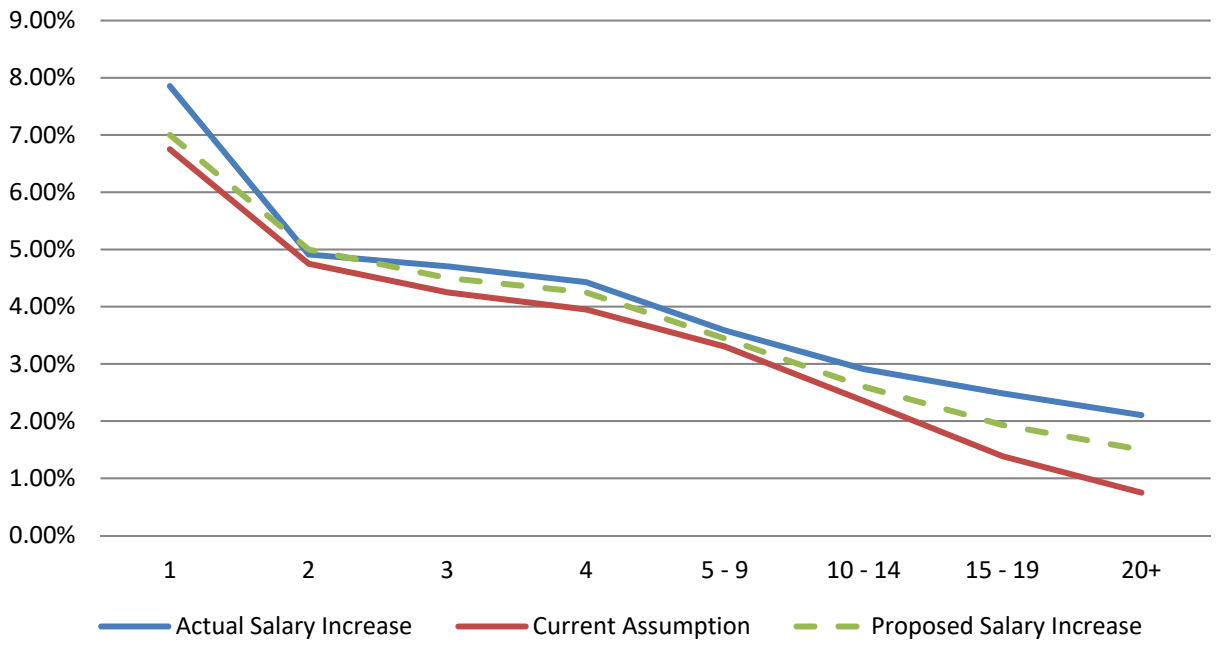
Years of Service	Total Exposure	Actual Increase Above Inflation	Expected Increase Above Inflation	Proposed Increase Above Inflation
1	15,871	7.85%	6.75%	7.00%
2	17,485	4.91%	4.75%	5.00%
3	16,931	4.70%	4.25%	4.50%
4	15,585	4.43%	3.95%	4.25%
5 - 9	84,364	3.58%	3.30%	3.44%
10 - 14	84,708	2.91%	2.35%	2.60%
15 - 19	63,447	2.49%	1.39%	1.93%
20+	74,117	2.10%	0.75%	1.50%
Total	**372,508**	**3.05%**	**2.23%**	**2.65%**

II. Economic Assumptions

Table 1:
Actual and Expected Salary Increases
Compared to Proposed, in Excess of Inflation

Years of Service	Prior Year Salaries (in $000s)	Actual Salaries[1] (in $000s)	Expected Salaries[2] (in $000s)	Ratio of Actual to Expected	Proposed Salaries[3] (in $000s)	Ratio of Actual to Proposed
1	706,056	761,514	753,715	101.03%	755,480	100.80%
2	826,270	866,852	865,517	100.15%	867,583	99.92%
3	831,249	870,358	866,577	100.44%	868,655	100.20%
4	798,158	833,495	829,685	100.46%	832,079	100.17%
5 - 9	4,945,488	5,122,780	5,108,817	100.27%	5,115,649	100.14%
10 - 14	5,945,144	6,118,192	6,085,073	100.54%	6,099,932	100.30%
15 - 19	5,099,385	5,226,114	5,170,129	101.08%	5,197,933	100.54%
20+	6,842,940	6,986,973	6,894,263	101.34%	6,945,585	100.60%
Total	**25,994,690**	**26,786,278**	**26,573,776**	**100.80%**	**26,682,896**	**100.39%**

Graph 1:
Actual and Expected Salary Increases
Compared to Proposed, in Excess of Inflation



[1] Adjusted for actual average inflation of approximately 1.00% during the experience period.
[2] Adjusted for assumed inflation of 2.50%.
[3] Proposed rate of individual salary increases table does not reflect underlying assumption for inflation.

II. Economic Assumptions

As shown on the prior page, the actual rate of individual salary increases above inflation was greater than the expected rate for all service bands. Based on this experience, we recommend increasing the merit component of the individual salary increases. The table showing the proposed total rates of individual salary increases is included in Appendix A.

D. Tier II COLA / Pay Cap

The COLA and pensionable salary cap increases for Tier II members are based on annual inflation, as annual increases are the lesser of 3% and ½ of CPI-U. The table below shows a history of the COLA and pensionable salary cap increases since its inception in 2011.

Fiscal Year Ending June 30	Prior Year CPI-U	½ CPI-U	Tier II COLA	Tier II Pensionable Salary Limit
2011				$106,800
2012	3.90%	1.95%	1.95%	$108,883
2013	2.00%	1.00%	1.00%	$109,971
2014	1.20%	0.60%	0.60%	$110,631
2015	1.70%	0.85%	0.85%	$111,572
2016	0.00%	0.00%	0.00%	$111,572
2017	1.50%	0.75%	0.75%	$112,408
2018	2.20%	1.10%	1.10%	$113,645

Since we recommend maintaining the 2.50% inflation assumption, we recommend that the Tier II COLA and rate of increase in the pensionable salary cap remain at 1.25%, which is half of the 2.50% inflation assumption. Since the minimum is 0% and the maximum is 3%, stochastically modeling the likely range of this assumption results in approximately the same 50th percentile outcome.

E. Severance Pay

Additional compensation in the final year of employment prior to retirement is referred to as "severance pay." This may include payment for unused vacation days, unused sick or personal leave, retirement incentives, 403(b) or 457(b) contributions, and bonuses for performance, good attendance, longevity, etc.

The current assumption is that 20% of retirees will receive, on average, 2.50% of pensionable earnings in the last year of employment prior to retirement.

II. Economic Assumptions

The following table compares the actual versus expected plan experience of severance pay during the period of the experience study.

Percent of retirees receiving severance pay

Total Active Retirements	Actual Retirees Paid Severance	Expected Retirees Paid Severance	Ratio of Actual to Expected
10,883	2,113	2,177	97.06%

Amount of average severance pay

Actual Severance	Expected Severance	Ratio of Actual to Expected	Proposed Severance	Ratio of Actual to Proposed
$20,074,307	$5,022,777	399.67%	$20,091,109	99.92%

As shown above, there were 10,883 members who retired from active status during the study period, 2,113 of which received severance pay (or 19.4% of active retirements). Given that recent plan experience is consistent with the current assumption (20% of retirees are assumed to receive severance pay), we recommend no changes to the percent assumed to receive severance pay.

However, the current assumption of the average severance payment (2.5% of other pensionable earnings in the last year of employment) produces an assumed severance payment of approximately $5 million, compared to an actual severance payment of approximately $20 million, during the study period. Therefore, we recommend increasing the average severance payment from 2.5% to 10.0% of other pensionable earnings in the last year of employment. Note that this change is the result of fixing an apparent calculation error from the last experience review performed by the prior actuary and does not represent an actual increase in average severance pay during the study period.

III. Demographic Assumptions

The demographic assumptions used to value the System reflect the expected occurrences of various events among members of the System. The assumptions should reflect specific characteristics of the System and produce reasonable results. A reasonable assumption is one that is expected to model the contingency being measured and not expected to produce significant gains and losses. The types of demographic assumptions used to measure pension obligations include, but are not limited to, the following:

- Mortality;
- Retirement;
- Termination;
- Disability retirement; and
- Other assumptions such as sick leave service credit and optional service purchase

The Actuarial Standards Board (ASB) has adopted Actuarial Standard of Practice No. 35 (ASOP 35 - *Selection of Demographic and Other Non-Economic Assumptions for Measuring Pension Obligations*) to provide actuaries guidance in developing demographic assumptions. The standard recommends the actuary follow a general procedure for selecting demographic assumptions. The first step is to identify the types of assumptions to use. The actuary should consider relevant plan provisions that will affect timing and value of any potential benefit payments, all contingencies that give rise to benefits or loss of benefits and the characteristics of the covered group. The next step is to identify the relevant assumption universe. The assumption universe may include prior experience studies or general studies of trends relevant to the type of demographic assumption in addition to plan experience to the extent that it is credible. The third step is to consider the assumption format. The format may include different tables for different segments of the covered population (i.e., different termination tables for males/females). The final step is to select the specific assumption and evaluate the reasonableness of each assumption. The specific experience of the System should be incorporated but not given undue weight to past experience if recent experience is attributable to a phenomenon that is unlikely to continue. For example, if recent rates of termination were due to a one-time reduction in workforce it may be unreasonable to assume that such rates will continue.

III. Demographic Assumptions

A. Mortality

One of the most significant actuarial assumptions is the probability of death. The mortality assumption takes the form of a mortality table that contains for each age in the table a probability of a person dying between that age and the next. TRS currently uses four sets of mortality tables for its population: post-retirement mortality, disabled mortality, beneficiary mortality, and pre-retirement mortality tables.

1. Healthy Post-Retirement Mortality

The mortality experience of healthy retirees is important as it helps estimate the durations over which retirement benefits are paid. Lower mortality rates mean longer benefit payment periods and, therefore, higher benefit costs.

Currently, TRS uses healthy post-retirement mortality rates based on the RP-2014 White Collar Annuitant Mortality Table, projected generationally using Scale MP-2014. Male rates are Adjusted by 115% for ages 78 to 114, and female rates are adjusted by 76% for ages 50 to 77 and by 106% for ages 78 to 114.

The experience analysis for the past three years reveals that, in total, more participants in pay status have died than expected on a counts basis, whereas fewer participants in pay status have died than expected on a benefits-weighted basis. For the post-retirement mortality assumption, our analysis uses a benefits-weighted approach, which weights the probability of death with each annuitant's pension benefit amount. This methodology takes into consideration any correlation between the health of the annuitant and the size of their benefit.

The following table provides a summary of mortality experience for service annuitants by basis and gender for the study period:

Gender	Exposures	Actual Deaths	Expected Deaths	Ratio of Actual to Expected
Basis – Counts				
Male	94,135	2,500	2,472	101.11%
Female	217,355	4,099	4,023	101.89%
Total	**311,490**	**6,599**	**6,495**	**101.60%**
Basis – Benefits (in 000's)				
Male	6,120,969	132,876	139,921	94.97%
Female	10,297,764	146,111	145,647	100.32%
Total	**16,418,733**	**278,987**	**285,568**	**97.70%**

To better match the System's experience, we have adjusted the base RP-2014 White Collar Annuitant Mortality Table by applying 70% of rates through age 77 and 110% of rates between ages 78 and 114 for females, and 94% of rates under age 80 and 110% of rates thereafter for males. The proposed healthy post-retirement mortality rates are included in Appendix B.

III. Demographic Assumptions

In order to reflect future improvements in life expectancy, we recommend applying the latest generational mortality improvement scale ("MP-2017"), which is intended to be used with the RP-2014 tables, from 2015 forward. Applying a generational adjustment to the mortality table results in slight improvements in life expectancy in each future year and decreases the likelihood, for example, that the projected life expectancy of a 35-year old active member today will be understated when benefit payments are projected to start 30 years from now.

Table 2 shows further detail regarding the post-retirement mortality experience for the study period. Graph 2 presents this information graphically for both males and females.

Table 2:
Healthy Post-Retirement Mortality Rates
Actual and Expected Experience, Benefits-Weighted Basis (in 000's)

Male

Age Range	Exposures	Actual Deaths	Expected Deaths	Ratio of Actual to Expected	Proposed Death	Ratio of Actual to Proposed
50 – 54	237	0	1	0.00%	1	0.00%
55 – 59	219,378	911	1,001	91.01%	952	95.69%
60 – 64	913,930	4,030	5,641	71.44%	5,378	74.93%
65 – 69	1,801,033	15,174	16,626	91.27%	15,810	95.98%
70 – 74	1,440,361	20,899	21,525	97.09%	20,457	102.16%
75 – 79	841,363	22,140	23,101	95.84%	20,681	107.05%
80 – 84	533,158	26,460	28,123	94.09%	26,499	99.85%
85 – 89	273,295	25,545	26,254	97.30%	25,467	100.31%
90 – 94	86,696	14,755	14,402	102.45%	13,946	105.80%
95 – 99	10,129	2,536	2,727	93.00%	2,629	96.46%
100 and over	1,389	426	520	81.92%	501	85.03%
Total	**6,120,969**	**132,876**	**139,921**	**94.97%**	**132,321**	**100.42%**

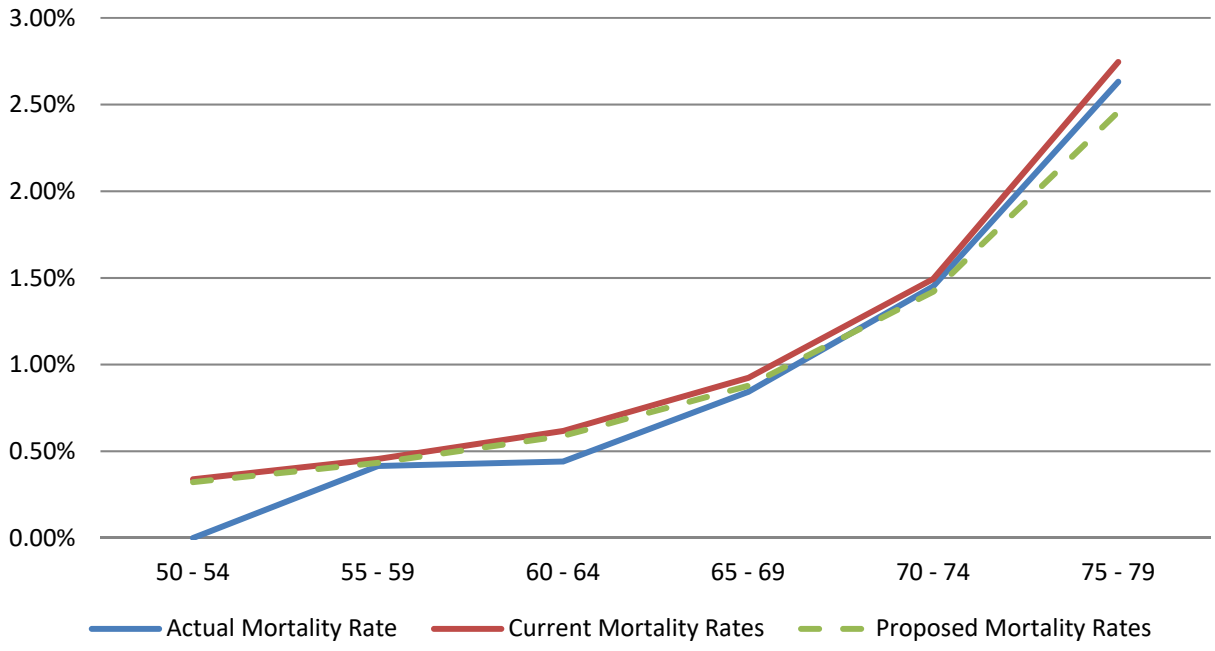
III. Demographic Assumptions

Female

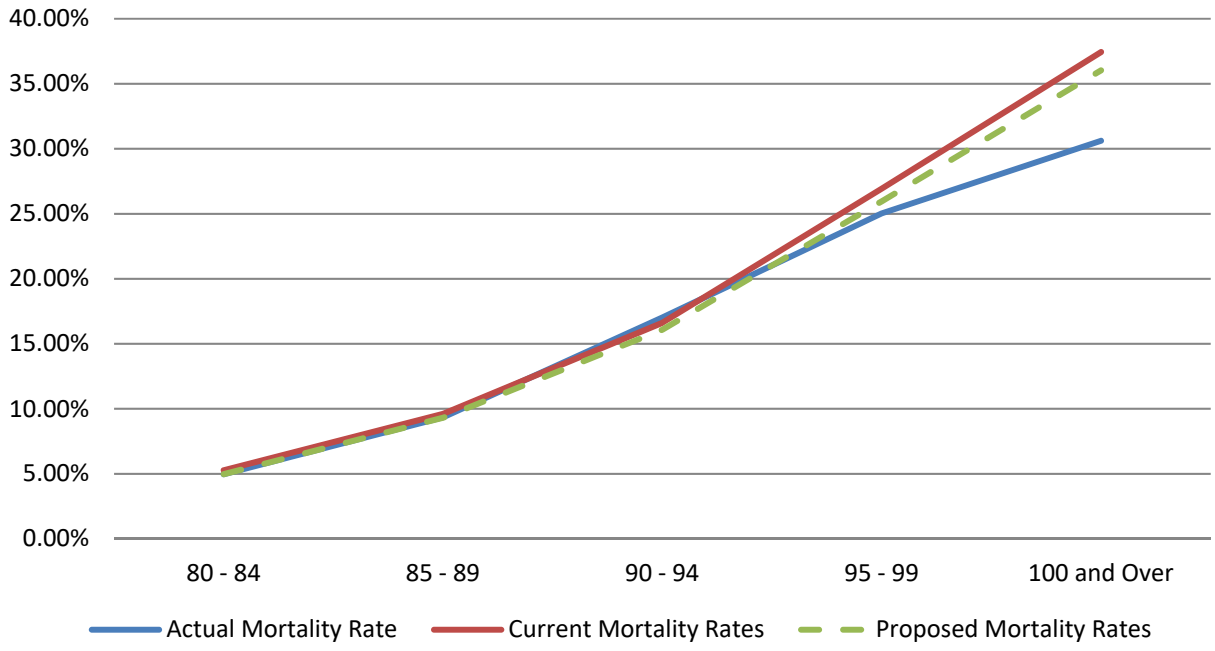
Age Range	Exposures	Actual Deaths	Expected Deaths	Ratio of Actual to Expected	Proposed Death	Ratio of Actual to Proposed
50 – 54	137	0	0	0.00%	0	0.00%
55 – 59	504,739	810	1,265	64.03%	1,185	68.35%
60 – 64	2,384,478	6,531	9,118	71.63%	8,543	76.45%
65 – 69	3,296,086	18,550	19,458	95.33%	18,144	102.24%
70 – 74	1,956,230	18,372	18,577	98.90%	17,305	106.17%
75 – 79	1,031,456	19,368	19,130	101.24%	18,931	102.31%
80 – 84	580,059	23,931	22,828	104.83%	24,066	99.44%
85 – 89	342,858	24,122	24,311	99.22%	25,681	93.93%
90 – 94	146,438	21,254	18,641	114.02%	19,668	108.06%
95 – 99	47,681	10,541	9,915	106.31%	10,426	101.10%
100 and over	7,602	2,632	2,404	109.48%	2,520	104.44%
Total	**10,297,764**	**146,111**	**145,647**	**100.32%**	**146,469**	**99.76%**

Graph 2:
Healthy Post-Retirement Mortality Rates
Actual Versus Expected Experience, Benefits-Weighted Basis

Males Age 50-79

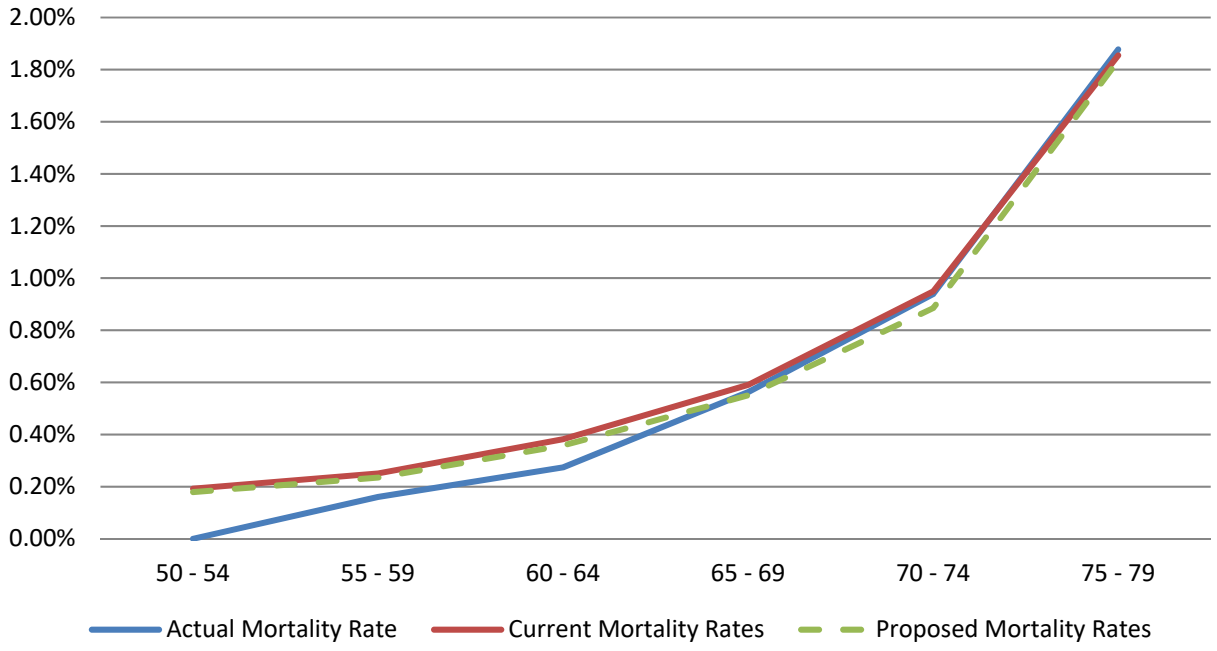


Male Age 80 and Over

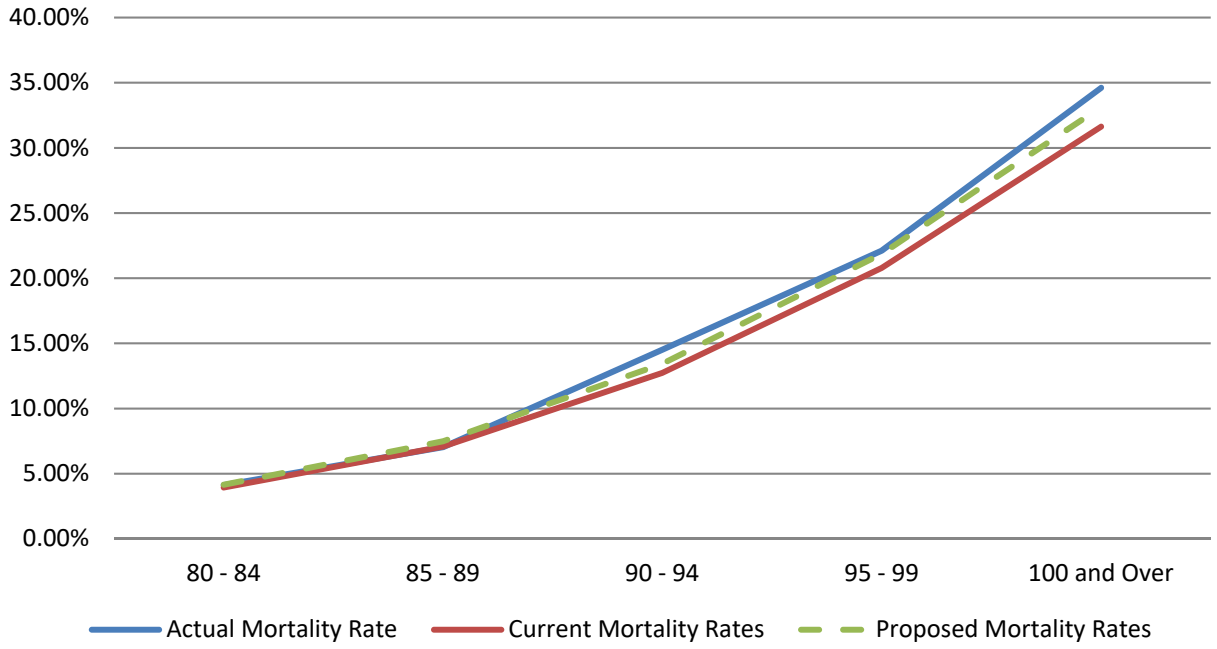


III. Demographic Assumptions

Female Age 50-79



Females Age 80 and Over



III. Demographic Assumptions

2. Disabled Post-Retirement Mortality

Mortality experience among disabled annuitants is studied separately from service retirees because of characteristically high levels of mortality exhibited by disability retirees. The current rates are based on gender and age, and were developed in prior experience studies.

The experience analysis for the past three years reveals that more disabled annuitants have died than expected. Similar to healthy post-retirement mortality, our analysis of the disabled mortality rates uses a benefits-weighted approach.

The following table summarizes the disabled annuitant mortality experience by basis and gender for the study period:

Gender	Exposures	Actual Deaths	Expected Deaths	Ratio of Actual to Expected
Basis – Counts				
Male	532	32	18	177.19%
Female	2,448	81	57	141.31%
Total	**2,980**	**113**	**75**	**149.90%**
Basis – Benefits (in 000's)				
Male	16,264	844	529	159.39%
Female	67,887	2,247	1,429	157.26%
Total	**84,151**	**3,091**	**1,958**	**157.87%**

We recommend the continual use of RP-2014 Disabled Mortality Tables as the mortality assumption for disabled lives, adjusted to better match recent plan experience.

After adjusting for the credibility of the size of the experience data, we recommend using 117% of male and female rates from the RP-2014 Disabled Mortality Table. This will produce a ratio of actual to expected deaths for the entire population of about 133%. The proposed disabled post-retirement mortality rates are included in Appendix B. Similar to the proposed healthy post-retirement mortality assumption, we recommend applying future mortality improvement projected on a generational basis using projection scale MP-2017 from 2015 forward.

On the following pages, Table 3 summarizes the disabled annuitant mortality experience for the study period. Graph 3 presents this information graphically for both males and females.

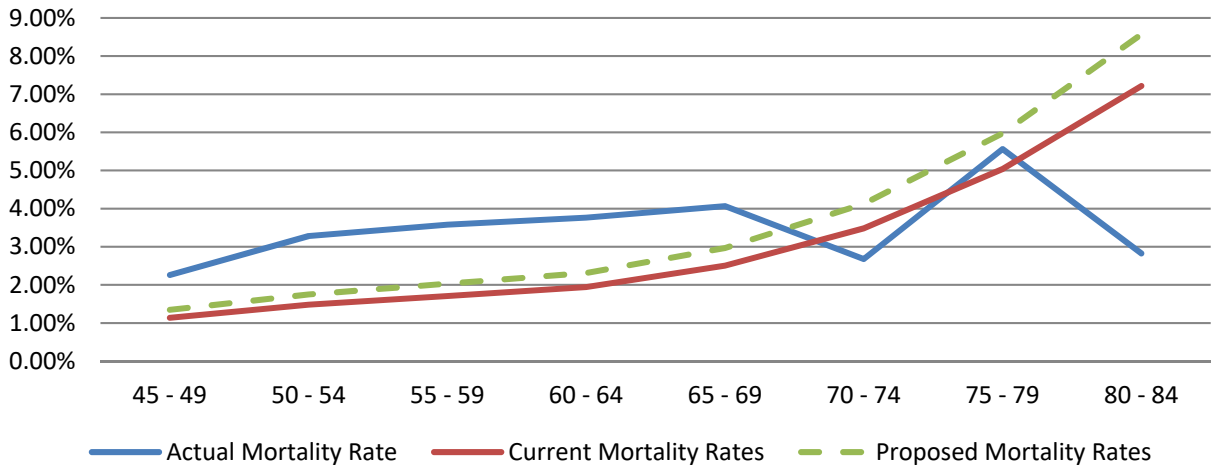
Table 3:
Disabled Post-Retirement Mortality Rates
Actual Versus Expected Experience, Compared to Proposed, Benefits-Weighted Basis (in 000's)

Male and Female

Age Range	Exposures	Actual Deaths	Expected Deaths	Ratio of Actual to Expected	Proposed Deaths	Ratio of Actual to Proposed
40 – 44	3,515	78	29	268.97%	29	268.97%
45 – 49	7,171	162	82	197.56%	96	168.75%
50 – 54	10,816	355	160	221.88%	189	187.83%
55 – 59	18,395	659	314	209.87%	373	176.68%
60 – 64	18,159	683	353	193.48%	420	162.62%
65 – 69	13,267	539	332	162.35%	394	136.80%
70 – 74	6,520	175	227	77.09%	269	65.06%
75 – 79	2,527	141	127	111.02%	151	93.38%
80 – 84	2,650	75	191	39.27%	227	33.04%
85 and Over	1,131	224	143	156.64%	170	131.76%
Total	**84,151**	**3,091**	**1,958**	**157.87%**	**2,318**	**133.35%**

Graph 3:
Disabled Post-Retirement Mortality Rates
Actual Versus Expected Experience, Compared to Proposed, Benefits-Weighted Basis

Males and Females



III. Demographic Assumptions

3. Beneficiary Post-Retirement Mortality

Mortality experience among beneficiaries in pay status is studied separately from service retirees. The current rates are based on gender and age, and were reviewed in prior experience studies.

The experience analysis for the past three years reveals that fewer beneficiaries have died than expected. Similar to healthy post-retirement mortality, our analysis of the beneficiary mortality rates uses a benefits-weighted approach.

The following table summarizes the beneficiary annuitant mortality experience by basis and gender for the study period:

Gender	Exposures	Actual Deaths	Expected Deaths	Ratio of Actual to Expected
Basis – Counts				
Male	10,313	721	678	106.30%
Female	20,317	1,065	1,149	92.68%
Total	**30,630**	**1,786**	**1,827**	**97.73%**
Basis – Benefits (in 000's)				
Male	190,907	11,209	10,371	108.08%
Female	493,566	20,656	23,653	87.33%
Total	**684,473**	**31,865**	**34,024**	**93.65%**

We recommend the continual use of RP-2014 Healthy Annuitant Mortality Table as the mortality assumption for beneficiary lives, adjusted to better match recent plan experience.

After adjusting for the credibility of the size of the experience data, we recommend using 116% of male rates and 96% of female rates for ages 50 to 114 of the RP-2014 Healthy Annuitant Mortality Table. This will produce a ratio of actual to expected deaths for the entire population of about 101%. The proposed disabled post-retirement mortality rates are included in Appendix B. Similar to the healthy post-retirement mortality assumption, we also recommend applying the latest generational mortality improvement scale (MP-2017) from 2015 forward, in order to account for future mortality improvements.

On the following pages, Table 4 summarizes the beneficiary annuitant mortality experience for the study period. Graph 4 presents this information graphically for both males and females.

Table 4:
Beneficiary Post-Retirement Mortality Rates
Actual Versus Expected Experience, Compared to Proposed,
Benefits-Weighted Basis (in 000's)

Males

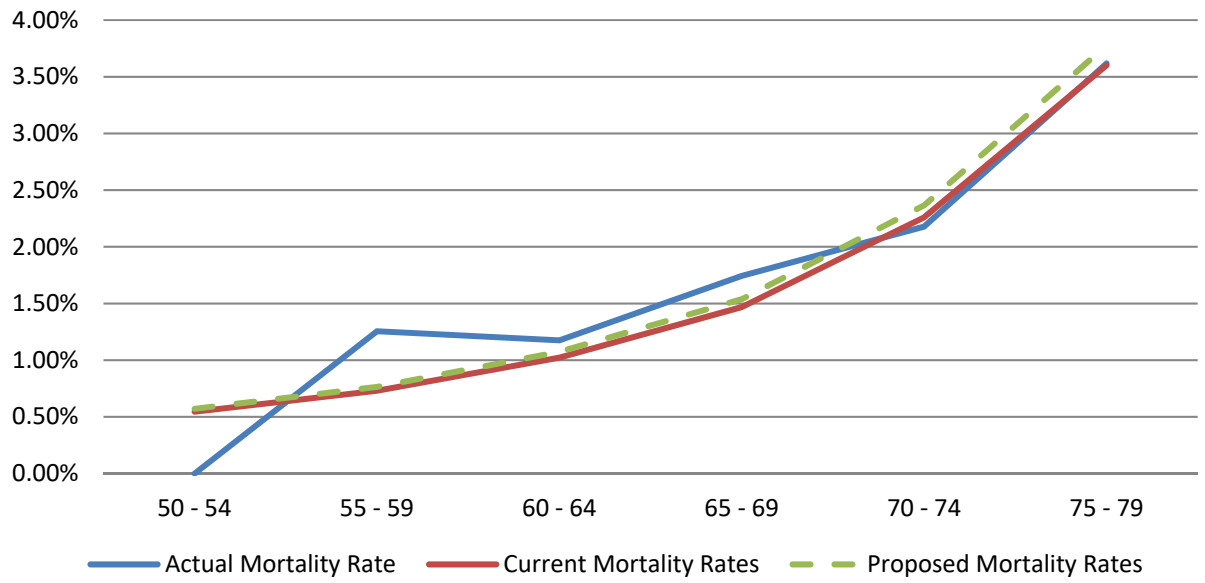
Age Range	Exposures	Actual Deaths	Expected Deaths	Ratio of Actual to Expected	Proposed Deaths	Ratio of Actual to Proposed
50 – 54	1,803	0	10	0.00%	10	0.00%
55 – 59	6,540	82	48	170.83%	50	164.00%
60 – 64	14,596	171	149	114.77%	157	108.92%
65 – 69	30,698	535	451	118.63%	472	113.35%
70 – 74	34,966	762	790	96.46%	827	92.14%
75 – 79	30,532	1,105	1,100	100.45%	1,153	95.84%
80 – 84	31,077	2,128	1,926	110.49%	2,023	105.19%
85 – 89	23,801	2,768	2,517	109.97%	2,644	104.69%
90 – 94	13,214	2,583	2,361	109.40%	2,475	104.36%
95 – 99	3,337	964	893	107.95%	933	103.32%
100 and Over	343	111	126	88.10%	131	84.73%
Total	**190,907**	**11,209**	**10,371**	**108.08%**	**10,875**	**103.07%**

Females

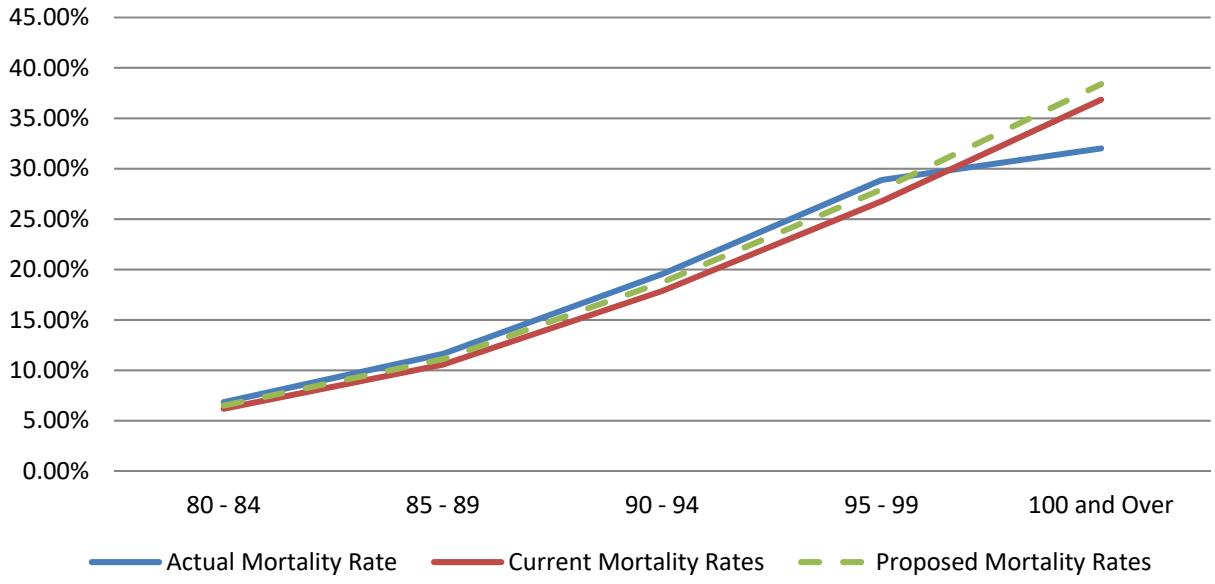
Age Range	Exposures	Actual Deaths	Expected Deaths	Ratio of Actual to Expected	Proposed Deaths	Ratio of Actual to Proposed
50 – 54	3,970	35	14	250.00%	12	291.67%
55 – 59	9,174	36	43	83.72%	38	94.74%
60 – 64	26,609	196	190	103.16%	166	118.07%
65 – 69	60,156	462	657	70.32%	570	81.05%
70 – 74	83,224	898	1,451	61.89%	1,258	71.38%
75 – 79	94,993	1,803	2,705	66.65%	2,349	76.76%
80 – 84	90,843	4,314	4,379	98.52%	3,814	113.11%
85 – 89	77,152	5,554	6,359	87.34%	5,548	100.11%
90 – 94	35,418	4,413	4,999	88.28%	4,357	101.29%
95 – 99	10,357	2,384	2,313	103.07%	2,009	118.67%
100 and Over	1,670	561	543	103.31%	469	119.62%
Total	**493,566**	**20,656**	**23,653**	**87.33%**	**20,590**	**100.32%**

Graph 4:
Beneficiary Post-Retirement Mortality Rates
Actual Versus Expected Experience, Compared to Proposed, Benefits-Weighted Basis

Males Ages 50-79

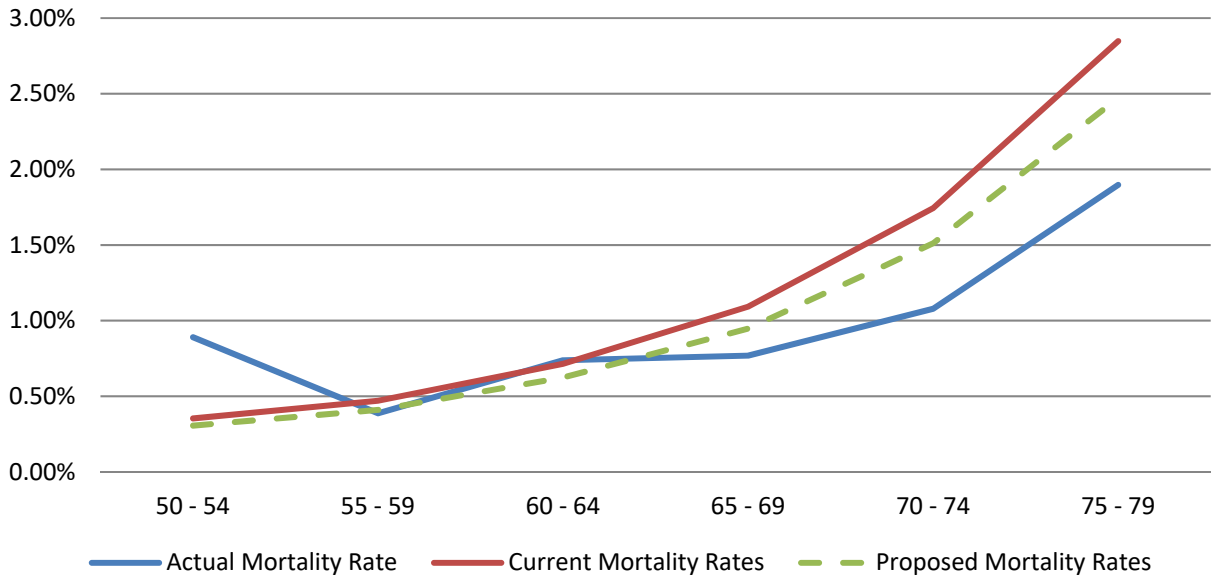


Males Ages 80 and Over

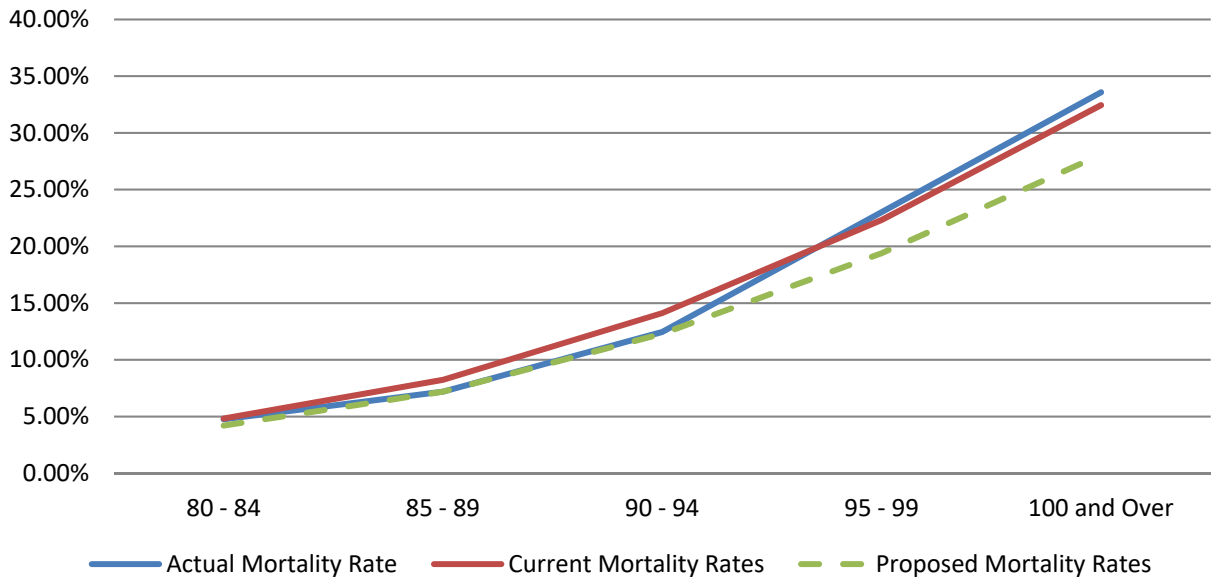


III. Demographic Assumptions

Females Ages 50-79



Females Ages 80 and Over



III. Demographic Assumptions

4. Healthy Pre-Retirement Mortality

The mortality experience of active and terminated vested members should be considered for several reasons. First, in combination with termination and disability rates, the pre-retirement mortality table enables the actuary to estimate the number of individuals who will eventually be eligible for a service retirement benefit, and thereby estimate the liability for those individuals. In addition, the death of a member before retirement may result in a benefit payable to a beneficiary, and the liability for these benefits must be taken into account in the valuation.

The experience analysis for the past three years reveals that slightly more actives and terminated members have died than expected. Our analysis of the pre-retirement mortality rates uses a count-based approach.

The following table summarizes the pre-retirement mortality experience by gender for the study period:

Gender	Exposures	Actual Deaths	Expected Deaths	Ratio of Actual to Expected
Male	118,148	161	136	118.00%
Female	404,085	312	303	102.96%
Total	**522,233**	**473**	**439**	**107.74%**

We recommend the continual use of RP-2014 White Collar Employee Mortality Tables as the pre-retirement mortality assumption, adjusted to better match recent plan experience.

After adjusting for the credibility of the size of the experience data, we recommend using 104% of the RP-2014 White Collar Employee Table for the pre-retirement mortality assumption. The proposed healthy pre-retirement mortality rates are included in Appendix B. Similar to the healthy post-retirement mortality assumption, we also recommend applying the latest generational mortality improvement scale (MP-2017) from 2015 forward, in order to account for future mortality improvements.

III. Demographic Assumptions

B. Retirement

1. Active Retirement

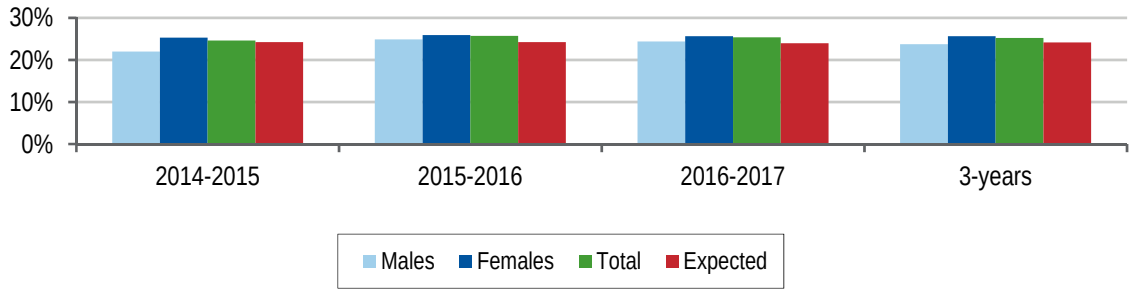
Under the plan, members are eligible to retire following attainment of various eligibilities. The normal retirement eligibility conditions for the various tiers are:

- Tier 1: Age 60 with 10 years of service or Age 62 with 5 years of service
- Tier 2: Age 67 with 10 years of service

Participants are allowed to retire early with a reduced benefit if they meet the following eligibility:

- Tier 1: Age 55 with 20 years of service (unreduced for members who retire prior to age 60 with 35 years of service)
- Tier 2: Age 62 with 10 years of service

As the graph below illustrates, the actual retirement experience has been greater than expected in all years:



The actual number of total active retirements is about 5% greater than expected (shown in the table below).

Gender	Exposures	Actual Retirements	Expected Retirements	Ratio of Actual to Expected
Male	8,215	1,878	1,877	100.01%
Female	32,191	7,859	7,372	106.61%
Total	**40,406**	**9,737**	**9,249**	**105.28%**

Currently, the retirement assumption used in the valuation is based on the member's age and service. We did examine experience by gender to determine whether there is enough difference in male and female experience to warrant using separate sex-distinct tables for the retirement assumption. However, we did not see a large enough difference in the experience data to recommend a change in this regard.

III. Demographic Assumptions

The current assumption for Tier 1 retirement uses five unisex tables of age-based rates for members from age 54 to 70, based on the following service bands:

- Less than 19 years of service
- 19 – 30 years of service
- 31 years of service
- 32 – 33 years of service
- 34 or more years of service

The current assumption for Tier 2 retirement uses a similar set of unisex, age-based tables for members starting at age 62 and ceasing at 100% probability of retirement at age 70. Tables 5 – 9 present comparisons of actual to expected retirements under the various service bands for the period.

Actual experience for Tier 1 members under each service band was slightly greater than expected. Therefore, we recommend adjusting these retirement rates to better reflect recent plan experience, including changing two of the service bands from 19 – 30 and 31 years of service to 19 – 29 and 30 – 31 years of service, respectively. There has been no experience for Tier 2 members, so we recommend continued use of the current assumption. We believe the current assumed pattern of retirement for Tier 2 members is not unreasonable, and we will continue to track actual Tier 2 retirement experience as it emerges.

On the following pages, Tables 5 through 9 summarize the active retirement experience for the study period. Graphs 5 through 9 present this information graphically.

The tables showing the proposed Tier I active retirement rates for all ages are included in Appendix C.

Table 5:
Tier I Active Member Retirement, Less than 19 Years of Service
Actual Versus Expected Experience, Compared to Proposed

Age	Exposures	Actual Retirements	Expected Retirements	Ratio of Actual to Expected	Proposed Retirements	Ratio of Actual to Proposed
60	1,803	370	252	146.83%	361	102.49%
61	1,454	286	204	140.20%	247	115.79%
62	1,637	277	229	120.96%	246	112.60%
63	1,333	206	187	110.16%	200	103.00%
64	1,082	247	260	95.00%	238	103.78%
65	806	212	210	100.95%	202	104.95%
66	567	139	147	94.56%	142	97.89%
67	388	80	101	79.21%	78	102.56%
68	282	54	73	73.97%	56	96.43%
69	201	51	52	98.08%	49	104.08%
Total	**9,553**	**1,922**	**1,715**	**112.07%**	**1,819**	**105.66%**

Graph 5:
Tier I Active Member Retirement, Less than 19 Years of Service
Actual Versus Expected Experience, Compared to Proposed

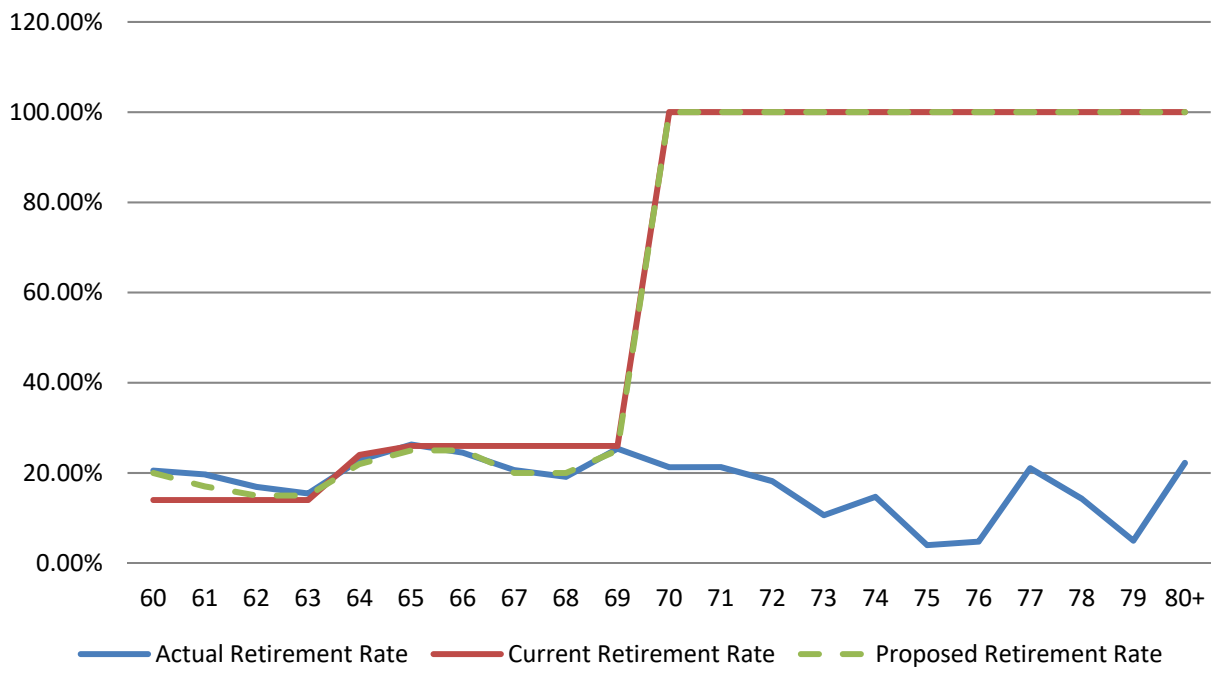


Table 6:
Tier I Active Member Retirement, 19 – 29 Years of Service[1]
Actual Versus Expected Experience, Compared to Proposed

Age	Exposures	Actual Retirements	Expected Retirements	Ratio of Actual to Expected	Proposed Retirements	Ratio of Actual to Proposed
55	2,622	167	262	63.74%	184	90.76%
56	2,333	104	163	63.80%	163	63.80%
57	2,226	134	156	85.90%	156	85.90%
58	2,143	126	150	84.00%	150	84.00%
59	2,182	675	546	123.63%	655	103.05%
60	1,911	623	573	108.73%	573	108.73%
61	1,469	411	397	103.53%	441	93.20%
62	1,257	369	339	108.85%	377	97.88%
63	1,067	338	288	117.36%	320	105.63%
64	893	347	330	105.15%	357	97.20%
65	589	251	218	115.14%	236	106.36%
66	375	143	139	102.88%	150	95.33%
67	244	98	90	108.89%	98	100.00%
68	160	59	53	111.32%	64	92.19%
69	103	40	34	117.65%	40	100.00%
Total	**19,574**	**3,885**	**3,738**	**103.93%**	**3,964**	**98.01%**

Graph 6:
Tier I Active Member Retirement, 19 – 29 Years of Service[1]
Actual Versus Expected Experience, Compared to Proposed

[1] Previous grouping was 19-30 years of service

Table 7:
Tier I Active Member Retirement, 30 – 31 Years of Service[1]
Actual Versus Expected Experience, Compared to Proposed

Age	Exposures	Actual Retirements	Expected Retirements	Ratio of Actual to Expected	Proposed Retirements	Ratio of Actual to Proposed
55	967	46	86	53.49%	77	59.74%
56	694	41	52	78.85%	56	73.21%
57	529	43	52	82.69%	53	81.13%
58	382	58	36	161.11%	38	152.63%
59	384	149	121	123.14%	134	111.19%
60	300	134	118	113.56%	120	111.67%
61	165	73	50	146.00%	66	110.61%
62	139	51	52	98.08%	56	91.07%
63	134	55	43	127.91%	54	101.85%
64	94	41	41	100.00%	42	97.62%
65	62	26	27	96.30%	28	92.86%
66	42	20	18	111.11%	19	105.26%
67	27	10	11	90.91%	11	90.91%
68	18	8	7	114.29%	7	114.29%
69	11	6	5	120.00%	4	150.00%
Total	**3,948**	**761**	**719**	**105.84%**	**765**	**99.48%**

Graph 7:
Tier I Active Member Retirement, 30 – 31 Years of Service[1]
Actual Versus Expected Experience, Compared to Proposed

[1] Previous grouping was 31 years of service only

Table 8:
Tier I Active Member Retirement, 32 – 33 Years of Service
Actual Versus Expected Experience, Compared to Proposed

Age	Exposures	Actual Retirements	Expected Retirements	Ratio of Actual to Expected	Proposed Retirements	Ratio of Actual to Proposed
55	1,003	385	381	101.05%	401	96.01%
56	858	339	326	103.99%	343	98.83%
57	601	236	240	98.33%	240	98.33%
58	472	215	189	113.76%	236	91.10%
59	299	181	179	101.12%	179	101.12%
60	174	106	104	101.92%	104	101.92%
61	145	77	65	118.46%	80	96.25%
62	118	56	53	105.66%	59	94.92%
63	76	39	38	102.63%	38	102.63%
64	62	32	37	86.49%	31	103.23%
65	41	20	21	95.24%	21	95.24%
66	27	12	14	85.71%	14	85.71%
67	29	16	15	106.67%	15	106.67%
68	16	1	8	12.50%	8	12.50%
69	6	2	3	66.67%	3	66.67%
Total	**3,927**	**1,717**	**1,673**	**102.63%**	**1,772**	**96.90%**

Graph 8:
Tier I Active Member Retirement, 32 – 33 Years of Service
Actual Versus Expected Experience, Compared to Proposed

Note that for age 68, 7% is an outlier due to small sample size. There was 1 retirement and 16 exposures.

Table 9:
Tier I Active Member Retirement, 34 or More Years of Service
Actual Versus Expected Experience, Compared to Proposed

Age	Exposures	Actual Retirements	Expected Retirements	Ratio of Actual to Expected	Proposed Retirements	Ratio of Actual to Proposed
55	21	10	13	76.92%	9	111.11%
56	304	154	137	112.41%	137	112.41%
57	459	195	207	94.20%	207	94.20%
58	516	246	206	119.42%	232	106.03%
59	457	191	183	104.37%	183	104.37%
60	361	153	144	106.25%	144	106.25%
61	286	109	114	95.61%	114	95.61%
62	246	97	98	98.98%	98	98.98%
63	217	82	87	94.25%	87	94.25%
64	179	70	72	97.22%	72	97.22%
65	133	52	53	98.11%	53	98.11%
66	98	38	39	97.44%	39	97.44%
67	65	28	26	107.69%	29	96.55%
68	35	16	14	114.29%	16	100.00%
69	27	11	11	100.00%	13	91.67%
Total	**3,404**	**1,452**	**1,404**	**103.42%**	**1,433**	**101.33%**

Graph 9:
Tier I Active Member Retirement, 34 or More Years of Service
Actual Versus Expected Experience, Compared to Proposed

III. Demographic Assumptions

C. Termination

The termination rates used in annual actuarial valuations project the percentage of employees at each age or service duration that are expected to terminate membership before retirement age. These rates take account of possible terminations for all causes other than retirement, death, or disability and include both voluntary and involuntary withdrawals from service.

Terminations before retirement age give rise to some benefit rights, but may also involve the forfeiture of a portion of previously accrued benefits. Forfeitures resulting from turnover are anticipated in advance and help finance benefits that become payable to other members. In some cases, members who leave the plan with five or more years of service and are eligible for deferred vested benefits withdraw their deposits, thus forfeiting the portion of their accrued benefit rights based on employer contributions.

The turnover experience studied includes all terminations of active employment for members not vested at termination (since such members are not eligible for other benefits, termination of employment will, most likely, result in a withdrawal of employee contributions), and terminations of membership for members who were vested and either withdrew their contributions or are eligible for future benefits. These terminations are offset by rehired members to arrive at "net" turnover for each year of the study period. Note that this analysis excludes hourly and substitute teachers due to their high turnover rate that would overstate the probability of turnover for full-time teachers.

Currently, the turnover assumption used in the valuation is based on the members' age and service. The current assumption has separate age-based rates for members with less than five years of service and for members with five or more years of service.

Actual terminations were significantly lower than expected, as shown in the table below.

Gender	Exposures	Actual Terminations	Expected Terminations	Ratio of Actual to Expected
Termination – Less Than Five Years of Service				
Male	18,367	1,320	1,827	72.25%
Female	61,794	4,107	6,184	66.41%
Total	**80,161**	**5,427**	**8,011**	**67.74%**
Termination – Five or More Years of Service				
Male	69,363	1,048	1,501	69.82%
Female	217,315	4,224	6,460	65.39%
Total	**286,678**	**5,272**	**7,961**	**66.22%**

After reviewing the experience further, we recommend decreasing termination rates to reflect the experience over the past three years. Comparisons of the actual experience, expected turnovers, and proposed rates for members with less than five years of service are shown in Table 10. A comparison of the actual experience, expected turnovers, and proposed rates for members with at least five years of service is shown in Table 11. The complete listing of the proposed termination rates are included in Appendix D.

Table 10:
Termination – Less Than Five Years of Service
Actual and Expected Experience Compared to Proposed, Age-Based

Male

Age Range	Exposures	Actual Terminations[1]	Expected Terminations	Ratio of Actual to Expected	Proposed Terminations	Ratio of Actual to Proposed
< 30	9,385	565	828	68.26%	642	88.01%
30 – 34	3,959	227	350	64.86%	278	81.65%
35 – 39	1,985	160	205	78.07%	173	92.49%
40 – 44	1,083	104	138	75.45%	112	92.86%
45 – 49	818	84	122	68.75%	93	90.32%
50 – 54	525	49	95	51.77%	62	79.03%
55 – 59[2]	333	44	60	73.02%	43	102.33%
60 & Over[2]	279	87	29	181.25%	58	150.00%
Total	**18,367**	**1,320**	**1,827**	**72.25%**	**1,461**	**90.35%**

Female

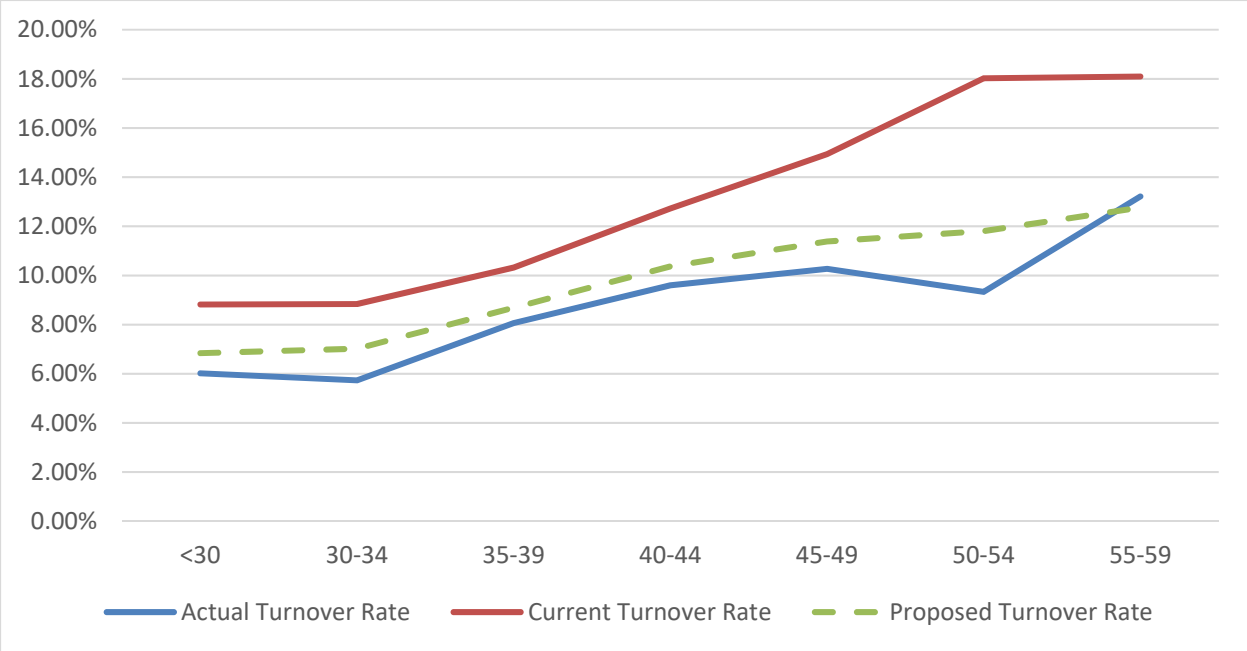
Age Range	Exposures	Actual Terminations[1]	Expected Terminations	Ratio of Actual to Expected	Proposed Terminations	Ratio of Actual to Proposed
< 30	34,731	2,067	3,024	68.35%	2,307	89.60%
30 – 34	10,873	772	1,250	61.75%	779	99.10%
35 – 39	5,433	394	626	62.96%	417	94.48%
40 – 44	4,158	272	461	59.02%	333	81.68%
45 – 49	3,249	237	365	64.89%	260	91.15%
50 – 54	1,949	158	263	60.14%	182	86.81%
55 – 59[2]	945	103	151	68.14%	118	87.29%
60 & Over[2]	456	104	44	236.4%	96	108.33%
Total	**61,794**	**4,107**	**6,184**	**66.41%**	**4,492**	**91.43%**

Grand Total	**80,161**	**5,427**	**8,011**	**67.74%**	**5,953**	**91.16%**

[1] Actual terminations as shown in the table are net of rehired employees.
[2] Excludes terminations from members who are eligible for retirement.

Graph 10:
Termination – Less Than Five Years of Service
Actual and Expected Experience Compared to Proposed, Age-Based

Male



Female

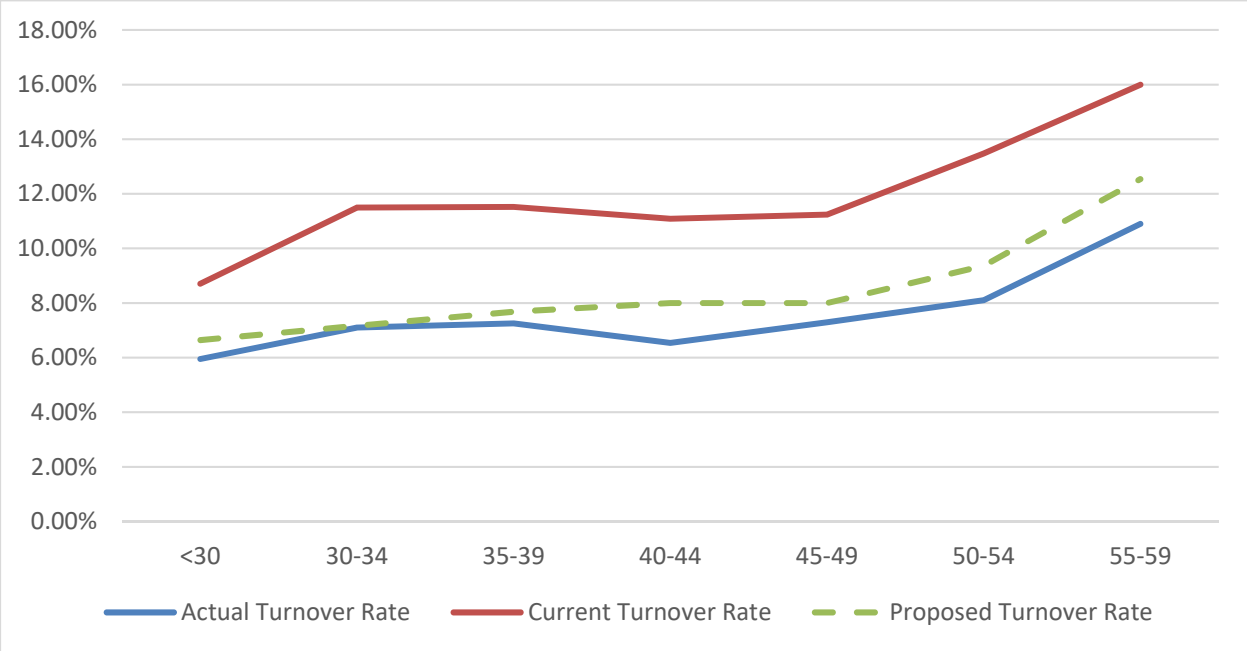


Table 11:
Termination – Five or More Years of Service
Actual and Expected Experience Compared to Proposed, Age-Based

Male

Age Range	Exposures	Actual Terminations[1]	Expected Terminations	Ratio of Actual to Expected	Proposed Terminations	Ratio of Actual to Proposed
< 30	2,125	61	73	83.13%	64	95.31%
30 – 34	11,949	272	328	82.89%	278	97.84%
35 – 39	15,139	198	289	68.48%	242	81.82%
40 – 44	14,833	196	246	79.53%	230	85.22%
45 – 49	13,013	129	232	55.62%	163	79.14%
50 – 54	9,925	128	217	58.92%	153	83.66%
55 – 59	2,181	40	105	38.23%	52	76.92%
60 & Over	198	24	11	240.00%	5	480.00%
Total	**69,363**	**1,048**	**1,501**	**69.82%**	**1,187**	**88.29%**

Female

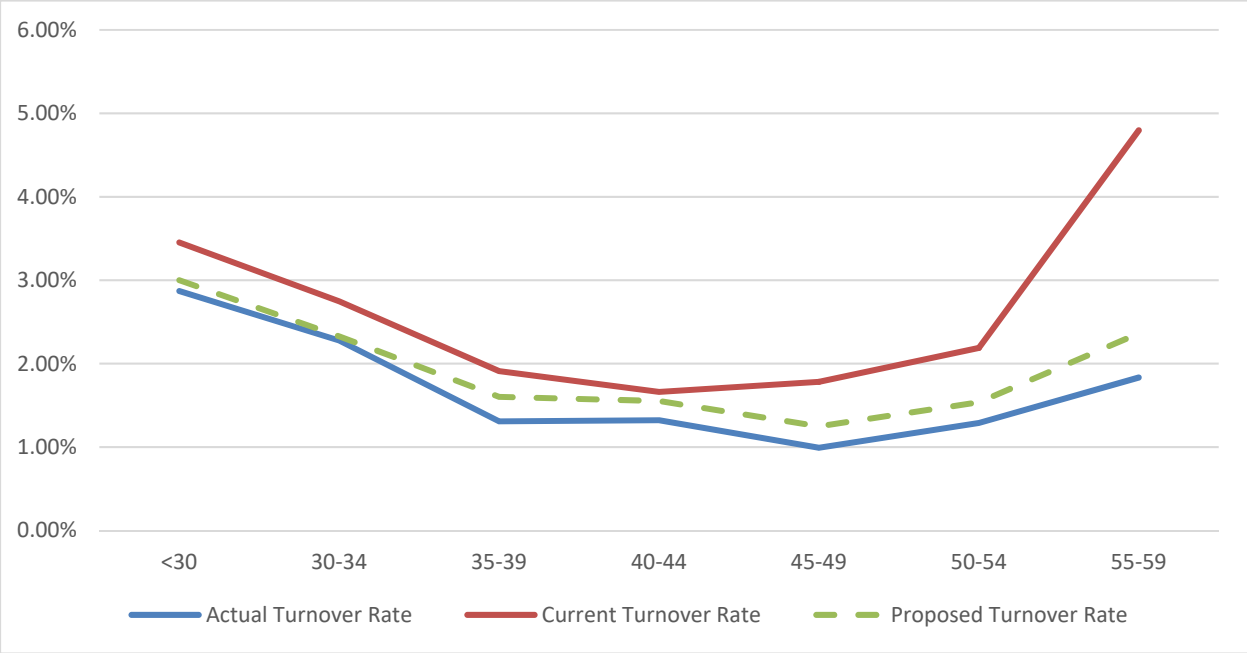
Age Range	Exposures	Actual Terminations[1]	Expected Terminations	Ratio of Actual to Expected	Proposed Terminations	Ratio of Actual to Proposed
< 30	9,591	434	516	84.16%	463	93.74%
30 – 34	40,323	1,427	1,909	74.77%	1,611	88.58%
35 – 39	44,477	875	1,380	63.40%	1,073	81.55%
40 – 44	40,221	429	802	53.52%	563	76.20%
45 – 49	37,275	369	670	55.03%	501	73.65%
50 – 54	32,088	401	639	62.71%	546	73.44%
55 – 59	12,787	245	517	47.41%	279	87.81%
60 & Over	553	44	27	157.14%	22	200.00%
Total	**217,315**	**4,224**	**6,460**	**65.39%**	**5,058**	**83.51%**

Grand Total	**286,678**	**5,272**	**7,961**	**66.22%**	**6,245**	**84.42%**

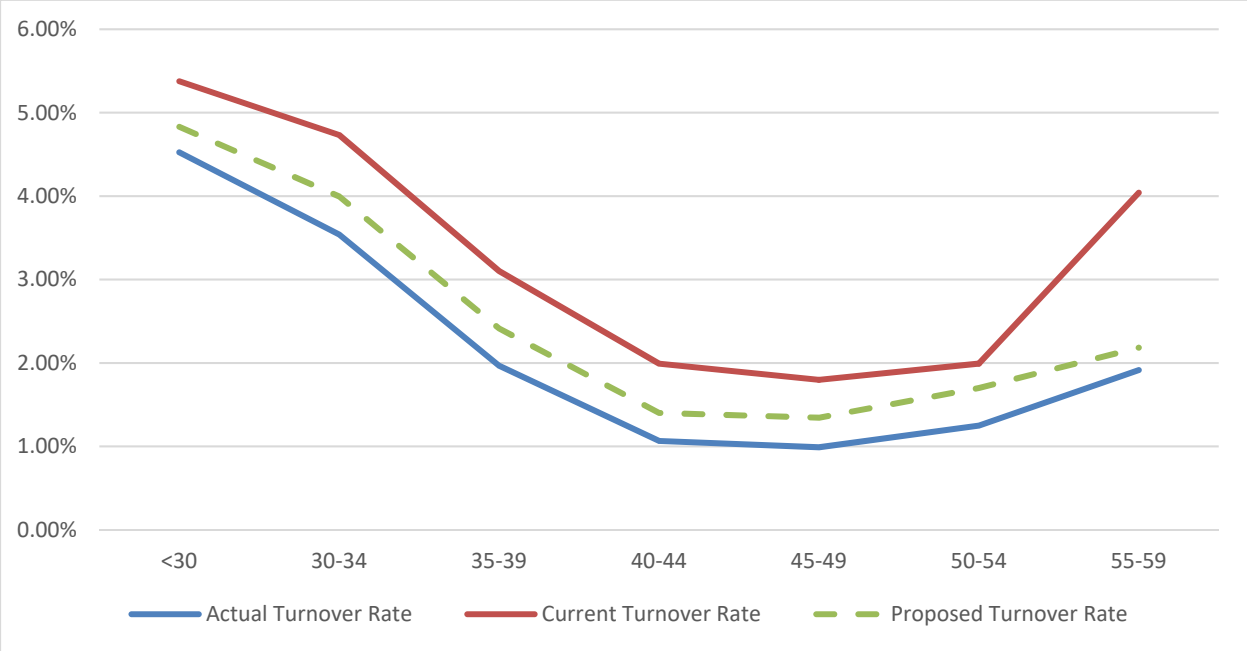
[1] Actual terminations as shown in the table are net of rehired employees.

Graph 11:
Termination – Five or More Years of Service
Actual and Expected Experience Compared to Proposed, Age-Based

Male



Females



III. Demographic Assumptions

D. Disability Retirement

Disability rate tables function in the same way as mortality tables. The rate at each age indicates the probability of becoming disabled before the next age. Disability rates add liability for the value of the disability benefits, but lessen the value of retirement benefits ultimately payable, since anyone who becomes disabled is not projected to receive retirement benefits other than the disability benefit.

The current disability rates are based on members' age and gender and range from 0.03% at age 20 to 0.61% at age 69 for males and 0.03% at age 20 to 0.41% at age 69 for females. The following table summarizes the disability experience for the plan during the study period. Overall, the number of actual male and females disabilities were less than the number of assumed disabilities.

Gender	Exposures	Actual Disabilities	Expected Disabilities	Ratio of Actual to Expected
Male	104,244	46	77	59.54%
Female	338,173	295	422	69.98%
Total	**442,417**	**341**	**499**	**68.36%**

In light of the above, considering the small sample size, we recommend maintaining a sex-distinct, age-based table with decreased rates to better match recent plan experience. The complete listing of the proposed disability rates are included in Appendix E.

Table 12:
Disability Retirement
Actual and Expected Experience Compared to Proposed, Age-Based

Males

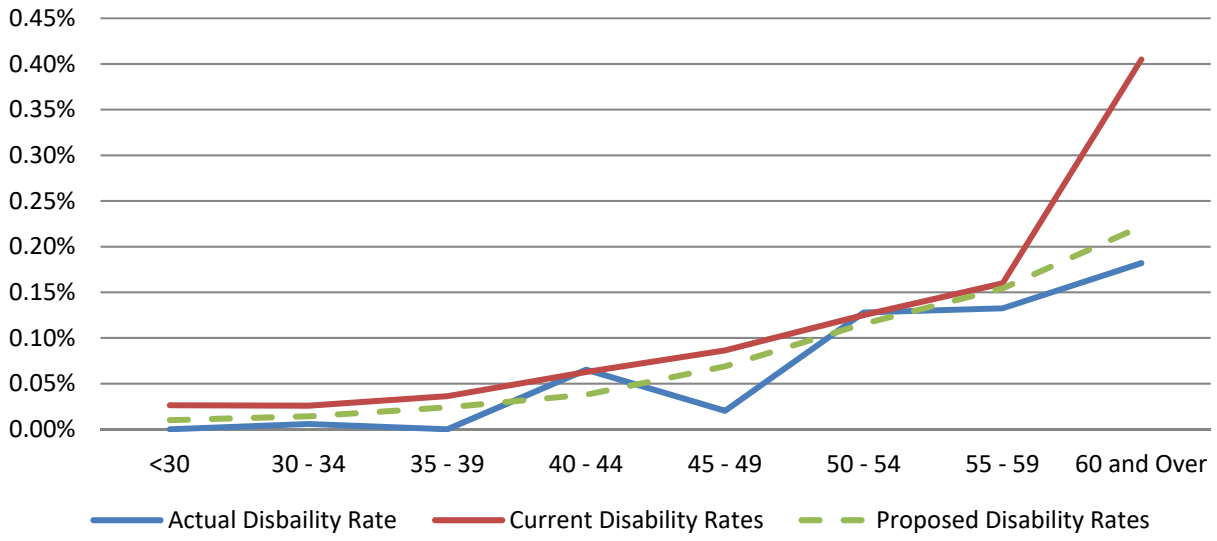
Age Range	Exposures	Actual Disabilities	Expected Disabilities	Ratio of Actual to Expected	Proposed Disabilities	Ratio of Actual to Proposed
< 30	14,380	0	4	0.00%	1	0.00%
30 – 34	17,339	1	4	22.32%	2	50.00%
35 – 39	18,058	0	7	0.00%	4	0.00%
40 – 44	16,857	11	11	103.90%	6	183.33%
45 - 49	14,835	3	13	23.41%	10	30.00%
50 – 54	11,725	15	15	102.24%	14	107.14%
55 – 59	8,302	11	13	82.93%	13	84.62%
60 & Over	2,748	5	10	44.94%	7	71.43%
Total	**104,244**	**46**	**77**	**59.54%**	**57**	**80.70%**

Females

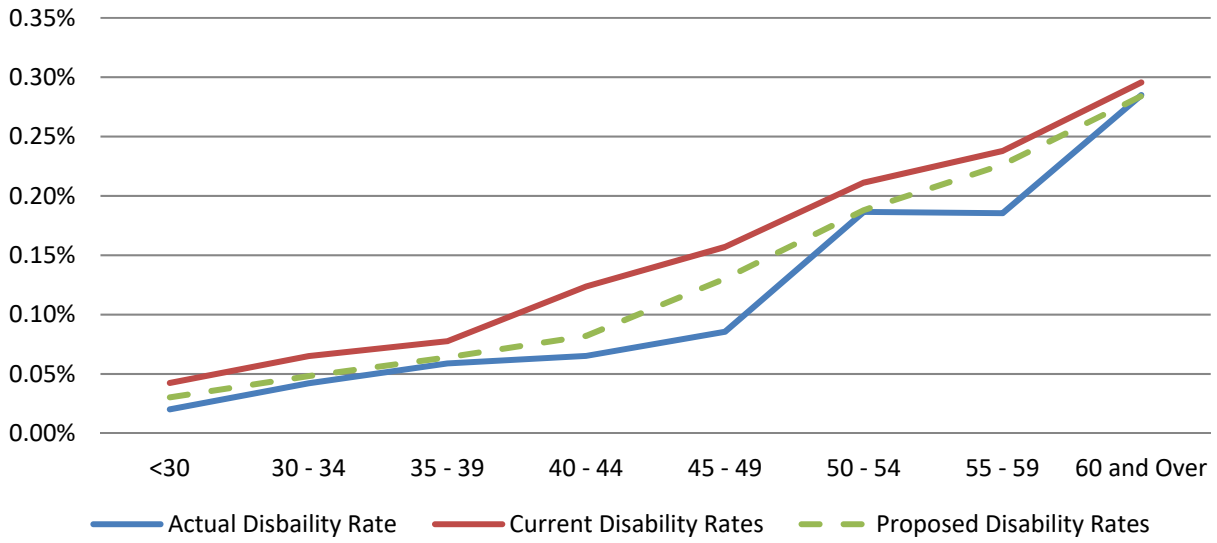
Age Range	Exposures	Actual Disabilities	Expected Disabilities	Ratio of Actual to Expected	Proposed Disabilities	Ratio of Actual to Proposed
< 30	49,551	10	21	47.63%	15	66.67%
30 – 34	54,657	23	36	64.70%	26	88.46%
35 – 39	54,377	32	42	75.77%	35	91.43%
40 – 44	50,610	33	63	52.71%	42	78.57%
45 - 49	47,910	41	75	54.51%	62	66.13%
50 – 54	40,749	76	86	88.33%	77	98.70%
55 – 59	35,055	65	83	77.96%	79	82.28%
60 & Over	5,264	15	16	96.39%	15	100.00%
Total	**338,173**	**295**	**422**	**69.98%**	**351**	**84.05%**

Graph 12:
Disability Retirement
Actual and Expected Experience Compared to Proposed, Age-Based

Males



Females



Sick Leave Service Credit

The current assumption is based on service at retirement.

The following table summarizes the experience for the plan during the study period. Overall, plan experience, on average, is fairly consistent with the current assumption, although it is inconsistent at individual service levels (e.g., assumed service credit for low-service retirements are overstated while high-service retirements are understated).

Actual Sick Leave Credit	Expected Sick Leave Credit	Actual to Expected	Proposed Sick Leave Credit	Ratio of Actual to Proposed
10,757	10,260	104.84%	10,779	99.80%

In light of the above, we recommend slightly adjusting rates to better reflect plan experience. The complete listing of the proposed sick leave service credit rates are included in Appendix F.

Optional Service Purchase

The current assumption is based on service at retirement.

The following table summarizes the experience for the plan during the study period. Overall, plan experience, on average, shows less optional service years purchased than currently assumed.

Actual Optional Service Years Purchased	Expected Optional Service Years Purchased	Actual to Expected	Proposed Optional Service Years Purchased	Ratio of Actual to Proposed
5,201	6,104	85.21%	5,156	100.87%

In light of the above, we recommend slightly adjusting rates to better reflect plan experience. The complete listing of the proposed optional service purchase rates are included in Appendix G.

IV. Appendix

Appendix A: Proposed Salary Increases

Service	Current Increase Assumption[1]	Proposed Increase Assumption[2]	Proposed Increase Assumption Plus Inflation[3]
1	6.75%	7.00%	9.50%
2	4.75%	5.00%	7.50%
3	4.25%	4.50%	7.00%
4	3.95%	4.25%	6.75%
5	3.75%	4.00%	6.50%
6	3.55%	3.75%	6.25%
7	3.35%	3.50%	6.00%
8	3.15%	3.25%	5.75%
9	2.95%	3.00%	5.50%
10	2.75%	3.00%	5.50%
11	2.55%	2.75%	5.25%
12	2.35%	2.50%	5.00%
13	2.15%	2.50%	5.00%
14	1.95%	2.25%	4.75%
15	1.75%	2.25%	4.75%
16	1.55%	2.00%	4.50%
17	1.35%	2.00%	4.50%
18	1.15%	1.75%	4.25%
19	0.95%	1.50%	4.00%
20 or More	0.75%	1.50%	4.00%

[1] Adjusted for assumed inflation of 2.50%.
[2] Proposed rate of individual salary increases table does not reflect underlying assumption for inflation.
[3] Reflects proposed assumption for inflation of 2.50%.

IV. Appendix

Appendix B: Proposed Mortality Rates

Healthy Post-Retirement Mortality[1]

	Male		Female	
Age	Current Mortality Rates	Proposed Mortality Rates	Current Mortality Rates	Proposed Mortality Rates
50	0.28%	0.26%	0.16%	0.15%
55	0.39%	0.37%	0.21%	0.19%
60	0.52%	0.49%	0.30%	0.27%
65	0.76%	0.71%	0.50%	0.46%
70	1.24%	1.17%	0.80%	0.74%
75	2.13%	2.00%	1.34%	1.23%
80	4.29%	3.51%	3.22%	3.35%
85	7.87%	7.52%	5.79%	6.01%
90	14.51%	13.88%	10.62%	11.02%
95	24.34%	23.28%	18.42%	19.11%
100	36.11%	34.54%	28.71%	29.79%

Disabled Post-Retirement Mortality[1]

	Male		Female	
Age	Current Mortality Rates	Proposed Mortality Rates	Current Mortality Rates	Proposed Mortality Rates
45	1.10%	1.10%	0.55%	0.88%
50	1.70%	1.99%	0.90%	1.06%
55	2.04%	2.39%	1.19%	1.39%
60	2.34%	2.73%	1.45%	1.69%
65	2.66%	3.11%	1.70%	1.99%
70	3.17%	3.71%	2.09%	2.44%
75	4.03%	4.72%	2.82%	3.30%
80	5.43%	6.35%	4.10%	4.80%
85	7.66%	8.96%	6.10%	7.14%
90	11.33%	13.26%	9.04%	10.58%
95	17.30%	20.24%	13.27%	15.52%
100	24.72%	28.92%	19.59%	22.92%

[1] Proposed mortality rates above are sample rates for 2015, the mid-point of the experience study period. For actuarial valuation purposes, mortality rates will be projected from 2015 on a generational basis using MP-2017 improvement scale.

Appendix B: Proposed Mortality Rates *continued*

Beneficiary Post-Retirement Mortality[1]

	Male		Female	
Age	Current Mortality Rates	Proposed Mortality Rates	Current Mortality Rates	Proposed Mortality Rates
50	0.46%	0.47%	0.31%	0.27%
55	0.64%	0.67%	0.41%	0.35%
60	0.87%	0.90%	0.58%	0.50%
65	1.23%	1.28%	0.90%	0.77%
70	1.88%	1.95%	1.44%	1.24%
75	3.00%	3.11%	2.35%	2.01%
80	5.01%	5.19%	3.90%	3.35%
85	8.60%	8.99%	6.78%	5.81%
90	15.22%	15.77%	12.00%	10.28%
95	24.48%	25.35%	20.05%	17.19%
100	35.17%	36.42%	30.34%	26.00%

Healthy Pre-Retirement Mortality[1]

	Male		Female	
Age	Current Mortality Rates	Proposed Mortality Rates	Current Mortality Rates	Proposed Mortality Rates
25	0.03%	0.04%	0.01%	0.02%
30	0.03%	0.03%	0.02%	0.02%
35	0.04%	0.04%	0.02%	0.03%
40	0.04%	0.05%	0.03%	0.03%
45	0.07%	0.07%	0.06%	0.06%
50	0.12%	0.12%	0.09%	0.10%
55	0.20%	0.20%	0.14%	0.15%
60	0.33%	0.34%	0.21%	0.21%
65	0.58%	0.60%	0.31%	0.32%
70	1.03%	1.07%	0.54%	0.57%
75	1.82%	1.89%	0.95%	0.98%
80	3.22%	3.35%	1.65%	1.72%

[1] Proposed mortality rates above are sample rates for 2015, the mid-point of the experience study period. For actuarial valuation purposes, mortality rates will be projected from 2015 on a generational basis using MP-2017 improvement scale.

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Appendix C: Proposed Retirement Rates

Proposed Tier 1 Retirement (Unisex)

	Less than 19 Years of Service		19-29 Years of Service		30-31 Years of Service	
Age	Current	Proposed	Current	Proposed	Current	Proposed
54	0%	0%	6%	7%	6%	8%
55	0%	0%	10%	7%	10%	8%
56	0%	0%	7%	7%	7%	8%
57	0%	0%	7%	7%	7%	12%
58	0%	0%	7%	7%	7%	12%
59	0%	0%	25%	30%	25%	38%
60	14%	20%	30%	30%	30%	48%
61	14%	17%	27%	30%	27%	33%
62	14%	15%	27%	30%	27%	50%
63	14%	15%	27%	30%	27%	38%
64	24%	22%	37%	40%	37%	50%
65	26%	25%	37%	40%	37%	50%
66	26%	25%	37%	40%	37%	50%
67	26%	20%	37%	40%	37%	50%
68	26%	20%	33%	40%	33%	50%
69	26%	25%	33%	40%	33%	50%
70	100%	100%	100%	100%	100%	100%

Proposed Tier 1 Retirement (Unisex) *continued*

	32-33 Years of Service		34+ Years of Service	
Age	Current	Proposed	Current	Proposed
54	38%	40%	60%	45%
55	38%	40%	60%	45%
56	38%	40%	45%	45%
57	40%	40%	45%	45%
58	40%	40%	40%	40%
59	60%	60%	40%	40%
60	60%	60%	40%	40%
61	45%	50%	40%	40%
62	45%	50%	40%	40%
63	50%	50%	40%	40%
64	60%	50%	40%	40%
65	50%	50%	40%	40%
66	50%	50%	40%	40%
67	50%	50%	40%	45%
68	50%	50%	40%	45%
69	50%	50%	40%	45%
70	100%	50%	100%	30%
71	100%	50%	100%	30%
72	100%	50%	100%	30%
73	100%	50%	100%	30%
74	100%	100%	100%	30%
75	-	-	100%	100%

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Appendix D: Proposed Termination Rates

Terminations (Less than Five Years of Service)

	Male		Female	
Age	Current Non-Vested Termination Rates	Proposed Non-Vested Termination Rates	Current Non-Vested Termination Rates	Proposed Non-Vested Termination Rates
25	9.50%	7.00%	8.40%	6.50%
26	8.70%	6.90%	8.20%	6.50%
27	8.30%	6.80%	8.20%	6.50%
28	7.80%	6.70%	9.10%	6.50%
29	8.70%	6.60%	10.30%	6.50%
30	8.80%	6.50%	11.30%	6.50%
31	9.00%	6.80%	11.60%	6.50%
32	8.50%	7.10%	11.50%	6.60%
33	8.70%	7.40%	11.60%	6.70%
34	9.30%	7.70%	11.60%	6.80%
35	10.20%	8.00%	11.60%	6.90%
36	9.90%	8.40%	11.30%	7.00%
37	10.10%	8.80%	11.60%	7.10%
38	10.50%	9.20%	11.50%	7.20%
39	11.30%	9.60%	11.60%	7.30%
40	12.30%	10.00%	10.80%	7.40%
41	12.30%	10.20%	11.30%	7.50%
42	13.50%	10.40%	11.70%	7.60%
43	12.80%	10.60%	11.00%	7.70%
44	12.80%	10.80%	10.60%	7.80%
45	12.60%	11.00%	10.30%	7.90%
46	14.00%	11.20%	10.80%	8.00%
47	14.70%	11.40%	11.60%	8.00%
48	16.60%	11.60%	11.60%	8.00%
49	17.30%	11.80%	12.50%	8.00%
50	16.70%	12.00%	11.80%	8.00%
51	17.30%	11.90%	12.20%	8.00%
52	17.40%	11.80%	12.90%	8.00%
53	19.40%	11.70%	14.70%	8.00%
54	19.70%	11.60%	17.10%	8.00%
55	20.70%	11.50%	17.00%	8.00%
56	19.90%	12.20%	16.20%	8.00%
57	18.00%	12.90%	15.50%	8.75%
58	15.40%	13.60%	15.30%	9.50%
59	14.90%	14.30%	15.40%	10.25%
60	16.40%	15.00%	16.90%	11.00%
61	18.60%	18.00%	23.20%	11.75%
62	17.70%	21.00%	31.40%	12.20%
63	20.30%	24.00%	31.50%	12.65%
64	21.30%	27.00%	30.90%	13.10%
65	30.20%	30.00%	35.00%	13.55%

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Appendix D: Proposed Termination Rates *continued*

Terminations (Five or More Years of Service)

	Male		Female	
Age	Current Vested Termination Rates	Proposed Vested Termination Rates	Current Vested Termination Rates	Proposed Vested Termination Rates
25	6.00%	3.00%	6.50%	5.00%
26	6.00%	3.00%	5.10%	4.95%
27	2.90%	3.00%	4.80%	4.90%
28	2.80%	3.00%	4.90%	4.85%
29	2.90%	3.00%	4.80%	4.80%
30	2.80%	3.00%	5.00%	4.75%
31	2.60%	2.70%	5.00%	4.40%
32	2.50%	2.40%	4.90%	4.05%
33	2.60%	2.10%	4.20%	3.70%
34	2.50%	1.80%	3.90%	3.35%
35	2.10%	1.50%	3.50%	3.00%
36	1.90%	1.55%	3.40%	2.70%
37	1.70%	1.60%	3.00%	2.40%
38	1.70%	1.65%	2.70%	2.10%
39	1.80%	1.70%	2.40%	1.80%
40	1.70%	1.75%	2.20%	1.50%
41	1.70%	1.65%	1.90%	1.45%
42	1.60%	1.55%	1.80%	1.40%
43	1.60%	1.45%	1.80%	1.35%
44	1.50%	1.35%	1.90%	1.30%
45	1.50%	1.25%	1.90%	1.25%
46	1.70%	1.25%	1.80%	1.30%
47	2.00%	1.25%	1.70%	1.35%
48	1.80%	1.25%	1.60%	1.40%
49	1.80%	1.25%	1.60%	1.45%
50	1.90%	1.25%	1.70%	1.50%
51	2.00%	1.40%	1.70%	1.60%
52	1.90%	1.55%	1.70%	1.70%
53	2.10%	1.70%	2.00%	1.80%
54	2.90%	1.85%	2.60%	1.90%
55	5.00%	2.00%	3.80%	2.00%
56	4.60%	2.20%	4.00%	2.10%
57	4.60%	2.40%	4.00%	2.20%
58	4.60%	2.60%	4.00%	2.30%
59	4.60%	2.80%	4.00%	2.40%
60	4.60%	3.00%	4.00%	2.50%
61	4.60%	3.00%	4.00%	2.00%
62	4.60%	3.00%	4.00%	2.25%
63	4.60%	3.00%	4.00%	2.50%
64	4.60%	3.00%	4.00%	2.75%
65	4.60%	3.00%	4.00%	3.00%

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Appendix E: Proposed Disability Retirement Rates

	Male		Female	
Age	Current Disability Rates	Proposed Disability Rates	Current Disability Rates	Proposed Disability Rates
25	0.03%	0.01%	0.03%	0.03%
26	0.03%	0.01%	0.04%	0.03%
27	0.02%	0.01%	0.04%	0.03%
28	0.02%	0.01%	0.05%	0.03%
29	0.02%	0.01%	0.06%	0.04%
30	0.02%	0.01%	0.06%	0.04%
31	0.02%	0.01%	0.06%	0.04%
32	0.03%	0.01%	0.07%	0.05%
33	0.03%	0.02%	0.07%	0.05%
34	0.03%	0.02%	0.07%	0.06%
35	0.03%	0.02%	0.07%	0.06%
36	0.03%	0.02%	0.07%	0.06%
37	0.04%	0.02%	0.08%	0.06%
38	0.04%	0.03%	0.09%	0.07%
39	0.04%	0.03%	0.09%	0.07%
40	0.05%	0.03%	0.11%	0.07%
41	0.06%	0.03%	0.12%	0.08%
42	0.07%	0.04%	0.12%	0.08%
43	0.07%	0.04%	0.13%	0.09%
44	0.07%	0.05%	0.14%	0.09%
45	0.07%	0.05%	0.14%	0.10%
46	0.08%	0.06%	0.15%	0.12%
47	0.09%	0.07%	0.15%	0.13%
48	0.10%	0.08%	0.17%	0.15%
49	0.11%	0.09%	0.18%	0.16%
50	0.12%	0.10%	0.19%	0.18%
51	0.12%	0.11%	0.20%	0.18%
52	0.13%	0.12%	0.23%	0.19%
53	0.13%	0.12%	0.21%	0.19%
54	0.13%	0.13%	0.23%	0.20%
55	0.14%	0.14%	0.24%	0.20%
56	0.15%	0.15%	0.25%	0.21%
57	0.17%	0.16%	0.24%	0.23%
58	0.18%	0.16%	0.23%	0.24%
59	0.17%	0.17%	0.22%	0.26%
60	0.18%	0.18%	0.23%	0.27%
61	0.25%	0.19%	0.21%	0.28%
62	0.32%	0.21%	0.25%	0.28%
63	0.39%	0.22%	0.29%	0.29%
64	0.46%	0.24%	0.41%	0.29%
65	0.54%	0.25%	0.41%	0.30%

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Appendix F: Proposed Sick Leave Service Credits

Service	Current Assumption	Proposed Assumption
9	0.422	0.286
10	0.469	0.416
11	0.516	0.517
12	0.563	0.522
13	0.610	0.582
14	0.657	0.650
15	0.704	0.716
16	0.750	0.799
17	0.797	0.816
18	0.844	0.916
19	0.891	0.937
20	0.938	0.953
21	0.973	1.031
22	1.009	1.032
23	1.044	1.089
24	1.080	1.146
25	1.115	1.137
26	1.147	1.204
27	1.179	1.229
28	1.212	1.232
29	1.244	1.311
30	1.276	1.376
31	1.320	1.348
32	1.363	1.514
33	1.407	1.652
34	1.450	1.387

Appendix G: Proposed Optional Service Purchases

Service	Current Assumption	Proposed Assumption
9	0.2040	0.2210
10	0.2040	0.1065
11	0.2373	0.1666
12	0.2706	0.4190
13	0.3039	0.3237
14	0.3372	0.5291
15	0.3705	0.2994
16	0.4038	0.3217
17	0.4371	0.3705
18	0.4704	0.5967
19	0.5037	0.5067
20	0.5370	0.4453
21	0.6350	0.7448
22	0.7338	0.6047
23	0.8322	0.6977
24	0.9306	0.7459
25	1.0290	0.7523
26	1.1080	0.8730
27	1.1870	0.9338
28	1.2660	0.6953
29	1.3450	0.9784
30	1.4240	0.8414
31	1.0680	0.7399
32	0.7120	0.5608
33	0.0356	0.3528
34	0.0000	0.0000