Minnesota State Employees Retirement Fund

4-Year Experience Study

July 1, 2014 Through June 30, 2018

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June 27, 2019

Minnesota State Retirement System
State Employees Retirement Fund
St. Paul, Minnesota

Dear Board of Directors of the State Employees Retirement Fund:

The results of the four-year ***actuarial experience study*** of the State Employees Retirement Fund (SERF) are presented in this report. The investigation was conducted for the purpose of updating the actuarial assumptions used in valuing the actuarial liabilities of the State Employees Retirement Fund.

The investigation was based upon the statistical data furnished for annual active member and retired life actuarial valuations concerning members who died, withdrew, became disabled or retired during the four-year period of the study by the Minnesota State Retirement System (MSRS). We checked for internal and year-to-year consistency, but did not audit the data. We are not responsible for the accuracy or completeness of the information provided by MSRS.

The investigation covered the four-year period from ***July 1, 2014 to June 30, 2018***, and was carried out using generally accepted actuarial principles and techniques.

We believe that the actuarial assumptions recommended in this experience study report represent individually and in the aggregate reasonable estimates of future experience of the State Employees Retirement Fund.

This report should not be relied on for any purpose other than that described above. It was prepared at the request of MSRS and is intended for use by the Retirement System and those designated or approved by the Board of Directors. This report may be provided to parties other than the System only in its entirety and only with the permission of the Board of Directors.

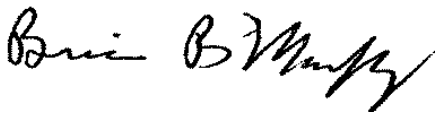
This report has been prepared by actuaries who have substantial experience valuing public employee retirement systems. To the best of our knowledge and belief, the information contained in this report was performed in accordance with Minnesota Statutes Section 356.215 and the requirements of the Standards for Actuarial Work established by the Legislative Commission on Pensions and Retirement. We certify that, to the best of our knowledge, this report is complete and accurate and was made in accordance with standards of practice promulgated by the Actuarial Standards Board.

Board of Directors
Minnesota State Retirement System
State Employees Retirement Fund
June 27, 2019

Brian B. Murphy and Bonita J. Wurst are independent of the plan sponsor and 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. In addition, Mr. Murphy meets the requirements of "approved actuary" under Minnesota Statutes Section 356.215, Subdivision 1, Paragraph (c).

Respectfully submitted,

Bonita J. Wurst, ASA, EA, FCA, MAAA



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

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Actuarial Experience Study
2014-2018

TABLE OF CONTENTS

SECTION A

OVERVIEW AND SUMMARY OF RESULTS

Summary of Findings

The four-year period (July 1, 2014 to June 30, 2018) covered by this experience study provided sufficient data to form a basis for recommending changes in some of the assumptions and/or methods used in actuarial valuations of the State Employees Retirement Fund. The recommended changes in actuarial assumptions and methods resulting from this experience study are summarized below:

Recommendations

- Decrease the price inflation assumption from 2.50% to 2.25%.
- Decrease the wage inflation (i.e., payroll growth) assumption from 3.25% to 3.00%.
- Adjust rates of merit and seniority, resulting in proposed merit and seniority increases that are approximately the same on average but with a slightly different allocation, with lower increases assumed at the beginning of a member's career. When combined with the proposed decrease in payroll growth assumption, the result is an overall decrease in gross salary increase rates.
- Adjust assumed retirement rates:
  - Increase the rate of assumed unreduced retirements (i.e., Normal Retirement) at age 66, 67 and 69.
  - Lower the assumed Rule of 90 retirement rates at all ages except age 55 (slight increase) and age 57 (no change).
  - Adjustments to early retirement rates for Tier 1 and Tier 2 members, generally resulting in fewer proposed early retirements
- Change the assumed rates of withdrawal (termination of membership before eligible to retire):
  - Generally, proposed rates are lower than current rates for years 1 to 5 and slightly higher thereafter.
- Lower rates of disability.
- Change the base mortality table to the PUB-2010 General mortality table, with rates adjusted to better fit observed plan experience and with future improvement projected using scale MP-2018.
- No change in the actuarial funding method.
- Consider layered amortization as an alternative to the current 30-year closed period amortization policy.
- Change Minnesota Standards for Actuarial Work requirements related to projected payroll.
- Minor changes to the spouse age difference and form of payment assumptions.

The recommendations are summarized on the following pages.

Introduction

Each year as of June 30, the actuarial liabilities of the 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 members (leaving before eligible to retire).
- Rates of **disability** among active members.
- Patterns of **pay increases** to active members.
- Rates of **retirement** among active members.
- Rates of **mortality** among active members, retirees, and beneficiaries.
- Long-term rates of **investment return** to be generated by the assets of the System.

Assumptions should be carefully chosen and continually monitored. An unrealistic set of assumptions can lead to:

- Understated costs resulting in either an inability to pay benefits when due, or gradual increases in required contributions as time progresses;

- Overstated costs resulting in an unnecessarily large burden on the current generation of employers and taxpayers.

All actuarial assumptions are prescribed by Minnesota Statutes, the Legislative Commission on Pensions and Retirement or the MSRS Board of Directors.

A single set of assumptions will not be suitable indefinitely. Things change, and our understanding of things (whether or not they are changing) also changes. 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 June 30, 2016 and 2018 actuarial valuations based on the results of the most recent experience study. Assumptions in effect prior to June 30, 2018 are ignored for purposes of this report.

No single experience period should be given full credibility in the setting of actuarial valuation assumptions. When we see significant differences between what is expected from our assumptions and the actual experience, we generally recommend a change in assumptions that produces results somewhere between the actual and expected experience. In this way, with each experience study the actuarial assumptions become better and better representations of actual experience. Consequently, temporary conditions that might influence a particular experience study period will not unduly influence the choice of long-term assumptions.

We are recommending certain changes in assumptions and methods. The various assumption changes are described on the following pages.

Summary of Decrement Experience
2014 - 2018

Decrement Risk Area	Actual Number	Expected		
		Present Assumptions	Proposed Assumptions	Change
Unreduced Retirement				
Normal Retirement	2,179	2,114	2,326	212
Rule of 90	1,964	2,427	2,064	(363)
Reduced Retirement				
Tier 1 Early Retirement	446	596	507	(89)
Tier 2 Early Retirement	2,142	2,540	2,294	(246)
Withdrawal				
Males	5,359	4,595	4,579	(16)
Females	8,535	7,374	7,272	(102)
Disability				
Males	96	181	127	(54)
Females	87	215	150	(65)
Mortality				
Healthy Retired Lives - Male	1,819	1,774	1,782	8
- Female	1,620	1,385	1,635	250
Disabled Retired Lives - Male	145	138	133	(5)
- Female	148	127	140	13
Active Lives - Male	123	135	132	(3)
- Female	110	98	99	1

Results presented in exhibit above are based on actual headcounts of occurrences. Results in the body of the report are liability weighted for retirement, withdrawal and active mortality and benefit weighted for healthy and disabled retiree mortality.

SECTION B

ECONOMIC ASSUMPTIONS

Economic Assumptions – Introduction

Economic assumptions include **long-term rates of investment return** (net of administrative and investment expenses), **inflation** (the across-the-board portion of salary increases), **payroll growth**, and pay increases due to **merit and seniority**. 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 affected more by external forces; namely inflation (both wage and price), general productivity changes and the local economic environment which defy accurate long-term prediction. Estimates of economic activities are generally selected on the basis of the expectations in an inflation-free environment and then both long-term rates of investment return and wage inflation are increased by some provision for long-term inflation.

Current economic assumptions for MSRS are as follows:

Investment Return	7.50%
Inflation	2.50%
Payroll Growth	3.25%

The remainder of this section addresses the economic assumptions other than pay increases due to merit and seniority. Pay increases due to merit and seniority are addressed in Section C.

Sources considered in the analysis of the economic assumptions included:

- Future expectations of the State Board of Investment (SBI) for the State of Minnesota, including information in an SBI memo dated March 14, 2019
- Future expectations of other investment consultants
- 2019 Social Security Trustees Report
- Historical observations of inflation statistics and investment returns
- U.S. Department of the Treasury yield curve rates (www.treasury.gov)
- National Average Wage Index

Economic Assumptions – ASOP No. 27

The relevant Actuarial Standard of Practice (ASOP) for economic assumptions is ASOP No. 27, Selection of Economic Assumptions for Measuring Pension Obligations. 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 historical and current economic data that is relevant as of the measurement date,
- It reflects the actuary's estimate of future experiences, observations of estimates inherent in market data, or a combination thereof, and
- It has no significant bias (i.e., it is not significantly optimistic or pessimistic), except when provisions for adverse deviation or other factors are included and disclosed under Section 3.5.1, or when alternative assumptions are used for the assessment of risk.

Economic Assumptions – Inflation

Inflation. Over the past 60 years, price inflation has averaged 3.7%. This result is heavily affected by the high inflationary period of the 1970s and early 1980s. During the past decade, price inflation averaged 1.8%.

Calendar Year Period	Inflation (CPI)
1950-1959	2.2%
1960-1969	2.5%
1970-1979	7.4%
1980-1989	5.1%
1990-1999	2.9%
2000-2009	2.5%
2000	3.4%
2001	1.6%
2002	2.4%
2003	1.9%
2004	3.3%
2005	3.4%
2006	2.5%
2007	4.1%
2008	0.1%
2009	2.7%
2010	1.5%
2011	3.0%
2012	1.7%
2013	1.5%
2014	0.8%
2015	0.7%
2016	2.1%
2017	2.1%
2018	1.9%
Last 5 Years	**1.5%**
Last 10 Years	**1.8%**
Last 20 Years	**2.2%**
Last 30 Years	**2.5%**
Last 40 Years	**3.3%**
Last 50 Years	**4.0%**
Last 60 Years	**3.7%**

The 2016 Asset Liability Study done by Callan for the SBI used a 2.25% price inflation assumption. Most of the investment consulting firms, in setting their capital market assumptions, currently assume that inflation will be less than 2.50%. We examined the capital market assumption sets for fourteen investment consulting firms. The average assumption for inflation was 2.18%, with a range of 1.70% to 2.50%. However, the investment consulting firms typically set their assumptions based on a shorter time horizon, while actuaries must make much longer projections.

Economic Assumptions – Inflation

Forward-Looking Economic Data

The assumed rate of price inflation should not give undue weight to recent experience. Some historical economic data may not be appropriate for use in developing assumptions for future periods due to changes in the underlying economic environment. Professional forecasters, economists, and investors are reliable sources to guide in the selection and evaluation of expected future price inflation rates.

The Survey of Professional Forecasters, maintained by the Federal Reserve Bank of Philadelphia, is the longest running quarterly survey of macroeconomic forecasts in the U.S. Over 50 forecasters from industry, government, banking, and academics are included in this Survey. With respect to price inflation, their median projections are published quarterly for the annual-average Headline CPI over the next 10 years. Headline CPI is the total CPI, as opposed to Core CPI, which excludes food and energy prices. The following table presents the Survey's quarterly projections through the first quarter of 2019.

Quarterly Median Projections of the 10-Year Annual-Average Headline CPI-U Inflation (Philadelphia Federal Reserve)

2016-2	2016-3	2016-4	2017-1	2017-2	2017-3	2017-4	2018-1	2018-2	2018-3	2018-4	2019-1
2.20%	2.15%	2.22%	2.30%	2.30%	2.25%	2.20%	2.25%	2.30%	2.20%	2.21%	2.20%

Source: Federal Reserve Bank of Philadelphia – Survey of Professional Forecasters Quarterly (Inflation.xlsx)

The Congressional Budget Office (CBO) regularly publishes its Budget and Economic Outlook. This report includes a forecast of annual CPI-U (All Urban Consumers). The following table presents the CBO's forecast for calendar years 2019 – 2029, as published in its report dated January, 2019.

Consumer Price Index Forecast (CBO)

2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	Compound Average
2.20%	2.60%	2.50%	2.50%	2.50%	2.30%	2.30%	2.30%	2.30%	2.30%	2.30%	2.37%

Source: Congressional Budget Office – The Budget and Economic Outlook: 2019 – 2029, Table 2-3 (p. 30)

The Trustees of the Social Security system prepare and publish an annual report. Social Security's economists develop a forecast of future CPI-W (for Urban Wage Earners and Clerical Workers). The following table presents their forecasts in the 2019 annual report.

Social Security Trustees' Ultimate CPI-W Assumption for 2021 and Later

Low-cost	3.20%
Intermediate	2.60%
High-cost	2.00%

Source: 2019 Social Security Trustees' Report

The figures in the table above are based on a horizon that well exceeds the duration of the plan's liabilities.

Economic Assumptions – Inflation

Another source of information about future price inflation is the market for U.S. Treasury bonds. Comparing spreads between nominal and inflation-indexed treasury securities (TIPS) provides an estimate of the bond market's expectation of inflation over the next decade or more. However, this analysis ignores the inflation risk premium that buyers of U.S. Treasury bonds often demand, and it ignores the differences in liquidity between U.S. Treasury bonds and TIPS.

Treasury Constant Maturities (2018 Annual Yields)

Term	Nominal	Inflation-Indexed	Implied Inflation
10-year	2.91%	0.83%	2.08%
20-year	3.02%	0.93%	2.09%
30-year	3.11%	1.01%	2.10%

Source: Board of Governors of the Federal Reserve System, H.15 Selected Interest Rates for March 21, 2019

Based upon the reviewed data, we recommend changing the inflation assumption from 2.50% to 2.25%.

Economic Assumptions – Payroll Growth

Payroll growth (wage inflation) represents the expected growth in total payroll for a stable population. Increases or decreases in covered population that lead to a change in total payroll are not reflected in this assumption. 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 on 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 current payroll growth assumption is 3.25%, which is comprised of a 2.50% price inflation assumption plus a real wage growth assumption of 0.75%. The payroll growth assumption is used to develop the amount necessary to amortize the unfunded actuarial accrued liability using the level percent of pay methodology.

Wage inflation (as measured by increases in the National Average Earnings) has averaged 2.3% over the past decade, while general inflation averaged 1.8% during this same period. This would imply a real growth rate of 0.5% (i.e., 2.3% - 1.8%). Over the past 60 years, measured in the same way, the real growth rate was 0.8%. The 2019 Social Security Trustees report uses 1.2% as the long-range intermediate real-wage differential assumption. The low-cost assumption is 1.8% and the high-cost assumption is 0.6%.

Salary increases for longer-service employees are almost entirely driven by wage inflation. Many of the factors that result in pay increases are largely inapplicable or have diminished importance for longer-service employees. Step or service-related increases have ceased or are minimal. Promotions occur with less frequency. Additional training or acquisition of advanced degrees usually occurs early in the career. Thus, longer service employees' wages are assumed to grow at the overall rate of wage inflation.

SERF salary increases observed in the study level off after about twenty-five years of service. For members with 25 or more years of service, the observed average salary increase during the four-year period was 3.1%. Inflation during this four-year period averaged 1.7%. Therefore, long-service employees received an average salary increase of 1.4% above inflation.

Based upon the data reviewed, we recommend maintaining the current real wage growth assumption of 0.75%. When combined with the proposed 2.25% price inflation assumption, the recommended payroll growth assumption is 3.00%. As noted above, the recommended payroll growth assumption is appropriate for a stable population.

Economic Assumptions – Investment Return

Investment Return. The investment return assumption is the actuarial assumption that has the largest impact on actuarial valuation results.

It is our understanding that the SBI's most recent asset liability study resulted in an expected net rate of return of 7.3%, comprised of an inflation assumption of 2.25%, and a real rate of return assumption of 5.05%. The asset liability study was completed by Callan in 2016.

MSRS's Comprehensive Annual Financial Report for the fiscal year ending June 30, 2018 includes the following investment return statistics:

- SBI retirement funds returned 4.6 percentage points above the CPI over the last 20 years.
- The average return over the ten-year period ending June 30, 2018 was 7.8%.

The following chart shows the estimated annual investment return on an actuarial and market value basis for each year in the four-year period under consideration:

Fiscal Year Ending	Actuarial Value of Assets	Market Value of Assets
June 30, 2015	12.6%	4.4%
June 30, 2016	7.9%	-0.1%
June 30, 2017	9.9%	15.1%
June 30, 2018	9.5%	10.3%
Average annual investment return July 1, 2014 to June 30, 2018	**10.0%**	**7.3%**

Historical results provide some useful and interesting information but cannot be the sole basis for forward-looking assumptions.

Economic Assumptions – Investment Return

For purposes of budgeting contributions as a level percentage of payroll 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 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 likely investment return outcomes for the asset classes in the current investment policy. For purposes of this analysis, we have analyzed the System's investment policy with the capital market assumptions from fourteen nationally recognized investment consultants.

Our analysis is based on the GRS Capital Market Assumption Modeler (CMAM). Because GRS is a benefits consulting firm and does not develop or maintain our own capital market expectations, we request and monitor forward-looking expectations developed by several major investment consulting firms. We update our CMAM on an annual basis. The capital market assumptions in the 2019 CMAM are from the following investment consultants (in alphabetical order): Aon Hewitt, Blackrock, BNY Mellon, Callan, Cambridge, JPMorgan, Marquette Associates, Meketa, Mercer, NEPC, RVK, Verus, Voya and Wilshire. We believe the benefit of performing this analysis using multiple investment consulting 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 consultants to be as consistent as possible.

To the best of our ability, we have adapted the System's investment policy to fit with the consultants' assumptions adjusting for these known differences in assumptions and methodology. 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.

It is important to note that certain alternative asset classes such as hedge funds and private equity may have implicit or explicit expectations of higher returns. In February 2019, the American Academy of Actuaries issued a public policy practice note: Forecasting Investment Returns and Expected Return Assumptions for Pension Actuaries. This Practice Note suggests that for alternative asset classes such as private equity, forecasting returns is challenging due to lack of data. In particular:

> Private equity return expectations may be estimated by adding an illiquidity premium to the expected return for public equities. Some research papers identify this illiquidity premium at 2.5% to 3.0% based on historical analysis of available data. However, many practitioners opt for a more modest 1.0% to 2.5% illiquidity premium, as can be seen in their published capital market assumptions reports.

Economic Assumptions – Investment Return

One approach is to analyze the implied capital market line of the average expectations of the various asset classes of all the investment consultants. A regression analysis of these average expectations suggests that the return expectations for private equity in the CMAM may be 1.0% to 1.5% higher than implied by the level of risk. A similar analysis for hedge funds in the CMAM may be 0.5% to 1.0% higher than implied by the level of risk. For purposes of this analysis, no adjustment has been made.

Presented below is the current target asset allocation, provided to GRS by the SBI for use in this study:

Asset Class	Asset Allocation
Domestic Equity	36%
International Equity	17
Fixed Income	20
Private Markets	25
Cash	2

Additionally, the SBI provided the following clarifications:

- The percentage weightings for SBI's private market investment portfolio (market value and unfunded commitments) as of June 30, 2018 are 13.5% private equity, 2.1% private credit, 4.5% real assets, 2.2% real estate, and 2.8% distressed/opportunistic.
- The SBI does not establish an allocation target for each segment within private markets. The weightings shown above are not targets.

We note that any uninvested portion of the Private Markets allocation is held in public equity. The actual investment mix as of March 31, 2019, compared to the policy target, is as follows:

Asset Class	Policy Target Asset Allocation	Actual Asset Allocation
Public Equity	53%	63%
Fixed Income	12	11
Private Markets	25	15
Treasuries	8	9
Cash	2	2

Economic Assumptions – Investment Return

The arithmetic expected return developed from the actual asset allocation is shown in the table below.

The CMAM begins with the nominal expected return from each consultant (column 2), takes out each consultant's price inflation assumption (column 3) to arrive at the real return (column 4). We then incorporate the current price inflation assumption of 2.25% (column 5) to get the adjusted nominal return (column 6). Investment expenses not already netted out of the return and/or administrative expenses paid out of trust assets 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. 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.

ASOP No. 27, Section 3.6.2, states that the actuary "should recognize the uncertain nature of the items for which assumptions are selected and, as a result, may consider several different assumptions reasonable for a given measurement." This range of reasonable assumptions is evident from the summaries we show from our CMAM.

Investment Consultant	Investment Consultant Expected Nominal Return	Investment Consultant Inflation Assumption	Expected Real Return (2)–(3)	Actuary Inflation Assumption	Expected Nominal Return (4)+(5)	Investment 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	5.90%	2.20%	3.70%	2.25%	5.95%	0.00%	5.95%		12.59%
2	6.65%	2.50%	4.15%	2.25%	6.40%	0.00%	6.40%		13.90%
3	7.18%	2.50%	4.68%	2.25%	6.93%	0.00%	6.93%		15.30%
4	6.94%	2.20%	4.74%	2.25%	6.99%	0.00%	6.99%		11.81%
5	7.14%	2.00%	5.14%	2.25%	7.39%	0.00%	7.39%		12.73%
6	7.76%	2.21%	5.55%	2.25%	7.80%	0.00%	7.80%		15.65%
7	7.81%	2.25%	5.56%	2.25%	7.81%	0.00%	7.81%		15.14%
8	7.56%	2.00%	5.56%	2.25%	7.81%	0.00%	7.81%		14.19%
9	8.23%	2.26%	5.97%	2.25%	8.22%	0.00%	8.22%		16.72%
10	8.19%	2.31%	5.88%	2.25%	8.13%	0.00%	8.13%		14.90%
11	8.31%	2.15%	6.16%	2.25%	8.41%	0.00%	8.41%		14.20%
12	8.82%	2.30%	6.52%	2.25%	8.77%	0.00%	8.77%		14.46%
13	8.39%	1.70%	6.69%	2.25%	8.94%	0.00%	8.94%		14.75%
14	8.55%	2.00%	6.55%	2.25%	8.80%	0.00%	8.80%		13.27%
Average	**7.67%**	**2.18%**	**5.49%**	**2.25%**	**7.74%**	**0.00%**	**7.74%**		**14.26%**

The average expected nominal return from column 8 is 7.74%. This is the average arithmetic rate of return. Note that the arithmetic rate of return represents the average future expected return which is higher than the median future expected. Setting the valuation assumption at the arithmetic expected return means that over time it is less than 50% likely that this return will be achieved. Additional analysis is required to adjust to the median (or geometric average) return which produces the 50th percentile of expectation.

Economic Assumptions – Investment 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 7.50% over a 10-year horizon. Note that the investment horizon for most of the capital market assumption sets is between 5 and 10 years (the average is 9.7 or roughly 10 years) [1].

Investment Consultant	Distribution of 10-Year Average Geometric Net Nominal Return			Probability of Exceeding 7.50%
	40th	50th	60th	
(1)	(2)	(3)	(4)	(5)
1	4.22%	5.21%	6.22%	28.28%
2	4.41%	5.51%	6.61%	32.45%
3	4.65%	5.85%	7.07%	36.57%
4	5.41%	6.35%	7.29%	37.82%
5	5.64%	6.64%	7.66%	41.54%
6	5.45%	6.68%	7.92%	43.33%
7	5.57%	6.76%	7.96%	43.78%
8	5.77%	6.89%	8.02%	44.52%
9	5.65%	6.95%	8.28%	45.83%
10	5.95%	7.12%	8.30%	46.75%
11	6.38%	7.49%	8.62%	49.93%
12	6.68%	7.82%	8.97%	52.83%
13	6.79%	7.95%	9.12%	53.91%
14	6.96%	8.00%	9.06%	54.82%
Average	**5.68%**	**6.80%**	**7.94%**	**43.74%**

[1] We requested capital market assumptions over a longer horizon from each of the fourteen investment consultants. Six of the investment consultants provided capital market assumptions over a period of 20, 25, or 30 years, the other eight did not provide assumptions over a period longer than 10 years. Each of the six that provided assumptions over a longer horizon had different expectations after the first 10 years. However, two of those six indicated that return expectations after the 10th year were set based on historical return experience, as opposed to a market-based or forward-looking methodology that is predominately used in the development of the 10-year expectations. The other investment consultants did not provide a description of methodology for the longer horizon.

Economic Assumptions – Investment Return

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 6.80% per year.

Column 5 of table 2 shows the estimated probability of achieving this 7.50% assumed rate of return over a 10-year period. The average probability of achieving 7.50% over 10 years is 44%.

As noted above, the investment horizon for most of the capital market assumption sets is between 5 and 10 years. We developed a revised model that is based on additional capital market assumptions provided to GRS. We adjusted the standard model to include assumptions applying to time horizons of 20 to 30 years. The capital market assumptions in this revised model are from the following investment consultants (in alphabetical order) Aon Hewitt, BlackRock, Cambridge, Meketa, Mercer and NEPC.

In the revised model, the average expected nominal return increases from 7.74% to 8.41%, and the average of 50th percentile returns for the six investment consultants in the revised model increases from 6.80% to 7.42% per year. The probability of exceeding 7.50% increases from 44% to 49%.

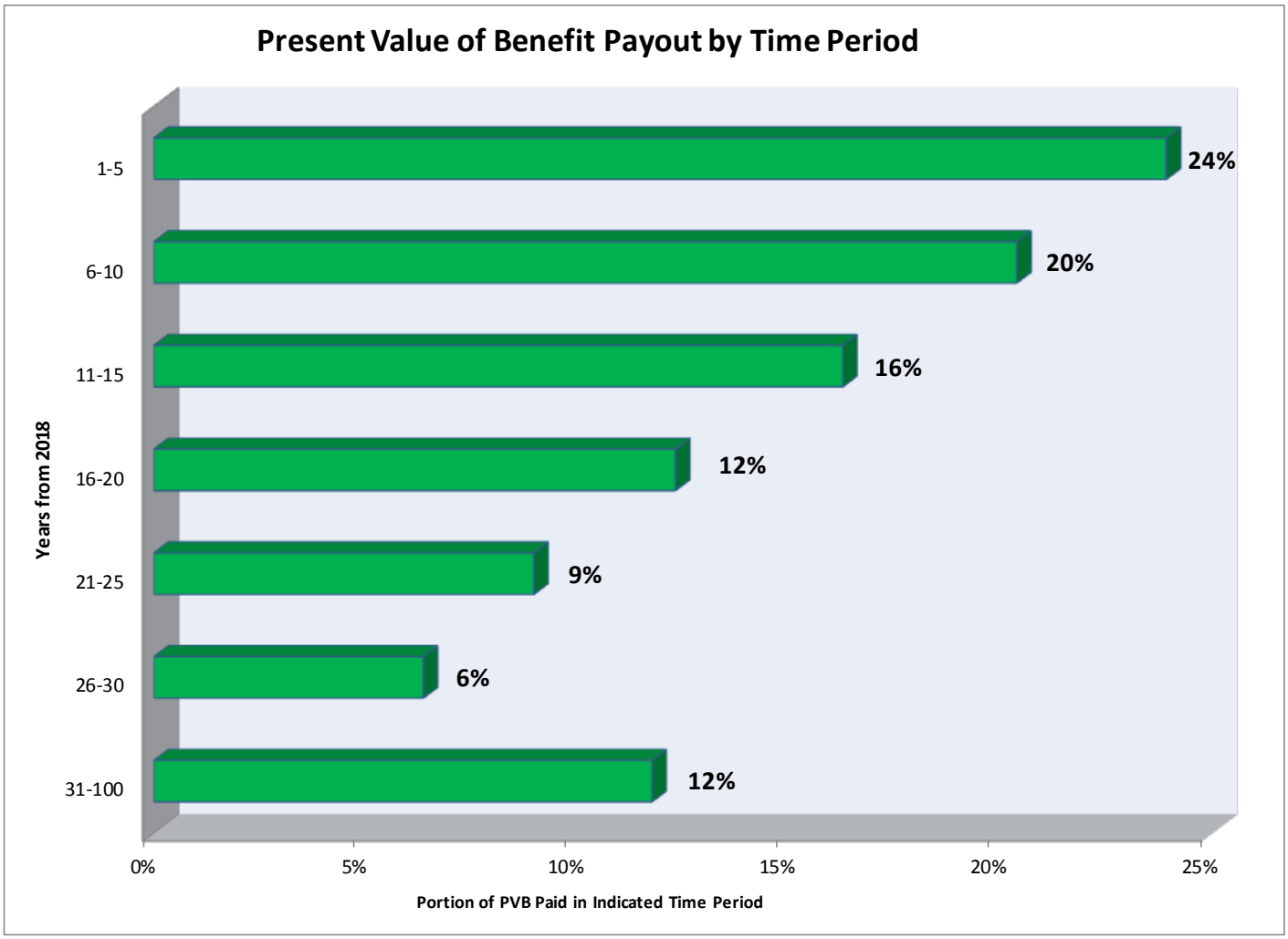
Keep in mind that the short-term does matter. Investment returns realized in the short term have a significant bearing on the long-term average return. As shown in the chart on the following page, a significant portion (44%) of liabilities will actually be paid out over the next ten years and 60% is estimated to be paid over the next fifteen years. Many of the investment consultants forecast relatively low returns for the next 10 or so years, followed by higher returns. Once the money is paid out, it will not be available to participate in the better returns that consultants predict for the longer term future.

The “right answer” is somewhere in between the two models, but is probably closer to the model based on shorter duration capital market assumptions.

In our opinion, the assumed rate of return of 7.50% is a reasonable assumption based on this analysis.

MSRS should note that the investment return assumption must be reviewed each year for reasonability based on actuarial standards. A rate near the median, such as 7.0%, would be more likely to be sustainable for a longer period. If in a future year the assumption is deemed unreasonable, we would need to qualify our report and we would not be able to use the assumption in the GASB calculations.

Nothing in this report should be construed as GRS giving investment advice.


Present Value of Benefit Payout by Time Period
Years from 2018
1-5
6-10
11-15
16-20
21-25
26-30
31-100
24%
20%
16%
12%
9%
6%
12%
0%
5%
10%
15%
20%
25%
Portion of PVB Paid in Indicated Time Period

SECTION C

PAY INCREASES

Pay Increases Due to Merit and Seniority

Pay increases granted to active members typically consist of two pieces:

- An across-the-board, economic type of increase granted to most or all members of the group. This increase is typically tied to inflation or cost-of-living changes, and

- An increase as a result of merit and seniority. This increase is typically related to the performance of an individual and includes promotions and increased years of experience.

The assumption for across-the-board increases is the pay inflation assumption discussed in Section B. The merit and seniority portion of pay increases is discussed on this page.

We reviewed the merit and seniority pay increases during the four-year period. For each year, we excluded individual pay increases that were more than 30% and also excluded individual pay increases that were less than -30%. Some occurrences of a negative salary increase are reasonable and expected in a plan that covers part-time employees. While this was a relatively small number of records, the experience distorted the experience of the overall group.

In order to study the merit and seniority portion of the salary increase assumption, it is necessary to separate out the portion attributable to wage inflation. General inflation, as measured by the change in the Consumer Price Index, has averaged about 1.7% over the four-year period ending June 30, 2018. During the same four-year period, the increase in the national average earnings has been about 2.8%, or 1.1% higher than inflation. Based on our review of salary experience for SERF members for the period July 1, 2014 through June 30, 2018, we observed that members with longer service averaged about a 3.1% annual increase for this period. For our analysis of the merit and seniority portion of total salary increase, we assumed that the salary increase amount in excess of the total salary increase for the longer-service members (i.e., those with 25 or more years of service) was attributable to wage inflation only. This assumes that once members reach a certain length of service, merit and seniority increases are much less common.

Pay Increases Due to Merit and Seniority

Findings

The assumed wage inflation was 3.75% at the beginning of the study period and 3.25% as of June 30, 2018. During the four years of the study, we estimated that the average actual wage inflation component of pay increases was around 3.1% for members of the State Employees Retirement Fund. This estimated actual increase was subtracted from the actual pay increases to obtain the estimated merit/seniority portion of the pay increases. It should be noted that the results of the analysis are very sensitive to the estimated wage inflation component.

Gross actual salary increases averaged 5.01% over the four-year period, ranging from 4.48% in 2018 to 5.56% in 2016. After adjusting for the 3.1% average wage inflation for this period, the average net salary increase (i.e., merit and seniority) averaged 1.91%, ranging from 1.38% to 2.46%.

Fiscal Year Ending	Count	Gross		Net*	
		Expected	Actual	Expected	Actual
2015	40,520	5.21%	5.20%	1.96%	2.10%
2016	40,318	5.17%	5.56%	1.92%	2.46%
2017	41,682	5.35%	4.85%	2.10%	1.75%
2018	41,651	5.31%	4.48%	2.06%	1.38%
Total	**164,171**	**5.26%**	**5.01%**	**2.01%**	**1.91%**

* *Net Expected increases are equal to Gross Expected increases minus the current assumed wage inflation assumption of 3.25%. Net Actual increases are equal to Gross Actual increases minus the estimated actual wage inflation for the period of 3.1%.*

The results of our analysis are shown on the following page. Using the techniques described above, observed merit and seniority pay increases were generally slightly lower than the presently assumed increases during the first few years and generally slightly higher than the current assumption during years three and later. The result is that the proposed merit and seniority increases are approximately the same on average but with a slightly different allocation, with lower increases assumed at the beginning of a member's career. When combined with the proposed decrease in payroll growth assumption, the result is an overall decrease in gross salary increase rates.

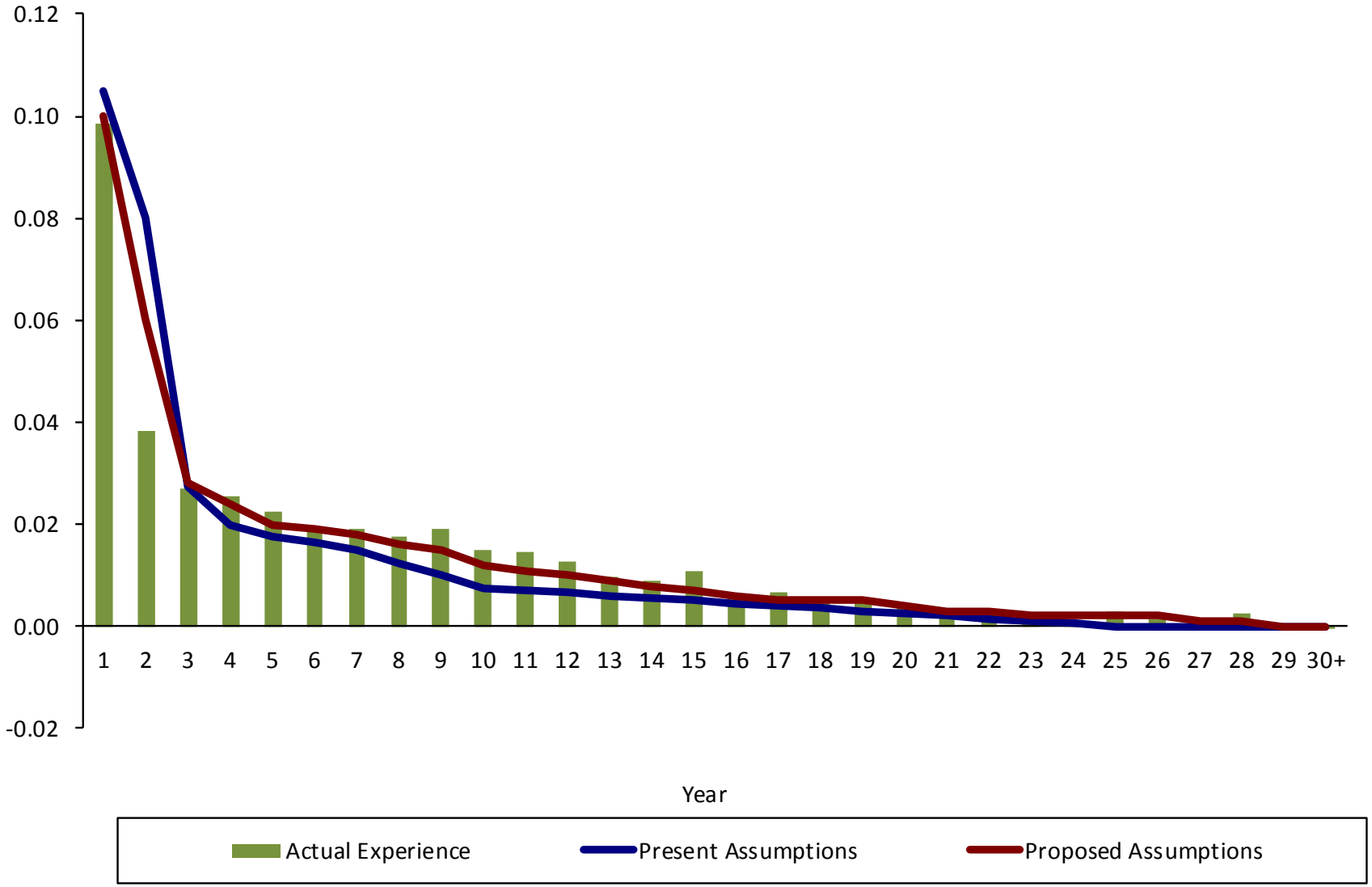
Recommendation

We recommend adjustments to the current merit/seniority pay increase assumption as shown on the following page.

Pay Increases Due to Merit and Seniority

Year	Exposures	Total Salary % Increase			Merit & Seniority % Increase		
		Actual	Current	Proposed	Actual	Current	Proposed
1	9,456	12.95%	13.75%	13.00%	9.85%	10.50%	10.00%
2	12,982	6.92%	11.25%	9.00%	3.82%	8.00%	6.00%
3	11,263	5.79%	6.00%	5.80%	2.69%	2.75%	2.80%
4	9,431	5.66%	5.25%	5.40%	2.56%	2.00%	2.40%
5	7,833	5.34%	5.00%	5.00%	2.24%	1.75%	2.00%
6	6,670	4.99%	4.90%	4.90%	1.89%	1.65%	1.90%
7	6,398	5.02%	4.75%	4.80%	1.92%	1.50%	1.80%
8	6,767	4.87%	4.50%	4.60%	1.77%	1.25%	1.60%
9	6,911	5.00%	4.25%	4.50%	1.90%	1.00%	1.50%
10	6,447	4.58%	4.00%	4.20%	1.48%	0.75%	1.20%
11	5,607	4.56%	3.95%	4.10%	1.46%	0.70%	1.10%
12	4,653	4.36%	3.90%	4.00%	1.26%	0.65%	1.00%
13	4,192	4.08%	3.85%	3.90%	0.98%	0.60%	0.90%
14	4,207	3.99%	3.80%	3.80%	0.89%	0.55%	0.80%
15	4,410	4.19%	3.75%	3.70%	1.09%	0.50%	0.70%
16	4,619	3.69%	3.70%	3.60%	0.59%	0.45%	0.60%
17	4,531	3.78%	3.65%	3.50%	0.68%	0.40%	0.50%
18	4,057	3.67%	3.60%	3.50%	0.57%	0.35%	0.50%
19	3,452	3.66%	3.55%	3.50%	0.56%	0.30%	0.50%
20	2,981	3.46%	3.50%	3.40%	0.36%	0.25%	0.40%
21	2,602	3.32%	3.45%	3.30%	0.22%	0.20%	0.30%
22	2,401	3.40%	3.40%	3.30%	0.30%	0.15%	0.30%
23	2,271	3.20%	3.35%	3.20%	0.10%	0.10%	0.20%
24	2,221	3.19%	3.30%	3.20%	0.09%	0.05%	0.20%
25	2,401	3.39%	3.25%	3.20%	0.29%	0.00%	0.20%
26	2,503	3.23%	3.25%	3.20%	0.13%	0.00%	0.20%
27	2,565	3.10%	3.25%	3.10%	0.00%	0.00%	0.10%
28	2,455	3.34%	3.25%	3.10%	0.24%	0.00%	0.10%
29	2,207	3.01%	3.25%	3.00%	-0.09%	0.00%	0.00%
30+	15,678	3.05%	3.25%	3.00%	-0.05%	0.00%	0.00%
Total	**164,171**	**5.01%**	**5.26%**	**5.01%**	**1.91%**	**2.01%**	**2.01%**

Pay Increases Due to Merit and Seniority



SECTION D

RETIREMENT EXPERIENCE

Liability Weighted Analysis

Our experience with similar systems has shown that sometimes the use of assumptions based solely on counts of people retiring or terminating employment does not always reduce the size of the gain or loss in a particular decrement. Sometimes this can be due to the relative magnitude of the actuarial accrued liability of the members that decrement, rather than number counts alone. Consistent with the last experience study, 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 (particularly with reduced retirement) 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 are typically not decisions at all but rather events that happen. Comments on specific assumptions are provided on the following pages.

While mortality is not 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 than others. As such, we also studied mortality rates on a 'benefit weighted' basis. This is discussed in more detail on page G-1.

Age and Service Unreduced (Normal) Retirement

Findings

The benefit provisions of the State Employees Retirement Fund (SERF) establish the minimum age and service requirements for unreduced or normal retirement. However, the actual cost of retirement is determined when members actually retire. The assumption about timing of retirements is a major ingredient in cost calculations. Note that higher rates of retirement with full benefits generally results in higher computed contributions, and vice-versa.

Some members terminate employment with eligibility for retirement but elect to defer the benefit. We included these terminations as retirements for the purposes of this study.

The current assumption ends at age 71; in other words, we assume all members currently under the age of 71 will retire by the age of 71. However, for members currently age 71 or older, we assume retirement one year after the valuation date (effectively 18 months due to mid-year decrementing), as required by the Minnesota Standards for Actuarial Work. As such, there are no Exposures for ages over 71 since the valuation assumption is all of these members work an additional year and then retire. During the four-year period, there were 270 actual retirements at ages 71 and older including 83 actual retirements at age 71. We believe assuming 100% retirement at age 71 is an appropriately conservative approach.

Overall, on both a population-weighted and liability-weighted basis, the plan experienced more unreduced retirements than projected by the present assumptions. We recommend increasing the assumed unreduced retirement rates, as shown on the next page.

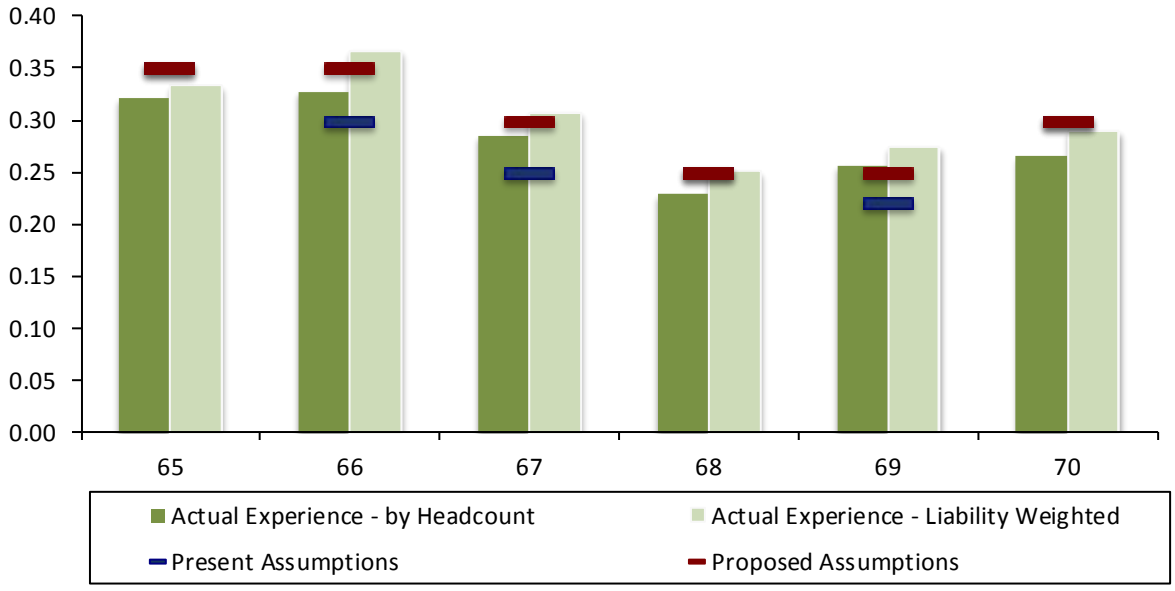
Age and Service Unreduced (Normal) Retirement

Recommendations

We recommend changes to the retirement rates as indicated below, which increase rates at all ages but not as much as the liability weighted actual experience suggests. In addition, we recommend the Minnesota Standards for Actuarial Work be modified to remove the requirement that members currently over age 70 delay retirement one year and instead assume these members retire mid-year, the same as members younger than age 71.

Age	Actual Retirements ($000s)	Exposure ($000s)	Crude Rates		Rates		Expected Retirements ($000s)		Actual / Expected	
			Population	Liability	Present	Proposed	Present	Proposed	Present	Proposed
65	177,539	533,056	32.1%	33.3%	35.0%	35.0%	186,570	186,570	95.2%	95.2%
66	221,231	603,103	32.8%	36.7%	30.0%	35.0%	180,931	211,086	122.3%	104.8%
67	113,266	368,034	28.5%	30.8%	25.0%	30.0%	92,009	110,410	123.1%	102.6%
68	61,740	246,150	22.9%	25.1%	25.0%	25.0%	61,538	61,538	100.3%	100.3%
69	47,308	172,282	25.6%	27.5%	22.0%	25.0%	37,902	43,071	124.8%	109.8%
70	33,363	115,160	26.5%	29.0%	30.0%	30.0%	34,548	34,548	96.6%	96.6%
71+	*	*	N/A	N/A	100.0%	*	0	0	N/A	N/A
Totals	**654,447**	**2,037,785**					**593,497**	**647,222**	**110.3%**	**101.1%**

* *The current assumption prescribed by the Minnesota Standards for Actuarial Work is that members who have reached 100% retirement eligibility will delay retirement for one year. Therefore, even though there are members that are over age 70, these members are not included in the Exposures since retirement is assumed to be delayed one year. There were 270 actual retirements over age 70.*



Rule of 90 (Unreduced) Early Retirement

Findings

SERF members who were hired prior to July 1, 1989 may retire with an unreduced benefit when age plus service is at least 90 years. We refer to these cases as Rule of 90 early retirements.

Generally, because of the subsidized early retirement benefit, these members are expected to retire at a higher rate than those members that do not qualify for Rule of 90. Higher rates of early retirement generally result in higher computed contributions due to the enhanced benefit, and vice-versa.

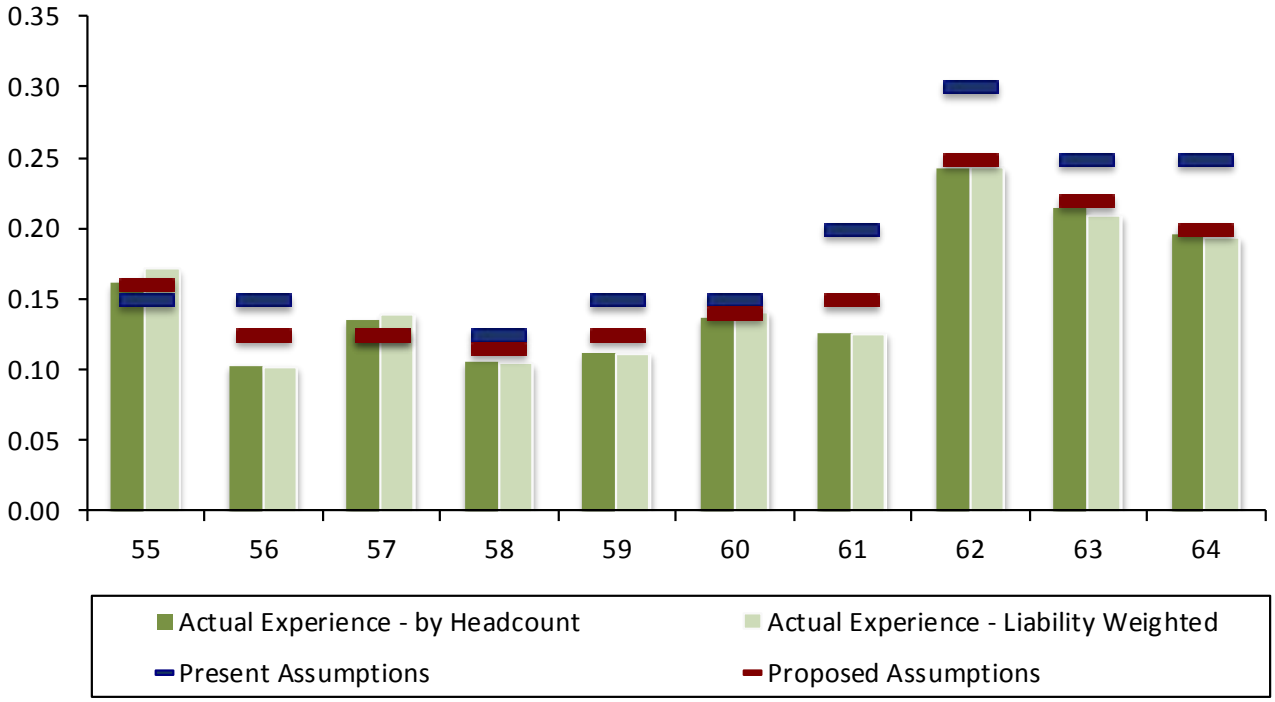
We reviewed the experience during the study period. Overall, on both a population-weighted and liability-weighted basis, the plan experienced fewer Rule of 90 early retirements than projected by the present assumptions. Similar experience was observed in the 2008 – 2014 period.

Recommendation

We recommend lowering the assumed Rule of 90 retirement rates to reflect the lower utilization observed.

Rule of 90 (Unreduced) Early Retirement

Age	Actual Retirements ($000s)	Exposure ($000s)	Crude Rates		Rates		Expected Retirements ($000s)		Actual / Expected	
			Population	Liability	Present	Proposed	Present	Proposed	Present	Proposed
55	20,968	122,239	16.2%	17.2%	15.0%	16.0%	18,336	19,558	114.4%	107.2%
56	23,822	231,773	10.3%	10.3%	15.0%	12.5%	34,766	28,972	68.5%	82.2%
57	51,216	367,353	13.6%	13.9%	12.5%	12.5%	45,919	45,919	111.5%	111.5%
58	50,554	481,239	10.6%	10.5%	12.5%	11.5%	60,155	55,342	84.0%	91.3%
59	67,832	604,359	11.2%	11.2%	15.0%	12.5%	90,654	75,545	74.8%	89.8%
60	100,135	706,648	13.7%	14.2%	15.0%	14.0%	105,997	98,931	94.5%	101.2%
61	95,742	758,531	12.6%	12.6%	20.0%	15.0%	151,706	113,780	63.1%	84.1%
62	189,175	777,883	24.4%	24.3%	30.0%	25.0%	233,365	194,471	81.1%	97.3%
63	141,136	673,098	21.5%	21.0%	25.0%	22.0%	168,275	148,082	83.9%	95.3%
64	114,387	589,583	19.7%	19.4%	25.0%	20.0%	147,396	117,917	77.6%	97.0%
Totals	**854,967**	**5,312,706**	**16.1%**	**16.1%**	**19.9%**	**16.9%**	**1,056,568**	**898,516**	**80.9%**	**95.2%**



Tier 1 Reduced Early Retirement

Findings

SERF members who were hired prior to July 1, 1989 (Tier 1 members) may also retire with a reduced benefit prior to the attainment of Normal Retirement. We refer to these cases as Tier 1 early retirements.

The early retirement benefit payable to Tier 1 members is the greater of (a) or (b):

(a) 1.2% of average salary for each of the first ten years of service and 1.7% for each subsequent year with a reduction equal to 0.25% for each month the member is under age 65 (or age 62 if 30 or more years of service).
(b) 1.7% of average salary for each year of service with actuarial reduction for each month the member is under age 65.

Because these benefits are reduced, these members are expected to retire at a lower rate than Tier 1 members who have attained Rule of 90. Higher rates of early retirement generally result in higher computed contributions due to the enhanced benefit, and vice-versa.

We reviewed the experience during the study period. Overall, on both a population-weighted and liability-weighted basis, the plan experienced fewer Tier 1 reduced early retirements than projected by the present assumptions.

Early retirement benefits were changed as follows effective June 30, 2018:

- the augmentation adjustment in actuarial early retirement factors is eliminated over a five-year period starting July 1, 2019, resulting in actuarial equivalence after June 30, 2024;
- post-retirement benefit increases changed to 1.0% for five years beginning January 1, 2019 and 1.5% thereafter; and
- the first benefit increase is delayed until Normal Retirement Age for retirements on or after January 1, 2024

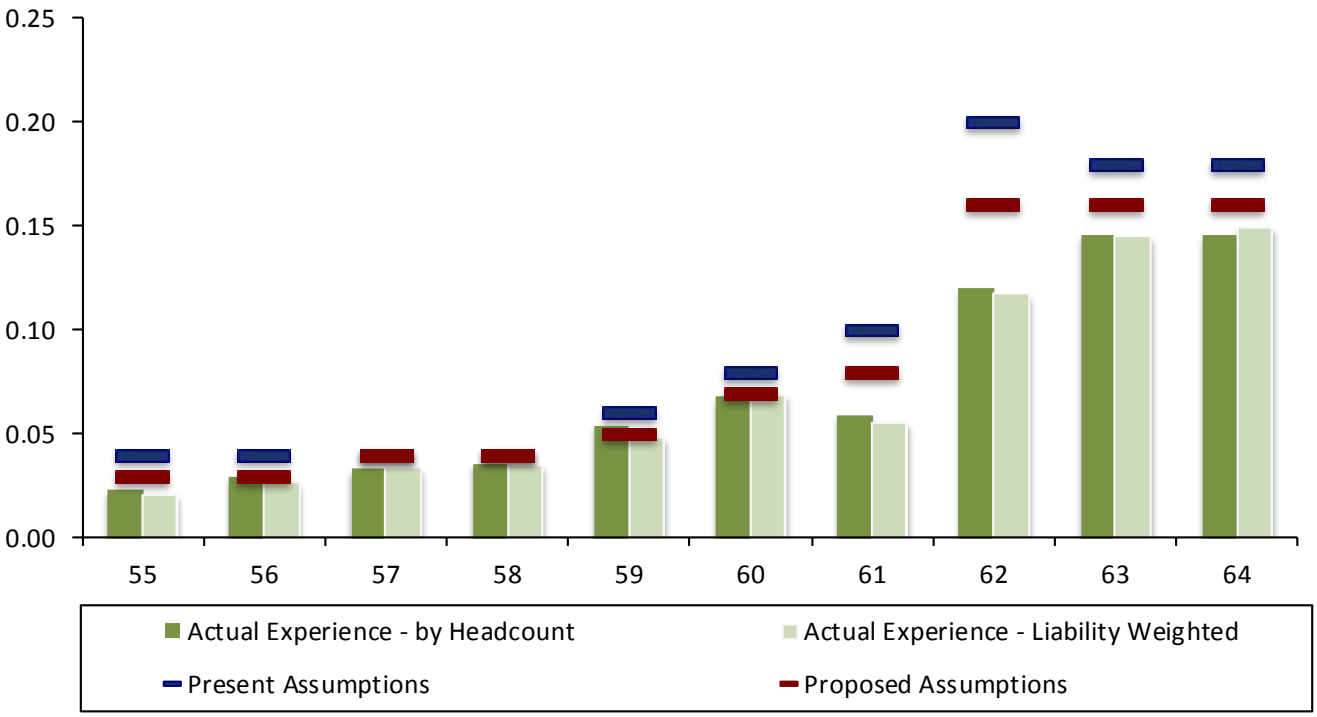
These changes may impact retirement behavior in the future and will be analyzed in the next experience study. Our recommendation to reduce Tier 1 early retirement rates is consistent with the expected behavior changes.

Recommendation

We recommend reductions to the Tier 1 Reduced early retirement rates, as indicated on the next page.

Tier 1 Reduced Early Retirement

Age	Actual Retirements ($000s)	Exposure ($000s)	Crude Rates		Rates		Expected Retirements ($000s)		Actual / Expected	
			Population	Liability	Present	Proposed	Present	Proposed	Present	Proposed
55	11,395	536,741	2.3%	2.1%	4.0%	3.0%	21,470	16,102	53.1%	70.8%
56	13,461	509,156	2.9%	2.6%	4.0%	3.0%	20,366	15,275	66.1%	88.1%
57	15,023	441,379	3.3%	3.4%	4.0%	4.0%	17,655	17,655	85.1%	85.1%
58	13,911	392,305	3.6%	3.5%	4.0%	4.0%	15,692	15,692	88.6%	88.6%
59	15,505	317,937	5.4%	4.9%	6.0%	5.0%	19,076	15,897	81.3%	97.5%
60	16,123	232,629	6.8%	6.9%	8.0%	7.0%	18,610	16,284	86.6%	99.0%
61	9,233	165,218	5.9%	5.6%	10.0%	8.0%	16,522	13,217	55.9%	69.9%
62	12,170	103,571	12.0%	11.8%	20.0%	16.0%	20,714	16,571	58.8%	73.4%
63	10,426	71,914	14.6%	14.5%	18.0%	16.0%	12,945	11,506	80.5%	90.6%
64	6,957	46,457	14.5%	15.0%	18.0%	16.0%	8,362	7,433	83.2%	93.6%
Totals	**124,204**	**2,817,307**	**5.0%**	**4.4%**	**6.1%**	**5.2%**	**171,413**	**145,633**	**72.5%**	**85.3%**



Tier 2 Reduced Early Retirement

Findings

SERF members who were hired after June 30, 1989 (Tier 2 members) may retire with a reduced benefit prior to the attainment of Normal Retirement. We refer to these cases as Tier 2 early retirements.

The Tier 2 early retirement benefit is the actuarial equivalent of the member's Normal Retirement benefit. In other words, there is no subsidy for early retirement. Because of the actuarially equivalent early retirement reduction, these members' benefits have about the same value as the deferred benefit to which they would be eligible if they did not request early commencement of the benefit. Higher rates of early retirement generally result in slightly lower computed contributions, and vice-versa.

We reviewed the experience during the study period. On both a population-weighted and liability-weighted basis, there were fewer Tier 2 reduced early retirements than projected by the present assumptions.

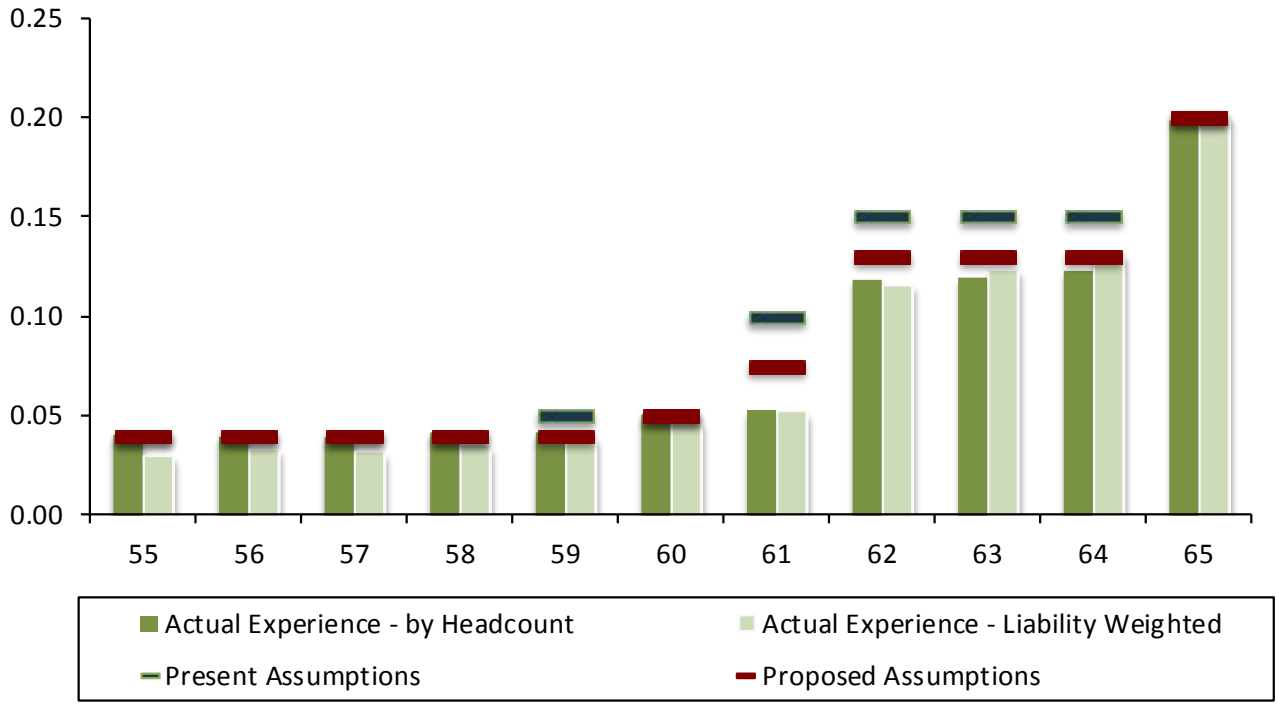
Legislative changes to early retirement benefits are described on page D-6. Our recommendation to reduce Tier 2 early retirement rates is consistent with the expected behavior changes.

Recommendation

We recommend reductions in Tier 2 early retirement rates, as indicated on the next page.

Tier 2 Reduced Early Retirement

Age	Actual Retirements ($000s)	Exposure ($000s)	Crude Rates		Rates		Expected Retirements ($000s)		Actual / Expected	
			Population	Liability	Present	Proposed	Present	Proposed	Present	Proposed
55	18,301	618,399	3.9%	3.0%	4.0%	4.0%	24,736	24,736	74.0%	74.0%
56	19,921	604,589	3.8%	3.3%	4.0%	4.0%	24,184	24,184	82.4%	82.4%
57	18,770	598,767	3.8%	3.1%	4.0%	4.0%	23,951	23,951	78.4%	78.4%
58	20,082	584,366	4.1%	3.4%	4.0%	4.0%	23,375	23,375	85.9%	85.9%
59	22,051	571,906	4.1%	3.9%	5.0%	4.0%	28,595	22,876	77.1%	96.4%
60	25,869	550,594	5.0%	4.7%	5.0%	5.0%	27,530	27,530	94.0%	94.0%
61	26,746	520,685	5.2%	5.1%	10.0%	7.5%	52,069	39,051	51.4%	68.5%
62	57,031	495,944	11.8%	11.5%	15.0%	13.0%	74,392	64,473	76.7%	88.5%
63	52,777	429,142	11.8%	12.3%	15.0%	13.0%	64,371	55,788	82.0%	94.6%
64	47,943	366,887	12.2%	13.1%	15.0%	13.0%	55,033	47,695	87.1%	100.5%
65	60,433	301,753	19.8%	20.0%	20.0%	20.0%	60,351	60,351	100.1%	100.1%
Totals	**369,924**	**5,643,032**	**6.8%**	**6.6%**	**8.1%**	**7.3%**	**458,585**	**414,009**	**80.7%**	**89.4%**



Retirement from Deferred Status

Members who terminate after completing three years of service (five if hired after June 30, 2010) are vested and entitled to either a refund of employee contributions, with interest, or a deferred retirement benefit.

While some members actually elect a refund even if it is less valuable than the deferred annuity, the current valuation assumption is that members will elect a refund only if it is more valuable than the deferred annuity. When a member elects a refund that is less valuable than his or her deferred annuity (or when a member elects the deferred annuity even if the refund is more valuable), the plan experiences a small liability gain. Since the current assumption results in very small gains to the plan, we recommend no change to this assumption.

For those deferred vested members for whom the deferred benefit is more valuable than a refund, the current valuation assumption is that the member will commence benefits at Normal Retirement Age. Except for long-service members hired prior to July 1, 1989 that may qualify for a subsidized reduction, when a member elects to commence benefits prior to Normal Retirement Age, the benefit is reduced on an actuarially equivalent basis, meaning there is no liability gain or loss to the plan. We recommend no change to this set of assumptions.

SECTION E

WITHDRAWAL EXPERIENCE

Withdrawal Experience

Members who leave active employment, for reasons other than retirement, disability or death, may be eligible for the following payments from the pension trust:

- A refund of employee contributions, or
- A deferred retirement benefit, if they are vested.

Deferred retirement benefits are based on the pay and service credit at the time of withdrawal. The benefit is increased with augmentation (if applicable) from termination until January 1, 2019 and is payable at Normal Retirement (or at Early Retirement with a reduction). Consequently, members who withdraw receive much less from the plan than members who stay in employment until retirement. Higher rates of withdrawal result in lower computed contributions, and vice-versa.

Some members are eligible for retirement when they terminate employment but elect to defer the benefit and are consequently reported for the valuation as a termination with a deferred benefit. We included these terminations as retirements for the purposes of this study.

Current valuation termination rates for members are gender-specific and service-based. The withdrawal assumption review was done on a liability-weighted basis, as described earlier in the report.

Withdrawal Experience

Findings

When we reviewed the liability that decremented out of the plan during the prior four-year period, we observed that the plan experienced slightly more liability than expected decrementing from the plan due to terminations.

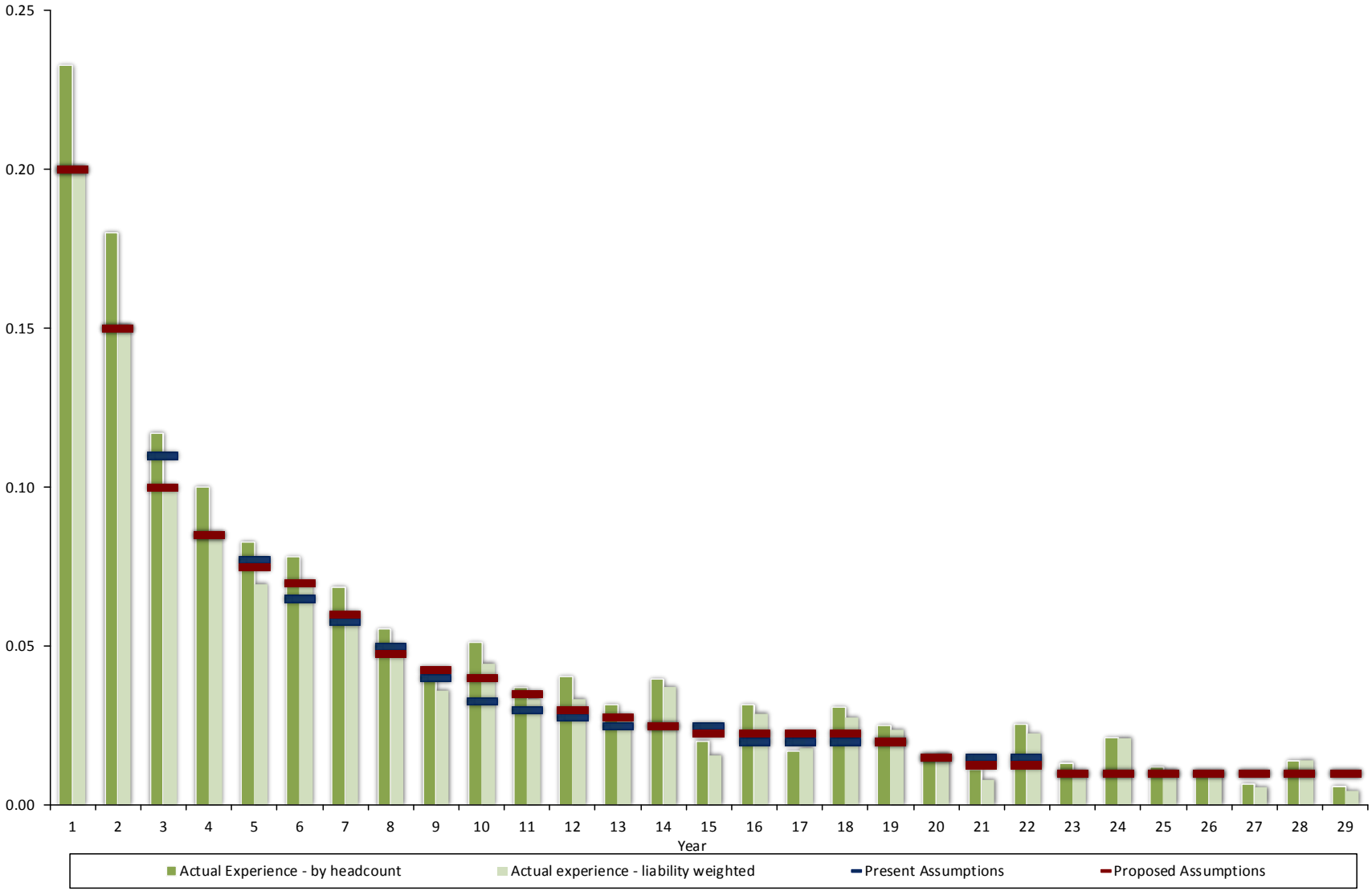
Recommendation

We have recommended proposed rates which are slightly lower than current rates during the first several years of employment and slightly higher in later years.

Withdrawal Experience
Males

Year	Liability Weighted ($ 000s)		Crude Rates		Sample Rates		Liability Weighted ($ 000s)			
							Expected Withdrawals		Ratio of Actuals/Expecteds	
	Withdrawal	Exposure	Liability Weighted	Population Weighted	Present	Proposed	Present	Proposed	Present	Proposed
1	21,236	105,813	0.2007	0.2328	0.2000	0.2000	21,163	21,163	100.3%	100.3%
2	53,797	356,148	0.1511	0.1803	0.1500	0.1500	53,422	53,422	100.7%	100.7%
3	35,396	355,337	0.0996	0.1172	0.1100	0.1000	39,087	35,534	90.6%	99.6%
4	28,306	337,124	0.0840	0.1002	0.0850	0.0850	28,656	28,656	98.8%	98.8%
5	20,230	290,392	0.0697	0.0829	0.0775	0.0750	22,505	21,779	89.9%	92.9%
6	16,634	239,871	0.0693	0.0781	0.0650	0.0700	15,592	16,791	106.7%	99.1%
7	13,984	232,432	0.0602	0.0687	0.0575	0.0600	13,365	13,946	104.6%	100.3%
8	12,205	253,457	0.0482	0.0553	0.0500	0.0475	12,673	12,039	96.3%	101.4%
9	9,487	262,421	0.0362	0.0410	0.0400	0.0425	10,497	11,153	90.4%	85.1%
10	11,579	258,771	0.0447	0.0511	0.0325	0.0400	8,410	10,351	137.7%	111.9%
11	8,116	242,469	0.0335	0.0369	0.0300	0.0350	7,274	8,486	111.6%	95.6%
12	6,789	202,930	0.0335	0.0404	0.0275	0.0300	5,581	6,088	121.6%	111.5%
13	5,258	188,820	0.0278	0.0316	0.0250	0.0275	4,721	5,193	111.4%	101.3%
14	7,296	195,845	0.0373	0.0396	0.0250	0.0250	4,896	4,896	149.0%	149.0%
15	3,176	201,657	0.0157	0.0202	0.0250	0.0225	5,041	4,537	63.0%	70.0%
16	6,721	232,138	0.0290	0.0315	0.0200	0.0225	4,643	5,223	144.8%	128.7%
17	4,529	252,773	0.0179	0.0169	0.0200	0.0225	5,055	5,687	89.6%	79.6%
18	6,682	242,448	0.0276	0.0308	0.0200	0.0225	4,849	5,455	137.8%	122.5%
19	5,341	225,218	0.0237	0.0250	0.0200	0.0200	4,504	4,504	118.6%	118.6%
20	3,046	187,469	0.0162	0.0159	0.0150	0.0150	2,812	2,812	108.3%	108.3%
21	1,276	159,475	0.0080	0.0112	0.0150	0.0125	2,392	1,993	53.4%	64.0%
22	3,046	135,433	0.0225	0.0254	0.0150	0.0125	2,031	1,693	150.0%	179.9%
23	1,211	128,192	0.0094	0.0133	0.0100	0.0100	1,282	1,282	94.4%	94.4%
24	2,512	118,340	0.0212	0.0212	0.0100	0.0100	1,183	1,183	212.4%	212.4%
25	1,419	131,747	0.0108	0.0119	0.0100	0.0100	1,317	1,317	107.8%	107.8%
26	1,382	137,705	0.0100	0.0103	0.0100	0.0100	1,377	1,377	100.3%	100.3%
27	779	138,338	0.0056	0.0067	0.0100	0.0100	1,383	1,383	56.3%	56.3%
28	2,055	144,860	0.0142	0.0141	0.0100	0.0100	1,449	1,449	141.8%	141.8%
29	539	121,456	0.0044	0.0061	0.0100	0.0100	1,215	1,215	44.4%	44.4%
30+	1,796	354,079	0.0051	0.0079	0.0100	0.0100	3,541	3,541	50.7%	50.7%
Totals	**295,823**	**6,433,157**	**0.0460**	**0.0888**	**0.0454**	**0.0457**	**291,916**	**294,148**	**101.3%**	**100.6%**

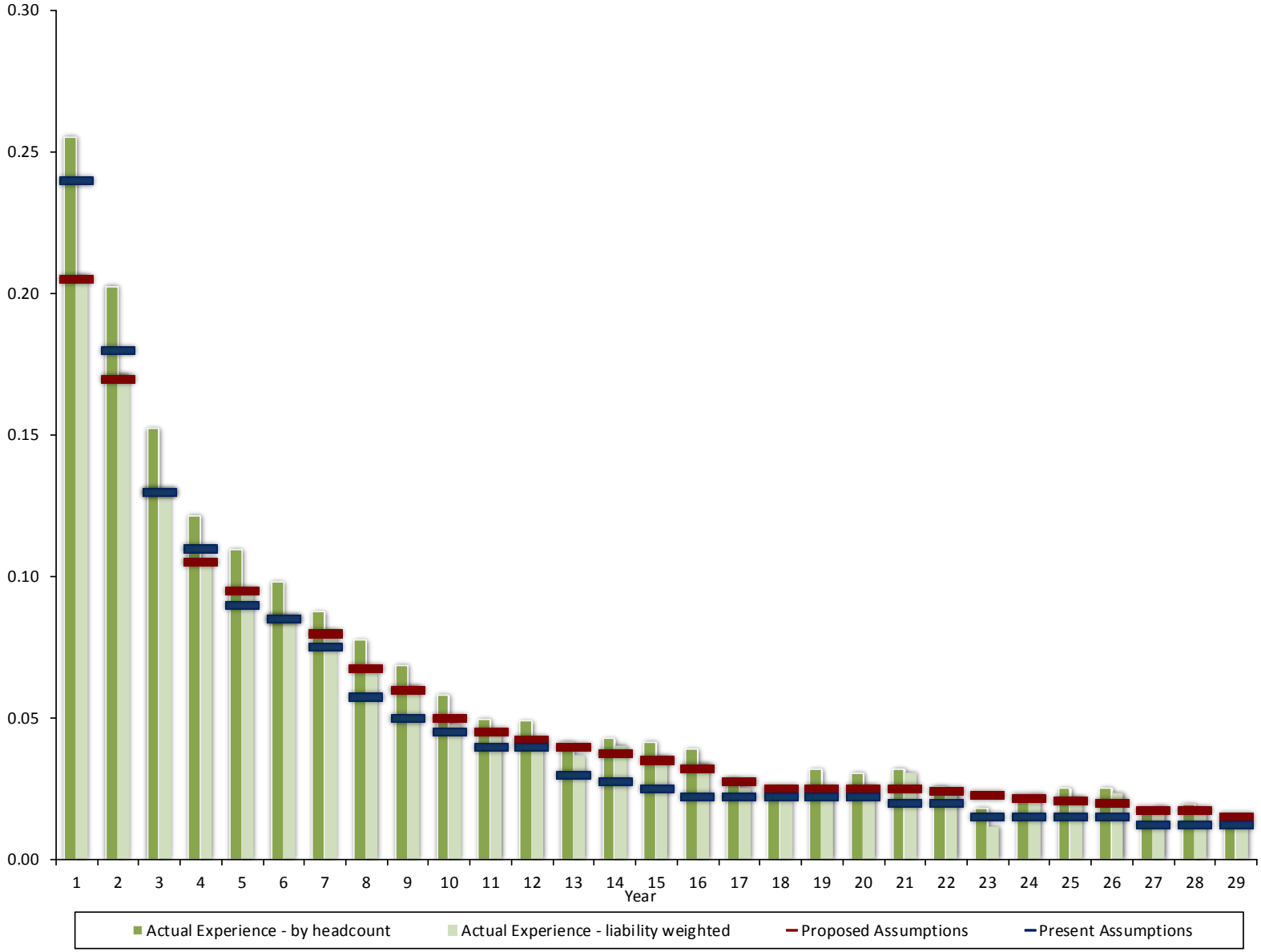
Withdrawal Experience
Males



Withdrawal Experience
Females

Year	Liability Weighted ($ 000s)		Crude Rates		Sample Rates		Liability Weighted ($ 000s)			
							Expected Withdrawals		Ratio of Actuals/Expecteds	
	Withdrawals	Exposure	Liability Weighted	Population Weighted	Present	Proposed	Present	Proposed	Present	Proposed
1	24,890	120,852	0.2060	0.2551	0.2400	0.2050	29,004	24,775	85.8%	100.5%
2	70,131	409,644	0.1712	0.2024	0.1800	0.1700	73,736	69,639	95.1%	100.7%
3	51,471	398,706	0.1291	0.1520	0.1300	0.1300	51,832	51,832	99.3%	99.3%
4	37,856	360,066	0.1051	0.1213	0.1100	0.1050	39,607	37,807	95.6%	100.1%
5	28,557	299,578	0.0953	0.1093	0.0900	0.0950	26,962	28,460	105.9%	100.3%
6	20,019	238,502	0.0839	0.0979	0.0850	0.0850	20,273	20,273	98.7%	98.7%
7	18,475	229,350	0.0806	0.0874	0.0750	0.0800	17,201	18,348	107.4%	100.7%
8	17,301	263,016	0.0658	0.0774	0.0575	0.0675	15,123	17,754	114.4%	97.4%
9	17,909	292,899	0.0611	0.0686	0.0500	0.0600	14,645	17,574	122.3%	101.9%
10	14,519	304,942	0.0476	0.0580	0.0450	0.0500	13,722	15,247	105.8%	95.2%
11	13,077	293,107	0.0446	0.0495	0.0400	0.0450	11,724	13,190	111.5%	99.1%
12	10,476	253,390	0.0413	0.0488	0.0400	0.0425	10,136	10,769	103.4%	97.3%
13	8,257	225,606	0.0366	0.0414	0.0300	0.0400	6,768	9,024	122.0%	91.5%
14	8,827	218,975	0.0403	0.0425	0.0275	0.0375	6,022	8,212	146.6%	107.5%
15	8,161	224,864	0.0363	0.0414	0.0250	0.0350	5,622	7,870	145.2%	103.7%
16	8,133	241,823	0.0336	0.0389	0.0225	0.0325	5,441	7,859	149.5%	103.5%
17	6,240	246,238	0.0253	0.0285	0.0225	0.0275	5,540	6,772	112.6%	92.1%
18	4,831	235,255	0.0205	0.0238	0.0225	0.0250	5,293	5,881	91.3%	82.1%
19	5,064	205,693	0.0246	0.0317	0.0225	0.0250	4,628	5,142	109.4%	98.5%
20	4,788	185,491	0.0258	0.0305	0.0225	0.0250	4,174	4,637	114.7%	103.3%
21	5,031	164,665	0.0306	0.0320	0.0200	0.0250	3,293	4,117	152.8%	122.2%
22	3,294	139,686	0.0236	0.0256	0.0200	0.0240	2,794	3,352	117.9%	98.3%
23	1,515	132,548	0.0114	0.0182	0.0150	0.0230	1,988	3,049	76.2%	49.7%
24	2,679	120,511	0.0222	0.0210	0.0150	0.0220	1,808	2,651	148.2%	101.1%
25	2,716	125,108	0.0217	0.0251	0.0150	0.0210	1,877	2,627	144.7%	103.4%
26	3,078	131,328	0.0234	0.0252	0.0150	0.0200	1,970	2,627	156.2%	117.2%
27	2,513	136,942	0.0183	0.0161	0.0125	0.0175	1,712	2,396	146.8%	104.9%
28	2,459	139,562	0.0176	0.0194	0.0125	0.0175	1,745	2,442	140.9%	100.7%
29	1,722	126,662	0.0136	0.0130	0.0125	0.0150	1,583	1,900	108.8%	90.6%
30+	5,809	591,937	0.0098	0.0118	0.0100	0.0100	5,919	5,919	98.1%	98.1%
Totals	**409,798**	**7,056,947**	**0.0581**	**0.1113**	**0.0556**	**0.0584**	**392,142**	**412,145**	**104.5%**	**99.4%**

Withdrawal Experience
Females



SECTION F

DISABILITY EXPERIENCE

Disability Experience

The assumed rates of disability (leaving active service due to injury or illness while not entitled to age and service retirement benefits) are a minor ingredient in cost calculations, since the incidence of disability is low. Higher rates of disability generally result in somewhat higher computed contributions, and vice-versa.

Findings

We reviewed the disability experience during the four-year period. The results are shown on the following pages. Overall, the actual number of disability retirements (183) is about 46 percent of the number projected by the present assumption (395 – see charts on the following pages).

The process of qualifying for a disability benefit requires some burden of proof. This process may result in a member being reported as a termination or withdrawal while the disability application is being reviewed. In fact, over the course of the four-year period, there were approximately 67 members who were reclassified as a disability retirement after first being reported as a termination. In recognition of this process, we recommend lowering the assumed rates of disability, but not as low as reported by the actual experience.

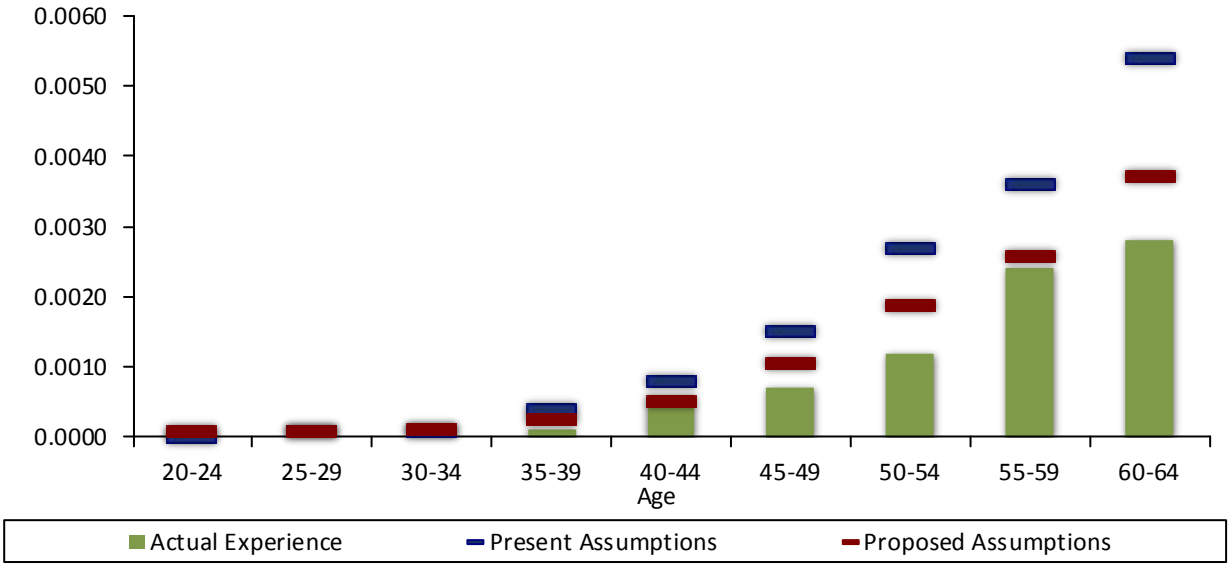
Recommendation

We recommend adopting lower rates of disability.

Disability Experience
Males

Male Disability Table

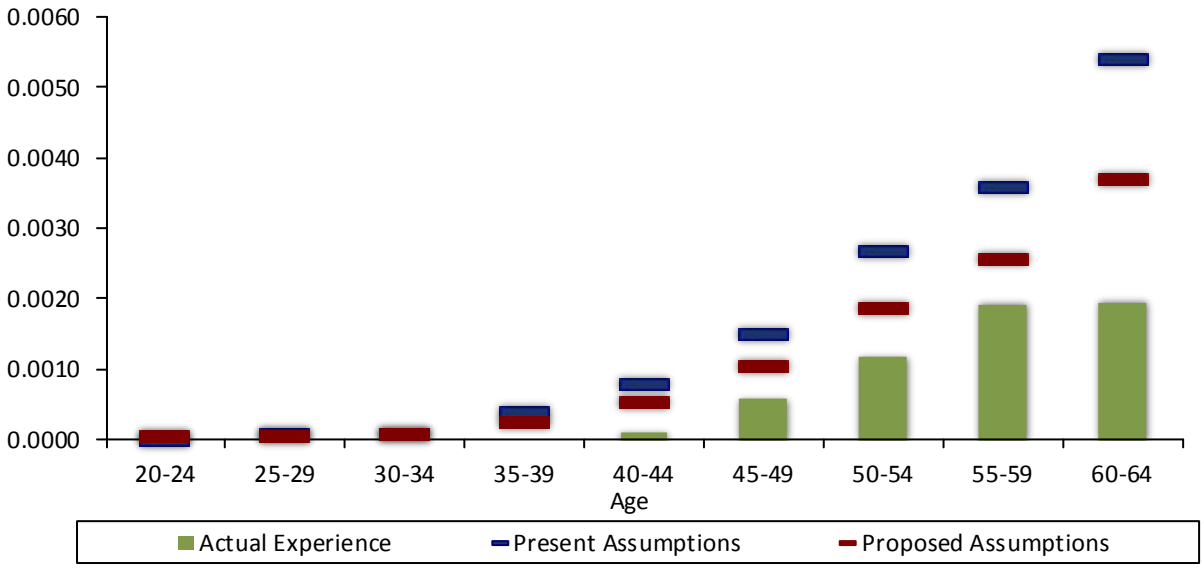
Age	Disabilities	Exposure	Crude Rates	Sample Rates		Expected Disabilities		Ratio of Actuals/Expecteds	
				Present	Proposed	Present	Proposed	Present	Proposed
Under 20	0	-	N/A	0.0000	0.0001	-	-	N/A	N/A
20-24	0	-	N/A	0.0000	0.0001	-	-	N/A	N/A
25-29	0	5,878	0.0000	0.0001	0.0001	0.59	0.59	0.0%	0.0%
30-34	-	8,752	0.0000	0.0001	0.0001	1.06	0.95	0.0%	0.0%
35-39	1	9,455	0.0001	0.0004	0.0003	3.56	2.49	28.1%	40.2%
40-44	4	8,529	0.0005	0.0008	0.0005	6.49	4.54	61.6%	88.1%
45-49	7	10,166	0.0007	0.0015	0.0011	15.35	10.74	45.6%	65.2%
50-54	15	12,775	0.0012	0.0027	0.0019	34.37	24.06	43.6%	62.3%
55-59	35	14,611	0.0024	0.0036	0.0026	54.12	37.88	64.7%	92.4%
60-64	34	12,200	0.0028	0.0054	0.0037	64.96	45.47	52.3%	74.8%
Totals	**96**	**82,366**	**0.0012**	**0.0022**	**0.0015**	**180.50**	**126.72**	**53.2%**	**75.8%**



Disability Experience
Females

Female Disability Table

Age	Disabilities	Exposure	Crude Rates	Sample Rates		Expected Disabilities		Ratio of Actuals/Expecteds	
				Present	Proposed	Present	Proposed	Present	Proposed
Under 20	-	-	N/A	0.0000	0.0001	-	-	N/A	N/A
20-24	-	-	N/A	0.0000	0.0001	-	-	N/A	N/A
25-29	-	8,489	0.0000	0.0001	0.0001	0.85	0.59	0.0%	0.0%
30-34	-	11,752	0.0000	0.0001	0.0001	1.42	0.99	0.0%	0.0%
35-39	-	11,811	0.0000	0.0004	0.0003	4.46	3.12	0.0%	0.0%
40-44	1	10,523	0.0001	0.0008	0.0005	7.99	5.59	12.5%	17.9%
45-49	7	12,327	0.0006	0.0015	0.0011	18.63	13.04	37.6%	53.7%
50-54	18	15,525	0.0012	0.0027	0.0019	41.67	29.17	43.2%	61.7%
55-59	34	17,812	0.0019	0.0036	0.0026	65.85	46.09	51.6%	73.8%
60-64	27	13,932	0.0019	0.0054	0.0037	74.02	51.81	36.5%	52.1%
Totals	**87**	**102,171**	**0.0009**	**0.0021**	**0.0015**	**214.89**	**150.40**	**40.5%**	**57.8%**



SECTION G

MORTALITY 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.

The New Mortality Tables and Projection Scale

Recently, the Society of Actuaries published a mortality study that was specific to public sector retirement systems. This is a very comprehensive study and there are numerous mortality tables created for each classification of employee (General members, Public Safety, Teachers, Survivors, Juvenile, headcount-weighted, benefit-weighted, above median, below median).

One of the key findings of the study is that there is a high correlation between longevity and income and education. As such, the SOA highly recommended the use of 'benefit weighted' rates when developing mortality tables. We were able to review SERF retiree and disability mortality on a 'benefit weighted' basis and have shown the results on page G-4 through G-7 of this report. Consistent with the SOA study, SERF members with higher benefits generally appear to experience longer lifespans, resulting in lower mortality rates.

Projection Scale

Fully generational tables, which are utilized for the MSRS valuations, help take into account future improvements in mortality that are expected to occur. The Society of Actuaries updates the projection scale annually and the latest published table is called the MP-2018 Projection Scale.

Mortality Experience

Findings

Most pension systems will have insufficient data for full credibility in setting a mortality assumption. The general rule of thumb is 1,000 deaths are required of each gender in the experience period for full credibility. When less than 1,000 deaths occur during the experience study period, partial credibility can be given to the plan's experience based on the actual number of deaths that occurred.

During the four-year period, there were 1,800 male retiree deaths and 1,600 female retiree deaths. Therefore, the experience is considered fully credible and there is no credibility constraint when fitting the standard mortality tables to the plan's experience.

During the four-year period, there were 145 male disabled retiree deaths and 148 female disabled retiree deaths. Similarly, there were 123 male active deaths and 110 female active deaths. The disabled retiree mortality experience and active mortality experience is not considered to be fully credible since there were less than 1,000 deaths. Therefore, we recommend a blend of the standard industry table and the plan's experience.

We reviewed the mortality experience during the four-year period. The results are shown on the following pages.

Healthy Retirees

Due to potential anti-selection bias as well as data needs which are outside the scope of the annual valuation process, we did not include beneficiary and survivor mortality experience in our study.
In total, on a benefit weighted basis, the plan experienced slightly more male deaths than expected ($44,788,000 actual versus $44,206,000 expected). While this seems like a good fit, the fit varies by age groups. The actual number of deaths on a benefit weighted basis among retired females ($24,941,000) was more than the number projected by the present assumptions ($21,072,000). The actual number of female deaths at ages below 75 was below expected while the actual number of female deaths at ages above 75 was far above expected.

Disabled Retirees

On a benefit weighted basis, the plan experienced approximately the same number of deaths among disabled males ($2,254,000) as projected by the present assumptions ($2,232,000). The actual number of deaths on a benefit weighted basis among disabled females ($1,977,000) was more than the number projected by the present assumptions ($1,667,000).

Active Members

On a liability-weighted basis, the plan experienced fewer deaths on a liability weighted basis among males ($21,676,000) than projected by the present assumptions ($29,875,000). The actual number of female deaths among active members ($20,381,000) was greater than the number projected by the present assumption ($18,732,000).

Mortality Experience

Recommendations

We did not find a published standard table that fit the observed experience at all ages. We focused on cohorts of members that represented a large percentage of counts and liability for each group. As such, we recommend adoption of the Pub-2010 mortality tables, with adjustments in order to produce a better fit to observed experience when possible. In some cases, even after adjustments, the fit was not uniform and we put more credibility on the rates in the published table than the plan's experience over the past four years. All recommended tables are Benefit Weighted.

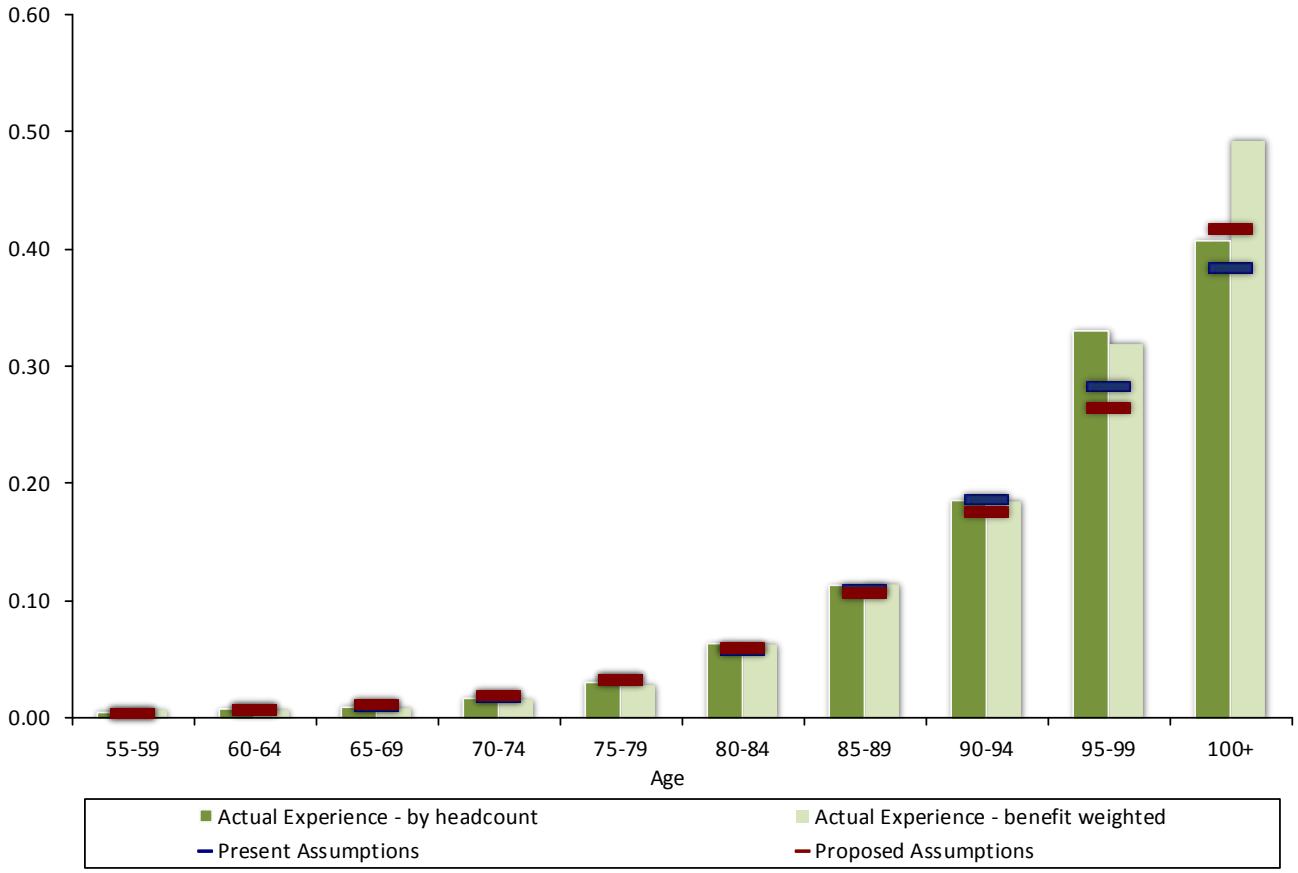
We recommend adoption of the following mortality tables:

Healthy Male Retirees:	Pub-2010 Male Healthy Retired General Mortality Table, adjusted for mortality improvements using projection scale MP-2018. Rates are multiplied by a factor of 1.04.
Healthy Female Retirees:	Pub-2010 Female Healthy Retired General Mortality Table, adjusted for mortality improvements using projection scale MP-2018. Rates are multiplied by a factor of 1.10.
Disabled Male Retirees:	Pub-2010 Male General/Teacher Disabled Retiree Mortality Table, adjusted for mortality improvements using projection scale MP-2018. Rates are set forward two years.
Disabled Female Retirees:	Pub-2010 Female General/Teacher Disabled Retiree Mortality Table, adjusted for mortality improvements using projection scale MP-2018. Rates are set forward five years.
Male Active Members:	Pub-2010 Male General Employee Mortality Table adjusted for mortality improvements using projection scale MP-2018. Rates are multiplied by a factor of 0.97.
Female Active Members:	Pub-2010 Female General Employee Mortality Table adjusted for mortality improvements using projection scale MP-2018. Rates are multiplied by a factor of 1.06.

Post-Retirement Mortality Experience
Healthy Males

	Benefit Weighted ($000s)		Crude Rates				Benefit Weighted ($000s)		Ratio of	
			Benefit	Headcount	Sample Rates		Expected Deaths		Actuals/Expecteds	
Age	Deaths	Exposure	Weighted	Weighted	Present	Proposed*	Present	Proposed*	Present	Proposed*
55-59	195	26,148	0.0075	0.0057	0.0048	0.0053	134.61	149.01	144.9%	130.9%
60-64	1,222	162,653	0.0075	0.0078	0.0069	0.0077	1,178.91	1,297.91	103.7%	94.2%
65-69	3,636	393,564	0.0092	0.0100	0.0110	0.0114	4,361.34	4,543.10	83.4%	80.0%
70-74	5,142	310,379	0.0166	0.0172	0.0186	0.0189	5,660.42	5,767.03	90.8%	89.2%
75-79	5,825	198,281	0.0294	0.0310	0.0325	0.0332	6,304.49	6,460.88	92.4%	90.2%
80-84	9,217	144,485	0.0638	0.0634	0.0592	0.0602	8,441.13	8,588.33	109.2%	107.3%
85-89	9,982	86,784	0.1150	0.1131	0.1094	0.1073	9,247.43	9,092.37	107.9%	109.8%
90-94	7,281	39,177	0.1858	0.1854	0.1872	0.1772	6,996.82	6,641.53	104.1%	109.6%
95-99	2,075	6,485	0.3200	0.3306	0.2839	0.2660	1,724.00	1,616.12	120.4%	128.4%
100+	213	432	0.4931	0.4074	0.3845	0.4178	156.87	149.85	135.8%	142.1%
Totals	**44,788**	**1,368,388**	**0.0327**	**0.0307**	**0.0323**	**0.0324**	**44,206.02**	**44,306.13**	**101.3%**	**101.1%**

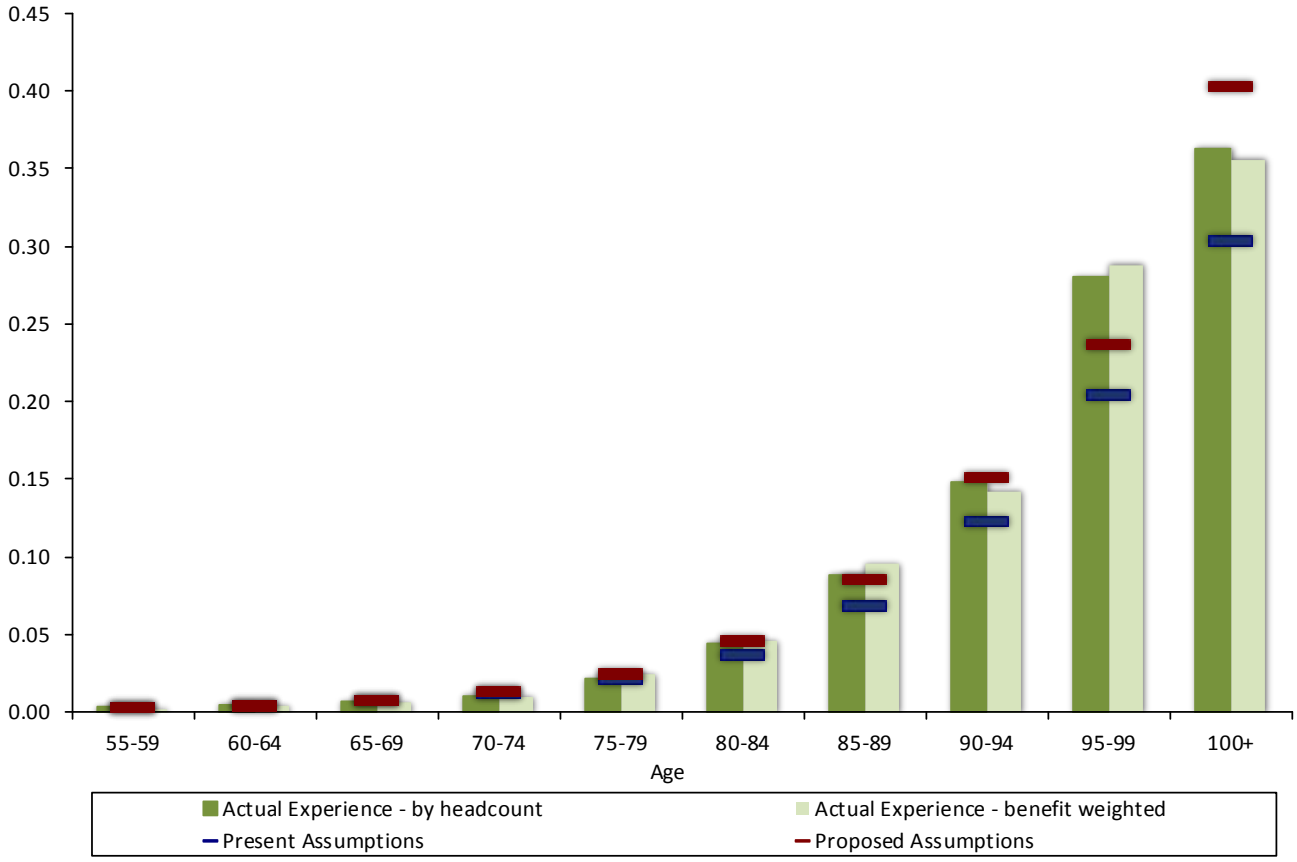
* *In order to show the fit for the four-year period of the study, Proposed Sample Rates and Proposed Expected Deaths were determined using the proposed mortality rates for 2010 projected to the mid-point of the study using projection scale MP-2018.*



Post-Retirement Mortality Experience
Healthy Females

	Benefit Weighted ($000s)		Crude Rates				Benefit Weighted ($000s)		Ratio of	
			Benefit	Headcount	Sample Rates		Expected Deaths		Actuals/Expecteds	
Age	Deaths	Exposure	Weighted	Weighted	Present	Proposed*	Present	Proposed*	Present	Proposed*
55-59	107	40,463	0.0026	0.0039	0.0031	0.0037	133.13	156.80	80.4%	68.2%
60-64	830	179,118	0.0046	0.0053	0.0048	0.0051	894.37	940.69	92.8%	88.2%
65-69	2,185	327,436	0.0067	0.0073	0.0077	0.0080	2,510.02	2,622.97	87.1%	83.3%
70-74	2,271	215,937	0.0105	0.0111	0.0125	0.0139	2,623.91	2,920.37	86.6%	77.8%
75-79	3,045	121,753	0.0250	0.0220	0.0213	0.0251	2,530.56	2,983.44	120.3%	102.1%
80-84	3,618	77,669	0.0466	0.0451	0.0377	0.0462	2,872.19	3,518.90	126.0%	102.8%
85-89	5,530	57,624	0.0960	0.0889	0.0685	0.0864	3,882.11	4,893.45	142.4%	113.0%
90-94	4,211	29,452	0.1430	0.1485	0.1234	0.1520	3,485.30	4,312.77	120.8%	97.6%
95-99	2,682	9,291	0.2887	0.2806	0.2048	0.2380	1,765.24	2,069.88	151.9%	129.6%
100+	462	1,297	0.3562	0.3636	0.3046	0.4037	374.69	428.03	123.3%	107.9%
Totals	**24,941**	**1,060,040**	**0.0235**	**0.0244**	**0.0199**	**0.0234**	**21,071.52**	**24,847.30**	**118.4%**	**100.4%**

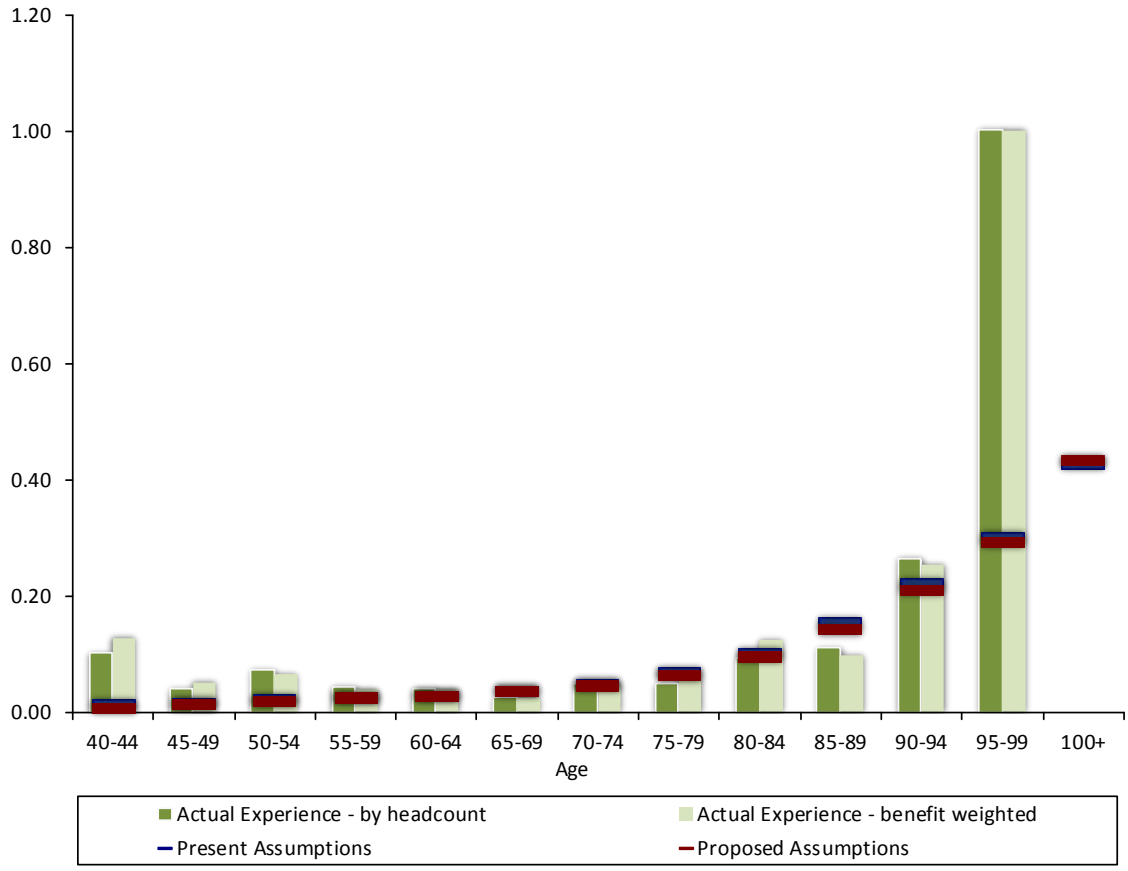
* *In order to show the fit for the four-year period of the study, Proposed Sample Rates and Proposed Expected Deaths were determined using the proposed mortality rates for 2010 projected to the mid-point of the study using projection scale MP-2018.*



Post-Retirement Mortality Experience
Disabled Males

Age	Benefit Weighted ($000s) Deaths	Exposure	Crude Rates Benefit Weighted	Headcount Weighted	Sample Rates Present	Proposed	Benefit Weighted ($000s) Expected Deaths Present	Proposed*	Ratio of Actuals/Expecteds Present	Proposed*
40-44	7	55	0.12727	0.10000	0.01499	0.00934	0.84	0.52	833.3%	1346.2%
45-49	21	416	0.05048	0.03922	0.01830	0.01377	7.75	5.97	271.0%	351.8%
50-54	108	1,684	0.06413	0.07101	0.02154	0.01929	37.11	33.62	291.0%	321.2%
55-59	253	6,576	0.03847	0.04260	0.02527	0.02460	168.30	164.15	150.3%	154.1%
60-64	476	12,783	0.03724	0.03946	0.03005	0.02999	387.58	386.74	122.8%	123.1%
65-69	358	14,881	0.02406	0.02426	0.03730	0.03641	552.12	539.84	64.8%	66.3%
70-74	357	7,602	0.04696	0.04867	0.04935	0.04631	369.21	347.25	96.7%	102.8%
75-79	276	4,769	0.05787	0.04693	0.06908	0.06445	325.23	303.79	84.9%	90.9%
80-84	232	1,892	0.12262	0.09346	0.10157	0.09503	185.66	174.02	125.0%	133.3%
85-89	92	954	0.09644	0.10909	0.15436	0.14291	141.73	131.39	64.9%	70.0%
90-94	60	238	0.25210	0.26316	0.22425	0.21155	52.47	49.43	114.4%	121.4%
95-99	14	14	1.00000	1.00000	0.30086	0.29423	3.73	3.59	375.3%	390.0%
100+	-	-	N/A	N/A	0.42857	0.43358	-	-	N/A	N/A
Totals	**2,254**	**51,864**	**0.04346**	**0.04387**	**0.04303**	**0.04127**	**2,231.73**	**2,140.31**	**101.0%**	**105.3%**

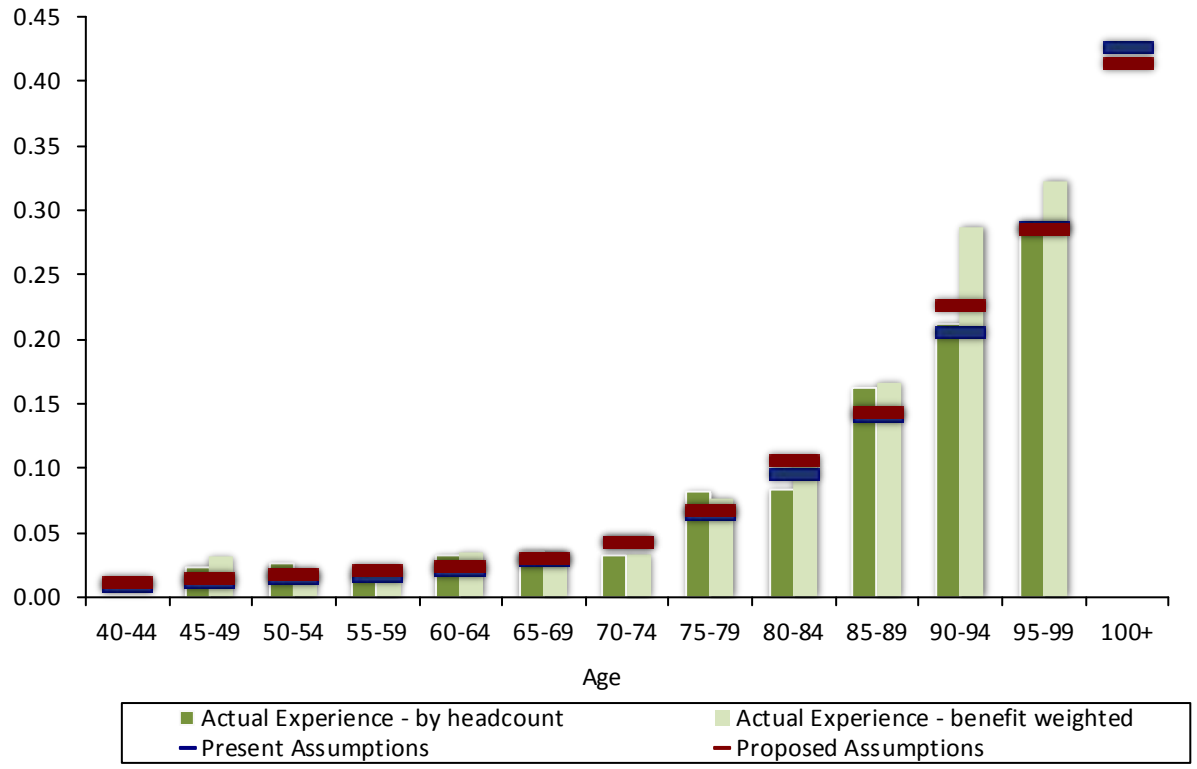
* *In order to show the fit for the four-year period of the study, Proposed Sample Rates and Proposed Expected Deaths were determined using the proposed mortality rates for 2010 projected to the mid-point of the study using projection scale MP-2018.*



Post-Retirement Mortality Experience
Disabled Females

Age	Benefit Weighted ($000s) Deaths	Exposure	Crude Rates Benefit Weighted	Headcount Weighted	Sample Rates Present	Proposed*	Benefit Weighted ($000s) Expected Deaths Present	Proposed*	Ratio of Actuals/Expecteds Present	Proposed*
40-44	-	130	0.0000	0.0000	0.00938	0.0121	1.24	1.57	0.0%	0.0%
45-49	20	658	0.0304	0.0230	0.01182	0.0156	8.06	10.27	248.1%	194.7%
50-54	58	3,075	0.0189	0.0248	0.01457	0.0188	45.68	57.76	127.0%	100.4%
55-59	163	8,762	0.0186	0.0189	0.01752	0.0218	154.87	190.72	105.2%	85.5%
60-64	460	13,785	0.0334	0.0313	0.02162	0.0248	299.34	341.43	153.7%	134.7%
65-69	458	13,440	0.0341	0.0346	0.02930	0.0303	386.02	407.68	118.6%	112.3%
70-74	191	5,892	0.0324	0.0318	0.04288	0.0436	248.86	256.69	76.7%	74.4%
75-79	282	3,731	0.0756	0.0807	0.06413	0.0671	234.39	250.44	120.3%	112.6%
80-84	144	1,371	0.1050	0.0825	0.09523	0.1063	130.40	145.78	110.4%	98.8%
85-89	131	793	0.1652	0.1613	0.14006	0.1443	103.98	114.40	126.0%	114.5%
90-94	52	182	0.2857	0.2105	0.20481	0.2270	38.99	41.32	133.4%	125.8%
95-99	18	56	0.3214	0.2857	0.28763	0.2857	14.75	16.00	122.0%	112.5%
100+	-	-	N/A	N/A	0.42623	0.4141	-	-	N/A	N/A
Totals	**1,977**	**51,875**	**0.0381**	**0.0372**	**0.0321**	**0.0354**	**1,666.58**	**1,834.06**	**118.6%**	**107.8%**

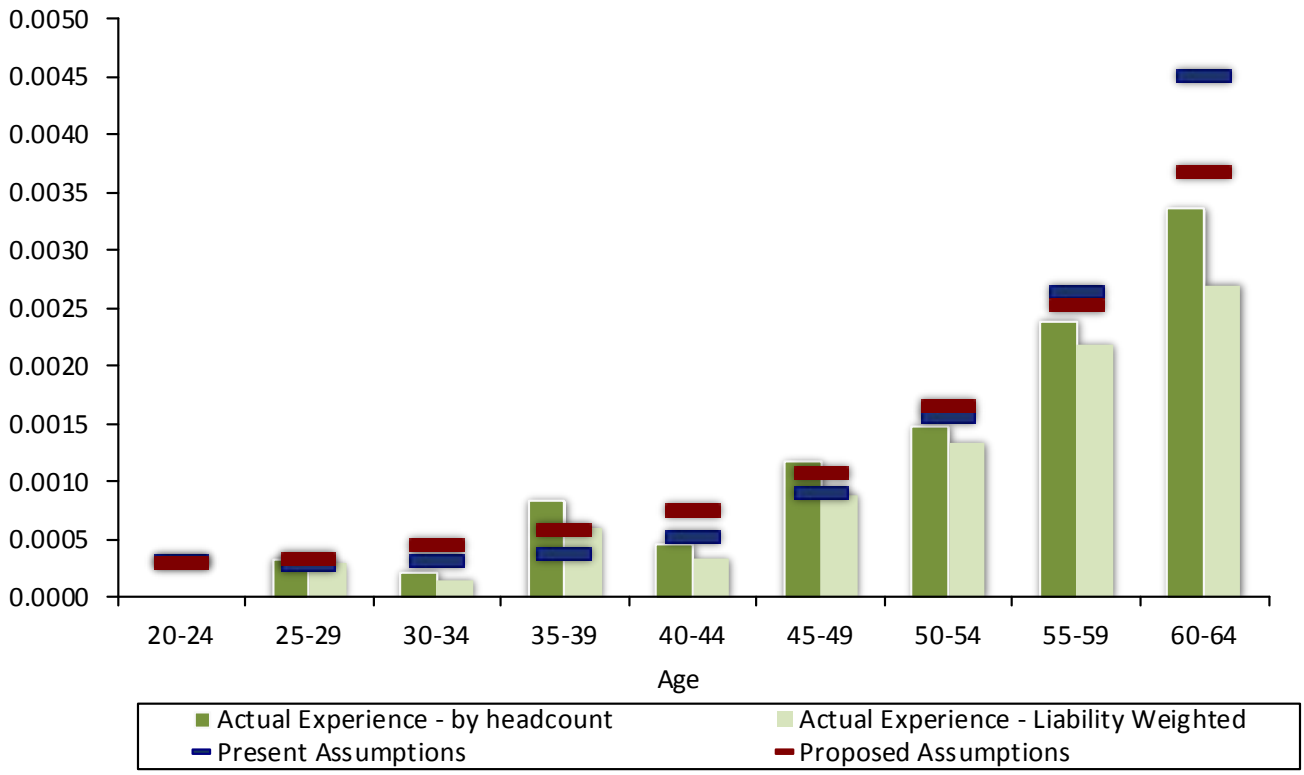
* *In order to show the fit for the four-year period of the study, Proposed Sample Rates and Proposed Expected Deaths were determined using the proposed mortality rates for 2010 projected to the mid-point of the study using projection scale MP-2018.*



Pre-Retirement Mortality Experience
Healthy Males

Age	Liability Weighted ($000s)		Crude Rates		Sample Rates		Liability Weighted ($000s) Expected Deaths		Ratio of Actuals/Expecteds	
	Deaths	Exposure	Liability Weighted	Population Weighted	Present	Proposed*	Present	Proposed*	Present	Proposed*
Under 20	-	367	0.0000	0.0000	0.0003	0.0004	0.09	0.13	0.0%	0.0%
20-24	-	31,972	0.0000	0.0000	0.0003	0.0003	10.42	9.64	0.0%	0.0%
25-29	68	229,733	0.0003	0.0003	0.0003	0.0003	66.95	79.05	101.6%	86.0%
30-34	81	514,470	0.0002	0.0002	0.0003	0.0005	169.85	237.28	47.7%	34.1%
35-39	478	784,225	0.0006	0.0008	0.0004	0.0006	302.56	464.07	158.0%	103.0%
40-44	316	932,407	0.0003	0.0005	0.0005	0.0008	498.23	710.73	63.4%	44.5%
45-49	1,256	1,398,565	0.0009	0.0012	0.0009	0.0011	1,270.63	1,508.82	98.8%	83.2%
50-54	3,153	2,355,779	0.0013	0.0015	0.0016	0.0017	3,708.52	3,926.96	85.0%	80.3%
55-59	7,446	3,409,370	0.0022	0.0024	0.0026	0.0025	9,018.56	8,646.82	82.6%	86.1%
60-64	8,878	3,287,228	0.0027	0.0034	0.0045	0.0037	14,829.07	12,082.23	59.9%	73.5%
Totals	**21,676**	**12,944,116**	**0.0017**	**0.0015**	**0.0023**	**0.0021**	**29,874.87**	**27,665.73**	**72.6%**	**78.3%**

* *In order to show the fit for the four-year period of the study, Proposed Sample Rates and Proposed Expected Deaths were determined using the proposed mortality rates for 2010 projected to the mid-point of the study using projection scale MP-2018.*



Pre-Retirement Mortality Experience
Healthy Females

Age	Liability Weighted ($000s)		Crude Rates		Sample Rates		Liability Weighted ($000s)		Ratio of	
							Expected Deaths		Actuals/Expecteds	
	Deaths	Exposure	Liability Weighted	Population Weighted	Present	Proposed	Present	Proposed*	Present	Proposed*
Under 20	0	455	0.0000	0.0000	0.0001	0.0001	0.06	0.06	0.0%	0.0%
20-24	28	40,497	0.0007	0.0005	0.0001	0.0001	5.31	4.37	527.7%	640.7%
25-29	-	279,691	0.0000	0.0000	0.0002	0.0001	43.52	38.23	0.0%	0.0%
30-34	42	601,096	0.0001	0.0001	0.0002	0.0002	125.58	133.82	33.4%	31.4%
35-39	246	847,691	0.0003	0.0003	0.0003	0.0003	229.75	279.15	107.1%	88.1%
40-44	507	1,010,473	0.0005	0.0007	0.0004	0.0005	400.77	470.08	126.5%	107.9%
45-49	839	1,496,659	0.0006	0.0007	0.0007	0.0007	1,004.13	1,021.72	83.6%	82.1%
50-54	2,688	2,586,051	0.0010	0.0012	0.0011	0.0011	2,870.79	2,761.01	93.6%	97.4%
55-59	8,427	3,817,867	0.0022	0.0022	0.0016	0.0016	6,276.77	6,201.50	134.3%	135.9%
60-64	7,604	3,326,140	0.0023	0.0022	0.0023	0.0023	7,775.15	7,791.38	97.8%	97.6%
Totals	**20,381**	**14,006,620**	**0.0015**	**0.0011**	**0.0013**	**0.0013**	**18,731.81**	**18,701.32**	**108.8%**	**109.0%**

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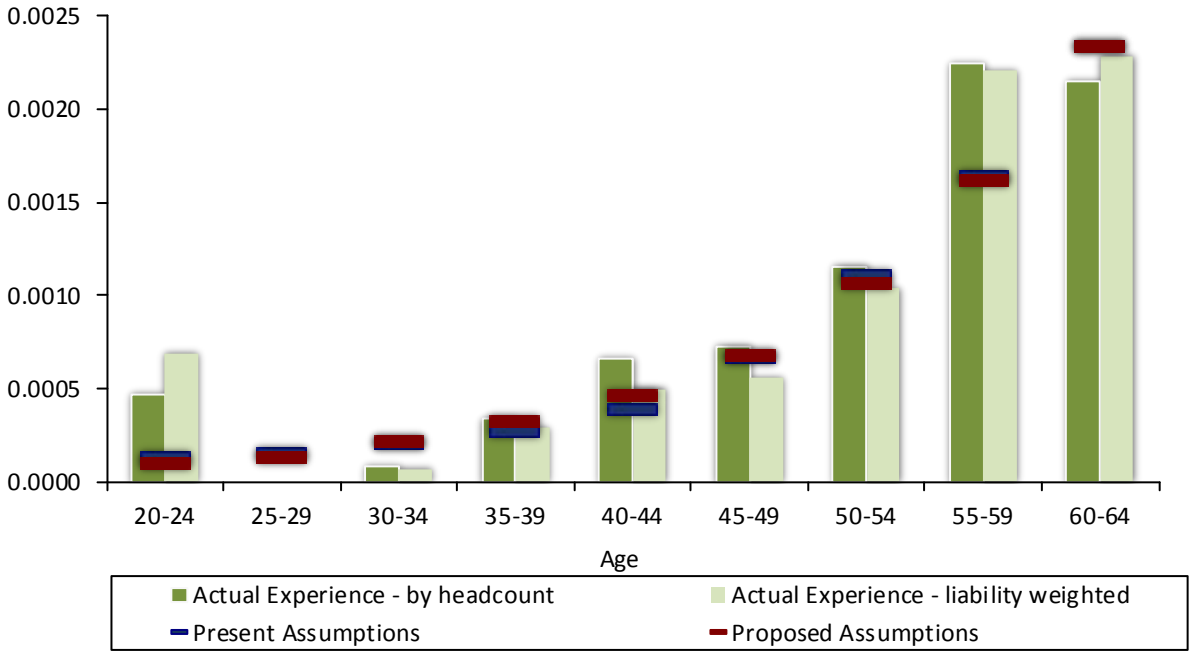

SECTION H

ACTUARIAL METHODS

Asset Valuation Method

Background

Employer contribution calculations are based on a smoothed asset valuation method (the actuarial value of assets). Such smoothed valuation methods aid in developing a contribution amount calculated to remain approximately level from year to year.

Per Minnesota Statute 356.215(f), the actuarial value of assets is based on a five-year moving average of expected and market values determined as follows:

- At the end of each plan year, an average asset value is calculated as the average of the market asset value at the beginning and end of the fiscal year, net of investment income for the fiscal year;
- The investment gain or (loss) is equal to the excess of actual investment income over the expected investment income based on the average asset value as calculated above;
- The investment gain or (loss) so determined is recognized over five years at 20% per year; and
- The asset value is the sum of the expected asset value plus the scheduled recognition of investment gains or (losses) during the current and the preceding four plan years.

During periods when investment performance exceeds the assumed rate, the actuarial value of assets will tend to be less than the market value of assets. During periods when investment performance is less than the assumed rate, the actuarial value of assets will tend to be greater than the market value of assets. If assumed rates are exactly realized for four consecutive years, the actuarial value of assets will become equal to market value of assets.

This asset valuation method satisfies current standards of practice, which require that the asset valuation method reflect some function of market value, be unbiased in relation to market value, and recognize gains and losses consistently and over a reasonable period.

In 2007, the Actuarial Standards Board issued a standard on asset valuation methods which requires that the asset valuation method bear a reasonable relationship to current market value. There may be some concern that if the deviation between the funding value of assets and the market value of assets becomes too large, it could be considered unreasonable. The alternative to allowing large deviations usually involves setting upper and lower bounds (corridors) for the relationship between funding value and market value. Once a corridor limit is reached, any further market experience in the same direction is recognized immediately, which can introduce substantial fluctuations in the results of the actuarial valuation. If a 20% corridor were applied to the June 30, 2018 actuarial value of assets, it would not change the numerical result (the asset value would be unchanged).

Recommendation

We recommend continued use of the current asset valuation method. MSRS should continue to consider results based on the market value of assets as well as the actuarial value of assets, especially when the two values are significantly different.

Funding Policy – Actuarial Funding Method

An actuarial funding method is a set of techniques for conversion of the actuarial present values of benefits into contribution information. Minnesota Statute requires the actuary to use the entry age actuarial cost method, characterized by:

1. Normal Cost – the level percent of payroll contribution, paid from each member's date of plan entry to date of retirement, which will accumulate enough assets at retirement to fund the member's projected benefits from retirement to death.

2. Actuarial Accrued Liability – the assets which would have accumulated to date had contributions been made at the level of the normal cost since the date of the first benefit accrual, all actuarial assumptions had been exactly realized, and there had been no benefit changes.

The total contribution produced by an actuarial method is the total of the normal cost and an amount to amortize any unfunded actuarial accrued liability.

The entry age actuarial method is the most prevalent funding method in the public sector. It is appropriate for the public sector because it produces costs that remain stable as a percentage of payroll over time, resulting in intergenerational equity for taxpayers.

Recommendations

We recommend continued use of the entry age actuarial cost method.

Funding Policy – Amortization

Amortization Period

Minnesota Statute 356.215, Subdivision 11 specifies June 30, 2048 as the established date for full funding of the State Employees Retirement Fund (SERF). If the unfunded liability increases due to changes in benefits, assumptions, or methods, the statutory amortization date may be extended (limited to 30 years). The June 30, 2018 actuarial valuation amortizes the UAAL over a 30-year period. The amortization period decreases each year by one year (like a typical mortgage).

In 2018, legislation changed the statutory amortization date from June 30, 2042 to June 30, 2048. Past practice has typically been to re-establish a new 30-year statutory amortization period occasionally in order to minimize volatility and manage cost requirements. This practice shifts costs to the future. In lieu of this, MSRS could consider using a shorter maximum period, such as 15, 20 or 25 years. Actuarial practice, including Governmental Accounting Standards Board policy, is moving toward shorter amortization periods than in the past.

Another option to consider is the use of "layered" amortization – which continues to amortize the initial unfunded liability over the closed amortization period, but spreads out gains and losses as they occur over a separate closed period. This methodology maintains steady progress toward eliminating the unfunded liability.

Amortization Method

Because SERF is an open retirement plan (new employees enter the plan), level percent of payroll amortization payments are used.

Longer amortization periods combined with the level percent of pay methodology results in initial payments that are less than the "interest only" payment on the unfunded actuarial accrued liability (UAAL), i.e., "negative amortization." Payments less than the interest only amount will result in the UAAL increasing for an initial period of time. Based on the proposed assumptions of 7.50% interest and 3.00% payroll growth, payments will continue to be less than the interest only amount, with amortization payments exceeding the interest only amount once the period declines to 20 years. This means that the UAAL is expected to increase for the next 10+ years under the current funding policy. Negative amortization, once commonly accepted, is increasingly attracting criticism. We greatly prefer combinations of amortization methods and assumptions that result in the UAAL decreasing each year.

It should be noted that actual growth in SERF payroll over the past four years, on average, has exceeded the expected rate of 3.25%. However, over the most recent ten year period, payroll growth, on average, has been lower than expected. When payroll grows slower than expected, contributions collected will also be less than expected, and insufficient to eliminate the UAAL by the statutory amortization date. Some plans address this issue by not permitting the payroll growth assumption to exceed the actual average growth rate over the past 5 years. If payroll growth continues to fall short of expectations, a method change should be considered.

Recommendation

We recommend MSRS consider layered amortization as an alternative to the current 30-year closed amortization policy, since the current method results in approximately ten years of negative amortization and an increasing unfunded actuarial accrued liability. We also recommend continued use of the level percent of payroll amortization method. Lastly, we recommend closely monitoring actual payroll growth with implementation of a payroll growth assumption equal to recent experience if payroll growth consistently falls short of the recommended 3.0% growth assumption.

Funding Policy – Projected Payroll

Required contributions are expressed as a percent of payroll. The Minnesota Standards for Actuarial Work state that the projected payroll will be developed from the reported payroll in the base year by increasing each person's pay by one full year's pay increase according to the actuarial salary scale. This appears to make sense on the surface, but in our judgement such a calculation is not fully in compliance with level percent of payroll funding. There are two issues:

1. With respect to the total payroll used for the amortization of the unfunded liability: Total payroll is expected to increase at 3% according to the actuarial assumptions. The total payroll, increased at the assumed payroll growth rate is the proper series of payroll amounts over which to fund the unfunded liability. The first year payroll stated in the Minnesota Standards is not consistent with this principle.
2. With respect to the normal cost dollar amount: The normal cost percentage for active members is developed as the ratio of the present value of future benefits at entry age to the present value of future pay at entry age. The present value of future pay must take into account both the timing of pay increases within the year, and the probability that an individual may exit the active member group during the year. The first year payroll stated in the Minnesota Standards is not mathematically consistent with this principle since it assumes the member will earn an entire year of payroll, even though there may be a probability of decrement for the member during the year.

Recommendation

We recommend the Minnesota Standards for Actuarial Practice be amended to be less prescriptive and more principles-based, so that the actuaries for the systems may use their best judgment to calculate contribution rates and liabilities in a mathematically consistent manner and in accordance with actuarial standards of practice.

SECTION I

MISCELLANEOUS AND TECHNICAL ASSUMPTIONS

Marital Status

Married members will frequently make different annuity selections than non-married members. The current valuation assumption is 80% of male members and 65% of female members are married. Actual marital status is used for retired members.

Findings

We reviewed the marital status of healthy members retiring from active status during the four-year period. The results are shown below.

Gender	Married New Retirees	Total New Retirees	Crude Rates	Sample Rates		Expected Married Retirees		Ratio of Actuals/Expecteds	
				Present	Proposed	Present	Proposed	Present	Proposed
Males	2,097	2,696	0.7778	0.8000	0.8000	2,156.80	2,156.80	97.2%	97.2%
Females	1,889	3,123	0.6049	0.6500	0.6000	2,029.95	1,873.80	93.1%	100.8%
Total	**3,986**	**5,819**	**0.6850**			**4,186.75**	**4,030.60**	**95.2%**	**98.9%**

The experience shows that there are fewer married new retirees than expected for females and about as expected for males.

Recommendation

We recommend changing the marital status assumption from 65% to 60% married for females.

Age of Survivor

Joint & Survivor annuity benefit amounts are determined based on the member's and survivor's age. Currently, the valuation assumes that male members have a beneficiary three years younger and female members have a beneficiary two years older.

Findings

We reviewed the ages of married new retirees and their beneficiaries during the four-year period. The results are shown below.

Gender	Married New Retirees	Average Age Difference	Expected Age Difference		Ratio of Actuals/Expecteds	
			Old	New	Old	New
Males	2,097	2.40	3.00	2.00	80.1%	120.1%
Females	1,889	(1.55)	(2.00)	(2.00)	77.6%	77.6%
Total	**3,986**					

The experience shows that the age difference for both males and females has been trending down. Actual average age differences for male new retirees were 2.64 years in the 2008-2014 study and 2.40 years in this 2014-2018 study. Actual average age differences for female new retirees were -1.88 years in the 2008-2014 study and -1.55 years in this 2014-2018 study.

Recommendation

We recommend changing the survivor age difference assumption for new male married retirees from 3 years to 2 years and maintaining the current two year age difference assumption for new female retirees.

Form of Payment

Upon retirement, a member can elect any of the following forms of payment:

- Single-life annuity – the benefit is paid for the lifetime of the member. No benefit is payable to a beneficiary upon the member's death.
- 15 Year Certain & Life – a reduced benefit is paid for the lifetime of the member. If the member dies before 180 payments have been made, the benefit continues to be paid to a beneficiary or estate until 180 payments have been made.
- 50% Joint & Survivor – a reduced benefit is paid for the lifetime of the member. Upon death of the member, 50% of the benefit is paid to a beneficiary. If the beneficiary predeceases the member, the benefit reverts back to the single life annuity amount.
- 75% Joint & Survivor – a reduced benefit is paid for the lifetime of the member. Upon death of the member, 75% of the benefit is paid to a beneficiary. If the beneficiary predeceases the member, the benefit reverts back to the single life annuity amount.
- 100% Joint & Survivor – a reduced benefit is paid for the lifetime of the member. Upon death of the member, 100% of the benefit is paid to a beneficiary. If the beneficiary predeceases the member, the benefit reverts back to the single life annuity amount.

There is no actuarial reduction for the bounce-back feature (i.e., this is subsidized by the plan). Married members retiring from active status are currently assumed to elect annuities as follows:

Males:	0% elect 15 Year Certain & Life option
	15% elect 50% Joint & Survivor option
	15% elect 75% Joint & Survivor option
	50% elect 100% Joint & Survivor option
Females:	0% elect 15 Year Certain & Life option
	15% elect 50% Joint & Survivor option
	10% elect 75% Joint & Survivor option
	30% elect 100% Joint & Survivor option

Remaining married and unmarried members are assumed to elect the Single-life option.

Findings

We reviewed the benefit elections of married new retirees during the four-year period. The results are shown on the following pages.

We found more married new retirees are electing the joint & survivor options for both males and females.

Recommendation

We recommend increasing the assumed percentage electing the 100% joint and survivor annuity and reducing the assumed percentage electing the single life annuity (and 50% joint & survivor for males) accordingly.

Form of Payment

Male Experience

Form of Payment	Actual Electing Annuity	Married New Retirees	Crude Rates	Sample Rates		Expected Electing Annuity		Ratio of Actuals/Expecteds	
				Present	Proposed	Present	Proposed	Present	Proposed
Single-life annuity	205	2,097	0.0978	0.4000	0.1000	838.80	209.70	24.4%	97.8%
15 year certain & life	29	2,097	0.0138	0.0000	0.0000	-	-	N/A	N/A
50% joint & survivor	223	2,097	0.1063	0.1500	0.1000	314.55	209.70	70.9%	106.3%
75% joint & survivor	265	2,097	0.1264	0.1500	0.1500	314.55	314.55	84.2%	84.2%
100% joint & survivor	1,375	2,097	0.6557	0.3000	0.6500	629.10	1,363.05	218.6%	100.9%
Total	**2,097**	**2,097**	**1.0000**	**1.0000**	**1.0000**	**2,097.00**	**2,097.00**		

Female Experience

Form of Payment	Actual Electing Annuity	Married New Retirees	Crude Rates	Sample Rates		Expected Electing Annuity		Ratio of Actuals/Expecteds	
				Old	New	Old	New	Old	New
Life annuity	549	1,889	0.2906	0.4500	0.3500	850.05	661.15	64.6%	83.0%
15 year certain & life	37	1,889	0.0196	0.0000	0.0000	-	-	N/A	N/A
50% joint & survivor	311	1,889	0.1646	0.1500	0.1500	283.35	283.35	109.8%	109.8%
75% joint & survivor	209	1,889	0.1106	0.1000	0.1000	188.90	188.90	110.6%	110.6%
100% joint & survivor	783	1,889	0.4145	0.3000	0.4000	566.70	755.60	138.2%	103.6%
Total	**1,889**	**1,889**	**1.0000**	**1.0000**	**1.0000**	**1,889.00**	**1,889.00**		

Actuarial Equivalent Factors

Early retirement and Joint and Survivor benefits are actuarially equivalent to the Single-life annuity. Actuarial equivalent factors are based on the RP-2014 mortality table for healthy annuitants, white collar adjustment, male rates set forward two years, projected to 2019 using Scale MP-2015, blended 50% males, 5.88% post-retirement interest and 7.5% pre-retirement interest. Reflecting statutory requirements, joint and survivor factors are based on an interest assumption of 6.5%.

Recommendation

We recommend updating the actuarial equivalent factors to reflect changes in expected mortality and developing an appropriate implementation schedule.

Proposed Miscellaneous and Technical Assumptions

Background

A number of miscellaneous and technical assumptions are used in the actuarial valuation. The present assumptions are listed on the following page.

The Allowance for Combined Service Annuity assumptions are based on an analysis completed by the LCPR actuary and documented in a report dated October 2016.

Recommendation

Miscellaneous and Technical Assumptions are listed on page I-7. We recommend continued use of the other Miscellaneous and Technical Assumptions.

Miscellaneous and Technical Assumptions

Benefit Service	Exact fractional service is used to determine the amount of benefit payable.
Decrement Operation	Withdrawal decrements do not operate during retirement eligibility.
Decrement Timing	Decrements of all types are assumed to occur mid-year.
Eligibility Testing	Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur.
Forfeitures	For vested separations from service, it is assumed that members separating will withdraw their contributions and forfeit an employer financed benefit when the value of member contributions is greater than the value of the employer financed benefit.
Incidence of Contributions	Contributions are assumed to be received on a monthly basis, per the Standards of Actuarial Work.
Liability Adjustments	Liabilities for former members are increased by 15% for vested members and 3% for non-vested members to account for the effect of some participants having eligibility for a Combined Service Annuity.
Pay Increase Timing	Pay increases were assumed to be at the beginning of the fiscal year. This is equivalent to assuming that reported pays represent amounts paid to members during the year ended on the valuation date.
Service Credit Accruals	Members were assumed to accrue one year of service credit per year.

SECTION J

PROPOSED ASSUMPTION LISTING

Proposed Actuarial Assumptions
Based on 2014-2018 Experience Study

Merit and Seniority Pay Increases

% Merit & Seniority Increases in Salaries Next Year	
Year	**Rate**
1	10.00%
2	6.00%
3	2.80%
4	2.40%
5	2.00%
6	1.90%
7	1.80%
8	1.60%
9	1.50%
10	1.20%
11	1.10%
12	1.00%
13	0.90%
14	0.80%
15	0.70%
16	0.60%
17	0.50%
18	0.50%
19	0.50%
20	0.40%
21	0.30%
22	0.30%
23	0.20%
24	0.20%
25	0.20%
26	0.20%
27	0.10%
28	0.10%
29	0.00%
30+	0.00%

Proposed Actuarial Assumptions
Based on 2014-2018 Experience Study

Age & Service Retirement Pattern
Unreduced (Normal) Retirement

Age	% Retiring
65	35.0%
66	35.0%
67	30.0%
68	25.0%
69	25.0%
70	30.0%
71+*	100.0%

* *The current assumption prescribed by the Minnesota Standards for Actuarial Work is that members who have reached 100% retirement eligibility will delay retirement one year.*

Proposed Actuarial Assumptions
Based on 2014-2018 Experience Study

Rule of 90 Retirement Pattern

Age	% Retiring
55	16.0%
56	12.5%
57	12.5%
58	11.5%
59	12.5%
60	14.0%
61	15.0%
62	25.0%
63	22.0%
64	20.0%

Proposed Actuarial Assumptions
Based on 2014-2018 Experience Study

Age & Service Retirement Pattern
Tier 1 Reduced (Early) Retirement

Age	% Retiring
55	3.0%
56	3.0%
57	4.0%
58	4.0%
59	5.0%
60	7.0%
61	8.0%
62	16.0%
63	16.0%
64	16.0%

Proposed Actuarial Assumptions
Based on 2014-2018 Experience Study

Age & Service Retirement Pattern
Tier 2 Reduced (Early) Retirement

Age	% Retiring
55	4.0%
56	4.0%
57	4.0%
58	4.0%
59	4.0%
60	5.0%
61	7.5%
62	13.0%
63	13.0%
64	13.0%
65	20.0%

Proposed Actuarial Assumptions
Based on 2014-2018 Experience Study

Withdrawal

Year	% Withdrawals	
	Male	Female
1	0.2000	0.2050
2	0.1500	0.1700
3	0.1000	0.1300
4	0.0850	0.1050
5	0.0750	0.0950
6	0.0700	0.0850
7	0.0600	0.0800
8	0.0475	0.0675
9	0.0425	0.0600
10	0.0400	0.0500
11	0.0350	0.0450
12	0.0300	0.0425
13	0.0275	0.0400
14	0.0250	0.0375
15	0.0225	0.0350
16	0.0225	0.0325
17	0.0225	0.0275
18	0.0225	0.0250
19	0.0200	0.0250
20	0.0150	0.0250
21	0.0125	0.0250
22	0.0125	0.0240
23	0.0100	0.0230
24	0.0100	0.0220
25	0.0100	0.0210
26	0.0100	0.0200
27	0.0100	0.0175
28	0.0100	0.0175
29	0.0100	0.0150
30+	0.0100	0.0100

Proposed Actuarial Assumptions
Based on 2014-2018 Experience Study

Disability Rates

Age	% Becoming Disabled	
	Male	Female
20	0.0100%	0.0070%
21	0.0100%	0.0070%
22	0.0100%	0.0070%
23	0.0100%	0.0070%
24	0.0100%	0.0070%
25	0.0100%	0.0070%
26	0.0100%	0.0070%
27	0.0100%	0.0070%
28	0.0100%	0.0070%
29	0.0100%	0.0070%
30	0.0100%	0.0070%
31	0.0100%	0.0070%
32	0.0100%	0.0070%
33	0.0100%	0.0070%
34	0.0140%	0.0140%
35	0.0140%	0.0140%
36	0.0210%	0.0210%
37	0.0280%	0.0280%
38	0.0350%	0.0350%
39	0.0350%	0.0350%
40	0.0420%	0.0420%
41	0.0490%	0.0490%
42	0.0560%	0.0560%
43	0.0560%	0.0560%
44	0.0630%	0.0630%
45	0.0770%	0.0770%
46	0.0910%	0.0910%
47	0.1050%	0.1050%
48	0.1190%	0.1190%
49	0.1330%	0.1330%
50	0.1540%	0.1540%
51	0.1680%	0.1680%
52	0.1890%	0.1890%
53	0.2030%	0.2030%
54	0.2170%	0.2170%
55	0.2240%	0.2240%
56	0.2380%	0.2380%
57	0.2520%	0.2520%
58	0.2800%	0.2800%
59	0.3010%	0.3010%
60	0.3290%	0.3290%
61	0.3500%	0.3500%
62	0.3780%	0.3780%
63	0.4060%	0.4060%
64	0.4270%	0.4270%

Proposed Actuarial Assumptions
Based on 2014-2018 Experience Study

Healthy Post-Retirement Mortality Rates

Age in 2018	% Dying Next Year*	
	Male	Female
50	0.2862%	0.2368%
51	0.3106%	0.2523%
52	0.3385%	0.2713%
53	0.3687%	0.2908%
54	0.4032%	0.3106%
55	0.4399%	0.3312%
56	0.4798%	0.3521%
57	0.5222%	0.3738%
58	0.5669%	0.3946%
59	0.6155%	0.4177%
60	0.6648%	0.4431%
61	0.7161%	0.4729%
62	0.7711%	0.5071%
63	0.8274%	0.5480%
64	0.8896%	0.5937%
65	0.9594%	0.6477%
66	1.0393%	0.7094%
67	1.1315%	0.7807%
68	1.2375%	0.8639%
69	1.3605%	0.9608%
70	1.5012%	1.0716%
71	1.6610%	1.1998%
72	1.8446%	1.3465%
73	2.0525%	1.5138%
74	2.2909%	1.7040%
75	2.5618%	1.9190%
76	2.8706%	2.1614%
77	3.2214%	2.4361%
78	3.6212%	2.7476%
79	4.0754%	3.1013%
80	4.5919%	3.5049%

Age in 2018	% Dying Next Year*	
	Male	Female
81	5.1790%	3.9663%
82	5.8448%	4.4928%
83	6.5925%	5.0919%
84	7.4276%	5.7765%
85	8.3532%	6.5564%
86	9.3724%	7.4436%
87	10.4843%	8.4454%
88	11.6926%	9.5632%
89	12.9974%	10.7979%
90	14.3973%	12.1279%
91	15.8785%	13.5368%
92	17.4252%	15.0033%
93	19.0272%	16.5199%
94	20.6786%	18.0908%
95	22.3761%	19.7321%
96	24.2511%	21.5428%
97	26.1962%	23.4622%
98	28.2070%	25.4894%
99	30.2716%	27.6341%
100	32.3714%	29.8723%
101	34.4944%	32.1827%
102	36.6004%	34.5204%
103	38.6865%	36.8532%
104	40.7211%	39.1889%
105	42.7076%	41.4701%
106	44.6265%	43.7141%
107	46.4586%	45.8803%
108	48.2094%	47.9568%
109	49.8696%	49.9435%
110	51.2046%	51.8328%

* *The rates shown are PUB-2010 mortality for healthy annuitants, General table, with adjustments, if applicable (see Section G). Recommended rates include mortality improvements using projection scale MP-2018.*

Proposed Actuarial Assumptions
Based on 2014-2018 Experience Study

Disabled Post-Retirement Mortality Rates

Age in 2018	% Dying Next Year*	
	Male	Female
20	0.3428%	0.1676%
21	0.3132%	0.1676%
22	0.2923%	0.1676%
23	0.2876%	0.1676%
24	0.2876%	0.1676%
25	0.2876%	0.2872%
26	0.3588%	0.3198%
27	0.3864%	0.3555%
28	0.4156%	0.3954%
29	0.4460%	0.4381%
30	0.4774%	0.4844%
31	0.5090%	0.5339%
32	0.5428%	0.5869%
33	0.5756%	0.6427%
34	0.6103%	0.7016%
35	0.6464%	0.7621%
36	0.6842%	0.8236%
37	0.7230%	0.8849%
38	0.7632%	0.9466%
39	0.8058%	1.0084%
40	0.8515%	1.0709%
41	0.9008%	1.1334%
42	0.9576%	1.1992%
43	1.0198%	1.2695%
44	1.0910%	1.3463%
45	1.1721%	1.4303%
46	1.2633%	1.4643%
47	1.3653%	1.5069%
48	1.4795%	1.5597%
49	1.5757%	1.6206%
50	1.6790%	1.6891%
51	1.7877%	1.7616%
52	1.9006%	1.8374%
53	2.0148%	1.9131%
54	2.1281%	1.9871%
55	2.2379%	2.0596%

Age in 2018	% Dying Next Year*	
	Male	Female
56	2.3463%	2.1267%
57	2.4528%	2.1915%
58	2.5598%	2.2523%
59	2.6686%	2.3101%
60	2.7823%	2.3666%
61	2.9014%	2.4242%
62	3.0238%	2.4879%
63	3.1451%	2.5599%
64	3.2669%	2.6456%
65	3.3881%	2.7489%
66	3.5110%	2.8738%
67	3.6391%	3.0247%
68	3.7768%	3.2046%
69	3.9332%	3.4185%
70	4.1092%	3.6687%
71	4.3129%	3.9579%
72	4.5461%	4.2896%
73	4.8130%	4.6654%
74	5.1163%	5.0902%
75	5.4606%	5.5653%
76	5.8494%	6.0966%
77	6.2871%	6.6867%
78	6.7774%	7.3403%
79	7.3229%	8.0597%
80	7.9215%	8.8486%
81	8.5798%	9.6764%
82	9.2954%	10.5205%
83	10.0653%	11.3743%
84	10.8938%	12.2382%
85	11.7846%	13.1264%
86	12.7498%	14.0479%
87	13.9584%	15.0293%
88	15.2952%	16.0883%
89	16.6642%	17.2525%
90	18.0461%	18.5225%

* *The rates shown are PUB-2010 mortality for disabled annuitants, General/Teachers table, with adjustments, if applicable (see Section G). Recommended rates include mortality improvements using projection scale MP-2018.*

Proposed Actuarial Assumptions
Based on 2014-2018 Experience Study

Healthy Pre-Retirement Mortality Rates

Age in 2018	% Dying Next Year*	
	Male	Female
20	0.0349%	0.0141%
21	0.0346%	0.0133%
22	0.0324%	0.0123%
23	0.0311%	0.0114%
24	0.0299%	0.0105%
25	0.0296%	0.0107%
26	0.0325%	0.0121%
27	0.0344%	0.0135%
28	0.0375%	0.0149%
29	0.0396%	0.0164%
30	0.0427%	0.0192%
31	0.0457%	0.0207%
32	0.0485%	0.0234%
33	0.0512%	0.0247%
34	0.0536%	0.0272%
35	0.0569%	0.0296%
36	0.0598%	0.0317%
37	0.0623%	0.0349%
38	0.0654%	0.0365%
39	0.0681%	0.0391%
40	0.0715%	0.0414%
41	0.0744%	0.0448%
42	0.0781%	0.0469%
43	0.0816%	0.0499%
44	0.0858%	0.0530%
45	0.0913%	0.0572%

Age in 2018	% Dying Next Year*	
	Male	Female
46	0.0977%	0.0617%
47	0.1045%	0.0665%
48	0.1136%	0.0716%
49	0.1232%	0.0782%
50	0.1335%	0.0853%
51	0.1463%	0.0939%
52	0.1598%	0.1030%
53	0.1747%	0.1136%
54	0.1904%	0.1243%
55	0.2086%	0.1373%
56	0.2280%	0.1499%
57	0.2499%	0.1631%
58	0.2728%	0.1765%
59	0.2965%	0.1911%
60	0.3216%	0.2068%
61	0.3476%	0.2224%
62	0.3742%	0.2389%
63	0.4019%	0.2577%
64	0.4297%	0.2788%
65	0.4587%	0.3014%
66	0.4890%	0.3278%
67	0.5220%	0.3583%
68	0.5578%	0.3922%
69	0.5993%	0.4308%
70	0.6450%	0.4751%

* *The rates shown are PUB-2010 mortality for employees, General table, with adjustments, if applicable (see Section G). Recommended rates include mortality improvements using projection scale MP-2018.*

SECTION K

GLOSSARY

Glossary

The following glossary is intended to provide definitions of a number of terms which are used throughout this report and which are somewhat unique to the discussion of an Experience Study.

Actuarial Decrement. The actual number of decrements which occurred during the study. This number is a straight tabulation of the actual number of occurrences of the particular decrement in question. Normally, the actual number of decrements will be subdivided by age and possibly sex.

Aggregate Assumptions. Assumptions which vary only by sex and/or age. The impact of year of service on the decrement is ignored. All experience is combined by age and/or sex without regard to service. Rates of death and disablement are more appropriate to aggregate measurement in a retirement system.

Crude Rate of Decrement. The rate of decrement determined by dividing the actual number of the respective decrement for that age and sex by the corresponding exposure for that age and sex. The rate is described as a crude rate because no smoothing or elimination of statistical fluctuations has been made. It is indicative of the underlying true rate of the decrement and is the basis used in graduation to obtain the graduated or tabular rate.

Decrements. The decrements are the means by which a member ceases to be a member. For active members, the decrements are death, withdrawal, service retirement, and disability retirement. For retired members, the only decrement is death. The purpose of the Experience Study is to determine the underlying rates of each decrement.

Expected Decrement. This is the number of occurrences of a given decrement expected to occur for a given age and sex based on the number of lives exposed to the risk of the particular decrement and the current assumed rate for that decrement. It may also be referred to as the tabular number of decrements. It is the number of deaths, withdrawals, retirements, or disabilities (whichever is applicable) that would have actually occurred had the actuarial assumptions been exactly realized.

Exposure. The number of lives exposed to a given risk of decrement for a particular age and sex. It represents the number of members who could have potentially died, retired, become disabled, or withdrawn at that particular age and for that particular sex. This term will also be described as “the number exposed to a given risk.”

Graduated Rates. Graduation is the mathematical process by which a set of crude rates of a particular type is translated into graduated or tabular rates. The graduation process attempts to smooth out statistical fluctuations and to arrive at a set of rates that adequately fit the underlying actual experience of the crude rates that are being graduated. The graduation process involves smoothing the results, but at the same time trying to fit the results to be consistent with the original data. It requires that the actuary exercise his or her judgment in what the underlying shape of the risk curve should look like.

Glossary

Interpolated Rates. For the active rates of decrement (death, disability, retirement, and withdrawal), the actuary will develop graduated rates based on quinquennial age groupings (see definition). To arrive at the rates of decrement for ages between two quinquennial ages, the graduated quinquennial rates must be interpolated for these intermediate ages. The interpolated results are arrived at by applying a mathematical interpolation formula to the quinquennial graduated rates.

Merit and Seniority Pay Increase Rate. The portion of the total salary scale which varies by service. It reflects the impact of moving up the salary grid in a given year, rather than the increase in the overall grid. It includes the salary increase associated with promotions during the year.

Quinquennial Age Groupings. For the active decrements, it is preferable to group the experience in five-year age groups for graduation and analysis purposes so as to minimize statistical fluctuations resulting from a lack of exposure which may occur for individual ages. Quinquennial age grouping is the five-year age grouping which is used to develop the graduated rates of decrement for active membership. The quinquennial age is the central age of the five-year grouping.

SECTION L

APPENDIX

Appendix – Detailed Experience Analysis

In this section, we present the annual experience for each major assumption that was analyzed for the study. Please note that totals may not sum correctly due to rounding of intermediate results.

Appendix – Detailed Experience Analysis
Salary Increases

2014-2018 Experience

Year	Exposure	Gross Actual Increases	Gross Expected Increases
1	9,456	12.95%	13.75%
2	12,982	6.92%	11.25%
3	11,263	5.79%	6.00%
4	9,431	5.66%	5.25%
5	7,833	5.34%	5.00%
6	6,670	4.99%	4.90%
7	6,398	5.02%	4.75%
8	6,767	4.87%	4.50%
9	6,911	5.00%	4.25%
10	6,447	4.58%	4.00%
11	5,607	4.56%	3.95%
12	4,653	4.36%	3.90%
13	4,192	4.08%	3.85%
14	4,207	3.99%	3.80%
15	4,410	4.19%	3.75%
16	4,619	3.69%	3.70%
17	4,531	3.78%	3.65%
18	4,057	3.67%	3.60%
19	3,452	3.66%	3.55%
20	2,981	3.46%	3.50%
21	2,602	3.32%	3.45%
22	2,401	3.40%	3.40%
23	2,271	3.20%	3.35%
24	2,221	3.19%	3.30%
25	2,401	3.39%	3.25%
26	2,503	3.23%	3.25%
27	2,565	3.10%	3.25%
28	2,455	3.34%	3.25%
29	2,207	3.01%	3.25%
30+	15,678	3.05%	3.25%
Totals	**164,171**	**5.01%**	**5.26%**

Appendix – Detailed Experience Analysis
Salary Increases

2014-2015 Experience

Year	Exposure	Gross Actual Increases	Gross Expected Increases
1	2,152	13.94%	13.75%
2	3,305	7.36%	11.25%
3	2,754	5.95%	6.00%
4	1,608	5.94%	5.25%
5	1,537	5.24%	5.00%
6	1,772	5.08%	4.90%
7	2,096	5.14%	4.75%
8	1,974	5.13%	4.50%
9	1,715	5.40%	4.25%
10	1,316	4.76%	4.00%
11	1,164	4.93%	3.95%
12	974	4.87%	3.90%
13	1,106	4.76%	3.85%
14	1,322	3.78%	3.80%
15	1,367	4.65%	3.75%
16	1,209	4.05%	3.70%
17	1,077	3.97%	3.65%
18	811	3.76%	3.60%
19	699	4.03%	3.55%
20	701	3.63%	3.50%
21	659	3.49%	3.45%
22	580	3.75%	3.40%
23	567	3.42%	3.35%
24	653	3.10%	3.30%
25	815	3.48%	3.25%
26	713	3.45%	3.25%
27	672	3.32%	3.25%
28	591	3.66%	3.25%
29	551	3.21%	3.25%
30+	4,060	3.09%	3.25%
Totals	**40,520**	**5.20%**	**5.21%**

Appendix – Detailed Experience Analysis
Salary Increases

2015-2016 Experience

Year	Exposure	Gross Actual Increases	Gross Expected Increases
1	1,930	14.15%	13.75%
2	3,242	7.44%	11.25%
3	2,927	6.65%	6.00%
4	2,427	6.10%	5.25%
5	1,480	6.05%	5.00%
6	1,420	5.44%	4.90%
7	1,654	5.65%	4.75%
8	1,934	5.53%	4.50%
9	1,846	5.77%	4.25%
10	1,607	5.14%	4.00%
11	1,226	4.95%	3.95%
12	1,083	4.99%	3.90%
13	914	4.26%	3.85%
14	1,044	4.74%	3.80%
15	1,232	4.82%	3.75%
16	1,277	3.82%	3.70%
17	1,138	4.41%	3.65%
18	1,021	4.13%	3.60%
19	749	4.30%	3.55%
20	668	3.97%	3.50%
21	661	3.88%	3.45%
22	619	4.09%	3.40%
23	537	4.08%	3.35%
24	527	4.07%	3.30%
25	609	3.86%	3.25%
26	754	3.49%	3.25%
27	666	3.54%	3.25%
28	602	3.63%	3.25%
29	543	3.56%	3.25%
30+	3,981	3.91%	3.25%
Totals	**40,318**	**5.56%**	**5.17%**

Appendix – Detailed Experience Analysis
Salary Increases

2016-2017 Experience

Year	Exposure	Gross Actual Increases	Gross Expected Increases
1	3,055	10.02%	13.75%
2	2,854	6.53%	11.25%
3	2,963	5.44%	6.00%
4	2,702	5.64%	5.25%
5	2,280	5.29%	5.00%
6	1,368	5.07%	4.90%
7	1,357	4.84%	4.75%
8	1,575	4.77%	4.50%
9	1,845	4.58%	4.25%
10	1,772	4.69%	4.00%
11	1,520	4.57%	3.95%
12	1,167	4.09%	3.90%
13	1,049	4.04%	3.85%
14	873	4.10%	3.80%
15	995	3.49%	3.75%
16	1,177	3.70%	3.70%
17	1,209	3.88%	3.65%
18	1,087	4.00%	3.60%
19	965	3.59%	3.55%
20	711	3.86%	3.50%
21	620	3.41%	3.45%
22	618	3.14%	3.40%
23	576	3.08%	3.35%
24	510	3.21%	3.30%
25	507	3.21%	3.25%
26	566	3.48%	3.25%
27	703	3.24%	3.25%
28	622	3.61%	3.25%
29	544	3.09%	3.25%
30+	3,892	3.02%	3.25%
Totals	**41,682**	**4.85%**	**5.35%**

Appendix – Detailed Experience Analysis
Salary Increases

2017-2018 Experience

Year	Exposure	Gross Actual Increases	Gross Expected Increases
1	2,319	14.89%	13.75%
2	3,581	6.35%	11.25%
3	2,619	5.07%	6.00%
4	2,694	5.10%	5.25%
5	2,536	5.02%	5.00%
6	2,110	4.56%	4.90%
7	1,291	4.21%	4.75%
8	1,284	3.63%	4.50%
9	1,505	4.10%	4.25%
10	1,752	3.83%	4.00%
11	1,697	4.01%	3.95%
12	1,429	3.75%	3.90%
13	1,123	3.30%	3.85%
14	968	3.38%	3.80%
15	816	3.32%	3.75%
16	956	3.04%	3.70%
17	1,107	2.83%	3.65%
18	1,138	2.89%	3.60%
19	1,039	3.02%	3.55%
20	901	2.64%	3.50%
21	662	2.49%	3.45%
22	584	2.61%	3.40%
23	591	2.34%	3.35%
24	531	2.39%	3.30%
25	470	2.81%	3.25%
26	470	2.21%	3.25%
27	524	2.07%	3.25%
28	640	2.51%	3.25%
29	569	2.20%	3.25%
30+	3,745	2.12%	3.25%
Totals	**41,651**	**4.48%**	**5.31%**

Appendix – Detailed Experience Analysis
Rule of 90 Retirement

2014-2018 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	20,968	122,239	18,335.85	114.4%
56	23,822	231,773	34,765.95	68.5%
57	51,216	367,353	45,919.13	111.5%
58	50,554	481,239	60,154.88	84.0%
59	67,832	604,359	90,653.85	74.8%
60	100,135	706,648	105,997.20	94.5%
61	95,742	758,531	151,706.20	63.1%
62	189,175	777,883	233,364.90	81.1%
63	141,136	673,098	168,274.50	83.9%
64	114,387	589,583	147,395.75	77.6%
Totals	**854,967**	**5,312,706**	**1,056,568.20**	**80.9%**

Appendix – Detailed Experience Analysis
Rule of 90 Retirement

2014-2015 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	5,084	31,193	4,678.95	108.7%
56	9,532	64,342	9,651.30	98.8%
57	14,885	97,786	12,223.25	121.8%
58	17,231	131,631	16,453.88	104.7%
59	20,418	162,785	24,417.75	83.6%
60	29,765	174,038	26,105.70	114.0%
61	25,836	189,594	37,918.80	68.1%
62	59,101	194,629	58,388.70	101.2%
63	47,227	187,862	46,965.50	100.6%
64	26,864	143,787	35,946.75	74.7%
Totals	**255,943**	**1,377,647**	**272,750.58**	**93.8%**

2015-2016 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	5,633	39,791	5,968.65	94.4%
56	2,976	59,809	8,971.35	33.2%
57	11,473	79,641	9,955.13	115.2%
58	14,111	118,301	14,787.63	95.4%
59	18,743	155,803	23,370.45	80.2%
60	24,413	181,622	27,243.30	89.6%
61	18,841	171,170	34,234.00	55.0%
62	37,642	193,041	57,912.30	65.0%
63	34,747	158,753	39,688.25	87.5%
64	31,812	155,251	38,812.75	82.0%
Totals	**200,391**	**1,313,182**	**260,943.80**	**76.8%**

Appendix – Detailed Experience Analysis
Rule of 90 Retirement

2016-2017 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	5,455	27,273	4,090.95	133.3%
56	5,935	57,434	8,615.10	68.9%
57	13,484	96,946	12,118.25	111.3%
58	12,540	109,590	13,698.75	91.5%
59	14,550	143,585	21,537.75	67.6%
60	19,555	179,506	26,925.90	72.6%
61	27,406	197,360	39,472.00	69.4%
62	47,305	185,577	55,673.10	85.0%
63	31,527	177,091	44,272.75	71.2%
64	25,256	134,336	33,584.00	75.2%
Totals	**203,013**	**1,308,698**	**259,988.55**	**78.1%**

2017-2018 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	4,796	23,982	3,597.30	133.3%
56	5,379	50,188	7,528.20	71.5%
57	11,374	92,980	11,622.50	97.9%
58	6,672	121,717	15,214.63	43.9%
59	14,121	142,186	21,327.90	66.2%
60	26,402	171,482	25,722.30	102.6%
61	23,659	200,407	40,081.40	59.0%
62	45,127	204,636	61,390.80	73.5%
63	27,635	149,392	37,348.00	74.0%
64	30,455	156,209	39,052.25	78.0%
Totals	**195,620**	**1,313,179**	**262,885.28**	**74.4%**

Appendix – Detailed Experience Analysis
Non-Rule of 90 Retirement – Tier 1 Members

2014-2018 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	11,395	536,741	21,469.64	53.1%
56	13,461	509,156	20,366.24	66.1%
57	15,023	441,379	17,655.16	85.1%
58	13,911	392,305	15,692.20	88.6%
59	15,505	317,937	19,076.22	81.3%
60	16,123	232,629	18,610.32	86.6%
61	9,233	165,218	16,521.80	55.9%
62	12,170	103,571	20,714.20	58.8%
63	10,426	71,914	12,944.52	80.5%
64	6,957	46,457	8,362.26	83.2%
65	177,539	533,056	186,569.60	95.2%
66	144,781	371,810	111,543.00	129.8%
67	67,863	221,940	55,485.00	122.3%
68	39,085	154,628	38,657.00	101.1%
69	28,899	110,434	24,295.48	118.9%
70	20,415	73,206	21,961.80	93.0%
Totals	**602,786**	**4,282,381**	**609,924.44**	**98.8%**

Appendix – Detailed Experience Analysis
Non-Rule of 90 Retirement – Tier 1 Members

2014-2015 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	4,760	164,917	6,596.68	72.2%
56	3,867	143,731	5,749.24	67.3%
57	5,777	136,587	5,463.48	105.7%
58	5,343	126,174	5,046.96	105.9%
59	5,329	110,604	6,636.24	80.3%
60	4,935	69,002	5,520.16	89.4%
61	4,757	56,589	5,658.90	84.1%
62	3,607	36,151	7,230.20	49.9%
63	4,793	28,177	5,071.86	94.5%
64	2,425	13,074	2,353.32	103.0%
65	49,883	133,189	46,616.15	107.0%
66	37,105	92,994	27,898.20	133.0%
67	18,560	49,735	12,433.75	149.3%
68	10,324	40,693	10,173.25	101.5%
69	4,828	21,603	4,752.66	101.6%
70	3,418	12,664	3,799.20	90.0%
Totals	**169,711**	**1,235,884**	**161,000.25**	**105.4%**

2015-2016 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	2,544	128,171	5,126.84	49.6%
56	3,081	133,923	5,356.92	57.5%
57	3,591	120,243	4,809.72	74.7%
58	3,621	99,725	3,989.00	90.8%
59	4,538	84,812	5,088.72	89.2%
60	5,933	72,488	5,799.04	102.3%
61	457	41,699	4,169.90	11.0%
62	2,440	26,139	5,227.80	46.7%
63	1,335	13,054	2,349.72	56.8%
64	2,293	11,788	2,121.84	108.1%
65	40,075	130,316	45,610.60	87.9%
66	31,499	82,216	24,664.80	127.7%
67	14,339	55,914	13,978.50	102.6%
68	8,301	30,808	7,702.00	107.8%
69	7,901	30,682	6,750.04	117.1%
70	4,606	16,677	5,003.10	92.1%
Totals	**136,554**	**1,078,655**	**147,748.54**	**92.4%**

Appendix – Detailed Experience Analysis
Non-Rule of 90 Retirement – Tier 1 Members

2016-2017 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	1,941	135,524	5,420.96	35.8%
56	4,136	112,784	4,511.36	91.7%
57	2,644	104,624	4,184.96	63.2%
58	2,742	87,607	3,504.28	78.2%
59	3,323	71,216	4,272.96	77.8%
60	3,172	53,088	4,247.04	74.7%
61	2,748	44,257	4,425.70	62.1%
62	3,202	21,913	4,382.60	73.1%
63	2,639	14,144	2,545.92	103.7%
64	1,502	11,858	2,134.44	70.4%
65	42,688	142,187	49,765.45	85.8%
66	34,535	95,147	28,544.10	121.0%
67	14,377	53,247	13,311.75	108.0%
68	11,140	43,469	10,867.25	102.5%
69	5,015	23,982	5,276.04	95.1%
70	4,033	24,403	7,320.90	55.1%
Totals	**139,837**	**1,039,450**	**154,715.71**	**90.4%**

2017-2018 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	2,150	108,129	4,325.16	49.7%
56	2,377	118,718	4,748.72	50.1%
57	3,011	79,925	3,197.00	94.2%
58	2,205	78,799	3,151.96	70.0%
59	2,315	51,305	3,078.30	75.2%
60	2,083	38,051	3,044.08	68.4%
61	1,271	22,673	2,267.30	56.1%
62	2,921	19,368	3,873.60	75.4%
63	1,659	16,539	2,977.02	55.7%
64	737	9,737	1,752.66	42.1%
65	44,893	127,364	44,577.40	100.7%
66	41,642	101,453	30,435.90	136.8%
67	20,587	63,044	15,761.00	130.6%
68	9,320	39,658	9,914.50	94.0%
69	11,155	34,167	7,516.74	148.4%
70	8,358	19,462	5,838.60	143.2%
Totals	**156,684**	**928,392**	**146,459.94**	**107.0%**

Appendix – Detailed Experience Analysis
Non-Rule of 90 Retirement – Tier 2 Members

2014-2018 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	18,301	618,399	24,735.96	74.0%
56	19,921	604,589	24,183.56	82.4%
57	18,770	598,767	23,950.68	78.4%
58	20,082	584,366	23,374.64	85.9%
59	22,051	571,906	28,595.30	77.1%
60	25,869	550,594	27,529.70	94.0%
61	26,746	520,685	52,068.50	51.4%
62	57,031	495,944	74,391.60	76.7%
63	52,777	429,142	64,371.30	82.0%
64	47,943	366,887	55,033.05	87.1%
65	60,433	301,753	60,350.60	100.1%
66	76,450	231,293	69,387.90	110.2%
67	45,403	146,094	36,523.50	124.3%
68	22,655	91,522	22,880.50	99.0%
69	18,409	61,848	13,606.56	135.3%
70	12,948	41,954	12,586.20	102.9%
Totals	**545,789**	**6,215,743**	**613,569.55**	**89.0%**

Appendix – Detailed Experience Analysis
Non-Rule of 90 Retirement – Tier 2 Members

2014-2015 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	4,552	137,089	5,483.56	83.0%
56	4,732	137,271	5,490.84	86.2%
57	5,027	129,489	5,179.56	97.1%
58	5,984	126,869	5,074.76	117.9%
59	4,951	127,581	6,379.05	77.6%
60	7,747	122,151	6,107.55	126.8%
61	7,501	110,737	11,073.70	67.7%
62	13,094	104,600	15,690.00	83.5%
63	11,530	86,115	12,917.25	89.3%
64	12,895	81,279	12,191.85	105.8%
65	12,795	59,648	11,929.60	107.3%
66	15,200	46,215	13,864.50	109.6%
67	10,045	29,666	7,416.50	135.4%
68	6,803	22,104	5,526.00	123.1%
69	3,948	9,619	2,116.18	186.6%
70	2,626	8,877	2,663.10	98.6%
Totals	**129,430**	**1,339,310**	**129,104.00**	**100.3%**

2015-2016 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	4,555	144,715	5,788.60	78.7%
56	5,338	143,885	5,755.40	92.7%
57	4,850	143,590	5,743.60	84.4%
58	3,856	134,096	5,363.84	71.9%
59	5,628	130,055	6,502.75	86.5%
60	5,231	131,488	6,574.40	79.6%
61	5,116	123,381	12,338.10	41.5%
62	13,778	111,970	16,795.50	82.0%
63	14,568	99,321	14,898.15	97.8%
64	10,734	79,187	11,878.05	90.4%
65	15,988	72,529	14,505.80	110.2%
66	17,234	51,955	15,586.50	110.6%
67	12,291	32,386	8,096.50	151.8%
68	4,343	20,304	5,076.00	85.6%
69	4,158	16,019	3,524.18	118.0%
70	2,726	5,973	1,791.90	152.1%
Totals	**130,394**	**1,440,854**	**140,219.27**	**93.0%**

Appendix – Detailed Experience Analysis
Non-Rule of 90 Retirement – Tier 2 Members

2016-2017 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	3,859	152,043	6,081.72	63.5%
56	5,133	154,024	6,160.96	83.3%
57	4,759	154,716	6,188.64	76.9%
58	4,088	154,383	6,175.32	66.2%
59	4,570	144,116	7,205.80	63.4%
60	6,643	139,174	6,958.70	95.5%
61	6,444	138,288	13,828.80	46.6%
62	12,622	131,424	19,713.60	64.0%
63	10,295	110,108	16,516.20	62.3%
64	11,217	95,084	14,262.60	78.6%
65	14,999	76,797	15,359.40	97.7%
66	19,331	63,559	19,067.70	101.4%
67	11,464	37,419	9,354.75	122.5%
68	4,233	21,811	5,452.75	77.6%
69	4,153	17,436	3,835.92	108.3%
70	2,557	12,933	3,879.90	65.9%
Totals	**126,367**	**1,603,315**	**160,042.76**	**79.0%**

2017-2018 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
55	5,335	184,552	7,382.08	72.3%
56	4,718	169,409	6,776.36	69.6%
57	4,134	170,972	6,838.88	60.4%
58	6,154	169,018	6,760.72	91.0%
59	6,902	170,154	8,507.70	81.1%
60	6,248	157,781	7,889.05	79.2%
61	7,685	148,279	14,827.90	51.8%
62	17,537	147,950	22,192.50	79.0%
63	16,384	133,598	20,039.70	81.8%
64	13,097	111,337	16,700.55	78.4%
65	16,651	92,779	18,555.80	89.7%
66	24,685	69,564	20,869.20	118.3%
67	11,603	46,623	11,655.75	99.5%
68	7,276	27,303	6,825.75	106.6%
69	6,150	18,774	4,130.28	148.9%
70	5,039	14,171	4,251.30	118.5%
Totals	**159,598**	**1,832,264**	**184,203.52**	**86.6%**

Appendix – Detailed Experience Analysis
Terminations

2014-2018 Experience ($000s)

	Males					Females			
Year	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected	Year	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
1	21,237	105,814	21,162.53	100.4%	1	24,890	120,852	29,004.41	85.8%
2	53,796	356,148	53,422.19	100.7%	2	70,131	409,644	73,735.90	95.1%
3	35,397	355,337	39,087.07	90.6%	3	51,470	398,706	51,831.79	99.3%
4	28,307	337,125	28,655.58	98.8%	4	37,857	360,067	39,607.31	95.6%
5	20,229	290,392	22,505.40	89.9%	5	28,557	299,577	26,962.00	105.9%
6	16,634	239,871	15,591.60	106.7%	6	20,019	238,501	20,272.66	98.7%
7	13,984	232,433	13,364.82	104.6%	7	18,474	229,349	17,201.22	107.4%
8	12,205	253,457	12,672.83	96.3%	8	17,302	263,017	15,123.44	114.4%
9	9,487	262,420	10,496.85	90.4%	9	17,909	292,898	14,644.94	122.3%
10	11,580	258,771	8,410.07	137.7%	10	14,520	304,941	13,722.38	105.8%
11	8,116	242,470	7,274.08	111.6%	11	13,077	293,108	11,724.29	111.5%
12	6,789	202,930	5,580.57	121.7%	12	10,476	253,390	10,135.59	103.4%
13	5,259	188,820	4,720.50	111.4%	13	8,257	225,606	6,768.16	122.0%
14	7,297	195,846	4,896.13	149.0%	14	8,827	218,976	6,021.81	146.6%
15	3,176	201,657	5,041.43	63.0%	15	8,160	224,863	5,621.59	145.2%
16	6,720	232,137	4,642.75	144.7%	16	8,133	241,823	5,441.00	149.5%
17	4,529	252,773	5,055.45	89.6%	17	6,240	246,238	5,540.33	112.6%
18	6,683	242,448	4,848.96	137.8%	18	4,831	235,256	5,293.23	91.3%
19	5,341	225,218	4,504.37	118.6%	19	5,063	205,693	4,628.08	109.4%
20	3,046	187,469	2,812.03	108.3%	20	4,789	185,491	4,173.54	114.7%
21	1,277	159,474	2,392.12	53.4%	21	5,031	164,666	3,293.29	152.8%
22	3,046	135,433	2,031.49	149.9%	22	3,294	139,687	2,793.72	117.9%
23	1,210	128,192	1,281.92	94.4%	23	1,514	132,548	1,988.22	76.1%
24	2,513	118,339	1,183.40	212.4%	24	2,679	120,511	1,807.65	148.2%
25	1,419	131,747	1,317.47	107.7%	25	2,715	125,109	1,876.62	144.7%
26	1,382	137,705	1,377.05	100.4%	26	3,078	131,328	1,969.91	156.3%
27	779	138,338	1,383.38	56.3%	27	2,512	136,942	1,711.76	146.7%
28	2,055	144,861	1,448.60	141.9%	28	2,458	139,563	1,744.52	140.9%
29	539	121,457	1,214.56	44.4%	29	1,722	126,663	1,583.27	108.8%
30+	1,797	354,080	3,540.79	50.8%	30	5,808	591,937	5,919.30	98.1%
Totals	**295,829**	**6,433,162**	**291,915.99**	**101.3%**	**Totals**	**409,793**	**7,056,950**	**392,141.94**	**104.5%**

Appendix – Detailed Experience Analysis
Terminations

2014-2015 Experience ($000s)

	Males				Females				
Year	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected	Year	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
1	5,044	24,663	4,932.51	102.3%	1	5,463	27,256	6,541.32	83.5%
2	12,504	84,866	12,729.94	98.2%	2	17,083	101,387	18,249.62	93.6%
3	9,666	89,186	9,810.48	98.5%	3	11,323	92,775	12,060.80	93.9%
4	6,574	66,471	5,650.03	116.4%	4	7,580	64,336	7,076.93	107.1%
5	4,890	53,923	4,179.06	117.0%	5	5,442	52,882	4,759.41	114.3%
6	3,676	54,788	3,561.21	103.2%	6	5,278	52,638	4,474.26	118.0%
7	4,799	70,805	4,071.26	117.9%	7	5,646	71,366	5,352.45	105.5%
8	3,621	75,765	3,788.25	95.6%	8	6,903	85,865	4,937.21	139.8%
9	2,817	58,507	2,340.29	120.4%	9	4,857	80,102	4,005.11	121.3%
10	2,224	52,329	1,700.70	130.8%	10	4,300	66,675	3,000.38	143.3%
11	1,590	52,525	1,575.74	100.9%	11	1,604	59,143	2,365.72	67.8%
12	1,067	37,289	1,025.45	104.1%	12	1,731	45,637	1,825.50	94.8%
13	816	45,064	1,126.60	72.4%	13	1,228	50,418	1,512.53	81.2%
14	2,458	61,375	1,534.38	160.2%	14	2,306	62,863	1,728.74	133.4%
15	1,343	61,735	1,543.38	87.0%	15	2,235	71,507	1,787.68	125.0%
16	2,759	66,268	1,325.36	208.2%	16	2,140	62,279	1,401.27	152.7%
17	1,771	67,314	1,346.28	131.5%	17	1,487	61,732	1,388.96	107.1%
18	2,001	54,773	1,095.46	182.7%	18	495	50,772	1,142.36	43.3%
19	1,911	43,505	870.11	219.6%	19	1,172	39,986	899.68	130.3%
20	531	36,239	543.58	97.7%	20	1,490	45,253	1,018.19	146.3%
21	716	36,492	547.38	130.8%	21	1,295	40,032	800.63	161.7%
22	742	31,418	471.27	157.4%	22	393	28,689	573.77	68.5%
23	642	38,007	380.07	168.9%	23	687	30,088	451.32	152.2%
24	627	29,682	296.83	211.2%	24	1,195	30,599	458.98	260.4%
25	487	49,675	496.75	98.0%	25	690	45,618	684.26	100.8%
26	443	43,639	436.39	101.5%	26	1,493	43,342	650.12	229.6%
27	343	44,664	446.64	76.8%	27	358	43,354	541.91	66.1%
28	292	36,677	366.77	79.6%	28	373	35,277	440.96	84.6%
29	270	34,031	340.31	79.3%	29	698	32,791	409.88	170.3%
30+	795	104,898	1,048.98	75.8%	30+	728	187,120	1,871.15	38.9%
Totals	**77,419**	**1,606,573**	**69,581.44**	**111.3%**	**Totals**	**97,673**	**1,761,782**	**92,411.07**	**105.7%**

Appendix – Detailed Experience Analysis
Terminations

2015-2016 Experience ($000s)

	Males				Females				
Year	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected	Year	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
1	4,350	22,166	4,433.16	98.1%	1	5,653	24,870	5,968.78	94.7%
2	13,099	84,316	12,647.36	103.6%	2	17,633	96,011	17,281.91	102.0%
3	8,748	90,608	9,966.88	87.8%	3	15,380	106,727	13,874.45	110.9%
4	7,601	89,276	7,588.46	100.2%	4	10,666	94,503	10,395.33	102.6%
5	3,575	62,605	4,851.89	73.7%	5	9,554	62,271	5,604.41	170.5%
6	3,214	49,288	3,203.71	100.3%	6	3,799	48,975	4,162.89	91.3%
7	3,769	55,955	3,217.39	117.1%	7	4,820	51,943	3,895.76	123.7%
8	4,513	71,797	3,589.84	125.7%	8	4,955	73,050	4,200.36	118.0%
9	3,085	77,464	3,098.58	99.6%	9	4,646	84,659	4,232.94	109.8%
10	2,656	59,611	1,937.37	137.1%	10	4,283	80,642	3,628.90	118.0%
11	2,133	53,200	1,595.99	133.6%	11	2,910	67,271	2,690.83	108.1%
12	1,599	52,460	1,442.64	110.8%	12	2,891	61,717	2,468.67	117.1%
13	1,649	37,723	943.08	174.9%	13	2,291	47,147	1,414.40	162.0%
14	1,907	44,308	1,107.69	172.2%	14	2,561	51,206	1,408.15	181.9%
15	973	60,358	1,508.96	64.5%	15	2,494	61,011	1,525.28	163.5%
16	1,479	61,477	1,229.54	120.3%	16	3,188	71,908	1,617.94	197.0%
17	651	66,078	1,321.55	49.3%	17	2,235	60,168	1,353.78	165.1%
18	1,100	62,763	1,255.26	87.6%	18	1,059	59,668	1,342.52	78.9%
19	1,186	54,548	1,090.96	108.7%	19	1,304	50,648	1,139.57	114.4%
20	163	40,102	601.53	27.1%	20	1,150	35,523	799.27	143.9%
21	390	34,394	515.92	75.6%	21	1,661	42,410	848.19	195.8%
22	957	33,825	507.37	188.6%	22	596	38,592	771.83	77.2%
23	205	29,268	292.68	70.0%	23	-	26,906	403.59	0.0%
24	667	33,721	337.21	197.8%	24	220	28,164	422.45	52.1%
25	591	27,138	271.38	217.8%	25	954	26,572	398.58	239.4%
26	-	44,512	445.12	0.0%	26	-	40,398	605.97	0.0%
27	-	37,164	371.64	0.0%	27	816	37,942	474.27	172.1%
28	699	39,965	399.65	174.9%	28	926	40,733	509.16	181.9%
29	269	29,471	294.71	91.3%	29	233	33,160	414.50	56.2%
30+	390	94,249	942.48	41.4%	30+	1,504	158,988	1,589.86	94.6%
Totals	**71,618**	**1,599,810**	**71,009.99**	**100.9%**	**Totals**	**110,382**	**1,763,783**	**95,444.54**	**115.7%**

Appendix – Detailed Experience Analysis
Terminations

2016-2017 Experience ($000s)

	Males					Females			
Year	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected	Year	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
1	5,738	30,906	6,181.11	92.8%	1	6,780	35,514	8,523.34	79.5%
2	13,080	86,624	12,993.64	100.7%	2	16,080	97,725	17,590.54	91.4%
3	9,572	87,146	9,586.01	99.9%	3	11,853	97,121	12,625.72	93.9%
4	6,816	91,120	7,745.16	88.0%	4	10,168	102,289	11,251.81	90.4%
5	6,354	83,933	6,504.81	97.7%	5	6,712	85,630	7,706.70	87.1%
6	3,883	55,306	3,594.90	108.0%	6	4,211	53,563	4,552.88	92.5%
7	2,693	48,531	2,790.51	96.5%	7	4,533	50,122	3,759.13	120.6%
8	1,931	54,712	2,735.58	70.6%	8	2,333	51,968	2,988.18	78.1%
9	2,455	68,816	2,752.65	89.2%	9	4,326	71,779	3,588.97	120.5%
10	3,259	75,660	2,458.94	132.5%	10	3,482	84,157	3,787.07	91.9%
11	2,287	59,718	1,791.55	127.7%	11	3,409	78,448	3,137.91	108.6%
12	2,180	52,062	1,431.71	152.3%	12	2,350	66,007	2,640.27	89.0%
13	1,121	52,014	1,300.36	86.2%	13	2,444	60,019	1,800.57	135.7%
14	1,216	37,184	929.60	130.8%	14	1,804	43,902	1,207.29	149.4%
15	454	42,039	1,050.98	43.2%	15	1,432	48,656	1,216.41	117.7%
16	1,178	60,312	1,206.25	97.7%	16	1,589	57,504	1,293.83	122.8%
17	1,153	58,913	1,178.26	97.9%	17	1,242	67,126	1,510.33	82.2%
18	1,275	64,635	1,292.71	98.6%	18	1,193	57,264	1,288.43	92.6%
19	1,153	61,443	1,228.86	93.8%	19	889	56,362	1,268.15	70.1%
20	1,843	51,298	769.47	239.5%	20	956	48,847	1,099.06	87.0%
21	-	38,806	582.09	0.0%	21	668	33,787	675.73	98.9%
22	459	32,766	491.49	93.4%	22	1,292	39,333	786.67	164.2%
23	149	30,232	302.32	49.3%	23	442	37,814	567.21	77.9%
24	503	25,346	253.46	198.5%	24	258	25,687	385.30	67.0%
25	145	31,450	314.50	46.1%	25	167	27,053	405.80	41.2%
26	939	21,380	213.80	439.2%	26	583	23,626	354.40	164.5%
27	254	37,850	378.50	67.1%	27	854	34,976	437.21	195.3%
28	616	34,849	348.49	176.8%	28	458	32,844	410.55	111.6%
29	-	31,993	319.93	0.0%	29	791	31,949	399.36	198.1%
30+	-	81,772	817.71	0.0%	30+	1,633	130,962	1,309.62	124.7%
Totals	**72,706**	**1,588,816**	**73,545.35**	**98.9%**	**Totals**	**94,932**	**1,732,034**	**98,568.41**	**96.3%**

Appendix – Detailed Experience Analysis
Terminations

2017-2018 Experience ($000s)

	Males					Females			
Year	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected	Year	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
1	6,105	28,079	5,615.75	108.7%	1	6,994	33,212	7,970.97	87.7%
2	15,113	100,342	15,051.24	100.4%	2	19,335	114,521	20,613.82	93.8%
3	7,411	88,397	9,723.71	76.2%	3	12,914	102,083	13,270.82	97.3%
4	7,316	90,258	7,671.92	95.4%	4	9,443	98,939	10,883.25	86.8%
5	5,410	89,931	6,969.64	77.6%	5	6,849	98,794	8,891.48	77.0%
6	5,861	80,489	5,231.79	112.0%	6	6,731	83,325	7,082.63	95.0%
7	2,723	57,142	3,285.65	82.9%	7	3,475	55,918	4,193.88	82.9%
8	2,140	51,183	2,559.17	83.6%	8	3,111	52,134	2,997.70	103.8%
9	1,130	57,633	2,305.34	49.0%	9	4,080	56,358	2,817.92	144.8%
10	3,441	71,171	2,313.06	148.8%	10	2,455	73,467	3,306.03	74.3%
11	2,106	77,027	2,310.80	91.1%	11	5,154	88,246	3,529.84	146.0%
12	1,943	61,119	1,680.76	115.6%	12	3,504	80,029	3,201.16	109.5%
13	1,673	54,019	1,350.47	123.9%	13	2,294	68,022	2,040.66	112.4%
14	1,716	52,979	1,324.47	129.6%	14	2,156	61,005	1,677.63	128.5%
15	406	37,525	938.12	43.3%	15	1,999	43,689	1,092.23	183.0%
16	1,304	44,080	881.60	147.9%	16	1,216	50,132	1,127.97	107.8%
17	954	60,468	1,209.36	78.9%	17	1,276	57,212	1,287.27	99.1%
18	2,307	60,277	1,205.54	191.4%	18	2,084	67,552	1,519.93	137.1%
19	1,091	65,722	1,314.44	83.0%	19	1,698	58,697	1,320.67	128.6%
20	509	59,830	897.46	56.7%	20	1,193	55,868	1,257.02	94.9%
21	171	49,782	746.73	22.9%	21	1,407	48,437	968.74	145.2%
22	888	37,424	561.36	158.2%	22	1,013	33,073	661.45	153.1%
23	214	30,685	306.85	69.7%	23	385	37,740	566.10	68.0%
24	716	29,590	295.90	242.0%	24	1,006	36,061	540.92	186.0%
25	196	23,484	234.84	83.5%	25	904	25,866	387.98	233.0%
26	-	28,174	281.74	0.0%	26	1,002	23,962	359.42	278.8%
27	182	18,660	186.60	97.5%	27	484	20,670	258.38	187.3%
28	448	33,370	333.70	134.3%	28	701	30,709	383.86	182.6%
29	-	25,962	259.62	0.0%	29	-	28,763	359.54	0.0%
30+	612	73,161	731.62	83.6%	30+	1,943	114,867	1,148.66	169.2%
Totals	**74,086**	**1,637,963**	**77,779.21**	**95.3%**	**Totals**	**106,806**	**1,799,351**	**105,717.92**	**101.0%**

Appendix – Detailed Experience Analysis
Disability Retirements

2014-2018 Experience

	Males				Females				
Age Group	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected	Age Group	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected
Under 20	-	-	-	N/A	Under 20	-	-	-	N/A
20-24	-	-	-	N/A	20-24	-	-	-	N/A
25-29	-	5,878	0.59	0.0%	25-29	-	8,489	0.85	0.0%
30-34	-	8,752	1.06	0.0%	30-34	-	11,752	1.42	0.0%
35-39	1	9,455	3.56	28.1%	35-39	-	11,811	4.46	0.0%
40-44	4	8,529	6.49	61.7%	40-44	1	10,523	7.99	12.5%
45-49	7	10,166	15.35	45.6%	45-49	7	12,327	18.63	37.6%
50-54	15	12,775	34.37	43.6%	50-54	18	15,525	41.67	43.2%
55-59	35	14,611	54.12	64.7%	55-59	34	17,812	65.85	51.6%
60-64	34	12,200	64.96	52.3%	60-64	27	13,932	74.02	36.5%
Totals	**96**	**82,366**	**180.50**	**53.2%**	**Totals**	**87**	**102,171**	**214.87**	**40.5%**

Appendix – Detailed Experience Analysis
Disability Retirements

2014-2015 Experience

	Males				Females				
Age Group	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected	Age Group	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected
Under 20	-	-	-	N/A	Under 20	-	-	-	N/A
20-24	-	-	-	N/A	20-24	-	-	-	N/A
25-29	-	1,473	0.15	0.0%	25-29	-	2,121	0.21	0.0%
30-34	-	2,157	0.26	0.0%	30-34	-	2,911	0.35	0.0%
35-39	-	2,165	0.81	0.0%	35-39	-	2,736	1.03	0.0%
40-44	-	2,098	1.60	0.0%	40-44	-	2,614	2.00	0.0%
45-49	4	2,555	3.82	104.7%	45-49	2	3,125	4.73	42.3%
50-54	5	3,436	9.19	54.4%	50-54	7	4,149	11.10	63.0%
55-59	14	3,772	13.98	100.1%	55-59	11	4,648	17.17	64.1%
60-64	8	3,069	16.34	49.0%	60-64	6	3,390	17.98	33.4%
Totals	**31**	**20,725**	**46.15**	**67.2%**	**Totals**	**26**	**25,694**	**54.58**	**47.6%**

2015-2016 Experience

	Males				Females				
Age Group	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected	Age Group	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected
Under 20	-	-	-	N/A	Under 20	-	-	-	N/A
20-24	-	-	-	N/A	20-24	-	-	-	N/A
25-29	-	1,432	0.14	0.0%	25-29	-	2,080	0.21	0.0%
30-34	-	2,148	0.26	0.0%	30-34	-	2,877	0.35	0.0%
35-39	-	2,268	0.85	0.0%	35-39	-	2,822	1.05	0.0%
40-44	1	2,060	1.57	63.8%	40-44	-	2,545	1.93	0.0%
45-49	2	2,535	3.81	52.5%	45-49	3	3,106	4.66	64.3%
50-54	5	3,256	8.77	57.0%	50-54	3	3,931	10.54	28.5%
55-59	7	3,657	13.57	51.6%	55-59	14	4,447	16.41	85.3%
60-64	13	3,011	16.04	81.0%	60-64	3	3,468	18.37	16.3%
Totals	**28**	**20,367**	**45.01**	**62.2%**	**Totals**	**23**	**25,276**	**53.50**	**43.0%**

Appendix – Detailed Experience Analysis
Disability Retirements

2016-2017 Experience

	Males				Females				
Age Group	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected	Age Group	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected
Under 20	-	-	-	N/A	Under 20	-	-	-	N/A
20-24	-	-	-	N/A	20-24	-	-	-	N/A
25-29	-	1,441	0.14	0.0%	25-29	-	2,073	0.21	0.0%
30-34	-	2,174	0.26	0.0%	30-34	-	2,909	0.35	0.0%
35-39	1	2,429	0.92	109.3%	35-39	-	3,064	1.16	0.0%
40-44	-	2,127	1.61	0.0%	40-44	1	2,596	1.97	50.7%
45-49	1	2,541	3.85	26.0%	45-49	1	3,052	4.61	21.7%
50-54	4	3,122	8.44	47.4%	50-54	3	3,790	10.19	29.5%
55-59	7	3,589	13.29	52.7%	55-59	4	4,396	16.25	24.6%
60-64	4	3,054	16.25	24.6%	60-64	9	3,484	18.51	48.6%
Totals	**17**	**20,477**	**44.77**	**38.0%**	**Totals**	**18**	**25,364**	**53.25**	**33.8%**

2017-2018 Experience

	Males				Females				
Age Group	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected	Age Group	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected
Under 20	-	-	-	N/A	Under 20	-	-	-	N/A
20-24	-	-	-	N/A	20-24	-	-	-	N/A
25-29	-	1,532	0.15	0.0%	25-29	-	2,215	0.22	0.0%
30-34	-	2,273	0.28	0.0%	30-34	-	3,055	0.37	0.0%
35-39	-	2,593	0.99	0.0%	35-39	-	3,189	1.21	0.0%
40-44	3	2,244	1.70	176.2%	40-44	-	2,768	2.09	0.0%
45-49	-	2,535	3.87	0.0%	45-49	1	3,044	4.63	21.6%
50-54	1	2,961	7.98	12.5%	50-54	5	3,655	9.84	50.8%
55-59	7	3,593	13.27	52.8%	55-59	5	4,321	16.01	31.2%
60-64	9	3,066	16.32	55.1%	60-64	9	3,590	19.15	47.0%
Totals	**20**	**20,797**	**44.57**	**44.9%**	**Totals**	**20**	**25,837**	**53.54**	**37.4%**

Appendix – Detailed Experience Analysis
Post-Retirement Mortality

2014-2018 Experience ($000s)

Males					Females				
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
55-59	195	26,148	134.60	144.9%	55-59	107	40,463	133.13	80.4%
60-64	1,222	162,653	1,178.92	103.7%	60-64	830	179,118	894.36	92.8%
65-69	3,636	393,564	4,361.34	83.4%	65-69	2,185	327,436	2,510.01	87.1%
70-74	5,142	310,379	5,660.42	90.8%	70-74	2,271	215,937	2,623.91	86.6%
75-79	5,825	198,281	6,304.49	92.4%	75-79	3,045	121,753	2,530.57	120.3%
80-84	9,217	144,485	8,441.13	109.2%	80-84	3,618	77,669	2,872.20	126.0%
85-89	9,982	86,784	9,247.42	107.9%	85-89	5,530	57,624	3,882.11	142.4%
90-94	7,281	39,177	6,996.82	104.1%	90-94	4,211	29,452	3,485.30	120.8%
95-99	2,075	6,485	1,724.00	120.4%	95-99	2,682	9,291	1,765.25	151.9%
100+	213	432	156.88	135.8%	100+	462	1,297	374.68	123.3%
Totals	**44,788**	**1,368,388**	**44,206.02**	**101.3%**	**Totals**	**24,941**	**1,060,040**	**21,071.52**	**118.4%**

Appendix – Detailed Experience Analysis
Post-Retirement Mortality

2014-2015 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
55-59	16	7,039	36.83	43.4%	55-59	55	10,417	34.32	160.3%
60-64	256	42,632	311.71	82.1%	60-64	248	41,886	210.76	117.7%
65-69	797	89,262	992.56	80.3%	65-69	443	67,288	523.33	84.7%
70-74	1,264	65,512	1,221.01	103.5%	70-74	536	43,154	541.06	99.1%
75-79	1,796	44,973	1,469.60	122.2%	75-79	616	26,094	557.73	110.4%
80-84	2,337	34,595	2,048.07	114.1%	80-84	853	17,935	679.64	125.5%
85-89	2,924	21,178	2,323.49	125.8%	85-89	1,600	14,641	996.36	160.6%
90-94	1,587	8,493	1,541.26	103.0%	90-94	772	6,753	825.83	93.5%
95-99	551	1,417	386.40	142.6%	95-99	769	2,149	422.15	182.2%
100+	37	75	28.59	129.4%	100+	108	273	79.16	136.4%
Totals	**11,565**	**315,176**	**10,359.52**	**111.6%**	**Totals**	**6,000**	**230,590**	**4,870.34**	**123.2%**

2015-2016 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
55-59	33	6,510	33.43	98.7%	55-59	20	10,850	35.77	55.9%
60-64	531	43,414	315.71	168.2%	60-64	187	45,671	229.54	81.5%
65-69	1,014	99,187	1,105.27	91.7%	65-69	495	78,380	607.47	81.5%
70-74	1,018	71,623	1,330.22	76.5%	70-74	681	48,090	596.81	114.1%
75-79	1,201	45,722	1,468.52	81.8%	75-79	923	28,544	602.22	153.3%
80-84	2,160	36,069	2,114.27	102.2%	80-84	847	18,774	702.67	120.5%
85-89	2,303	21,028	2,279.48	101.0%	85-89	1,209	14,119	958.66	126.1%
90-94	1,364	9,259	1,661.90	82.1%	90-94	1,127	7,347	881.92	127.8%
95-99	390	1,368	367.50	106.1%	95-99	643	2,127	402.12	159.9%
100+	30	116	41.82	71.7%	100+	116	327	93.47	124.1%
Totals	**10,044**	**334,296**	**10,718.12**	**93.7%**	**Totals**	**6,248**	**254,229**	**5,110.65**	**122.3%**

Appendix – Detailed Experience Analysis
Post-Retirement Mortality

2016-2017 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
55-59	54	6,625	33.88	159.4%	55-59	15	9,988	32.91	45.6%
60-64	156	39,387	285.20	54.7%	60-64	224	46,418	231.63	96.7%
65-69	747	102,197	1,132.92	65.9%	65-69	693	88,017	675.10	102.7%
70-74	1,248	81,268	1,479.20	84.4%	70-74	609	56,100	679.99	89.6%
75-79	1,481	50,634	1,604.52	92.3%	75-79	865	31,343	646.12	133.9%
80-84	2,080	36,471	2,134.89	97.4%	80-84	745	19,895	728.23	102.3%
85-89	1,883	20,965	2,194.87	85.8%	85-89	1,261	14,573	983.38	128.2%
90-94	2,265	10,927	1,925.50	117.6%	90-94	1,197	7,353	864.18	138.5%
95-99	523	1,805	475.19	110.1%	95-99	517	2,358	444.14	116.4%
100+	53	108	39.00	135.9%	100+	108	316	92.81	116.4%
Totals	**10,490**	**350,387**	**11,305.17**	**92.8%**	**Totals**	**6,234**	**276,361**	**5,378.49**	**115.9%**

2017-2018 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
55-59	92	5,974	30.46	302.0%	55-59	17	9,208	30.13	56.4%
60-64	279	37,220	266.30	104.8%	60-64	171	45,143	222.43	76.9%
65-69	1,078	102,918	1,130.59	95.3%	65-69	554	93,751	704.11	78.7%
70-74	1,612	91,976	1,629.99	98.9%	70-74	445	68,593	806.05	55.2%
75-79	1,347	56,952	1,761.85	76.5%	75-79	641	35,772	724.50	88.5%
80-84	2,640	37,350	2,143.90	123.1%	80-84	1,173	21,065	761.66	154.0%
85-89	2,872	23,613	2,449.58	117.2%	85-89	1,460	14,291	943.71	154.7%
90-94	2,065	10,498	1,868.16	110.5%	90-94	1,115	7,999	913.37	122.1%
95-99	611	1,895	494.91	123.5%	95-99	753	2,657	496.84	151.6%
100+	93	133	47.47	195.9%	100+	130	381	109.24	119.0%
Totals	**12,689**	**368,529**	**11,823.21**	**107.3%**	**Totals**	**6,459**	**298,860**	**5,712.04**	**113.1%**

Appendix – Detailed Experience Analysis
Pre-Retirement Mortality

2014-2018 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
Under 20	-	367	0.09	0.0%	Under 20	-	455	0.06	0.0%
20-24	-	31,972	10.42	0.0%	20-24	28	40,497	5.31	527.7%
25-29	68	229,733	66.95	101.6%	25-29	-	279,691	43.52	0.0%
30-34	81	514,470	169.85	47.7%	30-34	42	601,096	125.58	33.4%
35-39	478	784,225	302.56	158.0%	35-39	246	847,691	229.75	107.1%
40-44	316	932,407	498.23	63.4%	40-44	507	1,010,473	400.77	126.5%
45-49	1,256	1,398,565	1,270.63	98.8%	45-49	839	1,496,659	1,004.13	83.6%
50-54	3,153	2,355,779	3,708.52	85.0%	50-54	2,688	2,586,051	2,870.79	93.6%
55-59	7,446	3,409,370	9,018.56	82.6%	55-59	8,427	3,817,867	6,276.77	134.3%
60-64	8,878	3,287,228	14,829.07	59.9%	60-64	7,604	3,326,140	7,775.15	97.8%
Totals	**21,676**	**12,944,116**	**29,874.87**	**72.6%**	**Totals**	**20,381**	**14,006,620**	**18,731.81**	**108.8%**

Appendix – Detailed Experience Analysis
Pre-Retirement Mortality

2014-2015 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
Under 20	-	62	0.02	0.0%	Under 20	-	111	0.01	0.0%
20-24	-	6,529	2.26	0.0%	20-24	-	8,267	1.13	0.0%
25-29	-	54,036	16.49	0.0%	25-29	-	67,020	10.74	0.0%
30-34	-	121,152	41.31	0.0%	30-34	-	142,029	29.72	0.0%
35-39	183	172,681	68.58	266.9%	35-39	49	189,325	51.60	95.0%
40-44	155	220,385	123.02	126.0%	40-44	-	237,786	97.26	0.0%
45-49	247	350,680	330.57	74.7%	45-49	-	374,764	259.29	0.0%
50-54	649	637,481	1,028.10	63.1%	50-54	649	700,801	787.63	82.4%
55-59	1,127	888,605	2,394.99	47.1%	55-59	2,780	994,466	1,645.63	168.9%
60-64	1,640	834,107	3,805.78	43.1%	60-64	1,131	791,357	1,871.94	60.4%
Totals	**4,001**	**3,285,718**	**7,811.11**	**51.2%**	**Totals**	**4,609**	**3,505,926**	**4,754.96**	**96.9%**

2015-2016 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
Under 20	-	89	0.02	0.0%	Under 20	-	101	0.01	0.0%
20-24	-	6,563	2.19	0.0%	20-24	-	9,300	1.24	0.0%
25-29	44	55,517	16.44	267.6%	25-29	-	68,234	10.75	0.0%
30-34	55	126,821	42.35	129.9%	30-34	42	147,964	30.93	135.8%
35-39	141	189,280	73.79	191.1%	35-39	-	204,950	55.47	0.0%
40-44	132	226,667	122.58	107.7%	40-44	114	246,389	98.08	116.2%
45-49	92	350,860	321.66	28.6%	45-49	581	376,705	253.77	228.9%
50-54	107	597,811	950.60	11.3%	50-54	756	661,205	737.59	102.5%
55-59	2,749	841,037	2,243.84	122.5%	55-59	628	937,472	1,542.89	40.7%
60-64	3,249	793,882	3,597.96	90.3%	60-64	2,138	807,224	1,887.74	113.3%
Totals	**6,569**	**3,188,527**	**7,371.44**	**89.1%**	**Totals**	**4,259**	**3,459,544**	**4,618.47**	**92.2%**

Appendix – Detailed Experience Analysis
Pre-Retirement Mortality

2016-2017 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
Under 20	-	99	0.02	0.0%	Under 20	-	126	0.02	0.0%
20-24	-	9,061	2.91	0.0%	20-24	-	10,879	1.41	0.0%
25-29	24	57,533	16.53	145.2%	25-29	-	69,401	10.69	0.0%
30-34	-	128,102	41.85	0.0%	30-34	-	148,986	31.12	0.0%
35-39	107	201,037	76.86	139.2%	35-39	69	216,051	58.58	117.8%
40-44	29	231,841	122.07	23.8%	40-44	105	249,565	98.22	106.9%
45-49	607	341,954	306.42	198.1%	45-49	118	364,509	242.04	48.8%
50-54	885	571,516	893.25	99.1%	50-54	443	620,620	685.53	64.6%
55-59	2,409	826,191	2,171.03	111.0%	55-59	1,593	943,791	1,547.56	102.9%
60-64	1,420	824,074	3,695.36	38.4%	60-64	1,288	841,638	1,958.27	65.8%
Totals	**5,481**	**3,191,408**	**7,326.30**	**74.8%**	**Totals**	**3,616**	**3,465,566**	**4,633.43**	**78.0%**

2017-2018 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
Under 20	-	117	0.03	0.0%	Under 20	-	117	0.01	0.0%
20-24	-	9,819	3.06	0.0%	20-24	28	12,051	1.52	1838.9%
25-29	-	62,647	17.49	0.0%	25-29	-	75,036	11.34	0.0%
30-34	26	138,395	44.34	58.6%	30-34	-	162,117	33.80	0.0%
35-39	47	221,227	83.34	56.4%	35-39	128	237,365	64.10	199.7%
40-44	-	253,514	130.56	0.0%	40-44	288	276,733	107.21	268.6%
45-49	310	355,071	311.97	99.4%	45-49	140	380,681	249.03	56.2%
50-54	1,512	548,971	836.57	180.7%	50-54	840	603,425	660.04	127.3%
55-59	1,161	853,537	2,208.70	52.6%	55-59	3,426	942,138	1,540.69	222.4%
60-64	2,569	835,165	3,729.97	68.9%	60-64	3,047	885,921	2,057.21	148.1%
Totals	**5,625**	**3,278,463**	**7,366.02**	**76.4%**	**Totals**	**7,897**	**3,575,584**	**4,724.96**	**167.1%**

Appendix – Detailed Experience Analysis
Disabled Mortality

2014-2018 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
40-44	7	55	0.84	831.8%	41-44	-	130	1.24	0.0%
45-49	21	416	7.75	270.9%	45-49	20	658	8.06	248.1%
50-54	108	1,684	37.11	291.0%	50-54	58	3,075	45.68	127.0%
55-59	253	6,576	168.30	150.3%	55-59	163	8,762	154.87	105.3%
60-64	476	12,783	387.58	122.8%	60-64	460	13,785	299.34	153.7%
65-69	358	14,881	552.12	64.8%	65-69	458	13,440	386.02	118.6%
70-74	357	7,602	369.21	96.7%	70-74	191	5,892	248.86	76.8%
75-79	276	4,769	325.23	84.9%	75-79	282	3,731	234.39	120.3%
80-84	232	1,892	185.66	125.0%	80-84	144	1,371	130.40	110.4%
85-89	92	954	141.73	64.9%	85-89	131	793	103.98	126.0%
90-94	60	238	52.47	114.4%	90-94	52	182	38.99	133.4%
95-99	14	14	3.73	375.1%	95-99	18	56	14.75	122.0%
>= 100	-	-	-	N/A	>= 100	-	-	-	N/A
Totals	**2,254**	**51,864**	**2,231.74**	**101.0%**	**Totals**	**1,977**	**51,875**	**1,666.58**	**118.6%**

Appendix – Detailed Experience Analysis
Disabled Mortality

2014-2015 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
40-44	-	27	0.44	0.0%	41-44	-	31	0.31	0.0%
45-49	-	96	1.87	0.0%	45-49	-	232	2.91	0.0%
50-54	55	545	12.38	444.4%	50-54	11	885	13.31	82.7%
55-59	47	1,801	46.63	100.8%	55-59	48	2,327	41.26	116.3%
60-64	173	3,427	104.75	165.2%	60-64	118	3,669	80.73	146.2%
65-69	45	3,325	123.60	36.4%	65-69	205	2,885	83.90	244.3%
70-74	49	1,777	89.01	55.1%	70-74	10	1,263	55.50	18.0%
75-79	96	1,062	74.22	129.4%	75-79	87	780	49.77	174.8%
80-84	21	410	42.46	49.5%	80-84	73	355	34.50	211.6%
85-89	-	154	23.37	0.0%	85-89	51	167	21.61	236.0%
90-94	15	66	14.59	102.8%	90-94	30	81	17.31	173.3%
95-99	-	-	-	N/A	95-99	-	9	2.47	0.0%
>= 100	-	-	-	N/A	>= 100	-	-	-	N/A
Totals	**501**	**12,690**	**533.31**	**93.9%**	**Totals**	**633**	**12,684**	**403.58**	**156.8%**

2015-2016 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
40-44	-	11	0.17	0.0%	41-44	-	33	0.32	0.0%
45-49	-	105	1.97	0.0%	45-49	-	183	2.26	0.0%
50-54	8	372	8.20	97.5%	50-54	5	850	12.70	39.4%
55-59	102	1,806	46.38	219.9%	55-59	6	2,145	37.99	15.8%
60-64	106	3,315	100.95	105.0%	60-64	108	3,487	76.07	142.0%
65-69	114	3,758	140.16	81.3%	65-69	69	3,165	91.11	75.7%
70-74	116	1,698	84.26	137.7%	70-74	2	1,343	57.60	3.5%
75-79	116	1,146	78.19	148.4%	75-79	76	886	55.51	136.9%
80-84	-	466	46.09	0.0%	80-84	-	338	33.16	0.0%
85-89	21	250	37.67	55.8%	85-89	9	135	17.82	50.5%
90-94	20	52	12.20	163.9%	90-94	14	42	9.08	154.1%
95-99	-	-	-	N/A	95-99	18	22	5.89	305.6%
>= 100	-	-	-	N/A	>= 100	-	-	-	N/A
Totals	**603**	**12,979**	**556.24**	**108.4%**	**Totals**	**307**	**12,629**	**399.52**	**76.8%**

Appendix – Detailed Experience Analysis
Disabled Mortality

2016-2017 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
40-44	7	10	0.14	4864.1%	41-44	-	26	0.23	0.0%
45-49	7	129	2.37	295.6%	45-49	4	129	1.53	260.7%
50-54	30	430	9.39	319.6%	50-54	5	723	10.64	47.0%
55-59	102	1,565	39.91	255.6%	55-59	66	2,193	38.66	170.7%
60-64	103	3,119	94.40	109.1%	60-64	125	3,314	71.50	174.8%
65-69	120	3,894	144.75	82.9%	65-69	72	3,656	104.80	68.7%
70-74	148	1,935	93.79	157.8%	70-74	112	1,485	62.55	179.1%
75-79	47	1,220	83.72	56.1%	75-79	54	981	61.31	88.1%
80-84	143	467	45.85	311.9%	80-84	18	329	31.06	58.0%
85-89	32	281	40.80	78.4%	85-89	23	225	29.24	78.7%
90-94	25	65	13.63	183.5%	90-94	-	32	7.15	0.0%
95-99	14	14	3.73	375.1%	95-99	-	4	1.07	0.0%
>= 100	-	-	-	N/A	>= 100	-	-	-	N/A
Totals	**778**	**13,129**	**572.47**	**135.9%**	**Totals**	**479**	**13,097**	**419.75**	**114.1%**

2017-2018 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
40-44	-	7	0.09	0.0%	41-44	-	40	0.38	0.0%
45-49	14	86	1.54	908.1%	45-49	16	114	1.36	1175.6%
50-54	15	337	7.14	210.1%	50-54	37	617	9.03	409.7%
55-59	2	1,404	35.38	5.7%	55-59	43	2,097	36.96	116.3%
60-64	94	2,922	87.48	107.4%	60-64	109	3,315	71.03	153.4%
65-69	79	3,904	143.61	55.0%	65-69	112	3,734	106.21	105.5%
70-74	44	2,192	102.15	43.1%	70-74	67	1,801	73.21	91.5%
75-79	17	1,341	89.11	19.1%	75-79	65	1,084	67.80	95.9%
80-84	68	549	51.26	132.7%	80-84	53	349	31.68	167.3%
85-89	39	269	39.89	97.8%	85-89	48	266	35.30	136.0%
90-94	-	55	12.05	0.0%	90-94	8	27	5.44	147.0%
95-99	-	-	-	N/A	95-99	-	21	5.32	0.0%
>= 100	-	-	-	N/A	>= 100	-	-	-	N/A
Totals	**372**	**13,066**	**569.72**	**65.3%**	**Totals**	**558**	**13,465**	**443.74**	**125.7%**