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Correspondence Memorandum

Date: November 19, 2021

To: Employee Trust Funds Board

From: Cindy Klimke-Armatoski, Chief Trust Finance Officer
Division of Trust Finance

Subject: WRS Three-Year Experience Study

The Department of Employee Trust Funds (ETF) requests the Employee Trust Funds Board (Board) accept the Wisconsin Retirement System *Three-Year Experience Study January 1, 2018 – December 31, 2020*, including the updated demographic assumptions contained in the report, and select and approve specific economic assumptions.

Actuarial valuations of the Wisconsin Retirement System (WRS) are conducted annually by the Board's consulting actuary, Gabriel, Roeder, Smith & Company (GRS) and are based on several demographic and economic assumptions. Wisconsin statutes require the Board's actuary to conduct an experience study at least every three years to review the assumptions and determine if updates are needed. This study reviews current actuarial assumptions and methods and compares them to actual experience of the WRS during the years 2018 – 2020.

Demographic assumptions include rates of withdrawal, disability, retirement, and mortality. GRS has made specific recommendations for these assumptions in the report.

Economic assumptions have a more significant impact on valuations and include the investment return assumption and price and wage inflation assumptions. The investment return assumption is used to determine how much pension plan assets will grow to meet its pension liabilities. If the assumption is too optimistic, contributions to the fund will not meet pension obligations. If the assumption is too pessimistic, the contributions will be higher than necessary. The wage inflation assumption is used to help determine the rate of growth of future benefit liabilities.

Reviewed and approved by John Voelker, Secretary
Electronically Signed 11/23/21

Board	Mtg Date	Item #
JM	12.09.21	3A
ETF	12.09.21	4A

GRS has recommended a range for the economic assumptions they believe are reasonable, based on their analysis, and has provided options for your consideration. Page 19 of the report summarizes these options, along with the impact the changes would have had on the December 31, 2020, active lives valuation had the changes been in place at that time. While it is important to understand the impact of changing actuarial assumptions, the impact should not drive the decision in setting the assumptions. The Board will need to discuss the options presented for the economic assumptions and decide on the specific assumptions to be used.

Assumptions adopted by the Board will be used in the December 31, 2021, actuarial valuations and will be the basis for 2023 contribution rates. The assumptions will also be used in calculating new annuities beginning January 1, 2023.

Actuaries from GRS will be at the Board meeting to present their report and answer any questions.

Attachment: Wisconsin Retirement System Three-Year Experience Study January 1, 2018 – December 31, 2020

Wisconsin Retirement System

Three-Year Experience Study
January 1, 2018 – December 31, 2020

GRS

Table of Contents

November 19, 2021

The Employee Trust Funds Board
4822 Madison Yards Way
Madison, Wisconsin 53705

Ladies and Gentlemen:

The results of the *3-year investigation of experience* of the Wisconsin Retirement System are presented in this report. The investigation was made for the purpose of updating the actuarial assumptions used in valuing the actuarial liabilities of the Wisconsin Retirement System in compliance with Section 40.03(5)(b) of the Wisconsin Statutes.

The investigation was based upon the statistical data furnished for annual active member and retired life actuarial valuations, supplemental information furnished by your Secretary and his staff, concerning Participants who died, withdrew, became disabled or retired during the last 3 years and on published historical economic data.

The investigation covered the 3-year period from **January 1, 2018 to December 31, 2020**, and was carried out using generally accepted actuarial principles and techniques.

To the best of our knowledge, this report is complete and accurate and was made in accordance with generally recognized actuarial methods. Mark Buis, James D. Anderson, and Brian B. Murphy are Members of the American Academy of Actuaries (MAAA), and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. The signing actuaries are independent of the plan sponsor.

We believe that the new actuarial assumptions that are the result of this investigation represent a reasonable estimate of possible future experience of the Wisconsin Retirement System.

Respectfully submitted,
Gabriel, Roeder, Smith & Company

Mark Buis, FSA, EA, FCA, MAAA

James D. Anderson, FSA, EA, FCA, MAAA

Brian B. Murphy, FSA, EA, FCA, MAAA, PhD

MB/JDA/BBM:rmn

EXECUTIVE SUMMARY

Executive Summary

The Wisconsin Statutes require reviewing the actuarial assumptions every three years. The last review was prepared for the period from January 1, 2015 to December 31, 2017. In this report, we review the current actuarial assumptions and methods and compare them to the actual experience of the Retirement System for the years 2018-2020.

The table below lists each of the primary assumptions and methods that we analyzed, including our recommendations for each item, and the overall financial impact of any recommended changes.

Assumption	2018 Recommendation	2020 Recommendation	Financial Impact – Plan Liabilities and Contribution Rates
Withdrawal rates	Higher Rates	Lower Rates	Increase
Disability rates	Lower Rates	Higher Rates	Increase
Pay increases due to seniority	No Change	No Change	N/A
Retirement rates	Higher Rates	Higher Rates	Increase
Pre and post-retirement mortality rates	Lower Rates	Various	Little to no change
Investment return	Lower Rates	Lower Rates	Increase
Wage inflation	Lower Rates	No change	No Change
Price inflation	Lower Rates	Lower Rates	No direct impact
Total	**Various**	**Various**	**Various**

A common practice among public employee retirement systems is that the actuary recommends a set of demographic assumptions which the Board adopts. The actuary then suggests a range of reasonable alternate economic assumptions. Following discussion involving the actuary, the plan governing body, and other professionals, the plan governing body makes a final choice from the various alternatives.

See page 5 for the expected impact on the Retired lives mortality reserve due to the proposed mortality assumption change. The overall impact on the contribution rate will depend on the final economic set of assumptions selected. The impact of this is shown on page 19.

New assumptions will be first used in the December 31, 2021 actuarial valuations, at which time experience gains or losses incurred during 2021 will also be recognized. This would first impact rates in 2023. Consequently, no rate changes are recommended for 2020 based upon this study.

Summary of Findings

Introduction

Each year, as of December 31, the liabilities of the Wisconsin Retirement System are valued. In order to perform the valuation, assumptions must be made regarding the future experience of the System with regard to the following risk areas:

- Rates of **withdrawal** of active participants.
- Rates of **disability** among active participants.
- Patterns of **salary increases** to active participants.
- Rates of **retirement** among active participants.
- Rates of **mortality** among active participants, retirees, and beneficiaries.
- Long-term rates of **investment return** to be generated by the assets of the Fund.

Assumptions should be carefully chosen and continually monitored. A poor initial choice of assumptions or continued use of outdated assumptions can lead to:

- Understated costs resulting in either an inability to pay benefits when due, or sharp increases in required contributions at some point in the future; and
- Overstated costs resulting in either benefit levels that are kept below the level that could be supported by the computed rate or an unnecessarily large burden on the current generation of participants, employers and taxpayers.

A single set of assumptions will not be suitable indefinitely. Conditions change, and our understanding of conditions also changes.

In recognition of this, Wisconsin statutes require that assumptions used to value the liabilities of the Wisconsin Retirement System be studied in-depth every three years. The package of assumptions is then adjusted to reflect basic experience trends -- but not random year-to-year fluctuations. Actuarial assumptions were last revised for the December 31, 2018 valuation which impacted contribution rates in 2020.

Summary of Decrement Experience

Background: With the exception of mortality and disability, the decrements that we study tend to relate to voluntary human behavior. Human behavior in any short period can be influenced by economic and societal factors that change from time to time. Observed data will very often contain anomalies that cannot be assumed to continue into the future. This happens particularly in smaller groups.

In most cases, when adjustments are indicated, the proposed assumptions give partial recognition to present assumptions as well as to results from actual experience. Complete recognition is rarely given to actual experience over a limited period. This would cause contribution rates to be unduly sensitive to short-term experience fluctuations. In general, we moved about 75% of the way to the observed experience for trends that were consistent with prior studies and about 50% of the way to the observed experience for trends that reversed course from the prior studies.

Consistent with the past few experience studies, we have continued the use of the 'liability weighted rate' for certain decrements. This represents the crude rate of decrement on a liability weighted basis as opposed to strictly a number count basis. The liability weighted rates were found to be more highly correlated with withdrawal and retirement decrements than with the population related rates. This makes some intuitive sense, since retirement and termination decisions are often made based on how much the members have to gain or lose if they retire or change jobs, whereas death and disability is typically not a decision at all, rather an event that happens. Comments on specific assumptions are provided on the following pages. Tabular results are presented in summary form on page 7.

While mortality is not typically a voluntary human behavior, a recent study by the Society of Actuaries found that mortality experience was highly correlated with education and income. That is, people with higher incomes and higher levels of education tended to live longer. As such, we also studied mortality rates on a 'benefit weighted' basis in addition to a 'number count' basis. This is discussed in more detail on page 5.

Summary of Decrement Experience

Withdrawal Rates: In general, there were more withdrawals (terminations) than expected. However, this varied by age, service and group. Additionally, the operation of the withdrawal decrement is impacted by the operation of a 'forfeiture' assumption. The current assumption is that 25% of members at age 35 will forfeit the vested benefit (graded down to zero percent at retirement eligibility). We recommend that the forfeiture assumption remain unchanged and that the withdrawal (termination) rates be modified to move closer to the liability weighted rates (see discussion on page 3). This change had a small upward effect on liabilities. Detailed information, including proposed rates, is presented beginning on page A-1.

Disability Rates: Overall, there were more disabilities than expected and we recommend increasing the incidence of disability for most groups. The increase in actual disabilities was likely due to the closure of the LTDI program. This change had a small upward effect on liabilities. Detailed information, including proposed rates, begins on page B-1.

Pay Increase Rate (Merit and Longevity Portion): Actual rates varied by group and provide a fairly reasonable match to current assumptions. Additionally, the actual experience was slightly impacted for the study period as some members had 27 pay periods during 2020. No changes are being recommended to the merit and longevity portion. Additional discussion of general wage inflation is on page 10.

Normal and Reduced Retirement Experience: Overall, there were fewer normal retirements and fewer reduced retirements than expected in most groups. Additionally, retirement experience was found to be more highly correlated with the liability weighted method described on page 3 than with the headcount weighted method. As such, we recommend modifying the normal retirement rates slightly for all groups to move closer to the observed liability weighted rates. As more experience emerges, we will monitor these rates to see if further adjustments are necessary. This change had a small upward effect on liabilities. Detailed information, including proposed rates, begins on page D-1.

State versus non-State Experience: In conjunction with the experience study for the sick leave valuation, we also studied decrement experience between state and non-state members. As a result, the proposed rates for many of the decrements were developed separately for both state and non-state members.

Summary of Decrement Experience

Mortality Experience:
Post-retirement mortality is an important component in cost calculations and should be updated from time to time to reflect current and expected future longevity improvements. Pre-retirement mortality is a relatively minor component in cost calculations. The frequency of pre-retirement deaths is so low that mortality assumptions based on actual experience can only be produced for very large retirement systems, if at all.

Actuarial Standards of Practice:
Actuarial Standards of Practice (ASOP) No. 35 Disclosure Section 4.1.1 states, "The disclosure of the mortality assumption should contain sufficient detail to permit another qualified actuary to understand the provision made for future mortality improvement. If the actuary assumes zero mortality improvement after the measurement date, the actuary should state that no provision was made for future mortality improvement." The current mortality rates used in the valuation include a provision for future mortality improvement.

New Mortality Tables and Projection Scale:
Recently, the Society of Actuaries (SOA) published a mortality study specific to public sector retirement systems. This very comprehensive study includes numerous mortality tables created by classification of employee (General members, Public Safety, Teachers, Survivors, Juvenile, headcount-weighted, benefit-weighted, above median, below median). In addition, the SOA updates mortality projection scales annually – the latest published table is called the MP-2021 Projection Scale – which accounts for future improvements in mortality that are expected to occur. Lastly, the SOA recommends the use of "fully generational" (2-dimensional) projection scales.

Discussion:
Pre-retirement mortality is used to measure the probabilities of members dying before retirement. Post-Retirement mortality is used to measure the probabilities of each benefit payment being made after retirement. The following mortality tables are currently used in the annual valuation of the Retirement System:

Healthy Pre-Retirement: WRS specific active mortality table projected with mortality improvements using 60% of the fully generational MP-2018 projection scale.

Healthy Post-Retirement: WRS specific healthy retiree mortality table projected with mortality improvements using 60% of the fully generational MP-2018 projection scale.

Disabled Post-Retirement: WRS specific disabled mortality table projected with mortality improvements using 60% of the fully generational MP-2018 projection scale.

As recommended in the last actuarial audit, we considered the use of separate mortality tables for different classifications of employees (general, teacher, public safety, etc.). However, when breaking down the data into smaller and smaller subgroups, the data is not as credible to assign specific mortality assumptions to distinct groups. Additionally, we are also concerned that the use of different mortality assumptions for different occupations could have an unintended effect on the dividend process, reserve transfers and optional forms of payment. We also note that the mortality experience for the 3-year study period includes one year impacted by COVID. There is still not sufficient data to determine how COVID will impact mortality rates in the long term. However, in order to avoid overweighting the COVID experience in 2020, we expanded the mortality study period to include data from the last 5 years which includes one year impacted by COVID (2016 to 2020).

Proposal: We recommend the following mortality tables and mortality improvement scales for use in future valuations of the Retirement System. The base mortality tables were constructed as a blend of the benefit weighted and population weighted results and compared with the various Pub-2010 mortality table to determine best fit and shape (relative to Wisconsin experience). We recommend the use of 100% of the MP-2021 projection scale. We note that mortality experience among disabled retirees and active members is very limited. As a result, these tables were constructed in a manner similar to the healthy retiree tables. The change in mortality tables will be approximately cost neutral, but will provide a better measure of liabilities at certain ages and genders. In prior years, we phased into the ultimate table for the retired lives valuation over a 3-year period. Since the proposed table results in only a minor change to overall retiree liabilities, there will be no mortality adjustment over the next 3 years for retirees. Detailed information begins on page E-1.

Healthy Pre-Retirement:	2020 WRS Experience Table for Active Employees and projected with mortality improvements using 100% of the fully generational MP-2021 projection scale from a base year of 2010.
Healthy Post-Retirement:	2020 WRS Experience Table for Healthy Retirees and projected with mortality improvements using 100% of the fully generational MP-2021 projection scale from a base year of 2010.
Disabled Post-Retirement:	2020 WRS Experience Table for Disabled Retirees and projected with mortality improvements using 100% of the fully generational MP-2021 projection scale from a base year of 2010.

Complete listings of all assumptions begin on page F-1.

Summary of Decrement Experience

Decrement Risk Area	Actual	Expected Current Assumption	Expected Proposed Assumption
Withdrawal - Total			
General (Without Schools)	24,809	23,443	23,360
Public Schools and University	11,265	11,253	10,907
Protective			
With Social Security	2,468	1,890	2,153
Without Social Security	90	65	71
Executive and Elected	182	138	158
Withdrawal - Service Greater than 10			
General (Without Schools)	2,406	1,940	2,001
Public Schools and University	2,225	1,932	1,927
Protective			
With Social Security	466	355	366
Without Social Security	34	23	19
Executive and Elected	28	35	27
Disability			
General (Without Schools)	399	245	356
Public Schools and University	160	99	143
Protective			
With Social Security	44	14	35
Without Social Security	10	8	10
Executive and Elected	1	-	-
Reduced Retirement			
General (Without Schools)	6,187	7,823	7,918
Public Schools and University	4,107	4,781	4,864
Executive and Elected	37	26	33
Normal Retirement			
General (Without Schools) **	6,858	7,540	8,289
Public Schools and University **	3,904	3,937	4,087
Protective*			
With Social Security	1,828	1,767	1,974
Without Social Security	283	275	295
Executive and Elected	130	180	178
Mortality - Retired Lives			
Normal Retirement			
Male	11,632	11,115	10,684
Female	13,649	13,236	13,438
Disabled Retirement			
Male	427	389	411
Female	513	498	588

*   *Includes Reduced Retirements.*

**   *Figures shown are for people below age 75.*

Proposed rates for withdrawal, retirement and mortality decrements are based on liability weighting and therefore comparisons based on population counts alone may not be appropriate.

Economic Assumptions

Economic assumptions include long-term rates of investment return and wage inflation (the across-the-board portion of salary increases). Unlike demographic activities, economic activities do not lend themselves to analysis solely on the basis of internal historical patterns because both salary increases and investment return are driven by external forces; and in particular by inflation which defies accurate long-term prediction. Estimates of investment return and pay increases are generally selected on the basis of expectations in an inflation-free environment and then both are increased by some provision for long-term inflation.

If inflation and/or productivity increases are higher than expected, actual rates of salary increase and investment return are likely to exceed the assumed rates. Salaries increasing faster than expected produce unexpected liabilities. Investment return exceeding the assumed rates (whether due to manager performance, change in the mix of assets, or general inflation) results in unanticipated assets. To the extent that inflation, productivity, and other factors have about the same effect on both sides of the balance sheet, these additional assets and liabilities can offset one another over the long-term.

Sources considered in the analysis of the economic assumptions included:

- Actual System experience over the last 3 years (i.e., merit and seniority pay increases)
- Future expectations of the investment consultant for WRS and future expectations of other investment consultants
- 2021 Social Security Trustees Report
- Historical observations of inflation statistics (both price and wage) and investment returns

Current economic assumptions for WRS are as follows:

Price Inflation	2.5%
Wage Inflation	3.0%
Net Investment Return	7.0%
Real Rate of Return	4.0%

Economic Assumptions

Price Inflation: Price inflation underlies both the wage inflation and investment return assumptions. Therefore, we recommend that a specific price inflation assumption be adopted in conjunction with this Experience Study. The current price inflation assumption is 2.5%. The chart below shows forward looking inflation expectations from various published sources. Over the past 50 years, price inflation has averaged 3.8%. This result is heavily affected by the high inflationary period of the 1970's and early 1980's. During the past decade, price inflation averaged 1.7%. Although there has been a recent increase in short-term inflation rates, NEPC estimates the long-term inflation at 2.3%. Additional forward-looking forecasts are shown below. **Based upon the reviewed data, we are comfortable with an assumption in the 2.0% to 2.5% range. Our initial recommendation, however, is to lower this assumption to 2.4%.** (Remember that the selected wage inflation and investment return assumptions should be consistent with the final selected price inflation assumption.)

Forward-Looking Price Inflation Forecasts[a]	
Congressional Budget Office[b]	
5-Year Annual Average	2.18%
10-Year Annual Average	2.29%
Federal Reserve Bank of Philadelphia[c]	
5-Year Annual Average	2.40%
10-Year Annual Average	2.30%
Federal Reserve Bank of Cleveland[d]	
10-Year Expectation	1.60%
20-Year Expectation	1.82%
30-Year Expectation	2.00%
Federal Reserve Bank of St. Louis[e]	
10-Year Breakeven Inflation	2.34%
20-Year Breakeven Inflation	2.43%
30-Year Breakeven Inflation	2.29%
U.S. Department of the Treasury[f]	
10-Year Breakeven Inflation	2.36%
20-Year Breakeven Inflation	2.39%
30-Year Breakeven Inflation	2.41%
50-Year Breakeven Inflation	2.45%
100-Year Breakeven Inflation	2.48%
Social Security Trustees[g]	
Ultimate Intermediate Assumption	2.40%

[a] End of the Second Quarter, 2021. Version 2021-10-21 by Gabriel, Roeder, Smith & Company

[b] *The Budget and Economic Outlook: 2021 to 2031,* Release Date: February 2021, Consumer Price Index (CPI-U), Percentage Change from Year to Year, 5-Year Annual Average (2021 - 2025), 10-Year Annual Average (2021 - 2030).

[c] *Second Quarter 2021 Survey of Professional Forecasters,* Release Date: May 14, 2021, Headline CPI, Annualized Percentage Points, 5-Year Annual Average (2021 - 2025), 10-Year Annual Average (2021 - 2030).

[d] Inflation Expectations, Model output date: June 1, 2021.

[e] The breakeven inflation rate represents a measure of expected inflation derived from X-Year Treasury Constant Maturity Securities and X-Year Treasury Inflation-Indexed Constant Maturity Securities. Observation date: June 1, 2021.

[f] *The Treasury Breakeven Inflation (TBI) Curve,* Monthly Average Rates, June, 2021.

[g] *The 2020 Annual Report of The Board of Trustees of The Federal Old-Age And Survivors Insurance and Federal Disability Insurance Trust Funds,* April 22, 2020, Long-range (75-year) assumptions, Intermediate, Consumer Price Index (CPI-W), for 2024 and later.

Economic Assumptions

Wage Inflation: Wage inflation consists of two components, 1) a portion due to pure price inflation (i.e., increases due to changes in the CPI), and 2) increases in average salary levels in excess of pure price inflation (i.e., increases due to changes in productivity levels, supply and demand in the labor market and other macroeconomic factors). The long-term rate of increase in National Average Earnings over the last 50 years is somewhat higher than the current WRS assumption, although shorter term averages are below it. It is expected that, in the long run, salary increases in all parts of the country will be close to the national averages. However, none of the data we have reviewed suggests a repeat of the high inflation rates experienced in the 1970s. Average salaries in WRS have risen at approximately 2.5% a year since 1990, including 2.7% the last 3 years. **Given that the price inflation assumption of 2.4% and the current wage inflation of 3.0% results in a spread of 60 basis points, we recommend no change in the wage inflation assumption at this time.**

Year	Annual Increase in		
	Prices (CPI-U)	Wages (NAE)	Difference
1961-1970	2.9%	4.4%	1.5%
1971-1980	8.1%	7.3%	-0.8%
1981-1990	4.5%	5.3%	0.8%
1991-2000	2.7%	4.3%	1.6%
2001-2010	2.3%	2.6%	0.3%
2011-2020	1.7%	2.9%	1.2%
3-Year Avg	1.9%	3.4%	1.5%
5-Year Avg	1.9%	3.0%	1.1%
10-Year Avg	1.7%	2.9%	1.2%
20-Year Avg	2.0%	2.8%	0.8%
30-Year Avg	2.2%	3.3%	1.1%
50-Year Avg	3.8%	4.5%	0.7%

WRS Wage Inflation

Period	WRS Wage Inflation
Last 3 Years	**2.7%**
Last 5 Years	**2.2%**
Last 10 Years	**2.0%**
Last 20 Years	**2.3%**
Last 25 Years	**2.5%**

Economic Assumptions

The relevant Actuarial Standard of Practice (ASOP) for economic assumptions is ASOP No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations*[1]. Under ASOP No. 27, Section 3.6, an economic assumption is reasonable if 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 current and historical data that is relevant to selecting the assumption for the measurement date, to the extent such relevant data is reasonably available;
- It reflects the actuary's estimate of future experience, the actuary's observation of the estimates inherent in market data (if any), or a combination thereof; and
- It is expected to have 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 (as discussed in Section 3.5.1) or when alternative assumptions are used for the assessment of risk, in accordance with ASOP No. 51, *Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions*.

For purposes of budgeting contributions and measuring liabilities for public employee retirement systems, the assumed rate of investment return is used as the discount rate to determine the present value of a system's pension obligations. For most valuations, an actuarial investment return assumption based on expected future experience is a single estimate for all years and, therefore, implicitly assumes that returns above and below expectations will average out over time. In other words, the expected risk premium is reflected in the assumed rate of investment return in advance of being earned, while the investment risk (i.e., volatility) is not reflected until actual experience emerges with each valuation.

The analysis of the investment return assumption in this report is based on forward-looking measures of expected investment return outcomes for the asset classes in the System's current investment policy. For purposes of this analysis, we have analyzed the System's investment policy with the capital market assumptions from twelve nationally recognized investment firms.

Our analysis is based on the GRS 2021 Capital Market Assumption Modeler (CMAM[2]). The purpose of the CMAM is to assess the reasonability of the assumed rate of return for use in the actuarial valuations for the plan. In our professional judgment the CMAM has the capability to provide results that are consistent with this purpose. A description of the strengths, limitations and weaknesses of the model are incorporated in this report. In our opinion, the limitations and weaknesses are not material. We performed tests to ensure that the model reasonably represents that which is intended to be modeled. We are relying on the GRS actuaries and Internal Software, Training, and Processes Team who developed and maintain the model.

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[1] *This ASOP was recently revised by the Actuarial Standards Board. The new version is effective August 1, 2021. The discussion here is based on the new version.*
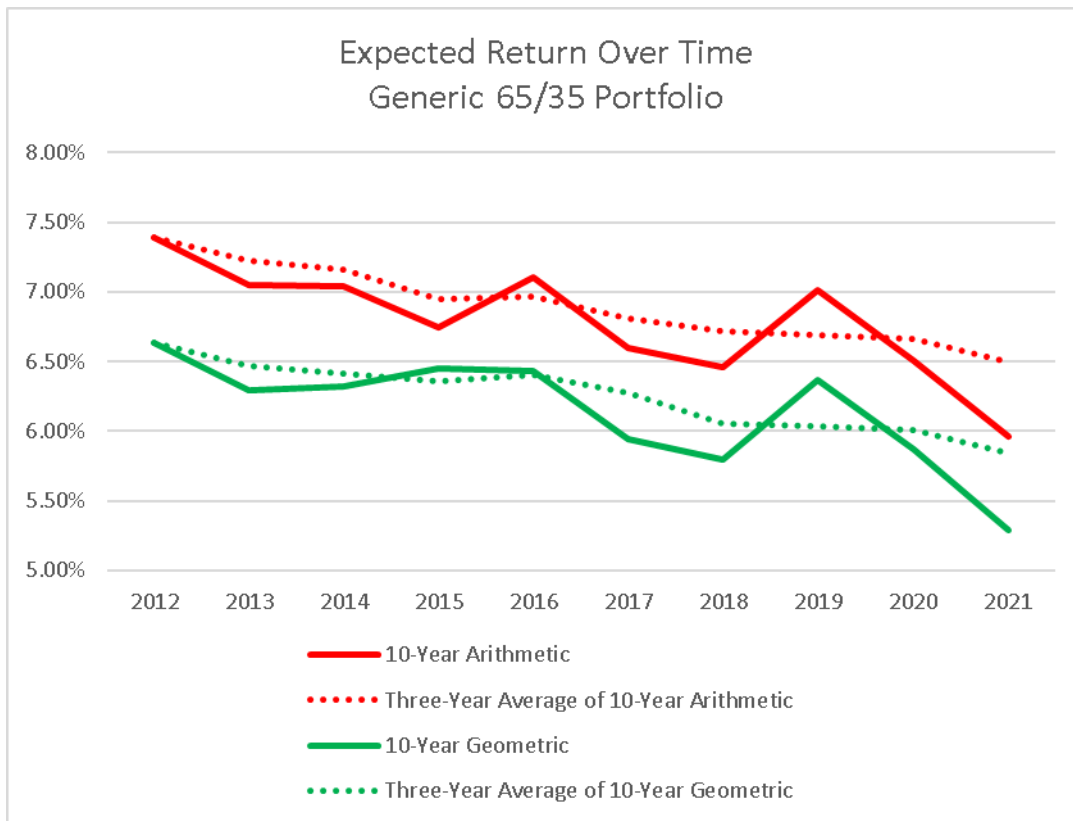[2] *Issued May 4, 2021.*

Because GRS is a benefits consulting firm and does not develop or maintain its own capital market expectations, we request and monitor forward-looking expectations developed by several major investment firms. We update our CMAM on an annual basis. The capital market assumptions in the 2021 CMAM are from the following investment firms (in alphabetical order): Aon Hewitt, Blackrock, BNY Mellon, Callan, Cambridge, JPMorgan, Meketa, Mercer, NEPC, RVK, Verus, and Wilshire. We believe that the benefit of performing this analysis using multiple investment firms is to recognize the uncertain nature of the items affecting the selection of the investment return assumption. While there may be differences in asset classes, investment horizons, inflation assumptions, treatment of investment expenses, excess manager performance (i.e., alpha), etc., we have attempted to align the various assumption sets from the different investment firms to be as consistent as possible. In some cases, we have made minor adjustments or assumptions to align the various assumptions sets with our model.

Each investment firm provided capital market assumptions over an investment horizon of approximately 10 years. Although investment firms often refer to this period as "short-term" it is important to remember that 10 years is actually a very long time. Therefore, returns during the next 10 years will affect the plan's funding materially. A subset of six investment firms provided capital market expectations over a longer horizon, varying between 20 and 30 years. For purposes of this report, the analysis is generally based on the 10-year expectations provided by the investment firms.

In general, our understanding is that the methodology for developing these capital market expectations is forward-looking, not purely backward-looking. Over the years, we have observed a general decreasing trend in capital market expectations. However, we have also observed that some of the investment firms' assumption sets are dependent on the market conditions at the time they are developed and consequently may be sensitive to short-term market fluctuations. Some expectations are contrarian – meaning that when the market is high, future expectations are lowered and when the market is low, future expectations are raised. The amount of these fluctuations as they appear in the year-to-year capital market assumptions varies between the various investment firms.

Each year, the GRS CMAM reflects the most up-to-date information at the time the data was collected (typically reflecting the firms' expectations at the beginning of the calendar year). The results of the 2021 survey were generally lower capital market assumptions than 2020 for most asset classes, in some cases substantially lower. This is perhaps due in part to the decrease in bond yields in 2020 to record lows and the high stock market at the end of 2020 (resulting in the contrarian expectation of lower future stock market returns). Looking back to 2019, return expectations were somewhat higher than prior years for some survey participants, perhaps in part due to an increase in bond yields and a decrease in the stock market at the end of 2018. If we consider the three-year average of return expectations, the general decreasing trend is more apparent and the short-term fluctuations are diminished. The chart on the following page illustrates the volatility from year to year from past CMAMs with a generic 65/35 asset allocation. The general declining trend is illustrated with the three-year average of CMAM returns.

Expected Return Over Time
Generic 65/35 Portfolio

Legend:
- 10-Year Arithmetic
- Three-Year Average of 10-Year Arithmetic
- 10-Year Geometric
- Three-Year Average of 10-Year Geometric

To the best of our ability, we have adapted the System's investment policy to fit with the investment firms' assumptions adjusting for these known differences in assumptions and methodology. The asset classes in the system's investment allocation often do not exactly align with the asset classes of all investment firms in the survey. This may require us to make approximations which can introduce some subjectivity into the process. In the following charts, to the extent possible all returns are net of passive investment expenses and administrative expenses and have no assumption for excess manager performance (alpha) in excess of active management fees.

Presented below is the approximate target asset allocation for the WRS Core fund:

Asset Class	Approximate Asset Allocation
Global Equities	52.0%
Fixed Income	25.0
Inflation Sensitive Assets	19.0
Real Estate	7.0
Private Equity/Debt	12.0
Cash Equivalents	-15.0

Based upon the approximate asset allocation, future expectations of various investment consultants were analyzed. The next few exhibits show the results of this analysis. Final expected nominal investment return results are based upon the recommended 2.4% price inflation assumption. We used the actuarial assumption for price inflation rather than the consultant assumption, in order to be consistent with the calculation of liabilities. Investment results presented are net of investment and administrative expenses.

The arithmetic expected return developed from this asset allocation is shown in Table 1. The CMAM begins with the nominal expected return from each Capital Market Assumption (CMA) set (column 2), takes out each CMA's price inflation assumption (column 3) to arrive at the real return (column 4). We then incorporate the current price inflation assumption of 2.40% (column 5) to get the adjusted nominal return (column 6). Expenses not already netted out of the return and/or administrative expenses paid out of trust assets (5 basis points, based on actual 2020 expenses) which are not reflected in the employer contributions (column 7) are netted out of the return. The final arithmetic expected return is shown in column 8. We believe that this is reasonable provided that the current price inflation assumption does not differ materially from the assumptions used by the investment firms. Note that the arithmetic return is in general higher than the median return due to the compounding effect of random returns. In general, the difference between the arithmetic and median return will be larger for larger standard deviation of returns. We have shown the standard deviation of returns as the investment risk in column 9.

Table 1

GRS 2021 CMAM									
Capital Market Assumption Set (CMA)	CMA Expected Nominal Return	CMA Inflation Assumption	Expected Real Return (2)–(3)	Actuary Inflation Assumption	Expected Nominal Return (4)+(5)	Plan Incurred Administrative Expenses	Expected Nominal Return Net of Expenses (6)-(7)		Standard Deviation of Expected Return (1-Year)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)		(9)
1	6.16%	2.15%	4.01%	2.40%	6.41%	0.05%	6.36%		13.82%
2	6.33%	2.21%	4.12%	2.40%	6.52%	0.05%	6.47%		14.42%
3	6.18%	2.00%	4.18%	2.40%	6.58%	0.05%	6.53%		12.86%
4	6.25%	2.01%	4.24%	2.40%	6.64%	0.05%	6.59%		12.53%
5	6.48%	2.00%	4.48%	2.40%	6.88%	0.05%	6.83%		13.72%
6	6.93%	2.34%	4.59%	2.40%	6.99%	0.05%	6.94%		14.44%
7	7.23%	2.40%	4.83%	2.40%	7.23%	0.05%	7.18%		14.15%
8	6.87%	2.00%	4.87%	2.40%	7.27%	0.05%	7.22%		14.29%
9	6.99%	2.01%	4.98%	2.40%	7.38%	0.05%	7.33%		14.27%
10	7.12%	2.11%	5.01%	2.40%	7.41%	0.05%	7.36%		13.74%
11	8.64%	3.10%	5.54%	2.40%	7.94%	0.05%	7.89%		15.65%
12	8.01%	1.92%	6.09%	2.40%	8.49%	0.05%	8.44%		13.93%
Average	**6.93%**	**2.19%**	**4.75%**	**2.40%**	**7.15%**	**0.05%**	**7.10%**		**13.99%**
					Average from last 3 CMAMs		**7.45%**		**13.71%**

The average expected nominal return from column 8 is 7.10%. This is the average arithmetic rate of return. The average arithmetic return of 7.45% from the last three years of CMAMs are shown at the bottom of the table for reference.

ASOP No. 27, Section 3.6.2, states that "[d]ue to the uncertain nature of the items for which assumptions are selected, the actuary may consider several different assumptions reasonable for a given measurement. Different actuaries will apply different professional judgment and may choose different reasonable assumptions. As a result, a range of reasonable assumptions may develop, both for an individual actuary and across actuarial practice." This range of different expectations from the CMAs is evident from the summaries we show from our CMAM.

As discussed above, the CMAs can be sensitive to actual asset performance in any given year. In particular, since 2020 was such a strong year for investments, future expectations declined significantly. Such a sharp decline may suggest an overreaction to current market conditions. Based on the 2021 CMAM analysis, the average expected nominal return of 7.10% is the upper end of our preferred range. Considering the three-year average of 7.45%, we believe that the current assumption of 7.0% is reasonable.

Note that the arithmetic rate of return represents the average future expected return which is higher than the median future expected. Accumulating assets and cash flows at the average arithmetic rate of return is expected to produce the average asset amount over time. However, in any given year it is less than 50% likely that the arithmetic average rate of return will be achieved. Moreover, over a period of longer than one year, the realized rate of return is generally computed as a geometric average. Additional analysis is required to adjust to the median (or geometric average) return.

Next, we compare the probabilities of achieving returns over a 10-year horizon. We compute the 40th, 50th, and 60th percentiles of returns as well as the probability of achieving the current assumption of 7.0% and various alternates (6.75%, 6.50%, 6.25% and 6.00%) over a 10-year horizon. These estimates are based on the assumption that the distribution of returns for the next 10 years is the same each year. The average median return of 6.59% from the last three years of CMAMs is shown at the bottom of the table below for reference.

GRS 2021 CMAM								
Capital Market Assumption Set (CMA)	Distribution of 10-Year Average Geometric Net Nominal Return			Probability of exceeding	Probability of exceeding	Probability of exceeding	Probability of exceeding	Probability of exceeding
	40th	50th	60th	7.00%	6.75%	6.50%	6.25%	6.00%
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	4.39%	5.47%	6.57%	36.28%	38.45%	40.65%	42.90%	45.17%
2	4.37%	5.51%	6.65%	37.10%	39.19%	41.32%	43.48%	45.66%
3	4.74%	5.76%	6.78%	37.96%	40.32%	42.72%	45.16%	47.62%
4	4.88%	5.86%	6.86%	38.67%	41.11%	43.58%	46.09%	48.62%
5	4.88%	5.96%	7.05%	40.48%	42.73%	45.02%	47.32%	49.64%
6	4.85%	5.98%	7.13%	41.09%	43.24%	45.42%	47.62%	49.83%
7	5.15%	6.26%	7.39%	43.37%	45.59%	47.84%	50.09%	52.35%
8	5.15%	6.28%	7.41%	43.59%	45.79%	48.01%	50.25%	52.48%
9	5.27%	6.39%	7.53%	44.60%	46.82%	49.05%	51.29%	53.53%
10	5.41%	6.49%	7.59%	45.32%	47.63%	49.94%	52.27%	54.59%
11	5.54%	6.77%	8.01%	48.13%	50.17%	52.22%	54.27%	56.31%
12	6.46%	7.56%	8.67%	55.11%	57.39%	59.64%	61.88%	64.08%
Average	5.09%	6.19%	7.30%	42.64%	44.87%	47.12%	49.38%	51.66%
Average from last 3 CMAMs over 10-year horizon	6.59%							

The 50th percentile return is also related to the geometric average return. The geometric average of a sequence of returns over a number of years is the compound average of those returns over the number of years compounded. As the number of years in the geometric average increases and if the distributions of returns each year are independent and identically distributed, then the geometric average will converge to the median return. The median return may be considered a reasonable rate of return for purposes of the valuation. The average of 50th percentile returns is 6.19% per year.

In summary, a reasonable range for the assumed rate of return based on the current CMAM's 10-year investment horizon is between the geometric median of 6.19% and the arithmetic nominal expected return of 7.10%. Returns outside that range are not necessarily unreasonable, but a separate justification may be needed.

In addition to conducting our own analysis, we also discussed the investment return assumption with SWIB and NEPC. According to NEPC, their 10-year forecast for the Core Fund was 5.4% and their 30 year forecast was 6.6%. The following table summarizes the various return forecasts.

	CMAM Forecast				SWIB/NEPC Forecast	
	Arithmetic Return		Geometric Return		Geometric Return	
	10yr	20-30yr	10yr	20-30yr	10yr	20-30yr
2019	7.88%	8.98%	7.04%	8.11%		
2020	7.39%	8.49%	6.54%	7.61%		
2021	7.10%	8.19%	6.19%	7.26%	5.40%	6.60%

Please note that it is not uncommon for the actuary and investment managers to develop different forecasted rates of return. The following areas are reasons for some of these differences:

- Number of managers – Actuary typically will use survey information from many investment managers instead of using just one forecast.
- Mapping error – The various asset classes provided by the various investment consultants may be difficult to map exactly to the WRS asset classes.
- Current year expectations – Year to year forecasts for portfolios can change by 50 to 100 basis points a year. Actuaries may decide to apply smoothing to these forecasts so that there will not be large changes each year in the investment return assumption.
- Purpose – The purpose of the return assumption for actuaries is generally to develop a discount rate for determining liabilities, which may be different from the overall purpose of the investment manager forecast (i.e. beating their benchmarks).
- Inflation – Inflation forecasts will tend to vary by investment forecaster.
- Time Horizon – While there is no universally agreed upon time horizon to base the investment return assumption on, longer term forecasts tend to be less reliable than shorter term forecasts.
- Treatment of alpha – In general, actuaries are not allowed to include alpha in their assumption. ASOP No. 27, Section 3.8.3 d. states, "Investment Manager Performance—Anticipating superior (or inferior) investment manager performance may be unduly optimistic (or pessimistic). The actuary should not assume that superior or inferior returns will be achieved, net of investment expenses, from an active investment management strategy compared to a passive investment management strategy unless the actuary believes, based on relevant supporting data, that such superior or inferior returns represent a reasonable expectation over the measurement period." In practice, assuming alpha as part of the total investment assumption is rare.

Summary Recommendation:

While a 7.0% investment assumption was historically conservative by industry standards, there is considerable movement among all Public Sector Retirement Systems to reduce this assumption. It is important to remember that this assumption should not drive the asset allocation or investment goals of the investment managers. Rather, it is intended to reflect the expected return of the portfolio based upon the given asset allocation. Based upon this data, and the liability structure of the WRS, our preferred assumption would be at the 50th percentile of investment return over the ten year horizon, which by our analysis is 6.2% and by NEPC's is 5.4%. We recognize that other assumptions are also reasonable, and that a longer horizon can be considered. To assist the board with decision making, we have illustrated results ranging from 6.2% to 7% in 20 basis point increments on Page 19.

<u>Summary of Economic Assumption Options</u>

Measure	Current Assumption	Reasonable Range	Recommended Assumption
Price Inflation	2.5%	2.0%-2.5%	2.4%
Wage Inflation	3.0%	2.7%-3.2%	3.0%
Investment Return	7.0%	5.4%-7.0%	6.2%-6.8%

Summary of Valuation Results

The table below describes hypothetical valuation results at December 31, 2021 with current and proposed actuarial assumptions.

	12/31/2020 Actual Results	Baseline (no changes)	Demographic Changes Only	Alternate Economic 1	Alternate Economic 2	Alternate Economic 3	Alternate Economic 4
		Hypothetical results as of 12/31/2021*					
Price Inflation	2.50%	2.50%	2.50%	2.40%	2.40%	2.40%	2.40%
Wage Inflation	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Investment Return	7.00%	7.00%	7.00%	6.80%	6.60%	6.40%	6.20%
General and Executive & Elected	**13.0%**	**12.4%**	**12.9%**	**13.4%**	**13.8%**	**14.3%**	**14.8%**
Protective With Social Security	**18.5%**	**17.7%**	**19.6%**	**20.3%**	**21.0%**	**21.7%**	**22.5%**
Protective Without Social Security	**22.9%**	**21.7%**	**23.7%**	**24.7%**	**25.8%**	**26.8%**	**27.8%**

*	*Results above include proposed demographic assumptions (changes to the withdrawal, retirement, disability and mortality rates discussed earlier in this report) and also includes estimated impact of asset gains in MRA for 2021. Note that participant data at 12/31/2020 was used for calculating System liabilities, without adjustment or rollforward.*

It should also be noted that there are currently unrecognized gains in the MRA for each of the next 4 years. Absent offsetting investment losses, the forecasted contribution rate will decrease over the next four years.

New assumptions will be first used in the December 31, 2021 actuarial valuations, at which time experience gains or losses incurred during 2021 will also be recognized. This would first impact rates in 2023. Consequently, no rate changes are recommended for 2022 based upon this study.

Other Recommendations

Miscellaneous and Technical Assumptions: We reviewed various miscellaneous and technical assumptions and make the following recommendations:

- Marriage Assumption
  - Current Assumption: 80% of males and 70% of females are assumed to be married for purposes of death-in-service benefits.
  - Proposed Assumption: 75% of males and 55% of females are assumed to be married for purposes of death-in-service benefits.
- Age Difference
  - Current Assumption: Male spouses are assumed to be three years older than female spouses.
  - Proposed Assumption: Male spouses are assumed to be two years older than female spouses.
- Liability Adjustments
  - Current Assumption: Final Average Salaries were increased 3.0% for Executive and Elected, 3.5% for Protective and 2.5% for all others to account for additional contingencies in actual benefit amount calculated at time of retirement.
  - Proposed Assumption: Final Average Salaries are increased 4.0% for Executive and Elected, 4.5% for Protective and 3.5% for all others to account for additional contingencies in actual benefit amount calculated at time of retirement.

Option Factors are calculated using a 5% interest assumption and the assumed rates of mortality with a blended mortality table consisting of 50% male rates and 50% female rates. If a retiring member elects an optional form of benefit, the straight life benefit is multiplied by the appropriate option factor to produce the benefit actually payable.

Recommended Implementation Schedule. It is recommended that the results of this experience study be implemented in accordance with the following schedule.

Active and Inactive Lives Valuation:	12/31/2021 Valuation
Retired Lives Valuation:	12/31/2021 Valuation
Option Factors:	Not later than January 1, 2023

Note that if the assumed investment return is changed from 7.0% to 6.x%, it is recommended that development of the Market Recognition Account in the 2021 valuation uses a rate of 7.0%, since the new 6.x% rate is not effective until 12/31/2021. Said another way, the fund expected:

- 7.0% investment return during the period 1/1/2021 through 12/31/2021, and
- 6.x% investment return during the period 1/1/2022 through 12/31/2022 (and forward).

This is the traditional asset smoothing approach used by actuaries when changing the investment return assumption. As always, liabilities as of 12/31/2021 would be valued at 6.x% under this approach.

Other Recommendations

The table below outlines additional recommendations from various audits and how they were handled in this study.

Recommendation	Considered?	Changed?
Withdrawal decrement 10-year period	Yes	No
Alternative withdrawal assumptions to fit particular groups	Yes	No
Analyze disability experience for combined group of Public School, University and Executive & Elected members	Yes	No
Review male and female retirement experience separately for Protective and Executive & Elected groups	Yes	No
Separate decrement assumptions for State vs. Non-State employees	Yes	Yes
Review miscellaneous and technical assumptions every so often	Yes	Yes

SECTION A

WITHDRAWAL EXPERIENCE

General Males Non-State
Withdrawal Experience

Male Service-Based Withdrawals

Service Index	Withdrawals	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates Present	Sample Rates Proposed	Expected Withdrawals Present	Expected Withdrawals Proposed
1	799	4,478	0.1784	0.1839	0.1700	0.1770	761	793
2	1,111	8,201	0.1355	0.1268	0.1230	0.1250	1,009	1,025
3	623	6,746	0.0924	0.0868	0.0930	0.0900	627	607
4	438	5,961	0.0735	0.0660	0.0760	0.0710	453	423
5	292	4,700	0.0621	0.0579	0.0750	0.0660	353	310
6	193	3,729	0.0518	0.0488	0.0580	0.0530	216	198
7	161	3,153	0.0511	0.0489	0.0480	0.0480	151	151
8	132	2,638	0.0500	0.0456	0.0470	0.0460	124	121
9	87	2,064	0.0422	0.0383	0.0410	0.0410	85	85
10	71	1,789	0.0397	0.0374	0.0400	0.0400	72	72
Totals (10 and under)	3,907	43,459	0.0899	0.0566	0.0618	0.0593	3,851	3,785

	Actual Experience		**Proposed Assumption**
Current	0.0899	0.0566	0.0593
Previous Investigation Results			
2015-2017	0.0978	0.0674	0.0620
2012-2014	0.0971	0.0596	0.0546
2009-2011	0.0870		0.0790

General Males Non-State
Withdrawal Experience

Male Age-Based Withdrawals
with 10 or More Years of Service

Age	Withdrawals	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates*		Expected Withdrawals	
					Present	Proposed	Present	Proposed
25-29	-	9	0.0000	0.0000	0.0400	0.0350	-	-
30-34	19	552	0.0344	0.0278	0.0350	0.0300	18	16
35-39	78	2,696	0.0289	0.0259	0.0260	0.0260	71	69
40-44	116	4,406	0.0263	0.0220	0.0230	0.0220	100	97
45-49	129	6,061	0.0213	0.0179	0.0180	0.0180	111	110
50-54	197	8,552	0.0230	0.0198	0.0160	0.0160	139	139
Totals	539	22,276	0.0242	0.0202	0.0187	0.0185	439	431

	Actual Experience		**Proposed Assumption**
Current	0.0242	0.0202	0.0185
Previous Investigation Results (combined)			
2015-2017	0.0256	0.0208	0.0185
2012-2014	0.0239	0.0202	0.0165
2009-2011	0.0547		0.0495

Sample rates are taken from midpoint of age group.

General Males State
Withdrawal Experience

Male Service-Based Withdrawals

Service Index	Withdrawals	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates		Expected Withdrawals	
					Present	Proposed	Present	Proposed
1	460	2,198	0.2093	0.1737	0.1700	0.1720	374	378
2	626	4,145	0.1510	0.1351	0.1230	0.1290	510	535
3	387	3,520	0.1099	0.0980	0.0930	0.0950	327	334
4	262	3,160	0.0829	0.0725	0.0760	0.0740	240	234
5	225	2,615	0.0860	0.0814	0.0750	0.0730	196	191
6	148	2,165	0.0684	0.0636	0.0580	0.0610	126	132
7	120	1,987	0.0604	0.0566	0.0480	0.0520	95	103
8	91	1,640	0.0555	0.0544	0.0470	0.0510	77	84
9	69	1,268	0.0544	0.0485	0.0410	0.0450	52	57
10	38	977	0.0389	0.0326	0.0400	0.0360	39	35
Totals (10 and under)	2,426	23,675	0.1025	0.0652	0.0609	0.0624	2,036	2,083

	Actual Experience		Proposed Assumption
Current	0.1025	0.0652	0.0624
Previous Investigation Results			
2015-2017	0.0978	0.0674	0.0620
2012-2014	0.0971	0.0596	0.0546
2009-2011	0.0870		0.0790

General Males State
Withdrawal Experience

Male Age-Based Withdrawals
with 10 or More Years of Service

Age	Withdrawals	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates*		Expected Withdrawals	
					Present	Proposed	Present	Proposed
25-29	-	2	0.0000	0.0000	0.0400	0.0350	-	-
30-34	8	262	0.0305	0.0254	0.0350	0.0280	9	7
35-39	45	1,430	0.0315	0.0276	0.0260	0.0270	38	39
40-44	68	2,270	0.0300	0.0280	0.0230	0.0260	51	58
45-49	77	3,038	0.0253	0.0236	0.0180	0.0220	55	66
50-54	85	4,116	0.0207	0.0179	0.0160	0.0170	67	72
Totals	283	11,118	0.0255	0.0218	0.0186	0.0207	220	242

	Actual Experience		Proposed Assumption
Current	0.0255	0.0218	0.0207
Previous Investigation Results (combined)			
2015-2017	0.0256	0.0208	0.0185
2012-2014	0.0239	0.0202	0.0165
2009-2011	0.0547		0.0495

* Sample rates are taken from midpoint of age group.

General Females Non-State
Withdrawal Experience

Female Service-Based Withdrawals

Service Index	Withdrawals	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates		Expected Withdrawals	
					Present	Proposed	Present	Proposed
1	2,447	12,425	0.1969	0.2080	0.2000	0.2000	2,485	2,485
2	3,119	20,125	0.1550	0.1535	0.1500	0.1500	3,019	3,019
3	1,822	15,260	0.1194	0.1197	0.1150	0.1150	1,755	1,755
4	1,171	12,446	0.0941	0.0925	0.1000	0.0960	1,245	1,195
5	816	9,276	0.0880	0.0850	0.0950	0.0900	881	835
6	504	6,922	0.0728	0.0705	0.0780	0.0740	540	512
7	336	5,760	0.0583	0.0559	0.0700	0.0630	403	363
8	289	4,707	0.0614	0.0582	0.0600	0.0600	282	282
9	226	3,908	0.0578	0.0564	0.0570	0.0570	223	223
10	165	3,451	0.0478	0.0445	0.0530	0.0500	183	173
Totals (10 and under)	10,895	94,280	0.1156	0.0774	0.0827	0.0800	11,016	10,842

	Actual Experience		Proposed Assumption
Current	0.1156	0.0774	0.0800
Previous Investigation Results			
2015-2017	0.1246	0.0919	0.0810
2012-2014	0.1091	0.0769	0.0697
2009-2011	0.0903		0.0937

General Females Non-State
Withdrawal Experience

Female Age-Based Withdrawals
with 10 or More Years of Service

Age	Withdrawals	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates*		Expected Withdrawals	
					Present	Proposed	Present	Proposed
25-29	4	15	0.2667	0.2555	0.0500	0.0500	1	1
30-34	39	717	0.0544	0.0508	0.0450	0.0480	31	32
35-39	136	3,495	0.0389	0.0371	0.0350	0.0360	123	126
40-44	199	5,887	0.0338	0.0302	0.0300	0.0300	176	180
45-49	300	8,225	0.0365	0.0320	0.0250	0.0290	204	231
50-54	380	13,091	0.0290	0.0228	0.0200	0.0220	268	297
Totals	1,058	31,430	0.0337	0.0279	0.0245	0.0267	803	867

	Actual Experience		Proposed Assumption
Current	0.0337	0.0279	0.0267
Previous Investigation Results (combined)			
2015-2017	0.0383	0.0319	0.0244
2012-2014	0.0293	0.0225	0.0203
2009-2011	0.0665		0.0686

* Sample rates are taken from midpoint of age group.

General Females State
Withdrawal Experience

Female Service-Based Withdrawals

Service Index	Withdrawals	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates		Expected Withdrawals	
					Present	Proposed	Present	Proposed
1	968	4,238	0.2284	0.1924	0.2000	0.1950	848	826
2	1,423	7,882	0.1805	0.1611	0.1500	0.1550	1,182	1,222
3	963	6,572	0.1465	0.1341	0.1150	0.1250	756	822
4	600	5,657	0.1061	0.1011	0.1000	0.1000	566	566
5	346	4,328	0.0799	0.0788	0.0950	0.0870	411	377
6	283	3,456	0.0819	0.0789	0.0780	0.0780	270	270
7	212	2,987	0.0710	0.0673	0.0700	0.0690	209	206
8	158	2,525	0.0626	0.0606	0.0600	0.0600	151	152
9	111	2,034	0.0546	0.0548	0.0570	0.0560	116	114
10	111	1,708	0.0650	0.0610	0.0530	0.0550	91	94
Totals (10 and under)	5,175	41,387	0.1250	0.0812	0.0806	0.0806	4,600	4,649

	Actual Experience		Proposed Assumption
Current	0.1250	0.0812	0.0806
Previous Investigation Results			
2015-2017	0.1246	0.0919	0.0810
2012-2014	0.1091	0.0769	0.0697
2009-2011	0.0903		0.0937

General Females State
Withdrawal Experience

Female Age-Based Withdrawals
with 10 or More Years of Service

Age	Withdrawals	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates*		Expected Withdrawals	
					Present	Proposed	Present	Proposed
25-29	-	2	0.0000	0.0000	0.0500	0.0500	-	-
30-34	32	612	0.0523	0.0480	0.0450	0.0470	26	27
35-39	93	2,511	0.0370	0.0331	0.0350	0.0340	88	86
40-44	118	4,044	0.0292	0.0254	0.0300	0.0280	121	115
45-49	149	4,665	0.0319	0.0261	0.0250	0.0260	116	117
50-54	134	6,154	0.0218	0.0161	0.0200	0.0180	127	116
Totals	526	17,988	0.0292	0.0225	0.0250	0.0240	478	461

	Actual Experience		Proposed Assumption
Current	0.0292	0.0225	0.0240
Previous Investigation Results (combined)			
2015-2017	0.0383	0.0319	0.0244
2012-2014	0.0293	0.0225	0.0203
2009-2011	0.0665		0.0686

* Sample rates are taken from midpoint of age group.

Public School Males Non-State
Withdrawal Experience

Male Service-Based Withdrawals

Service Index	Withdrawals	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates		Expected Withdrawals	
					Present	Proposed	Present	Proposed
1	172	1,448	0.1188	0.1057	0.1850	0.1260	268	182
2	294	2,770	0.1061	0.1183	0.1100	0.1160	305	321
3	236	2,714	0.0870	0.0869	0.0800	0.0850	217	231
4	158	2,602	0.0607	0.0586	0.0650	0.0600	169	156
5	135	2,488	0.0543	0.0557	0.0550	0.0560	137	139
6	111	2,434	0.0456	0.0461	0.0400	0.0450	97	110
7	86	2,285	0.0376	0.0375	0.0350	0.0370	80	85
8	59	2,127	0.0277	0.0274	0.0320	0.0290	68	62
9	50	1,852	0.0270	0.0256	0.0300	0.0260	56	48
10	40	1,640	0.0244	0.0242	0.0280	0.0250	46	41
Totals (10 and under)	1,341	22,360	0.0600	0.0407	0.0419	0.0410	1,443	1,375

	Actual Experience		Proposed Assumption
Current	0.0600	0.0407	0.0410
Previous Investigation Results			
2015-2017	0.0638	0.0420	0.0431
2012-2014	0.0599	0.0420	0.0371
2009-2011	0.0509		0.0553

Public School Males Non-State
Withdrawal Experience

Male Age-Based Withdrawals
with 10 or More Years of Service

Age	Withdrawals	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates* Present	Proposed	Expected Withdrawals Present	Proposed
25-29	-	1	0.0000	0.0000	0.0250	0.0250	-	-
30-34	8	500	0.0160	0.0164	0.0200	0.0170	9	8
35-39	73	4,435	0.0165	0.0151	0.0160	0.0150	72	67
40-44	105	7,298	0.0144	0.0129	0.0150	0.0140	109	103
45-49	136	8,397	0.0162	0.0144	0.0140	0.0135	117	113
50-54	139	8,307	0.0167	0.0132	0.0130	0.0130	109	109
Totals	461	28,938	0.0159	0.0137	0.0140	0.0135	416	400

	Actual Experience		Proposed Assumption
Current	0.0159	0.0137	0.0135
Previous Investigation Results (combined)			
2015-2017	0.0182	0.0156	0.0141
2012-2014	0.0184	0.0156	0.0125
2009-2011	0.0298		0.0309

* Sample rates are taken from midpoint of age group.

Public School Females Non-State
Withdrawal Experience

Female Service-Based Withdrawals

Service Index	Withdrawals	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates		Expected Withdrawals	
					Present	Proposed	Present	Proposed
1	411	4,534	0.0906	0.0884	0.1500	0.1200	680	544
2	746	8,572	0.0870	0.0982	0.1100	0.1000	943	857
3	703	8,479	0.0829	0.0897	0.0800	0.0850	678	721
4	517	8,258	0.0626	0.0632	0.0600	0.0620	495	512
5	498	8,002	0.0622	0.0606	0.0550	0.0580	440	464
6	361	7,726	0.0467	0.0458	0.0500	0.0480	386	371
7	307	7,205	0.0426	0.0426	0.0400	0.0410	288	295
8	225	6,424	0.0350	0.0337	0.0370	0.0350	238	225
9	200	5,574	0.0359	0.0350	0.0330	0.0340	184	190
10	162	5,042	0.0321	0.0306	0.0300	0.0300	151	151
Totals (10 and under)	4,130	69,816	0.0592	0.0457	0.0452	0.0453	4,483	4,330

	Actual Experience		Proposed Assumption
Current	0.0592	0.0457	0.0453
Previous Investigation Results			
2015-2017	0.0639	0.0496	0.0451
2012-2014	0.0601	0.0429	0.0397
2009-2011	0.0520		0.0565

Public School Females Non-State
Withdrawal Experience

Female Age-Based Withdrawals
with 10 or More Years of Service

Age	Withdrawals	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates*		Expected Withdrawals	
					Present	Proposed	Present	Proposed
25-29	-	-	N\A	N\A	0.0250	0.0250	-	-
30-34	31	1,627	0.0191	0.0176	0.0230	0.0200	34	31
35-39	268	13,407	0.0200	0.0185	0.0170	0.0180	229	237
40-44	320	18,479	0.0173	0.0151	0.0140	0.0145	263	272
45-49	326	20,303	0.0161	0.0133	0.0130	0.0130	264	263
50-54	311	21,743	0.0143	0.0113	0.0120	0.0115	264	254
Totals	1,256	75,559	0.0166	0.0133	0.0133	0.0132	1,054	1,057

	Actual Experience		Proposed Assumption
Current	0.0166	0.0133	0.0132
Previous Investigation Results (combined)			
2015-2017	0.0188	0.0152	0.0133
2012-2014	0.0178	0.0147	0.0113
2009-2011	0.0313		0.0336

Sample rates are taken from midpoint of age group.

University Males State
Withdrawal Experience

Male Service-Based Withdrawals

Service Index	Withdrawal	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates Present	Sample Rates Proposed	Expected Withdrawals Present	Expected Withdrawals Proposed
1	179	1,077	0.1662	0.1144	0.1600	0.1400	172	151
2	356	2,149	0.1657	0.1265	0.1500	0.1380	322	297
3	314	2,155	0.1457	0.1221	0.1300	0.1260	280	272
4	201	1,780	0.1129	0.1054	0.1100	0.1100	196	196
5	130	1,539	0.0845	0.0755	0.0900	0.0860	139	132
6	126	1,340	0.0940	0.0892	0.0800	0.0850	107	114
7	89	1,285	0.0693	0.0646	0.0750	0.0700	96	90
8	58	1,149	0.0505	0.0524	0.0600	0.0560	69	64
9	43	1,002	0.0429	0.0377	0.0550	0.0460	55	46
10	37	856	0.0432	0.0351	0.0500	0.0430	43	37
Totals (10 and under)	1,533	14,332	0.1070	0.0670	0.0766	0.0724	1,479	1,399

	Actual Experience		Proposed Assumption
Current	0.1070	0.0670	0.0724
Previous Investigation Results			
2015-2017	0.1244	0.0836	0.0777
2012-2014	0.1187	0.0771	0.0720
2009-2011	0.1050		0.0967

University Males State
Withdrawal Experience

Male Age-Based Withdrawals
with 10 or More Years of Service

Age	Withdrawals	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates*		Expected Withdrawals	
					Present	Proposed	Present	Proposed
25-29	-	-	N\A	N\A	0.0500	0.0430	-	-
30-34	3	67	0.0448	0.0478	0.0450	0.0410	3	3
35-39	24	521	0.0461	0.0370	0.0400	0.0385	20	19
40-44	51	1,425	0.0358	0.0312	0.0300	0.0305	43	44
45-49	64	2,339	0.0274	0.0257	0.0250	0.0255	58	60
50-54	79	2,838	0.0278	0.0235	0.0200	0.0220	58	64
Totals	221	7,190	0.0307	0.0259	0.0240	0.0251	182	190

	Actual Experience		Proposed Assumption
Current	0.0307	0.0259	0.0251
Previous Investigation Results (combined)			
2015-2017	0.0335	0.0284	0.0240
2012-2014	0.0289	0.0248	0.0206
2009-2011	0.0749		0.0695

* Sample rates are taken from midpoint of age group.

University Females State
Withdrawal Experience

Female Service-Based Withdrawals

Service Index	Withdrawals	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates		Expected Withdrawals	
					Present	Proposed	Present	Proposed
1	223	1,438	0.1551	0.1348	0.1450	0.1410	209	203
2	452	2,880	0.1569	0.1414	0.1400	0.1400	403	403
3	406	2,920	0.1390	0.1242	0.1300	0.1270	380	371
4	304	2,556	0.1189	0.1016	0.1000	0.1000	256	256
5	206	2,083	0.0989	0.0913	0.0950	0.0930	198	194
6	126	1,811	0.0696	0.0718	0.0900	0.0810	163	147
7	120	1,626	0.0738	0.0694	0.0700	0.0700	114	114
8	78	1,437	0.0543	0.0523	0.0600	0.0560	86	80
9	63	1,232	0.0511	0.0472	0.0500	0.0490	62	60
10	58	1,127	0.0515	0.0461	0.0400	0.0430	45	48
Totals (10 and under)	2,036	19,110	0.1065	0.0717	0.0753	0.0735	1,916	1,876

	Actual Experience		Proposed Assumption
Current	0.1065	0.0717	0.0735
Previous Investigation Results			
2015-2017	0.1156	0.0797	0.0750
2012-2014	0.1140	0.0734	0.0735
2009-2011	0.0999		0.1054

University Females State
Withdrawal Experience

Female Age-Based Withdrawals
with 10 or More Years of Service

Age	Withdrawals	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates*		Expected Withdrawals	
					Present	Proposed	Present	Proposed
25-29	-	-	N\A	N\A	0.0400	0.0400	-	-
30-34	4	158	0.0253	0.0287	0.0400	0.0400	6	6
35-39	45	1,068	0.0421	0.0409	0.0400	0.0400	42	42
40-44	75	2,141	0.0350	0.0361	0.0350	0.0350	75	75
45-49	70	2,636	0.0266	0.0216	0.0300	0.0300	79	79
50-54	93	3,031	0.0307	0.0259	0.0250	0.0250	78	78
Totals	287	9,034	0.0318	0.0274	0.0295	0.0295	280	280

	Actual Experience		Proposed Assumption
Current	0.0318	0.0274	0.0295
Previous Investigation Results (combined)			
2015-2017	0.0373	0.0333	0.0294
2012-2014	0.0322	0.0256	0.0238
2009-2011	0.0765		0.0799

* Sample rates are taken from midpoint of age group.

Protective With Social Security Non-State Withdrawal Experience

Male and Female Service-Based Withdrawals

Service Index	Withdrawals	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates Present	Sample Rates Proposed	Expected Withdrawals Present	Expected Withdrawals Proposed
1	102	839	0.1216	0.1526	0.1600	0.1560	134	131
2	185	2,020	0.0916	0.0935	0.0950	0.0940	192	190
3	82	1,769	0.0464	0.0453	0.0600	0.0530	106	94
4	68	1,648	0.0413	0.0377	0.0500	0.0440	82	73
5	62	1,481	0.0419	0.0383	0.0450	0.0420	67	62
6	37	1,357	0.0273	0.0248	0.0400	0.0330	54	45
7	36	1,277	0.0282	0.0257	0.0375	0.0320	48	41
8	31	1,155	0.0268	0.0241	0.0350	0.0300	40	35
9	29	1,024	0.0283	0.0247	0.0300	0.0270	31	28
10	23	975	0.0236	0.0210	0.0250	0.0230	24	22
Totals (10 and under)	655	13,545	0.0484	0.0298	0.0389	0.0345	778	721

	Actual Experience		Proposed Assumption
Current	0.0484	0.0298	0.0345
Previous Investigation Results			
2015-2017	0.0779	0.0445	0.0382
2012-2014	0.0537	0.0366	0.0313
2009-2011	0.0357		0.0390

Protective With Social Security Non-State
Withdrawal Experience

Male and Female Age-Based Withdrawals
with 10 or More Years of Service

Age	Withdrawals	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates*		Expected Withdrawals	
					Present	Proposed	Present	Proposed
25-29	-	3	0.0000	0.0000	0.0250	0.0220	-	-
30-34	17	930	0.0183	0.0185	0.0220	0.0200	20	18
35-39	52	3,421	0.0152	0.0142	0.0180	0.0160	62	56
40-44	68	4,107	0.0166	0.0144	0.0150	0.0150	62	62
45-49	92	5,008	0.0184	0.0157	0.0130	0.0140	66	70
50-54	33	587	0.0562	0.0969	0.0120	0.0130	7	8
Totals	262	14,056	0.0186	0.0187	0.0146	0.0147	217	214

	Actual Experience		Proposed Assumption
Current	0.0186	0.0187	0.0147
Previous Investigation Results (combined)			
2015-2017	0.0247	0.0206	0.0146
2012-2014	0.0182	0.0163	0.0121
2009-2011	0.0238		0.0249

* Sample rates are taken from midpoint of age group.

Protective With Social Security State
Withdrawal Experience

Male and Female Service-Based Withdrawals

Service Index	Withdrawals	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates		Expected Withdrawals	
					Present	Proposed	Present	Proposed
1	311	1,151	0.2702	0.1971	0.1600	0.1880	184	216
2	428	2,220	0.1928	0.1755	0.0950	0.1550	211	344
3	239	1,834	0.1303	0.1202	0.0600	0.1050	110	193
4	121	1,525	0.0793	0.0706	0.0500	0.0650	76	99
5	80	1,251	0.0639	0.0602	0.0450	0.0550	56	69
6	56	984	0.0569	0.0525	0.0400	0.0500	39	49
7	47	864	0.0544	0.0491	0.0375	0.0450	32	39
8	16	646	0.0248	0.0214	0.0350	0.0400	23	26
9	31	490	0.0633	0.0572	0.0300	0.0350	15	17
10	18	426	0.0423	0.0353	0.0250	0.0330	11	14
Totals (10 and under)	1,347	11,391	0.1183	0.0624	0.0430	0.0574	757	1,066

	Actual Experience		Proposed Assumption
Current	0.1183	0.0624	0.0574
Previous Investigation Results			
2015-2017	0.0779	0.0445	0.0382
2012-2014	0.0537	0.0366	0.0313
2009-2011	0.0357		0.0390

Protective With Social Security State
Withdrawal Experience

Male and Female Age-Based Withdrawals
with 10 or More Years of Service

Age	Withdrawals	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates*		Expected Withdrawals	
					Present	Proposed	Present	Proposed
25-29	-	9	0.0000	0.0000	0.0250	0.0300	-	-
30-34	20	551	0.0363	0.0330	0.0220	0.0280	12	15
35-39	55	1,839	0.0299	0.0251	0.0180	0.0220	33	40
40-44	58	2,706	0.0214	0.0178	0.0150	0.0160	41	44
45-49	55	3,316	0.0166	0.0129	0.0130	0.0130	43	44
50-54	16	729	0.0219	0.0252	0.0120	0.0120	9	9
Totals	204	9,150	0.0223	0.0176	0.0144	0.0155	138	152

	Actual Experience		Proposed Assumption
Current	0.0223	0.0176	0.0155
Previous Investigation Results (combined)			
2015-2017	0.0247	0.0206	0.0146
2012-2014	0.0182	0.0163	0.0121
2009-2011	0.0238		0.0249

* Sample rates are taken from midpoint of age group.

Protective Without Social Security Non-State Withdrawal Experience

Male and Female Service-Based Withdrawals

Service Index	Withdrawals	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates		Expected Withdrawals	
					Present	Proposed	Present	Proposed
1	7	102	0.0686	0.0085	0.0400	0.0450	4	5
2	15	322	0.0466	0.0554	0.0350	0.0400	11	13
3	2	343	0.0058	0.0112	0.0150	0.0200	5	7
4	6	327	0.0183	0.0223	0.0130	0.0180	4	6
5	7	341	0.0205	0.0212	0.0120	0.0170	4	6
6	6	343	0.0175	0.0160	0.0110	0.0130	4	4
7	6	326	0.0184	0.0169	0.0100	0.0120	3	4
8	2	297	0.0067	0.0060	0.0090	0.0090	3	3
9	3	278	0.0108	0.0097	0.0080	0.0080	2	2
10	2	279	0.0072	0.0071	0.0070	0.0070	2	2
Totals (10 and under)	56	2,958	0.0189	0.0130	0.0100	0.0116	42	52

	Actual Experience		Proposed Assumption
Current	0.0189	0.0130	0.0116
Previous Investigation Results			
2015-2017	0.0146	0.0111	0.0102
2012-2014	0.0161	0.0119	0.0100
2009-2011	0.0129		0.0148

Protective Without Social Security Non-State Withdrawal Experience

Male and Female Age-Based Withdrawals with 10 or More Years of Service

Age	Withdrawals	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates* Present	Sample Rates* Proposed	Expected Withdrawals* Present	Expected Withdrawals* Proposed
25-29	-	4	0.0000	0.0000	0.0070	0.0070	-	-
30-34	2	234	0.0085	0.0096	0.0070	0.0065	2	1
35-39	4	745	0.0054	0.0039	0.0065	0.0060	5	4
40-44	6	1,095	0.0055	0.0049	0.0060	0.0055	7	6
45-49	9	1,390	0.0065	0.0052	0.0055	0.0050	8	7
50-54	13	199	0.0653	0.1096	0.0050	0.0045	1	1
Totals	34	3,667	0.0093	0.0115	0.0058	0.0053	23	19

	Actual Experience		Proposed Assumption
Current	0.0093	0.0115	0.0053
Previous Investigation Results			
2015-2017	0.0113	0.0170	0.0058
2012-2014	0.0107	0.0160	0.0058
2009-2011	0.0108		0.0094

* Sample rates are taken from midpoint of age group.

Executive and Elective Non-State
Withdrawal Experience

Male and Female Service-Based Withdrawals

Service Index	Withdrawals	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates Present	Sample Rates Proposed	Expected Withdrawals Present	Expected Withdrawals Proposed
1	12	41	0.2927	0.3864	0.1400	0.2500	6	10
2	25	99	0.2525	0.2578	0.1300	0.2000	13	20
3	16	98	0.1633	0.1491	0.1200	0.1700	12	17
4	15	64	0.2344	0.2280	0.1000	0.1600	6	10
5	7	35	0.2000	0.1684	0.1000	0.1300	4	5
6	1	37	0.0270	0.0143	0.0500	0.0400	2	1
7	-	23	0.0000	0.0000	0.0500	0.0400	1	1
8	1	30	0.0333	0.0522	0.0500	0.0400	2	1
9	2	21	0.0952	0.0847	0.0500	0.0400	1	1
10	-	15	0.0000	0.0000	0.0500	0.0400	1	1
Totals(10 and under)	79	463	0.1706	0.1126	0.0793	0.0994	48	67

	Actual Experience		Proposed Assumption
Current	0.1706	0.1126	0.0994
Previous Investigation Results			
2015-2017	0.0931	0.0689	0.0799
2012-2014	0.1217	0.0801	0.0913
2009-2011	0.1212		0.1246

Executive and Elective Non-State
Withdrawal Experience

Male and Female Age-Based Withdrawals
with 10 or More Years of Service

Age	Withdrawals	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates*		Expected Withdrawals*	
					Present	Proposed	Present	Proposed
25-29	-	-	N\A	N\A	0.0500	0.0450	-	-
30-34	-	5	0.0000	0.0000	0.0500	0.0450	-	-
35-39	-	10	0.0000	0.0000	0.0500	0.0450	1	-
40-44	2	57	0.0351	0.0314	0.0500	0.0400	3	2
45-49	2	82	0.0244	0.0254	0.0450	0.0350	4	3
50-54	4	164	0.0244	0.0222	0.0400	0.0300	7	5
Totals	8	318	0.0252	0.0237	0.0430	0.0332	15	10

	Actual Experience		Proposed Assumption
Current	0.0252	0.0237	0.0332
Previous Investigation Results (combined)			
2015-2017	0.0415	0.0506	0.0431
2012-2014	0.0300	0.0273	0.0268
2009-2011	0.0797		0.0855

* Sample rates are taken from midpoint of age group.

Executive and Elective State
Withdrawal Experience

Male and Female Service-Based Withdrawals

Service Index	Withdrawals	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates		Expected Withdrawals	
					Present	Proposed	Present	Proposed
1	3	18	0.1667	0.2323	0.1400	0.1900	3	3
2	14	98	0.1429	0.1909	0.1300	0.1600	13	16
3	8	67	0.1194	0.1327	0.1200	0.1300	8	9
4	13	86	0.1512	0.2058	0.1000	0.1250	9	11
5	7	61	0.1148	0.1450	0.1000	0.1200	6	7
6	5	65	0.0769	0.0531	0.0500	0.0600	3	4
7	7	56	0.1250	0.0778	0.0500	0.0600	3	3
8	9	71	0.1268	0.0997	0.0500	0.0600	4	4
9	8	63	0.1270	0.1052	0.0500	0.0600	3	4
10	1	51	0.0196	0.0144	0.0500	0.0600	3	3
Totals(10 and under)	75	636	0.1179	0.1047	0.0687	0.0826	55	64

	Actual Experience		Proposed Assumption
Current	0.1179	0.1047	0.0826
Previous Investigation Results			
2015-2017	0.0931	0.0689	0.0799
2012-2014	0.1217	0.0801	0.0913
2009-2011	0.1212		0.1246

Executive and Elective State
Withdrawal Experience

Male and Female Age-Based Withdrawals
with 10 or More Years of Service

Age	Withdrawals	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates* Present	Sample Rates* Proposed	Expected Withdrawals* Present	Expected Withdrawals* Proposed
25-29	-	-	N\A	N\A	0.0500	0.0450	-	-
30-34	-	-	N\A	N\A	0.0500	0.0450	-	-
35-39	-	32	0.0000	0.0000	0.0500	0.0450	2	1
40-44	2	67	0.0299	0.0223	0.0500	0.0450	3	3
45-49	7	142	0.0493	0.0334	0.0450	0.0400	6	6
50-54	11	210	0.0524	0.0519	0.0400	0.0350	9	7
Totals	20	451	0.0443	0.0421	0.0429	0.0379	20	17

	Actual Experience		Proposed Assumption
Current	0.0443	0.0421	0.0379
Previous Investigation Results (combined)			
2015-2017	0.0415	0.0506	0.0431
2012-2014	0.0300	0.0273	0.0268
2009-2011	0.0797		0.0855

* Sample rates are taken from midpoint of age group.

SECTION B

DISABILITY EXPERIENCE

General Males Non-State
Disability Experience

Male Disability Experience

Age	Disabilities	Exposure	Population Weighted Rates	Sample Rates*		Expected Disabilities	
				Present	Proposed	Present	Proposed
Under 20	-	43	0.0000	0.0000	0.0001	-	-
20-24	-	2,054	0.0000	0.0000	0.0001	-	-
25-29	-	6,143	0.0000	0.0000	0.0001	-	-
30-34	-	8,344	0.0000	0.0000	0.0001	-	-
35-39	2	10,000	0.0002	0.0001	0.0002	1	2
40-44	3	10,301	0.0003	0.0003	0.0005	3	5
45-49	5	11,318	0.0004	0.0004	0.0006	6	8
50-54	26	13,398	0.0019	0.0012	0.0017	16	23
55-59	45	10,086	0.0045	0.0021	0.0030	21	30
60-64	32	6,863	0.0047	0.0041	0.0059	24	35
65-69	3	-	N\A	0.0016	0.0023	-	-
70-74	-	-	N\A	0.0014	0.0020	-	-
75 and over	-	-	N\A	0.0014	0.0020	-	-
Totals	116	78,550	0.0015	0.0009	0.0013	71	103

	Actual Experience	Proposed Assumption
Current	0.0015	0.0013
Previous Investigation Results		
2015-2017	0.0007	0.0011
2012-2014	0.0011	0.0016
2009-2011	0.0011	0.0018

* Sample rates are taken from midpoint of age group.

General Males State
Disability Experience

Male Disability Experience

Age	Disabilities	Exposure	Population Weighted Rates	Sample Rates*		Expected Disabilities	
				Present	Proposed	Present	Proposed
Under 20	-	7	0.0000	0.0000	0.0001	-	-
20-24	-	750	0.0000	0.0000	0.0001	-	-
25-29	-	3,742	0.0000	0.0000	0.0001	-	-
30-34	1	5,477	0.0002	0.0000	0.0001	-	-
35-39	1	5,642	0.0002	0.0001	0.0002	1	1
40-44	1	5,178	0.0002	0.0003	0.0005	2	2
45-49	4	5,598	0.0007	0.0004	0.0006	3	4
50-54	9	6,534	0.0014	0.0012	0.0017	8	11
55-59	22	4,476	0.0049	0.0021	0.0030	9	13
60-64	16	3,224	0.0050	0.0041	0.0059	11	16
65-69	1	-	N\A	0.0016	0.0023	-	-
70-74	-	-	N\A	0.0014	0.0020	-	-
75 and over	-	-	N\A	0.0014	0.0020	-	-
Totals	55	40,628	0.0014	0.0008	0.0012	34	47

	Actual Experience	Proposed Assumption
Current	0.0014	0.0012
Previous Investigation Results		
2015-2017	0.0007	0.0011
2012-2014	0.0011	0.0016
2009-2011	0.0011	0.0018

* Sample rates are taken from midpoint of age group.

General Females Non-State
Disability Experience

Female Disability Experience

Age	Disabilities	Exposure	Population Weighted Rates	Sample Rates*		Expected Disabilities	
				Present	Proposed	Present	Proposed
Under 20	-	98	0.0000	0.0000	0.0000	-	-
20-24	-	3,686	0.0000	0.0000	0.0000	-	-
25-29	-	10,905	0.0000	0.0000	0.0000	1	1
30-34	1	14,578	0.0001	0.0002	0.0002	2	3
35-39	1	17,499	0.0001	0.0002	0.0002	4	4
40-44	5	19,868	0.0003	0.0003	0.0004	7	8
45-49	8	22,513	0.0004	0.0004	0.0005	11	12
50-54	24	27,325	0.0009	0.0008	0.0009	22	25
55-59	30	21,192	0.0014	0.0014	0.0016	29	33
60-64	48	15,049	0.0032	0.0018	0.0020	26	29
65-69	2	-	N\A	0.0014	0.0016	-	-
70-74	-	-	N\A	0.0012	0.0014	-	-
75 and over	-	-	N\A	0.0012	0.0014	-	-
Totals	119	152,713	0.0008	0.0007	0.0008	102	115

	Actual Experience	Proposed Assumption
Current	0.0008	0.0008
Previous Investigation Results		
2015-2017	0.0005	0.0007
2012-2014	0.0007	0.0010
2009-2011	0.0007	0.0013

* Sample rates are taken from midpoint of age group.

General Females State
Disability Experience

Female Disability Experience

Age	Disabilities	Exposure	Population Weighted Rates	Sample Rates*		Expected Disabilities	
				Present	Proposed	Present	Proposed
Under 20	-	17	0.0000	0.0000	0.0001	-	-
20-24	-	2,071	0.0000	0.0000	0.0001	-	-
25-29	-	8,155	0.0000	0.0000	0.0001	1	2
30-34	1	9,602	0.0001	0.0002	0.0004	2	4
35-39	2	9,250	0.0002	0.0002	0.0005	2	5
40-44	4	8,837	0.0005	0.0003	0.0008	3	7
45-49	10	8,764	0.0011	0.0004	0.0011	4	10
50-54	24	10,002	0.0024	0.0008	0.0019	8	20
55-59	30	7,054	0.0043	0.0014	0.0036	10	24
60-64	36	4,538	0.0079	0.0018	0.0045	8	19
65-69	2	-	N\A	0.0014	0.0036	-	-
70-74	-	-	N\A	0.0012	0.0030	-	-
75 and over	-	-	N\A	0.0012	0.0030	-	-
Totals	109	68,290	0.0016	0.0006	0.0013	38	91

	Actual Experience	Proposed Assumption
Current	0.0016	0.0013
Previous Investigation Results		
2015-2017	0.0005	0.0007
2012-2014	0.0007	0.0010
2009-2011	0.0007	0.0013

* Sample rates are taken from midpoint of age group.

Public School Males Non-State
Disability Experience

Male Disability Experience

Age	Disabilities	Exposure	Population Weighted Rates	Sample Rates* Present	Sample Rates* Proposed	Expected Disabilities Present	Expected Disabilities Proposed
Under 20	-	-	N\A	0.0000	0.0001	-	-
20-24	-	487	0.0000	0.0000	0.0001	-	-
25-29	-	4,902	0.0000	0.0000	0.0001	-	-
30-34	-	7,102	0.0000	0.0000	0.0001	-	-
35-39	1	8,551	0.0001	0.0000	0.0001	-	1
40-44	-	9,808	0.0000	0.0001	0.0002	1	2
45-49	2	10,193	0.0002	0.0003	0.0003	3	4
50-54	8	9,596	0.0008	0.0010	0.0012	9	11
55-59	12	3,947	0.0030	0.0013	0.0016	5	6
60-64	8	1,604	0.0050	0.0023	0.0028	4	4
65-69	-	-	N\A	0.0032	0.0040	-	-
70-74	-	-	N\A	0.0034	0.0041	-	-
75 and over	-	-	N\A	0.0034	0.0041	-	-
Totals	31	56,190	0.0006	0.0004	0.0005	22	28

	Actual Experience	Proposed Assumption
Current	0.0006	0.0005
Previous Investigation Results		
2015-2017	0.0003	0.0005
2012-2014	0.0005	0.0006
2009-2011	0.0006	0.0009

* Sample rates are taken from midpoint of age group.

Public School Females Non-State
Disability Experience

Female Disability Experience

Age	Disabilities	Exposure	Population Weighted Rates	Sample Rates*		Expected Disabilities	
				Present	Proposed	Present	Proposed
Under 20	-	1	0.0000	0.0001	0.0001	-	-
20-24	-	2,451	0.0000	0.0001	0.0001	-	-
25-29	1	18,063	0.0001	0.0001	0.0001	1	1
30-34	-	22,038	0.0000	0.0001	0.0001	1	2
35-39	1	24,185	0.0000	0.0001	0.0001	2	2
40-44	4	25,273	0.0002	0.0002	0.0002	5	7
45-49	10	25,810	0.0004	0.0006	0.0008	14	19
50-54	27	25,812	0.0010	0.0008	0.0011	21	29
55-59	39	11,036	0.0035	0.0013	0.0017	13	18
60-64	16	4,808	0.0033	0.0018	0.0024	8	11
65-69	-	-	N\A	0.0010	0.0014	-	-
70-74	-	-	N\A	0.0008	0.0011	-	-
75 and over	-	-	N\A	0.0008	0.0011	-	-
Totals	98	159,477	0.0006	0.0004	0.0006	65	89

	Actual Experience	Proposed Assumption
Current	0.0006	0.0006
Previous Investigation Results		
2015-2017	0.0003	0.0005
2102-2014	0.0005	0.0006
2009-2011	0.0006	0.0008

* Sample rates are taken from midpoint of age group.

University Males State
Disability Experience

Male Disability Experience

Age	Disabilities	Exposure	Population Weighted Rates	Sample Rates*		Expected Disabilities	
				Present	Proposed	Present	Proposed
Under 20	-	-	N\A	0.0000	0.0000	-	-
20-24	-	240	0.0000	0.0000	0.0000	-	-
25-29	-	1,341	0.0000	0.0000	0.0000	-	-
30-34	-	2,875	0.0000	0.0000	0.0000	-	-
35-39	1	4,132	0.0002	0.0000	0.0000	-	-
40-44	-	4,208	0.0000	0.0000	0.0001	-	-
45-49	1	4,028	0.0002	0.0001	0.0002	-	1
50-54	1	3,979	0.0003	0.0002	0.0004	1	2
55-59	3	2,450	0.0012	0.0006	0.0012	1	3
60-64	3	1,879	0.0016	0.0005	0.0011	1	2
65-69	-	-	N\A	0.0007	0.0014	-	-
70-74	-	-	N\A	0.0006	0.0012	-	-
75 and over	-	-	N\A	0.0006	0.0012	-	-
Totals	9	25,132	0.0004	0.0001	0.0003	3	8

	Actual Experience	Proposed Assumption
Current	0.0004	0.0003
Previous Investigation Results		
2015-2017	0.0001	0.0002
2012-2014	0.0000	0.0003
2009-2011	0.0004	0.0005

Sample rates are taken from midpoint of age group.

University Females State
Disability Experience

Female Disability Experience

Age	Disabilities	Exposure	Population Weighted Rates	Sample Rates* Present	Sample Rates* Proposed	Expected Disabilities Present	Expected Disabilities Proposed
Under 20	-	-	N\A	0.0000	0.0001	-	-
20-24	-	414	0.0000	0.0000	0.0001	-	-
25-29	-	2,645	0.0000	0.0000	0.0001	-	-
30-34	1	4,296	0.0002	0.0000	0.0001	-	1
35-39	1	5,362	0.0002	0.0002	0.0004	1	2
40-44	5	5,360	0.0009	0.0003	0.0005	1	2
45-49	2	4,675	0.0004	0.0002	0.0004	1	2
50-54	3	4,546	0.0007	0.0005	0.0009	2	4
55-59	8	2,955	0.0027	0.0007	0.0013	2	4
60-64	2	1,812	0.0011	0.0011	0.0020	2	3
65-69	-	-	N\A	0.0007	0.0013	-	-
70-74	-	-	N\A	0.0006	0.0011	-	-
75 and over	-	-	N\A	0.0006	0.0011	-	-
Totals	22	32,065	0.0007	0.0003	0.0006	9	18

	Actual Experience	Proposed Assumption
Current	0.0007	0.0006
Previous Investigation Results		
2015-2017	0.0001	0.0004
2012-2014	0.0004	0.0005
2009-2011	0.0004	0.0006

* Sample rates are taken from midpoint of age group.

Protective With Social Security Non-State
Disability Experience

Male and Female Disability Experience

Age	Disabilities	Exposure	Population Weighted Rates	Sample Rates* Present	Sample Rates* Proposed	Expected Disabilities Present	Expected Disabilities Proposed
Under 20	-	-	N\A	0.0001	0.0002	-	-
20-24	-	1,150	0.0000	0.0001	0.0002	-	-
25-29	-	4,491	0.0000	0.0001	0.0002	-	1
30-34	1	5,296	0.0002	0.0001	0.0002	-	1
35-39	1	5,299	0.0002	0.0001	0.0003	1	2
40-44	6	4,915	0.0012	0.0002	0.0004	1	2
45-49	2	5,472	0.0004	0.0003	0.0006	2	4
50-54	9	2,474	0.0036	0.0005	0.0010	2	4
55-59	-	61	0.0000	0.0098	0.0224	1	1
60-64	-	52	0.0000	0.0105	0.0240	-	1
65-69	-	12	0.0000	0.0007	0.0016	-	-
70-74	-	11	0.0000	0.0007	0.0016	-	-
75 and over	-	5	0.0000	0.0007	0.0016	-	-
Totals	19	29,238	0.0006	0.0002	0.0005	7	16

	Actual Experience	Proposed Assumption
Current	0.0006	0.0005
Previous Investigation Results		
2015-2017	0.0005	0.0007
2012-2014	0.0005	0.0010
2009-2011	0.0007	0.0011

* Sample rates are taken from midpoint of age group.

Protective With Social Security State
Disability Experience

Male and Female Disability Experience

Age	Disabilities	Exposure	Population Weighted Rates	Sample Rates*		Expected Disabilities	
				Present	Proposed	Present	Proposed
Under 20	-	-	N\A	0.0001	0.0002	-	-
20-24	-	1,150	0.0000	0.0001	0.0002	-	-
25-29	-	4,491	0.0000	0.0001	0.0002	-	1
30-34	1	5,296	0.0002	0.0001	0.0002	-	1
35-39	2	5,299	0.0004	0.0001	0.0004	1	2
40-44	4	4,915	0.0008	0.0002	0.0005	1	3
45-49	5	5,472	0.0009	0.0003	0.0008	2	5
50-54	13	2,474	0.0053	0.0005	0.0013	2	5
55-59	-	61	0.0000	0.0098	0.0280	1	1
60-64	-	52	0.0000	0.0105	0.0300	-	1
65-69	-	12	0.0000	0.0007	0.0020	-	-
70-74	-	11	0.0000	0.0007	0.0020	-	-
75 and over	-	5	0.0000	0.0007	0.0020	-	-
Totals	25	29,238	0.0009	0.0002	0.0006	7	19

	Actual Experience	Proposed Assumption
Current	0.0009	0.0006
Previous Investigation Results		
2015-2017	0.0005	0.0007
2012-2014	0.0005	0.0010
2009-2011	0.0007	0.0011

* Sample rates are taken from midpoint of age group.

Protective Without Social Security Non-State Disability Experience

Male and Female Disability Experience

Age	Disabilities	Exposure	Population Weighted Rates	Sample Rates*		Expected Disabilities	
				Present	Proposed	Present	Proposed
Under 20	-	-	N\A	0.0003	0.0003	-	-
20-24	-	143	0.0000	0.0003	0.0003	-	-
25-29	-	827	0.0000	0.0003	0.0003	-	-
30-34	-	1,274	0.0000	0.0003	0.0003	-	-
35-39	1	1,357	0.0007	0.0003	0.0004	-	1
40-44	-	1,314	0.0000	0.0005	0.0006	1	1
45-49	3	1,465	0.0020	0.0010	0.0012	3	3
50-54	6	708	0.0085	0.0070	0.0084	4	5
55-59	-	9	0.0000	0.0010	0.0012	-	-
60-64	-	4	0.0000	0.0010	0.0012	-	-
65-69	-	1	0.0000	0.0010	0.0012	-	-
70-74	-	-	N\A	0.0010	0.0012	-	-
75 and over	-	-	N\A	0.0010	0.0012	-	-
Totals	10	7,102	0.0014	0.0011	0.0014	8	10

	Actual Experience	Proposed Assumption
Current	0.0014	0.0014
Previous Investigation Results		
2015-2017	0.0005	0.0011
2012-2014	0.0012	0.0018
2009-2011	0.0014	0.0019

* *Sample rates are taken from midpoint of age group.*

Executive and Elected Non-State
Disability Experience

Male and Female Disability Experience

Age	Disabilities	Exposure	Population Weighted Rates	Sample Rates*		Expected Disabilities	
				Present	Proposed	Present	Proposed
Under 20	-	-	N\A	0.0000	0.0000	-	-
20-24	-	1	0.0000	0.0000	0.0000	-	-
25-29	-	4	0.0000	0.0000	0.0000	-	-
30-34	-	35	0.0000	0.0000	0.0000	-	-
35-39	-	54	0.0000	0.0001	0.0001	-	-
40-44	-	122	0.0000	0.0001	0.0001	-	-
45-49	1	154	0.0065	0.0002	0.0002	-	-
50-54	-	295	0.0000	0.0003	0.0003	-	-
55-59	-	252	0.0000	0.0012	0.0012	-	-
60-64	-	87	0.0000	0.0011	0.0011	-	-
65-69	-	-	N\A	0.0009	0.0009	-	-
70-74	-	-	N\A	0.0009	0.0009	-	-
75 and over	-	-	N\A	0.0009	0.0009	-	-
Totals	1	1,004	0.0010	0.0000	0.0000	-	-

	Actual Experience	Proposed Assumption
Current	0.0010	0.0000
Previous Investigation Results		
2015-2017	0.0000	0.0003
2012-2014	0.0000	0.0006
2009-2011	0.0000	0.0003

* Sample rates are taken from midpoint of age group.

Executive and Elected State
Disability Experience

Male and Female Disability Experience

Age	Disabilities	Exposure	Population Weighted Rates	Sample Rates*		Expected Disabilities	
				Present	Proposed	Present	Proposed
Under 20	-	-	N\A	0.0000	0.0000	-	-
20-24	-	1	0.0000	0.0000	0.0000	-	-
25-29	-	17	0.0000	0.0000	0.0000	-	-
30-34	-	93	0.0000	0.0000	0.0000	-	-
35-39	-	122	0.0000	0.0001	0.0001	-	-
40-44	-	155	0.0000	0.0001	0.0001	-	-
45-49	-	267	0.0000	0.0002	0.0002	-	-
50-54	-	350	0.0000	0.0003	0.0003	-	-
55-59	-	251	0.0000	0.0012	0.0012	-	-
60-64	-	85	0.0000	0.0011	0.0011	-	-
65-69	-	-	N\A	0.0009	0.0009	-	-
70-74	-	-	N\A	0.0009	0.0009	-	-
75 and over	-	-	N\A	0.0009	0.0009	-	-
Totals	-	1,341	0.0000	0.0000	0.0000	-	-

	Actual Experience	Proposed Assumption
Current	0.0000	0.0000
Previous Investigation Results		
2015-2017	0.0000	0.0003
2012-2014	0.0000	0.0006
2009-2011	0.0000	0.0003

* Sample rates are taken from midpoint of age group.

SECTION C

PAY INCREASES
MERIT & LONGEVITY PORTION

General Non-State
Merit & Longevity Pay Increase Assumption

Service-Based Pay Increase Experience

| Service Group | | Merit/Seniority % Increase | | |
| Beginning | | | Expected* | |
of Year	Number	Actual	Present	Proposed
1-5	89,625	3.55 %	3.45 %	3.45 %
6-10	49,105	2.02 %	1.90 %	1.90 %
11-15	34,154	1.23 %	1.25 %	1.25 %
16-20	29,151	0.63 %	1.00 %	1.00 %
21-25	19,630	0.56 %	0.75 %	0.75 %
26-30	11,987	0.44 %	0.50 %	0.50 %
31-35	5,683	0.30 %	0.30 %	0.30 %
36-40	2,149	0.29 %	0.20 %	0.20 %
Over 40	706	0.40 %	0.10 %	0.10 %
Total	242,190			

* *Sample values are selected from mid-point of service group.*

General State
Merit & Longevity Pay Increase Assumption

Service-Based Pay Increase Experience

Service Group		Merit/Seniority % Increase		
Beginning			Expected*	
of Year	Number	Actual	Present	Proposed
1-5	38,186	3.27 %	3.45 %	3.45 %
6-10	24,070	2.41 %	1.90 %	1.90 %
11-15	15,267	1.81 %	1.25 %	1.25 %
16-20	12,736	1.33 %	1.00 %	1.00 %
21-25	8,980	1.35 %	0.75 %	0.75 %
26-30	6,484	0.95 %	0.50 %	0.50 %
31-35	3,385	0.82 %	0.30 %	0.30 %
36-40	1,205	0.23 %	0.20 %	0.20 %
Over 40	366	0.13 %	0.10 %	0.10 %
Total	110,679			

* *Sample values are selected from mid-point of service group.*

Public Schools Non-State
Merit & Longevity Pay Increase Assumption

Service-Based Pay Increase Experience

Service Group		Merit/Seniority % Increase		
Beginning			Expected*	
of Year	Number	Actual	Present	Proposed
1-5	46,664	4.70 %	5.60 %	5.60 %
6-10	43,688	3.77 %	3.40 %	3.40 %
11-15	36,527	2.82 %	2.10 %	2.10 %
16-20	37,122	1.65 %	1.00 %	1.00 %
21-25	29,708	1.04 %	0.35 %	0.35 %
26-30	18,377	0.64 %	0.20 %	0.20 %
31-35	6,887	0.45 %	0.15 %	0.15 %
36-40	1,078	0.22 %	0.10 %	0.10 %
Over 40	184	0.00 %	0.05 %	0.05 %
Total	220,235			

*   *Sample values are selected from mid-point of service group.*

University State
Merit & Longevity Pay Increase Assumption

Service-Based Pay Increase Experience

| Service Group | | Merit/Seniority % Increase | | |
| Beginning of Year | Number | Actual | Expected* | |
			Present	Proposed
1-5	18,102	3.29 %	3.00 %	3.00 %
6-10	13,890	2.62 %	2.50 %	2.50 %
11-15	9,714	2.05 %	2.00 %	2.00 %
16-20	7,976	1.37 %	1.50 %	1.50 %
21-25	4,978	0.80 %	0.95 %	0.95 %
26-30	2,997	0.99 %	0.80 %	0.80 %
31-35	1,651	0.47 %	0.60 %	0.60 %
36-40	636	0.00 %	0.20 %	0.20 %
Over 40	251	0.16 %	0.10 %	0.10 %
Total	60,195			

* Sample values are selected from mid-point of service group.

Protective With Social Security Non-State
Merit & Longevity Pay Increase Assumption

Service-Based Pay Increase Experience

Service Group		Merit/Seniority % Increase		
Beginning			Expected*	
of Year	Number	Actual	Present	Proposed
1-5	7,129	6.05 %	4.75 %	4.75 %
6-10	5,729	2.01 %	1.50 %	1.50 %
11-15	5,269	1.29 %	0.90 %	0.90 %
16-20	5,078	1.07 %	0.80 %	0.80 %
21-25	4,502	1.16 %	0.70 %	0.70 %
26-30	2,385	0.88 %	0.60 %	0.60 %
31-35	444	1.14 %	0.50 %	0.50 %
36-40	96	0.45 %	0.40 %	0.40 %
Over 40	38	0.00 %	0.20 %	0.20 %
Total	30,670			

* *Sample values are selected from mid-point of service group.*

Protective With Social Security State
Merit & Longevity Pay Increase Assumption

Service-Based Pay Increase Experience

Service Group		Merit/Seniority % Increase		
Beginning			Expected*	
of Year	Number	Actual	Present	Proposed
1-5	6,508	4.63 %	4.75 %	4.75 %
6-10	3,340	2.83 %	1.50 %	1.50 %
11-15	3,307	2.91 %	0.90 %	0.90 %
16-20	4,105	1.69 %	0.80 %	0.80 %
21-25	3,373	1.37 %	0.70 %	0.70 %
26-30	1,365	1.10 %	0.60 %	0.60 %
31-35	213	0.00 %	0.50 %	0.50 %
36-40	27	0.00 %	0.40 %	0.40 %
Over 40	4	0.00 %	0.20 %	0.20 %
Total	22,242			

* Sample values are selected from mid-point of service group.

Protective Without Social Security Non-State
Merit & Longevity Pay Increase Assumption

Service-Based Pay Increase Experience

Service Group		Merit/Seniority % Increase		
Beginning			Expected*	
of Year	Number	Actual	Present	Proposed
1-5	1,385	6.45 %	5.50 %	5.50 %
6-10	1,507	1.55 %	1.30 %	1.30 %
11-15	1,347	0.83 %	0.60 %	0.60 %
16-20	1,374	0.47 %	0.50 %	0.50 %
21-25	1,373	0.43 %	0.40 %	0.40 %
26-30	724	0.31 %	0.30 %	0.30 %
31-35	120	0.23 %	0.20 %	0.20 %
36-40	14	0.00 %	0.10 %	0.10 %
Over 40	1	0.00 %	0.05 %	0.05 %
Total	7,845			

* *Sample values are selected from mid-point of service group.*

Executive and Elected Non-State
Merit & Longevity Pay Increase Assumption

Service-Based Pay Increase Experience

Service Group		Merit/Seniority % Increase		
Beginning			Expected*	
of Year	Number	Actual	Present	Proposed
1-5	494	0.96 %	2.50 %	2.50 %
6-10	303	0.86 %	0.20 %	0.20 %
11-15	168	0.81 %	0.20 %	0.20 %
16-20	176	0.72 %	0.20 %	0.20 %
21-25	155	0.82 %	0.20 %	0.20 %
26-30	153	0.34 %	0.20 %	0.20 %
31-35	79	1.20 %	0.20 %	0.20 %
36-40	63	0.07 %	0.20 %	0.20 %
Over 40	27	0.41 %	0.20 %	0.20 %
Total	1,618			

* *Sample values are selected from mid-point of service group.*

Executive and Elected State
Merit & Longevity Pay Increase Assumption

Service-Based Pay Increase Experience

| Service Group | | Merit/Seniority % Increase | | |
| Beginning | | | Expected* | |
of Year	Number	Actual	Present	Proposed
1-5	355	5.79 %	2.50 %	2.50 %
6-10	436	1.31 %	0.20 %	0.20 %
11-15	259	0.20 %	0.20 %	0.20 %
16-20	238	0.62 %	0.20 %	0.20 %
21-25	216	1.04 %	0.20 %	0.20 %
26-30	149	0.18 %	0.20 %	0.20 %
31-35	123	0.00 %	0.20 %	0.20 %
36-40	39	0.36 %	0.20 %	0.20 %
Over 40	23	0.99 %	0.20 %	0.20 %
Total	1,838			

* *Sample values are selected from mid-point of service group.*

SECTION D

NORMAL & REDUCED RETIREMENT EXPERIENCE

General Males Non-State
Normal Retirement Experience

Male Age-Based Retirement Experience

Age	Retirements	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates Present	Sample Rates Proposed	Expected Retirements Present	Expected Retirements Proposed
57	114	489	0.2331	0.2009	0.1900	0.2000	93	98
58	94	507	0.1854	0.1791	0.1900	0.2000	96	101
59	65	509	0.1277	0.1201	0.1900	0.2000	97	102
60	101	472	0.2140	0.2114	0.1900	0.2000	90	94
61	97	439	0.2210	0.2296	0.1900	0.2000	83	88
62	126	436	0.2890	0.2951	0.2600	0.3000	113	131
63	102	362	0.2818	0.3092	0.2900	0.3000	105	109
64	73	283	0.2580	0.2684	0.2800	0.3000	79	85
65	320	1,365	0.2344	0.3294	0.3000	0.3000	410	410
66	303	984	0.3079	0.4437	0.3500	0.4000	344	394
67	152	629	0.2417	0.3447	0.3000	0.3200	189	201
68	93	473	0.1966	0.3633	0.1900	0.3200	90	151
69	45	346	0.1301	0.2500	0.1900	0.2800	66	97
70	43	281	0.1530	0.3143	0.1900	0.2800	53	79
71	23	204	0.1127	0.2684	0.1900	0.2800	39	57
72	18	171	0.1053	0.4184	0.1900	0.2800	32	48
73	12	134	0.0896	0.1742	0.1900	0.1800	25	24
74	10	108	0.0926	0.1640	0.1900	0.1800	21	19
Sub Totals	1,791	8,192	0.2186	0.2620	0.2380	0.2604	2,025	2,288
75 & Over	46	458	0.1004	0.2253			458	458
Total	1,837	8,650	0.2124	0.2616			2,483	2,746

	Actual Experience		Proposed Assumption
Current	0.2186	0.2620	0.2604
Previous Investigation Results			
2015-2017	0.2218	0.2560	0.2367
2012-2014	0.1900	0.2166	0.2163
2009-2011	0.2103		0.2196

General Males State
Normal Retirement Experience

Male Age-Based Retirement Experience

Age	Retirements	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates Present	Sample Rates Proposed	Expected Retirements Present	Expected Retirements Proposed
57	54	205	0.2634	0.2012	0.1900	0.1900	39	39
58	38	220	0.1727	0.1793	0.1900	0.1900	42	42
59	39	245	0.1592	0.1481	0.1900	0.1900	47	47
60	46	236	0.1949	0.1893	0.1900	0.1900	45	45
61	46	232	0.1983	0.1804	0.1900	0.1900	44	44
62	59	220	0.2682	0.2986	0.2600	0.2800	57	62
63	55	177	0.3107	0.3081	0.2900	0.3000	51	53
64	33	148	0.2230	0.2221	0.2800	0.2500	41	37
65	130	641	0.2028	0.2398	0.3000	0.2700	192	173
66	150	535	0.2804	0.3465	0.3500	0.3500	187	187
67	95	356	0.2669	0.3449	0.3000	0.3200	107	114
68	57	275	0.2073	0.2697	0.1900	0.2100	52	58
69	43	211	0.2038	0.2497	0.1900	0.2100	40	44
70	29	153	0.1895	0.2263	0.1900	0.2100	29	32
71	30	122	0.2459	0.3108	0.1900	0.2100	23	26
72	6	80	0.0750	0.1116	0.1900	0.2100	15	17
73	12	64	0.1875	0.3500	0.1900	0.3000	12	19
74	7	40	0.1750	0.4070	0.1900	0.3000	8	12
Sub Totals	929	4,160	0.2233	0.2454	0.2413	0.2447	1,031	1,051
75 & Over	18	109	0.1651	0.3405			109	109
Total	947	4,269	0.2218	0.2465			1,140	1,160

	Actual Experience		**Proposed Assumption**
Current	0.2233	0.2454	0.2447
Previous Investigation Results			
2015-2017	0.2218	0.2560	0.2367
2012-2014	0.1900	0.2166	0.2163
2009-2011	0.2103		0.2196

General Males Non-State
Reduced Retirement Experience

Male Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates Present	Sample Rates Proposed	Expected Retirements Present	Expected Retirements Proposed
55	130	2,554	0.0509	0.0709	0.0800	0.0730	204	186
56	112	2,644	0.0424	0.0548	0.0800	0.0600	212	159
57	94	2,247	0.0418	0.0527	0.0480	0.0520	108	117
58	93	2,208	0.0421	0.0553	0.0570	0.0560	126	124
59	96	2,066	0.0465	0.0561	0.0680	0.0590	140	122
60	142	1,969	0.0721	0.0953	0.0850	0.0930	167	183
61	111	1,755	0.0632	0.0782	0.0900	0.0800	158	140
62	252	1,598	0.1577	0.1905	0.1700	0.1900	272	304
63	223	1,318	0.1692	0.2057	0.1800	0.2000	237	264
64	154	1,094	0.1408	0.1799	0.1700	0.1800	186	197
Totals	1,407	19,453	0.0723	0.0886	0.0912	0.0895	1,810	1,796

	Actual Experience		**Proposed Assumption**
Current	0.0723	0.0886	0.0895
Previous Investigation Results			
2015-2017	0.0733	0.0892	0.0913
2012-2014	0.0735	0.0946	0.0913
2009-2011	0.0736		0.0819

General Males State
Reduced Retirement Experience

Male Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates Present	Sample Rates Proposed	Expected Retirements Present	Expected Retirements Proposed
55	40	1,169	0.0342	0.0487	0.0800	0.0550	94	64
56	60	1,188	0.0505	0.0611	0.0800	0.0650	95	77
57	44	939	0.0469	0.0570	0.0480	0.0550	45	52
58	38	930	0.0409	0.0504	0.0570	0.0550	53	51
59	46	892	0.0516	0.0635	0.0680	0.0650	61	58
60	70	891	0.0786	0.0967	0.0850	0.0900	76	80
61	76	820	0.0927	0.1364	0.0900	0.1250	74	103
62	95	760	0.1250	0.1521	0.1700	0.1600	129	122
63	93	660	0.1409	0.1637	0.1800	0.1700	119	112
64	97	548	0.1770	0.2169	0.1700	0.2100	93	115
Totals	659	8,797	0.0749	0.0904	0.0931	0.0914	839	834

	Actual Experience		Proposed Assumption
Current	0.0749	0.0904	0.0914
Previous Investigation Results			
2015-2017	0.0733	0.0892	0.0913
2012-2014	0.0735	0.0946	0.0913
2009-2011	0.0736		0.0819

General Females Non-State
Normal Retirement Experience

Female Age-Based Retirement Experience

Age	Retirements	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates Present	Sample Rates Proposed	Expected Retirements Present	Expected Retirements Proposed
57	101	508	0.1988	0.1730	0.1700	0.1700	86	86
58	101	539	0.1874	0.1827	0.1700	0.1800	92	97
59	74	538	0.1375	0.1312	0.1700	0.1400	91	75
60	114	555	0.2054	0.2113	0.1700	0.2000	94	111
61	96	535	0.1794	0.1778	0.1700	0.1800	91	96
62	109	473	0.2304	0.2234	0.2700	0.2400	128	114
63	117	412	0.2840	0.3011	0.2700	0.2900	111	119
64	75	320	0.2344	0.2191	0.2700	0.2300	86	74
65	731	2,623	0.2787	0.3616	0.3000	0.3500	787	918
66	517	1,728	0.2992	0.3970	0.3500	0.3900	605	674
67	260	1,119	0.2324	0.3366	0.3000	0.3300	336	369
68	152	787	0.1931	0.3191	0.2500	0.3000	197	236
69	85	579	0.1468	0.2137	0.2500	0.2200	145	127
70	81	447	0.1812	0.2659	0.2500	0.2600	112	116
71	60	334	0.1796	0.3071	0.2000	0.2800	67	94
72	41	269	0.1524	0.3416	0.2000	0.3000	54	81
73	28	219	0.1279	0.3410	0.2000	0.3000	44	66
74	19	179	0.1061	0.1452	0.2000	0.1600	36	29
Sub Totals	2,761	12,164	0.2270	0.2551	0.2376	0.2517	3,162	3,482
75 & Over	85	634	0.1341	0.2363			634	634
Total	2,846	12,798	0.2224	0.2547			3,796	4,116

	Actual Experience		Proposed Assumption
Current	0.2270	0.2551	0.2517
Previous Investigation Results			
2015-2017	0.2314	0.2524	0.2269
2012-2014	0.2075	0.2147	0.2029
2009-2011	0.2198		0.2125

General Females State
Normal Retirement Experience

Female Age-Based Retirement Experience

Age	Retirements	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates Present	Sample Rates Proposed	Expected Retirements Present	Expected Retirements Proposed
57	82	355	0.2310	0.1990	0.1700	0.1900	60	67
58	69	387	0.1783	0.1849	0.1700	0.1900	66	74
59	76	386	0.1969	0.1990	0.1700	0.1900	66	73
60	90	395	0.2278	0.2250	0.1700	0.2100	67	83
61	99	374	0.2647	0.2769	0.1700	0.2500	64	94
62	91	320	0.2844	0.2976	0.2700	0.2900	86	93
63	73	255	0.2863	0.2770	0.2700	0.2800	69	71
64	67	202	0.3317	0.3243	0.2700	0.3100	55	63
65	233	883	0.2639	0.3189	0.3000	0.3100	265	274
66	192	593	0.3238	0.3701	0.3500	0.3600	208	213
67	92	361	0.2548	0.3424	0.3000	0.3300	108	119
68	58	272	0.2132	0.2499	0.2500	0.2500	68	68
69	54	212	0.2547	0.2730	0.2500	0.2700	53	57
70	43	150	0.2867	0.3019	0.2500	0.2900	38	44
71	27	105	0.2571	0.3889	0.2000	0.3400	21	36
72	11	66	0.1667	0.3788	0.2000	0.3300	13	22
73	11	46	0.2391	0.2499	0.2000	0.2400	9	11
74	9	31	0.2903	0.1737	0.2000	0.1800	6	6
Sub Totals	1,377	5,393	0.2553	0.2665	0.2270	0.2565	1,322	1,468
75 & Over	12	91	0.1319	0.3819			91	91
Total	1,389	5,484	0.2533	0.2675			1,413	1,559

	Actual Experience		Proposed Assumption
Current	0.2553	0.2665	0.2565
Previous Investigation Results			
2015-2017	0.2314	0.2524	0.2269
2012-2014	0.2075	0.2147	0.2029
2009-2011	0.2198		0.2125

General Females Non-State
Reduced Retirement Experience

Female Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates		Expected Retirements	
					Present	Proposed	Present	Proposed
55	192	4,913	0.0391	0.0717	0.0700	0.0700	344	344
56	181	4,976	0.0364	0.0504	0.0700	0.0700	348	348
57	169	4,626	0.0365	0.0478	0.0550	0.0550	254	254
58	195	4,562	0.0427	0.0629	0.0650	0.0650	297	297
59	244	4,525	0.0539	0.0708	0.0700	0.0700	317	317
60	321	4,271	0.0752	0.1016	0.0950	0.0950	406	406
61	317	3,963	0.0800	0.1064	0.0950	0.0950	376	376
62	502	3,610	0.1391	0.1704	0.1600	0.1600	578	578
63	504	3,085	0.1634	0.1995	0.1800	0.1800	555	555
64	414	2,469	0.1677	0.1949	0.1800	0.1800	444	444
Totals	3,039	41,000	0.0741	0.0963	0.0948	0.0948	3,919	3,919

	Actual Experience		Proposed Assumption
Current	0.0741	0.0963	0.0948
Previous Investigation Results			
2015-2017	0.0746	0.0980	0.0912
2012-2014	0.0702	0.0910	0.0835
2009-2011	0.0669		0.0768

General Females State
Reduced Retirement Experience

Female Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates Present	Sample Rates Proposed	Expected Retirements Present	Expected Retirements Proposed
55	75	1,825	0.0411	0.0544	0.0700	0.0600	128	110
56	125	1,915	0.0653	0.0848	0.0700	0.0800	134	153
57	71	1,521	0.0467	0.0606	0.0550	0.0600	84	91
58	98	1,537	0.0638	0.0959	0.0650	0.0900	100	138
59	85	1,491	0.0570	0.0755	0.0700	0.0750	104	112
60	109	1,400	0.0779	0.1009	0.0950	0.1000	133	140
61	103	1,226	0.0840	0.1123	0.0950	0.1100	116	135
62	173	1,048	0.1651	0.1925	0.1600	0.1800	168	189
63	145	863	0.1680	0.2002	0.1800	0.1950	155	168
64	98	738	0.1328	0.1668	0.1800	0.1800	133	133
Totals	1,082	13,564	0.0798	0.0995	0.0903	0.0981	1,255	1,369

	Actual Experience		Proposed Assumption
Current	0.0798	0.0995	0.0981
Previous Investigation Results			
2015-2017	0.0746	0.0980	0.0912
2012-2014	0.0702	0.0910	0.0835
2009-2011	0.0669		0.0768

Public School Males Non-State
Normal Retirement Experience

Male Age-Based Retirement Experience

Age	Retirements	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates Present	Sample Rates Proposed	Expected Retirements Present	Expected Retirements Proposed
57	124	417	0.2974	0.2855	0.3300	0.3100	138	129
58	105	352	0.2983	0.2950	0.2900	0.2900	102	102
59	91	291	0.3127	0.3161	0.2400	0.2800	70	81
60	73	240	0.3042	0.2946	0.2500	0.2700	60	65
61	54	197	0.2741	0.2721	0.2500	0.2600	49	51
62	63	147	0.4286	0.4378	0.3500	0.3900	51	57
63	35	104	0.3365	0.3495	0.3200	0.3300	33	34
64	24	75	0.3200	0.3128	0.2900	0.3000	22	23
65	76	294	0.2585	0.3480	0.2900	0.3200	85	94
66	59	244	0.2418	0.2902	0.3500	0.3500	85	85
67	39	187	0.2086	0.2933	0.3300	0.3100	62	58
68	27	150	0.1800	0.2879	0.2700	0.2800	41	42
69	15	111	0.1351	0.1782	0.2300	0.2000	26	22
70	21	86	0.2442	0.3541	0.2500	0.3000	22	26
71	10	61	0.1639	0.2684	0.2000	0.2500	12	15
72	6	43	0.1395	0.3022	0.1500	0.2500	6	11
73	7	40	0.1750	0.5070	0.1500	0.2500	6	10
74	5	33	0.1515	0.3271	0.1500	0.2500	5	8
Totals	834	3,072	0.2715	0.3102	0.2882	0.2997	875	913
75 & Over	10	82	0.1220	0.3879			82	82
Total	844	3,154	0.2676	0.3109			957	995

	Actual Experience		Proposed Assumption
Current	0.2715	0.3102	0.2997
Previous Investigation Results			
2015-2017	0.2487	0.2840	0.2878
2012-2014	0.2720	0.3163	0.3024
2009-2011	0.3295		0.3000

Public School Males Non-State
Reduced Retirement Experience

Male Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates		Expected Retirements	
					Present	Proposed	Present	Proposed
55	159	1,665	0.0955	0.1109	0.1300	0.1200	216	200
56	159	1,446	0.1100	0.1354	0.1300	0.1300	188	188
57	95	851	0.1116	0.1350	0.1200	0.1300	102	111
58	69	738	0.0935	0.1107	0.1300	0.1200	96	89
59	72	648	0.1111	0.1461	0.1400	0.1430	91	93
60	82	574	0.1429	0.1714	0.1400	0.1600	80	92
61	61	485	0.1258	0.1660	0.1500	0.1600	73	78
62	84	395	0.2127	0.2573	0.2100	0.2300	83	91
63	52	291	0.1787	0.2105	0.2100	0.2100	61	61
64	49	243	0.2016	0.2222	0.2100	0.2100	51	51
Totals	882	7,336	0.1202	0.1420	0.1399	0.1404	1,041	1,054

	Actual Experience		Proposed Assumption
Current	0.1202	0.1420	0.1404
Previous Investigation Results			
2015-2017	0.1147	0.1330	0.1402
2012-2014	0.1358	0.1596	0.1407
2009-2011	0.1316		0.1307

Public School Females Non-State
Normal Retirement Experience

Female Age-Based Retirement Experience

Age	Retirements	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates Present	Sample Rates Proposed	Expected Retirements Present	Expected Retirements Proposed
57	294	1,048	0.2805	0.2795	0.2700	0.2750	283	288
58	239	856	0.2792	0.2794	0.2700	0.2750	231	235
59	181	721	0.2510	0.2517	0.2700	0.2600	195	187
60	178	576	0.3090	0.3057	0.2700	0.2900	156	167
61	127	454	0.2797	0.2762	0.2700	0.2700	123	123
62	123	341	0.3607	0.3483	0.3700	0.3600	126	123
63	91	257	0.3541	0.3291	0.3000	0.3100	77	80
64	60	170	0.3529	0.3254	0.2800	0.3000	48	51
65	271	774	0.3501	0.3998	0.3700	0.3850	286	298
66	212	550	0.3855	0.4823	0.3900	0.4400	215	242
67	79	343	0.2303	0.2901	0.3300	0.3100	113	106
68	60	260	0.2308	0.3094	0.3000	0.3000	78	78
69	42	190	0.2211	0.3272	0.2800	0.3000	53	57
70	21	133	0.1579	0.2694	0.3800	0.3200	51	43
71	22	109	0.2018	0.3939	0.2000	0.2500	22	27
72	12	64	0.1875	0.2702	0.2000	0.2500	13	16
73	12	59	0.2034	0.4435	0.2000	0.2500	12	15
74	5	40	0.1250	0.1976	0.2000	0.2500	8	10
Totals	2,029	6,945	0.2922	0.3089	0.2941	0.3007	2,090	2,146
75 & Over	13	116	0.1121	0.1458			116	116
Total	2,042	7,061	0.2892	0.3084			2,206	2,262

	Actual Experience		Proposed Assumption
Current	0.2922	0.3089	0.3007
Previous Investigation Results			
2015-2017	0.2723	0.2943	0.2957
2012-2014	0.2879	0.3166	0.2972
2009-2011	0.3323		0.2716

Public School Females Non-State
Reduced Retirement Experience

Female Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Population Weighted Rates	Liability Weighte Rates	Sample Rates Present	Sample Rates Proposed	Expected Retirements Present	Expected Retirements Proposed
55	354	4,380	0.0808	0.1054	0.1200	0.1100	526	482
56	427	3,938	0.1084	0.1344	0.1200	0.1300	473	512
57	240	2,496	0.0962	0.1219	0.1200	0.1200	300	300
58	234	2,244	0.1043	0.1399	0.1200	0.1300	269	292
59	234	2,068	0.1132	0.1384	0.1300	0.1350	269	279
60	260	1,806	0.1440	0.1832	0.1700	0.1700	307	307
61	201	1,446	0.1390	0.1705	0.1700	0.1700	246	246
62	255	1,237	0.2061	0.2480	0.2300	0.2400	285	297
63	179	900	0.1989	0.2279	0.2300	0.2400	207	216
64	156	737	0.2117	0.2570	0.2300	0.2400	170	177
Totals	2,540	21,252	0.1195	0.1455	0.1405	0.1428	3,052	3,108

	Actual Experience		Proposed Assumption
Current	0.1195	0.1455	0.1428
Previous Investigation Results			
2015-2017	0.1168	0.1377	0.1409
2012-2014	0.1383	0.1691	0.1429
2009-2011	0.1357		0.1286

University Males State
Normal Retirement Experience

Male Age-Based Retirement Experience

Age	Retirements	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates Present	Sample Rates Proposed	Expected Retirements Present	Expected Retirements Proposed
57	6	58	0.1034	0.1117	0.1200	0.1200	7	7
58	13	71	0.1831	0.1763	0.1200	0.1600	9	11
59	7	68	0.1029	0.0726	0.1200	0.0900	8	6
60	14	89	0.1573	0.1621	0.1200	0.1500	11	13
61	9	106	0.0849	0.0787	0.1200	0.0900	13	10
62	15	131	0.1145	0.0848	0.1200	0.1000	16	13
63	18	145	0.1241	0.1044	0.1200	0.1100	17	16
64	31	156	0.1987	0.1655	0.1200	0.1550	19	24
65	77	528	0.1458	0.1554	0.1500	0.1550	79	82
66	97	435	0.2230	0.2159	0.2000	0.2100	87	91
67	68	353	0.1926	0.1731	0.2000	0.1800	71	64
68	54	291	0.1856	0.1963	0.1800	0.1900	52	55
69	34	237	0.1435	0.1340	0.1600	0.1400	38	33
70	34	185	0.1838	0.2206	0.2000	0.2100	37	39
71	42	156	0.2692	0.2727	0.1800	0.2400	28	37
72	26	118	0.2203	0.2984	0.1600	0.2400	19	28
73	13	95	0.1368	0.1551	0.1600	0.2400	15	23
74	18	74	0.2432	0.3306	0.1600	0.2400	12	18
Sub Totals	576	3,296	0.1748	0.1745	0.1600	0.1711	538	570
75 & Over	38	225	0.1689	0.2037			225	225
Total	614	3,521	0.1744	0.1786			763	795

	Actual Experience		Proposed Assumption
Current	0.1748	0.1745	0.1711
Previous Investigation Results			
2015-2017	0.1732	0.1714	0.1578
2012-2014	0.1300	0.1199	0.1430
2009-2011	0.1947		0.1617

University Males State
Reduced Retirement Experience

Male Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates Present	Sample Rates Proposed	Expected Retirements Present	Expected Retirements Proposed
55	24	697	0.0344	0.0365	0.0300	0.0330	21	23
56	25	668	0.0374	0.0362	0.0300	0.0330	20	22
57	22	573	0.0384	0.0471	0.0300	0.0400	17	23
58	22	542	0.0406	0.0469	0.0300	0.0400	16	22
59	30	554	0.0542	0.0483	0.0400	0.0440	22	24
60	25	541	0.0462	0.0414	0.0550	0.0480	30	26
61	20	526	0.0380	0.0404	0.0550	0.0480	29	25
62	39	489	0.0798	0.0645	0.0740	0.0700	36	34
63	45	463	0.0972	0.0910	0.0740	0.0830	34	38
64	48	392	0.1224	0.1298	0.1000	0.1150	39	45
Totals	300	5,445	0.0551	0.0548	0.0491	0.0523	264	282

	Actual Experience		Proposed Assumption
Current	0.0551	0.0548	0.0523
Previous Investigation Results			
2015-2017	0.0570	0.0564	0.0494
2012-2014	0.0382	0.0355	0.0413
2009-2011	0.0402		0.0451

University Females State
Normal Retirement Experience

Female Age-Based Retirement Experience

Age	Retirements	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates		Expected Retirements	
					Present	Proposed	Present	Proposed
57	4	73	0.0548	0.0423	0.1500	0.1000	11	7
58	17	80	0.2125	0.2235	0.1500	0.2000	12	16
59	14	84	0.1667	0.1482	0.1000	0.1200	8	10
60	15	91	0.1648	0.1596	0.1200	0.1400	11	13
61	13	97	0.1340	0.0937	0.1600	0.1300	16	13
62	15	98	0.1531	0.1487	0.1500	0.1500	15	15
63	23	110	0.2091	0.1756	0.2000	0.1900	22	21
64	14	98	0.1429	0.1317	0.2000	0.1700	20	17
65	81	417	0.1942	0.2175	0.2000	0.2100	83	88
66	77	332	0.2319	0.2616	0.2400	0.2500	80	83
67	66	241	0.2739	0.3107	0.2000	0.2500	48	60
68	36	185	0.1946	0.1837	0.1700	0.1800	31	33
69	24	137	0.1752	0.1607	0.1700	0.1650	23	23
70	30	105	0.2857	0.2582	0.1800	0.2200	19	23
71	11	69	0.1594	0.1494	0.1800	0.1650	12	11
72	8	58	0.1379	0.1552	0.1800	0.1700	10	10
73	12	51	0.2353	0.2761	0.1500	0.2100	8	11
74	5	32	0.1563	0.1268	0.1500	0.1400	5	4
Totals	465	2,358	0.1972	0.1914	0.1793	0.1864	434	458
75 & Over	17	84	0.2024	0.2593			84	84
Total	482	2,442	0.1974	0.1961			518	542

	Actual Experience		Proposed Assumption
Current	0.1972	0.1914	0.1864
Previous Investigation Results			
2015-2017	0.2205	0.2010	0.1796
2012-2014	0.1501	0.1332	0.1561
2009-2011	0.2185		0.1811

University Females State
Reduced Retirement Experience

Female Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates		Expected Retirements	
					Present	Proposed	Present	Proposed
55	31	831	0.0373	0.0484	0.0500	0.0500	42	42
56	36	809	0.0445	0.0426	0.0500	0.0500	40	40
57	31	679	0.0457	0.0500	0.0500	0.0500	34	34
58	33	667	0.0495	0.0598	0.0500	0.0550	33	37
59	38	616	0.0617	0.0690	0.0500	0.0600	31	37
60	36	540	0.0667	0.0610	0.0900	0.0750	49	41
61	41	499	0.0822	0.0897	0.0900	0.0900	45	45
62	43	427	0.1007	0.1029	0.1200	0.1100	51	47
63	48	390	0.1231	0.1153	0.1200	0.1200	47	47
64	48	345	0.1391	0.1393	0.1500	0.1450	52	50
Totals	385	5,803	0.0663	0.0716	0.0750	0.0740	424	420

	Actual Experience		Proposed Assumption
Current	0.0663	0.0716	0.0740
Previous Investigation Results			
2015-2017	0.0781	0.0817	0.0747
2012-2014	0.0682	0.0749	0.0704
2009-2011	0.0651		0.0647

Protective With Social Security Non-State Normal Retirement Experience

Male and Female Age-Based Retirement Experience

Age	Retirements	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates Present	Sample Rates Proposed	Expected Retirements Present	Expected Retirements Proposed
50	53	810	0.0654	0.0616	0.0600	0.0600	49	49
51	70	765	0.0915	0.0881	0.0800	0.0800	61	61
52	87	709	0.1227	0.1174	0.1000	0.1100	71	78
53	235	659	0.3566	0.3647	0.2500	0.3400	165	224
54	170	546	0.3114	0.3536	0.2000	0.3200	109	175
55	98	408	0.2402	0.2763	0.2000	0.2600	82	106
56	66	313	0.2109	0.2448	0.2000	0.2300	63	72
57	63	265	0.2377	0.2944	0.2000	0.2700	53	72
58	41	198	0.2071	0.2182	0.2000	0.2100	40	42
59	33	159	0.2075	0.2393	0.2000	0.2300	32	37
60	27	129	0.2093	0.2327	0.2000	0.2200	26	28
61	29	101	0.2871	0.3190	0.2000	0.3000	20	30
62	29	92	0.3152	0.3598	0.3000	0.3500	28	32
63	17	74	0.2297	0.2552	0.3000	0.2700	22	20
64	18	67	0.2687	0.3092	0.3000	0.3000	20	20
65	17	48	0.3542	0.3451	0.4000	0.3400	19	16
66	7	28	0.2500	0.3333	0.4000	0.3500	11	10
67	5	16	0.3125	0.4943	0.4000	0.3500	6	6
68	2	10	0.2000	0.1252	0.4000	0.3500	4	4
69	2	5	0.4000	0.3643	0.4000	0.3500	2	2
70	-	4	0.0000	0.0000	1.0000	1.0000	4	4
71	1	4	0.2500	0.3469	1.0000	1.0000	4	4
72	1	3	0.3333	0.8086	1.0000	1.0000	3	3
73	1	3	0.3333	0.7131	1.0000	1.0000	3	3
74	-	-	N\A	N\A	1.0000	1.0000	-	-
Totals	1,072	5,416	0.1979	0.2142	0.1638	0.2015	897	1,098
75 & Over	3	15	0.2000	0.3200			15	15
Total	1,075	5,431	0.1979	0.2142			912	1,113

	Actual Experience		Proposed Assumption
Current	0.1979	0.2142	0.2015
Previous Investigation Results			
2015-2017	0.1812	0.1945	0.1702
2012-2014	0.1502	0.1683	0.1552
2009-2011	0.1468		0.1534

Protective With Social Security State
Normal Retirement Experience

Male and Female Age-Based Retirement Experience

Age	Retirements	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates Present	Sample Rates Proposed	Expected Retirements Present	Expected Retirements Proposed
50	50	566	0.0883	0.0882	0.0600	0.0750	34	42
51	48	486	0.0988	0.0965	0.0800	0.0900	39	44
52	49	409	0.1198	0.1177	0.1000	0.1100	41	45
53	81	340	0.2382	0.2471	0.2500	0.2500	85	85
54	79	470	0.1681	0.2085	0.2000	0.2000	94	94
55	61	388	0.1572	0.1993	0.2000	0.2000	78	78
56	49	337	0.1454	0.1830	0.2000	0.2000	67	67
57	45	325	0.1385	0.1855	0.2000	0.2000	65	65
58	45	300	0.1500	0.1885	0.2000	0.2000	60	60
59	38	246	0.1545	0.2199	0.2000	0.2000	49	49
60	40	219	0.1826	0.2549	0.2000	0.2000	44	44
61	24	174	0.1379	0.1511	0.2000	0.2000	35	35
62	32	148	0.2162	0.2159	0.3000	0.2500	44	37
63	22	116	0.1897	0.1994	0.3000	0.2500	35	29
64	35	96	0.3646	0.4182	0.3000	0.3600	29	35
65	21	67	0.3134	0.3563	0.4000	0.3800	27	25
66	13	40	0.3250	0.3728	0.4000	0.3800	16	15
67	15	28	0.5357	0.4425	0.4000	0.3800	11	11
68	1	10	0.1000	0.0675	0.4000	0.3800	4	4
69	4	9	0.4444	0.5285	0.4000	0.3800	4	3
70	2	3	0.6667	0.6337	1.0000	1.0000	3	3
71	1	1	1.0000	1.0000	1.0000	1.0000	1	1
72	1	2	0.5000	0.6620	1.0000	1.0000	2	2
73	-	1	0.0000	0.0000	1.0000	1.0000	1	1
74	-	2	0.0000	0.0000	1.0000	1.0000	2	2
Totals	756	4,783	0.1581	0.1728	0.1683	0.1712	870	876
75 & Over	-	2	0.0000	0.0000			2	2
Total	756	4,785	0.1580	0.1728			872	878

	Actual Experience		Proposed Assumption
Current	0.1581	0.1728	0.1712
Previous Investigation Results			
2015-2017	0.1812	0.1945	0.1702
2012-2014	0.1502	0.1683	0.1552
2009-2011	0.1468		0.1534

Protective Without Social Security Non-State Normal Retirement Experience

Male and Female Age-Based Retirement Experience

Age	Retirements	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates Present	Sample Rates Proposed	Expected Retirements Present	Expected Retirements Proposed
50	9	220	0.0409	0.0380	0.0200	0.0300	4	7
51	7	203	0.0345	0.0334	0.0400	0.0350	8	7
52	10	185	0.0541	0.0448	0.0400	0.0450	7	8
53	35	205	0.1707	0.1759	0.1700	0.1700	35	35
54	53	230	0.2304	0.2483	0.2300	0.2400	53	55
55	45	165	0.2727	0.3007	0.2500	0.2900	41	48
56	40	120	0.3333	0.3484	0.2500	0.3200	30	38
57	16	82	0.1951	0.2184	0.2500	0.2300	21	19
58	17	77	0.2208	0.2438	0.3300	0.2700	25	21
59	20	53	0.3774	0.4195	0.3300	0.4000	17	21
60	7	32	0.2188	0.2675	0.2000	0.2500	6	8
61	8	27	0.2963	0.2733	0.2000	0.2500	5	7
62	5	17	0.2941	0.2812	0.4000	0.3100	7	5
63	5	13	0.3846	0.4069	0.4000	0.4000	5	5
64	2	6	0.3333	0.3981	0.4000	0.4000	2	2
65	2	5	0.4000	0.3118	0.4000	0.4000	2	2
66	1	2	0.5000	0.0110	1.0000	1.0000	2	2
67	1	3	0.3333	0.1358	1.0000	1.0000	3	3
68	-	1	0.0000	0.0000	1.0000	1.0000	1	1
69	-	1	0.0000	0.0000	1.0000	1.0000	1	1
70	-	-	N\A	N\A	1.0000	1.0000	-	-
71	-	-	N\A	N\A	1.0000	1.0000	-	-
72	-	-	N\A	N\A	1.0000	1.0000	-	-
73	-	-	N\A	N\A	1.0000	1.0000	-	-
74	-	-	N\A	N\A	1.0000	1.0000	-	-
Totals	283	1,647	0.1718	0.1810	0.1718	0.1824	275	295
75 & Over	1	-	N\A	N\A			-	-
Total	284	1,647	0.1724	0.1811			275	295

	Actual Experience		Proposed Assumption
Current	0.1718	0.1810	0.1824
Previous Investigation Results			
2015-2017	0.1560	0.1719	0.1658
2012-2014	0.1485	0.1630	0.1626
2009-2011	0.1196		0.1632

Executive and Elective Non-State
Normal Retirement Experience

Male and Female Age-Based Retirement Experience

Age	Retirements	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates Present	Sample Rates Proposed	Expected Retirements Present	Expected Retirements Proposed
57	1	9	0.1111	0.0065	0.0800	0.1000	1	1
58	2	14	0.1429	0.2054	0.0800	0.1000	1	1
59	2	17	0.1176	0.1970	0.0800	0.1000	1	2
60	-	22	0.0000	0.0000	0.2000	0.1000	4	2
61	1	20	0.0500	0.0683	0.1200	0.1000	2	2
62	1	50	0.0200	0.0049	0.1200	0.1000	6	7
63	3	58	0.0517	0.0902	0.1200	0.1000	7	6
64	7	60	0.1167	0.1872	0.1500	0.1500	9	9
65	5	57	0.0877	0.1914	0.1500	0.1500	9	9
66	6	49	0.1224	0.1308	0.1500	0.1500	7	7
67	4	39	0.1026	0.1454	0.1500	0.1500	6	6
68	2	37	0.0541	0.0578	0.1500	0.1000	6	4
69	1	29	0.0345	0.0334	0.2000	0.1000	6	3
70	2	27	0.0741	0.0821	0.2000	0.1000	5	3
71	2	26	0.0769	0.0774	0.2000	0.1000	5	3
72	-	22	0.0000	0.0000	0.2000	0.1000	4	2
73	2	20	0.1000	0.1809	0.2000	0.2000	4	4
74	3	15	0.2000	0.7969	0.2000	0.2000	3	3
Totals	44	571	0.0771	0.1123	0.1448	0.1213	86	74
75 & Over	5	101	0.0495	0.1075			101	101
Total	49	672	0.0729	0.1121			187	175

	Actual Experience		**Proposed Assumption**
Current	0.0771	0.1123	0.1213
Previous Investigation Results			
2015-2017	0.1270	0.1717	0.1483
2012-2014	0.0967	0.1151	0.1307
2009-2011	0.1341		0.1408

Executive and Elective State
Normal Retirement Experience

Male and Female Age-Based Retirement Experience

Age	Retirements	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates Present	Sample Rates Proposed	Expected Retirements Present	Expected Retirements Proposed
57	2	11	0.1818	0.1103	0.0800	0.1200	1	1
58	4	20	0.2000	0.1866	0.0800	0.1200	2	2
59	2	21	0.0952	0.0277	0.0800	0.1200	2	3
60	1	24	0.0417	0.0545	0.2000	0.1200	5	3
61	3	20	0.1500	0.1155	0.1200	0.1200	2	2
62	9	76	0.1184	0.1640	0.1200	0.1800	9	14
63	6	58	0.1034	0.0797	0.1200	0.1800	7	10
64	3	53	0.0566	0.1809	0.1500	0.1800	8	10
65	8	57	0.1404	0.1605	0.1500	0.1800	9	10
66	10	55	0.1818	0.2795	0.1500	0.1800	8	10
67	10	50	0.2000	0.2179	0.1500	0.1800	8	9
68	9	51	0.1765	0.2192	0.1500	0.1800	8	9
69	8	35	0.2286	0.2597	0.2000	0.1800	7	6
70	5	27	0.1852	0.2276	0.2000	0.1800	5	5
71	2	23	0.0870	0.1053	0.2000	0.1500	5	3
72	2	17	0.1176	0.1754	0.2000	0.1500	3	3
73	2	16	0.1250	0.1386	0.2000	0.1500	3	2
74	-	12	0.0000	0.0000	0.2000	0.1500	2	2
Totals	86	626	0.1374	0.1696	0.1522	0.1675	94	104
75 & Over	8	45	0.1778	0.3048			45	45
Total	94	671	0.1401	0.1830			139	149

	Actual Experience		**Proposed Assumption**
Current	0.1374	0.1696	0.1675
Previous Investigation Results			
2015-2017	0.1270	0.1717	0.1483
2012-2014	0.0967	0.1151	0.1307
2009-2011	0.1341		0.1408

GRS

Executive and Elective Non-State
Reduced Retirement Experience

Male and Female Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates		Expected Retirements	
					Present	Proposed	Present	Proposed
55	3	50	0.0600	0.0464	0.0300	0.0250	2	1
56	-	54	0.0000	0.0000	0.0300	0.0250	2	1
57	-	48	0.0000	0.0000	0.0300	0.0250	1	1
58	2	52	0.0385	0.0546	0.0300	0.0250	2	1
59	1	46	0.0217	0.0198	0.0300	0.0250	1	1
60	3	44	0.0682	0.0556	0.0500	0.0500	2	2
61	2	38	0.0526	0.0385	0.0500	0.0500	2	2
62	-	17	0.0000	0.0000	0.0200	0.0100	-	-
63	-	16	0.0000	0.0000	0.0200	0.0100	-	-
64	-	15	0.0000	0.0000	0.0200	0.0100	-	-
Totals	11	380	0.0289	0.0292	0.0350	0.0312	12	9

	Actual Experience		Proposed Assumption
Current	0.0289	0.0292	0.0312
Previous Investigation Results			
2015-2017	0.0445	0.0542	0.0347
2012-2014	0.0245	0.0309	0.0361
2009-2011	0.0459		0.0449

Executive and Elective State
Reduced Retirement Experience

Male and Female Age-Based Reduced Retirement Experience

Age	Retirements	Exposure	Population Weighted Rates	Liability Weighted Rates	Sample Rates Present	Sample Rates Proposed	Expected Retirements Present	Expected Retirements Proposed
55	4	70	0.0571	0.0708	0.0300	0.0600	2	4
56	4	54	0.0741	0.1268	0.0300	0.0600	2	3
57	-	53	0.0000	0.0000	0.0300	0.0600	2	3
58	6	59	0.1017	0.1152	0.0300	0.0600	2	4
59	2	47	0.0426	0.0715	0.0300	0.0600	1	3
60	5	45	0.1111	0.1156	0.0500	0.0600	2	3
61	4	51	0.0784	0.0670	0.0500	0.0600	3	3
62	1	11	0.0909	0.1077	0.0200	0.0600	-	1
63	-	10	0.0000	0.0000	0.0200	0.0300	-	-
64	-	8	0.0000	0.0000	0.0200	0.0300	-	-
Totals	26	408	0.0637	0.0820	0.0358	0.0597	14	24

	Actual Experience		Proposed Assumption
Current	0.0637	0.0820	0.0597
Previous Investigation Results			
2015-2017	0.0445	0.0542	0.0347
2012-2014	0.0245	0.0309	0.0361
2009-2011	0.0459		0.0449

SECTION E

MORTALITY EXPERIENCE

Male Retired-Life Mortality Experience
Population-Weighted
(Normal Retirement, Original Annuitants Only)

Age	Life Years Exposure	Post - Retirement Death			Post - Retirement Death Rates			A/E Ratio	
		Actual Experience	Expected				Expected		
			Present	Proposed	Actual	Present	Proposed	Present	Proposed
55-59	26,733	111	125	88	0.0042	0.0046	0.0031	0.8880	1.2614
60-64	58,729	376	379	311	0.0064	0.0061	0.0052	0.9921	1.2090
65-69	94,958	918	981	803	0.0097	0.0102	0.0083	0.9358	1.1432
70-74	88,439	1,416	1,455	1,287	0.0160	0.0163	0.0144	0.9732	1.1002
75-79	59,324	1,795	1,691	1,626	0.0303	0.0281	0.0271	1.0615	1.1039
80-84	39,044	2,179	2,095	2,047	0.0558	0.0536	0.0519	1.0401	1.0645
85-89	23,468	2,461	2,283	2,306	0.1049	0.0995	0.0992	1.0780	1.0672
90-94	9,553	1,756	1,543	1,650	0.1838	0.1647	0.1793	1.1380	1.0642
95-99	2,089	620	563	566	0.2968	0.2921	0.2861	1.1012	1.0954
Totals	**402,337**	**11,632**	**11,115**	**10,684**	**0.0289**	**0.0276**	**0.0266**	**1.0465**	**1.0887**

Current	0.0289	0.0266
Previous Investigation Results		
2015-2017	0.0278	0.0265
2012-2014	0.0273	0.0271
2009-2011	0.0286	0.0264

Male Retired-Life Mortality Experience
Benefits-Weighted
(Normal Retirement, Original Annuitants Only)

Age	Life Years Exposure	Post - Retirement Death Actual Experience	Post - Retirement Death Expected Present	Post - Retirement Death Expected Proposed	Post - Retirement Death Rates Actual	Post - Retirement Death Rates Expected Present	Post - Retirement Death Rates Expected Proposed	A/E Ratio Present	A/E Ratio Proposed
55-59	60,998,210	188,005	284,957	200,449	0.0031	0.0046	0.0031	0.6598	0.9379
60-64	142,932,545	749,208	920,357	756,532	0.0052	0.0061	0.0052	0.8140	0.9903
65-69	231,843,722	1,930,206	2,399,567	1,962,843	0.0083	0.0102	0.0083	0.8044	0.9834
70-74	222,662,205	3,203,200	3,668,280	3,246,059	0.0144	0.0163	0.0144	0.8732	0.9868
75-79	152,967,193	4,167,704	4,361,019	4,194,075	0.0272	0.0281	0.0271	0.9557	0.9937
80-84	102,698,828	5,053,239	5,517,042	5,391,272	0.0492	0.0536	0.0519	0.9159	0.9373
85-89	63,857,989	6,197,863	6,224,588	6,286,155	0.0971	0.0995	0.0992	0.9957	0.9860
90-94	25,972,591	4,489,801	4,190,861	4,481,944	0.1729	0.1647	0.1793	1.0713	1.0018
95-99	5,600,340	1,523,572	1,508,717	1,516,399	0.2720	0.2921	0.2861	1.0098	1.0047
Totals	**1,019,911,859**	**27,521,753**	**29,104,013**	**28,055,180**	**0.0270**	**0.0285**	**0.0275**	**0.9456**	**0.9810**

Female Retired-Life Mortality Experience
Population-Weighted
(Normal Retirement, Original Annuitants Only)

Age	Life Years Exposure	Post - Retirement Death Actual Experience	Post - Retirement Death Expected Present	Post - Retirement Death Expected Proposed	Actual	Post - Retirement Death Rates Expected Present	Post - Retirement Death Rates Expected Proposed	A/E Ratio Present	A/E Ratio Proposed
55-59	35,080	124	104	103	0.0035	0.0028	0.0028	1.1923	1.2039
60-64	91,963	338	388	379	0.0037	0.0041	0.0040	0.8711	0.8918
65-69	147,681	851	951	895	0.0058	0.0062	0.0059	0.8948	0.9508
70-74	121,107	1,263	1,332	1,270	0.0104	0.0109	0.0103	0.9482	0.9945
75-79	78,385	1,662	1,590	1,621	0.0212	0.0201	0.0204	1.0453	1.0253
80-84	54,102	2,146	2,113	2,203	0.0397	0.0384	0.0403	1.0156	0.9741
85-89	36,604	2,933	2,845	2,849	0.0801	0.0798	0.0779	1.0309	1.0295
90-94	18,939	2,783	2,500	2,662	0.1469	0.1334	0.1448	1.1132	1.0455
95-99	6,168	1,549	1,413	1,456	0.2511	0.2430	0.2466	1.0962	1.0639
Totals	**590,029**	**13,649**	**13,236**	**13,438.0**	**0.0231**	**0.0224**	**0.0228**	**1.0312**	**1.0157**

Current	0.0231	0.0228
Previous Investigation Results		
2015-2017	0.0233	0.0223
2012-2014	0.0234	0.0230
2009-2011	0.0256	0.0239

Female Retired-Life Mortality Experience
Benefits-Weighted
(Normal Retirement, Original Annuitants Only)

Age	Life Years Exposure	Post - Retirement Death Actual Experience	Post - Retirement Death Expected Present	Post - Retirement Death Expected Proposed	Post - Retirement Death Rates Actual	Post - Retirement Death Rates Expected Present	Post - Retirement Death Rates Expected Proposed	A/E Ratio Present	A/E Ratio Proposed
55-59	57,441,581	188,504	170,352	169,152	0.0033	0.0028	0.0028	1.1066	1.1144
60-64	173,480,138	560,180	733,496	715,939	0.0032	0.0041	0.0040	0.7637	0.7824
65-69	282,263,167	1,524,032	1,818,798	1,711,182	0.0054	0.0062	0.0059	0.8379	0.8906
70-74	220,782,513	2,230,639	2,416,714	2,302,201	0.0101	0.0109	0.0103	0.9230	0.9689
75-79	129,565,300	2,589,712	2,620,304	2,669,910	0.0200	0.0201	0.0204	0.9883	0.9700
80-84	88,754,643	3,444,109	3,475,981	3,622,958	0.0388	0.0384	0.0403	0.9908	0.9506
85-89	63,381,778	4,995,332	4,930,749	4,937,483	0.0788	0.0798	0.0779	1.0131	1.0117
90-94	32,322,904	4,598,051	4,257,312	4,531,642	0.1423	0.1334	0.1448	1.0800	1.0147
95-99	10,010,391	2,396,849	2,284,060	2,350,701	0.2394	0.2430	0.2466	1.0494	1.0196
Totals	**1,058,002,415**	**22,527,408**	**22,707,766**	**23,011,168.0**	**0.0213**	**0.0215**	**0.0217**	**0.9921**	**0.9790**

SECTION F

COMPLETE LISTS OF PROPOSED DECREMENT ASSUMPTIONS

Actuarial Assumptions
Based on 2018-2020 Experience Study

Select and Ultimate Withdrawal

Age	Service	General Non-State		General State		Public Schools Non-State		University State		Protective			Executive & Elected Non-State	Executive & Elected State
										With SS Non-State	With SS State	Without SS Non-State		
		Male	Female	Male	Female	Male	Female	Male	Female					
	0-1	17.7%	20.0%	17.2%	19.5%	12.6%	12.0%	14.0%	14.1%	15.6%	18.8%	4.5%	25.0%	19.0%
	1-2	12.5%	15.0%	12.9%	15.5%	11.6%	10.0%	13.8%	14.0%	9.4%	15.5%	4.0%	20.0%	16.0%
	2-3	9.0%	11.5%	9.5%	12.5%	8.5%	8.5%	12.6%	12.7%	5.3%	10.5%	2.0%	17.0%	13.0%
	3-4	7.1%	9.6%	7.4%	10.0%	6.0%	6.2%	11.0%	10.0%	4.4%	6.5%	1.8%	16.0%	12.5%
	4-5	6.6%	9.0%	7.3%	8.7%	5.6%	5.8%	8.6%	9.3%	4.2%	5.5%	1.7%	13.0%	12.0%
	5-6	5.3%	7.4%	6.1%	7.8%	4.5%	4.8%	8.5%	8.1%	3.3%	5.0%	1.3%	4.0%	6.0%
	6-7	4.8%	6.3%	5.2%	6.9%	3.7%	4.1%	7.0%	7.0%	3.2%	4.5%	1.2%	4.0%	6.0%
	7-8	4.6%	6.0%	5.1%	6.0%	2.9%	3.5%	5.6%	5.6%	3.0%	4.0%	0.9%	4.0%	6.0%
	8-9	4.1%	5.7%	4.5%	5.6%	2.6%	3.4%	4.6%	4.9%	2.7%	3.5%	0.8%	4.0%	6.0%
	9-10	4.0%	5.0%	3.6%	5.5%	2.5%	3.0%	4.3%	4.3%	2.3%	3.3%	0.7%	4.0%	6.0%
Under 30	10 & Up	3.2%	4.9%	3.1%	4.8%	2.0%	2.2%	4.2%	4.0%	2.1%	2.9%	0.7%	4.5%	4.5%
31		3.1%	4.8%	2.9%	4.8%	1.9%	2.1%	4.1%	4.0%	2.0%	2.8%	0.7%	4.5%	4.5%
32		3.0%	4.8%	2.8%	4.7%	1.7%	2.0%	4.1%	4.0%	2.0%	2.8%	0.7%	4.5%	4.5%
33		2.9%	4.6%	2.8%	4.4%	1.7%	2.0%	4.1%	4.0%	1.9%	2.7%	0.6%	4.5%	4.5%
34		2.8%	4.3%	2.8%	4.2%	1.6%	1.9%	4.0%	4.0%	1.8%	2.6%	0.6%	4.5%	4.5%
35		2.8%	4.1%	2.7%	3.9%	1.6%	1.9%	4.0%	4.0%	1.8%	2.4%	0.6%	4.5%	4.5%
36		2.7%	3.8%	2.7%	3.7%	1.5%	1.8%	3.9%	4.0%	1.7%	2.3%	0.6%	4.5%	4.5%
37		2.6%	3.6%	2.7%	3.4%	1.5%	1.8%	3.9%	4.0%	1.6%	2.2%	0.6%	4.5%	4.5%
38		2.5%	3.5%	2.7%	3.3%	1.5%	1.7%	3.7%	3.9%	1.6%	2.1%	0.6%	4.4%	4.5%
39		2.4%	3.4%	2.7%	3.2%	1.5%	1.7%	3.5%	3.8%	1.6%	2.0%	0.6%	4.3%	4.5%
40		2.4%	3.2%	2.6%	3.0%	1.4%	1.6%	3.4%	3.7%	1.5%	1.8%	0.6%	4.2%	4.5%
41		2.3%	3.1%	2.6%	2.9%	1.4%	1.5%	3.2%	3.6%	1.5%	1.7%	0.6%	4.1%	4.5%
42		2.2%	3.0%	2.6%	2.8%	1.4%	1.5%	3.1%	3.5%	1.5%	1.6%	0.6%	4.0%	4.5%
43		2.1%	3.0%	2.5%	2.8%	1.4%	1.4%	3.0%	3.4%	1.5%	1.5%	0.5%	3.9%	4.4%
44		2.0%	3.0%	2.4%	2.7%	1.4%	1.4%	2.9%	3.3%	1.5%	1.5%	0.5%	3.8%	4.3%
45		2.0%	2.9%	2.4%	2.7%	1.4%	1.4%	2.8%	3.2%	1.4%	1.4%	0.5%	3.7%	4.2%
46		1.9%	2.9%	2.3%	2.6%	1.4%	1.3%	2.7%	3.1%	1.4%	1.4%	0.5%	3.6%	4.1%
47		1.8%	2.9%	2.2%	2.6%	1.4%	1.3%	2.6%	3.0%	1.4%	1.3%	0.5%	3.5%	4.0%
48		1.8%	2.8%	2.1%	2.4%	1.3%	1.3%	2.5%	2.9%	1.4%	1.3%	0.5%	3.4%	3.9%
49		1.7%	2.6%	2.0%	2.3%	1.3%	1.2%	2.4%	2.8%	1.4%	1.3%	0.5%	3.3%	3.8%
50		1.7%	2.5%	1.9%	2.1%	1.3%	1.2%	2.3%	2.7%	1.3%	1.2%	0.5%	3.2%	3.7%
51		1.6%	2.3%	1.8%	2.0%	1.3%	1.2%	2.3%	2.6%	1.3%	1.2%	0.5%	3.1%	3.6%
52		1.6%	2.2%	1.7%	1.8%	1.3%	1.2%	2.2%	2.5%	1.3%	1.2%	0.5%	3.0%	3.5%
53		1.6%	2.2%	1.7%	1.8%	1.3%	1.2%	2.2%	2.5%	1.3%	1.2%	0.5%	3.0%	3.5%
54		1.6%	2.2%	1.7%	1.8%	1.3%	1.2%	2.2%	2.5%	1.3%	1.2%	0.5%	3.0%	3.5%

% of Active Participants Withdrawing

GRS

Actuarial Assumptions
Based on 2018-2020 Experience Study

Disability Rates

| | General Non-State | | General State | | Public Schools Non-State | | University State | | Protective | | | Executive & Elected | Executive & Elected |
| | | | | | | | | | With SS Non-State | With SS State | Without SS Non-State | & Elected Non-State | & Elected State |
Age	Male	Female	Male	Female	Male	Female	Male	Female	Non-State	State	SS Non-State	Non-State	State
20	0.01%	0.00%	0.01%	0.01%	0.01%	0.01%	0.00%	0.01%	0.02%	0.02%	0.03%	0.00%	0.00%
21	0.01%	0.00%	0.01%	0.01%	0.01%	0.01%	0.00%	0.01%	0.02%	0.02%	0.03%	0.00%	0.00%
22	0.01%	0.00%	0.01%	0.01%	0.01%	0.01%	0.00%	0.01%	0.02%	0.02%	0.03%	0.00%	0.00%
23	0.01%	0.00%	0.01%	0.01%	0.01%	0.01%	0.00%	0.01%	0.02%	0.02%	0.03%	0.00%	0.00%
24	0.01%	0.00%	0.01%	0.01%	0.01%	0.01%	0.00%	0.01%	0.02%	0.02%	0.03%	0.00%	0.00%
25	0.01%	0.00%	0.01%	0.01%	0.01%	0.01%	0.00%	0.01%	0.02%	0.02%	0.03%	0.00%	0.00%
26	0.01%	0.00%	0.01%	0.01%	0.01%	0.01%	0.00%	0.01%	0.02%	0.02%	0.03%	0.00%	0.00%
27	0.01%	0.00%	0.01%	0.01%	0.01%	0.01%	0.00%	0.01%	0.02%	0.02%	0.03%	0.00%	0.00%
28	0.01%	0.01%	0.01%	0.03%	0.01%	0.01%	0.00%	0.01%	0.02%	0.02%	0.03%	0.00%	0.00%
29	0.01%	0.01%	0.01%	0.03%	0.01%	0.01%	0.00%	0.01%	0.02%	0.02%	0.03%	0.00%	0.00%
30	0.01%	0.02%	0.01%	0.04%	0.01%	0.01%	0.00%	0.01%	0.02%	0.02%	0.03%	0.00%	0.00%
31	0.01%	0.02%	0.01%	0.04%	0.01%	0.01%	0.00%	0.01%	0.02%	0.02%	0.03%	0.00%	0.00%
32	0.01%	0.02%	0.01%	0.04%	0.01%	0.01%	0.00%	0.01%	0.02%	0.02%	0.03%	0.00%	0.00%
33	0.01%	0.02%	0.01%	0.04%	0.01%	0.01%	0.00%	0.02%	0.02%	0.02%	0.03%	0.00%	0.00%
34	0.01%	0.02%	0.01%	0.05%	0.01%	0.01%	0.00%	0.02%	0.02%	0.03%	0.03%	0.00%	0.00%
35	0.01%	0.02%	0.01%	0.05%	0.01%	0.01%	0.00%	0.03%	0.03%	0.03%	0.03%	0.01%	0.01%
36	0.01%	0.02%	0.01%	0.05%	0.01%	0.01%	0.00%	0.03%	0.03%	0.04%	0.03%	0.01%	0.01%
37	0.02%	0.02%	0.02%	0.05%	0.01%	0.01%	0.00%	0.04%	0.03%	0.04%	0.04%	0.01%	0.01%
38	0.02%	0.03%	0.02%	0.06%	0.01%	0.01%	0.00%	0.04%	0.03%	0.04%	0.04%	0.01%	0.01%
39	0.03%	0.03%	0.03%	0.07%	0.01%	0.02%	0.00%	0.04%	0.04%	0.04%	0.05%	0.01%	0.01%
40	0.03%	0.03%	0.03%	0.07%	0.01%	0.02%	0.01%	0.04%	0.04%	0.05%	0.05%	0.01%	0.01%
41	0.04%	0.04%	0.04%	0.08%	0.02%	0.02%	0.01%	0.04%	0.04%	0.05%	0.06%	0.01%	0.01%
42	0.05%	0.04%	0.05%	0.08%	0.02%	0.02%	0.01%	0.05%	0.04%	0.05%	0.06%	0.01%	0.01%
43	0.05%	0.04%	0.05%	0.09%	0.02%	0.04%	0.01%	0.04%	0.04%	0.06%	0.07%	0.01%	0.01%
44	0.06%	0.05%	0.06%	0.10%	0.03%	0.05%	0.01%	0.04%	0.05%	0.06%	0.08%	0.01%	0.01%
45	0.06%	0.05%	0.06%	0.10%	0.03%	0.05%	0.02%	0.04%	0.05%	0.07%	0.10%	0.01%	0.01%
46	0.06%	0.05%	0.06%	0.11%	0.03%	0.07%	0.02%	0.04%	0.06%	0.07%	0.11%	0.02%	0.02%
47	0.06%	0.05%	0.06%	0.11%	0.03%	0.08%	0.02%	0.04%	0.06%	0.08%	0.12%	0.02%	0.02%
48	0.09%	0.06%	0.09%	0.13%	0.04%	0.08%	0.02%	0.05%	0.07%	0.09%	0.26%	0.02%	0.02%
49	0.11%	0.06%	0.11%	0.14%	0.06%	0.09%	0.02%	0.06%	0.08%	0.10%	0.41%	0.02%	0.02%
50	0.13%	0.07%	0.13%	0.16%	0.08%	0.10%	0.03%	0.07%	0.09%	0.11%	0.55%	0.02%	0.02%
51	0.15%	0.08%	0.15%	0.17%	0.10%	0.11%	0.03%	0.08%	0.10%	0.12%	0.70%	0.03%	0.03%
52	0.17%	0.09%	0.17%	0.19%	0.12%	0.11%	0.04%	0.09%	0.10%	0.13%	0.84%	0.03%	0.03%
53	0.19%	0.10%	0.19%	0.22%	0.13%	0.12%	0.05%	0.10%	0.53%	0.66%	0.70%	0.05%	0.05%
54	0.21%	0.12%	0.21%	0.26%	0.13%	0.14%	0.07%	0.10%	0.96%	1.20%	0.55%	0.08%	0.08%
55	0.24%	0.13%	0.24%	0.29%	0.14%	0.14%	0.08%	0.11%	1.39%	1.73%	0.41%	0.09%	0.09%
56	0.27%	0.14%	0.27%	0.32%	0.15%	0.16%	0.10%	0.12%	1.81%	2.27%	0.26%	0.11%	0.11%
57	0.30%	0.16%	0.30%	0.36%	0.16%	0.17%	0.12%	0.13%	2.24%	2.80%	0.12%	0.12%	0.12%
58	0.33%	0.17%	0.33%	0.38%	0.19%	0.19%	0.12%	0.14%	2.27%	2.84%	0.12%	0.12%	0.12%
59	0.36%	0.18%	0.36%	0.39%	0.21%	0.20%	0.11%	0.15%	2.30%	2.88%	0.12%	0.11%	0.11%
60	0.43%	0.18%	0.43%	0.41%	0.24%	0.21%	0.11%	0.17%	2.34%	2.92%	0.12%	0.11%	0.11%

Actuarial Assumptions
Based on 2018-2020 Experience Study

Salary Scale – Service Based Rates

Service	% Merit Increases in Salaries Next Year								
	General Non-State (Not Including Schools)	General State (Not Including Schools)	University Teachers State	Public School Teachers Non-State	Protective With SS Non-State	Protective With SS State	Protective Without SS Non-State	Executive & Elected Non-State	Executive & Elected State
1	3.5%	3.5%	3.0%	5.6%	4.8%	4.8%	5.5%	2.5%	2.5%
2	3.5%	3.5%	3.0%	5.6%	4.8%	4.8%	5.5%	2.5%	2.5%
3	3.1%	3.1%	2.9%	5.2%	4.1%	4.1%	4.7%	2.0%	2.0%
4	2.8%	2.8%	2.8%	4.7%	3.5%	3.5%	3.8%	1.6%	1.6%
5	2.5%	2.5%	2.7%	4.3%	2.8%	2.8%	3.0%	1.1%	1.1%
6	2.2%	2.2%	2.6%	3.8%	2.2%	2.2%	2.1%	0.7%	0.7%
7	1.9%	1.9%	2.5%	3.4%	1.5%	1.5%	1.3%	0.2%	0.2%
8	1.8%	1.8%	2.4%	3.1%	1.4%	1.4%	1.2%	0.2%	0.2%
9	1.6%	1.6%	2.3%	2.9%	1.3%	1.3%	1.0%	0.2%	0.2%
10	1.5%	1.5%	2.2%	2.6%	1.1%	1.1%	0.9%	0.2%	0.2%
11	1.4%	1.4%	2.1%	2.4%	1.0%	1.0%	0.7%	0.2%	0.2%
12	1.3%	1.3%	2.0%	2.1%	0.9%	0.9%	0.6%	0.2%	0.2%
13	1.2%	1.2%	1.9%	1.9%	0.9%	0.9%	0.6%	0.2%	0.2%
14	1.2%	1.2%	1.8%	1.7%	0.9%	0.9%	0.6%	0.2%	0.2%
15	1.1%	1.1%	1.7%	1.4%	0.8%	0.8%	0.5%	0.2%	0.2%
16	1.1%	1.1%	1.6%	1.2%	0.8%	0.8%	0.5%	0.2%	0.2%
17	1.0%	1.0%	1.5%	1.0%	0.8%	0.8%	0.5%	0.2%	0.2%
18	1.0%	1.0%	1.4%	0.9%	0.8%	0.8%	0.5%	0.2%	0.2%
19	0.9%	0.9%	1.3%	0.7%	0.8%	0.8%	0.5%	0.2%	0.2%
20	0.9%	0.9%	1.2%	0.6%	0.7%	0.7%	0.4%	0.2%	0.2%
21	0.8%	0.8%	1.1%	0.5%	0.7%	0.7%	0.4%	0.2%	0.2%
22	0.8%	0.8%	1.0%	0.4%	0.7%	0.7%	0.4%	0.2%	0.2%
23	0.7%	0.7%	0.9%	0.3%	0.7%	0.7%	0.4%	0.2%	0.2%
24	0.7%	0.7%	0.9%	0.3%	0.7%	0.7%	0.4%	0.2%	0.2%
25	0.6%	0.6%	0.9%	0.3%	0.6%	0.6%	0.3%	0.2%	0.2%
26	0.6%	0.6%	0.8%	0.2%	0.6%	0.6%	0.3%	0.2%	0.2%
27	0.5%	0.5%	0.8%	0.2%	0.6%	0.6%	0.3%	0.2%	0.2%
28	0.5%	0.5%	0.8%	0.2%	0.6%	0.6%	0.3%	0.2%	0.2%
29	0.4%	0.4%	0.7%	0.2%	0.6%	0.6%	0.3%	0.2%	0.2%
30	0.4%	0.4%	0.7%	0.2%	0.5%	0.5%	0.2%	0.2%	0.2%
31	0.3%	0.3%	0.6%	0.2%	0.5%	0.5%	0.2%	0.2%	0.2%
32	0.3%	0.3%	0.6%	0.2%	0.5%	0.5%	0.2%	0.2%	0.2%
33	0.3%	0.3%	0.5%	0.1%	0.5%	0.5%	0.2%	0.2%	0.2%
34	0.3%	0.3%	0.4%	0.1%	0.5%	0.5%	0.2%	0.2%	0.2%
35	0.2%	0.2%	0.4%	0.1%	0.4%	0.4%	0.1%	0.2%	0.2%
36	0.2%	0.2%	0.3%	0.1%	0.4%	0.4%	0.1%	0.2%	0.2%
37	0.2%	0.2%	0.2%	0.1%	0.4%	0.4%	0.1%	0.2%	0.2%
38	0.2%	0.2%	0.2%	0.1%	0.4%	0.4%	0.1%	0.2%	0.2%
39	0.2%	0.2%	0.2%	0.1%	0.3%	0.3%	0.1%	0.2%	0.2%
40	0.1%	0.1%	0.1%	0.1%	0.3%	0.3%	0.1%	0.2%	0.2%

Actuarial Assumptions
Based on 2018-2020 Experience Study

Normal Retirement Pattern

Age	General Non-State		General State		Public Schools Non-State		University State		Protective			Executive & Elected Non-State	Executive & Elected State
									With SS Non-State *	With SS State *	Without SS Non-State*		
	Male	Female	Male	Female	Male	Female	Male	Female					
50									6%	8%	3%		
51									8%	9%	4%		
52									11%	11%	5%		
53									34%	25%	17%		
54									32%	20%	24%		
55									26%	20%	29%		
56									23%	20%	32%		
57	20%	17%	19%	19%	31%	28%	12%	10%	27%	20%	23%	10%	12%
58	20%	18%	19%	19%	29%	28%	16%	20%	21%	20%	27%	10%	12%
59	20%	14%	19%	19%	28%	26%	9%	12%	23%	20%	40%	10%	12%
60	20%	20%	19%	21%	27%	29%	15%	14%	22%	20%	25%	10%	12%
61	20%	18%	19%	25%	26%	27%	9%	13%	30%	20%	25%	10%	12%
62	30%	24%	28%	29%	39%	36%	10%	15%	35%	25%	31%	10%	18%
63	30%	29%	30%	28%	33%	31%	11%	19%	27%	25%	40%	10%	18%
64	30%	23%	25%	31%	30%	30%	16%	17%	30%	36%	40%	15%	18%
65	30%	35%	27%	31%	32%	39%	16%	21%	34%	38%	40%	15%	18%
66	40%	39%	35%	36%	35%	44%	21%	25%	35%	38%	100%	15%	18%
67	32%	33%	32%	33%	31%	31%	18%	25%	35%	38%	100%	15%	18%
68	32%	30%	21%	25%	28%	30%	19%	18%	35%	38%	100%	10%	18%
69	28%	22%	21%	27%	20%	30%	14%	17%	35%	38%	100%	10%	18%
70	28%	26%	21%	29%	30%	32%	21%	22%	100%	100%	100%	10%	18%
71	28%	28%	21%	34%	25%	25%	24%	17%	100%	100%	100%	10%	15%
72	28%	30%	21%	33%	25%	25%	24%	17%	100%	100%	100%	10%	15%
73	18%	30%	30%	24%	25%	25%	24%	21%	100%	100%	100%	20%	15%
74	18%	16%	30%	18%	25%	25%	24%	14%	100%	100%	100%	20%	15%
75	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

% of Active Participants Retiring

* Includes Reduced Retirement.

Actuarial Assumptions
Based on 2018-2020 Experience Study

Reduced Retirement Pattern

Age	General Non-State		General State		Public Schools Non-State		University State		Executive & Elected Non-State	Executive & Elected State
	Male	Female	Male	Female	Male	Female	Male	Female		
55	7%	7%	6%	6%	12%	11%	3%	5%	3%	6%
56	6%	7%	7%	8%	13%	13%	3%	5%	3%	6%
57	5%	6%	6%	6%	13%	12%	4%	5%	3%	6%
58	6%	7%	6%	9%	12%	13%	4%	6%	3%	6%
59	6%	7%	7%	8%	14%	14%	4%	6%	3%	6%
60	9%	10%	9%	10%	16%	17%	5%	8%	5%	6%
61	8%	10%	13%	11%	16%	17%	5%	9%	5%	6%
62	19%	16%	16%	18%	23%	24%	7%	11%	1%	6%
63	20%	18%	17%	20%	21%	24%	8%	12%	1%	3%
64	18%	18%	21%	18%	21%	24%	12%	15%	1%	3%

Age	General Non-State		General State		Public Schools Non-State		University State		Executive & Elected Non-State	Executive & Elected State
	Male	Female	Male	Female	Male	Female	Male	Female		
55	7%	7%	6%	6%	12%	11%	3%	5%	3%	6%
56	6%	7%	7%	8%	13%	13%	3%	5%	3%	6%
57	5%	6%	6%	6%	13%	12%	4%	5%	3%	6%
58	6%	7%	6%	9%	12%	13%	4%	6%	3%	6%
59	6%	7%	7%	8%	14%	14%	4%	6%	3%	6%
60	9%	10%	9%	10%	16%	17%	5%	8%	5%	6%
61	8%	10%	13%	11%	16%	17%	5%	9%	5%	6%
62	19%	16%	16%	18%	23%	24%	7%	11%	1%	6%
63	20%	18%	17%	20%	21%	24%	8%	12%	1%	3%
64	18%	18%	21%	18%	21%	24%	12%	15%	1%	3%

% of Active Participants Retiring

GRS

Actuarial Assumptions
Based on 2018-2020 Experience Study

Post-Retirement
Mortality Rates* – Healthy Lives

Age	% Dying Next Year Male	% Dying Next Year Female	Age	% Dying Next Year Male	% Dying Next Year Female	Age	% Dying Next Year Male	% Dying Next Year Female
20	0.0396%	0.0163%	60	0.4228%	0.3519%	100	35.6135%	31.8439%
21	0.0355%	0.0153%	61	0.4673%	0.3784%	101	37.9337%	34.2998%
22	0.0302%	0.0131%	62	0.5155%	0.4046%	102	40.2333%	36.7802%
23	0.0260%	0.0121%	63	0.5654%	0.4330%	103	42.5179%	39.2695%
24	0.0230%	0.0123%	64	0.6213%	0.4637%	104	44.7448%	41.7374%
25	0.0211%	0.0126%	65	0.6818%	0.4995%	105	46.9039%	44.1757%
26	0.0233%	0.0144%	66	0.7500%	0.5395%	106	48.9965%	46.5427%
27	0.0254%	0.0147%	67	0.8274%	0.5879%	107	51.0027%	48.8393%
28	0.0277%	0.0165%	68	0.9162%	0.6462%	108	52.9035%	51.0548%
29	0.0315%	0.0184%	69	1.0184%	0.7170%	109	54.7197%	53.1592%
30	0.0339%	0.0218%	70	1.1370%	0.8033%	110	56.1733%	55.1534%
31	0.0377%	0.0236%	71	1.2757%	0.9060%	111	56.3309%	57.0367%
32	0.0399%	0.0254%	72	1.4363%	1.0282%	112	56.4891%	58.0802%
33	0.0435%	0.0269%	73	1.6243%	1.1730%	113	56.6419%	58.2139%
34	0.0454%	0.0300%	74	1.8414%	1.3432%	114	56.8121%	58.3481%
35	0.0484%	0.0311%	75	2.0920%	1.5414%	115	56.9715%	58.4766%
36	0.0512%	0.0335%	76	2.3821%	1.7715%	116	56.9886%	58.4883%
37	0.0535%	0.0356%	77	2.7129%	2.0352%	117	56.9943%	58.5000%
38	0.0569%	0.0373%	78	3.0887%	2.3378%	118	57.0000%	58.5000%
39	0.0581%	0.0402%	79	3.5169%	2.6830%	119	57.0000%	58.5000%
40	0.0604%	0.0414%	80	4.0033%	3.0758%	120	100.0000%	100.0000%
41	0.0636%	0.0436%	81	4.5584%	3.5243%			
42	0.0665%	0.0457%	82	5.1942%	4.0335%			
43	0.0701%	0.0489%	83	5.9181%	4.6126%			
44	0.0735%	0.0509%	84	6.7445%	5.2701%			
45	0.0792%	0.0542%	85	7.6830%	6.0133%			
46	0.0848%	0.0586%	86	8.7379%	6.8500%			
47	0.0915%	0.0633%	87	9.9175%	7.7909%			
48	0.0995%	0.0682%	88	11.2328%	8.8487%			
49	0.1078%	0.0737%	89	12.6925%	10.0318%			
50	0.1220%	0.0883%	90	14.3006%	11.3550%			
51	0.1389%	0.1059%	91	16.0542%	12.8386%			
52	0.1596%	0.1276%	92	17.9281%	14.4764%			
53	0.1835%	0.1553%	93	19.9079%	16.2637%			
54	0.2118%	0.1886%	94	21.9667%	18.1745%			
55	0.2469%	0.2291%	95	24.0680%	20.1948%			
56	0.2757%	0.2521%	96	26.3223%	22.3849%			
57	0.3075%	0.2761%	97	28.6109%	24.6624%			
58	0.3435%	0.3015%	98	30.9289%	27.0094%			
59	0.3817%	0.3265%	99	33.2753%	29.4102%			

* *Mortality rates for 2020. Future years will reflect improvements in mortality.*

Actuarial Assumptions
Based on 2018-2020 Experience Study

Mortality Rates* – Disabled Lives

Age	% Dying Next Year Male	% Dying Next Year Female	Age	% Dying Next Year Male	% Dying Next Year Female	Age	% Dying Next Year Male	% Dying Next Year Female
20	0.4789%	0.2916%	60	2.9648%	2.3983%	100	35.6135%	31.8439%
21	0.4563%	0.2746%	61	3.0726%	2.4254%	101	37.9337%	34.2998%
22	0.4250%	0.2533%	62	3.1795%	2.4476%	102	40.2333%	36.7802%
23	0.3916%	0.2353%	63	3.2873%	2.4692%	103	42.5179%	39.2695%
24	0.3690%	0.2245%	64	3.3964%	2.4933%	104	44.7448%	41.7374%
25	0.3669%	0.2300%	65	3.5058%	2.5264%	105	46.9039%	44.1757%
26	0.3985%	0.2570%	66	3.6176%	2.5724%	106	48.9965%	46.5427%
27	0.4319%	0.2881%	67	3.7340%	2.6381%	107	51.0027%	48.8393%
28	0.4677%	0.3229%	68	3.8576%	2.7259%	108	52.9035%	51.0548%
29	0.5056%	0.3599%	69	3.9938%	2.8408%	109	54.7197%	53.1592%
30	0.5447%	0.3999%	70	4.1456%	2.9857%	110	56.1733%	55.1534%
31	0.5845%	0.4425%	71	4.3219%	3.1615%	111	56.3309%	57.0367%
32	0.6242%	0.4865%	72	4.5243%	3.3709%	112	56.4891%	58.0802%
33	0.6630%	0.5327%	73	4.7611%	3.6153%	113	56.6419%	58.2139%
34	0.7032%	0.5780%	74	5.0341%	3.8984%	114	56.8121%	58.3481%
35	0.7403%	0.6231%	75	5.3480%	4.2232%	115	56.9715%	58.4766%
36	0.7779%	0.6669%	76	5.7050%	4.5903%	116	56.9886%	58.4883%
37	0.8152%	0.7103%	77	6.1099%	5.0032%	117	56.9943%	58.5000%
38	0.8527%	0.7527%	78	6.5654%	5.4673%	118	57.0000%	58.5000%
39	0.8899%	0.7958%	79	7.0775%	5.9831%	119	57.0000%	58.5000%
40	0.9278%	0.8394%	80	7.6486%	6.5567%	120	100.0000%	100.0000%
41	0.9685%	0.8844%	81	8.2842%	7.1912%			
42	1.0133%	0.9321%	82	8.9858%	7.8904%			
43	1.0633%	0.9846%	83	9.7502%	8.6588%			
44	1.1229%	1.0435%	84	10.5835%	9.4988%			
45	1.1907%	1.1104%	85	11.4832%	10.4179%			
46	1.2711%	1.1859%	86	12.4471%	11.3753%			
47	1.3633%	1.2726%	87	13.4812%	12.3538%			
48	1.4683%	1.3726%	88	14.5954%	13.3483%			
49	1.5859%	1.4877%	89	15.9918%	14.3519%			
50	1.7174%	1.6167%	90	17.5285%	15.3796%			
51	1.8282%	1.6928%	91	19.1032%	16.4544%			
52	1.9473%	1.7776%	92	20.6811%	17.5933%			
53	2.0734%	1.8719%	93	22.2643%	18.8217%			
54	2.2057%	1.9697%	94	23.8589%	20.1534%			
55	2.3406%	2.0673%	95	25.4734%	21.6175%			
56	2.4759%	2.1585%	96	27.2693%	23.3148%			
57	2.6058%	2.2395%	97	29.1634%	25.2175%			
58	2.7325%	2.3063%	98	31.1840%	27.2718%			
59	2.8514%	2.3585%	99	33.3483%	29.4858%			

* *Mortality rates for 2020. Future years will reflect improvements in mortality.*

Actuarial Assumptions
Based on 2018-2020 Experience Study

Mortality Rates* – Death-in-Service

	% Dying Next Year				% Dying Next Year	
Age	**Male**	**Female**	**Age**	**Male**	**Female**
20	0.0396%	0.0163%	60	0.3127%	0.1974%
21	0.0355%	0.0153%	61	0.3460%	0.2147%
22	0.0302%	0.0131%	62	0.3812%	0.2339%
23	0.0260%	0.0121%	63	0.4178%	0.2539%
24	0.0230%	0.0123%	64	0.4578%	0.2771%
25	0.0211%	0.0126%	65	0.5010%	0.3023%
26	0.0233%	0.0144%	66	0.5449%	0.3311%
27	0.0254%	0.0147%	67	0.5925%	0.3640%
28	0.0277%	0.0165%	68	0.6426%	0.4032%
29	0.0315%	0.0184%	69	0.6972%	0.4503%
30	0.0339%	0.0218%	70	0.7534%	0.5060%
31	0.0377%	0.0236%	71	0.8133%	0.5721%
32	0.0399%	0.0254%	72	0.8780%	0.6504%
33	0.0435%	0.0269%	73	0.9483%	0.7410%
34	0.0454%	0.0300%	74	1.0244%	0.8482%
35	0.0484%	0.0311%	75	1.1093%	0.9717%
36	0.0512%	0.0335%	76	1.2714%	1.1216%
37	0.0535%	0.0356%	77	1.4591%	1.2952%
38	0.0569%	0.0373%	78	1.6768%	1.4963%
39	0.0581%	0.0402%	79	1.9276%	1.7265%
40	0.0604%	0.0414%	80	2.2172%	1.9931%
41	0.0636%	0.0436%	81	2.7855%	2.4527%
42	0.0665%	0.0457%	82	3.5009%	3.0160%
43	0.0701%	0.0489%	83	4.3986%	3.7059%
44	0.0735%	0.0509%	84	5.5287%	4.5513%
45	0.0792%	0.0542%	85	6.9505%	5.5857%
46	0.0848%	0.0586%			
47	0.0915%	0.0633%			
48	0.0995%	0.0682%			
49	0.1078%	0.0737%			
50	0.1188%	0.0796%			
51	0.1303%	0.0872%			
52	0.1425%	0.0963%			
53	0.1575%	0.1051%			
54	0.1736%	0.1152%			
55	0.1905%	0.1269%			
56	0.2103%	0.1388%			
57	0.2320%	0.1515%			
58	0.2564%	0.1661%			
59	0.2831%	0.1811%			

* *Mortality rates for 2020. Future years will reflect improvements in mortality.*