Minnesota State Patrol Retirement Fund

Four-Year Experience Study

July 1, 2019 through June 30, 2023

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July 16, 2024

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, 2019 to June 30, 2023***, 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 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 standards of practice promulgated by the Actuarial Standards Board.

Board of Directors
Minnesota State Retirement System
State Patrol Retirement Fund
July 16, 2024

Bonita J. Wurst and Sheryl L. Christensen 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, GRS meets the requirements of "approved actuary" under Minnesota Statutes Section 356.215, Subdivision 1, Paragraph (c).

Respectfully submitted,
Gabriel, Roeder, Smith & Company

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

Sheryl L. Christensen, FSA, EA, FCA, MAAA

BJW/SLC:sc

Actuarial Experience Study
2019-2023

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SECTION A

OVERVIEW AND SUMMARY OF RESULTS

Summary of Findings

The four-year period (July 1, 2019 to June 30, 2023) 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 the 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

- Adjust rates of merit and seniority, resulting in proposed merit and seniority increases that are approximately 28 basis points lower on average than the current rates.
- Adjust assumed retirement rates:
  - Increase 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 51, 52, and 54.
- Change the assumed rates of withdrawal (termination of membership before eligible to retire):
  - At most ages, proposed rates are greater than the present assumption.
- Change the assumed rates of disability:
  - Slightly increase rates under age 31.
  - More substantial increase to rates above age 40.
- Change the mortality table from the Pub-2010 General Mortality tables to the Pub-2010 Public Safety mortality tables. In addition, update the mortality projection scale to MP-2021.
- Minor changes to the form of payment assumptions.
- Minor changes to the assumptions made with respect to missing participant data.

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, 2023. This report concluded that the current investment return assumption of 7.0% was within a reasonable range as of the date of the report.

Introduction

Each year as of June 30, the actuarial liabilities of the System are valued. In order to perform the valuation, assumptions must be made regarding the future experience of the System with regard to the following risk areas:

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

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

- Understated costs resulting in either an inability to pay benefits when due, or gradual increases in required contributions as time progresses; 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, 2021 actuarial valuation based on the results of the most recent experience study. Economic assumptions were last revised for the June 30, 2023 actuarial valuation. All experience was compared to assumptions in effect as of the June 30, 2023 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
2019-2023

Results presented in this exhibit and in the body of the report are liability weighted for retirement, withdrawal and active mortality and benefit weighted for healthy and disabled retiree mortality.

Decrement Risk Area	Actual Number	Expected		
		Present Assumptions	Proposed Assumptions	Change
Unreduced Retirement ($000s)*	90,705	78,571	84,441	5,870
Reduced Retirement ($000s)	10,147	18,459	13,877	(4,582)
Withdrawal ($000s)	24,457	17,424	22,216	4,792
Disability	35	10	18	8
Mortality ($000s)				
Healthy Retired Lives** - Male	6,293	6,038	6,285	247
- Female	43	91	106	15
Disabled Retired Lives** - Male	217	305	140	(165)
- Female	0	36	13	(23)
Active Lives** - Male	1,053	2,196	1,876	(320)
- Female	1,057	146	165	19

* *Normal retirements less than age 60. See Section C for full detail.*

** *Adjustments to fit plan experience are limited due to a lack of credible data (deaths).*

In general, increased incidence of withdrawals and lower future salaries result in lower liability and contribution requirements while increased incidence of unreduced and disability retirements result in higher liabilities and contribution requirements. We will follow up with the impact of the proposed changes.

SECTION B

PAY INCREASES

Pay Increases Due to Merit and Seniority

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. 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 2.25% and the payroll growth assumption is currently 3.00%.

General inflation, as measured by the change in Consumer Price Index, has averaged about 4.5% over the four-year period ending June 30, 2023. During the 2020 to 2022 calendar year period, the average increase in the national average earnings has been about 5.7% (the 2023 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, 2023 has averaged approximately 7.2%.

Overall, active membership decreased 3.8%, from 943 as of July 1, 2019 to 979 as of July 1, 2023. However, active membership decreased for the first three years, from 943 as of July 1, 2019 to 937 as of July 1, 2020 and 912 as of July 1, 2021. Active membership increased to 937 as of July 1, 2022 and 979 as of July 1, 2023. We note that, although active membership decreased from 2019 to 2021, payroll increased during this period, more than the assumed annual rate of 3.00%.

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, 2023. In that report, we concluded:

> "although current inflation rates are higher than they have been in previous decades, the future outlook … suggest 2.25% continues to be reasonable."
>
> and
>
> "When combined with the 2.25% price inflation assumption, the recommended payroll growth assumption remains at 3.00% ... The recommended payroll growth assumption is appropriate for a stable population."

We recommend maintaining the price inflation assumption of 2.25% and a payroll growth assumption of 3.00% for the State Patrol Fund. These assumptions are supported by experience and are 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 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. Based on our review of salary experience for SPRF members for the period July 1, 2019 through June 30, 2023, we observed that members with longer service averaged approximately a 5.5% annual increase for this period. For our analysis of the merit and seniority portion of total salary increase, we assumed that the salary increase amount in excess of the total salary increase for the longer-service members (i.e., those with 25 or more years of service) was attributable to wage inflation only. This assumes that once members reach a certain length of service, merit and seniority increases are much less common.

Findings

The assumed wage inflation was 3.00% during the study period. During the four years of the study, we estimate the average actual wage inflation component of pay increases was around 5.5% for members of the State Patrol Retirement Fund (based on the average increase for members with 25 or more years of service). However, we note average salary for this group of members varied, from 1.8% in 2022 to 13.8% in 2023. This estimated actual wage inflation of 5.5% was subtracted from the actual pay increases to obtain the estimated merit/seniority portion of the pay increases. It should be noted that the results of the analysis are very sensitive to the estimated wage inflation component.

Gross actual salary increases were volatile over the four-year period, ranging from 1.77% in 2023 to 15.11% in 2022. After adjusting for the 5.50% average wage inflation for this period, the average net salary increases (i.e., merit and seniority) averaged 1.09%, ranging from -3.73% to 9.61%. Note, this does not mean that members on average received negative merit and seniority increases in 2023.

Fiscal Year Ending	Exposures	Gross		Net*	
		Actual	Expected	Actual	Expected
2020	810	3.99%	5.27%	-1.51%	2.27%
2021	825	7.16%	5.46%	1.66%	2.46%
2022	699	15.11%	5.24%	9.61%	2.24%
2023	810	1.77%	5.19%	-3.73%	2.19%
Total	**3,144**	**6.59%**	**5.28%**	**1.09%**	**2.28%**

* *Net Expected increases are equal to Gross Expected increases minus the current assumed wage inflation assumption of 3.00%. Net Actual increases are equal to Gross Actual increases minus the estimated actual wage inflation for the period of 5.50%.*

Pay Increases Due to Merit and Seniority

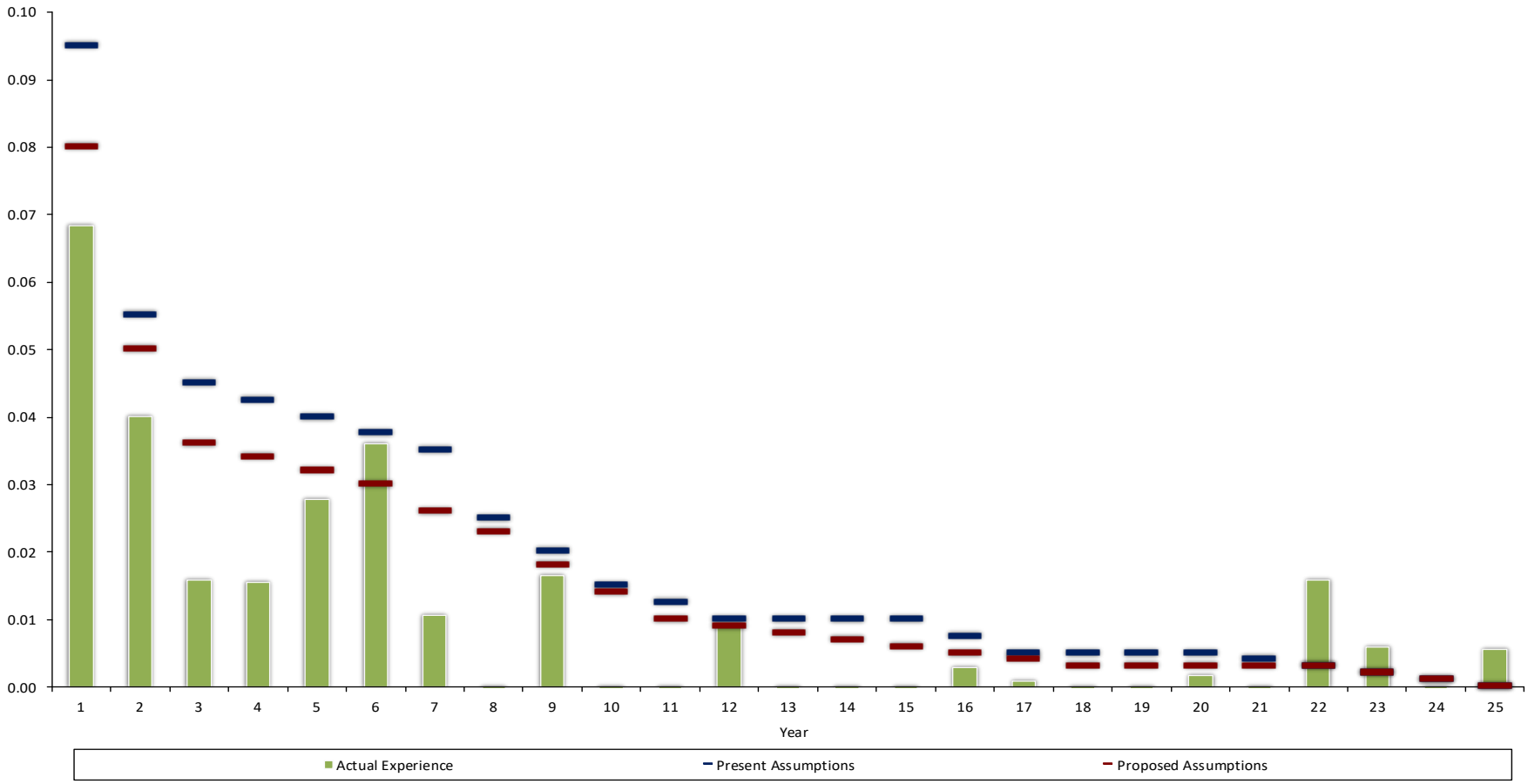
The results of our analysis are shown below. Using the techniques described above, observed merit and seniority pay increases on average were lower than the presently assumed increase. However, we note the experience was volatile, especially in the last two years, and did not follow an expected pattern. The four-year period was very unique, with a pandemic and civil unrest. We also note there were more terminations than expected during this period. For these reasons, we partially recognized the actual experience and made minor changes.

Recommendation

We recommend adjustments to the current merit/seniority pay increase assumption as shown on the following page. Overall, the proposed merit/seniority rates are 28 basis points lower than the current assumption.

Service Index	Number	Total % Increase			Merit/Seniority % Increase		
		Actual	Current	Proposed	Actual	Current	Proposed
1	183	12.34 %	12.50 %	11.00 %	6.84 %	9.50 %	8.00 %
2	187	9.51 %	8.50 %	8.00 %	4.01 %	5.50 %	5.00 %
3	192	7.09 %	7.50 %	6.60 %	1.59 %	4.50 %	3.60 %
4	204	7.06 %	7.25 %	6.40 %	1.56 %	4.25 %	3.40 %
5	184	8.28 %	7.00 %	6.20 %	2.78 %	4.00 %	3.20 %
6	193	9.10 %	6.75 %	6.00 %	3.60 %	3.75 %	3.00 %
7	162	6.56 %	6.50 %	5.60 %	1.06 %	3.50 %	2.60 %
8	125	5.45 %	5.50 %	5.30 %	(0.05)%	2.50 %	2.30 %
9	79	7.16 %	5.00 %	4.80 %	1.66 %	2.00 %	1.80 %
10	86	4.87 %	4.50 %	4.40 %	(0.63)%	1.50 %	1.40 %
11	90	4.84 %	4.25 %	4.00 %	(0.66)%	1.25 %	1.00 %
12	90	6.40 %	4.00 %	3.90 %	0.90 %	1.00 %	0.90 %
13	108	3.96 %	4.00 %	3.80 %	(1.54)%	1.00 %	0.80 %
14	110	4.50 %	4.00 %	3.70 %	(1.00)%	1.00 %	0.70 %
15	109	5.02 %	4.00 %	3.60 %	(0.48)%	1.00 %	0.60 %
16	118	5.79 %	3.75 %	3.50 %	0.29 %	0.75 %	0.50 %
17	102	5.59 %	3.50 %	3.40 %	0.09 %	0.50 %	0.40 %
18	89	5.46 %	3.50 %	3.30 %	(0.04)%	0.50 %	0.30 %
19	81	4.25 %	3.50 %	3.30 %	(1.25)%	0.50 %	0.30 %
20	105	5.68 %	3.50 %	3.30 %	0.18 %	0.50 %	0.30 %
21	120	5.34 %	3.40 %	3.30 %	(0.16)%	0.40 %	0.30 %
22	119	7.09 %	3.30 %	3.30 %	1.59 %	0.30 %	0.30 %
23	106	6.10 %	3.20 %	3.20 %	0.60 %	0.20 %	0.20 %
24	63	5.26 %	3.10 %	3.10 %	(0.24)%	0.10 %	0.10 %
25+	139	6.05 %	3.00 %	3.00 %	0.55 %	0.00 %	0.00 %
Total	**3,144**	**6.59 %**	**5.28 %**	**5.00 %**	**1.09 %**	**2.28 %**	**2.00 %**

Pay Increases Due to Merit and Seniority



SECTION C

RETIREMENT EXPERIENCE

Liability-Weighted Analysis

In most recent experience studies, we have noticed that in order to develop assumptions that reduce the size of the gain or loss in a particular decrement it is necessary to consider the relative magnitude of the liability of the members that decrement, rather than number counts alone. For example, consider a plan with only two members who are both the same age and assume member one has a liability of $10,000 and member two has a liability of $90,000. If one of the members leaves and forfeits all of his or her liability, the net rate of decrement is one out of two for a rate of 50%. However, the net gain or loss to the System will be 10% if member one leaves versus 90% if member two leaves.

As a result, some of our tables include a column entitled 'liability weighted rate' or 'benefit weighted'. This represents the crude rate of decrement on a liability or benefit weighted basis as opposed to strictly a number count basis. The liability weighted rates were found to be most highly correlated with withdrawal and retirement decrements. This makes some intuitive sense, since retirement and termination decisions are often made based on how much the members have to gain or lose if they retire or change jobs, whereas death and disability is typically not a decision at all, rather an event that happens to someone. 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 in the mortality section of this report.

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 14 actual retirements at ages 60 and older (10 at age 60 and 4 at age 61).

Overall, the plan experienced more unreduced retirements than projected by the present assumptions.

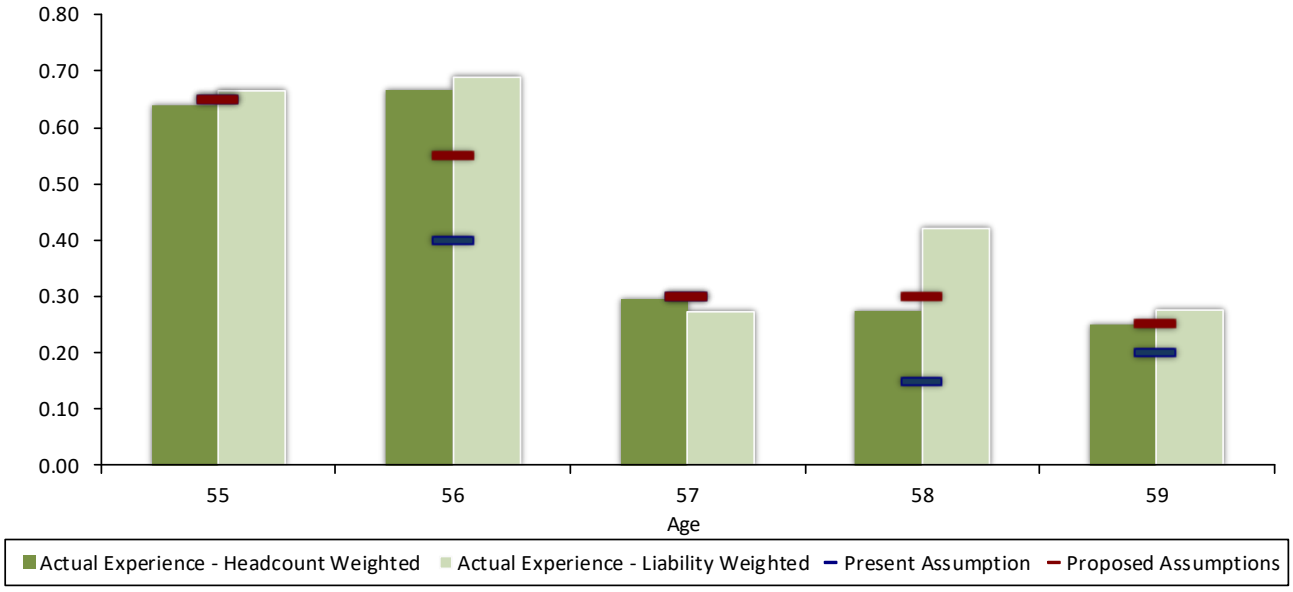
Recommendations

We recommend adjusting the assumed unreduced retirement rates to reflect observed liability weighted 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	Actual Retirements ($000s)	Exposure ($000s)	Crude Rates		Rates		Expected Retirements ($000s)		Actuals/Expecteds	
			Population	Liability	Present	Proposed	Present	Proposed	Present	Proposed
55	61,749	92,741	63.83%	66.58%	65.00%	65.00%	60,282	60,282	102.4%	102.4%
56	19,700	28,579	66.67%	68.93%	40.00%	55.00%	11,432	15,719	172.3%	125.3%
57	3,746	13,688	29.41%	27.37%	30.00%	30.00%	4,106	4,106	91.2%	91.2%
58	3,353	7,954	27.27%	42.16%	15.00%	30.00%	1,193	2,386	281.1%	140.5%
59	2,157	7,792	25.00%	27.68%	20.00%	25.00%	1,558	1,948	138.4%	110.7%
60	*	*	N/A	N/A	*	*	N/A	N/A	N/A	N/A
Totals	90,705	150,754	14.47%	60.17%	52.12%	56.01%	78,571	84,441	115.4%	107.4%

* *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 60 or older, these members are not included in the Exposures since retirement is assumed to be delayed one year. There were 10 actual retirements at age 60 and 4 at age 61.*



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 reduced by 0.34% per month for each month that the member is under age 55.

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

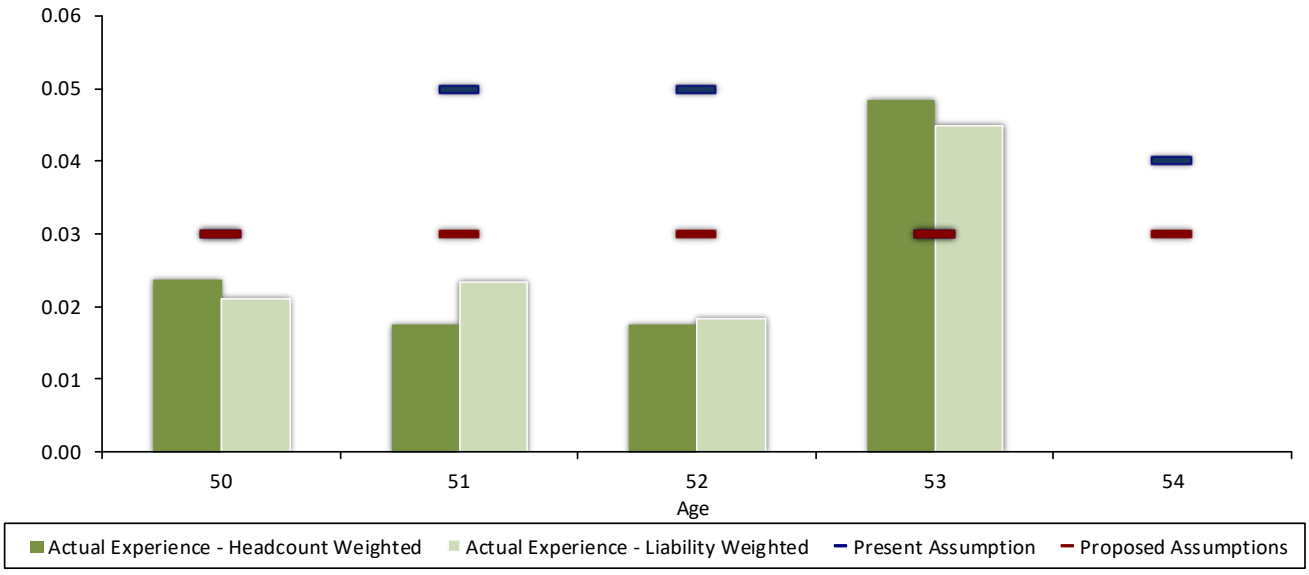
On both a population and liability weighted basis, retirement rates were lower than expected prior to age 53 and higher than expected at age 53.

Recommendation

We recommend slight adjustments to early retirement rates as shown on the next page.

Reduced Early Retirement

Age	Actual Retirements ($000s)	Exposure ($000s)	Crude Rates		Rates		Expected Retirements ($000s)		Actuals/Expecteds	
			Population	Liability	Present	Proposed	Present	Proposed	Present	Proposed
50	2,084	99,226	2.38%	2.10%	3.00%	3.00%	2,977	2,977	70.0%	70.0%
51	2,155	92,301	1.75%	2.34%	5.00%	3.00%	4,615	2,769	46.7%	77.8%
52	1,752	95,289	1.75%	1.84%	5.00%	3.00%	4,764	2,859	36.8%	61.3%
53	4,155	92,725	4.85%	4.48%	3.00%	3.00%	2,782	2,782	149.4%	149.4%
54	-	83,037	0.00%	0.00%	4.00%	3.00%	3,321	2,491	0.0%	0.0%
Totals	10,147	462,577	2.19%	2.19%	3.99%	3.00%	18,459	13,877	55.0%	73.1%



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 service-based, with higher terminations assumed earlier in the member's career. The withdrawal assumption review was done on a liability-weighted basis, as described earlier in the report.

Note that if a member who terminated during the experience period was later reclassified as a disability, they were not included as a termination for this study.

Findings

We observed that the plan experienced more liability decrementing from the plan due to terminations than expected during the four-year period. We also note that terminations for members during the 2022-2023 fiscal year were lower than the other years in this study. Due to this volatility, we did not adjust the withdrawal rates as much as we would have otherwise.

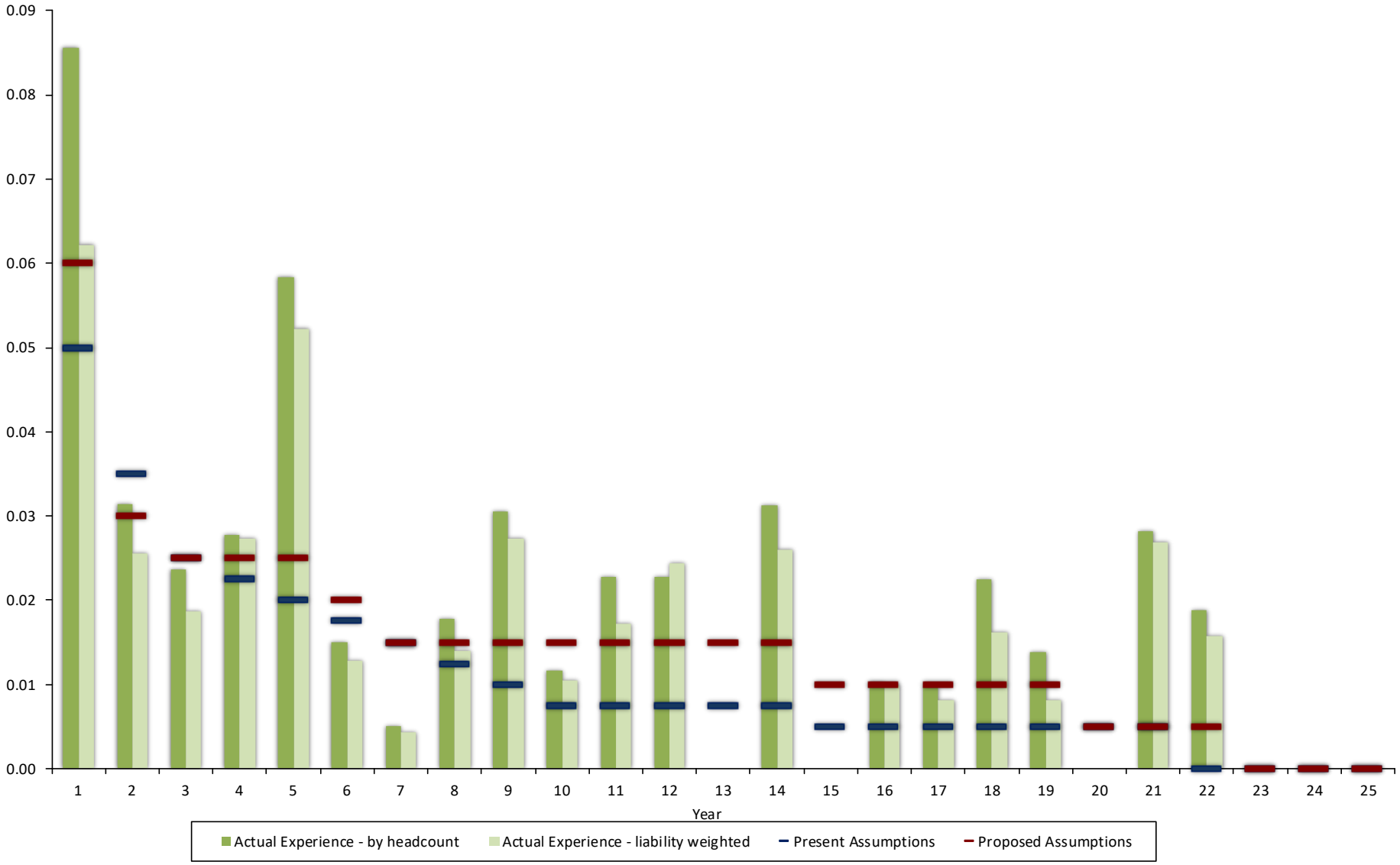
Recommendation

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

Withdrawal Experience – Males and Females

Year	Liability Weighted ($000s)		Crude Rates		Sample Rates		Liability Weighted ($000s)			
							Expected Withdrawals		Ratio of Actuals/Expecteds	
	Withdrawal	Exposure	Population Weighted	Liability Weighted	Present	Proposed	Present	Proposed	Present	Proposed
1	1,655	26,645	8.55%	6.21%	5.00%	6.00%	1,332	1,599	124.3%	103.5%
2	1,804	70,544	3.14%	2.56%	3.50%	3.00%	2,469	2,116	73.1%	85.3%
3	1,384	74,325	2.37%	1.86%	2.50%	2.50%	1,858	1,858	74.5%	74.5%
4	2,224	81,262	2.78%	2.74%	2.25%	2.50%	1,828	2,032	121.6%	109.5%
5	4,601	88,208	5.83%	5.22%	2.00%	2.50%	1,764	2,205	260.8%	208.7%
6	1,055	82,195	1.50%	1.28%	1.75%	2.00%	1,439	1,644	73.3%	64.2%
7	370	86,345	0.51%	0.43%	1.50%	1.50%	1,295	1,295	28.6%	28.6%
8	1,098	78,902	1.79%	1.39%	1.25%	1.50%	986	1,184	111.4%	92.8%
9	1,732	63,494	3.05%	2.73%	1.00%	1.50%	635	952	272.8%	181.9%
10	451	43,389	1.16%	1.04%	0.75%	1.50%	325	651	138.9%	69.4%
11	773	44,890	2.27%	1.72%	0.75%	1.50%	336	673	230.0%	114.8%
12	1,136	46,616	2.27%	2.44%	0.75%	1.50%	349	699	325.4%	162.4%
13	-	46,377	0.00%	0.00%	0.75%	1.50%	348	696	0.0%	0.0%
14	1,438	55,363	3.13%	2.60%	0.75%	1.50%	415	830	346.6%	173.2%
15	-	56,974	0.00%	0.00%	0.50%	1.00%	285	570	0.0%	0.0%
16	613	61,924	1.01%	0.99%	0.50%	1.00%	310	619	197.6%	98.9%
17	549	68,107	0.97%	0.81%	0.50%	1.00%	340	681	161.6%	80.7%
18	1,056	65,197	2.25%	1.62%	0.50%	1.00%	326	652	323.9%	161.9%
19	442	54,499	1.39%	0.81%	0.50%	1.00%	273	545	161.9%	81.1%
20	-	48,632	0.00%	0.00%	0.50%	0.50%	243	243	0.0%	0.0%
21	1,437	53,557	2.82%	2.68%	0.50%	0.50%	268	268	536.2%	536.6%
22	639	40,668	1.89%	1.57%	0.00%	0.50%	-	203	N/A	314.0%
23	-	20,403	0.00%	0.00%	0.00%	0.00%	-	-	N/A	N/A
24	-	11,668	0.00%	0.00%	0.00%	0.00%	-	-	N/A	N/A
25+	-	11,060	0.00%	0.00%	0.00%	0.00%	-	-	N/A	N/A
Totals	**24,457**	**1,381,244**	**2.48%**	**1.77%**	**1.26%**	**1.61%**	**17,424**	**22,216**	**140.4%**	**110.1%**

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 duty-related. Effective July 1, 2023, psychological treatment is required prior to approval of a duty disability benefit related to a psychological condition relating to the member's occupation.

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 duty-related).

Effective July 1, 2023, SPRF members who are not able to perform any substantial gainful activity as a direct result of a disability (physical or psychological) relating to an act of duty, which is expected to persist for a period of 12 months or more, qualify for a Total and Permanent Duty Disability Benefit equal to 99% of average monthly salary.

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. At that time, the member may elect an actuarially equivalent option (unless an optional form of payment was elected at the time of disability).

All disabilities are assumed to be duty-related since actual disability status (duty or non-duty related) is not reported in the valuation data. There is no assumed incidence of the total and permanent duty disability benefit since this benefit change is newly effective July 1, 2023 and MSRS' expectation is that an extremely low number of members will qualify for this benefit. If actual experience differs, we will consider revising this assumption in the future.

In the past, the assumed rates of disability (leaving active service due to injury or illness while not entitled to age and service retirement benefits) were considered a minor ingredient in cost calculations, since the incidence of disability has historically been low. However, in recent years, the duty disability incidence has gradually increased. Higher rates of disability generally result in somewhat higher computed contributions, and vice-versa.

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. In fact, over the course of the four-year period, there were four members who were reclassified as a disability retirement after first being reported as a termination. In recognition of this process, we included these members in our analysis and recommend rates including these incidences.

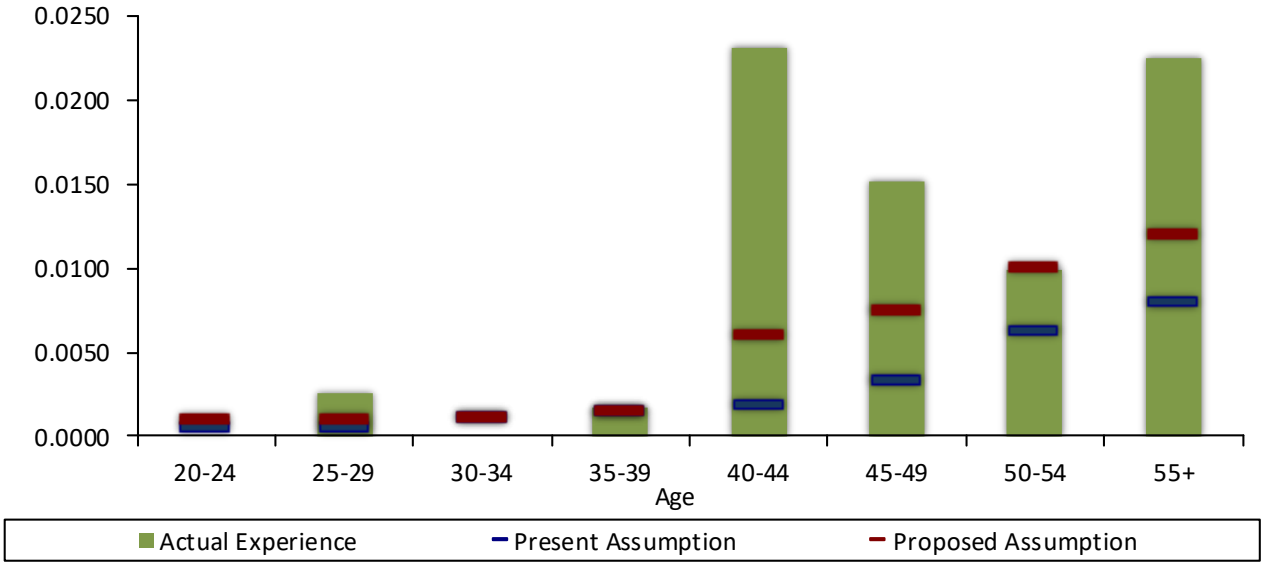
The results of our analysis are shown on the next page. Overall, the actual number of disability retirements (35) was significantly higher than the number projected by the present assumption (9.8). The number of disabilities increased dramatically in the second and third year of the study period (after the civil unrest that began in May of 2020). The number of disability retirements decreased in the fourth year and MSRS indicated this trend is continuing after July 1, 2023. In addition, effective July 1, 2023, members seeking a duty disability benefit due to a psychological condition must first undergo treatment. Due to this volatility and the new treatment requirement, we did not adjust rates as much as the experience indicates.

Disability Experience

Recommendation

We recommend adopting higher rates of disability for members age 40 and older and a minor increase for ages under age 30. We also recommend reviewing disability experience in each future valuation, and potentially changing disability assumptions prior to the next regularly scheduled experience study, if needed, to recognize emerging trends.

Age	Actual	Exposure	Crude Rates	Sample Rates		Expected Disabilities		Ratio of Actuals/Expecteds	
				Present	Proposed	Present	Proposed	Present	Proposed
Under 20	-	-	N/A	0.0568%	0.1000%	-	-	N/A	N/A
20-24	-	54	0.0000%	0.0568%	0.1000%	0.0	0.1	0.0%	0.0%
25-29	1	387	0.2584%	0.0568%	0.1000%	0.2	0.4	455.0%	258.4%
30-34	-	552	0.0000%	0.1116%	0.1136%	0.6	0.6	0.0%	0.0%
35-39	1	597	0.1675%	0.1470%	0.1470%	0.9	0.9	113.9%	113.9%
40-44	14	605	2.3140%	0.1857%	0.6000%	1.1	3.6	1246.3%	385.7%
45-49	11	726	1.5152%	0.3361%	0.7512%	2.4	5.5	450.9%	201.7%
50-54	6	603	0.9950%	0.6341%	1.0130%	3.8	6.1	156.9%	98.2%
55+	2	89	2.2472%	0.8000%	1.2000%	0.7	1.1	280.9%	187.3%
Totals	**35**	**3,613**	**0.9687%**	**0.2723%**	**0.5039%**	**9.8**	**18.2**	**355.8%**	**192.2%**



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.

Mortality Tables and Projection Scales

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

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

Fully generational tables, which are utilized for the MSRS valuations, help take into account future improvements in mortality that are expected to occur. Typically, the Society of Actuaries updates the projection scale annually; however, no Scale MP-2022 was issued due to skewed mortality experience during the COVID-19 pandemic. The latest published table is called the MP-2021 Projection Scale.

Credibility

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 89 male retiree deaths and 2 female retiree deaths. The healthy retiree mortality experience is not considered to be credible since there are so few deaths. Pre-retirement mortality and disabled retiree mortality experience is also not considered to be credible.

Mortality Experience

Findings

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

Healthy Retirees

Due to potential anti-selection bias as well as data needs which are outside the scope of the annual valuation process, we did not include beneficiary and survivor mortality experience in our study.

In total, on a benefit weighted basis, the plan experienced slightly more male deaths than expected ($6,293,000 actual versus $6,039,000 expected). The actual number of deaths on a benefit weighted basis among retired females ($43,000) was lower than the number projected by the present assumptions ($90,000).

Disabled Retirees

On a benefit weighted basis, the plan experienced fewer deaths among disabled males ($217,000) than projected by the present assumptions ($305,000). The actual number of deaths on a benefit weighted basis among disabled females ($0) was less than the number projected by the present assumptions ($36,000).

Active Members

On a liability weighted basis, the actual amount of liabilities removed due to deaths among active male members ($1,053,000) was lower than the number projected by the present assumption ($2,196,000). The plan also experienced more deaths on a liability weighted basis among females ($1,057,000) than projected by the present assumptions ($146,000).

Mortality Experience

Recommendations

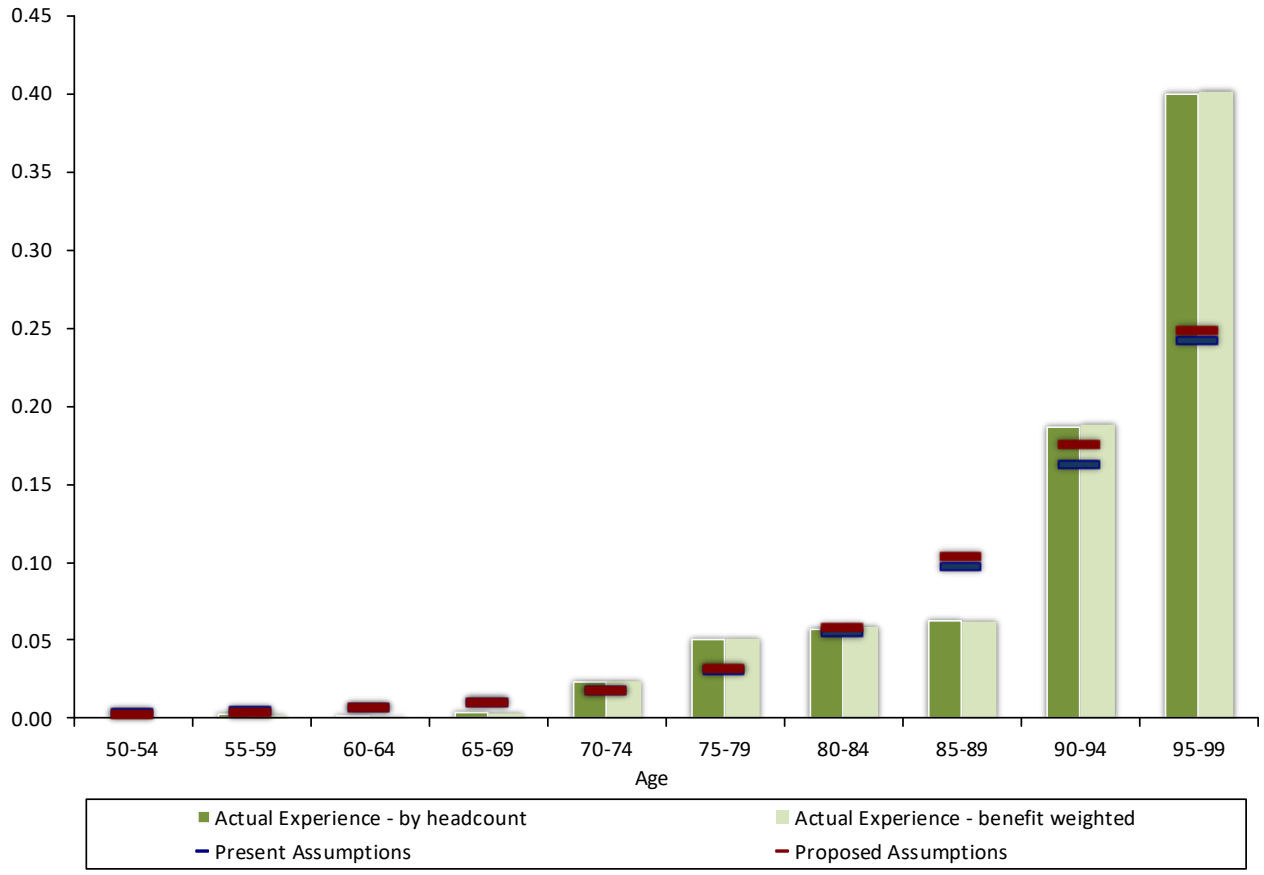
Due to the size of this plan, the experience is not considered credible. We recommend adoption of the following mortality tables (all recommended tables are Benefit Weighted):

Healthy Male Retirees:	Pub-2010 Male Healthy Retired Public Safety Mortality Table, adjusted for mortality improvements using projection scale MP-2021.
Healthy Female Retirees:	Pub-2010 Female Healthy Retired Public Safety Mortality Table, adjusted for mortality improvements using projection scale MP-2021.
Disabled Male Retirees:	Pub-2010 Male Public Safety Disabled Retiree Mortality Table, adjusted for mortality improvements using projection scale MP-2021.
Disabled Female Retirees:	Pub-2010 Female Public Safety Disabled Retiree Mortality Table, adjusted for mortality improvements using projection scale MP-2021.
Male Active Members:	Pub-2010 Male Public Safety Employee Mortality Table adjusted for mortality improvements using projection scale MP-2021.
Female Active Members:	Pub-2010 Female Public Safety Employee Mortality Table adjusted for mortality improvements using projection scale MP-2021.

We reviewed both the public safety and general plan Pub-2010 mortality tables and found the safety plan mortality rates to be a better fit in most cases. Although the recommended pre-retirement and disability 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 active member and disabled retiree deaths during the four-year period was very low (2 male deaths and 2 female deaths among active members; 5 male deaths and no female deaths among disabled retirees).

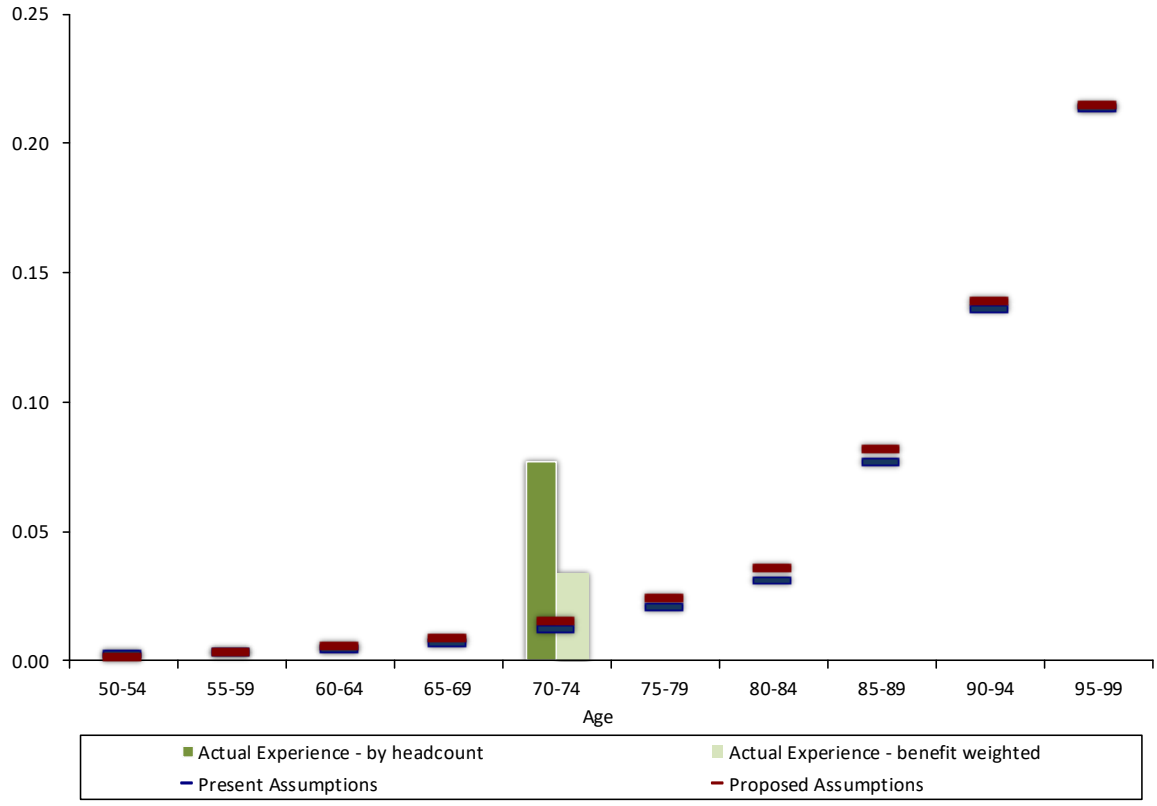
Post-Retirement Mortality Experience
Healthy Males

	Benefit Weighted ($000s)		Crude Rates				Benefit Weighted ($000s)		Ratio of	
			Benefit	Headcount	Sample Rates		Expected Deaths		Actuals/Expecteds	
Age	Deaths	Exposure	Weighted	Weighted	Present	Proposed	Present	Proposed	Present	Proposed
50-54	-	1,365	0.00%	0.00%	0.36%	0.25%	4.9	3.3	0.0%	0.0%
55-59	54	26,291	0.21%	0.23%	0.51%	0.39%	134.9	102.1	40.0%	52.9%
60-64	29	38,099	0.08%	0.16%	0.74%	0.66%	283.5	252.1	10.2%	11.5%
65-69	109	32,051	0.34%	0.36%	1.08%	1.08%	346.1	344.9	31.5%	31.6%
70-74	719	30,529	2.36%	2.29%	1.78%	1.84%	542.5	561.7	132.5%	128.0%
75-79	1,520	29,888	5.09%	5.04%	3.05%	3.22%	913.0	962.7	166.5%	157.9%
80-84	1,161	19,948	5.82%	5.73%	5.50%	5.84%	1,098.1	1,165.9	105.7%	99.6%
85-89	781	12,694	6.15%	6.21%	9.73%	10.40%	1,235.4	1,319.6	63.2%	59.2%
90-94	1,071	5,682	18.85%	18.67%	16.23%	17.57%	922.2	998.6	116.1%	107.3%
95-99	849	2,116	40.12%	40.00%	24.15%	24.90%	511.0	526.8	166.1%	161.2%
100+	-	147	0.00%	0.00%	31.79%	31.98%	46.7	47.0	0.0%	0.0%
Totals	**6,293**	**198,810**	**3.17%**	**2.79%**	**3.04%**	**3.16%**	**6,038.5**	**6,284.7**	**104.2%**	**100.1%**



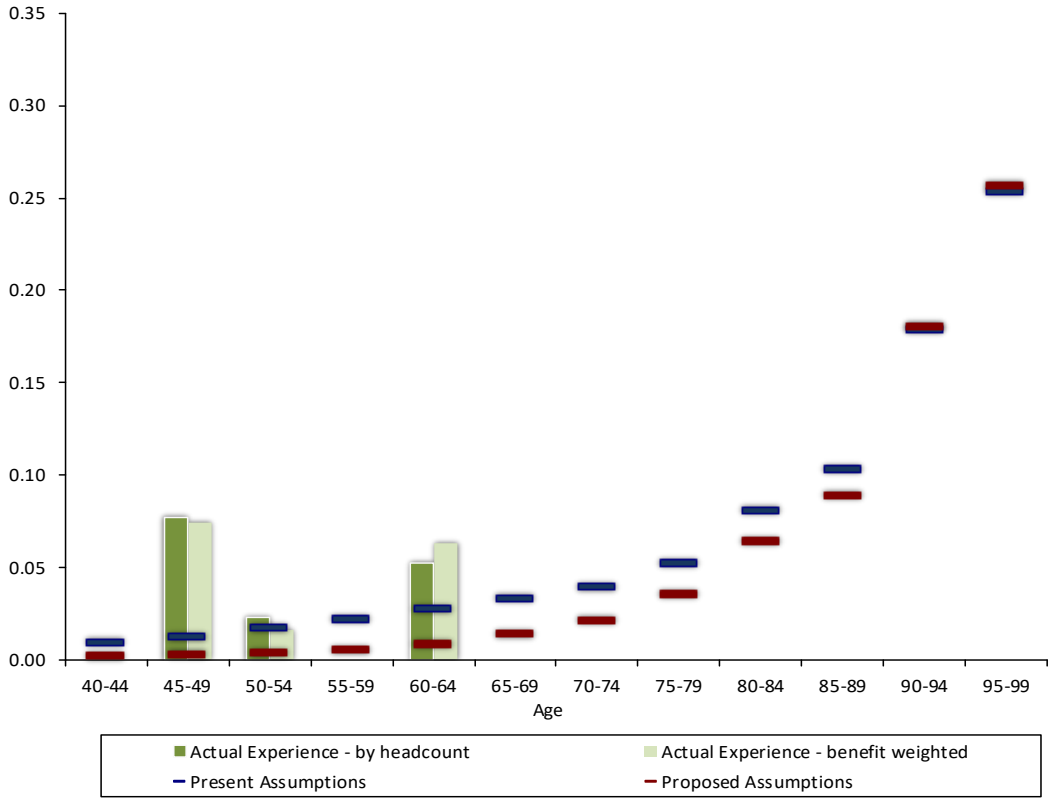
Post-Retirement Mortality Experience
Healthy Females

	Benefit Weighted ($000s)		Crude Rates				Benefit Weighted ($000s)		Ratio of	
			Benefit	Headcount	Sample Rates		Expected Deaths		Actuals/Expecteds	
Age	Deaths	Exposure	Weighted	Weighted	Present	Proposed*	Present	Proposed*	Present	Proposed*
50-54	-	382	0.00%	0.00%	0.24%	0.18%	0.9	0.7	0.0%	0.0%
55-59	-	4,369	0.00%	0.00%	0.35%	0.36%	15.3	15.5	0.0%	0.0%
60-64	-	4,742	0.00%	0.00%	0.47%	0.56%	22.1	26.4	0.0%	0.0%
65-69	-	2,709	0.00%	0.00%	0.70%	0.87%	19.0	23.5	0.0%	0.0%
70-74	43	1,269	3.39%	7.69%	1.24%	1.51%	15.8	19.2	272.2%	224.5%
75-79	-	784	0.00%	0.00%	2.05%	2.44%	16.1	19.1	0.0%	0.0%
80-84	-	42	0.00%	0.00%	3.09%	3.60%	1.3	1.5	0.0%	0.0%
85-89	-	-	N/A	N/A	7.71%	8.20%	-	-	N/A	N/A
90-94	-	-	N/A	N/A	13.61%	13.93%	-	-	N/A	N/A
95-99	-	-	N/A	N/A	21.37%	21.47%	-	-	N/A	N/A
100+	-	-	N/A	N/A	32.98%	32.97%	-	-	N/A	N/A
Totals	**43**	**14,297**	**0.30%**	**0.57%**	**0.63%**	**0.74%**	**90.6**	**105.9**	**47.5%**	**40.6%**



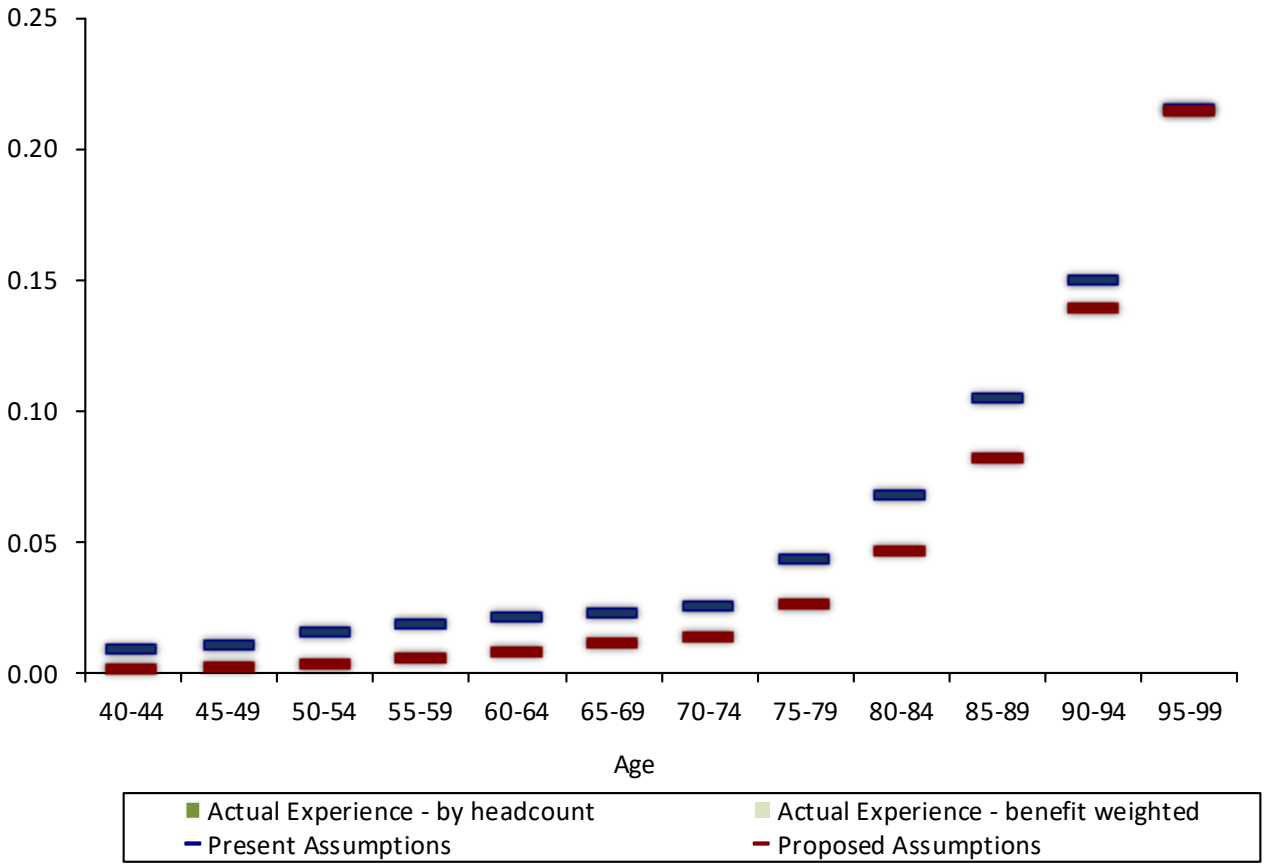
Post-Retirement Mortality Experience
Disabled Males

	Benefit Weighted ($000s)		Crude Rates				Benefit Weighted ($000s)		Ratio of	
			Benefit	Headcount	Sample Rates		Expected Deaths		Actuals/Expecteds	
Age	Deaths	Exposure	Weighted	Weighted	Present	Proposed	Present	Proposed	Present	Proposed
<40	40	178	22.47%	25.00%	0.73%	0.21%	1.3	0.4	3086.3%	10522.7%
40-44	-	555	0.00%	0.00%	0.94%	0.25%	5.2	1.4	0.0%	0.0%
45-49	88	1,179	7.46%	7.69%	1.25%	0.29%	14.8	3.4	595.2%	2574.1%
50-54	33	2,042	1.62%	2.33%	1.71%	0.37%	35.0	7.7	94.3%	431.3%
55-59	-	2,285	0.00%	0.00%	2.24%	0.55%	51.2	12.5	0.0%	0.0%
60-64	56	887	6.31%	5.26%	2.75%	0.90%	24.4	8.0	230.0%	703.4%
65-69	-	1,213	0.00%	0.00%	3.30%	1.43%	40.0	17.3	0.0%	0.0%
70-74	-	1,204	0.00%	0.00%	3.99%	2.14%	48.1	25.8	0.0%	0.0%
75-79	-	895	0.00%	0.00%	5.27%	3.55%	47.1	31.8	0.0%	0.0%
80-84	-	284	0.00%	0.00%	8.09%	6.46%	23.0	18.4	0.0%	0.0%
85-89	-	149	0.00%	0.00%	10.33%	8.93%	15.4	13.3	0.0%	0.0%
90-94	-	-	N/A	N/A	17.90%	18.01%	-	-	N/A	N/A
95-99	-	-	N/A	N/A	25.35%	25.67%	-	-	N/A	N/A
100+	-	-	N/A	0.00%	42.94%	43.03%	-	-	N/A	N/A
Totals	**217**	**10,871**	**2.00%**	**2.17%**	**2.81%**	**1.29%**	**305.4**	**139.9**	**71.0%**	**155.1%**



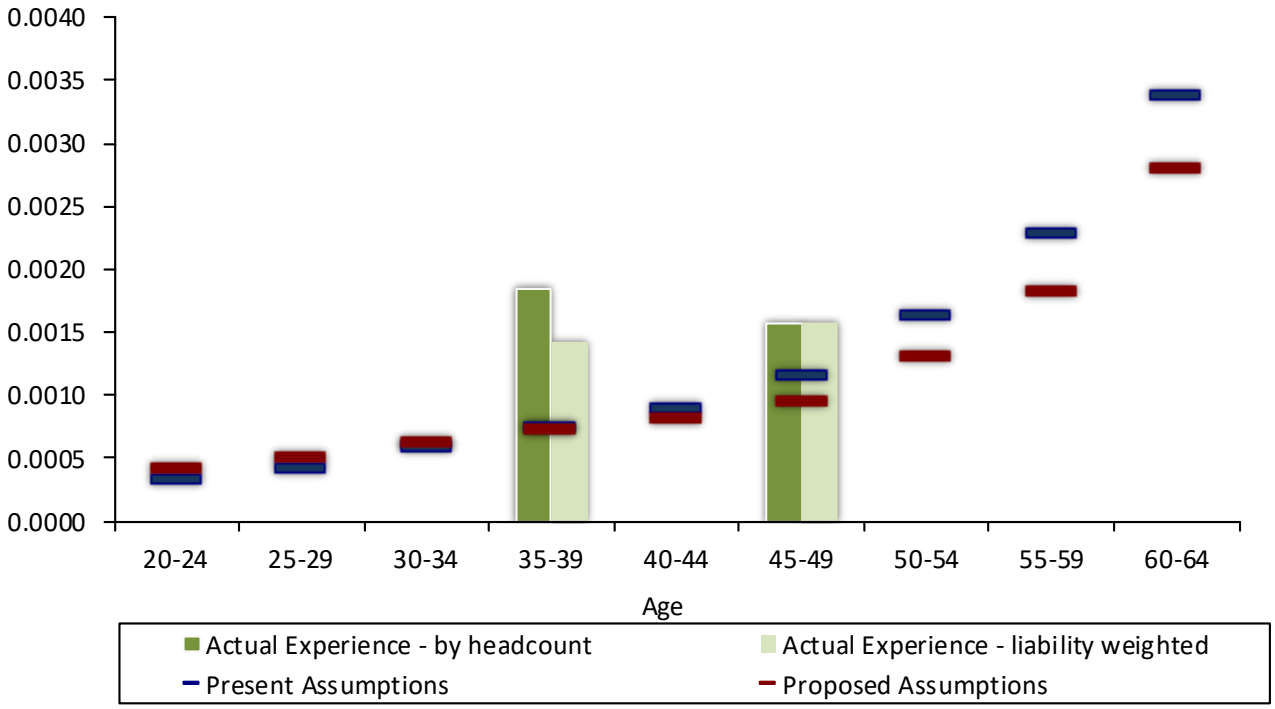
Post-Retirement Mortality Experience
Disabled Females

	Benefit Weighted ($000s)		Crude Rates				Benefit Weighted ($000s)		Ratio of Actuals/Expecteds	
			Benefit	Headcount	Sample Rates		Expected Deaths			
Age	Deaths	Exposure	Weighted	Weighted	Present	Proposed	Present	Proposed	Present	Proposed
<40	-	54	0.00%	0.00%	0.68%	0.18%	0.4	0.1	0.0%	0.0%
40-44	-	306	0.00%	0.00%	0.89%	0.21%	2.7	0.6	0.0%	0.0%
45-49	-	145	0.00%	0.00%	1.08%	0.23%	1.6	0.3	0.0%	0.0%
50-54	-	195	0.00%	0.00%	1.56%	0.34%	3.0	0.7	0.0%	0.0%
55-59	-	662	0.00%	0.00%	1.93%	0.55%	12.8	3.6	0.0%	0.0%
60-64	-	242	0.00%	0.00%	2.12%	0.85%	5.1	2.1	0.0%	0.0%
65-69	-	387	0.00%	0.00%	2.29%	1.15%	8.9	4.4	0.0%	0.0%
70-74	-	46	0.00%	0.00%	2.56%	1.40%	1.2	0.6	0.0%	0.0%
75-79	-	-	N/A	N/A	4.31%	2.66%	-	-	N/A	N/A
80-84	-	-	N/A	N/A	6.78%	4.66%	-	-	N/A	N/A
85-89	-	-	N/A	N/A	10.49%	8.20%	-	-	N/A	N/A
90-94	-	-	N/A	N/A	14.97%	13.93%	-	-	N/A	N/A
95-99	-	-	N/A	N/A	21.57%	21.47%	-	-	N/A	N/A
100+	-	-	N/A	N/A	40.64%	40.63%	-	-	N/A	N/A
Totals	**-**	**2,037**	**0.00%**	**0.00%**	**1.75%**	**0.61%**	**35.6**	**12.5**	**0.0%**	**0.0%**



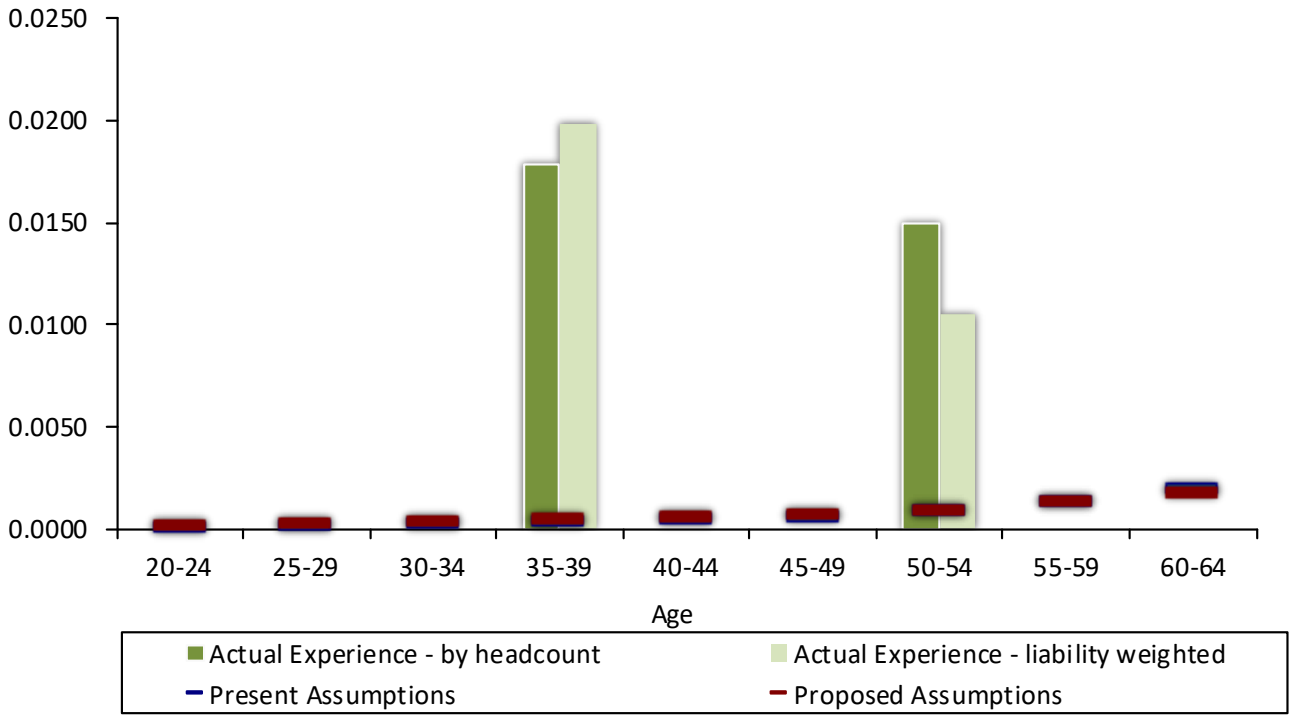
Pre-Retirement Mortality Experience
Healthy Males

Age	Liability Weighted ($000s)		Crude Rates		Sample Rates		Liability Weighted ($000s) Expected Deaths		Ratio of Actuals/Expecteds	
	Deaths	Exposure	Liability Weighted	Population Weighted	Present	Proposed	Present	Proposed	Present	Proposed
Under 20	-	-	N/A	N/A	0.03%	0.03%	-	-	0.0%	0.0%
20-24	-	9,733	0.00%	0.00%	0.03%	0.04%	3.3	4.2	0.0%	0.0%
25-29	-	104,065	0.00%	0.00%	0.04%	0.05%	43.6	52.4	0.0%	0.0%
30-34	-	198,781	0.00%	0.00%	0.06%	0.06%	116.9	123.7	0.0%	0.0%
35-39	362	255,244	0.14%	0.18%	0.08%	0.07%	192.7	186.1	187.8%	194.5%
40-44	-	303,741	0.00%	0.00%	0.09%	0.08%	276.4	245.6	0.0%	0.0%
45-49	691	435,500	0.16%	0.16%	0.12%	0.10%	501.3	416.8	137.8%	165.8%
50-54	-	427,501	0.00%	0.00%	0.16%	0.13%	701.8	559.9	0.0%	0.0%
55-59	-	142,910	0.00%	0.00%	0.23%	0.18%	327.5	261.1	0.0%	0.0%
60-64	-	9,491	0.00%	0.00%	0.34%	0.28%	32.1	26.6	0.0%	0.0%
Totals	**1,053**	**1,886,966**	**0.06%**	**0.06%**	**0.12%**	**0.10%**	**2,195.7**	**1,876.3**	**48.0%**	**56.1%**



Pre-Retirement Mortality Experience
Healthy Females

Age	Liability Weighted ($000s)		Crude Rates		Sample Rates		Liability Weighted ($000s) Expected Deaths		Ratio of Actuals/Expecteds	
	Deaths	Exposure	Liability Weighted	Population Weighted	Present	Proposed	Present	Proposed	Present	Proposed
Under 20	-	-	N/A	N/A	0.01%	0.01%	-	-	0.0%	0.0%
20-24	-	2,602	0.00%	0.00%	0.01%	0.02%	0.3	0.6	0.0%	0.0%
25-29	-	21,806	0.00%	0.00%	0.01%	0.03%	3.1	6.3	0.0%	0.0%
30-34	-	20,866	0.00%	0.00%	0.02%	0.04%	5.1	8.6	0.0%	0.0%
35-39	489	24,602	1.99%	1.79%	0.04%	0.05%	9.3	13.3	5276.0%	3687.8%
40-44	-	40,179	0.00%	0.00%	0.05%	0.06%	19.2	24.2	0.0%	0.0%
45-49	-	52,542	0.00%	0.00%	0.06%	0.07%	33.4	37.1	0.0%	0.0%
50-54	568	54,184	1.05%	1.49%	0.10%	0.10%	51.9	52.6	1095.0%	1079.6%
55-59	-	15,107	0.00%	0.00%	0.14%	0.13%	20.9	19.8	0.0%	0.0%
60-64	-	1,220	0.00%	0.00%	0.20%	0.17%	2.4	2.1	0.0%	0.0%
Totals	**1,057**	**233,108**	**0.45%**	**0.45%**	**0.06%**	**0.07%**	**145.5**	**164.6**	**726.2%**	**642.2%**



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 Actual/Expected	
				Present	Proposed	Present	Proposed	Present	Proposed
Males	90	101	89.11%	85.00%	85.00%	86	86	104.8%	104.8%
Females	6	13	46.15%	85.00%	85.00%	11	11	54.3%	54.3%
Total	**96**	**114**	**84.21%**			**97**	**97**	**99.1%**	**99.1%**

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 approximately as expected for males and is lower than expected for females. However, due to the low number of female retirees, we do not recommend changing this assumption.

Recommendation

We recommend continuation of the 85% marital status assumption for both males and females.

Age of Survivor

Joint & Survivor annuity benefit amounts are determined based on the member's and survivor's age. Currently, the valuation assumes that male members have a beneficiary 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 Actual/Expected	
			Present	Proposed	Present	Proposed
Males	90	1.22	2.00	2.00	61.0%	61.0%
Females	6	0.53	-2.00	-2.00	-26.5%	-26.5%
Total	**96**					

Recommendation

Due to the variation in yearly results and the low number of retirements, we recommend continuing the present assumption.

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 no change to the 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:	12.5% elect 50% Joint & Survivor option
	12.5% elect 75% Joint & Survivor option
	70.0% 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.

Form of Payment

Recommendation

We recommend minor changes to the assumed percentage electing joint and survivor annuities as shown below.

Form of Payment	Actual Electing Annuity	Married New Retirees	Crude Rates	Sample Rates		Expected Electing Annuity		Ratio of Actuals/Expected	
				Present	Proposed	Present	Proposed	Present	Proposed
Single-Life Annuity	4	96	4.17%	5.00%	5.00%	4.80	4.80	83.3%	83.3%
15-year certain & life	0	96	0.00%	0.00%	0.00%	0.00	0.00	N/A	N/A
50% joint & Survivor	8	96	8.33%	12.50%	7.50%	12.00	7.20	66.7%	111.1%
75% joint & Survivor	11	96	11.46%	12.50%	12.50%	12.00	12.00	91.7%	91.7%
100% joint & Survivor	73	96	76.04%	70.00%	75.00%	67.20	72.00	108.6%	101.4%
Total	**96**	**96**	**100.00%**	**100.00%**	**100.00%**	**96.00**	**96.00**		

Actuarial Equivalent Factors

Joint and 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, 2023 and phased in over a 24 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 7.5% pre-retirement interest. Reflecting statutory requirements, joint and survivor factors are based on an interest assumption of 6.5%.

Recommendation

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

Assumptions for Missing Participant Data

Background

To prepare the annual valuation report, GRS uses and relies on participant data supplied by MSRS. In cases where submitted data was missing or incomplete, the following assumptions are currently applied:

Data for active members:

- For members reported without a gender: male is assumed.
- For members reported with zero or invalid salary (<$100): Salary is set equal to prior year salary, if available, otherwise, high five salary with a 10% load to account for salary increases. If neither pay nor high five salary is available, salary is set to $65,000.

Data for terminated members:

- For members reported without a gender: male is assumed.
- For members reported without a benefit, we calculate benefits using the reported Average Salary, Credited Service, and Termination Date provided.
    - If Average Salary was not reported: Assume a value of $45,000.
    - If Credited Service was not reported: Assume a value of 5.0 years.

Data for retired members:

- For members reported without a gender: assume retirees are male and beneficiaries are female.
- For members reported without a benefit: no adjustment is made.
- For members reported with a bounceback annuity and an unreasonable reduction factor (<.5 or >1), a factor of 0.80, 0.85, and 0.90 is assumed for the 100%, 75% and 50% joint and survivor annuity, respectively.

Recommendation

We recommend updating the assumptions for missing participant data as follows:

- *For active members reported with zero or invalid salary (<$100) and prior pay or high five salary is not available: assume salary is equal to the average salary at hire of new members with one to five years of service as of the last projection required by the Legislative Commission on Pensions and Retirement. This value is $85,000 as of July 1, 2022.*
- *For active members reported with an invalid date of birth: assume member was hired at the same age as new members with one to five years of service as of the last projection required by the Legislative Commission on Pensions and Retirement. This value is 32 years as of July 1, 2022.*
- *For terminated members if Average Salary was not reported or invalid: assume Average Salary equals $75,000.*
- *For terminated members reported without Credited Service: assume a value equal to elapsed time from hire to termination date; if elapsed time is not available, assume nine years.*
- *For terminated members reported without a date of birth: assume age 46 at valuation date.*

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 the following page. 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 and 0% for non-vested members to account for the effect of some participants having eligibility for a Combined Service Annuity.
Pay Increase Timing	Pay increases were assumed to be at the beginning of the fiscal year. This is equivalent to assuming that reported pays represent amounts paid to members during the year ended on the valuation date.
Service Credit Accruals	Members were assumed to accrue one year of service credit per year.

SECTION H

PROPOSED ASSUMPTION LISTING

Proposed Actuarial Assumptions
Based on the 2019-2023 Experience Study

Merit and Seniority Pay Increases

% Merit Increases in Salaries Next Year	
Service Index	Rate
1	8.00%
2	5.00%
3	3.60%
4	3.40%
5	3.20%
6	3.00%
7	2.60%
8	2.30%
9	1.80%
10	1.40%
11	1.00%
12	0.90%
13	0.80%
14	0.70%
15	0.60%
16	0.50%
17	0.40%
18	0.30%
19	0.30%
20	0.30%
21	0.30%
22	0.30%
23	0.20%
24	0.10%
25+	0.00%

Proposed Actuarial Assumptions
Based on the 2019-2023 Experience Study

Age and Service Retirement Pattern
Unreduced (Normal) Retirement

Age	% Retiring
55	65%
56	55%
57	30%
58	30%
59	25%
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 the 2019-2023 Experience Study

Age and Service Retirement Pattern
Reduced (Early) Retirement

Age	% Retiring
50	3%
51	3%
52	3%
53	3%
54	3%

Proposed Actuarial Assumptions
Based on the 2019-2023 Experience Study

Withdrawal

Year	% Withdrawals	
	Male	Female
1	6.00%	6.00%
2	3.00%	3.00%
3	2.50%	2.50%
4	2.50%	2.50%
5	2.50%	2.50%
6	2.00%	2.00%
7	1.50%	1.50%
8	1.50%	1.50%
9	1.50%	1.50%
10	1.50%	1.50%
11	1.50%	1.50%
12	1.50%	1.50%
13	1.50%	1.50%
14	1.50%	1.50%
15	1.00%	1.00%
16	1.00%	1.00%
17	1.00%	1.00%
18	1.00%	1.00%
19	1.00%	1.00%
20	0.50%	0.50%
21	0.50%	0.50%
22	0.50%	0.50%
23	0.00%	0.00%
24	0.00%	0.00%
25+	0.00%	0.00%

Proposed Actuarial Assumptions
Based on the 2019-2023 Experience Study

Disability Rates

Age	% Becoming Disabled	
	Male	Female
20	0.1000%	0.1000%
21	0.1000%	0.1000%
22	0.1000%	0.1000%
23	0.1000%	0.1000%
24	0.1000%	0.1000%
25	0.1000%	0.1000%
26	0.1000%	0.1000%
27	0.1000%	0.1000%
28	0.1000%	0.1000%
29	0.1000%	0.1000%
30	0.1000%	0.1000%
31	0.1050%	0.1050%
32	0.1130%	0.1130%
33	0.1200%	0.1200%
34	0.1280%	0.1280%
35	0.1350%	0.1350%
36	0.1500%	0.1500%
37	0.1500%	0.1500%
38	0.1500%	0.1500%
39	0.1500%	0.1500%
40	0.6000%	0.6000%
41	0.6000%	0.6000%
42	0.6000%	0.6000%
43	0.6000%	0.6000%
44	0.6000%	0.6000%
45	0.6500%	0.6500%
46	0.7000%	0.7000%
47	0.7500%	0.7500%
48	0.8000%	0.8000%
49	0.8500%	0.8500%
50	0.9000%	0.9000%
51	0.9500%	0.9500%
52	1.0000%	1.0000%
53	1.0875%	1.0875%
54	1.2000%	1.2000%
55+	1.2000%	1.2000%

Proposed Actuarial Assumptions
Based on the 2019-2023 Experience Study

Healthy Post-Retirement Mortality Rates

Age in 2023	% Dying Next Year*	
	Male	Female
50	0.18%	0.14%
51	0.20%	0.15%
52	0.21%	0.17%
53	0.24%	0.20%
54	0.26%	0.22%
55	0.29%	0.25%
56	0.33%	0.29%
57	0.37%	0.33%
58	0.41%	0.37%
59	0.46%	0.41%
60	0.52%	0.46%
61	0.58%	0.51%
62	0.65%	0.56%
63	0.72%	0.61%
64	0.80%	0.67%
65	0.89%	0.73%
66	0.98%	0.80%
67	1.08%	0.87%
68	1.19%	0.95%
69	1.31%	1.05%
70	1.45%	1.16%
71	1.61%	1.28%
72	1.79%	1.43%
73	1.99%	1.60%
74	2.23%	1.79%
75	2.50%	2.00%
76	2.81%	2.25%
77	3.16%	2.53%
78	3.56%	2.85%
79	4.02%	3.20%
80	4.54%	3.60%

Age in 2023	% Dying Next Year*	
	Male	Female
81	5.14%	4.05%
82	5.81%	4.54%
83	6.56%	5.10%
84	7.40%	5.72%
85	8.34%	6.42%
86	9.39%	7.19%
87	10.54%	8.05%
88	11.83%	9.00%
89	13.24%	10.07%
90	14.80%	11.25%
91	16.39%	12.51%
92	17.95%	13.82%
93	19.46%	15.17%
94	20.91%	16.56%
95	22.31%	18.01%
96	23.84%	19.60%
97	25.43%	21.28%
98	27.13%	23.08%
99	28.96%	24.99%
100	30.91%	27.00%
101	32.93%	29.09%
102	34.95%	31.21%
103	36.96%	33.34%
104	38.92%	35.45%
105	40.82%	37.54%
106	42.67%	39.57%
107	44.46%	41.55%
108	46.14%	43.45%
109	47.76%	45.27%
110	49.07%	46.99%

** The rates shown are Pub-2010 mortality for healthy annuitants, Public Safety table, with adjustments, if applicable (see Section F). Recommended rates include mortality improvements using projection scale MP-2021.*

Proposed Actuarial Assumptions
Based on the 2019-2023 Experience Study

Disabled Post-Retirement Mortality Rates

Age in 2023	% Dying Next Year*	
	Male	Female
20	0.13%	0.06%
21	0.13%	0.06%
22	0.13%	0.07%
23	0.13%	0.07%
24	0.13%	0.07%
25	0.13%	0.08%
26	0.14%	0.09%
27	0.15%	0.10%
28	0.15%	0.11%
29	0.16%	0.11%
30	0.17%	0.12%
31	0.18%	0.13%
32	0.19%	0.14%
33	0.20%	0.15%
34	0.20%	0.16%
35	0.21%	0.17%
36	0.22%	0.18%
37	0.22%	0.18%
38	0.23%	0.19%
39	0.23%	0.19%
40	0.24%	0.20%
41	0.24%	0.20%
42	0.25%	0.20%
43	0.25%	0.21%
44	0.26%	0.21%
45	0.26%	0.22%
46	0.27%	0.23%
47	0.28%	0.23%
48	0.30%	0.25%
49	0.31%	0.26%
50	0.33%	0.28%
51	0.35%	0.30%
52	0.37%	0.33%
53	0.39%	0.37%
54	0.42%	0.41%
55	0.46%	0.45%

Age in 2023	% Dying Next Year*	
	Male	Female
56	0.50%	0.50%
57	0.55%	0.55%
58	0.61%	0.61%
59	0.68%	0.67%
60	0.75%	0.72%
61	0.83%	0.78%
62	0.92%	0.84%
63	1.01%	0.89%
64	1.10%	0.95%
65	1.19%	1.01%
66	1.29%	1.07%
67	1.39%	1.14%
68	1.50%	1.22%
69	1.62%	1.30%
70	1.76%	1.40%
71	1.91%	1.52%
72	2.10%	1.64%
73	2.31%	1.79%
74	2.56%	1.95%
75	2.86%	2.13%
76	3.21%	2.34%
77	3.59%	2.57%
78	4.02%	2.85%
79	4.48%	3.20%
80	4.98%	3.60%
81	5.53%	4.05%
82	6.12%	4.54%
83	6.79%	5.10%
84	7.54%	5.72%
85	8.41%	6.42%
86	9.39%	7.19%
87	10.54%	8.05%
88	11.83%	9.00%
89	13.24%	10.07%
90	14.80%	11.25%

* *The rates shown are Pub-2010 mortality for disabled annuitants, Public Safety table, with adjustments, if applicable (see Section F). Recommended rates include mortality improvements using projection scale MP-2021.*

Proposed Actuarial Assumptions
Based on the 2019-2023 Experience Study

Healthy Pre-Retirement Mortality Rates

Age in 2023	% Dying Next Year*	
	Male	Female
20	0.04%	0.02%
21	0.04%	0.02%
22	0.04%	0.02%
23	0.04%	0.02%
24	0.04%	0.02%
25	0.04%	0.02%
26	0.05%	0.03%
27	0.05%	0.03%
28	0.05%	0.03%
29	0.06%	0.03%
30	0.06%	0.04%
31	0.06%	0.04%
32	0.06%	0.04%
33	0.07%	0.05%
34	0.07%	0.05%
35	0.07%	0.05%
36	0.07%	0.05%
37	0.07%	0.05%
38	0.08%	0.06%
39	0.08%	0.06%
40	0.08%	0.06%
41	0.08%	0.06%
42	0.08%	0.06%
43	0.08%	0.06%
44	0.09%	0.06%
45	0.09%	0.07%

Age in 2023	% Dying Next Year*	
	Male	Female
46	0.09%	0.07%
47	0.10%	0.07%
48	0.10%	0.07%
49	0.11%	0.08%
50	0.11%	0.08%
51	0.12%	0.09%
52	0.13%	0.10%
53	0.14%	0.10%
54	0.15%	0.11%
55	0.17%	0.12%
56	0.18%	0.13%
57	0.20%	0.14%
58	0.22%	0.15%
59	0.25%	0.16%
60	0.27%	0.18%
61	0.30%	0.18%
62	0.33%	0.19%
63	0.36%	0.20%
64	0.38%	0.21%
65	0.41%	0.22%
66	0.46%	0.24%
67	0.51%	0.27%
68	0.57%	0.31%
69	0.64%	0.35%
70	0.71%	0.40%

** The rates shown are Pub-2010 mortality for employees, Public Safety table, with adjustments, if applicable (see Section F). Recommended rates include mortality improvements using projection scale MP-2021.*

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

2019-2023 Experience

Year	Exposure	Prior Year	Current Year	Gross Actual Increases	Gross Expected Increases
1	183	13,321,950	14,966,104	12.34%	12.50%
2	187	15,239,226	16,688,446	9.51%	8.50%
3	192	16,154,694	17,299,486	7.09%	7.50%
4	204	17,766,775	19,021,080	7.06%	7.25%
5	184	16,300,799	17,649,735	8.28%	7.00%
6	193	18,113,694	19,761,710	9.10%	6.75%
7	162	16,245,068	17,310,091	6.56%	6.50%
8	125	12,773,620	13,469,537	5.45%	5.50%
9	79	8,137,582	8,720,273	7.16%	5.00%
10	86	8,593,029	9,011,326	4.87%	4.50%
11	90	8,773,594	9,198,399	4.84%	4.25%
12	90	8,742,916	9,302,856	6.40%	4.00%
13	108	11,069,749	11,508,111	3.96%	4.00%
14	110	11,286,423	11,793,938	4.50%	4.00%
15	109	11,324,506	11,893,085	5.02%	4.00%
16	118	12,510,851	13,234,919	5.79%	3.75%
17	102	11,525,232	12,169,774	5.59%	3.50%
18	89	9,926,307	10,468,542	5.46%	3.50%
19	81	8,938,879	9,319,087	4.25%	3.50%
20	105	10,862,120	11,478,903	5.68%	3.50%
21	120	12,892,378	13,580,708	5.34%	3.40%
22	119	13,120,122	14,049,887	7.09%	3.30%
23	106	12,268,370	13,016,149	6.10%	3.20%
24	63	7,322,043	7,706,994	5.26%	3.10%
25+	139	15,700,497	16,650,640	6.05%	3.00%
Totals	**3,144**	**308,910,424**	**329,269,780**	**6.59%**	**5.28%**

Appendix – Detailed Experience Analysis
Salary Increases

2019-2020 Experience

Year	Exposure	Prior Year	Current Year	Gross Actual Increases	Gross Expected Increases
1	47	3,306,332	3,507,896	6.10%	12.50%
2	40	2,905,846	3,110,883	7.06%	8.50%
3	60	4,635,311	4,894,331	5.59%	7.50%
4	64	5,182,493	5,439,014	4.95%	7.25%
5	47	3,987,766	4,187,848	5.02%	7.00%
6	39	3,305,129	3,513,371	6.30%	6.75%
7	24	2,166,365	2,197,224	1.42%	6.50%
8	25	2,239,720	2,295,527	2.49%	5.50%
9	8	732,967	786,827	7.35%	5.00%
10	40	3,501,183	3,632,819	3.76%	4.50%
11	26	2,336,799	2,383,116	1.98%	4.25%
12	24	2,301,421	2,376,971	3.28%	4.00%
13	29	2,777,978	2,826,756	1.76%	4.00%
14	42	4,115,123	4,192,008	1.87%	4.00%
15	36	3,461,682	3,558,641	2.80%	4.00%
16	28	2,699,153	2,815,317	4.30%	3.75%
17	8	776,868	820,957	5.68%	3.50%
18	26	2,566,594	2,685,612	4.64%	3.50%
19	24	2,280,350	2,392,598	4.92%	3.50%
20	57	5,492,960	5,646,170	2.79%	3.50%
21	35	3,535,538	3,633,046	2.76%	3.40%
22	23	2,408,062	2,478,351	2.92%	3.30%
23	15	1,408,725	1,482,410	5.23%	3.20%
24	6	565,342	581,362	2.83%	3.10%
25+	37	3,737,817	3,880,426	3.82%	3.00%
Totals	**810**	**72,427,524**	**75,319,481**	**3.99%**	**5.27%**

Appendix – Detailed Experience Analysis
Salary Increases

2020-2021 Experience

Year	Exposure	Prior Year	Current Year	Gross Actual Increases	Gross Expected Increases
1	69	4,946,233	5,435,684	9.90%	12.50%
2	54	4,084,494	4,409,785	7.96%	8.50%
3	37	2,911,843	3,110,477	6.82%	7.50%
4	54	4,372,067	4,761,110	8.90%	7.25%
5	61	5,217,476	5,667,809	8.63%	7.00%
6	46	4,122,316	4,486,005	8.82%	6.75%
7	37	3,319,723	3,621,310	9.08%	6.50%
8	23	2,124,007	2,191,715	3.19%	5.50%
9	23	2,143,616	2,319,094	8.19%	5.00%
10	7	698,020	716,837	2.70%	4.50%
11	38	3,439,384	3,699,041	7.55%	4.25%
12	25	2,288,913	2,403,922	5.02%	4.00%
13	22	2,198,320	2,341,145	6.50%	4.00%
14	26	2,523,719	2,586,196	2.48%	4.00%
15	39	3,911,523	4,121,040	5.36%	4.00%
16	34	3,399,200	3,580,645	5.34%	3.75%
17	26	2,655,671	2,848,268	7.25%	3.50%
18	7	724,698	768,753	6.08%	3.50%
19	25	2,611,052	2,785,014	6.66%	3.50%
20	23	2,285,933	2,450,390	7.19%	3.50%
21	49	4,897,969	5,265,732	7.51%	3.40%
22	34	3,515,918	3,713,922	5.63%	3.30%
23	21	2,289,873	2,479,870	8.30%	3.20%
24	13	1,287,354	1,390,432	8.01%	3.10%
25+	32	3,432,149	3,643,536	6.16%	3.00%
Totals	**825**	**75,401,471**	**80,797,732**	**7.16%**	**5.46%**

Appendix – Detailed Experience Analysis
Salary Increases

2021-2022 Experience

Year	Exposure	Prior Year	Current Year	Gross Actual Increases	Gross Expected Increases
1	30	2,380,598	2,869,162	20.52%	12.50%
2	49	3,946,757	4,648,977	17.79%	8.50%
3	41	3,434,969	3,969,281	15.56%	7.50%
4	34	2,963,485	3,404,232	14.87%	7.25%
5	45	4,017,727	4,597,280	14.42%	7.00%
6	54	5,048,882	5,906,251	16.98%	6.75%
7	41	4,044,901	4,621,398	14.25%	6.50%
8	34	3,408,897	3,901,994	14.47%	5.50%
9	14	1,351,954	1,604,247	18.66%	5.00%
10	17	1,780,289	2,021,698	13.56%	4.50%
11	6	612,332	694,329	13.39%	4.25%
12	35	3,466,575	3,831,439	10.53%	4.00%
13	19	1,825,599	2,060,251	12.85%	4.00%
14	20	2,157,914	2,493,008	15.53%	4.00%
15	13	1,331,754	1,620,650	21.69%	4.00%
16	33	3,469,464	4,030,950	16.18%	3.75%
17	31	3,333,546	3,789,270	13.67%	3.50%
18	24	2,648,776	3,054,180	15.31%	3.50%
19	6	726,859	822,069	13.10%	3.50%
20	17	2,004,958	2,287,209	14.08%	3.50%
21	17	1,852,114	2,156,838	16.45%	3.40%
22	42	4,638,603	5,282,335	13.88%	3.30%
23	29	3,207,651	3,656,206	13.98%	3.20%
24	16	1,918,631	2,202,527	14.80%	3.10%
25+	32	3,576,153	4,069,887	13.81%	3.00%
Totals	**699**	**69,149,388**	**79,595,668**	**15.11%**	**5.24%**

Appendix – Detailed Experience Analysis
Salary Increases

2022-2023 Experience

Year	Exposure	Prior Year	Current Year	Gross Actual Increases	Gross Expected Increases
1	37	2,688,787	3,153,362	17.28%	12.50%
2	44	4,302,129	4,518,801	5.04%	8.50%
3	54	5,172,571	5,325,397	2.95%	7.50%
4	52	5,248,730	5,416,724	3.20%	7.25%
5	31	3,077,830	3,196,798	3.87%	7.00%
6	54	5,637,367	5,856,083	3.88%	6.75%
7	60	6,714,079	6,870,159	2.32%	6.50%
8	43	5,000,996	5,080,301	1.59%	5.50%
9	34	3,909,045	4,010,105	2.59%	5.00%
10	22	2,613,537	2,639,972	1.01%	4.50%
11	20	2,385,079	2,421,913	1.54%	4.25%
12	6	686,007	690,524	0.66%	4.00%
13	38	4,267,852	4,279,959	0.28%	4.00%
14	22	2,489,667	2,522,726	1.33%	4.00%
15	21	2,619,547	2,592,754	-1.02%	4.00%
16	23	2,943,034	2,808,007	-4.59%	3.75%
17	37	4,759,147	4,711,279	-1.01%	3.50%
18	32	3,986,239	3,959,997	-0.66%	3.50%
19	26	3,320,618	3,319,406	-0.04%	3.50%
20	8	1,078,269	1,095,134	1.56%	3.50%
21	19	2,606,757	2,525,092	-3.13%	3.40%
22	20	2,557,539	2,575,279	0.69%	3.30%
23	41	5,362,121	5,397,663	0.66%	3.20%
24	28	3,550,716	3,532,673	-0.51%	3.10%
25+	38	4,954,378	5,056,791	2.07%	3.00%
Totals	**810**	**91,932,041**	**93,556,899**	**1.77%**	**5.19%**

Appendix – Detailed Experience Analysis
Retirements

2019-2023 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
50	2,084	99,226	2,977	70.0%
51	2,155	92,301	4,615	46.7%
52	1,752	95,289	4,764	36.8%
53	4,155	92,725	2,782	149.4%
54	0	83,037	3,321	0.0%
55	61,749	92,741	60,282	102.4%
56	19,700	28,579	11,432	172.3%
57	3,746	13,688	4,106	91.2%
58	3,353	7,954	1,193	281.1%
59	2,157	7,792	1,558	138.4%
Totals	**100,852**	**613,330**	**97,031**	**103.9%**

Appendix – Detailed Experience Analysis
Retirements

2019-2020 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
50	585	23,567	707	82.8%
51	0	17,746	887	0.0%
52	0	24,875	1,244	0.0%
53	578	15,056	452	127.9%
54	0	17,207	688	0.0%
55	18,863	24,999	16,249	116.1%
56	4,086	5,306	2,123	192.5%
57	2,981	5,330	1,599	186.5%
58	0	1,110	167	0.0%
59	1,574	3,621	724	217.4%
Totals	**28,667**	**138,818**	**24,840**	**115.4%**

2020-2021 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
50	1,499	21,955	659	227.6%
51	0	24,359	1,218	0.0%
52	854	19,086	954	89.5%
53	1,900	26,949	808	235.1%
54	0	16,124	645	0.0%
55	10,176	18,772	12,202	83.4%
56	3,502	6,459	2,584	135.6%
57	765	1,574	472	162.0%
58	761	2,620	393	193.6%
59	583	1,169	234	249.4%
Totals	**20,041**	**139,067**	**20,169**	**99.4%**

Appendix – Detailed Experience Analysis
Retirements

2021-2022 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
50	0	23,038	691	0.0%
51	721	21,960	1,098	65.7%
52	0	26,187	1,309	0.0%
53	0	19,331	580	0.0%
54	0	26,772	1,071	0.0%
55	9,278	17,421	11,324	81.9%
56	5,233	8,304	3,322	157.5%
57	0	3,062	919	0.0%
58	0	873	131	0.0%
59	0	1,997	399	0.0%
Totals	**15,231**	**148,945**	**20,843**	**73.1%**

2022-2023 Experience ($000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
50	0	30,665	920	0.0%
51	1,434	28,235	1,412	101.6%
52	898	25,141	1,257	71.4%
53	1,677	31,388	942	178.1%
54	0	22,933	917	0.0%
55	23,432	31,549	20,507	114.3%
56	6,879	8,510	3,404	202.1%
57	0	3,722	1,117	0.0%
58	2,592	3,351	503	515.8%
59	0	1,005	201	0.0%
Totals	**36,913**	**186,500**	**31,179**	**118.4%**

Appendix – Detailed Experience Analysis
Terminations

2019-2023 Experience ($000s)

	Males and Females			
Year	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
1	1,655	26,645	1,332	124.3%
2	1,804	70,544	2,469	73.1%
3	1,384	74,325	1,858	74.5%
4	2,224	81,262	1,828	121.6%
5	4,601	88,208	1,764	260.8%
6	1,055	82,195	1,439	73.3%
7	370	86,345	1,295	28.6%
8	1,098	78,902	986	111.4%
9	1,732	63,494	635	272.8%
10	451	43,389	325	138.9%
11	773	44,890	336	230.0%
12	1,136	46,616	349	325.4%
13	-	46,377	348	0.0%
14	1,438	55,363	415	346.6%
15	-	56,974	285	0.0%
16	613	61,924	310	197.6%
17	549	68,107	340	161.6%
18	1,056	65,197	326	323.9%
19	442	54,499	273	161.9%
20	-	48,632	243	0.0%
21	1,437	53,557	268	536.2%
22	639	40,668	-	N/A
23	-	20,403	-	N/A
24	-	11,668	-	N/A
25+	-	11,060	-	N/A
Totals	**24,457**	**1,381,244**	**17,424**	**140.4%**

Appendix – Detailed Experience Analysis
Terminations

2019-2020 Experience ($000s)

	Males and Females			
Year	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
1	709	9,127	456	155.4%
2	261	19,743	691	37.7%
3	500	14,901	373	134.0%
4	626	23,562	530	118.1%
5	1,104	26,118	522	211.5%
6	-	17,713	310	0.0%
7	-	15,478	232	0.0%
8	-	9,491	119	0.0%
9	958	12,350	124	772.4%
10	-	3,225	24	0.0%
11	395	18,668	140	282.3%
12	626	12,718	95	658.6%
13	-	10,883	82	0.0%
14	619	12,955	97	637.8%
15	-	23,028	115	0.0%
16	613	20,060	100	612.6%
17	-	16,701	84	0.0%
18	-	3,966	20	0.0%
19	-	12,729	64	0.0%
20	-	11,901	60	0.0%
21	-	25,318	127	0.0%
22	-	16,795	-	N/A
23	-	7,324	-	N/A
24	-	6,501	-	N/A
25+	-	4,218	-	N/A
Totals	**6,409**	**355,475**	**4,365**	**146.8%**

Appendix – Detailed Experience Analysis
Terminations

2020-2021 Experience ($000s)

	Males and Females			
Year	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
1	607	11,139	557	108.9%
2	270	19,891	696	38.8%
3	619	21,623	541	114.4%
4	370	14,829	334	110.8%
5	1,972	23,837	477	413.5%
6	-	25,890	453	0.0%
7	370	18,706	281	131.7%
8	372	16,858	211	176.4%
9	374	9,822	98	381.9%
10	451	11,732	88	513.0%
11	-	3,564	27	0.0%
12	510	18,298	137	372.2%
13	-	13,021	98	0.0%
14	-	10,425	78	0.0%
15	-	11,687	58	0.0%
16	-	23,201	116	0.0%
17	549	19,264	96	572.3%
18	1,056	18,042	90	1173.2%
19	-	4,307	22	0.0%
20	-	12,531	63	0.0%
21	-	12,400	62	0.0%
22	-	23,873	-	N/A
23	-	13,080	-	N/A
24	-	5,167	-	N/A
25+	-	6,842	-	N/A
Totals	**7,522**	**370,027**	**4,583**	**164.1%**

Appendix – Detailed Experience Analysis
Terminations

2021-2022 Experience ($000s)

	Males and Females			
Year	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
1	132	1,668	84	157.6%
2	60	14,496	507	11.9%
3	265	19,076	477	55.5%
4	312	19,605	441	70.7%
5	818	14,451	289	283.1%
6	613	22,682	397	154.5%
7	-	25,936	389	0.0%
8	726	20,748	259	280.2%
9	400	17,667	177	226.0%
10	-	9,138	69	0.0%
11	377	11,331	85	444.0%
12	-	3,088	23	0.0%
13	-	18,852	141	0.0%
14	514	11,120	83	619.0%
15	-	10,442	52	0.0%
16	-	9,694	48	0.0%
17	-	23,381	117	0.0%
18	-	17,834	89	0.0%
19	-	17,649	88	0.0%
20	-	3,893	19	0.0%
21	1,437	11,100	56	2566.1%
22	639	-	-	N/A
23	-	-	-	N/A
24	-	-	-	N/A
25+	-	-	-	N/A
Totals	**6,293**	**303,850**	**3,890**	**161.8%**

Appendix – Detailed Experience Analysis
Terminations

2022-2023 Experience ($000s)

	Males and Females			
Year	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
1	208	4,711	235	88.3%
2	1,213	16,414	575	211.0%
3	-	18,725	467	0.0%
4	916	23,266	523	175.2%
5	707	23,802	476	148.5%
6	442	15,910	279	158.4%
7	-	26,225	393	0.0%
8	-	31,805	397	0.0%
9	-	23,656	236	0.0%
10	-	19,294	144	0.0%
11	-	11,327	84	0.0%
12	-	12,512	94	0.0%
13	-	3,620	27	0.0%
14	306	20,863	157	194.8%
15	-	11,817	60	0.0%
16	-	8,969	46	0.0%
17	-	8,761	43	0.0%
18	-	25,356	127	0.0%
19	442	19,814	99	446.5%
20	-	20,306	101	0.0%
21	-	4,739	23	0.0%
22	-	-	-	N/A
23	-	-	-	N/A
24	-	-	-	N/A
25+	-	-	-	N/A
Totals	**4,234**	**351,892**	**4,586**	**92.3%**

Appendix – Detailed Experience Analysis
Disability Retirements

2019-2023 Experience

	Males and Females			
Age Group	**Actual Disabilities**	**Exposure**	**Expected Disabilities**	**Actual/ Expected**
Under 20	-	-	-	N/A
20-24	-	54	0.1	0.0%
25-29	1	387	0.3	346.6%
30-34	-	552	0.7	0.0%
35-39	1	597	0.9	111.3%
40-44	14	605	1.3	1097.4%
45-49	11	726	2.8	392.8%
50-54	6	603	3.5	170.3%
55+	2	89	0.3	625.0%
Totals	**35**	**3,613**	**9.8**	**355.8%**

Appendix – Detailed Experience Analysis
Disability Retirements

2019-2020 Experience

	Males and Females			
Age Group	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected
Under 20	-	-	-	N/A
20-24	-	19	0.0	0.0%
25-29	-	103	0.1	0.0%
30-34	-	132	0.2	0.0%
35-39	-	144	0.2	0.0%
40-44	1	161	0.3	296.6%
45-49	2	185	0.7	284.6%
50-54	1	138	0.7	144.2%
55+	-	-	-	N/A
Totals	**4**	**882**	**2.2**	**180.9%**

2020-2021 Experience

	Males and Females			
Age Group	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected
Under 20	-	-	-	N/A
20-24	-	14	0.0	0.0%
25-29	-	96	0.1	0.0%
30-34	-	143	0.2	0.0%
35-39	-	147	0.2	0.0%
40-44	3	158	0.3	916.5%
45-49	2	185	0.7	283.9%
50-54	3	147	0.8	394.4%
55+	1	-	-	N/A
Totals	**9**	**890**	**2.3**	**395.1%**

Appendix – Detailed Experience Analysis
Disability Retirements

2021-2022 Experience

Age Group	Males and Females			
	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected
Under 20	-	-	-	N/A
20-24	-	8	0.0	0.0%
25-29	-	98	0.1	0.0%
30-34	-	127	0.2	0.0%
35-39	1	150	0.2	453.5%
40-44	6	149	0.3	1907.6%
45-49	6	185	0.7	853.7%
50-54	1	154	1.0	102.0%
55+	1	39	0.2	625.0%
Totals	**15**	**910**	**2.6**	**571.1%**

2022-2023 Experience

Age Group	Males and Females			
	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected
Under 20	-	-	-	N/A
20-24	-	13	0.0	0.0%
25-29	1	90	0.1	1312.3%
30-34	-	150	0.2	0.0%
35-39	-	156	0.2	0.0%
40-44	4	137	0.3	1348.2%
45-49	1	171	0.7	144.9%
50-54	1	164	1.1	91.9%
55+	-	50	0.2	0.0%
Totals	**7**	**931**	**2.7**	**257.2%**

Appendix – Detailed Experience Analysis
Post-Retirement Mortality

2019-2023 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
50-54	-	1,365	4.9	0.0%	50-54	-	382	0.9	0.0%
55-59	54	26,291	134.9	40.0%	55-59	-	4,369	15.3	0.0%
60-64	29	38,099	283.5	10.2%	60-64	-	4,742	22.1	0.0%
65-69	109	32,051	346.1	31.5%	65-69	-	2,709	19.0	0.0%
70-74	719	30,529	542.5	132.5%	70-74	43	1,269	15.8	272.2%
75-79	1,520	29,888	913.0	166.5%	75-79	-	784	16.1	0.0%
80-84	1,161	19,948	1,098.1	105.7%	80-84	-	42	1.3	0.0%
85-89	781	12,694	1,235.4	63.2%	85-89	-	-	-	N/A
90-94	1,071	5,682	922.2	116.1%	90-94	-	-	-	N/A
95-99	849	2,116	511.0	166.1%	95-99	-	-	-	N/A
100+	-	147	46.7	0.0%	100+	-	-	-	N/A
Totals	**6,293**	**198,810**	**6,038.5**	**104.2%**	**Totals**	**43**	**14,297**	**90.6**	**47.5%**

Appendix – Detailed Experience Analysis
Post-Retirement Mortality

2019-2020 Experience ($000s)

Age Group	Males Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Females Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
50-54	-	479	1.7	0.0%	50-54	-	33	0.1	0.0%
55-59	-	6,922	36.2	0.0%	55-59	-	1,355	4.7	0.0%
60-64	-	9,164	69.0	0.0%	60-64	-	870	4.1	0.0%
65-69	-	6,865	74.5	0.0%	65-69	-	482	3.2	0.0%
70-74	260	8,175	144.3	180.2%	70-74	-	377	4.7	0.0%
75-79	103	7,236	216.9	47.5%	75-79	-	107	2.3	0.0%
80-84	284	4,755	260.3	109.1%	80-84	-	-	-	N/A
85-89	165	2,806	259.9	63.5%	85-89	-	-	-	N/A
90-94	351	1,688	277.7	126.4%	90-94	-	-	-	N/A
95-99	166	515	122.5	135.5%	95-99	-	-	-	N/A
100+	-	-	-	N/A	100+	-	-	-	N/A
Totals	**1,329**	**48,605**	**1,463.1**	**90.8%**	**Totals**	**-**	**3,224**	**19.1**	**0.0%**

2020-2021 Experience ($000s)

Age Group	Males Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Females Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
50-54	-	322	1.1	0.0%	50-54	-	53	0.1	0.0%
55-59	-	6,718	34.0	0.0%	55-59	-	1,182	4.2	0.0%
60-64	-	9,861	73.0	0.0%	60-64	-	1,148	5.4	0.0%
65-69	109	7,964	86.4	126.2%	65-69	-	615	4.3	0.0%
70-74	228	7,436	132.3	172.4%	70-74	22	305	4.0	550.0%
75-79	645	7,701	231.7	278.4%	75-79	-	185	3.9	0.0%
80-84	361	4,848	263.9	136.8%	80-84	-	-	-	N/A
85-89	219	3,298	317.1	69.1%	85-89	-	-	-	N/A
90-94	153	1,272	205.6	74.4%	90-94	-	-	-	N/A
95-99	102	618	146.1	69.8%	95-99	-	-	-	N/A
100+	-	-	-	N/A	100+	-	-	-	N/A
Totals	**1,817**	**50,038**	**1,491.3**	**121.8%**	**Totals**	**22**	**3,435**	**21.7**	**101.2%**

Appendix – Detailed Experience Analysis
Post-Retirement Mortality

2021-2022 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
50-54	-	363	1.3	0.0%	50-54	-	139	0.3	0.0%
55-59	54	6,837	35.1	154.0%	55-59	-	872	3.1	0.0%
60-64	29	9,460	70.5	41.1%	60-64	-	1,289	6.0	0.0%
65-69	-	8,331	89.7	0.0%	65-69	-	770	5.5	0.0%
70-74	166	7,617	136.5	121.6%	70-74	21	269	3.4	623.6%
75-79	333	7,510	235.3	141.5%	75-79	-	233	4.8	0.0%
80-84	334	4,858	271.5	123.0%	80-84	-	-	-	N/A
85-89	145	3,192	313.7	46.2%	85-89	-	-	-	N/A
90-94	335	1,423	227.9	147.0%	90-94	-	-	-	N/A
95-99	256	578	139.9	183.0%	95-99	-	-	-	N/A
100+	-	73	22.5	0.0%	100+	-	-	-	N/A
Totals	**1,652**	**49,879**	**1,542.6**	**107.1%**	**Totals**	**21**	**3,433**	**22.7**	**92.6%**

2022-2023 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
50-54	-	201	0.7	0.0%	50-54	-	157	0.4	0.0%
55-59	-	5,814	29.6	0.0%	55-59	-	960	3.3	0.0%
60-64	-	9,614	71.0	0.0%	60-64	-	1,435	6.7	0.0%
65-69	-	8,891	95.5	0.0%	65-69	-	842	6.0	0.0%
70-74	65	7,301	129.4	50.2%	70-74	-	318	3.7	0.0%
75-79	439	7,441	229.1	191.6%	75-79	-	259	5.2	0.0%
80-84	182	5,487	302.3	60.2%	80-84	-	42	1.3	0.0%
85-89	252	3,398	344.7	73.1%	85-89	-	-	-	N/A
90-94	232	1,299	211.0	110.0%	90-94	-	-	-	N/A
95-99	325	405	102.6	316.9%	95-99	-	-	-	N/A
100+	-	74	24.2	0.0%	100+	-	-	-	N/A
Totals	**1,495**	**49,724**	**1,539.4**	**97.1%**	**Totals**	**-**	**3,856**	**26.2**	**0.0%**

Appendix – Detailed Experience Analysis
Pre-Retirement Mortality

2019-2023 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
Under 20	-	-	-	N/A	Under 20	-	-	-	N/A
20-24	-	20,737	7.1	0.0%	20-24	-	6,303	0.7	0.0%
25-29	-	127,558	57.3	0.0%	25-29	-	23,389	3.8	0.0%
30-34	-	215,482	134.8	0.0%	30-34	-	17,408	4.6	0.0%
35-39	362	255,469	200.8	180.3%	35-39	489	30,014	11.8	4149.6%
40-44	-	331,329	313.2	0.0%	40-44	-	44,059	22.3	0.0%
45-49	691	449,612	550.9	125.4%	45-49	-	53,799	37.1	0.0%
50-54	-	419,423	752.5	0.0%	50-54	568	50,810	53.5	1060.8%
55-59	-	64,656	169.5	0.0%	55-59	-	7,326	11.8	0.0%
60-64	-	2,700	9.7	0.0%	60-64	-	-	-	N/A
Totals	**1,053**	**1,886,966**	**2,195.7**	**48.0%**	**Totals**	**1,057**	**233,108**	**145.5**	**726.2%**

Appendix – Detailed Experience Analysis
Pre-Retirement Mortality

2019-2020 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
Under 20	-	-	-	N/A	Under 20	-	-	-	N/A
20-24	-	6,373	2.2	0.0%	20-24	-	2,474	0.3	0.0%
25-29	-	33,243	14.7	0.0%	25-29	-	4,092	0.7	0.0%
30-34	-	52,883	32.2	0.0%	30-34	-	2,360	0.6	0.0%
35-39	-	58,513	44.8	0.0%	35-39	-	8,433	3.1	0.0%
40-44	-	82,501	76.1	0.0%	40-44	-	12,850	6.4	0.0%
45-49	-	102,644	124.3	0.0%	45-49	-	12,470	8.9	0.0%
50-54	-	91,968	167.9	0.0%	50-54	-	9,659	10.2	0.0%
55-59	-	17,812	48.1	0.0%	55-59	-	982	1.5	0.0%
60-64	-	1,846	6.6	0.0%	60-64	-	-	-	N/A
Totals	**-**	**447,783**	**516.9**	**0.0%**	**Totals**	**-**	**53,320**	**31.7**	**0.0%**

2020-2021 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
Under 20	-	-	-	N/A	Under 20	-	-	-	N/A
20-24	-	6,257	2.1	0.0%	20-24	-	1,694	0.2	0.0%
25-29	-	34,510	15.5	0.0%	25-29	-	6,550	1.0	0.0%
30-34	-	54,289	33.7	0.0%	30-34	-	3,863	1.0	0.0%
35-39	-	62,397	48.6	0.0%	35-39	489	8,949	3.5	13794.8%
40-44	-	84,843	79.7	0.0%	40-44	-	10,465	5.3	0.0%
45-49	-	105,366	128.2	0.0%	45-49	-	13,340	9.2	0.0%
50-54	-	94,842	169.0	0.0%	50-54	568	12,776	13.4	4224.4%
55-59	-	14,606	38.9	0.0%	55-59	-	1,027	1.7	0.0%
60-64	-	505	1.8	0.0%	60-64	-	-	-	N/A
Totals	**-**	**457,615**	**517.5**	**0.0%**	**Totals**	**1,057**	**58,664**	**35.4**	**2982.5%**

Appendix – Detailed Experience Analysis
Pre-Retirement Mortality

2021-2022 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
Under 20	-	-	-	N/A	Under 20	-	-	-	N/A
20-24	-	4,128	1.4	0.0%	20-24	-	700	0.1	0.0%
25-29	-	26,897	12.2	0.0%	25-29	-	5,646	0.9	0.0%
30-34	-	52,917	33.5	0.0%	30-34	-	4,576	1.2	0.0%
35-39	362	59,853	47.5	761.3%	35-39	-	6,640	2.7	0.0%
40-44	-	79,424	75.9	0.0%	40-44	-	10,648	5.5	0.0%
45-49	691	111,588	137.4	503.0%	45-49	-	11,946	8.2	0.0%
50-54	-	101,813	181.1	0.0%	50-54	-	13,799	14.7	0.0%
55-59	-	13,098	33.4	0.0%	55-59	-	3,024	4.7	0.0%
60-64	-	-	-	N/A	60-64	-	-	-	N/A
Totals	**1,053**	**449,718**	**522.3**	**201.6%**	**Totals**	**-**	**56,979**	**37.9**	**0.0%**

2022-2023 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
Under 20	-	-	-	N/A	Under 20	-	-	-	N/A
20-24	-	3,979	1.4	0.0%	20-24	-	1,435	0.2	0.0%
25-29	-	32,908	15.1	0.0%	25-29	-	7,101	1.2	0.0%
30-34	-	55,393	35.4	0.0%	30-34	-	6,609	1.8	0.0%
35-39	-	74,706	59.8	0.0%	35-39	-	5,992	2.4	0.0%
40-44	-	84,561	81.6	0.0%	40-44	-	10,096	5.0	0.0%
45-49	-	130,014	161.0	0.0%	45-49	-	16,043	10.8	0.0%
50-54	-	130,800	234.5	0.0%	50-54	-	14,576	15.2	0.0%
55-59	-	19,140	49.1	0.0%	55-59	-	2,293	3.9	0.0%
60-64	-	349	1.2	0.0%	60-64	-	-	-	N/A
Totals	**-**	**531,850**	**639.0**	**0.0%**	**Totals**	**-**	**64,145**	**40.4**	**0.0%**

Appendix – Detailed Experience Analysis
Disabled Mortality

2019-2023 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
<40	40	178	1.3	3086.3%	<40	-	54	0.4	0.0%
40-44	-	555	5.2	0.0%	40-44	-	306	2.7	0.0%
45-49	88	1,179	14.8	595.2%	45-49	-	145	1.6	0.0%
50-54	33	2,042	35.0	94.3%	50-54	-	195	3.0	0.0%
55-59	-	2,285	51.2	0.0%	55-59	-	662	12.8	0.0%
60-64	56	887	24.4	230.0%	60-64	-	242	5.1	0.0%
65-69	-	1,213	40.0	0.0%	65-69	-	387	8.9	0.0%
70-74	-	1,204	48.1	0.0%	70-74	-	46	1.2	0.0%
75-79	-	895	47.1	0.0%	75-79	-	-	-	N/A
80-84	-	284	23.0	0.0%	80-84	-	-	-	N/A
85-89	-	149	15.4	0.0%	85-89	-	-	-	N/A
90-94	-	-	-	N/A	90-94	-	-	-	N/A
95-99	-	-	-	N/A	95-99	-	-	-	N/A
100+	-	-	-	N/A	100+	-	-	-	N/A
Totals	**217**	**10,871**	**305.4**	**71.0%**	**Totals**	**-**	**2,037**	**35.6**	**0.0%**

Appendix – Detailed Experience Analysis
Disabled Mortality

2019-2020 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
<40	-	39	0.2	0.0%	<40	-	27	0.2	0.0%
40-44	-	52	0.5	0.0%	40-44	-	-	-	N/A
45-49	-	242	3.0	0.0%	45-49	-	44	0.6	0.0%
50-54	-	414	7.4	0.0%	50-54	-	59	1.0	0.0%
55-59	-	461	10.4	0.0%	55-59	-	130	2.4	0.0%
60-64	-	198	5.6	0.0%	60-64	-	65	1.4	0.0%
65-69	-	336	11.1	0.0%	65-69	-	90	2.0	0.0%
70-74	-	238	9.4	0.0%	70-74	-	-	-	N/A
75-79	-	206	10.7	0.0%	75-79	-	-	-	N/A
80-84	-	72	6.2	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
100+	-	-	-	N/A	100+	-	-	-	N/A
Totals	**-**	**2,258**	**64.4**	**0.0%**	**Totals**	**-**	**415**	**7.6**	**0.0%**

2020-2021 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
<40	40	40	0	15656.8%	<40	-	27	0.2	0.0%
40-44	-	52	1	0.0%	40-44	-	47	0.4	0.0%
45-49	43	249	3	1316.5%	45-49	-	-	-	N/A
50-54	-	444	8	0.0%	50-54	-	45	0.6	0.0%
55-59	-	517	12	0.0%	55-59	-	191	3.6	0.0%
60-64	-	177	5	0.0%	60-64	-	43	0.9	0.0%
65-69	-	329	11	0.0%	65-69	-	113	2.6	0.0%
70-74	-	320	13	0.0%	70-74	-	-	-	N/A
75-79	-	162	8	0.0%	75-79	-	-	-	N/A
80-84	-	119	10	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
100+	-	-	-	N/A	100+	-	-	-	N/A
Totals	**83**	**2,409**	**70.2**	**118.2%**	**Totals**	**-**	**466**	**8.3**	**0.0%**

Appendix – Detailed Experience Analysis
Disabled Mortality

2021-2022 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
<40	-	-	-	N/A	<40	-	-	-	N/A
40-44	-	143	1	0.0%	40-44	-	128	1.1	0.0%
45-49	45	238	3	1593.5%	45-49	-	-	-	N/A
50-54	-	542	9	0.0%	50-54	-	45	0.7	0.0%
55-59	-	709	16	0.0%	55-59	-	193	3.8	0.0%
60-64	56	231	6	866.2%	60-64	-	43	0.9	0.0%
65-69	-	321	11	0.0%	65-69	-	114	2.7	0.0%
70-74	-	262	11	0.0%	70-74	-	-	-	N/A
75-79	-	237	12	0.0%	75-79	-	-	-	N/A
80-84	-	46	3	0.0%	80-84	-	-	-	N/A
85-89	-	74	7	0.0%	85-89	-	-	-	N/A
90-94	-	-	-	N/A	90-94	-	-	-	N/A
95-99	-	-	-	N/A	95-99	-	-	-	N/A
100+	-	-	-	N/A	100+	-	-	-	N/A
Totals	**101**	**2,803**	**80.1**	**126.1%**	**Totals**	**-**	**523**	**9.2**	**0.0%**

2022-2023 Experience ($000s)

	Males					Females			
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/ Expected
<40	-	99	1	0.0%	<40	-	-	-	N/A
40-44	-	308	3	0.0%	40-44	-	131	1.2	0.0%
45-49	-	450	6	0.0%	45-49	-	101	1.0	0.0%
50-54	33	642	11	302.8%	50-54	-	46	0.7	0.0%
55-59	-	598	13	0.0%	55-59	-	148	2.9	0.0%
60-64	-	281	7	0.0%	60-64	-	91	1.9	0.0%
65-69	-	227	7	0.0%	65-69	-	70	1.6	0.0%
70-74	-	384	15	0.0%	70-74	-	46	1.2	0.0%
75-79	-	290	16	0.0%	75-79	-	-	-	N/A
80-84	-	47	4	0.0%	80-84	-	-	-	N/A
85-89	-	75	8	0.0%	85-89	-	-	-	N/A
90-94	-	-	-	N/A	90-94	-	-	-	N/A
95-99	-	-	-	N/A	95-99	-	-	-	N/A
100+	-	-	-	N/A	100+	-	-	-	N/A
Totals	**33**	**3,401**	**90.7**	**36.4%**	**Totals**	**-**	**633**	**10.5**	**0.0%**