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Minnesota State Patrol Retirement Fund

Four-Year Experience Study

July 1, 2015 through June 30, 2019

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June 30, 2020

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

Dear Board of Directors:

The results of the four-year ***actuarial experience study*** of the State Patrol Retirement Fund (SPRF) 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 Patrol 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, 2015 through June 30, 2019***, 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 Patrol 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. This report may be provided to parties other than the Retirement System only in its entirety and only with the permission of the Board.

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 the standards of practice promulgated by the Actuarial Standards Board.

Board of Directors
Minnesota State Retirement System
State Patrol Retirement Fund
June 30, 2020

This report does not reflect the recent and still developing impact of COVID-19, which is likely to influence demographic experience and economic expectations, at least in the short-term. We will continue to monitor these developments and their impact on retirement plans.

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

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

Brian B. Murphy

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

BJW/BBM:sc

Actuarial Experience Study
2015-2019

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SECTION A

OVERVIEW AND SUMMARY OF RESULTS

Summary of Findings

The four-year period (July 1, 2015 through June 30, 2019) 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 Patrol 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 23 basis points lower on average than the current rates. When combined with the proposed decrease in payroll growth assumption, the result is an overall decrease in gross salary increase rates of approximately 48 basis points.
- Adjust assumed retirement rates:
  - Decrease the rate of assumed unreduced retirements (i.e., Normal Retirement) at ages 56, 58 and 59.
  - Decrease rates of assumed early retirement rates at ages 50, 53 and 54.
- Change the assumed rates of withdrawal (termination of membership before eligible to retire):
  - Proposed rates are service-based.
  - Generally, proposed rates are higher than current rates for members with less than 22 years of service.
- Increase rates of disability for ages 30-39 and over age 50, lower rates of disability for ages 40-49 and extend the disability incidence assumption to age 60. Proposed rates result in a slight increase in the assumed number of disability retirements.
- Change the base mortality table to the PUB-2010 General mortality table, with future improvement projected using scale MP-2019.
- Minor changes to the form of payment assumptions.

The recommendations are summarized on the following pages.

Review of the investment return assumption and actuarial methods is outside the scope of this experience study. Please refer to GRS' State Employees Retirement Fund experience study dated June 29, 2019. This report concluded that the current investment return assumption was within a reasonable range as of the date of the report, but that a rate near the median, such as 7.0%, would be likely to be sustainable for a longer period.

It is important to note that, by lowering the assumed rate of inflation but not the assumed investment return rate, the assumptions are actually more optimistic than before because the assumed real rate of return is higher than previously assumed. The 7.50% investment return assumption is required per Minnesota Statutes.

Introduction

Each year as of June 30th, 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; and
- 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 revised for the June 30, 2017 actuarial valuation based on the results of the most recent experience study. Economic assumptions were last revised for the June 30, 2018 actuarial valuation. All experience was compared to assumptions in effect as of the June 30, 2019 actuarial valuation.

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
2015-2019

Decrement Risk Area	Actual Number	Expected		
		Current Assumptions	Proposed Assumptions	Change
Unreduced Retirement	84	98.6	92.6	(6.0)
Reduced Retirement	15	24.8	19.8	(5.0)
Withdrawal, < 3 years of service	30	13.0	23.6	10.6
Withdrawal, > 3 years of service	23	10.0	20.7	10.7
Disability	11	8.2	8.4	0.2
Mortality				
Healthy Retired Lives - Male	80	70.6	82.3	11.7
- Female	3	1.5	1.5	-
Disabled Retired Lives - Male	7	1.6	5.3	3.7
- Female	1	0.1	0.7	0.6
Active Lives - Male	5	2.2	3.1	0.9
- Female	1	0.2	0.2	-

The figures in the exhibit above are actual headcounts of occurrences. Calculations 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

PAY INCREASES

Pay Increases

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

- Payroll growth is an across-the-board, economic type of increase granted to most or all members of the group and is associated with a stable or level population. 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.

Inflation and Payroll Growth

For the State Patrol plan, the general inflation assumption is currently 2.50% and the payroll growth assumption is currently 3.25%.

General inflation, as measured by the change in the Consumer Price Index, has averaged about 1.8% over the four-year period ending June 30, 2019. During the 2016 to 2018 calendar year period, the increase in the national average earnings has been about 2.7% (the 2019 national average earnings amount was not available at the time this report was published). Actual annual payroll growth for this plan for the four-year period ending June 30, 2019 has averaged approximately 4.2%. Active membership during this time increased 11.9%, from 843 as of July 1, 2015 to 943 as of July 1, 2019.

A thorough review of general inflation and payroll growth is presented in Section B of the MSRS State Employees Retirement Fund experience study report dated June 29, 2019. In that report, we recommended a general inflation assumption equal to 2.25% and a payroll growth assumption of 3.00%; note that the decrease in payroll growth assumption is due to the change in inflation only (i.e., there was no recommended change to the 0.75% real wage growth assumption).

We recommend reducing the assumed rate to 2.25% for general inflation and 3.00% for payroll growth (i.e., no recommended change to the 0.75% real wage growth assumption). Changing the inflation assumption to 2.25% is supported by experience and is consistent with the assumption used for MSRS' State Employees Retirement Fund.

Pay Increases Due to Merit and Seniority

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 would have 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 for this group. Based on our review of salary experience for SPRF members for the period July 1, 2015 through June 30, 2019, we observed members with longer service averaged about a 2.25% annual increase for this period. We assumed the salary increase amount for these members 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.

The assumed wage inflation was 3.50% at the beginning of the study period and 3.25% as of June 30, 2019. However, as described above, we estimated the average actual wage inflation component of pay increases was around 2.25% for members of the State Patrol Retirement Fund. This estimated 2.25% wage inflation increase was subtracted from the actual pay increases to obtain the estimated merit/seniority portion of the pay increases. It should be noted the results of the analysis are very sensitive to the estimated wage inflation component.

Pay Increases Due to Merit and Seniority

Findings

Gross actual salary increases averaged 4.09% over the four-year period, ranging from 1.74% in 2016 to 8.18% in 2019. After adjusting for the 2.25% average wage inflation for this period, the average net salary increase (i.e., merit and seniority) averaged 1.84%, ranging from -0.51% to 5.93%.

Fiscal Year Ending	Count	Gross		Net*	
		Expected	Actual	Expected	Actual
2016	742	5.74%	1.74%	2.49%	-0.51%
2017	772	6.00%	4.15%	2.75%	1.90%
2018	805	6.05%	2.08%	2.80%	-0.17%
2019	809	5.81%	8.18%	2.56%	5.93%
Total	**3,128**	**5.90%**	**4.09%**	**2.65%**	**1.84%**

* *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 2.25%.*

The results of our analysis are shown on the following page. Using the techniques described above, observed merit and seniority pay increases were generally lower than the presently assumed increases, especially early in the member's career. The result is that the proposed merit and seniority increases are 23 basis points lower on average but with a slightly different allocation. When combined with the proposed decrease in payroll growth assumption, the result is an overall decrease in gross salary increase rates of approximately 48 basis points.

Recommendation

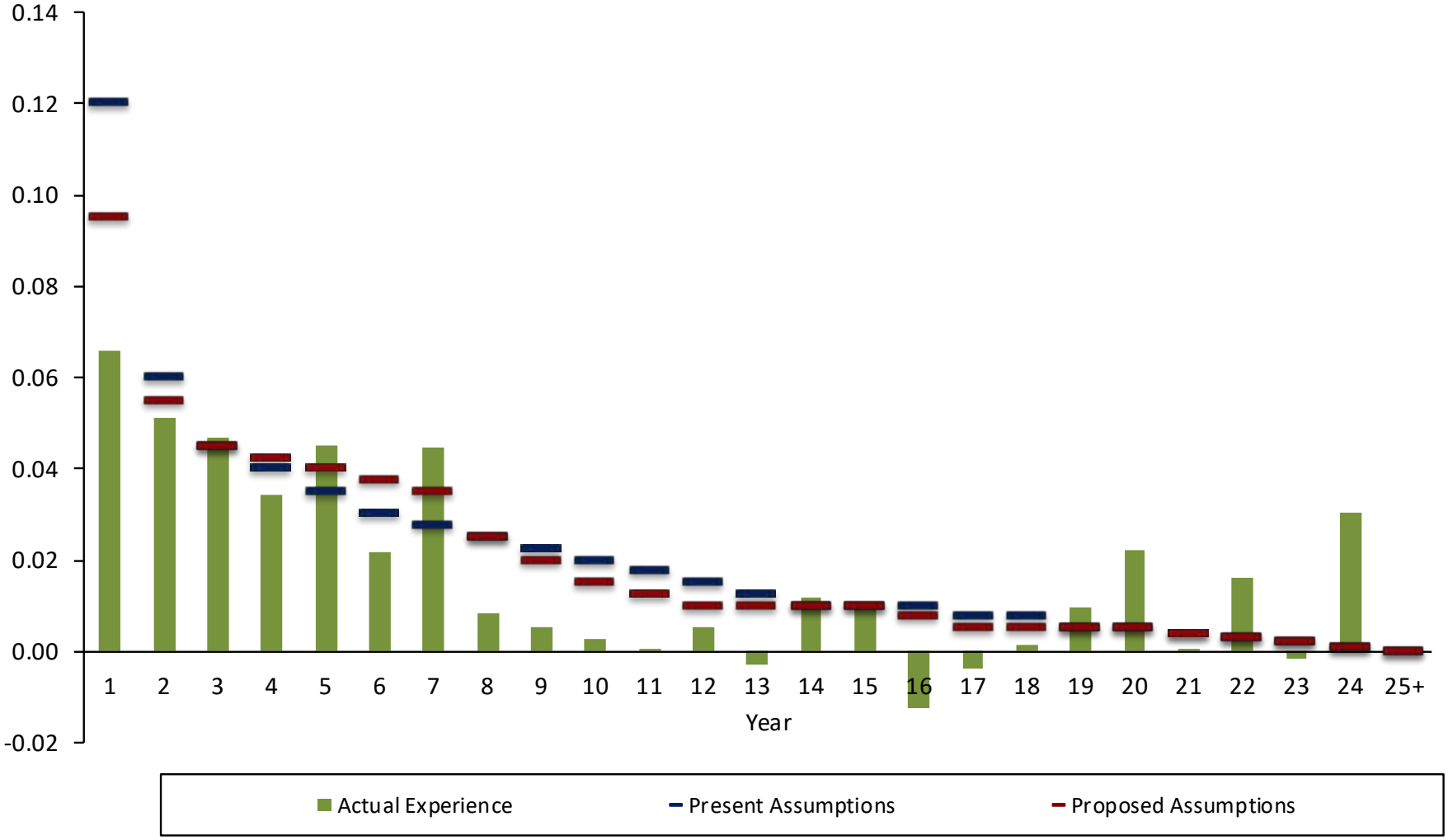
We recommend adjustments to the current merit/seniority pay increase assumption as shown on the following page.

Pay Increases Due to Merit and Seniority

Year	Exposures	Total Salary % Increase			Merit & Seniority % Increase		
		Actual	Current	Proposed	Actual	Current	Proposed
1	195	8.83%	15.25%	12.50%	6.58%	12.00%	9.50%
2	231	7.37%	9.25%	8.50%	5.12%	6.00%	5.50%
3	186	6.93%	7.75%	7.50%	4.68%	4.50%	4.50%
4	146	5.69%	7.25%	7.25%	3.44%	4.00%	4.25%
5	99	6.78%	6.75%	7.00%	4.53%	3.50%	4.00%
6	105	4.43%	6.25%	6.75%	2.18%	3.00%	3.75%
7	107	6.72%	6.00%	6.50%	4.47%	2.75%	3.50%
8	102	3.07%	5.75%	5.50%	0.82%	2.50%	2.50%
9	127	2.76%	5.50%	5.00%	0.51%	2.25%	2.00%
10	132	2.52%	5.25%	4.50%	0.27%	2.00%	1.50%
11	144	2.26%	5.00%	4.25%	0.01%	1.75%	1.25%
12	151	2.79%	4.75%	4.00%	0.54%	1.50%	1.00%
13	125	1.97%	4.50%	4.00%	-0.28%	1.25%	1.00%
14	113	3.42%	4.25%	4.00%	1.17%	1.00%	1.00%
15	102	3.27%	4.25%	4.00%	1.02%	1.00%	1.00%
16	136	1.02%	4.25%	3.75%	-1.23%	1.00%	0.75%
17	157	1.85%	4.00%	3.50%	-0.40%	0.75%	0.50%
18	154	2.42%	4.00%	3.50%	0.17%	0.75%	0.50%
19	152	3.19%	3.75%	3.50%	0.94%	0.50%	0.50%
20	95	4.48%	3.75%	3.50%	2.23%	0.50%	0.50%
21	74	2.31%	3.65%	3.40%	0.06%	0.40%	0.40%
22	46	3.86%	3.55%	3.30%	1.61%	0.30%	0.30%
23	28	2.08%	3.45%	3.20%	-0.17%	0.20%	0.20%
24	23	5.28%	3.35%	3.10%	3.03%	0.10%	0.10%
25+	198	2.25%	3.25%	3.00%	0.00%	0.00%	0.00%
Total*	**3,128**	**4.09%**	**5.90%**	**5.42%**	**1.84%**	**2.65%**	**2.42%**

**Totals equal weighted average of results for each service year in the table.*

Pay Increases Due to Merit and Seniority



SECTION C

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 recent experience studies for other MSRS plans, we have used "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 F-1.

Age and Service Unreduced (Normal) Retirement

Findings

The benefit provisions of the State Patrol Retirement Fund (SPRF) 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 60; in other words, we assume all members currently under the age of 60 will retire by the age of 60. However, for members currently age 60 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 60 since the valuation assumption is all of these members work an additional year and then retire. During the four-year period, there were nine actual retirements at ages 60 and older.

Overall, on a liability-weighted basis, the plan experienced slightly fewer unreduced retirements than projected by the present assumptions, but the results varied by age.

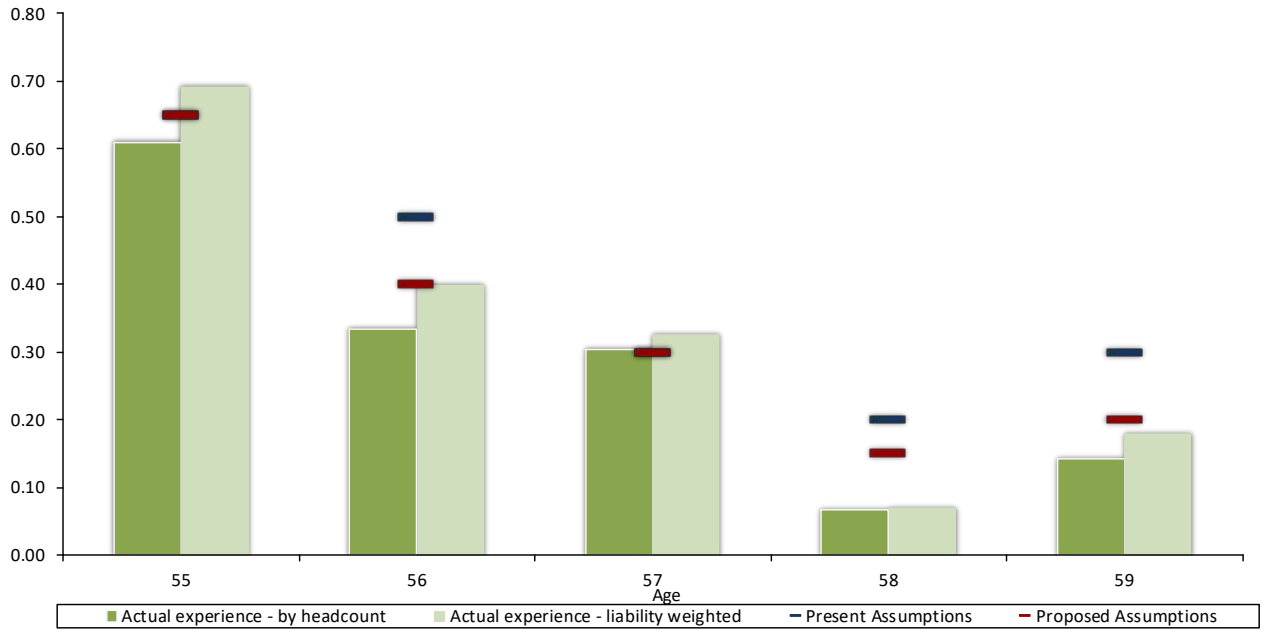
Recommendations

We recommend adjusting the assumed unreduced retirement rates to reflect observed experience, as shown on the next page. In addition, we recommend the Minnesota Standards for Actuarial Work be modified to remove the requirement that members currently over age 60 delay retirement one year and instead assume these members retire mid-year after the valuation date, the same as members younger than age 60.

Age and Service Unreduced (Normal) Retirement

Age	Liability Weighted ($000s)		Crude Rates		Sample Rates		Expected Retirements*		Ratio of Actuals/Expecteds	
	Retirements	Exposure	Liability Weighted	Population Weighted	Current	Proposed	Current	Proposed	Current	Proposed
55	54,755	79,144	0.6918	0.6100	0.6500	0.6500	51,443.09	51,443.60	106.4%	106.4%
56	10,288	25,779	0.3991	0.3333	0.5000	0.4000	12,889.89	10,311.60	79.8%	99.8%
57	4,657	14,316	0.3253	0.3043	0.3000	0.3000	4,294.71	4,294.80	108.4%	108.4%
58	704	9,948	0.0708	0.0667	0.2000	0.1500	1,989.66	1,492.20	35.4%	47.2%
59	1,444	8,000	0.1805	0.1429	0.3000	0.2000	2,400.08	1,600.00	60.2%	90.3%
60	*	*	N/A	N/A	1.0000	1.0000	-	-	N/A	N/A
Totals	**71,848**	**137,187**					**73,017.43**	**69,142.20**	**98.4%**	**103.9%**

* *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 age 60 or older, these members are not included in the Exposures since retirement is assumed to be delayed one year. There were nine actual retirements at age 60 or older.*



Reduced Early Retirement

Findings

SPRF members may retire with a reduced benefit prior to the attainment of Normal Retirement. We refer to these cases as early retirements.

Early retirement benefits are equal to the normal retirement benefit with a reduction for early retirement as follows:

> Normal Retirement Benefit based on Allowable Service and Average Salary at retirement date reduce by 0.34% per month for each month that the member is under age 55. If the effective date of retirement was before July 1, 2015, the reduction was 0.10% for each month that the member was under age 55.

Generally, higher rates of early retirement result in slightly lower computed contributions, and vice versa.

We reviewed the experience during the study period. On a population-weighted basis, there were fewer early retirements than expected. There were similar results on a liability-weighted basis.

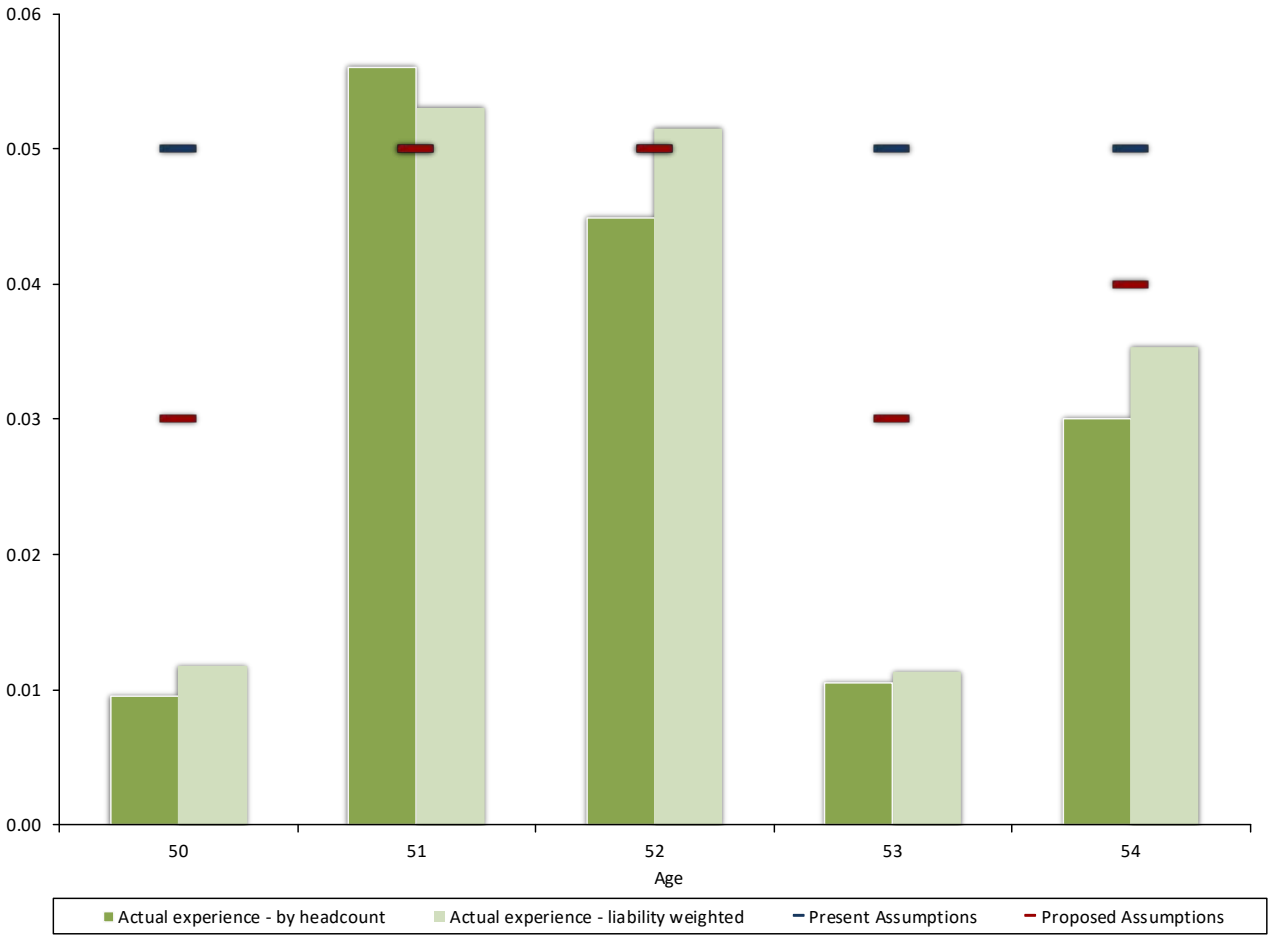
It was noted in the prior experience study that the number of early retirements was greater than expected. The changes to early retirement benefits described above resulted in more early retirements before June 30, 2015 and fewer retirements after June 30, 2015. Our recommendation to decrease early retirement rates is consistent with expected behavior changes as a result of the change in benefit provisions.

Recommendation

We recommend a decrease in early retirement rates, as indicated on the following page.

Reduced Early Retirement

Age	Liability Weighted ($000s)		Crude Rates		Sample Rates		Expected Retirements* ($000s)		Ratio of Actuals/Expecteds	
	Retirements	Exposure	Liability Weighted	Population Weighted	Current	Proposed	Current	Proposed	Current	Proposed
50	813	68,989	0.0118	0.0095	0.0500	0.0300	3,449.44	2,069.67	23.6%	39.3%
51	4,039	76,227	0.0530	0.0561	0.0500	0.0500	3,811.33	3,811.35	106.0%	106.0%
52	3,477	67,591	0.0514	0.0449	0.0500	0.0500	3,379.56	3,379.55	102.9%	102.9%
53	801	70,925	0.0113	0.0105	0.0500	0.0300	3,546.28	2,127.75	22.6%	37.6%
54	2,732	77,216	0.0354	0.0300	0.0500	0.0400	3,860.78	3,088.64	70.8%	88.5%
Total	**11,862**	**360,948**	**0.0329**	**0.0302**			**18,047.39**	**14,476.96**	**65.7%**	**81.9%**



Retirement from Deferred Status

Members who terminate and have three years of service (ten years if first hired after June 30, 2013) are 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 the member's 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. The benefit is reduced 0.34% per month, meaning this assumption would generate a small actuarial loss if retirement occurs prior to Normal Retirement Age. We recommend no change to this set of assumptions.

SECTION D

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 age-based, with higher terminations assumed in the first three years of service. The withdrawal assumption review was done on a liability-weighted basis, as described earlier in the report.

Withdrawal Experience

Findings

As we examined patterns of terminations, the experience has a strong relationship to service. As such, our recommended rates are service-based (rather than age-based).

Recommendation

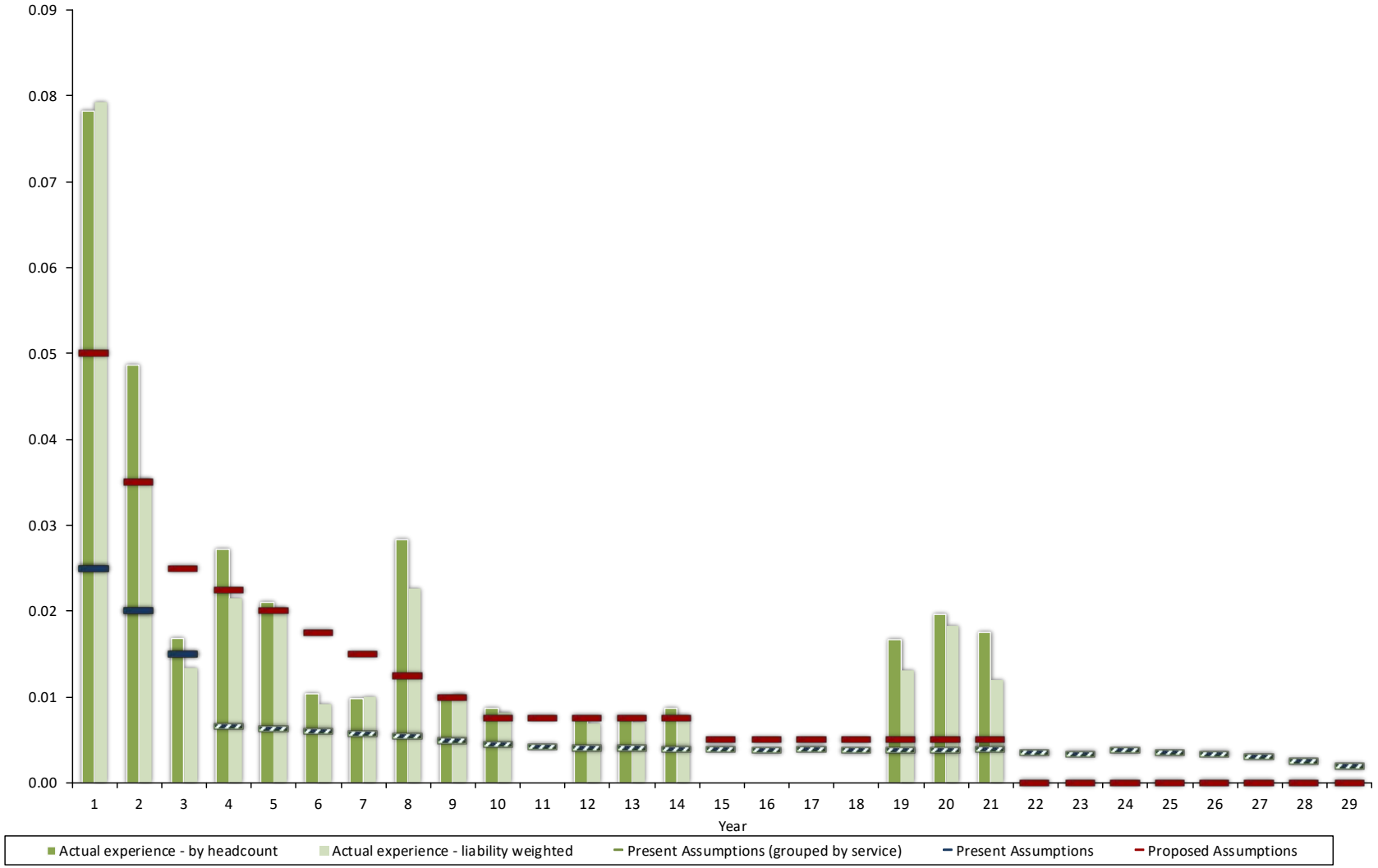
We have recommended increased rates of withdrawal as detailed on the following pages.

Withdrawal Experience* – Males and Females

	Liability Weighted ($ 000s)		Crude Rates				Liability Weighted ($ 000s)			
							Expected Withdrawals		Ratio of Actuals/Expecteds	
			Liability	Population	Sample Rates					
Year	Withdrawals	Exposure	Weighted	Weighted	Current	Proposed	Current	Proposed	Current	Proposed
1	2,345	29,570	0.0793	0.0782	0.0250	0.0500	739.26	1,478.50	317.2%	158.6%
2	2,796	78,850	0.0355	0.0486	0.0200	0.0350	1,577.00	2,759.75	177.3%	101.3%
3	1,120	83,293	0.0134	0.0168	0.0150	0.0250	1,249.41	2,082.33	89.6%	53.8%
4	1,447	67,099	0.0216	0.0272	0.0066	0.0225	444.36	1,509.73	325.5%	95.8%
5	1,111	54,616	0.0203	0.0210	0.0063	0.0200	346.44	1,092.31	320.6%	101.7%
6	348	37,788	0.0092	0.0104	0.0060	0.0175	224.99	661.29	154.5%	52.6%
7	427	42,701	0.0100	0.0098	0.0057	0.0150	243.60	640.51	175.4%	66.7%
8	993	43,963	0.0226	0.0283	0.0054	0.0125	237.52	549.54	418.0%	180.7%
9	464	45,265	0.0103	0.0100	0.0050	0.0100	224.30	452.65	207.0%	102.6%
10	446	54,800	0.0081	0.0086	0.0045	0.0075	247.60	411.00	180.2%	108.5%
11	-	59,781	0.0000	0.0000	0.0042	0.0075	249.76	448.36	0.0%	0.0%
12	481	70,065	0.0069	0.0074	0.0041	0.0075	284.14	525.49	169.4%	91.6%
13	525	73,553	0.0071	0.0072	0.0040	0.0075	293.51	551.65	178.7%	95.1%
14	483	63,707	0.0076	0.0086	0.0040	0.0075	252.63	477.80	191.3%	101.1%
15	-	55,724	0.0000	0.0000	0.0040	0.0050	220.41	278.62	0.0%	0.0%
16	-	51,158	0.0000	0.0000	0.0038	0.0050	195.18	255.79	0.0%	0.0%
17	-	64,090	0.0000	0.0000	0.0040	0.0050	254.10	320.45	0.0%	0.0%
18	-	79,828	0.0000	0.0000	0.0038	0.0050	304.88	399.14	0.0%	0.0%
19	1,011	76,794	0.0132	0.0167	0.0038	0.0050	290.76	383.97	347.7%	263.3%
20	1,252	68,321	0.0183	0.0196	0.0038	0.0050	256.70	341.61	487.8%	366.6%
21	471	39,223	0.0120	0.0175	0.0039	0.0050	154.28	196.12	305.1%	240.0%
22	-	30,334	0.0000	0.0000	0.0034	0.0000	104.63	-	0.0%	N/A
23	-	15,950	0.0000	0.0000	0.0033	0.0000	53.38	-	0.0%	N/A
24	-	5,114	0.0000	0.0000	0.0037	0.0000	19.17	-	0.0%	N/A
25	-	7,501	0.0000	0.0000	0.0036	0.0000	26.75	-	0.0%	N/A
26	-	10,670	0.0000	0.0000	0.0033	0.0000	35.42	-	0.0%	N/A
27	-	10,221	0.0000	0.0000	0.0031	0.0000	31.92	-	0.0%	N/A
28	-	7,719	0.0000	0.0000	0.0025	0.0000	19.25	-	0.0%	N/A
29	-	1,086	0.0000	0.0000	0.0020	0.0000	2.17	-	0.0%	N/A
30+	-	-	N/A	N/A	0.0000	0.0000	-	-	N/A	N/A
Totals	**15,719**	**1,328,786**	**0.0118**	**0.0187**	**0.0065**	**0.0119**	**8,583.52**	**15,816.61**	**183.1%**	**99.4%**

* *The current withdrawal assumption is based on service for the first three years of employment and based on age after three years of service. Our recommended table is service-based for all years of employment.*

Withdrawal Experience – Males and Females



SECTION E

DISABILITY EXPERIENCE

Disability Experience

State Patrol members who are unable to perform normal duties are eligible to receive a disability benefit. Members must have at least one year of service unless disability is occupation-related.

The current disability benefit is equal to 3.0% of average salary for each year of service, with a minimum benefit equal to 45% of average salary (60% of average salary if disability is occupation-related).

Payments begin at disability and end at age 55, or the five-year anniversary of the effective date of the disability benefit, whichever is later. Payments stop earlier if disability ceases or death occurs. At that time, the member may elect an actuarially equivalent option (unless an optional form of payment was elected at the time of disability).

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.

All disabilities are assumed to be duty-related since actual disability status (duty or non-duty related) is not reported in the valuation data.

Findings

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. We reviewed termination experience for the SPRF over the course of the four-year period and found there were no members who were reclassified as a disability retirement after first being reported as a termination.

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 (11) is about 33 percent greater than the number projected by the present assumption (8 – see charts on the following pages).

Recommendation

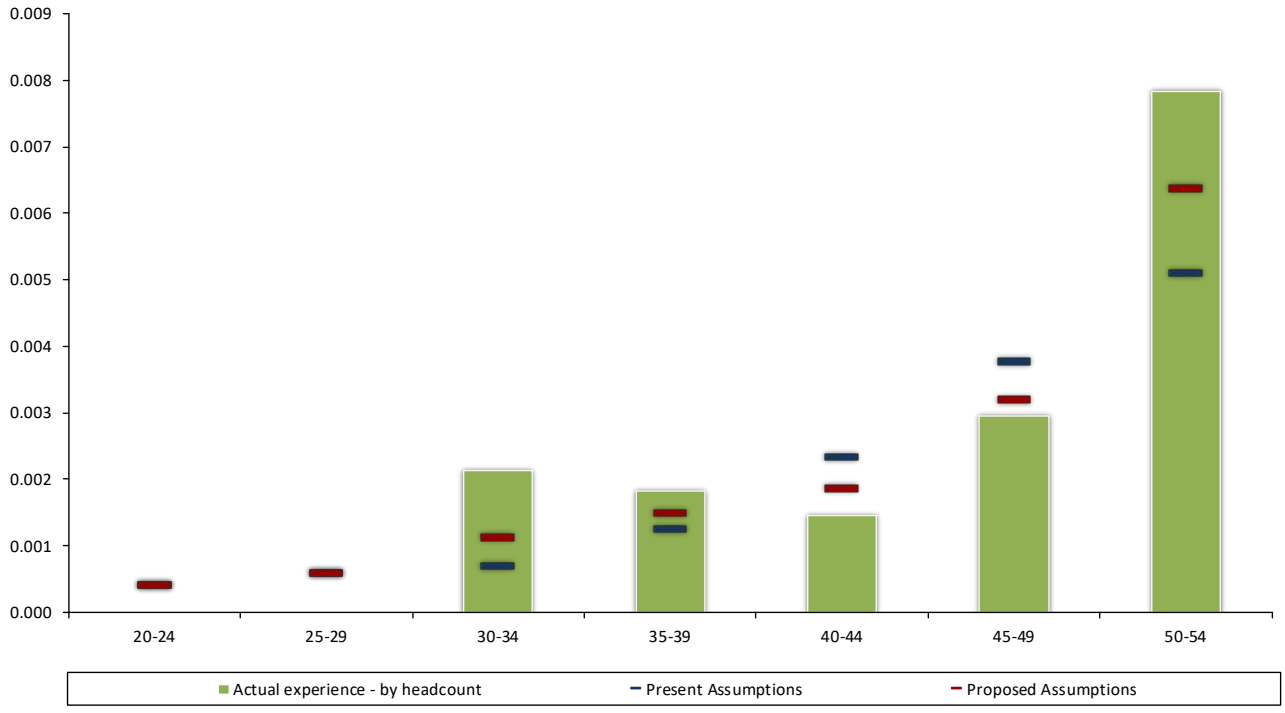
We recommend adopting lower rates of disability for members age 40-49 and higher rates of disability for members age 30-39 and age 50 or older. We also recommend continuing the disability incidence assumption to age 60.

Disability Experience
Males and Females

Age	Disabilities	Exposure	Crude Rates	Sample Rates*		Expected Disabilities**		Ratio of Actuals/Expecteds	
				Current	Proposed	Current	Proposed	Current	Proposed
20-24	-	65	0.0000	0.0004	0.0004	0.03	0.03	0.0%	0.0%
25-29	-	371	0.0000	0.0006	0.0006	0.21	0.21	0.0%	0.0%
30-34	1	470	0.0021	0.0007	0.0011	0.34	0.52	296.0%	192.3%
35-39	1	550	0.0018	0.0013	0.0015	0.75	0.81	133.3%	123.5%
40-44	1	690	0.0014	0.0023	0.0019	1.59	1.28	62.9%	78.1%
45-49	2	679	0.0029	0.0038	0.0032	2.58	2.23	77.5%	89.7%
50-54	4	511	0.0078	0.0051	0.0064	2.75	3.30	145.6%	121.2%
55+	2	-	N/A	0.0000	0.0000	-	-	N/A	N/A
Totals	**11**	**3,336**	**0.0033**	**0.0025**	**0.0025**	**8.25**	**8.38**	**133.4%**	**131.3%**

* *Sample rates taken from the mid-point of the age group.*

** *Currently, the disability assumption is only applied to members that are not eligible for Normal Retirement (age 55 with three years of service; members hired after June 30, 2010 are eligible after five years of service), which is the reason for no Exposures after age 55.*



SECTION F

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.

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 income, below median income).

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 SPRF retiree and disability mortality on a "benefit-weighted" basis and have shown the results on pages F-4 through F-7 of this report. Consistent with the SOA study, SPRF 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-2019 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 that approximately 1,000 deaths are required of each gender in the experience period for full credibility with a 90% confidence level. 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 80 male retiree deaths and 3 female retiree deaths. The healthy retiree mortality experience is not considered to be credible since there were so few deaths. Pre-retirement mortality and disabled retiree experience is also not considered to be credible. Therefore, we are recommending the use of standard mortality tables without adjustment.

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 more male deaths than expected ($5,102,000 actual versus $4,812,000 expected) and more female deaths than expected ($124,000 actual versus $60,000 expected).

Disabled Retirees

On a benefit-weighted basis, the plan experienced more deaths among disabled males ($370,000) than projected by the present assumptions ($75,000). The actual number of deaths on a benefit-weighted basis among disabled females ($44,000) was also greater than the number projected by the present assumptions ($5,000).

Active Members

On a liability-weighted basis, the actual number of male deaths among active members ($2,261,000) was greater than the number projected by the present assumption ($1,319,000). The plan experienced more deaths on a liability-weighted basis among females ($377,000) than projected by the present assumptions ($116,000).

Mortality Experience

Recommendations

Due to the size of this plan, the experience is not considered credible. As such, we recommend adoption of the Pub-2010 mortality tables. All recommended tables are Benefit-Weighted.

We recommend adoption of the following mortality tables:

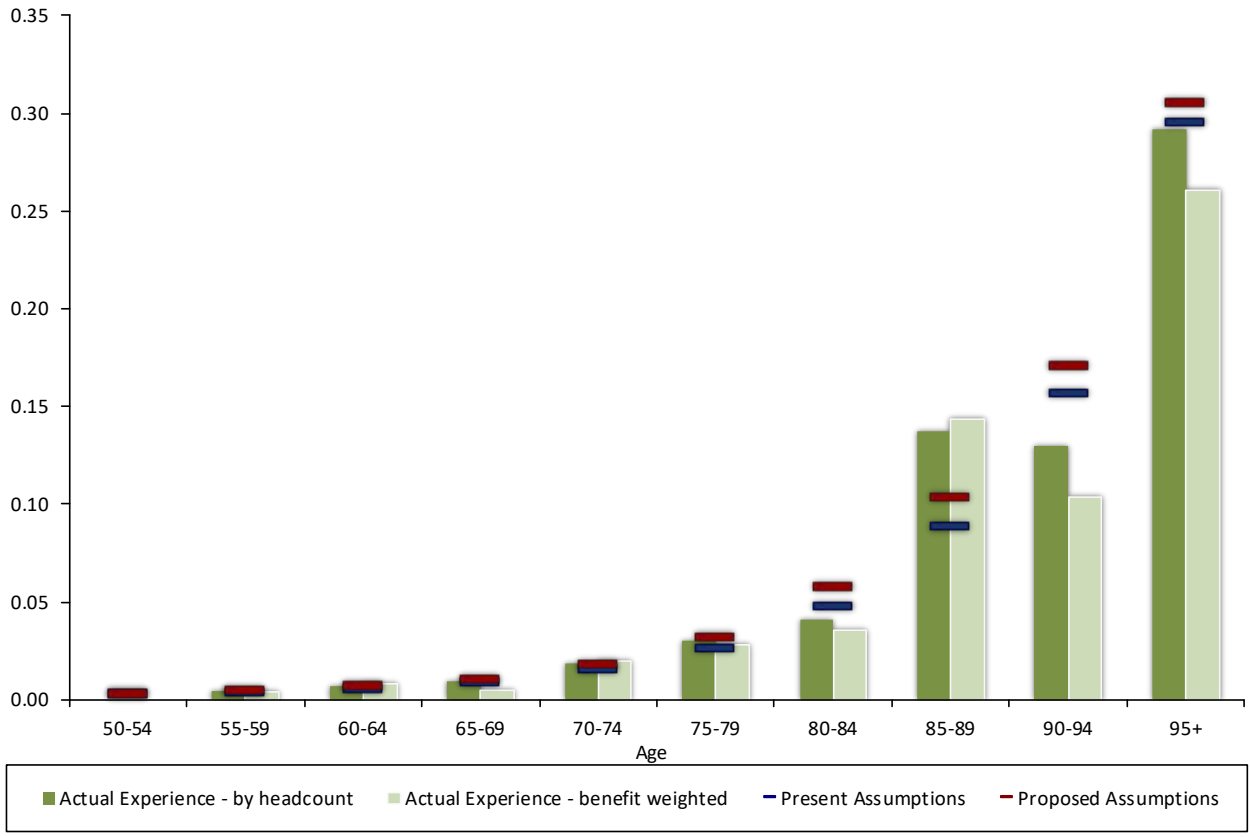
Healthy Male Retirees:	Pub-2010 Male Healthy Retired General Mortality Table adjusted for mortality improvements using projection scale MP-2019.
Healthy Female Retirees:	Pub-2010 Female Healthy Retired General Mortality Table, adjusted for mortality improvements using projection scale MP-2019.
Disabled Male Retirees:	Pub-2010 Male General Disabled Retiree Mortality Table, adjusted for mortality improvements using projection scale MP-2019.
Disabled Female Retirees:	Pub-2010 Female General Disabled Retiree Mortality Table, adjusted for mortality improvements using projection scale MP-2019.
Male Active Members:	Pub-2010 Male General Mortality Table adjusted for mortality improvements using projection scale MP-2019.
Female Active Members:	Pub-2010 Female General Mortality Table adjusted for mortality improvements using projection scale MP-2019.

We reviewed both the Public Safety and General plan Pub-2010 mortality tables and found the General plan mortality rates to be a better fit in most cases. Although the recommended female post-retirement and pre-retirement mortality tables appear to not be a good fit based on the plan's actual experience, the plan's experience is not considered to be credible, as noted earlier in this report. The number of female retired and active member deaths during the four-year period was very low (3 retiree deaths and 1 active member death).

Post-Retirement Mortality Experience
Healthy Males

	Benefit Weighted ($000s)		Crude Rates		Sample Rates		Benefit Weighted ($000s)		Ratio of	
			Benefit	Population			Expected Deaths		Actuals/Expecteds	
Age	Deaths	Exposure	Weighted	Weighted	Current	Proposed*	Current	Proposed*	Current	Proposed*
50-54	-	4,565	0.000000	0.000000	0.002984	0.003333	14.37	16.05	0.0%	0.0%
55-59	118	28,852	0.004090	0.004141	0.004228	0.005073	124.43	150.14	94.8%	78.6%
60-64	269	33,316	0.008074	0.006734	0.005886	0.007408	194.57	244.96	138.3%	109.8%
65-69	139	29,681	0.004683	0.009311	0.008949	0.010935	268.26	327.42	51.8%	42.5%
70-74	665	33,550	0.019821	0.018282	0.015236	0.018037	511.42	605.50	130.0%	109.8%
75-79	684	24,252	0.028204	0.030387	0.026726	0.031846	635.30	757.58	107.7%	90.3%
80-84	632	17,793	0.035520	0.041322	0.048203	0.057912	848.98	1,020.99	74.4%	61.9%
85-89	1,539	10,735	0.143363	0.137255	0.088958	0.103360	939.04	1,092.65	163.9%	140.9%
90-94	593	5,712	0.103817	0.129870	0.156655	0.170660	868.63	949.91	68.3%	62.4%
95+	463	1,779	0.260259	0.291667	0.295898	0.305663	407.44	430.97	113.6%	107.4%
Totals	**5,102**	**190,235**	**0.026819**	**0.025740**	**0.025297**	**0.029333**	**4,812.44**	**5,580.12**	**106.0%**	**91.4%**

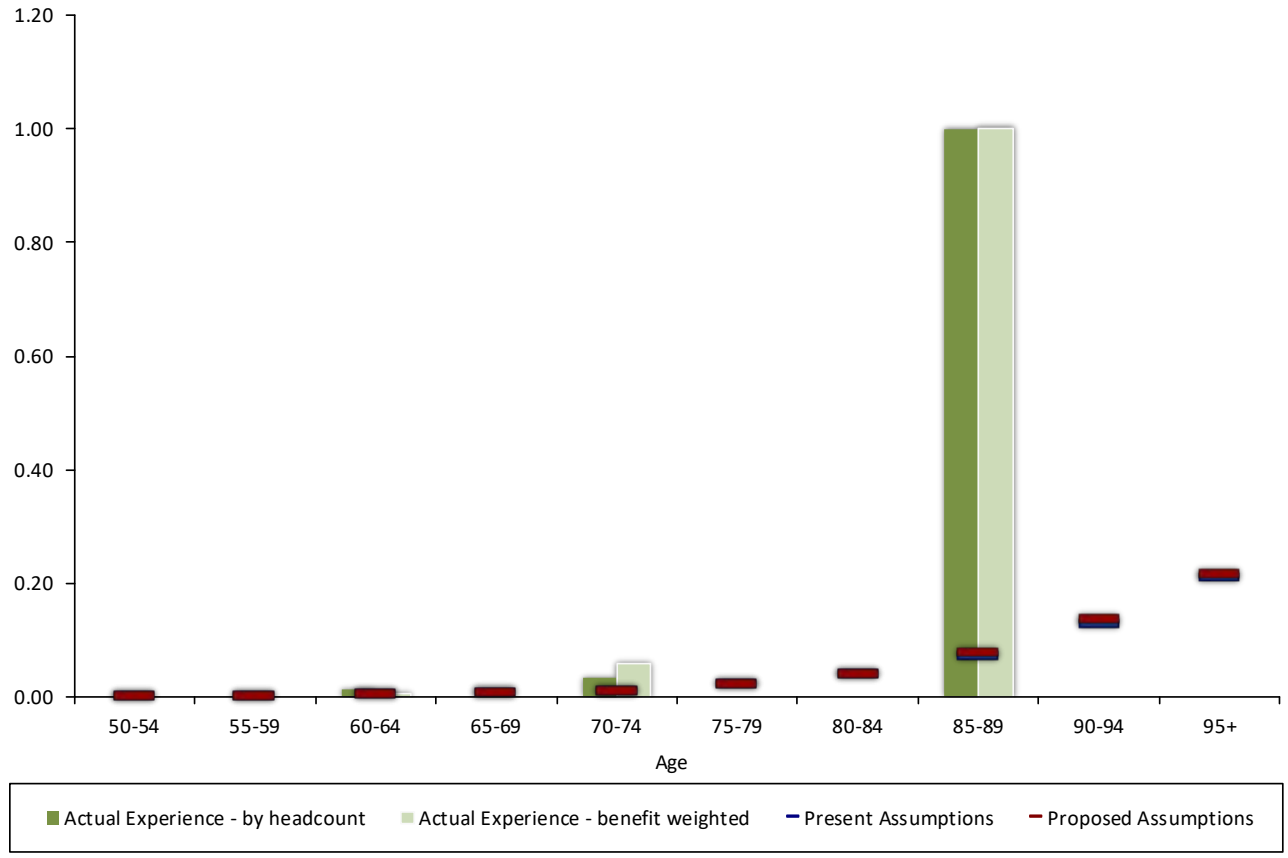
** In order to show the fit for the four-year period of the study, Proposed Sample Rates and Proposed Expected Deaths were determined using the proposed mortality rates for 2010 projected to the mid-point of the study using projection scale MP-2019.*



Post-Retirement Mortality Experience
Healthy Females

	Benefit Weighted ($000s)		Crude Rates		Sample Rates		Benefit Weighted ($000s)		Ratio of	
			Benefit	Population			Expected Deaths		Actuals/Expecteds	
Age	Deaths	Exposure	Weighted	Weighted	Current	Proposed	Current	Proposed*	Current	Proposed*
50-54	-	975	0.000000	0.000000	0.002220	0.002478	2.33	2.59	0.0%	0.0%
55-59	-	3,983	0.000000	0.000000	0.003170	0.003386	12.64	13.51	0.0%	0.0%
60-64	15	2,912	0.005151	0.014085	0.004850	0.004659	13.85	13.38	108.3%	112.1%
65-69	-	1,302	0.000000	0.000000	0.007741	0.007238	9.94	9.30	0.0%	0.0%
70-74	64	1,073	0.059646	0.034483	0.012724	0.012555	12.85	12.62	498.1%	507.1%
75-79	-	177	0.000000	0.000000	0.021942	0.022750	3.17	3.29	0.0%	0.0%
80-84	-	44	0.000000	0.000000	0.039482	0.041956	2.22	2.33	0.0%	0.0%
85-89	45	45	1.000000	1.000000	0.072456	0.078565	2.53	2.71	1775.7%	1660.5%
90-94	-	-	N/A	N/A	0.128802	0.138540	-	-	N/A	N/A
95+	-	-	N/A	N/A	0.209951	0.217224	-	-	N/A	N/A
Totals	**124**	**10,511**	**0.011797**	**0.011673**	**0.005663**	**0.005436**	**59.53**	**57.14**	**208.3%**	**217.0%**

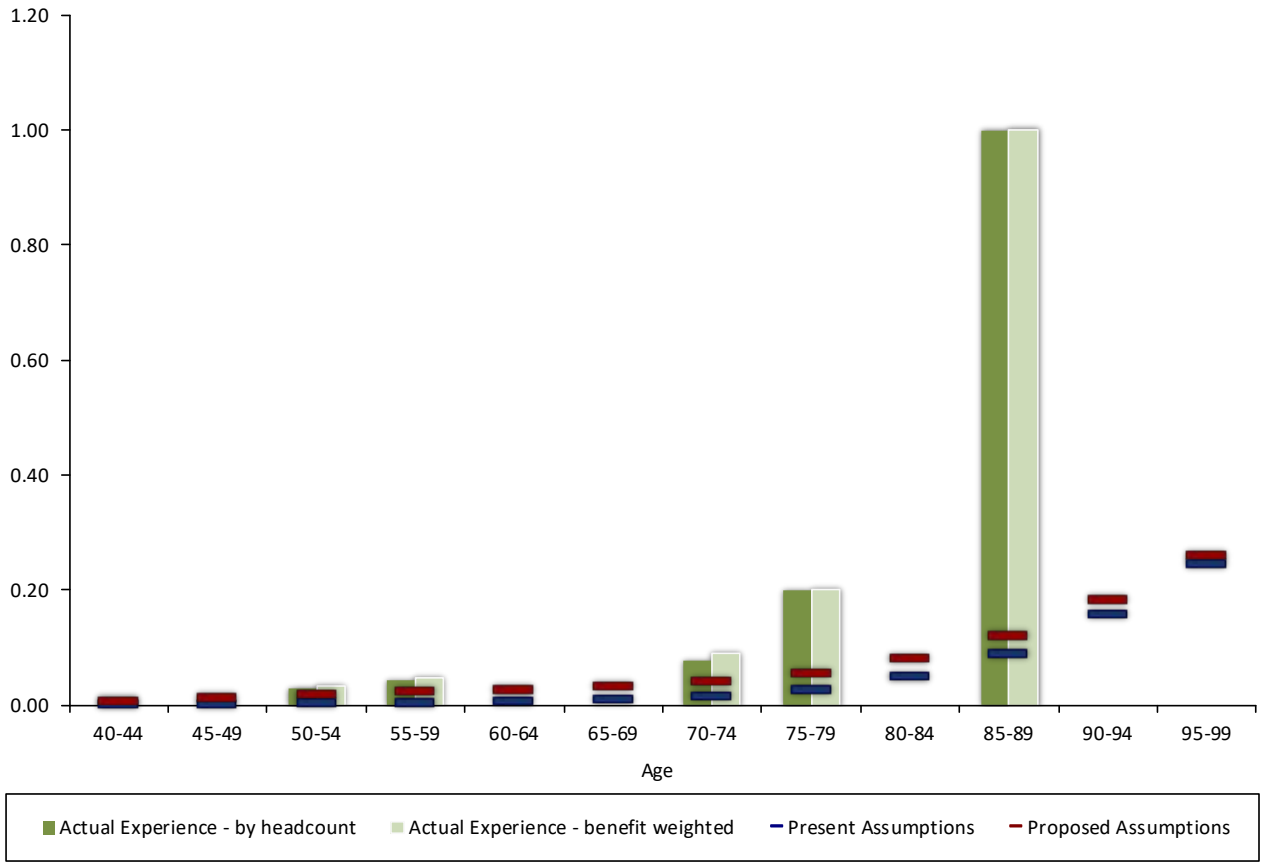
** In order to show the fit for the four-year period of the study, Proposed Sample Rates and Proposed Expected Deaths were determined using the proposed mortality rates for 2010 projected to the mid-point of the study using projection scale MP-2019.*



Post-Retirement Mortality Experience
Disabled Males

	Benefit Weighted ($000s)		Crude Rates				Benefit Weighted ($000s)		Ratio of	
			Benefit	Population	Sample Rates		Expected Deaths		Actuals/Expecteds	
Age	Deaths	Exposure	Weighted	Weighted	Current	Proposed*	Current	Proposed*	Current	Proposed*
40-44	-	386	0.000000	0.000000	0.001319	0.008146	0.53	2.90	0.0%	0.0%
45-49	-	767	0.000000	0.000000	0.001982	0.011692	1.47	8.86	0.0%	0.0%
50-54	58	1,846	0.031419	0.028571	0.003015	0.017400	5.60	32.59	1035.3%	178.0%
55-59	55	1,157	0.047537	0.043478	0.004255	0.023097	4.74	26.15	1160.5%	210.3%
60-64	-	1,133	0.000000	0.000000	0.005912	0.027741	6.79	31.68	0.0%	0.0%
65-69	-	1,277	0.000000	0.000000	0.008991	0.032765	11.50	41.91	0.0%	0.0%
70-74	101	1,128	0.089539	0.076923	0.015332	0.040848	16.73	45.54	603.6%	221.8%
75-79	104	515	0.201942	0.200000	0.026903	0.055704	13.28	28.05	782.9%	370.8%
80-84	-	213	0.000000	0.000000	0.048502	0.081397	8.94	15.95	0.0%	0.0%
85-89	52	52	1.000000	1.000000	0.089488	0.121322	5.92	7.40	878.6%	702.7%
90-94	-	-	N/A	N/A	0.157582	0.183382	-	-	N/A	N/A
95-99	-	-	N/A	N/A	0.246100	0.259294	-	-	N/A	N/A
Totals	**370**	**8,474**	**0.043663**	**0.037838**	**0.008911**	**0.028443**	**75.52**	**241.03**	**490.0%**	**153.5%**

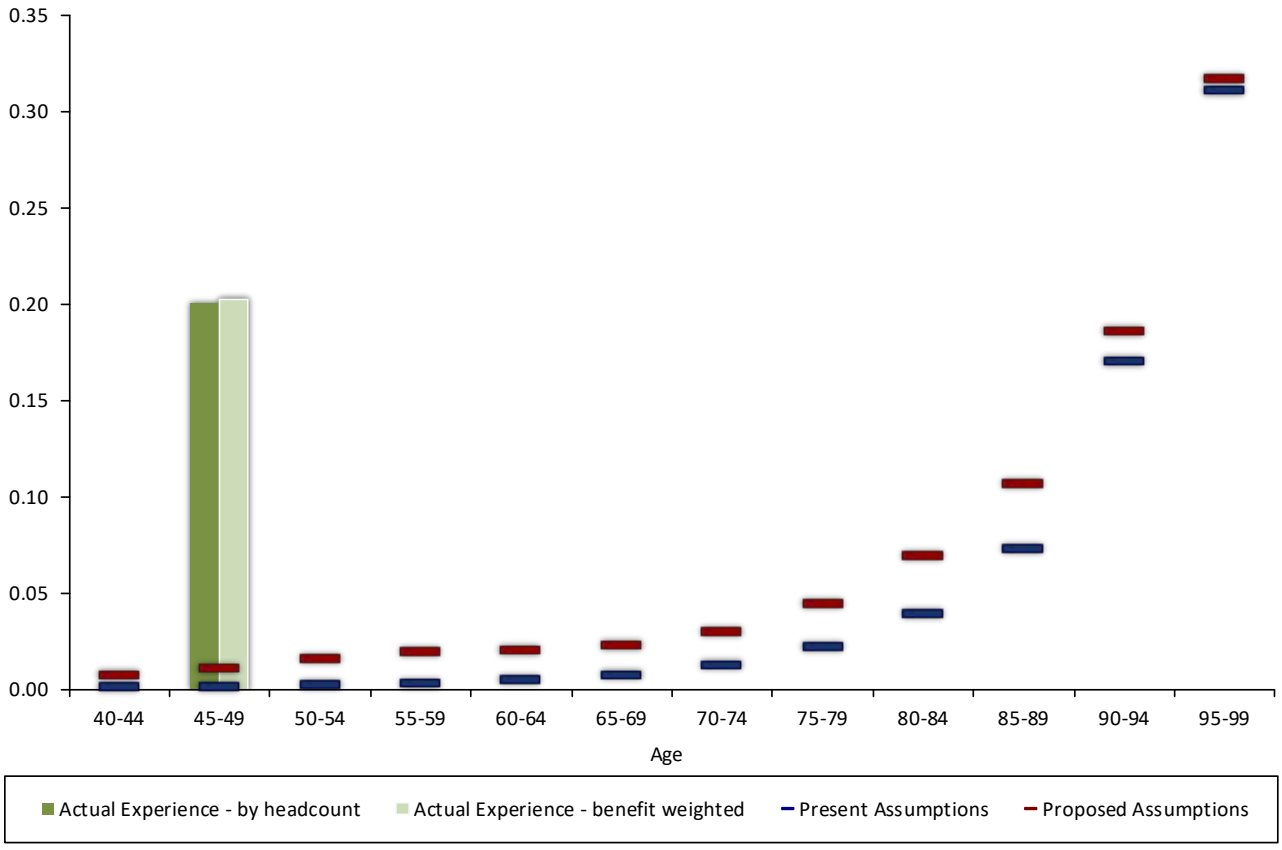
** In order to show the fit for the four-year period of the study, Proposed Sample Rates and Proposed Expected Deaths were determined using the proposed mortality rates for 2010 projected to the mid-point of the study using projection scale MP-2019.*



Post-Retirement Mortality Experience
Disabled Females

	Benefit Weighted ($000s)		Crude Rates		Sample Rates		Benefit Weighted ($000s)		Ratio of	
			Benefit	Population			Expected Deaths		Actuals/Expecteds	
Age	Deaths	Exposure	Weighted	Weighted	Current	Proposed	Current	Proposed*	Current	Proposed*
40-44	-	-	N/A	N/A	0.001272	0.007796	-	-	N/A	N/A
45-49	44	217	0.202765	0.200000	0.001644	0.011262	0.36	2.45	12365.1%	1795.9%
50-54	-	616	0.000000	0.000000	0.002234	0.015953	1.40	9.96	0.0%	0.0%
55-59	-	213	0.000000	0.000000	0.003182	0.019378	0.67	4.12	0.0%	0.0%
60-64	-	393	0.000000	0.000000	0.004870	0.020846	1.95	8.21	0.0%	0.0%
65-69	-	88	0.000000	0.000000	0.007787	0.023178	0.58	1.93	0.0%	0.0%
70-74	-	-	N/A	N/A	0.012816	0.030284	-	-	N/A	N/A
75-79	-	-	N/A	N/A	0.022084	0.044694	-	-	N/A	N/A
80-84	-	-	N/A	N/A	0.039711	0.069597	-	-	N/A	N/A
85-89	-	-	N/A	N/A	0.072860	0.106984	-	-	N/A	N/A
90-94	-	-	N/A	N/A	0.170283	0.185774	-	-	N/A	N/A
95-99	-	-	N/A	N/A	0.311270	0.316929	-	-	N/A	N/A
Totals	**44**	**1,527**	**0.028815**	**0.027027**	**0.003243**	**0.017466**	**4.95**	**26.67**	**888.4%**	**165.0%**

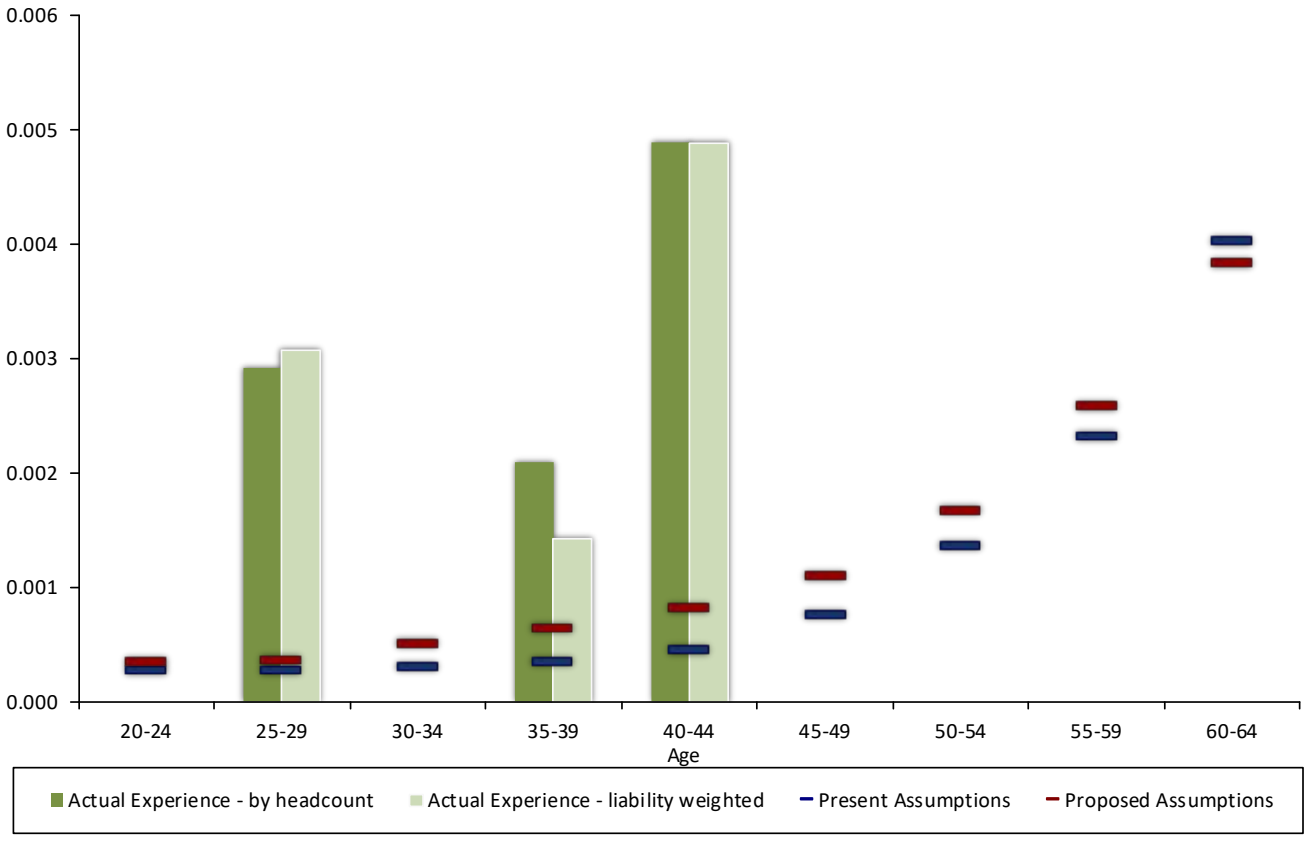
** In order to show the fit for the four-year period of the study, Proposed Sample Rates and Proposed Expected Deaths were determined using the proposed mortality rates for 2010 projected to the mid-point of the study using projection scale MP-2019.*



Pre-Retirement Mortality Experience
Healthy Males

	Liability Weighted ($000s)		Crude Rates		Sample Rates		Liability Weighted ($000s) Expected Deaths		Ratio of Actuals/Expecteds	
Age	Deaths	Exposure	Liability Weighted	Population Weighted	Current	Proposed	Current	Proposed	Current	Proposed
20-24	-	11,412	0.0000	0.0000	0.0003	0.0003	3.28	3.68	0.0%	0.0%
25-29	329	107,298	0.0031	0.0029	0.0003	0.0004	28.83	40.34	1141.4%	815.6%
30-34	-	167,494	0.0000	0.0000	0.0003	0.0005	50.23	85.16	0.0%	0.0%
35-39	308	217,129	0.0014	0.0021	0.0004	0.0006	77.23	142.96	398.8%	215.4%
40-44	1,624	332,603	0.0049	0.0049	0.0005	0.0008	153.53	273.29	1057.8%	594.2%
45-49	-	349,170	0.0000	0.0000	0.0008	0.0011	266.18	387.84	0.0%	0.0%
50-54	-	330,502	0.0000	0.0000	0.0014	0.0017	451.86	557.80	0.0%	0.0%
55-59	-	127,776	0.0000	0.0000	0.0023	0.0026	264.61	301.59	0.0%	0.0%
60-64	-	7,040	0.0000	0.0000	0.0040	0.0038	23.12	23.73	0.0%	0.0%
Totals	**2,261**	**1,650,424**	**0.0014**	**0.0016**	**0.0008**	**0.0011**	**1,318.85**	**1,816.39**	**171.4%**	**124.5%**

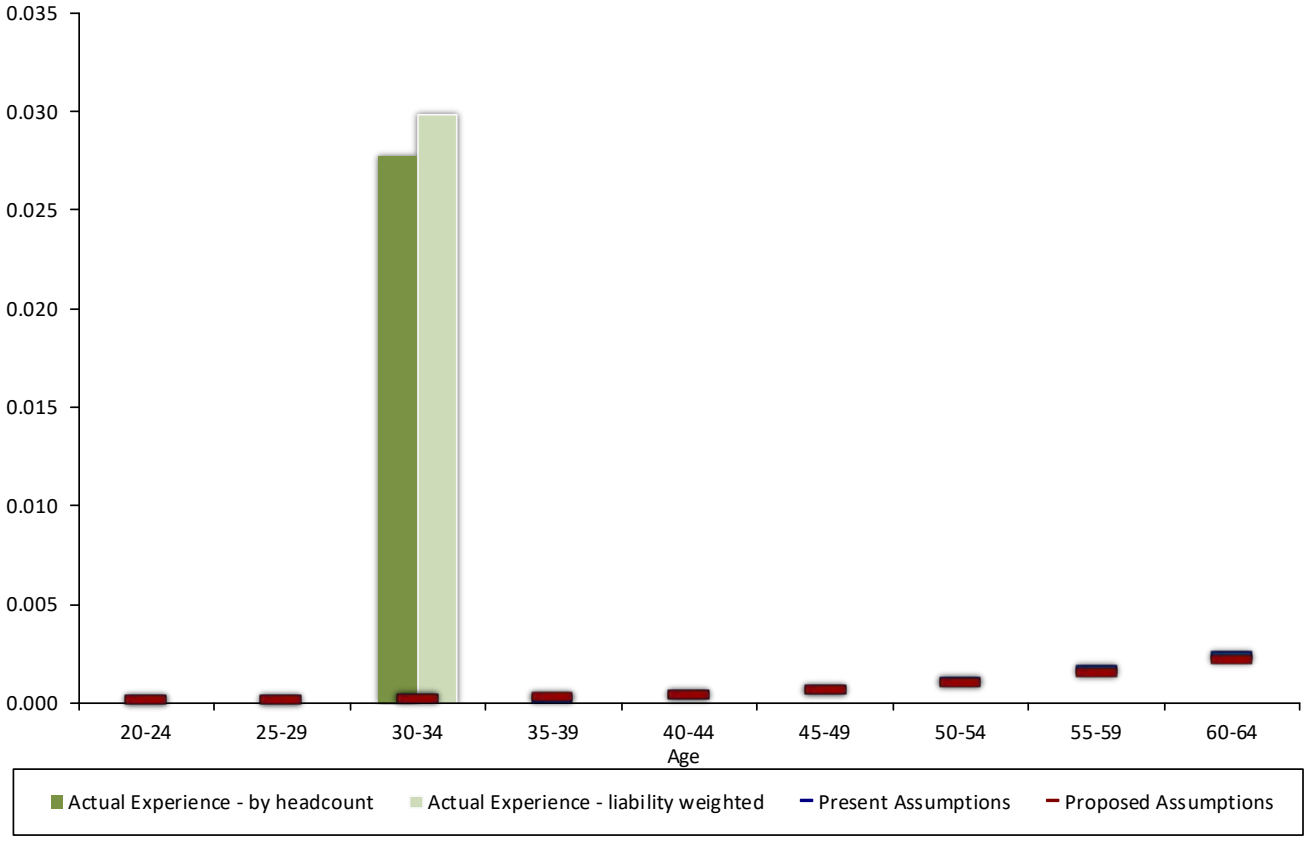
** In order to show the fit for the four-year period of the study, Proposed Sample Rates and Proposed Expected Deaths were determined using the proposed mortality rates for 2010 projected to the mid-point of the study using projection scale MP-2019.*



Pre-Retirement Mortality Experience
Healthy Females

	Liability Weighted ($000s)		Crude Rates		Sample Rates		Liability Weighted ($000s)		Ratio of	
			Liability	Population			Expected Deaths		Actuals/Expecteds	
Age	Deaths	Exposure	Weighted	Weighted	Current	Proposed	Current	Proposed	Current	Proposed
20-24	-	2,053	0.0000	0.0000	0.0001	0.0001	0.24	0.22	0.0%	0.0%
25-29	-	8,869	0.0000	0.0000	0.0001	0.0001	1.23	1.12	0.0%	0.0%
30-34	377	12,635	0.0298	0.0278	0.0002	0.0002	2.74	2.90	13767.9%	13000.0%
35-39	-	31,103	0.0000	0.0000	0.0003	0.0003	8.81	10.07	0.0%	0.0%
40-44	-	38,659	0.0000	0.0000	0.0004	0.0004	15.06	17.18	0.0%	0.0%
45-49	-	46,459	0.0000	0.0000	0.0006	0.0006	29.51	29.49	0.0%	0.0%
50-54	-	34,750	0.0000	0.0000	0.0011	0.0010	37.75	34.48	0.0%	0.0%
55-59	-	13,915	0.0000	0.0000	0.0017	0.0015	20.92	19.10	0.0%	0.0%
60-64	-	0	0.0000	0.0000	0.0024	0.0023	-	-	N/A	N/A
Totals	**377**	**188,443**	**0.0020**	**0.0027**	**0.0006**	**0.0006**	**116.26**	**114.56**	**324.3%**	**329.1%**

** 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-2019.*



SECTION G

MISCELLANEOUS AND TECHNICAL ASSUMPTIONS

Marital Status

Married members will frequently make different annuity selections than non-married members. The current valuation assumption is 85% of 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	
				Current	Proposed	Current	Proposed	Current	Proposed
Males	81	94	0.8617	0.8500	0.8500	79.90	79.90	101.4%	101.4%
Females	9	12	0.7500	0.8500	0.8500	10.20	10.20	88.2%	88.2%
Total	**90**	**106**	**0.8491**	**0.8500**	**0.8500**	**90.10**	**90.10**	**99.9%**	**99.9%**

In the analysis of retirements during the four-year period presented in Section C of this report, we included members who terminated employment after retirement eligibility but did not begin receiving payments. The analysis above includes only those members that terminated employment and began receiving payments.

The experience shows that the number of married new retirees is slightly lower than expected for females.

Recommendation

We recommend continuation of the 85% marital status assumption.

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 two 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	
			Current	Proposed	Current	Proposed
Males	81	1.91	2.00	2.00	95.6%	95.6%
Females	9	(0.40)	(2.00)	(2.00)	19.8%	19.8%
Total	**90**					

The experience shows that the average age difference for males is 1.91 years. For females, the average difference is (0.40) years. The year-by-year experience rates from (5.40) years (2016-2017 experience of 1 retiree) to 0.73 years (2018-2019 experience of 2 retirees).

Recommendation

Due to the varied experience and the low number of retirements, we recommend continuation of the current survivor age difference at this time.

Children of Members

Upon the death of an active member of the SPRF, the surviving spouse or legal guardian receives a benefit for each dependent child until the child is 18 years of age (23 years if a full-time student).

The current valuation assumption is each active member has two children; the first child is assumed to be born when the member is age 28 and the second child is assumed to be born when the member is age 31.

The data collected for the annual valuation does not contain information regarding children of active members. As such, we are unable to evaluate the credibility of this assumption.

Recommendation

We recommend continuation of the current assumption regarding children of active members.

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 (other than a refund of remaining employee contributions, if applicable) 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 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 and Females:	20% elect 50% Joint & Survivor option
	10% elect 75% Joint & Survivor option
	55% 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 75% and 100% Joint & Survivor annuities as shown on the following page and reducing the assumed percentage electing the 50% Joint & Survivor annuity and Single-Life annuity accordingly.

Form of Payment

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	6	90	0.0667	0.1500	0.0500	13.50	4.50	44.4%	133.3%
15-year certain & life	-	90	0.0000	0.0000	0.0000	0.00	0.00	N/A	N/A
50% joint & survivor	11	90	0.1222	0.2000	0.1250	18.00	11.25	61.1%	97.8%
75% joint & survivor	11	90	0.1222	0.1000	0.1250	9.00	11.25	122.2%	97.8%
100% joint & survivor	62	90	0.6889	0.5500	0.7000	49.50	63.00	125.3%	98.4%
Total	**90**	**90**	**1.0000**	**1.0000**	**1.0000**	**90.00**	**90.00**		

Actuarial Equivalent Factors

Joint & Survivor benefits are actuarially equivalent to the Single-Life annuity, except there is no actuarial reduction for the bounce-back feature (i.e., this is subsidized by the plan). Effective July 1, 2019 and phased in over a 12-month period, actuarial equivalent factors are based on the RP-2014 mortality table for healthy annuitants, reflecting projected mortality improvements for a member turning age 55 in 2021 using Scale MP-2017, white collar adjustment, blended 90% males, 6.44% post-retirement interest and 7.50% pre-retirement interest. Reflecting statutory requirements, Joint & 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. Updating the analysis of these assumptions is outside the scope of this assignment due to significant data requirements.

Recommendation

Miscellaneous and Technical Assumptions are listed on page G-8. 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 13% for 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 H

PROPOSED ASSUMPTION LISTING

Proposed Actuarial Assumptions
Based on 2015-2019 Experience Study

Merit and Seniority Pay Increases

% Merit & Seniority Increases in Salaries Next Year	
Year	**Rate**
1	9.50%
2	5.50%
3	4.50%
4	4.25%
5	4.00%
6	3.75%
7	3.50%
8	2.50%
9	2.00%
10	1.50%
11	1.25%
12	1.00%
13	1.00%
14	1.00%
15	1.00%
16	0.75%
17	0.50%
18	0.50%
19	0.50%
20	0.50%
21	0.40%
22	0.30%
23	0.20%
24	0.10%
25+	0.00%

Proposed Actuarial Assumptions
Based on 2015-2019 Experience Study

Age and Service Retirement Pattern
Unreduced (Normal) Retirement

Age	% Retiring
55	65.0%
56	40.0%
57	30.0%
58	15.0%
59	20.0%
60+*	100%

** 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 2015-2019 Experience Study

Age and Service Retirement Pattern
Reduced (Early) Retirement

Age	% Retiring
50	3.0%
51	5.0%
52	5.0%
53	3.0%
54	4.0%

Proposed Actuarial Assumptions
Based on 2015-2019 Experience Study

Withdrawal

Year	% Terminating	
	Male	Female
1	5.000%	5.000%
2	3.500%	3.500%
3	2.500%	2.500%
4	2.250%	2.250%
5	2.000%	2.000%
6	1.750%	1.750%
7	1.500%	1.500%
8	1.250%	1.250%
9	1.000%	1.000%
10	0.750%	0.750%
11	0.750%	0.750%
12	0.750%	0.750%
13	0.750%	0.750%
14	0.750%	0.750%
15	0.500%	0.500%
16	0.500%	0.500%
17	0.500%	0.500%
18	0.500%	0.500%
19	0.500%	0.500%
20	0.500%	0.500%
21	0.500%	0.500%
22	0.000%	0.000%
23	0.000%	0.000%
24	0.000%	0.000%
25+	0.000%	0.000%

Proposed Actuarial Assumptions
Based on 2015-2019 Experience Study

Disability Rates

Age	% Becoming Disabled	
	Male	Female
20	0.030%	0.030%
21	0.030%	0.030%
22	0.040%	0.040%
23	0.040%	0.040%
24	0.050%	0.050%
25	0.050%	0.050%
26	0.050%	0.050%
27	0.060%	0.060%
28	0.060%	0.060%
29	0.060%	0.060%
30	0.090%	0.090%
31	0.105%	0.105%
32	0.113%	0.113%
33	0.120%	0.120%
34	0.128%	0.128%
35	0.135%	0.135%
36	0.150%	0.150%
37	0.150%	0.150%
38	0.150%	0.150%
39	0.150%	0.150%
40	0.155%	0.155%
41	0.166%	0.166%
42	0.187%	0.187%
43	0.198%	0.198%
44	0.218%	0.218%
45	0.239%	0.239%
46	0.270%	0.270%
47	0.320%	0.320%
48	0.365%	0.365%
49	0.481%	0.481%
50	0.481%	0.481%
51	0.601%	0.601%
52	0.638%	0.638%
53	0.725%	0.725%
54	0.800%	0.800%
55	0.800%	0.800%
56	0.800%	0.800%
57	0.800%	0.800%
58	0.800%	0.800%
59	0.800%	0.800%
60+	0.000%	0.000%

Proposed Actuarial Assumptions
Based on 2015-2019 Experience Study

Healthy Post-Retirement Mortality Rates

Age in 2019	% Dying Next Year*	
	Male	Female
50	0.2789%	0.2142%
51	0.3015%	0.2281%
52	0.3275%	0.2450%
53	0.3559%	0.2630%
54	0.3886%	0.2814%
55	0.4238%	0.3008%
56	0.4621%	0.3207%
57	0.5033%	0.3415%
58	0.5468%	0.3616%
59	0.5941%	0.3839%
60	0.6419%	0.4079%
61	0.6917%	0.4356%
62	0.7441%	0.4669%
63	0.7978%	0.5038%
64	0.8563%	0.5444%
65	0.9214%	0.5920%
66	0.9959%	0.6466%
67	1.0822%	0.7093%
68	1.1819%	0.7831%
69	1.2981%	0.8689%
70	1.4315%	0.9681%
71	1.5836%	1.0831%
72	1.7597%	1.2156%
73	1.9596%	1.3671%
74	2.1892%	1.5398%
75	2.4515%	1.7360%
76	2.7505%	1.9574%
77	3.0913%	2.2088%
78	3.4799%	2.4941%
79	3.9208%	2.8180%
80	4.4230%	3.1879%

Age in 2019	% Dying Next Year*	
	Male	Female
81	4.9935%	3.6097%
82	5.6394%	4.0906%
83	6.3652%	4.6388%
84	7.1744%	5.2641%
85	8.0734%	5.9754%
86	9.0612%	6.7859%
87	10.1372%	7.7007%
88	11.3089%	8.7235%
89	12.5695%	9.8499%
90	13.9248%	11.0720%
91	15.3528%	12.3669%
92	16.8482%	13.7136%
93	18.3917%	15.1121%
94	19.9820%	16.5642%
95	21.6137%	18.0815%
96	23.4247%	19.7288%
97	25.2907%	21.4821%
98	27.2292%	23.3335%
99	29.2162%	25.2814%
100	31.2364%	27.3181%
101	33.2716%	29.4221%
102	35.3028%	31.5433%
103	37.2999%	33.6715%
104	39.2536%	35.7732%
105	41.1519%	37.8479%
106	42.9921%	39.8838%
107	44.7481%	41.8393%
108	46.4297%	43.7197%
109	48.0045%	45.5171%
110	49.2895%	47.2105%

** The rates shown are PUB-2010 mortality for healthy annuitants, General table, with adjustments, if applicable (see Section F). Recommended rates include mortality improvements using projection scale MP-2019.*

Proposed Actuarial Assumptions
Based on 2015-2019 Experience Study

Disabled Post-Retirement Mortality Rates

Age in 2019	% Dying Next Year*	
	Male	Female
20	0.4280%	0.2532%
21	0.4081%	0.2381%
22	0.3803%	0.2192%
23	0.3501%	0.2031%
24	0.3292%	0.1933%
25	0.3264%	0.1976%
26	0.3537%	0.2202%
27	0.3819%	0.2458%
28	0.4122%	0.2745%
29	0.4439%	0.3047%
30	0.4763%	0.3374%
31	0.5091%	0.3720%
32	0.5411%	0.4080%
33	0.5720%	0.4460%
34	0.6034%	0.4837%
35	0.6319%	0.5217%
36	0.6610%	0.5593%
37	0.6898%	0.5972%
38	0.7191%	0.6351%
39	0.7487%	0.6740%
40	0.7798%	0.7140%
41	0.8136%	0.7555%
42	0.8519%	0.7998%
43	0.8955%	0.8482%
44	0.9484%	0.9026%
45	1.0096%	0.9640%
46	1.0828%	1.0335%
47	1.1685%	1.1135%
48	1.2669%	1.2060%
49	1.3775%	1.3119%
50	1.5020%	1.4307%
51	1.6078%	1.5025%
52	1.7207%	1.5808%
53	1.8381%	1.6650%
54	1.9576%	1.7502%
55	2.0785%	1.8323%

Age in 2019	% Dying Next Year*	
	Male	Female
56	2.1966%	1.9060%
57	2.3089%	1.9684%
58	2.4159%	2.0170%
59	2.5173%	2.0522%
60	2.6126%	2.0777%
61	2.7041%	2.0944%
62	2.7936%	2.1094%
63	2.8855%	2.1259%
64	2.9786%	2.1482%
65	3.0721%	2.1788%
66	3.1704%	2.2243%
67	3.2750%	2.2865%
68	3.3889%	2.3695%
69	3.5166%	2.4751%
70	3.6595%	2.6065%
71	3.8247%	2.7638%
72	4.0148%	2.9493%
73	4.2330%	3.1634%
74	4.4812%	3.4098%
75	4.7653%	3.6905%
76	5.0851%	4.0076%
77	5.4460%	4.3635%
78	5.8508%	4.7621%
79	6.3039%	5.2066%
80	6.8078%	5.6993%
81	7.3676%	6.2433%
82	7.9811%	6.8400%
83	8.6530%	7.4956%
84	9.3804%	8.2086%
85	10.1634%	8.9857%
86	11.0054%	9.7948%
87	11.9053%	10.6193%
88	12.8764%	11.4546%
89	14.0871%	12.2998%
90	15.4253%	13.1713%

** The rates shown are PUB-2010 mortality for disabled annuitants, General table, with adjustments, if applicable (see Section F). Recommended rates include mortality improvements using projection scale MP-2019.*

Proposed Actuarial Assumptions
Based on 2015-2019 Experience Study

Healthy Pre-Retirement Mortality Rates

Age in 2019	% Dying Next Year*	
	Male	Female
20	0.0384%	0.0141%
21	0.0381%	0.0133%
22	0.0357%	0.0124%
23	0.0343%	0.0115%
24	0.0330%	0.0106%
25	0.0329%	0.0108%
26	0.0363%	0.0123%
27	0.0387%	0.0138%
28	0.0424%	0.0153%
29	0.0448%	0.0169%
30	0.0484%	0.0197%
31	0.0520%	0.0212%
32	0.0554%	0.0239%
33	0.0585%	0.0252%
34	0.0612%	0.0277%
35	0.0648%	0.0299%
36	0.0680%	0.0319%
37	0.0706%	0.0349%
38	0.0739%	0.0364%
39	0.0765%	0.0387%
40	0.0798%	0.0409%
41	0.0825%	0.0439%
42	0.0860%	0.0456%
43	0.0891%	0.0483%
44	0.0932%	0.0510%
45	0.0983%	0.0548%

Age in 2019	% Dying Next Year*	
	Male	Female
46	0.1045%	0.0588%
47	0.1110%	0.0630%
48	0.1199%	0.0676%
49	0.1293%	0.0736%
50	0.1394%	0.0801%
51	0.1521%	0.0881%
52	0.1656%	0.0966%
53	0.1808%	0.1066%
54	0.1967%	0.1169%
55	0.2153%	0.1294%
56	0.2355%	0.1417%
57	0.2582%	0.1546%
58	0.2821%	0.1679%
59	0.3069%	0.1823%
60	0.3330%	0.1976%
61	0.3600%	0.2126%
62	0.3872%	0.2283%
63	0.4155%	0.2458%
64	0.4435%	0.2653%
65	0.4723%	0.2859%
66	0.5024%	0.3100%
67	0.5352%	0.3378%
68	0.5712%	0.3689%
69	0.6130%	0.4043%
70	0.6595%	0.4453%

** The rates shown are PUB-2010 mortality for employees, General table, with adjustments, if applicable (see Section F). Recommended rates include mortality improvements using projection scale MP-2019.*

SECTION I

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.

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.

Glossary

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 J

APPENDIX

Appendix – Detailed Experience Analysis

In this section, we present the annual experience for each major assumption that was analyzed for the study. Results are based on liability-weighted experience for withdrawal, retirement and pre-retirement mortality, benefit-weighted for post-retirement and disabled mortality, and population-weighted for all other analysis. Please note that totals may not sum correctly due to rounding of intermediate results.

Appendix – Detailed Experience Analysis
Salary Increases

2015-2019 Experience

Year	Exposure	Gross Actual Increases	Gross Expected Increases
1	195	8.83%	15.25%
2	231	7.37%	9.25%
3	186	6.93%	7.75%
4	146	5.69%	7.25%
5	99	6.78%	6.75%
6	105	4.43%	6.25%
7	107	6.72%	6.00%
8	102	3.07%	5.75%
9	127	2.76%	5.50%
10	132	2.52%	5.25%
11	144	2.26%	5.00%
12	151	2.79%	4.75%
13	125	1.97%	4.50%
14	113	3.42%	4.25%
15	102	3.27%	4.25%
16	136	1.02%	4.25%
17	157	1.85%	4.00%
18	154	2.42%	4.00%
19	152	3.19%	3.75%
20	95	4.48%	3.75%
21	74	2.31%	3.65%
22	46	3.86%	3.55%
23	28	2.08%	3.45%
24	23	5.28%	3.35%
25+	198	2.25%	3.25%
Totals	**3,128**	**4.09%**	**5.90%**

Appendix – Detailed Experience Analysis
Salary Increases

2015-2016 Experience

Year	Exposure	Gross Actual Increases	Gross Expected Increases
1	45	8.68%	15.25%
2	43	4.82%	9.25%
3	25	5.23%	7.75%
4	32	4.48%	7.25%
5	7	3.42%	6.75%
6	44	2.43%	6.25%
7	27	2.09%	6.00%
8	24	2.67%	5.75%
9	34	- 0.99%	5.50%
10	49	0.03%	5.25%
11	43	0.59%	5.00%
12	33	0.35%	4.75%
13	9	- 2.67%	4.50%
14	34	0.67%	4.25%
15	30	0.37%	4.25%
16	67	- 0.21%	4.25%
17	37	0.10%	4.00%
18	31	1.48%	4.00%
19	25	- 0.03%	3.75%
20	10	2.76%	3.75%
21	20	0.40%	3.65%
22	2	5.27%	3.55%
23	2	- 0.52%	3.45%
24	6	4.59%	3.35%
25+	63	0.77%	3.25%
Totals	**742**	**1.74%**	**5.74%**

Appendix – Detailed Experience Analysis
Salary Increases

2016-2017 Experience

Year	Exposure	Gross Actual Increases	Gross Expected Increases
1	60	9.06%	15.25%
2	53	6.96%	9.25%
3	41	4.16%	7.75%
4	25	5.01%	7.25%
5	31	5.39%	6.75%
6	7	6.21%	6.25%
7	43	7.54%	6.00%
8	27	3.24%	5.75%
9	25	1.84%	5.50%
10	32	2.65%	5.25%
11	46	3.32%	5.00%
12	42	3.43%	4.75%
13	32	2.03%	4.50%
14	8	2.28%	4.25%
15	34	4.54%	4.25%
16	29	2.37%	4.25%
17	65	1.92%	4.00%
18	36	3.37%	4.00%
19	31	3.09%	3.75%
20	23	2.95%	3.75%
21	8	3.71%	3.65%
22	17	3.72%	3.55%
23	2	3.57%	3.45%
24	2	5.06%	3.35%
25+	53	2.30%	3.25%
Totals	**772**	**4.15%**	**6.00%**

Appendix – Detailed Experience Analysis
Salary Increases

2017-2018 Experience

Year	Exposure	Gross Actual Increases	Gross Expected Increases
1	55	6.11%	15.25%
2	73	5.43%	9.25%
3	50	3.95%	7.75%
4	40	1.99%	7.25%
5	24	4.45%	6.75%
6	30	2.81%	6.25%
7	8	7.42%	6.00%
8	43	2.10%	5.75%
9	25	1.83%	5.50%
10	26	0.52%	5.25%
11	32	0.49%	5.00%
12	46	1.13%	4.75%
13	41	- 0.58%	4.50%
14	31	1.53%	4.25%
15	8	2.50%	4.25%
16	32	1.53%	4.25%
17	26	- 0.22%	4.00%
18	62	0.53%	4.00%
19	35	0.04%	3.75%
20	28	1.90%	3.75%
21	20	- 1.03%	3.65%
22	8	- 1.48%	3.55%
23	16	- 1.05%	3.45%
24	2	1.23%	3.35%
25+	44	1.50%	3.25%
Totals	**805**	**2.08%**	**6.05%**

Appendix – Detailed Experience Analysis
Salary Increases

2018-2019 Experience

Year	Exposure	Gross Actual Increases	Gross Expected Increases
1	35	12.91%	15.25%
2	62	11.77%	9.25%
3	70	11.28%	7.75%
4	49	9.84%	7.25%
5	37	10.09%	6.75%
6	24	9.59%	6.25%
7	29	9.62%	6.00%
8	8	8.90%	5.75%
9	43	6.81%	5.50%
10	25	9.28%	5.25%
11	23	5.72%	5.00%
12	30	7.12%	4.75%
13	43	5.32%	4.50%
14	40	7.44%	4.25%
15	30	4.94%	4.25%
16	8	4.33%	4.25%
17	29	5.82%	4.00%
18	25	6.88%	4.00%
19	61	6.38%	3.75%
20	34	8.15%	3.75%
21	26	5.91%	3.65%
22	19	6.09%	3.55%
23	8	8.61%	3.45%
24	13	6.26%	3.35%
25+	38	5.48%	3.25%
Totals	**809**	**8.18%**	**5.81%**

Appendix – Detailed Experience Analysis
Retirements

2015-2019 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
50	813	68,989	3,449.44	23.6%
51	4,039	76,227	3,811.33	106.0%
52	3,477	67,591	3,379.56	102.9%
53	801	70,925	3,546.28	22.6%
54	2,732	77,216	3,860.78	70.8%
55	54,755	79,144	51,443.09	106.4%
56	10,288	25,779	12,889.89	79.8%
57	4,657	14,316	4,294.71	108.4%
58	704	9,948	1,989.66	35.4%
59	1,444	8,000	2,400.08	60.2%
Totals	**83,710**	**498,135**	**91,064.82**	**91.9%**

Appendix – Detailed Experience Analysis
Retirements

2015-2016 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
50	-	15,202	760.08	0.0%
51	2,081	22,902	1,145.09	181.7%
52	3,477	16,427	821.34	423.3%
53	-	18,782	939.09	0.0%
54	967	20,192	1,009.58	95.8%
55	20.862	24.530	15.944.69	130.8%
56	2,553	6,041	3,020.60	84.5%
57	-	3,897	1,169.03	0.0%
58	-	761	152.17	0.0%
59	235	1,690	506.95	46.4%
Totals	**30,175**	**130,424**	**25,468.62**	**118.5%**

2016-2017 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
50	-	13,815	690.75	0.0%
51	-	15,447	772.33	0.0%
52	-	21,686	1,084.32	0.0%
53	-	13,345	667.27	0.0%
54	1,128	19,798	989.91	113.9%
55	13,530	20,578	13,375.39	101.2%
56	619	3,890	1,945.08	31.8%
57	2,102	3,612	1,083.60	194.0%
58	704	4,193	838.62	83.9%
59	-	803	240.96	0.0%
Totals	**18,083**	**117,167**	**21,688.23**	**83.4%**

Appendix – Detailed Experience Analysis
Retirements

2017-2018 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
50	813	23,524	1,176.20	69.1%
51	1,958	15,078	753.89	259.7%
52	-	15,929	796.45	0.0%
53	801	23,106	1,155.31	69.3%
54	637	14,148	707.40	90.0%
55	11,353	19,882	12,923.19	87.8%
56	3,643	6,956	3,478.11	104.7%
57	187	3,403	1,020.92	18.3%
58	-	1,618	323.62	0.0%
59	1,209	3,826	1,147.73	105.3%
Totals	**20,601**	**127,470**	**23,482.82**	**87.7%**

2018-2019 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
50	-	16,448	822.41	0.0%
51	-	22,800	1,140.02	0.0%
52	-	13,549	677.45	0.0%
53	-	15,692	784.61	0.0%
54	-	23,078	1,153.89	0.0%
55	9,010	14,154	9,199.82	97.9%
56	3,473	8,892	4,446.10	78.1%
57	2,368	3,404	1,021.16	231.9%
58	-	3,376	675.25	0.0%
59	-	1,681	504.44	0.0%
Totals	**14,851**	**123,074**	**20,425.15**	**72.7%**

Appendix – Detailed Experience Analysis
Terminations – First Three Years

Terminations

2015-2019 Experience, ($000s)

	Males and Females			
Year	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
1	2,345	29,570	739.26	317.2%
2	2,796	78,850	1,577.00	177.3%
3	1,120	83,293	1,249.41	89.6%
Totals	**6,261**	**191,713**	**3,565.67**	**175.6%**

Appendix – Detailed Experience Analysis
Terminations – First Three Years

2015-2016 Experience, ($000s)

	Males and Females			
Year	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
1	140	5,341	133.53	104.8%
2	861	18,276	365.52	235.6%
3	-	15,758	236.37	0.0%
Totals	**1,001**	**39,375**	**735.42**	**136.1%**

2016-2017 Experience, ($000s)

	Males and Females			
Year	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
1	1,408	11,508	287.70	489.4%
2	278	23,851	477.02	58.3%
3	820	18,737	281.06	291.8%
Totals	**2,506**	**54,096**	**1,045.78**	**239.6%**

Appendix – Detailed Experience Analysis
Terminations – First Three Years

2017-2018 Experience, ($000s)

	Males and Females			
Year	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
1	425	5,641	141.03	301.4%
2	222	22,985	459.70	48.3%
3	-	26,808	402.13	0.0%
Totals	**647**	**55,434**	**1,002.86**	**64.5%**

2018-2019 Experience, ($000s)

	Males and Females			
Year	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
1	372	7,080	177.00	210.2%
2	1,435	13,738	274.76	522.3%
3	300	21,990	329.85	91.0%
Totals	**2,107**	**42,808**	**781.61**	**269.6%**

Appendix – Detailed Experience Analysis
Terminations – After Third Year

2015-2019 Experience, ($000s)

	Males and Females			
Age Group	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
20-24	-	355	4.26	0.0%
25-29	265	44,781	421.85	62.8%
30-34	1,504	135,829	892.33	168.5%
35-39	2,301	211,774	869.19	264.7%
40-44	3,161	356,936	1,427.74	221.4%
45-49	1,995	387,395	1,402.43	142.3%
50+	233	-	-	N/A
Totals	**9,459**	**1,137,070**	**5,017.80**	**188.5%**

Appendix – Detailed Experience Analysis
Terminations – After Third Year

2015-2016 Experience, ($000s)

	Males and Females			
Age Group	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
20-24	-	-	-	N/A
25-29	-	9,777	88.83	0.0%
30-34	-	28,522	186.86	0.0%
35-39	1,428	61,358	251.32	568.2%
40-44	607	90,213	360.85	168.2%
45-49	1,099	90,241	335.08	328.0%
50+	-	-	-	N/A
Totals	**3,134**	**280,111**	**1,222.95**	**256.3%**

2016-2017 Experience, ($000s)

	Total			
Age Group	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
20-24	-	-	-	N/A
25-29	-	7,977	75.46	0.0%
30-34	833	33,296	223.15	373.3%
35-39	-	50,751	208.20	0.0%
40-44	1,008	87,995	351.98	286.4%
45-49	-	93,483	330.14	0.0%
50+	-	-	-	N/A
Totals	**1,841**	**273,502**	**1,188.94**	**154.8%**

Appendix – Detailed Experience Analysis
Terminations – After Third Year

2017-2018 Experience, ($000s)

	Males and Females			
Age Group	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
20-24	-	355	4.26	0.0%
25-29	-	12,101	116.04	0.0%
30-34	-	36,835	240.97	0.0%
35-39	427	49,869	204.01	209.3%
40-44	340	92,961	371.84	91.4%
45-49	896	100,028	367.53	243.8%
50+	-	-	-	N/A
Totals	**1,663**	**292,149**	**1,304.66**	**127.5%**

2018-2019 Experience, ($000s)

	Males and Females			
Age Group	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
20-24	-	-	-	N/A
25-29	265	14,926	141.51	187.3%
30-34	671	37,176	241.34	278.0%
35-39	446	49,796	205.65	216.9%
40-44	1,206	85,767	343.07	351.5%
45-49	-	103,643	369.67	0.0%
50+	233	-	-	N/A
Totals	**2,821**	**291,308**	**1,301.25**	**216.8%**

Appendix – Detailed Experience Analysis
Disability Retirements

2015-2019 Experience

	Males and Females			
Age Group	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected
20-24	-	65	0.03	0.0%
25-29	-	371	0.21	0.0%
30-34	1	470	0.34	296.0%
35-39	1	550	0.75	133.3%
40-44	1	690	1.59	62.9%
45-49	2	679	2.58	77.5%
50-54	4	511	2.75	145.6%
55-59	2	-	-	N/A
60-64	-	-	-	N/A
Totals	**11**	**3,336**	**8.25**	**133.4%**

Appendix – Detailed Experience Analysis
Disability Retirements

2015-2016 Experience

	Males and Females			
Age Group	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected
20-24	-	12	0.01	0.0%
25-29	-	78	0.04	0.0%
30-34	-	97	0.07	0.0%
35-39	-	139	0.19	0.0%
40-44	-	173	0.40	0.0%
45-49	-	156	0.58	0.0%
50-54	-	136	0.74	0.0%
55-59	-	-	-	N/A
60-64	-	-	-	N/A
Totals	**-**	**791**	**2.03**	**0.0%**

2016-2017 Experience

	Males and Females			
Age Group	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected
20-24	-	17	0.01	0.0%
25-29	-	93	0.05	0.0%
30-34	1	120	0.09	1171.0%
35-39	-	137	0.19	0.0%
40-44	1	180	0.41	241.4%
45-49	2	168	0.64	311.2%
50-54	1	122	0.66	151.4%
55-59	1	-	-	N/A
60-64	-	-	-	N/A
Totals	**6**	**837**	**2.05**	**292.9%**

Appendix – Detailed Experience Analysis
Disability Retirements

2017-2018 Experience

Age Group	Males and Females			
	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected
20-24	-	15	0.01	0.0%
25-29	-	99	0.06	0.0%
30-34	-	125	0.09	0.0%
35-39	1	135	0.18	542.4%
40-44	-	171	0.39	0.0%
45-49	-	172	0.65	0.0%
50-54	2	125	0.66	301.1%
55-59	-	-	-	N/A
60-64	-	-	-	N/A
Totals	**3**	**842**	**2.05**	**146.5%**

2018-2019 Experience

Age Group	Males and Females			
	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected
20-24	-	21	0.01	0.0%
25-29	-	101	0.06	0.0%
30-34	-	128	0.09	0.0%
35-39	-	139	0.19	0.0%
40-44	-	166	0.38	0.0%
45-49	-	183	0.70	0.0%
50-54	1	128	0.69	145.8%
55-59	1	-	-	N/A
60-64	-	-	-	N/A
Totals	**2**	**866**	**2.12**	**94.3%**

Appendix – Detailed Experience Analysis
Post-Retirement Mortality

2015-2019 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
50-54	-	4,565	14.37	0.0%	50-54	-	975	2.33	0.0%
55-59	118	28,852	124.43	94.8%	55-59	-	3,983	12.64	0.0%
60-64	269	33,316	194.57	138.3%	60-64	15	2,912	13.85	108.3%
65-69	139	29,681	268.26	51.8%	65-69	-	1,302	9.94	0.0%
70-74	665	33,550	511.42	130.0%	70-74	64	1,073	12.85	498.1%
75-79	684	24,252	635.30	107.7%	75-79	-	177	3.17	0.0%
80-84	632	17,793	848.98	74.4%	80-84	-	44	2.22	0.0%
85-89	1,539	10,735	939.04	163.9%	85-89	45	45	2.53	1775.7%
90-94	593	5,712	868.63	68.3%	90-94	-	-	-	N/A
95+	463	1,779	407.44	113.6%	95+	-	-	-	N/A
Totals	**5,102**	**190,235**	**4,812.44**	**106.0%**	**Totals**	**124**	**10,511**	**59.53**	**208.3%**

Appendix – Detailed Experience Analysis
Post-Retirement Mortality

2015-2016 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
50-54	-	1,142	3.56	0.0%	50-54	-	317	0.76	0.0%
55-59	59	7,416	32.51	181.5%	55-59	-	853	2.75	0.0%
60-64	66	7,816	46.25	142.7%	60-64	-	582	2.81	0.0%
65-69	62	7,520	69.00	89.9%	65-69	-	290	2.44	0.0%
70-74	195	8,162	123.94	157.3%	70-74	64	206	2.45	2617.1%
75-79	102	5,515	146.21	69.8%	75-79	-	-	-	N/A
80-84	229	4,245	202.48	113.1%	80-84	-	44	2.22	0.0%
85-89	336	2,818	251.58	133.6%	85-89	-	-	-	N/A
90-94	-	1,242	191.64	0.0%	90-94	-	-	-	N/A
95+	-	219	53.05	0.0%	95+	-	-	-	N/A
Totals	**1,049**	**46,095**	**1,120.23**	**93.6%**	**Totals**	**64**	**2,292**	**13.42**	**476.8%**

2016-2017 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
50-54	-	1,372	4.28	0.0%	50-54	-	246	0.57	0.0%
55-59	59	7,513	32.47	181.7%	55-59	-	910	2.90	0.0%
60-64	203	8,165	47.86	424.1%	60-64	-	718	3.48	0.0%
65-69	-	7,608	69.64	0.0%	65-69	-	256	2.05	0.0%
70-74	136	8,546	133.16	102.1%	70-74	-	277	3.44	0.0%
75-79	187	5,577	149.78	124.8%	75-79	-	-	-	N/A
80-84	41	4,181	199.55	20.5%	80-84	-	-	-	N/A
85-89	349	2,667	234.11	149.1%	85-89	45	45	2.53	1775.7%
90-94	194	1,483	219.20	88.5%	90-94	-	-	-	N/A
95+	127	478	110.28	115.2%	95+	-	-	-	N/A
Totals	**1,296**	**47,590**	**1,200.33**	**108.0%**	**Totals**	**45**	**2,452**	**14.98**	**300.5%**

Appendix – Detailed Experience Analysis
Post-Retirement Mortality

2017-2018 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
50-54	-	1,013	3.21	0.0%	50-54	-	255	0.61	0.0%
55-59	-	7,107	30.41	0.0%	55-59	-	1,088	3.45	0.0%
60-64	-	8,550	49.74	0.0%	60-64	15	779	3.73	401.8%
65-69	-	7,333	66.21	0.0%	65-69	-	324	2.42	0.0%
70-74	123	8,592	131.95	93.2%	70-74	-	266	3.13	0.0%
75-79	206	6,255	165.57	124.4%	75-79	-	75	1.29	0.0%
80-84	292	4,561	222.26	131.4%	80-84	-	-	-	N/A
85-89	309	2,434	212.60	145.3%	85-89	-	-	-	N/A
90-94	263	1,637	250.26	105.1%	90-94	-	-	-	N/A
95+	-	410	92.09	0.0%	95+	-	-	-	N/A
Totals	**1,193**	**47,892**	**1,224.30**	**97.4%**	**Totals**	**15**	**2,787**	**14.63**	**102.5%**

2018-2019 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
50-54	-	1,038	3.32	0.0%	50-54	-	157	0.39	0.0%
55-59	-	6,816	29.04	0.0%	55-59	-	1,132	3.55	0.0%
60-64	-	8,785	50.71	0.0%	60-64	-	833	3.83	0.0%
65-69	77	7,220	63.41	121.4%	65-69	-	432	3.02	0.0%
70-74	211	8,250	122.37	172.4%	70-74	-	324	3.84	0.0%
75-79	189	6,905	173.74	108.8%	75-79	-	102	1.88	0.0%
80-84	70	4,806	224.69	31.2%	80-84	-	-	-	N/A
85-89	545	2,816	240.74	226.4%	85-89	-	-	-	N/A
90-94	136	1,350	207.53	65.5%	90-94	-	-	-	N/A
95+	336	672	152.01	221.0%	95+	-	-	-	N/A
Totals	**1,564**	**48,658**	**1,267.57**	**123.4%**	**Totals**	**-**	**2,980**	**16.50**	**0.0%**

Appendix – Detailed Experience Analysis
Pre-Retirement Mortality

2015-2019 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
20-24	-	11,412	3.28	0.0%	20-24	-	2,053	0.24	0.0%
25-29	329	107,298	28.83	1141.4%	25-29	-	8,869	1.23	0.0%
30-34	-	167,494	50.23	0.0%	30-34	377	12,635	2.74	13767.9%
35-39	308	217,129	77.23	398.8%	35-39	-	31,103	8.81	0.0%
40-44	1,624	332,603	153.53	1057.8%	40-44	-	38,659	15.06	0.0%
45-49	-	349,170	266.18	0.0%	45-49	-	46,459	29.51	0.0%
50-54	-	330,502	451.86	0.0%	50-54	-	34,750	37.75	0.0%
55-59	-	127,776	264.61	0.0%	55-59	-	13,915	20.92	0.0%
60-64	-	7,040	23.12	0.0%	60-64	-	-	-	N/A
Totals	**2,261**	**1,650,424**	**1,318.85**	**171.4%**	**Totals**	**377**	**188,443**	**116.26**	**324.3%**

Appendix – Detailed Experience Analysis
Pre-Retirement Mortality

2015-2016 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
20-24	-	1,816	0.55	0.0%	20-24	-	508	0.06	0.0%
25-29	-	22,992	6.47	0.0%	25-29	-	1,086	0.14	0.0%
30-34	-	34,039	10.55	0.0%	30-34	-	4,868	1.06	0.0%
35-39	-	59,164	21.64	0.0%	35-39	-	8,193	2.42	0.0%
40-44	-	86,133	40.88	0.0%	40-44	-	7,468	3.05	0.0%
45-49	-	80,031	63.01	0.0%	45-49	-	11,734	7.36	0.0%
50-54	-	84,329	118.95	0.0%	50-54	-	10,286	11.82	0.0%
55-59	-	35,309	72.25	0.0%	55-59	-	1,950	2.96	0.0%
60-64	-	932	3.17	0.0%	60-64	-	-	-	N/A
Totals	**-**	**404,745**	**337.48**	**0.0%**	**Totals**	**-**	**46,093**	**28.87**	**0.0%**

2016-2017 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
20-24	-	3,537	1.04	0.0%	20-24	-	610	0.07	0.0%
25-29	-	27,051	7.39	0.0%	25-29	-	2,006	0.28	0.0%
30-34	-	41,068	12.42	0.0%	30-34	-	3,218	0.70	0.0%
35-39	-	52,580	18.86	0.0%	35-39	-	7,671	2.15	0.0%
40-44	-	83,763	39.12	0.0%	40-44	-	8,746	3.31	0.0%
45-49	-	84,569	66.19	0.0%	45-49	-	11,483	7.15	0.0%
50-54	-	76,038	105.76	0.0%	50-54	-	9,239	10.36	0.0%
55-59	-	30,025	62.26	0.0%	55-59	-	4,066	6.14	0.0%
60-64	-	1,994	6.75	0.0%	60-64	-	-	-	N/A
Totals	**-**	**400,625**	**319.77**	**0.0%**	**Totals**	**-**	**47,039**	**30.15**	**0.0%**

Appendix – Detailed Experience Analysis
Pre-Retirement Mortality

2017-2018 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
20-24	-	2,865	0.81	0.0%	20-24	-	133	0.02	0.0%
25-29	-	29,967	7.94	0.0%	25-29	-	2,733	0.37	0.0%
30-34	-	47,787	14.22	0.0%	30-34	-	2,791	0.63	0.0%
35-39	308	54,660	19.23	1601.7%	35-39	-	7,469	2.09	0.0%
40-44	650	85,887	39.13	1661.0%	40-44	-	10,706	4.09	0.0%
45-49	-	89,951	67.14	0.0%	45-49	-	12,192	7.72	0.0%
50-54	-	86,031	115.09	0.0%	50-54	-	6,708	6.69	0.0%
55-59	-	31,996	67.39	0.0%	55-59	-	5,088	7.39	0.0%
60-64	-	1,191	3.94	0.0%	60-64	-	-	-	N/A
Totals	**958**	**430,335**	**334.90**	**286.1%**	**Totals**	**-**	**47,820**	**28.99**	**0.0%**

2018-2019 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
20-24	-	3,194	0.88	0.0%	20-24	-	802	0.09	0.0%
25-29	329	27,288	7.03	4678.0%	25-29	-	3,044	0.43	0.0%
30-34	-	44,600	13.04	0.0%	30-34	377	1,758	0.35	108209.3%
35-39	-	50,725	17.50	0.0%	35-39	-	7,770	2.15	0.0%
40-44	974	76,820	34.39	2832.4%	40-44	-	11,739	4.61	0.0%
45-49	-	94,619	69.84	0.0%	45-49	-	11,050	7.29	0.0%
50-54	-	84,104	112.05	0.0%	50-54	-	8,517	8.88	0.0%
55-59	-	30,446	62.70	0.0%	55-59	-	2,811	4.43	0.0%
60-64	-	2,923	9.26	0.0%	60-64	-	-	-	N/A
Totals	**1,303**	**414,719**	**326.70**	**398.8%**	**Totals**	**377**	**47,491**	**28.24**	**1334.9%**

Appendix – Detailed Experience Analysis
Disabled Mortality

2015-2019 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
40-44	-	386	0.53	0.0%	40-44	-	-	-	N/A
45-49	-	767	1.47	0.0%	45-49	44	217	0.36	12365.1%
50-54	58	1,846	5.60	1035.3%	50-54	-	616	1.40	0.0%
55-59	55	1,157	4.74	1160.5%	55-59	-	213	0.67	0.0%
60-64	-	1,133	6.79	0.0%	60-64	-	393	1.95	0.0%
65-69	-	1,277	11.50	0.0%	65-69	-	88	0.58	0.0%
70-74	101	1,128	16.73	603.6%	70-74	-	-	-	N/A
75-79	104	515	13.28	782.9%	75-79	-	-	-	N/A
80-84	-	213	8.94	0.0%	80-84	-	-	-	N/A
85-89	52	52	5.92	878.6%	85-89	-	-	-	N/A
90-94	-	-	-	N/A	90-94	-	-	-	N/A
95-99	-	-	-	N/A	95-99	-	-	-	N/A
Totals	**370**	**8,474**	**75.52**	**490.0%**	**Totals**	**44**	**1,527**	**4.95**	**888.4%**

Appendix – Detailed Experience Analysis
Disabled Mortality

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	-	103	0.16	0.0%	40-44	-	-	-	N/A
45-49	-	118	0.24	0.0%	45-49	44	87	0.15	30047.5%
50-54	-	478	1.46	0.0%	50-54	-	174	0.37	0.0%
55-59	-	233	0.98	0.0%	55-59	-	41	0.13	0.0%
60-64	-	326	1.94	0.0%	60-64	-	108	0.51	0.0%
65-69	-	379	3.62	0.0%	65-69	-	-	-	N/A
70-74	25	225	3.49	715.8%	70-74	-	-	-	N/A
75-79	57	171	5.04	1132.0%	75-79	-	-	-	N/A
80-84	-	-	-	N/A	80-84	-	-	-	N/A
85-89	52	52	5.92	878.6%	85-89	-	-	-	N/A
90-94	-	-	-	N/A	90-94	-	-	-	N/A
95-99	-	-	-	N/A	95-99	-	-	-	N/A
Totals	**134**	**2,085**	**22.84**	**586.6%**	**Totals**	**44**	**410**	**1.16**	**3801.9%**

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	-	81	0.10	0.0%	40-44	-	-	-	N/A
45-49	-	150	0.27	0.0%	45-49	-	43	0.07	0.0%
50-54	-	474	1.47	0.0%	50-54	-	175	0.39	0.0%
55-59	55	278	1.20	4595.9%	55-59	-	41	0.14	0.0%
60-64	-	321	2.02	0.0%	60-64	-	109	0.56	0.0%
65-69	-	250	2.34	0.0%	65-69	-	-	-	N/A
70-74	76	302	4.25	1786.2%	70-74	-	-	-	N/A
75-79	-	90	2.02	0.0%	75-79	-	-	-	N/A
80-84	-	70	2.63	0.0%	80-84	-	-	-	N/A
85-89	-	-	-	N/A	85-89	-	-	-	N/A
90-94	-	-	-	N/A	90-94	-	-	-	N/A
95-99	-	-	-	N/A	95-99	-	-	-	N/A
Totals	**131**	**2,016**	**16.31**	**803.3%**	**Totals**	**-**	**368**	**1.16**	**0.0%**

Appendix – Detailed Experience Analysis
Disabled Mortality

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	-	101	0.13	0.0%	40-44	-	-	-	N/A
45-49	-	268	0.51	0.0%	45-49	-	43	0.07	0.0%
50-54	-	364	1.08	0.0%	50-54	-	133	0.30	0.0%
55-59	-	376	1.48	0.0%	55-59	-	86	0.27	0.0%
60-64	-	224	1.30	0.0%	60-64	-	67	0.34	0.0%
65-69	-	376	3.26	0.0%	65-69	-	44	0.28	0.0%
70-74	-	276	4.28	0.0%	70-74	-	-	-	N/A
75-79	-	92	2.28	0.0%	75-79	-	-	-	N/A
80-84	-	71	2.96	0.0%	80-84	-	-	-	N/A
85-89	-	-	-	N/A	85-89	-	-	-	N/A
90-94	-	-	-	N/A	90-94	-	-	-	N/A
95-99	-	-	-	N/A	95-99	-	-	-	N/A
Totals	**-**	**2,148**	**17.28**	**0.0%**	**Totals**	**-**	**373**	**1.27**	**0.0%**

2018-2019 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
40-44	-	101	0.14	0.0%	40-44	-	-	-	N/A
45-49	-	231	0.45	0.0%	45-49	-	44	0.07	0.0%
50-54	58	530	1.59	3640.0%	50-54	-	134	0.33	0.0%
55-59	-	270	1.08	0.0%	55-59	-	45	0.13	0.0%
60-64	-	262	1.53	0.0%	60-64	-	109	0.54	0.0%
65-69	-	272	2.28	0.0%	65-69	-	44	0.30	0.0%
70-74	-	325	4.71	0.0%	70-74	-	-	-	N/A
75-79	47	162	3.96	1187.8%	75-79	-	-	-	N/A
80-84	-	72	3.35	0.0%	80-84	-	-	-	N/A
85-89	-	-	-	N/A	85-89	-	-	-	N/A
90-94	-	-	-	N/A	90-94	-	-	-	N/A
95-99	-	-	-	N/A	95-99	-	-	-	N/A
Totals	**105**	**2,225**	**19.08**	**550.2%**	**Totals**	**-**	**376**	**1.37**	**0.0%**