

Public Employees Police and Fire Plan

Four-Year Experience Study

July 1, 2015 through June 30, 2019





July 14, 2020

Public Employees Retirement Association of Minnesota
Public Employees Police and Fire Plan
St. Paul, Minnesota

Dear Trustees of the Public Employees Police and Fire Plan:

The results of the four-year **actuarial experience study** of the Public Employees Police and Fire Plan (PEFPF) 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 Public Employees Police and Fire Plan.

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 Public Employees Retirement Association of Minnesota (PERA). 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 PERA.

The investigation covered the four-year period from **July 1, 2015 to June 30, 2019**, and was carried out using generally accepted actuarial principles and techniques.

We believe that the actuarial assumptions recommended in this experience study report represent individually and in the aggregate reasonable estimates of future experience of the Public Employees Police and Fire Plan.

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

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.

Trustees
Public Employees Retirement Association of Minnesota
Public Employees Police and Fire Plan
July 14, 2020

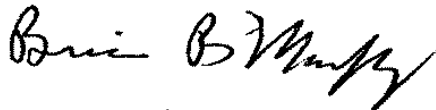
This report does not reflect the recent and still developing impact of COVID-19, which is likely to influence demographic experience and economic expectations, at least in the short-term. We will continue to monitor these developments and their impact on retirement plans.

Brian B. Murphy and Bonita J. Wurst are independent of the plan sponsor and are Members of the American Academy of Actuaries (MAAA) and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. In addition, Mr. Murphy meets the requirements of "approved actuary" under Minnesota Statutes Section 356.215, Subdivision 1, Paragraph (c).

Respectfully submitted,



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



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

BJW/BBM:dj



Actuarial Experience Study 2015-2019

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SECTION A

OVERVIEW AND SUMMARY OF RESULTS

Summary of Findings

The four-year period (July 1, 2015 to June 30, 2019) covered by this experience study provided sufficient data to form a basis for recommending changes in some of the assumptions and/or methods used in actuarial valuations of the Public Employees Police and Fire Plan. The recommended changes in actuarial assumptions and methods resulting from this experience study are summarized below:

Recommendations

- Decrease the price inflation assumption from 2.50% to 2.25%.
- Decrease the wage inflation (i.e., payroll growth) assumption from 3.25% to 3.00%.
- Adjust rates of merit and seniority, resulting in proposed merit and seniority increases that are approximately 24 basis points lower in total than the current rates, with the most significant changes to assumed rates at the beginning of a member's career. When combined with the proposed decrease in payroll growth assumption, the result is an overall decrease in gross salary increase rates of 49 basis points.
- Adjust assumed retirement rates:
 - Slight adjustments in assumed unreduced retirements (i.e., Normal Retirement), resulting in slightly more projected normal retirements in total.
 - Lower early retirement rates at ages 50-53, resulting in fewer projected early retirements in total.
- Change the assumed rates of withdrawal (termination of membership before eligible to retire):
 - Proposed rates are service-based
 - Generally, proposed rates are higher than current rates, especially for early years of service.
- Increase rates of disability for ages 25-44 and decrease rates of disability for ages 50+ and extend the disability incidence assumption to the earlier of age 55 with 20 years of service or age 70; overall, proposed rates result in more projected disabilities.
- Change the base mortality table to the PUB-2010 public safety mortality table, with rates adjusted to better fit observed plan experience and with future improvement projected using scale MP-2019.
- Minor changes to the form of payment and percent married assumptions.

The recommendations are summarized on the following pages.

Review of the investment return assumption and actuarial methods is outside the scope of this experience study. Please refer to GRS' General Employees Retirement Plan experience study dated June 27, 2019. This report concluded that the current investment return assumption was within a reasonable range as of the date of the report, but that a rate near the median, such as 7.0%, would be likely to be sustainable for a longer period.

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

Introduction

Each year as of June 30, the actuarial liabilities of the Association 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 PERA Trustees.

A single set of assumptions will not be suitable indefinitely. Things change, and our understanding of things (whether or not they are changing) also changes. The package of assumptions is then adjusted to reflect basic experience trends -- but not random year to year fluctuations. Actuarial assumptions were last revised for the June 30, 2017 actuarial valuation based on the results of the most recent experience study. Economic assumptions were last revised for the June 30, 2018 actuarial valuation. Minor assumption changes to the mortality projection scale were adopted with the June 30, 2019 actuarial valuation. All experience was compared to assumptions in effect as of the June 30, 2019 actuarial valuation.

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

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

Summary of Decrement Experience 2015-2019

Decrement Risk Area	Actual Number	Expected		
		Present Assumptions	Proposed Assumptions	Change
<i>Unreduced Retirement</i>	717	683.7	718.1	34.4
<i>Reduced Retirement</i>	357	518.3	405.5	(112.8)
<i>Withdrawal, < 3 years of service</i> Males and females	402	200.9	287.4	86.5
<i>Withdrawal, > 3 years of service</i> Males and females	581	446.0	453.2	7.2
<i>Disability</i>	285	214.8	272.6	57.8
<i>Mortality</i>				
Healthy Retired Lives - Male	636	669.5	636.5	(33.0)
- Female	15	23.7	21.6	(2.1)
Disabled Retired Lives - Male	79	60.4	69.9	9.5
- Female	0	2.5	2.8	0.3
Active Lives - Male	26	48.0	34.6	(13.4)
- Female	2	3.3	2.9	(0.4)

The figures in the exhibit above are actual headcounts of occurrences. Calculations in the body of the report are liability-weighted for retirement, withdrawal and active mortality and benefit-weighted for healthy and disabled retiree mortality.

SECTION B

PAY INCREASES

Pay Increases

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

- Payroll growth is an across-the-board, economic type of increase granted to most or all members of the group and is associated with a stable or level population. This increase is typically tied to inflation or cost-of-living changes, and
- An increase as a result of merit and seniority. This increase is typically related to the performance of an individual and includes promotions and increased years of experience.

Inflation and Payroll Growth

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

General inflation, as measured by the change in Consumer Price Index, has averaged about 1.8% over the four-year period ending June 30, 2019. During the 2016 to 2018 calendar year period, the increase in the national average earnings has been about 2.7% (the 2019 national average earnings amount was not available at the time this report was published). Actual annual payroll growth for this plan for the four-year period ending June 30, 2019 has averaged approximately 4.6%. Active membership during this time increased 5.4%, from 11,157 as of July 1, 2015 to 11,763 as of July 1, 2019.

A thorough review of general inflation and payroll growth is presented in Section B of the PERA General Employees Retirement Plan experience study report dated June 27, 2019. In that report, we recommended a general inflation assumption equal to 2.25% and a payroll growth assumption of 3.00%; note that the decrease in payroll growth assumption is due to the change in inflation only (i.e., there was no recommended change to the 0.75% real wage growth assumption).

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

Pay Increases Due to Merit and Seniority

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

In order to study the merit and seniority portion of the salary increase assumption, it is necessary to separate out the portion attributable to wage inflation for this group. Based on our review of salary experience for PEPFP members for the period July 1, 2015 through June 30, 2019, we observed that members with longer service averaged about a 3.5% annual increase for this period. We assumed the salary increase amount for these members was attributable to wage inflation only. This assumes that once members reach a certain length of service, merit and seniority increases are much less common.

The assumed wage inflation was 3.50% at the beginning of the study period and 3.25% as of June 30, 2019. As described above, during the four years of the study, we estimated that the average actual wage inflation component of pay increases was around 3.50% for members of the Public Employees Police and Fire Plan. This estimated 3.50% wage inflation increase was subtracted from the actual pay increases to obtain the estimated merit/seniority portion of the pay increases. It should be noted that the results of the analysis are very sensitive to the estimated wage inflation component.

Pay Increases Due to Merit and Seniority

Findings

Gross actual salary increases averaged 4.92% over the four-year period, ranging from 4.32% in 2016 to 5.62% in 2017. After adjusting for the 3.5% average wage inflation for this period, the average net salary increase (i.e., merit and seniority) averaged 1.42%, ranging from 0.82% to 2.12%.

Fiscal Year Ending	Count	Gross		Net*	
		Expected	Actual	Expected	Actual
2016	9,877	5.16%	4.32%	1.91%	0.82%
2017	10,018	5.24%	5.62%	1.99%	2.12%
2018	10,225	5.27%	5.08%	2.02%	1.58%
2019	10,231	5.31%	4.66%	2.06%	1.16%
Total	40,351	5.24%	4.92%	1.99%	1.42%

** Net Expected increases are equal to Gross Expected increases minus the current assumed wage inflation assumption of 3.25%. Net Actual increases are equal to Gross Actual increases minus the estimated actual wage inflation for the period of 3.5%.*

Actual salary increases in fiscal years ending June 30, 2017 and June 30, 2018 were greater than the other two years. A number of special events, including protests and civil unrest in urban areas as well as the 2018 Super Bowl likely resulted in additional earnings for some active members.

Using the techniques described above, observed merit and seniority pay increases were generally lower than the presently assumed increases, especially early in the member's career. The result is that the proposed merit and seniority increases are 24 basis points lower on average, with more significant proposed changes in years 2 through 10. When combined with the proposed decrease in payroll growth assumption, the result is an overall decrease in gross salary increase rates of approximately 49 basis points.

Recommendation

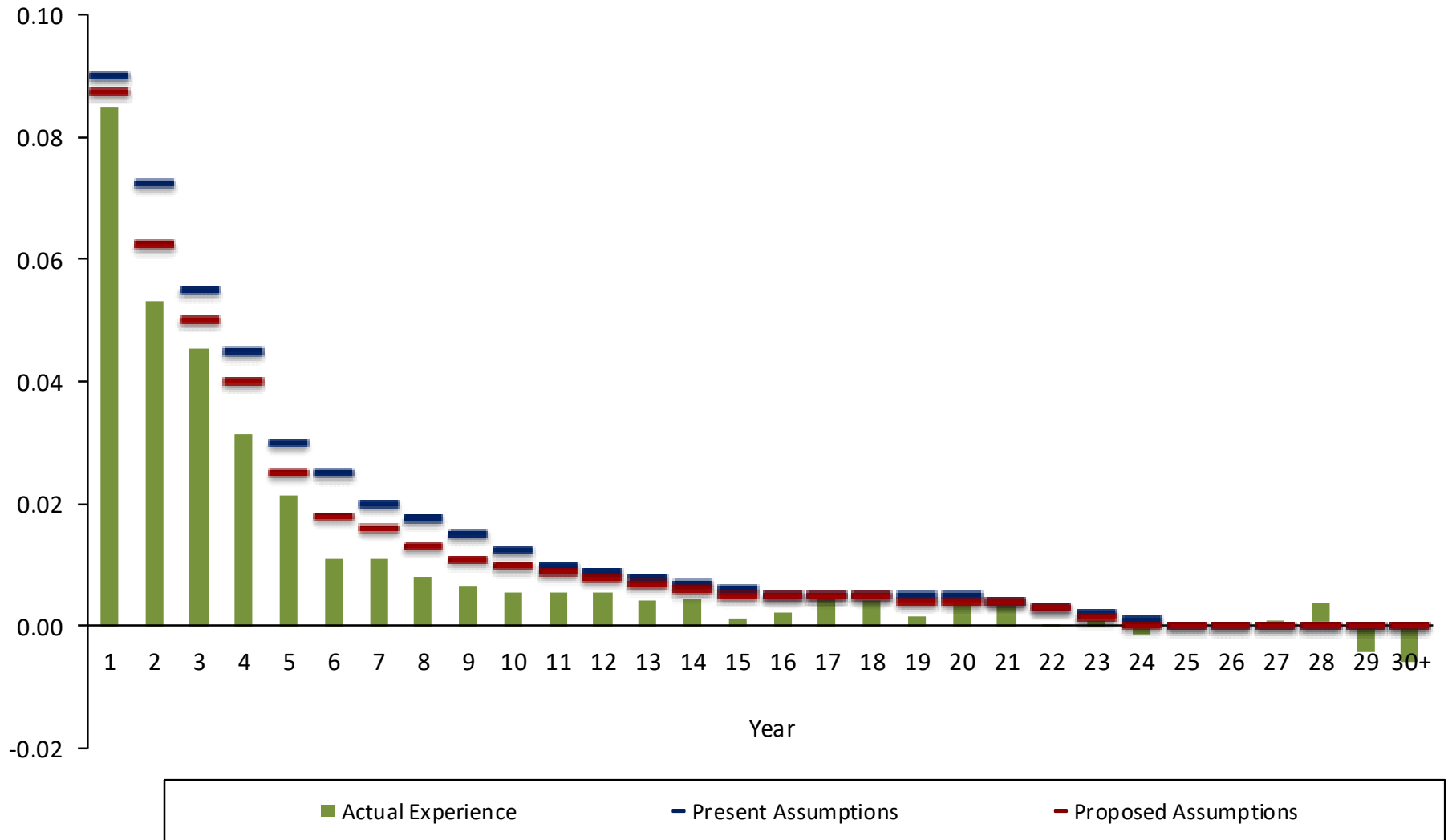
We recommend adjustments to the current merit/seniority pay increase assumption as shown on the following page.

Pay Increases Due to Merit and Seniority

Year	Exposures	Total Salary % Increase			Merit & Seniority % Increase		
		Actual	Current	Proposed	Actual	Current	Proposed
1	1,708	11.99%	12.25%	11.75%	8.49%	9.00%	8.75%
2	2,315	8.81%	10.50%	9.25%	5.31%	7.25%	6.25%
3	2,077	8.05%	8.75%	8.00%	4.55%	5.50%	5.00%
4	1,778	6.65%	7.75%	7.00%	3.15%	4.50%	4.00%
5	1,442	5.62%	6.25%	5.50%	2.12%	3.00%	2.50%
6	1,237	4.61%	5.75%	4.80%	1.11%	2.50%	1.80%
7	1,218	4.59%	5.25%	4.60%	1.09%	2.00%	1.60%
8	1,409	4.30%	5.00%	4.30%	0.80%	1.75%	1.30%
9	1,629	4.15%	4.75%	4.10%	0.65%	1.50%	1.10%
10	1,846	4.04%	4.50%	4.00%	0.54%	1.25%	1.00%
11	1,838	4.04%	4.25%	3.90%	0.54%	1.00%	0.90%
12	1,651	4.04%	4.15%	3.80%	0.54%	0.90%	0.80%
13	1,541	3.91%	4.05%	3.70%	0.41%	0.80%	0.70%
14	1,444	3.94%	3.95%	3.60%	0.44%	0.70%	0.60%
15	1,487	3.63%	3.85%	3.50%	0.13%	0.60%	0.50%
16	1,663	3.72%	3.75%	3.50%	0.22%	0.50%	0.50%
17	1,732	3.95%	3.75%	3.50%	0.45%	0.50%	0.50%
18	1,767	3.92%	3.75%	3.50%	0.42%	0.50%	0.50%
19	1,677	3.66%	3.75%	3.40%	0.16%	0.50%	0.40%
20	1,529	3.95%	3.75%	3.40%	0.45%	0.50%	0.40%
21	1,357	3.96%	3.65%	3.40%	0.46%	0.40%	0.40%
22	1,157	3.52%	3.55%	3.30%	0.02%	0.30%	0.30%
23	954	3.59%	3.45%	3.15%	0.09%	0.20%	0.15%
24	765	3.36%	3.35%	3.00%	-0.14%	0.10%	0.00%
25	649	3.46%	3.25%	3.00%	-0.04%	0.00%	0.00%
26	547	3.56%	3.25%	3.00%	0.06%	0.00%	0.00%
27	528	3.60%	3.25%	3.00%	0.10%	0.00%	0.00%
28	468	3.87%	3.25%	3.00%	0.37%	0.00%	0.00%
29	365	3.07%	3.25%	3.00%	-0.43%	0.00%	0.00%
30+	573	2.91%	3.25%	3.00%	-0.59%	0.00%	0.00%
Total*	40,351	4.92%	5.24%	4.75%	1.42%	1.99%	1.75%

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

Pay Increases Due to Merit and Seniority



SECTION C

RETIREMENT EXPERIENCE

Liability-Weighted Analysis

Our experience with similar systems has shown that sometimes the use of assumptions based solely on counts of people retiring or terminating employment does not always reduce the size of the gain or loss in a particular decrement. Sometimes this can be due to the relative magnitude of the actuarial accrued liability of the members that decrement, rather than number counts alone. Consistent with recent experience studies for other PERA plans, we have used “liability-weighted rate” for certain decrements. This represents the crude rate of decrement on a liability-weighted basis as opposed to strictly a number count basis. The liability-weighted rates were found to be more highly correlated with withdrawal and retirement decrements (particularly with reduced retirement) than with the population related rates. This makes some intuitive sense, since retirement and termination decisions are often made based on how much the members have to gain or lose if they retire or change jobs, whereas death and disability are typically not decisions at all but rather events that happen. Comments on specific assumptions are provided on the following pages.

While mortality is not a voluntary human behavior, a recent study by the Society of Actuaries found that mortality experience was highly correlated with education and income. That is, people with higher incomes and higher levels of education tended to live longer than others. As such, we also studied mortality rates on a “benefit-weighted” basis. This is discussed in more detail on page F-1.

Age and Service Unreduced (Normal) Retirement

Findings

The benefit provisions of the Public Employees Police and Fire Plan (PEPFP) 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 70; in other words, we assume all members currently under the age of 70 will retire by the age of 70. However, for members currently age 70 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 70 since the valuation assumption is all of these members work an additional year and then retire. During the four-year period, there were three actual retirements at ages 70 and older.

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

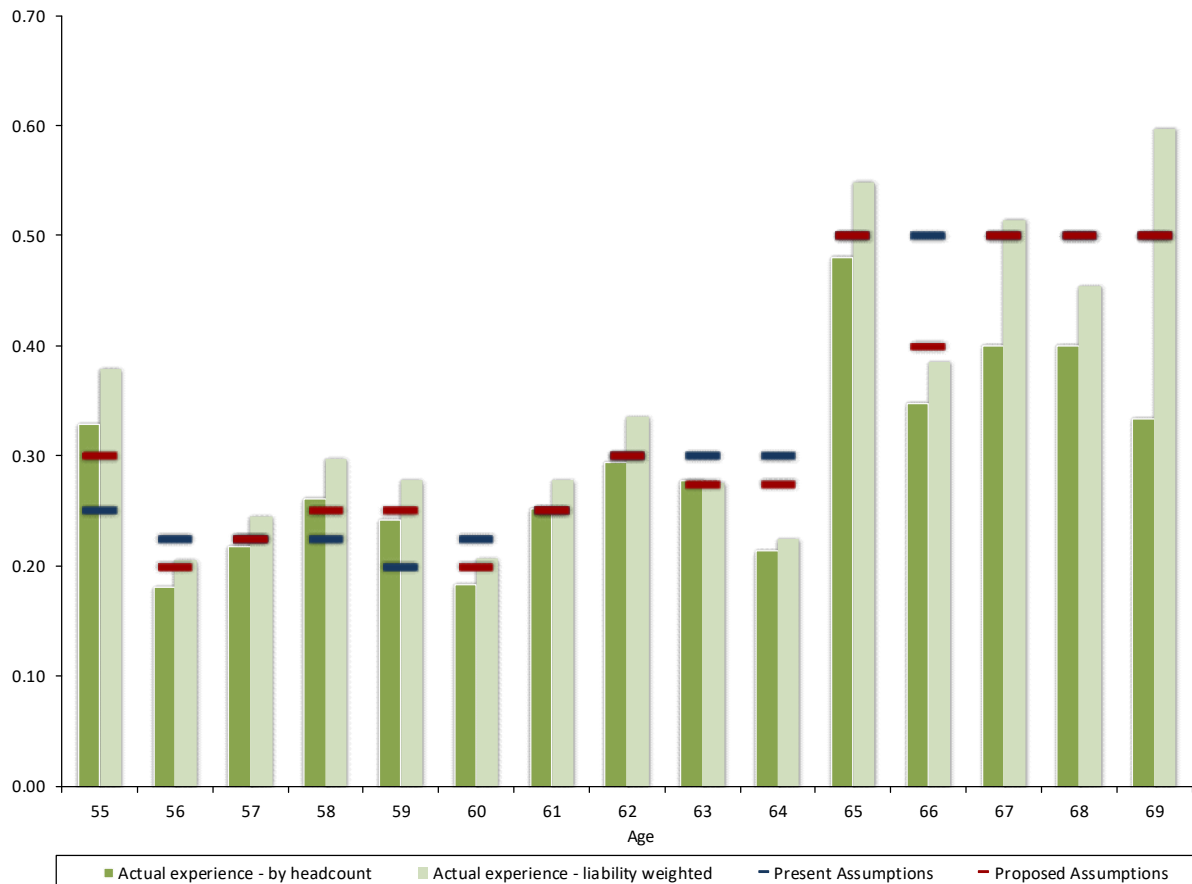
Recommendations

We recommend changes to the retirement rates as indicated 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 70 delay retirement one year and instead assume these members retire mid-year after the valuation date, the same as members younger than age 70.

Age and Service Unreduced (Normal) Retirement

Age	Liability-Weighted (\$000s)		Crude Rates		Sample Rates		Expected Retirements*		Ratio of Actuals/Expecteds	
	Retirements	Exposure	Liability-Weighted	Population-Weighted			Current	Proposed	Current	Proposed
55	221,750	585,882	0.3785	0.3285	0.2500	0.3000	146,470.74	175,764.60	151.4%	126.2%
56	75,482	368,184	0.2050	0.1800	0.2250	0.2000	82,841.21	73,636.80	91.1%	102.5%
57	70,471	288,575	0.2442	0.2168	0.2250	0.2250	64,929.01	64,929.38	108.5%	108.5%
58	66,545	224,341	0.2966	0.2606	0.2250	0.2500	50,476.71	56,085.25	131.8%	118.6%
59	43,618	156,718	0.2783	0.2422	0.2000	0.2500	31,343.69	39,179.50	139.2%	111.3%
60	22,383	108,435	0.2064	0.1824	0.2250	0.2000	24,397.97	21,687.00	91.7%	103.2%
61	24,998	89,935	0.2780	0.2520	0.2500	0.2500	22,483.88	22,483.75	111.2%	111.2%
62	20,282	60,397	0.3358	0.2935	0.3000	0.3000	18,119.01	18,119.10	111.9%	111.9%
63	12,143	44,144	0.2751	0.2778	0.3000	0.2750	13,242.85	12,139.60	91.7%	100.0%
64	9,115	40,613	0.2244	0.2131	0.3000	0.2750	12,184.07	11,168.58	74.8%	81.6%
65	17,385	31,726	0.5480	0.4800	0.5000	0.5000	15,863.15	15,863.00	109.6%	109.6%
66	4,753	12,353	0.3848	0.3478	0.5000	0.4000	6,177.09	4,941.20	76.9%	96.2%
67	2,912	5,672	0.5134	0.4000	0.5000	0.5000	2,836.13	2,836.00	102.7%	102.7%
68	440	970	0.4536	0.4000	0.5000	0.5000	484.77	485.00	90.8%	90.7%
69	468	784	0.5969	0.3333	0.5000	0.5000	391.85	392.00	119.4%	119.4%
70	*	*	N/A	N/A	*	*	N/A	N/A	N/A	N/A
Totals	592,745	2,018,729					492,242.13	519,710.76	120.4%	114.1%

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



Reduced Early Retirement

Findings

PEPFP 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 and 0.10% (0.20% for members enrolled in the plan after June 30, 2007) reduction for each month the member is under age 55. If the effective date of retirement is after June 30, 2019, the reduction is 5/12% for each month that the member is under age 55 at the time of retirement. The change in early retirement factors was phased-in over a five-year period for retirements occurring between July 1, 2014 and June 30, 2019.

Generally, higher rates of early retirement result in higher computed contributions due to the enhanced benefit, and vice-versa.

We reviewed the experience during the study period. On a population-weighted basis, there were fewer early retirements than expected at ages 50 to 53. There were similar results on a liability-weighted basis.

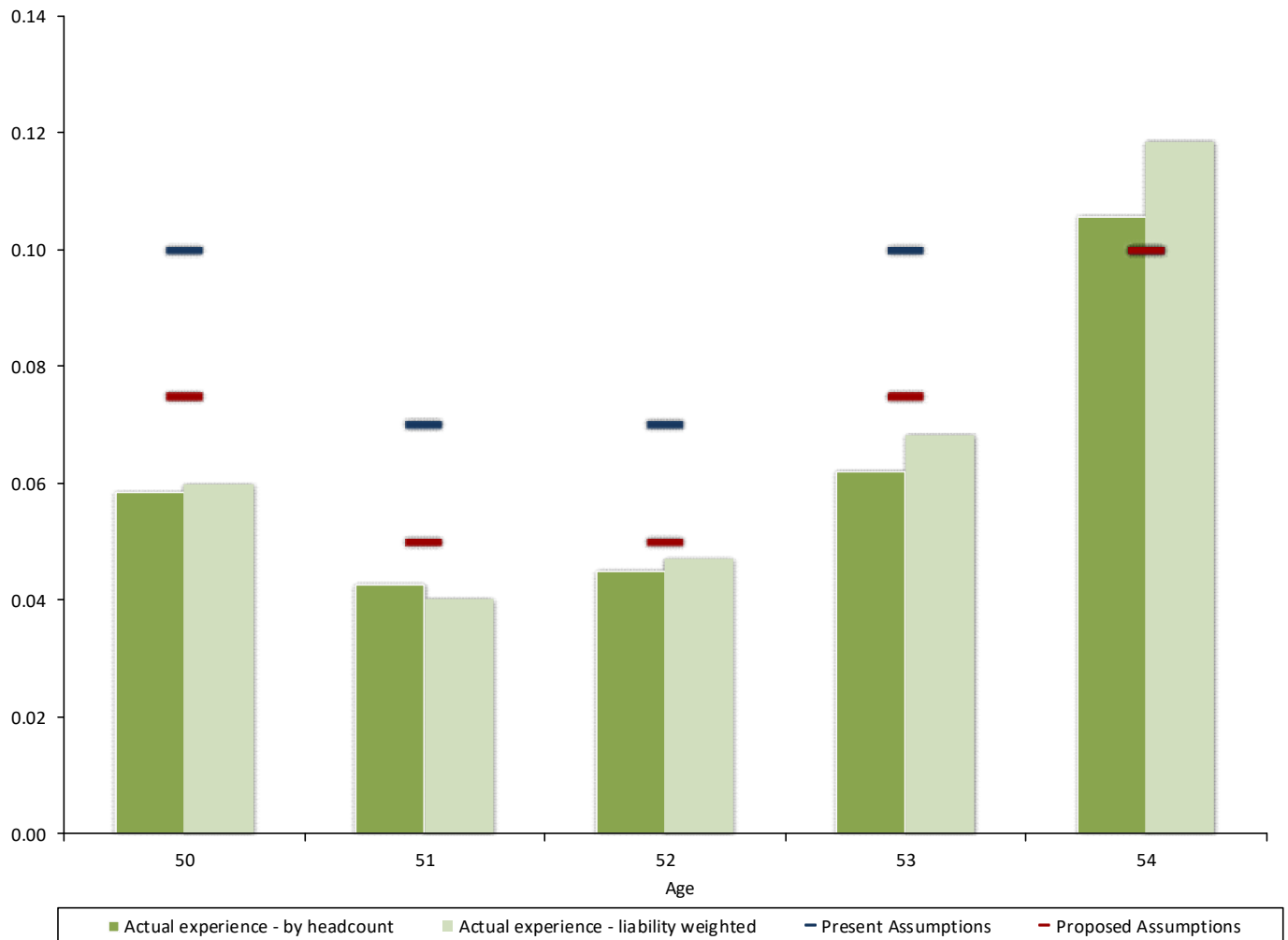
It was noted in the prior experience study that early retirements for the year ending June 30, 2014 were significantly greater than other years in that study. The changes to early retirement benefits described above resulted in more early retirements before June 30, 2014, thereby resulting in fewer retirements after June 30, 2014. Our recommendation to decrease early retirement rates is consistent with expected behavior changes as a result of the change in benefit provisions.

Recommendation

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

Reduced Early Retirement

Age	Liability-Weighted (\$000s)		Crude Rates		Sample Rates		Expected Retirements		Ratio of Actuals/Expecteds	
	Retirements	Exposure	Liability-Weighted	Population-Weighted			Current	Proposed	Current	Proposed
50	59,963	1,000,694	0.0599	0.0584	0.1000	0.0750	100,069.49	75,052.05	59.9%	79.9%
51	36,946	916,154	0.0403	0.0427	0.0700	0.0500	64,130.76	45,807.70	57.6%	80.7%
52	41,008	873,260	0.0470	0.0450	0.0700	0.0500	61,128.19	43,663.00	67.1%	93.9%
53	55,271	809,960	0.0682	0.0621	0.1000	0.0750	80,995.98	60,747.00	68.2%	91.0%
54	83,933	708,576	0.1185	0.1055	0.1000	0.1000	70,857.65	70,857.60	118.5%	118.5%
Total	277,121	4,308,644	0.0643	0.0603			377,182.07	296,127.35	73.5%	93.6%



Retirement from Deferred Status

Members who terminate and meet the following vesting requirements are entitled to either a refund of employee contributions, with interest, or a deferred retirement benefit:

Years of Service	Vesting Percent if First Hired		
	Before 7/1/2010	After 6/30/2010 & before 7/1/2014	After 6/30/2014
< 3	0	0	0
3 – 4	100	0	0
5	100	50	0
6	100	60	0
7	100	70	0
8	100	80	0
9	100	90	0
10	100	100	50
11	100	100	55
12	100	100	60
13	100	100	65
14	100	100	70
15	100	100	75
16	100	100	80
17	100	100	85
18	100	100	90
19	100	100	95
20+	100	100	100

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 on approximately an actuarially equivalent basis, meaning this assumption results in no significant liability gain or loss to the plan 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 assume a higher rate of termination during the first three years of employment with age-based rates after the three-year select period. The withdrawal assumption review was done on a liability-weighted basis, as described earlier in the report.

Withdrawal Experience

Findings

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

We observed the plan experienced more liability decrementing from the plan than expected due to terminations.

Recommendation

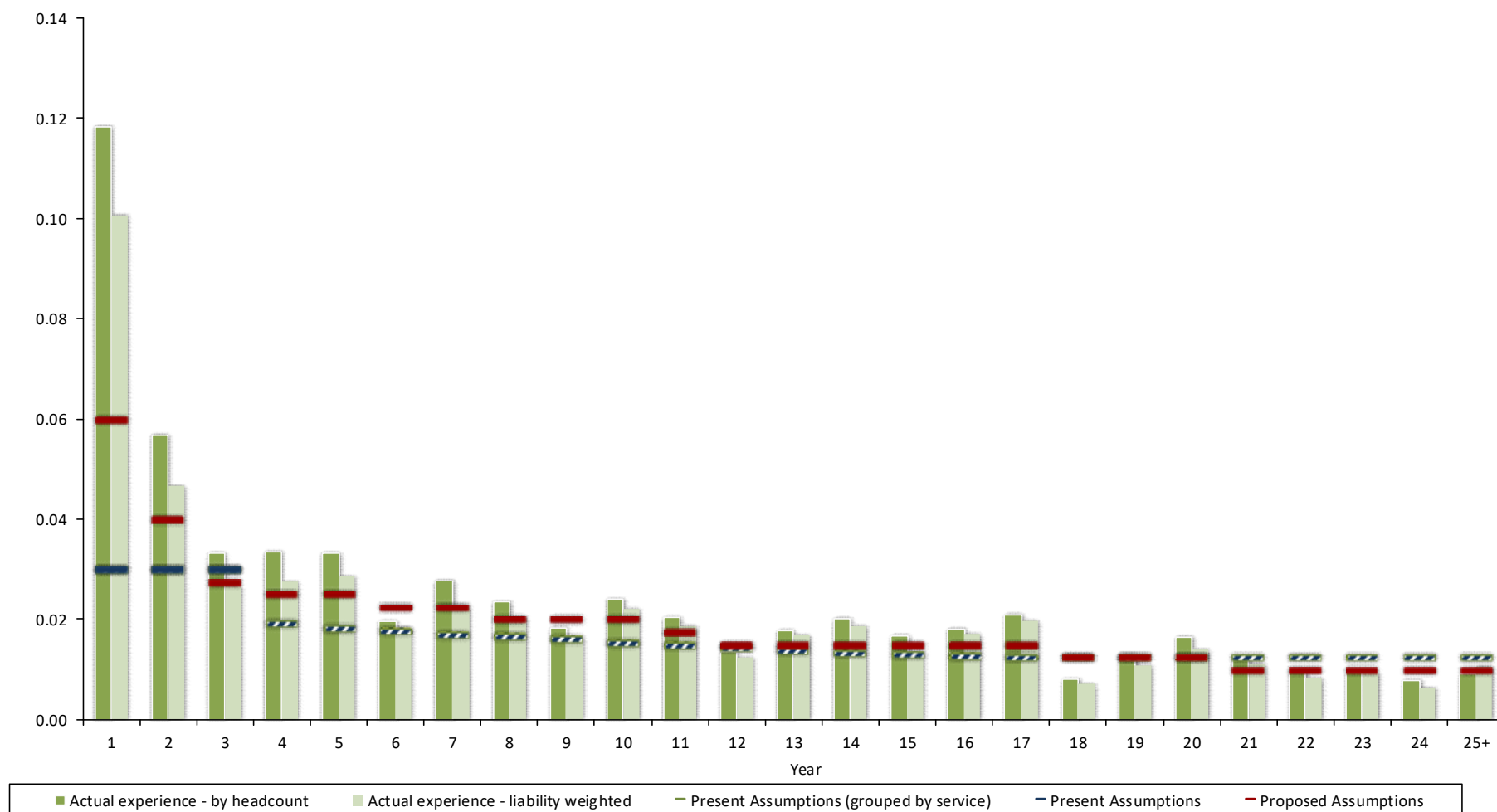
We recommend increased rates of withdrawal as detailed on the next pages.

Withdrawal Experience* – Males and Females

Year	Liability-Weighted (\$ 000s)		Crude Rates		Sample Rates		Liability-Weighted (\$ 000s)			
	Withdrawals	Exposure	Liability-Weighted	Population-Weighted	Sample Rates		Expected Withdrawals		Ratio of Actuals/Expecteds	
					Current	Proposed	Current	Proposed	Current	Proposed
1	16,414	163,233	0.1006	0.1182	0.0300	0.0600	4,897	9,794	335.2%	167.6%
2	27,375	586,016	0.0467	0.0567	0.0300	0.0400	17,580	23,441	155.7%	116.8%
3	16,999	643,110	0.0264	0.0332	0.0300	0.0275	19,293	17,686	88.1%	96.1%
4	16,450	599,014	0.0275	0.0335	0.0192	0.0250	11,530	14,975	142.7%	109.8%
5	15,381	536,461	0.0287	0.0331	0.0183	0.0250	9,841	13,412	156.3%	114.7%
6	8,095	446,192	0.0181	0.0197	0.0176	0.0225	7,869	10,039	102.9%	80.6%
7	8,867	397,779	0.0223	0.0278	0.0171	0.0225	6,792	8,950	130.6%	99.1%
8	8,126	402,917	0.0202	0.0235	0.0166	0.0200	6,683	8,058	121.6%	100.8%
9	7,947	491,300	0.0162	0.0184	0.0161	0.0200	7,902	9,826	100.6%	80.9%
10	13,247	597,449	0.0222	0.0239	0.0155	0.0200	9,236	11,949	143.4%	110.9%
11	13,105	704,441	0.0186	0.0203	0.0148	0.0175	10,455	12,328	125.3%	106.3%
12	8,989	722,888	0.0124	0.0134	0.0143	0.0150	10,315	10,843	87.1%	82.9%
13	11,266	668,348	0.0169	0.0178	0.0138	0.0150	9,193	10,025	122.6%	112.4%
14	12,080	645,435	0.0187	0.0201	0.0133	0.0150	8,578	9,682	140.8%	124.8%
15	8,113	612,579	0.0132	0.0167	0.0129	0.0150	7,931	9,189	102.3%	88.3%
16	11,220	659,543	0.0170	0.0180	0.0127	0.0150	8,370	9,893	134.1%	113.4%
17	14,895	750,900	0.0198	0.0208	0.0126	0.0150	9,435	11,264	157.9%	132.2%
18	5,747	809,012	0.0071	0.0081	0.0125	0.0125	10,125	10,113	56.8%	56.8%
19	9,113	835,621	0.0109	0.0131	0.0125	0.0125	10,447	10,445	87.2%	87.2%
20	11,303	810,012	0.0140	0.0165	0.0125	0.0125	10,125	10,125	111.6%	111.6%
21	8,065	734,916	0.0110	0.0122	0.0125	0.0100	9,186	7,349	87.8%	109.7%
22	5,029	622,821	0.0081	0.0097	0.0125	0.0100	7,785	6,228	64.6%	80.8%
23	4,866	520,620	0.0093	0.0095	0.0125	0.0100	6,508	5,206	74.8%	93.5%
24	2,437	378,716	0.0064	0.0077	0.0125	0.0100	4,734	3,787	51.5%	64.4%
25+	7,261	682,446	0.0106	0.0090	0.0125	0.0100	8,531	6,824	85.1%	106.4%
Totals	272,390	15,021,769	0.0181	0.0267	0.0155	0.0174	233,340	261,431	116.7%	104.2%

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

Withdrawal Experience – Males and Females



SECTION E

DISABILITY EXPERIENCE

Disability Experience

PEPFP members who are physically or mentally unable to perform normal duties as a police officer or fire fighter are eligible to receive a disability retirement benefit. Members must have at least one year of service unless disability is duty-related. Eligibility for disability benefits continues until age 55 or older with 15 or more years of service (20 years if duty-related disability).

The current disability retirement benefit is equal to 3% 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).

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

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

Findings

We reviewed the disability experience during the four-year period. The results are shown on the following pages. Overall, the actual number of disability retirements (285) is more than the number projected by the present assumption (215 – see charts on the following pages).

Members must apply within 18 months from the date public service is terminated and must provide evidence of the inability to perform job-related duties. As such, there could be a delay in the classification of a member as a disability retirement. In fact, over the course of the four-year period, there were approximately 57 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.

Most members will have 20 years of service by age 55 and will not be eligible for a disability benefit. However, there were 24 members age 55 or older that were reported as disabilities over the four-year period of our study; this suggests there is high utilization among the few members that are eligible. Experience for this group was similar in the prior experience study.

Recommendation

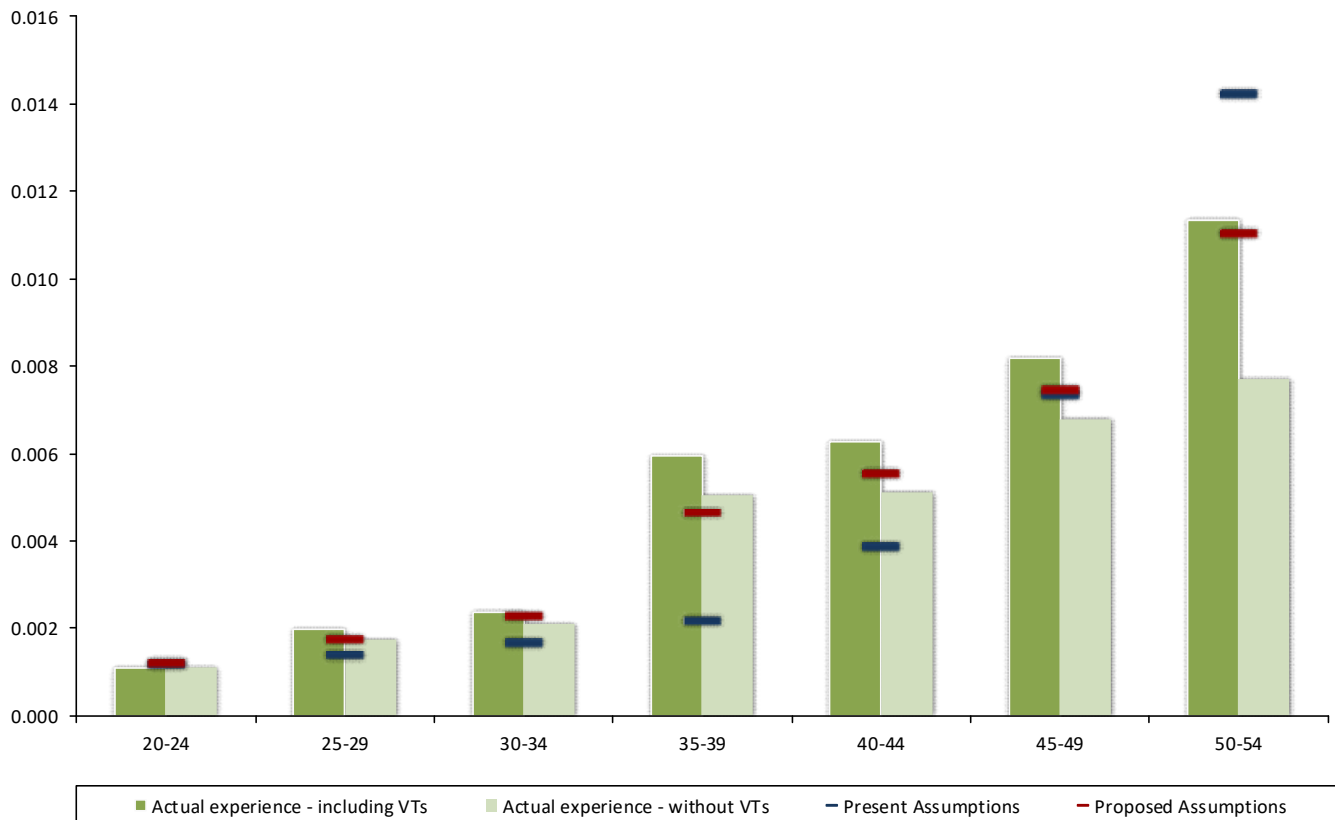
We recommend adopting higher rates of disability for members younger than age 45 and lower rates of disability at ages 50 to 54. We also recommend continuing the disability incidence assumption to the earlier of age 55 with 20 years of service or age 70.

Disability Experience Males and Females

Age	Disabilities Including Terminations	Exposure**	Crude Rates		Sample Rates*		Expected Disabilities**		Ratio of Actuals/Expecteds	
			With Terminations	Without Terminations						
					Current	Proposed	Current	Proposed	Current	Proposed
20-24	1	912	0.0011	0.0011	0.0012	0.0013	1.14	1.14	87.7%	87.7%
25-29	9	4,548	0.0020	0.0018	0.0014	0.0018	6.41	8.03	140.5%	112.1%
30-34	17	7,179	0.0024	0.0021	0.0017	0.0023	12.12	16.46	140.3%	103.3%
35-39	47	7,916	0.0059	0.0051	0.0022	0.0047	17.05	37.02	275.6%	127.0%
40-44	49	7,811	0.0063	0.0051	0.0039	0.0056	30.60	43.49	160.1%	112.7%
45-49	69	8,426	0.0082	0.0068	0.0074	0.0075	61.72	63.06	111.8%	109.4%
50-54	69	6,088	0.0113	0.0077	0.0143	0.0111	84.17	67.38	82.0%	102.4%
55-59	21	75	0.2800	0.2267	0.0209	0.3904	1.55	29.28	1352.6%	71.7%
60+	3	-	N/A	N/A	0.0220	N/A	-	6.73	N/A	44.6%
Totals	285	42,955	0.0066	0.0053	0.0050	0.0063	214.76	272.59	132.7%	104.6%

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

** Currently, the disability assumption is only applied to members that are not eligible for Normal Retirement (age 55 with three years of service; members hired after June 30, 2010 are eligible after five years of service), which is the reason for the low number of Exposures after age 55. In order to measure the proposed rates at ages 55+, proposed expected disabilities are based on exposures for all active members at these ages.



Actual experience for ages 55 and over is not shown on the graph above since including it would make the remaining data on the graph illegible.

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.

The New Mortality Tables and Projection Scale

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

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

Projection Scale

Fully generational tables, which are utilized for the PERA valuations, help take into account future improvements in mortality that are expected to occur. The Society of Actuaries updates the projection scale annually and the latest published table is called the MP-2019 Projection Scale.

Mortality Experience

Findings

Most pension systems will have insufficient data for full credibility in setting a mortality assumption. The general rule of thumb is that approximately 1,000 deaths are required of each gender in the experience period for full credibility with a 90% confidence level. When less than 1,000 deaths occur during the experience study period, partial credibility can be given to the plan's experience based on the actual number of deaths that occurred.

During the four-year period, there were 636 male retiree deaths and 15 female retiree deaths. The healthy retiree mortality experience is not considered to be fully credible since there were less than 1,000 deaths. Therefore, we recommend a blend of the standard industry table and the plan's experience. Pre-retirement mortality and disabled retiree experience is also not considered to be fully credible.

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 fewer male deaths than expected (\$34,696,000 actual versus \$37,162,000 expected) and fewer female deaths than expected (\$477,000 actual versus \$871,000 expected).

Disabled Retirees

On a benefit-weighted basis, the plan experienced more deaths among disabled males (\$3,817,000) as projected by the present assumptions (\$3,060,000). There were no actual deaths among disabled females while \$100,000 were projected by the present assumptions.

Active Members

On a liability-weighted basis, the actual number of male deaths among active members (\$15,232,000) was lower than the number projected by the present assumption (\$27,177,000). The plan experienced fewer deaths on a liability-weighted basis among females (\$1,462,000) than projected by the present assumptions (\$1,846,000).

Mortality Experience

The recommended adjustment factors are based on credibility theory formulas. For example, in the Police and Fire Plan, the proposed male disabled retiree mortality table predicts too few deaths. If the experience were fully credible (i.e., more than 1,000 deaths), we would adjust the table by a factor of 1.18. However, since there were only 79 male disabled retiree deaths (on a headcount-weighted basis) during the four-year period, we restrict the credibility of the plan's experience and limit the adjustment applied to the standard table to a factor of 1.05.

Recommendations

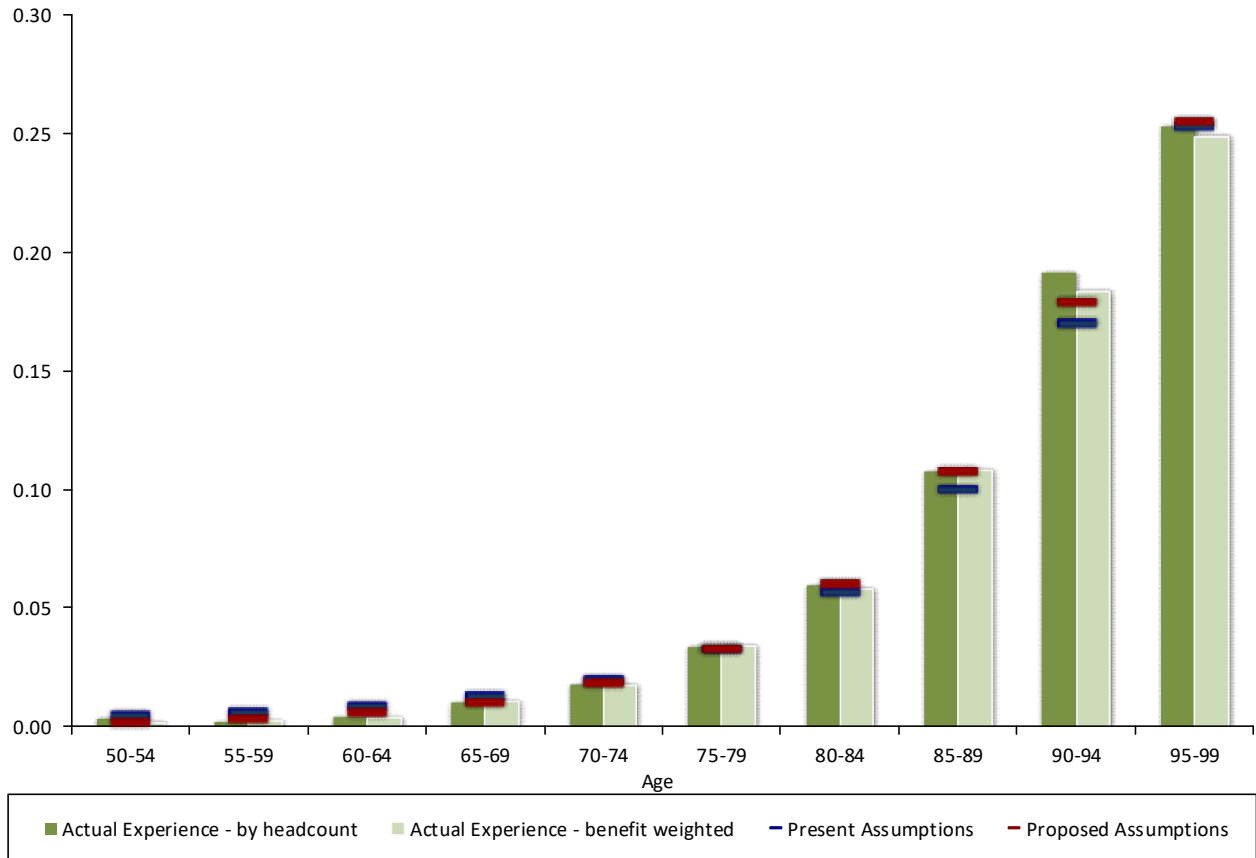
We recommend adoption of the Pub-2010 mortality tables, with adjustments as indicated below. All recommended tables are Benefit-Weighted.

Healthy Male Retirees:	Pub-2010 Male Healthy Retired Public Safety Mortality Table adjusted for mortality improvements using projection scale MP-2019. Rates are multiplied by a factor of 0.98.
Healthy Female Retirees:	Pub-2010 Female Healthy Retired Public Safety Mortality Table, adjusted for mortality improvements using projection scale MP-2019.
Disabled Male Retirees:	Pub-2010 Male Public Safety Disabled Retiree Mortality Table, adjusted for mortality improvements using projection scale MP-2019. Rates are multiplied by a factor of 1.05.
Disabled Female Retirees:	Pub-2010 Female Public Safety Disabled Retiree Mortality Table, adjusted for mortality improvements using projection scale MP-2019.
Male Active Members:	Pub-2010 Male Public Safety Employee Mortality Table adjusted for mortality improvements using projection scale MP-2019.
Female Active Members:	Pub-2010 Female Public Safety Employee Mortality Table adjusted for mortality improvements using projection scale MP-2019.

Post-Retirement Mortality Experience Healthy Males

Age	Benefit-Weighted (\$000s)		Crude Rates		Sample Rates		Benefit-Weighted (\$000s)		Ratio of Actuals/Expecteds	
	Deaths	Exposure	Benefit-Weighted	Population-Weighted	Expected Deaths		Current	Proposed*	Current	Proposed*
					Current	Proposed*				
50-54	121	68,180	0.001775	0.003529	0.004660	0.002190	334.30	160.28	36.2%	75.5%
55-59	476	227,099	0.002096	0.002237	0.006498	0.003753	1,495.32	871.22	31.8%	54.6%
60-64	1,032	282,857	0.003648	0.004111	0.009200	0.006451	2,612.65	1,834.89	39.5%	56.2%
65-69	3,017	294,585	0.010242	0.010296	0.013318	0.010695	3,927.24	3,154.89	76.8%	95.6%
70-74	4,144	236,245	0.017541	0.017638	0.020383	0.018434	4,737.87	4,270.21	87.5%	97.0%
75-79	6,061	179,225	0.033818	0.033600	0.033353	0.033222	5,900.55	5,868.86	102.7%	103.3%
80-84	6,449	111,596	0.057789	0.059512	0.057165	0.060542	6,273.63	6,639.69	102.8%	97.1%
85-89	7,235	66,951	0.108064	0.107901	0.100530	0.108131	6,550.19	7,047.91	110.5%	102.7%
90-94	4,907	26,724	0.183618	0.191579	0.170397	0.179473	4,251.45	4,511.79	115.4%	108.8%
95-99	974	3,915	0.248787	0.253333	0.253627	0.255310	953.87	964.54	102.1%	101.0%
100+	280	394	0.710660	0.714286	0.348242	0.348154	125.36	124.85	223.4%	224.3%
Totals	34,696	1,497,771	0.023165	0.023139	0.024812	0.023561	37,162.44	35,288.85	93.4%	98.3%

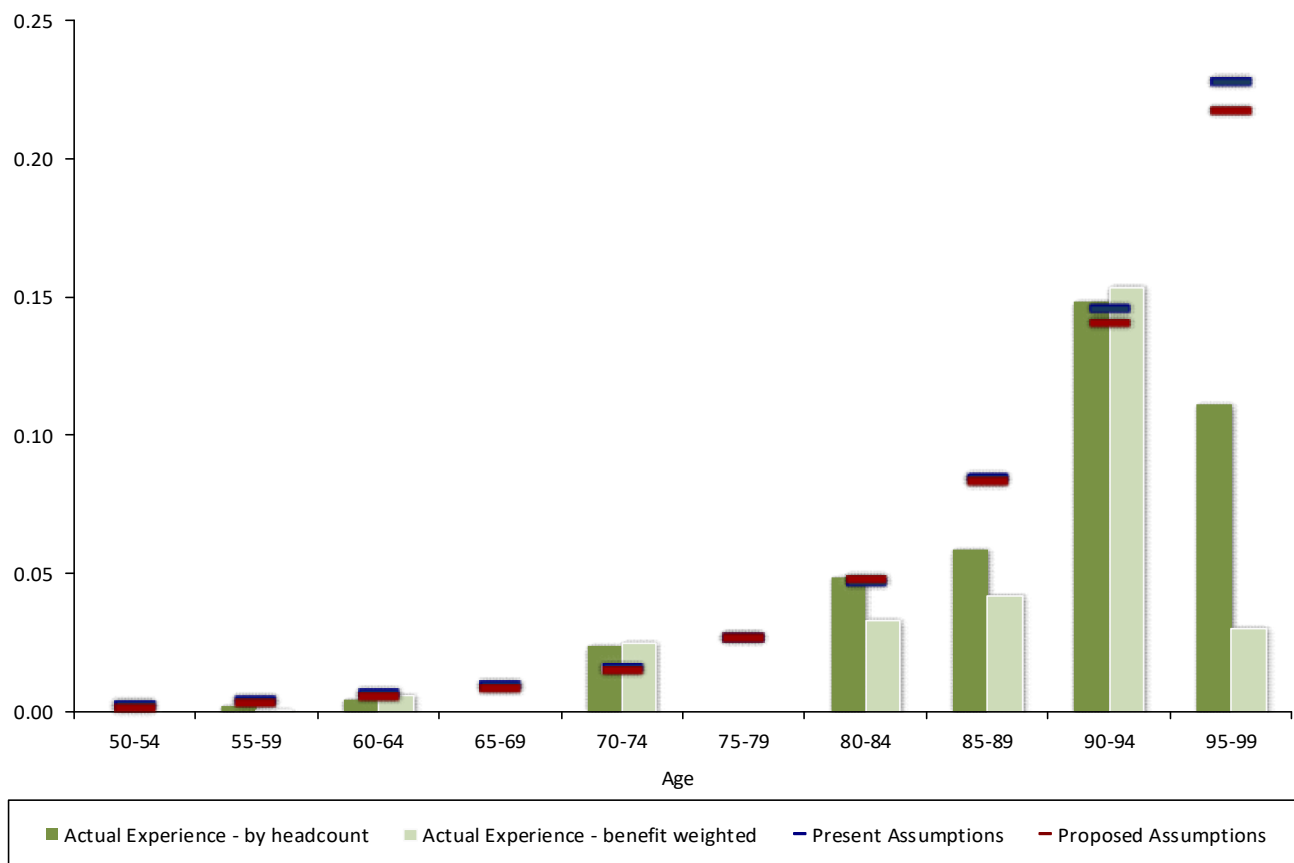
* In order to show the fit for the four-year period of the study, Proposed Sample Rates and Proposed Expected Deaths were determined using the proposed mortality rates for 2010 projected to the mid-point of the study using projection scale MP-2019.



Post-Retirement Mortality Experience Healthy Females

Age	Benefit-Weighted (\$000s)		Crude Rates		Sample Rates		Benefit-Weighted (\$000s)		Ratio of Actuals/Expecteds	
	Deaths	Exposure	Benefit-Weighted	Population-Weighted	Current	Proposed	Current	Proposed*	Current	Proposed*
50-54	-	12,067	0.000000	0.000000	0.003159	0.001894	40.13	25.10	0.0%	0.0%
55-59	18	29,937	0.000601	0.001761	0.004607	0.003439	137.98	102.92	13.0%	17.5%
60-64	125	21,889	0.005711	0.004376	0.006851	0.005664	147.16	121.12	84.9%	103.2%
65-69	-	9,284	0.000000	0.000000	0.010231	0.009097	93.19	82.67	0.0%	0.0%
70-74	74	3,017	0.024528	0.024096	0.016274	0.015524	46.33	43.97	159.7%	168.3%
75-79	-	2,278	0.000000	0.000000	0.027158	0.027374	62.23	62.71	0.0%	0.0%
80-84	67	2,026	0.033070	0.048387	0.047373	0.048158	93.68	95.37	71.5%	70.3%
85-89	50	1,195	0.041841	0.058824	0.084787	0.083571	99.42	98.09	50.3%	51.0%
90-94	140	914	0.153173	0.148148	0.146425	0.140993	128.74	124.27	108.7%	112.7%
95-99	3	100	0.030000	0.111111	0.228282	0.217819	21.99	20.98	13.6%	14.3%
100+	-	-	N/A	N/A	0.325971	0.316929	-	-	N/A	N/A
Totals	477	82,707	0.005767	0.008338	0.010530	0.009094	870.86	752.10	54.8%	63.4%

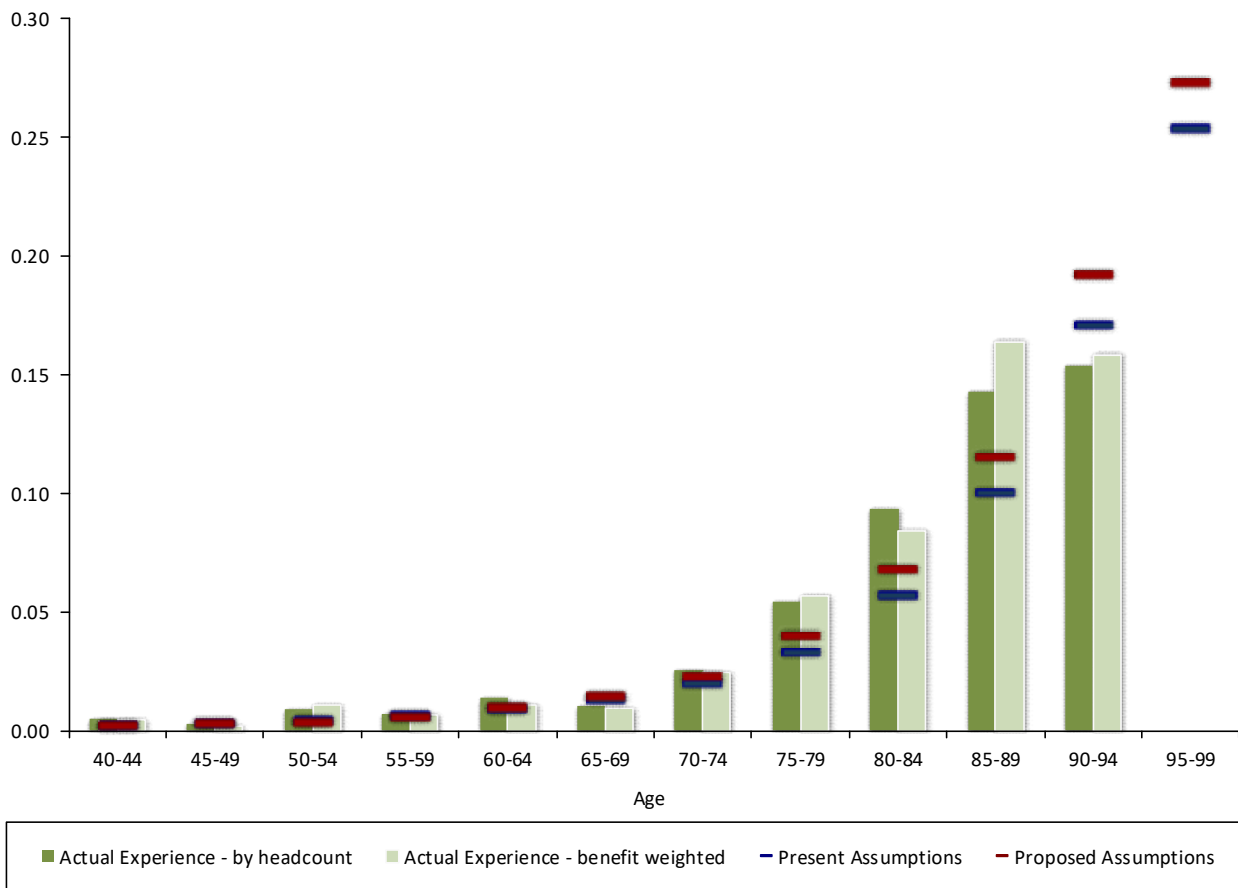
* In order to show the fit for the four-year period of the study, Proposed Sample Rates and Proposed Expected Deaths were determined using the proposed mortality rates for 2010 projected to the mid-point of the study using projection scale MP-2019.



Post-Retirement Mortality Experience Disabled Males

Age	Benefit-Weighted (\$000s)		Crude Rates		Sample Rates		Benefit-Weighted (\$000s)		Ratio of	
	Deaths	Exposure	Benefit-Weighted	Population-Weighted	Current	Proposed*	Expected Deaths		Actuals/Expecteds	
							Current	Proposed*	Current	Proposed*
40-44	31	7,427	0.004174	0.005102	0.002339	0.002198	17.80	16.47	174.2%	188.2%
45-49	23	13,562	0.001696	0.003012	0.003244	0.002818	44.85	38.94	51.3%	59.1%
50-54	215	20,037	0.010730	0.008772	0.004676	0.004004	94.63	81.34	227.2%	264.3%
55-59	163	24,578	0.006632	0.007005	0.006512	0.006060	160.60	150.15	101.5%	108.6%
60-64	383	34,821	0.010999	0.013587	0.009197	0.009716	323.23	342.23	118.5%	111.9%
65-69	436	48,461	0.008997	0.010256	0.013315	0.014775	651.31	723.09	66.9%	60.3%
70-74	855	35,212	0.024281	0.025719	0.020434	0.023213	697.72	793.22	122.5%	107.8%
75-79	835	14,747	0.056622	0.054152	0.033489	0.040318	473.46	571.23	176.4%	146.2%
80-84	500	5,937	0.084218	0.093220	0.057403	0.068232	327.47	392.49	152.7%	127.4%
85-89	250	1,525	0.163934	0.142857	0.100907	0.116010	146.14	168.99	171.1%	147.9%
90-94	126	796	0.158291	0.153846	0.170976	0.192292	122.91	140.54	102.5%	89.7%
95-99	-	-	N/A	N/A	0.254403	0.273546	-	-	N/A	N/A
100+	-	-	N/A	N/A	0.392683	0.422038	-	-	N/A	N/A
Totals	3,817	207,103	0.018430	0.018107	0.014776	0.016507	3,060.12	3,418.69	124.7%	111.7%

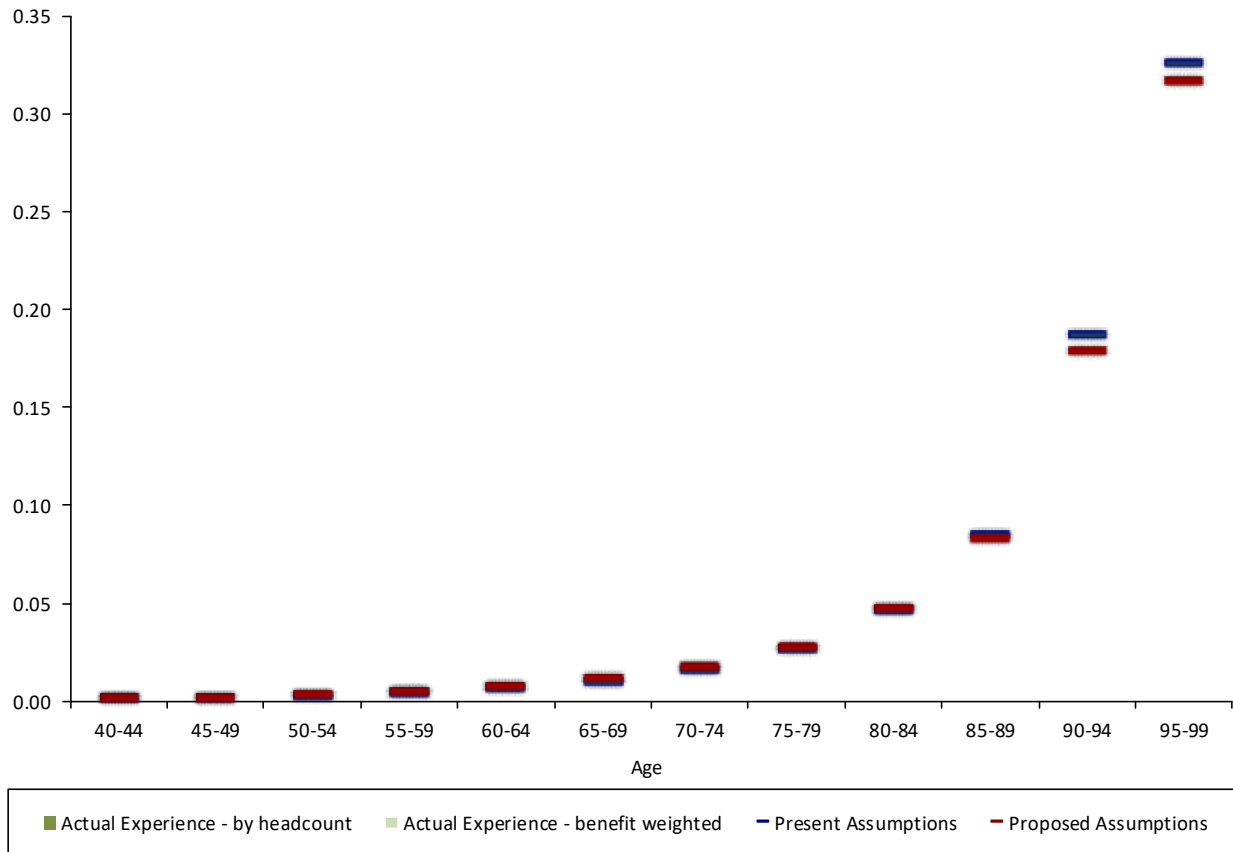
* In order to show the fit for the four-year period of the study, Proposed Sample Rates and Proposed Expected Deaths were determined using the proposed mortality rates for 2010 projected to the mid-point of the study using projection scale MP-2019.



Post-Retirement Mortality Experience Disabled Females

Age	Benefit-Weighted (\$000s)		Crude Rates		Sample Rates		Benefit-Weighted (\$000s)		Ratio of Actuals/Expecteds	
	Deaths	Exposure	Benefit-Weighted	Population-Weighted	Expected Deaths		Expected Deaths		Actuals/Expecteds	
					Current	Proposed*	Current	Proposed*	Current	Proposed*
40-44	-	1,551	0.000000	0.000000	0.001963	0.001917	3.08	2.98	0.0%	0.0%
45-49	-	4,285	0.000000	0.000000	0.002418	0.002437	10.47	10.60	0.0%	0.0%
50-54	-	6,169	0.000000	0.000000	0.003166	0.003638	19.47	22.41	0.0%	0.0%
55-59	-	3,792	0.000000	0.000000	0.004604	0.005805	17.07	21.47	0.0%	0.0%
60-64	-	3,660	0.000000	0.000000	0.006840	0.008405	25.11	30.81	0.0%	0.0%
65-69	-	1,449	0.000000	0.000000	0.010247	0.011860	14.25	16.61	0.0%	0.0%
70-74	-	650	0.000000	0.000000	0.016345	0.017773	9.55	10.62	0.0%	0.0%
75-79	-	56	0.000000	0.000000	0.027275	0.027913	1.43	1.48	0.0%	0.0%
80-84	-	-	N/A	N/A	0.047528	0.048158	-	-	N/A	N/A
85-89	-	-	N/A	N/A	0.085007	0.083571	-	-	N/A	N/A
90-94	-	-	N/A	N/A	0.187804	0.179406	-	-	N/A	N/A
95-99	-	-	N/A	N/A	0.326525	0.316929	-	-	N/A	N/A
100+	-	-	N/A	N/A	0.374340	0.316929	-	-	N/A	N/A
Totals	-	21,612	0.000000	0.000000	0.004647	0.005413	100.44	116.98	0.0%	0.0%

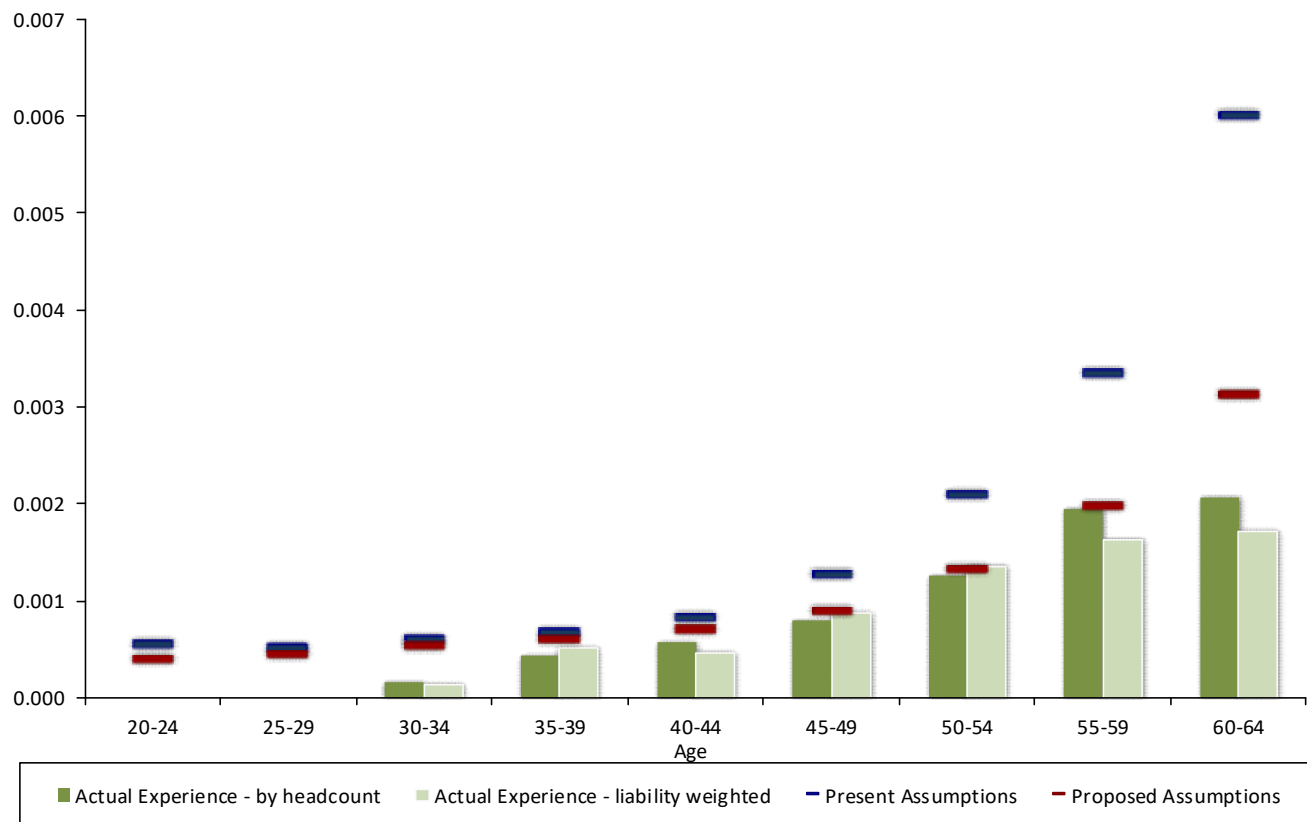
* In order to show the fit for the four-year period of the study, Proposed Sample Rates and Proposed Expected Deaths were determined using the proposed mortality rates for 2010 projected to the mid-point of the study using projection scale MP-2019.



Pre-Retirement Mortality Experience Healthy Males

Age	Liability-Weighted (\$000s)		Crude Rates		Sample Rates		Liability-Weighted (\$000s)		Ratio of Actuals/Expecteds	
	Deaths	Exposure	Liability-Weighted	Population-Weighted	Expected Deaths		Current	Proposed*	Current	Proposed
					Current	Proposed				
20-24	-	121,727	0.0000	0.0000	0.0006	0.0004	68.03	50.59	0.0%	0.0%
25-29	-	910,938	0.0000	0.0000	0.0005	0.0005	489.13	425.33	0.0%	0.0%
30-34	267	1,938,623	0.0001	0.0002	0.0006	0.0005	1,175.71	1,066.06	22.7%	25.0%
35-39	1,381	2,658,402	0.0005	0.0004	0.0007	0.0006	1,826.79	1,652.74	75.6%	83.6%
40-44	1,498	3,280,031	0.0005	0.0006	0.0008	0.0007	2,770.67	2,332.95	54.1%	64.2%
45-49	3,790	4,327,763	0.0009	0.0008	0.0013	0.0009	5,582.63	3,948.83	67.9%	96.0%
50-54	5,313	3,939,798	0.0013	0.0013	0.0021	0.0013	8,324.35	5,230.37	63.8%	101.6%
55-59	2,429	1,485,339	0.0016	0.0019	0.0034	0.0020	4,995.67	2,953.40	48.6%	82.2%
60-64	554	322,923	0.0017	0.0021	0.0060	0.0031	1,943.63	1,011.36	28.5%	54.8%
Totals	15,232	18,985,544	0.0008	0.0006	0.0014	0.0010	27,176.62	18,671.63	56.0%	81.6%

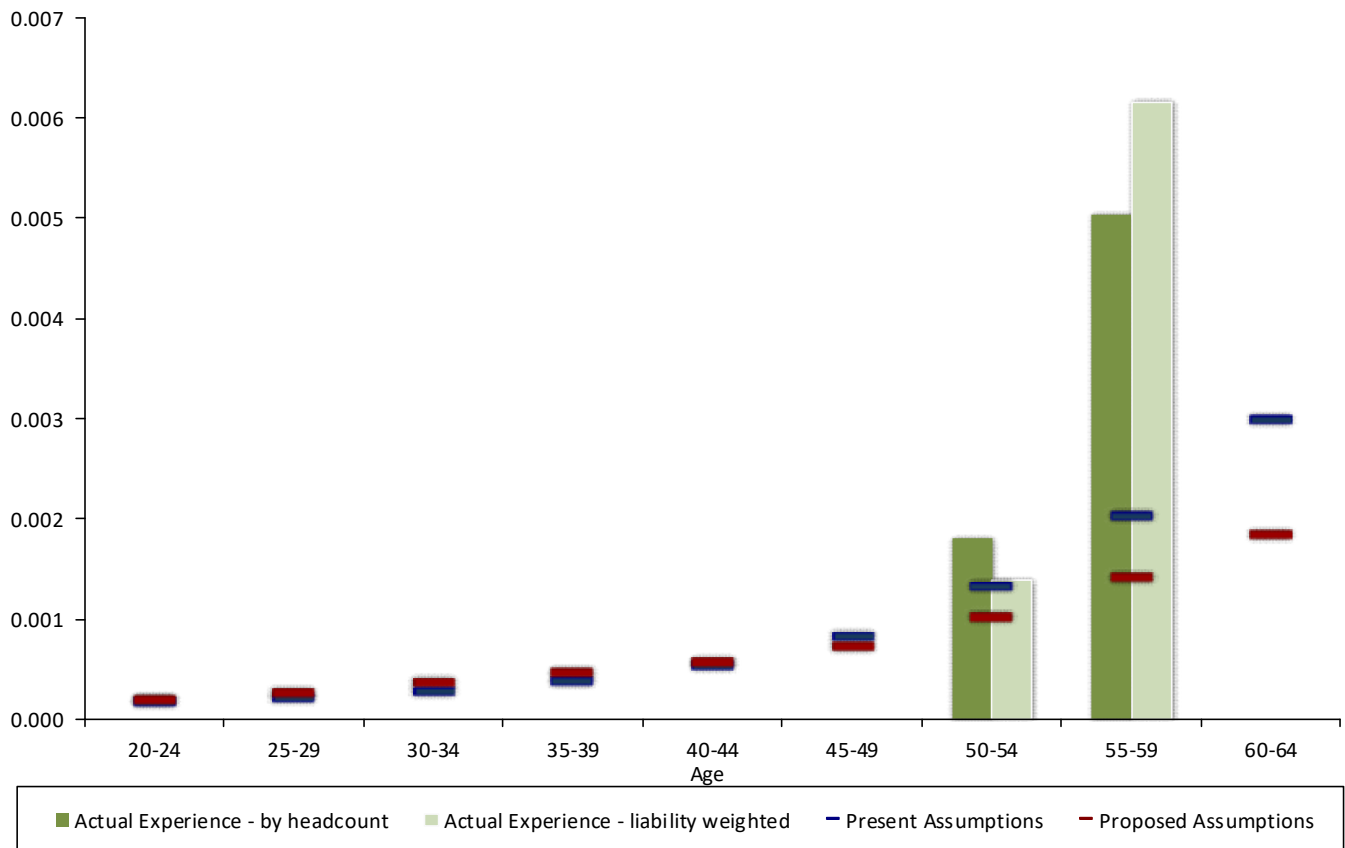
* In order to show the fit for the four-year period of the study, Proposed Sample Rates and Proposed Expected Deaths were determined using the proposed mortality rates for 2010 projected to the mid-point of the study using projection scale MP-2019.



Pre-Retirement Mortality Experience Healthy Females

Age	Liability-Weighted (\$000s)		Crude Rates		Sample Rates*		Liability-Weighted (\$000s)		Ratio of Actuals/Expecteds	
	Deaths	Exposure	Liability-Weighted	Population-Weighted	Expected Deaths		Current	Proposed	Current	Proposed
					Current	Proposed				
20-24	-	23,078	0.0000	0.0000	0.0002	0.0002	4.23	4.77	0.0%	0.0%
25-29	-	144,734	0.0000	0.0000	0.0002	0.0003	31.55	39.12	0.0%	0.0%
30-34	-	247,401	0.0000	0.0000	0.0003	0.0004	73.08	93.83	0.0%	0.0%
35-39	-	360,261	0.0000	0.0000	0.0004	0.0005	141.99	171.35	0.0%	0.0%
40-44	-	436,850	0.0000	0.0000	0.0006	0.0006	240.31	251.69	0.0%	0.0%
45-49	-	546,370	0.0000	0.0000	0.0008	0.0007	455.65	396.79	0.0%	0.0%
50-54	553	399,675	0.0014	0.0018	0.0013	0.0010	534.03	409.81	103.6%	134.9%
55-59	909	147,779	0.0062	0.0050	0.0020	0.0014	301.48	209.61	301.5%	433.7%
60-64	-	21,388	0.0000	0.0000	0.0030	0.0019	64.13	39.67	0.0%	0.0%
Totals	1,462	2,327,536	0.0006	0.0004	0.0008	0.0007	1,846.45	1,616.64	79.2%	90.4%

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



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 male members are married and 60% of female members are married. Actual marital status is used for retired members.

Findings

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

Gender	Married New Retirees	Total New Retirees	Crude Rates	Sample Rates		Expected Married Retirees		Ratio of Actuals/Expecteds	
				Present	Proposed	Present	Proposed	Present	Proposed
Males	722	815	0.8859	0.8500	0.8500	692.75	692.75	104.2%	104.2%
Females	68	84	0.8095	0.6000	0.7000	50.40	58.80	134.9%	115.6%
Total	790	899	0.8788			743.15	751.55	106.3%	105.1%

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 there are more married new retirees than expected.

Recommendation

We recommend changing the percent married assumption from 85% married for males and 60% married for females to 85% married for males and 70% married for females.

Age of Survivor

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

Findings

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

Gender	Married New Retirees	Average Age Difference	Expected Age Difference		Ratio of Actuals/Expecteds	
			Present	Proposed	Present	Proposed
Males	722	2.61	2.00	2.00	130.5%	130.5%
Females	68	1.48	(2.00)	(2.00)	-74.0%	-74.0%
Total	790					

The experience shows that the average age difference for females is 1.48 years. However, the year-by-year experience ranges from 0.27 years (2018-2019 average of 15 retirees) to 3.02 years (2015-2016 experience of 14 retirees).

Recommendation

Due to the varied experience and the low number of retirements, we recommend continuing the present assumption.

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.
- 25% Joint & Survivor – a reduced benefit is paid for the lifetime of the member. Upon death of the member, 25% of the benefit is paid to a beneficiary. If the beneficiary predeceases the member, the benefit reverts back to the single life annuity amount.
- 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:	10% elect 25% Joint & Survivor option
	20% elect 50% Joint & Survivor option
	20% elect 75% Joint & Survivor option
	35% elect 100% Joint & Survivor option
Females:	20% elect 25% Joint & Survivor option
	20% elect 50% Joint & Survivor option
	10% elect 75% Joint & Survivor option
	20% elect 100% Joint & Survivor option

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

Findings

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

We found more married new retirees are electing the joint & survivor options.

Recommendation

We recommend increasing the assumed percentage electing the joint and survivor annuities as shown on the next page and reducing the assumed percentage electing the single life annuity accordingly.

Form of Payment

Male Experience

Form of Payment	Actual Electing Annuity	Married New Retirees	Crude Rates	Sample Rates		Expected Electing Annuity		Ratio of Actuals/Expecteds	
				Present	Proposed	Present	Proposed	Present	Proposed
Life annuity	71	722	0.0983	0.1500	0.1000	108.30	72.20	65.6%	98.3%
25% joint & survivor	47	722	0.0651	0.1000	0.0750	72.20	54.15	65.1%	86.8%
50% joint & survivor	109	722	0.1510	0.2000	0.1500	144.40	108.30	75.5%	100.6%
75% joint & survivor	84	722	0.1163	0.2000	0.1250	144.40	90.25	58.2%	93.1%
100% joint & survivor	411	722	0.5693	0.3500	0.5500	252.70	397.10	162.6%	103.5%
Total	722	722	1.0000	1.0000	1.0000	722.00	722.00		

Female Experience

Form of Payment	Actual Electing Annuity	Married New Retirees	Crude Rates	Sample Rates		Expected Electing Annuity		Ratio of Actuals/Expecteds	
				Old	New	Old	New	Old	New
Life annuity	20	68	0.2941	0.3000	0.3000	20.40	20.40	98.0%	98.0%
25% joint & survivor	9	68	0.1324	0.2000	0.1500	13.60	10.20	66.2%	88.2%
50% joint & survivor	22	68	0.3235	0.2000	0.3000	13.60	20.40	161.8%	107.8%
75% joint & survivor	3	68	0.0441	0.1000	0.0500	6.80	3.40	44.1%	88.2%
100% joint & survivor	14	68	0.2059	0.2000	0.2000	13.60	13.60	102.9%	102.9%
Total	68	68	1.0000	1.0000	1.0000	68.00	68.00		

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, 2019, 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, male rates multiplied by 0.96, 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.

Proposed Miscellaneous and Technical Assumptions

Background

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

The Allowance for Combined Service Annuity assumptions are based on an analysis completed by the LCPR actuary and documented in a report dated October 2016. Updating the analysis of these assumptions is outside the scope of this assignment due to significant data requirements.

Recommendation

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

Miscellaneous and Technical Assumptions

<i>Benefit Service</i>	Exact fractional service is used to determine the amount of benefit payable.
<i>Decrement Operation</i>	Withdrawal decrements do not operate during retirement eligibility.
<i>Decrement Timing</i>	Decrement of all types are assumed to occur mid-year.
<i>Eligibility Testing</i>	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.
<i>Forfeitures</i>	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.
<i>Incidence of Contributions</i>	Contributions are assumed to be received on a monthly basis, per the Standards of Actuarial Work.
<i>Liability Adjustments</i>	Liabilities for former members are increased by 33% for vested members and 2% for non-vested members to account for the effect of some participants having eligibility for a Combined Service Annuity.
<i>Pay Increase Timing</i>	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.
<i>Service Credit Accruals</i>	Members were assumed to accrue one year of service credit per year.

SECTION H

PROPOSED ASSUMPTION LISTING

Proposed Actuarial Assumptions Based on 2015-2019 Experience Study

Merit and Seniority Pay Increases

% Merit & Seniority Increases in Salaries Next Year	
Year	Rate
1	8.75%
2	6.25%
3	5.00%
4	4.00%
5	2.50%
6	1.80%
7	1.60%
8	1.30%
9	1.10%
10	1.00%
11	0.90%
12	0.80%
13	0.70%
14	0.60%
15	0.50%
16	0.50%
17	0.50%
18	0.50%
19	0.40%
20	0.40%
21	0.40%
22	0.30%
23	0.15%
24	0.00%
25	0.00%
26	0.00%
27	0.00%
28	0.00%
29	0.00%
30+	0.00%

Proposed Actuarial Assumptions Based on 2015-2019 Experience Study

Age and Service Retirement Pattern Unreduced (Normal) Retirement

Age	% Retiring
55	30.0%
56	20.0%
57	22.5%
58	25.0%
59	25.0%
60	20.0%
61	25.0%
62	30.0%
63	27.5%
64	27.5%
65	50.0%
66	40.0%
67	50.0%
68	50.0%
69	50.0%
70+*	100%

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

Proposed Actuarial Assumptions Based on 2015-2019 Experience Study

Age and Service Retirement Pattern Reduced (Early) Retirement

Age	% Retiring
50	7.5%
51	5.0%
52	5.0%
53	7.5%
54	10.0%

Proposed Actuarial Assumptions Based on 2015-2019 Experience Study

Withdrawal

Year	% Terminating	
	Male	Female
1	6.00%	6.00%
2	4.00%	4.00%
3	2.75%	2.75%
4	2.50%	2.50%
5	2.50%	2.50%
6	2.25%	2.25%
7	2.25%	2.25%
8	2.00%	2.00%
9	2.00%	2.00%
10	2.00%	2.00%
11	1.75%	1.75%
12	1.50%	1.50%
13	1.50%	1.50%
14	1.50%	1.50%
15	1.50%	1.50%
16	1.50%	1.50%
17	1.50%	1.50%
18	1.25%	1.25%
19	1.25%	1.25%
20	1.25%	1.25%
21	1.00%	1.00%
22	1.00%	1.00%
23	1.00%	1.00%
24	1.00%	1.00%
25+	1.00%	1.00%

Proposed Actuarial Assumptions Based on 2015-2019 Experience Study

Disability Rates

Age	% Becoming Disabled	
	Male	Female
20	0.110%	0.110%
21	0.110%	0.110%
22	0.120%	0.120%
23	0.120%	0.120%
24	0.130%	0.130%
25	0.143%	0.143%
26	0.168%	0.168%
27	0.182%	0.182%
28	0.182%	0.182%
29	0.195%	0.195%
30	0.208%	0.208%
31	0.208%	0.208%
32	0.221%	0.221%
33	0.238%	0.238%
34	0.261%	0.261%
35	0.342%	0.342%
36	0.420%	0.420%
37	0.528%	0.528%
38	0.529%	0.529%
39	0.530%	0.530%
40	0.535%	0.535%
41	0.540%	0.540%
42	0.546%	0.546%
43	0.572%	0.572%
44	0.588%	0.588%
45	0.620%	0.620%
46	0.635%	0.635%
47	0.735%	0.735%
48	0.835%	0.835%
49	0.935%	0.935%
50	0.950%	0.950%
51	1.041%	1.041%
52	1.140%	1.140%
53	1.219%	1.219%
54	1.278%	1.278%
55*	1.300%	1.300%
56*	1.300%	1.300%
57*	1.300%	1.300%
58*	1.300%	1.300%
59*	1.300%	1.300%
60-69*	1.300%	1.300%

* Disability retirements are assumed to continue until the earlier of age 55 with 20 years of service or age 70.

Proposed Actuarial Assumptions Based on 2015-2019 Experience Study

Healthy Post-Retirement Mortality Rates

Age in 2019	% Dying Next Year*		Age in 2019	% Dying Next Year*	
	Male	Female		Male	Female
50	0.1761%	0.1437%	81	5.2297%	4.2131%
51	0.1942%	0.1635%	82	5.8992%	4.7162%
52	0.2142%	0.1853%	83	6.6482%	5.2770%
53	0.2373%	0.2102%	84	7.4837%	5.8987%
54	0.2640%	0.2389%	85	8.4129%	6.5888%
55	0.2949%	0.2714%	86	9.4451%	7.3555%
56	0.3296%	0.3068%	87	10.5833%	8.2079%
57	0.3692%	0.3447%	88	11.8434%	9.1575%
58	0.4142%	0.3853%	89	13.2267%	10.2124%
59	0.4643%	0.4278%	90	14.7513%	11.3882%
60	0.5197%	0.4738%	91	16.3028%	12.6464%
61	0.5805%	0.5205%	92	17.8269%	13.9592%
62	0.6453%	0.5698%	93	19.2879%	15.3209%
63	0.7148%	0.6227%	94	20.6948%	16.7324%
64	0.7900%	0.6806%	95	22.0699%	18.2083%
65	0.8713%	0.7436%	96	23.5930%	19.8154%
66	0.9604%	0.8135%	97	25.1748%	21.5332%
67	1.0596%	0.8931%	98	26.8732%	23.3577%
68	1.1705%	0.9851%	99	28.6871%	25.2882%
69	1.2972%	1.0894%	100	30.6117%	27.3181%
70	1.4415%	1.2103%	101	32.6062%	29.4221%
71	1.6076%	1.3478%	102	34.5967%	31.5433%
72	1.7970%	1.5051%	103	36.5539%	33.6715%
73	2.0133%	1.6840%	104	38.4685%	35.7732%
74	2.2606%	1.8865%	105	40.3289%	37.8479%
75	2.5419%	2.1158%	106	42.1323%	39.8838%
76	2.8620%	2.3738%	107	43.8531%	41.8393%
77	3.2251%	2.6631%	108	45.5011%	43.7197%
78	3.6380%	2.9886%	109	47.0444%	45.5171%
79	4.1049%	3.3522%	110	48.3037%	47.2105%
80	4.6332%	3.7591%			

* 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-2019.

Proposed Actuarial Assumptions Based on 2015-2019 Experience Study

Disabled Post-Retirement Mortality Rates

Age in 2019	% Dying Next Year*		Age in 2019	% Dying Next Year*	
	Male	Female		Male	Female
20	0.1320%	0.0576%	56	0.5418%	0.5338%
21	0.1343%	0.0620%	57	0.5965%	0.5842%
22	0.1339%	0.0655%	58	0.6592%	0.6372%
23	0.1326%	0.0692%	59	0.7293%	0.6894%
24	0.1326%	0.0731%	60	0.8056%	0.7425%
25	0.1326%	0.0783%	61	0.8889%	0.7959%
26	0.1437%	0.0861%	62	0.9752%	0.8495%
27	0.1507%	0.0928%	63	1.0662%	0.9048%
28	0.1578%	0.1009%	64	1.1594%	0.9626%
29	0.1660%	0.1089%	65	1.2568%	1.0247%
30	0.1723%	0.1168%	66	1.3595%	1.0932%
31	0.1797%	0.1258%	67	1.4706%	1.1703%
32	0.1860%	0.1342%	68	1.5914%	1.2572%
33	0.1914%	0.1420%	69	1.7257%	1.3546%
34	0.1956%	0.1502%	70	1.8783%	1.4663%
35	0.1999%	0.1574%	71	2.0534%	1.5915%
36	0.2042%	0.1647%	72	2.2601%	1.7319%
37	0.2083%	0.1708%	73	2.5031%	1.8885%
38	0.2122%	0.1758%	74	2.7894%	2.0616%
39	0.2160%	0.1820%	75	3.1234%	2.2523%
40	0.2209%	0.1862%	76	3.5043%	2.4646%
41	0.2245%	0.1919%	77	3.9326%	2.7013%
42	0.2309%	0.1973%	78	4.4020%	2.9886%
43	0.2368%	0.2036%	79	4.9065%	3.3522%
44	0.2447%	0.2101%	80	5.4457%	3.7591%
45	0.2547%	0.2182%	81	6.0286%	4.2131%
46	0.2666%	0.2292%	82	6.6659%	4.7162%
47	0.2814%	0.2414%	83	7.3753%	5.2770%
48	0.2994%	0.2560%	84	8.1747%	5.8987%
49	0.3217%	0.2733%	85	9.0908%	6.5888%
50	0.3468%	0.2933%	86	10.1198%	7.3555%
51	0.3678%	0.3230%	87	11.3393%	8.2079%
52	0.3926%	0.3576%	88	12.6894%	9.1575%
53	0.4220%	0.3960%	89	14.1714%	10.2124%
54	0.4559%	0.4386%	90	15.8049%	11.3882%
55	0.4955%	0.4849%			

* 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-2019.

Proposed Actuarial Assumptions Based on 2015-2019 Experience Study

Healthy Pre-Retirement Mortality Rates

Age in 2019	% Dying Next Year*		Age in 2019	% Dying Next Year*	
	Male	Female		Male	Female
20	0.0426%	0.0174%	46	0.0859%	0.0684%
21	0.0434%	0.0188%	47	0.0909%	0.0725%
22	0.0432%	0.0192%	48	0.0963%	0.0761%
23	0.0432%	0.0208%	49	0.1040%	0.0812%
24	0.0432%	0.0224%	50	0.1123%	0.0878%
25	0.0432%	0.0241%	51	0.1212%	0.0949%
26	0.0460%	0.0258%	52	0.1325%	0.1026%
27	0.0487%	0.0276%	53	0.1445%	0.1107%
28	0.0514%	0.0306%	54	0.1570%	0.1200%
29	0.0540%	0.0324%	55	0.1721%	0.1294%
30	0.0552%	0.0354%	56	0.1896%	0.1396%
31	0.0575%	0.0371%	57	0.2076%	0.1503%
32	0.0595%	0.0399%	58	0.2288%	0.1593%
33	0.0612%	0.0425%	59	0.2519%	0.1694%
34	0.0626%	0.0448%	60	0.2756%	0.1785%
35	0.0648%	0.0468%	61	0.3014%	0.1864%
36	0.0666%	0.0485%	62	0.3287%	0.1954%
37	0.0666%	0.0511%	63	0.3564%	0.2035%
38	0.0687%	0.0521%	64	0.3841%	0.2121%
39	0.0702%	0.0540%	65	0.4138%	0.2202%
40	0.0713%	0.0556%	66	0.4617%	0.2484%
41	0.0721%	0.0570%	67	0.5138%	0.2800%
42	0.0748%	0.0594%	68	0.5741%	0.3182%
43	0.0762%	0.0607%	69	0.6415%	0.3622%
44	0.0787%	0.0630%	70	0.7186%	0.4135%
45	0.0822%	0.0656%			

* 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-2019.

SECTION I

GLOSSARY

Glossary

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

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

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

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

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

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

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

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

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

Glossary

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

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

SECTION J

APPENDIX

Appendix – Detailed Experience Analysis

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

Appendix – Detailed Experience Analysis Salary Increases

2015-2019 Experience

Year	Exposure	Gross Actual Increases	Gross Expected Increases
1	1,708	11.99%	12.25%
2	2,315	8.81%	10.50%
3	2,077	8.05%	8.75%
4	1,778	6.65%	7.75%
5	1,442	5.62%	6.25%
6	1,237	4.61%	5.75%
7	1,218	4.59%	5.25%
8	1,409	4.30%	5.00%
9	1,629	4.15%	4.75%
10	1,846	4.04%	4.50%
11	1,838	4.04%	4.25%
12	1,651	4.04%	4.15%
13	1,541	3.91%	4.05%
14	1,444	3.94%	3.95%
15	1,487	3.63%	3.85%
16	1,663	3.72%	3.75%
17	1,732	3.95%	3.75%
18	1,767	3.92%	3.75%
19	1,677	3.66%	3.75%
20	1,529	3.95%	3.75%
21	1,357	3.96%	3.65%
22	1,157	3.52%	3.55%
23	954	3.59%	3.45%
24	765	3.36%	3.35%
25	649	3.46%	3.25%
26	547	3.56%	3.25%
27	528	3.60%	3.25%
28	468	3.87%	3.25%
29	365	3.07%	3.25%
30+	573	2.91%	3.25%
Totals	40,351	4.92%	5.24%

Appendix – Detailed Experience Analysis Salary Increases

2015-2016 Experience

Year	Exposure	Gross Actual Increases	Gross Expected Increases
1	462	11.64%	12.25%
2	490	9.31%	10.50%
3	405	7.91%	8.75%
4	336	6.36%	7.75%
5	247	4.45%	6.25%
6	279	3.82%	5.75%
7	400	4.17%	5.25%
8	517	3.09%	5.00%
9	496	3.50%	4.75%
10	503	3.42%	4.50%
11	403	3.51%	4.25%
12	319	3.51%	4.15%
13	382	3.38%	4.05%
14	413	3.89%	3.95%
15	453	3.27%	3.85%
16	490	3.04%	3.75%
17	464	3.02%	3.75%
18	447	3.28%	3.75%
19	384	3.22%	3.75%
20	336	3.21%	3.75%
21	274	3.17%	3.65%
22	249	3.34%	3.55%
23	186	3.50%	3.45%
24	163	2.43%	3.35%
25	172	3.39%	3.25%
26	153	3.11%	3.25%
27	153	2.30%	3.25%
28	114	2.90%	3.25%
29	70	1.67%	3.25%
30+	117	2.32%	3.25%
Totals	9,877	4.32%	5.16%

Appendix – Detailed Experience Analysis Salary Increases

2016-2017 Experience

Year	Exposure	Gross Actual Increases	Gross Expected Increases
1	428	12.06%	12.25%
2	622	9.18%	10.50%
3	482	8.68%	8.75%
4	398	7.23%	7.75%
5	331	5.90%	6.25%
6	244	4.80%	5.75%
7	265	5.49%	5.25%
8	398	5.07%	5.00%
9	499	4.22%	4.75%
10	477	4.50%	4.50%
11	495	4.47%	4.25%
12	393	4.58%	4.15%
13	303	4.11%	4.05%
14	365	4.26%	3.95%
15	401	4.01%	3.85%
16	437	4.00%	3.75%
17	472	5.49%	3.75%
18	447	4.78%	3.75%
19	430	5.08%	3.75%
20	373	5.10%	3.75%
21	323	5.40%	3.65%
22	257	4.00%	3.55%
23	234	4.62%	3.45%
24	170	3.97%	3.35%
25	141	5.25%	3.25%
26	149	4.99%	3.25%
27	132	5.49%	3.25%
28	129	5.57%	3.25%
29	90	6.64%	3.25%
30+	133	3.76%	3.25%
Totals	10,018	5.62%	5.24%

Appendix – Detailed Experience Analysis Salary Increases

2017-2018 Experience

Year	Exposure	Gross Actual Increases	Gross Expected Increases
1	418	12.53%	12.25%
2	607	8.78%	10.50%
3	593	8.12%	8.75%
4	475	6.63%	7.75%
5	394	6.36%	6.25%
6	324	4.96%	5.75%
7	236	4.89%	5.25%
8	267	4.65%	5.00%
9	389	4.76%	4.75%
10	488	4.17%	4.50%
11	472	4.23%	4.25%
12	485	4.43%	4.15%
13	383	4.22%	4.05%
14	291	3.43%	3.95%
15	354	4.02%	3.85%
16	394	4.22%	3.75%
17	426	3.52%	3.75%
18	460	3.72%	3.75%
19	426	3.57%	3.75%
20	421	4.18%	3.75%
21	361	3.95%	3.65%
22	313	3.65%	3.55%
23	242	3.60%	3.45%
24	211	2.97%	3.35%
25	149	3.02%	3.25%
26	124	3.10%	3.25%
27	134	3.82%	3.25%
28	114	3.55%	3.25%
29	110	2.88%	3.25%
30+	164	3.33%	3.25%
Totals	10,225	5.08%	5.27%

Appendix – Detailed Experience Analysis Salary Increases

2018-2019 Experience

Year	Exposure	Gross Actual Increases	Gross Expected Increases
1	400	11.76%	12.25%
2	596	8.03%	10.50%
3	597	7.57%	8.75%
4	569	6.45%	7.75%
5	470	5.43%	6.25%
6	390	4.78%	5.75%
7	317	4.13%	5.25%
8	227	5.30%	5.00%
9	245	4.33%	4.75%
10	378	4.11%	4.50%
11	468	3.84%	4.25%
12	454	3.54%	4.15%
13	473	3.97%	4.05%
14	375	4.09%	3.95%
15	279	3.18%	3.85%
16	342	3.73%	3.75%
17	370	3.63%	3.75%
18	413	3.92%	3.75%
19	437	2.74%	3.75%
20	399	3.26%	3.75%
21	399	3.34%	3.65%
22	338	3.15%	3.55%
23	292	2.82%	3.45%
24	221	3.96%	3.35%
25	187	2.52%	3.25%
26	121	2.84%	3.25%
27	109	2.87%	3.25%
28	111	3.23%	3.25%
29	95	0.96%	3.25%
30+	159	2.21%	3.25%
Totals	10,231	4.66%	5.31%

Appendix – Detailed Experience Analysis Retirements

2015-2019 Experience (\$000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
50	59,963	1,000,694	100,069.49	59.9%
51	36,946	916,154	64,130.76	57.6%
52	41,008	873,260	61,128.19	67.1%
53	55,271	809,960	80,995.98	68.2%
54	83,933	708,576	70,857.65	118.5%
55	221,750	585,882	146,470.74	151.4%
56	75,482	368,184	82,841.21	91.1%
57	70,471	288,575	64,929.01	108.5%
58	66,545	224,341	50,476.71	131.8%
59	43,618	156,718	31,343.69	139.2%
60	22,383	108,435	24,397.97	91.7%
61	24,998	89,935	22,483.88	111.2%
62	20,282	60,397	18,119.01	111.9%
63	12,143	44,144	13,242.85	91.7%
64	9,115	40,613	12,184.07	74.8%
65	17,385	31,726	15,863.15	109.6%
66	4,753	12,353	6,177.09	76.9%
67	2,912	5,672	2,836.13	102.7%
68	440	970	484.77	90.8%
69	468	784	391.85	119.4%
Totals	869,866	6,327,373	869,424.20	100.1%

Appendix – Detailed Experience Analysis Retirements

2015-2016 Experience (\$000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/Expected
50	18,809	245,019	24,501.94	76.8%
51	9,076	202,808	14,196.54	63.9%
52	9,788	189,998	13,299.84	73.6%
53	12,833	164,360	16,436.01	78.1%
54	13,863	153,644	15,364.45	90.2%
55	38,100	115,997	28,999.25	131.4%
56	14,135	97,848	22,015.76	64.2%
57	9,687	55,933	12,584.84	77.0%
58	14,757	55,912	12,580.11	117.3%
59	5,505	29,490	5,898.08	93.3%
60	7,105	20,773	4,674.01	152.0%
61	4,400	20,236	5,059.10	87.0%
62	2,627	18,120	5,436.10	48.3%
63	3,236	12,359	3,707.64	87.3%
64	1,205	9,978	2,993.42	40.3%
65	2,916	4,485	2,242.69	130.0%
66	1,035	1,401	700.73	147.7%
67	2,265	2,265	1,132.57	200.0%
68	-	447	223.45	0.0%
69	-	264	131.89	0.0%
Totals	171,342	1,401,337	192,178.42	89.2%

2016-2017 Experience (\$000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/Expected
50	17,188	221,589	22,158.89	77.6%
51	10,447	230,703	16,149.20	64.7%
52	5,738	197,803	13,846.21	41.4%
53	11,755	184,277	18,427.66	63.8%
54	18,736	153,279	15,327.90	122.2%
55	50,312	141,226	35,306.50	142.5%
56	22,671	80,148	18,033.21	125.7%
57	23,590	85,313	19,195.32	122.9%
58	12,925	47,051	10,586.44	122.1%
59	7,711	41,761	8,352.21	92.3%
60	4,538	24,295	5,466.27	83.0%
61	5,106	14,201	3,550.19	143.8%
62	7,619	15,665	4,699.47	162.1%
63	4,304	16,130	4,838.86	88.9%
64	2,269	9,901	2,970.35	76.4%
65	5,609	9,110	4,555.18	123.1%
66	917	1,630	815.03	112.5%
67	-	386	192.93	0.0%
68	-	-	-	N/A
69	468	468	234.21	199.8%
Totals	211,903	1,474,936	204,706.03	103.5%

Appendix – Detailed Experience Analysis Retirements

2017-2018 Experience (\$000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
50	13,249	255,740	25,574.02	51.8%
51	8,824	238,924	16,724.66	52.8%
52	11,896	254,021	17,781.45	66.9%
53	14,410	219,060	21,906.01	65.8%
54	20,923	197,757	19,775.75	105.8%
55	57,531	150,907	37,726.87	152.5%
56	17,003	99,275	22,336.78	76.1%
57	11,755	64,355	14,479.81	81.2%
58	20,404	68,802	15,480.50	131.8%
59	11,867	36,734	7,346.77	161.5%
60	4,985	38,039	8,558.81	58.2%
61	6,041	21,716	5,429.03	111.3%
62	3,391	10,001	3,000.16	113.0%
63	1,025	8,909	2,672.70	38.4%
64	3,849	12,757	3,827.19	100.6%
65	3,336	8,753	4,376.45	76.2%
66	1,736	3,854	1,927.10	90.1%
67	647	756	377.98	171.2%
68	351	406	202.76	173.1%
69	-	-	-	N/A
Totals	213,223	1,690,766	229,504.80	92.9%

2018-2019 Experience (\$000s)

Age	Actual Retirements	Exposure	Expected Retirements	Actual/ Expected
50	10,717	278,346	27,834.64	38.5%
51	8,599	243,719	17,060.36	50.4%
52	13,586	231,438	16,200.69	83.9%
53	16,273	242,263	24,226.30	67.2%
54	30,411	203,896	20,389.55	149.1%
55	75,807	177,752	44,438.12	170.6%
56	21,673	90,913	20,455.46	106.0%
57	25,439	82,974	18,669.04	136.3%
58	18,459	52,576	11,829.66	156.0%
59	18,535	48,733	9,746.63	190.2%
60	5,755	25,328	5,698.88	101.0%
61	9,451	33,782	8,445.56	111.9%
62	6,645	16,611	4,983.28	133.3%
63	3,578	6,746	2,023.65	176.8%
64	1,792	7,977	2,393.11	74.9%
65	5,524	9,378	4,688.83	117.8%
66	1,065	5,468	2,734.23	39.0%
67	-	2,265	1,132.65	0.0%
68	89	117	58.56	152.0%
69	-	52	25.75	0.0%
Totals	273,398	1,760,334	243,034.95	112.5%

Appendix – Detailed Experience Analysis Terminations – First Three Years

2015-2019 Experience, (\$000s)

Year	Males and Females			
	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
1	16,414	163,233	4,896.99	335.2%
2	27,375	586,016	17,580.48	155.7%
3	16,999	643,110	19,293.30	88.1%
Totals	60,788	1,392,359	41,770.77	145.5%

Appendix – Detailed Experience Analysis

Terminations – First Three Years

2015-2016 Experience, (\$000s)

Year	Males and Females			
	Actual Terminations	Exposure	Expected Terminations	Actual/Expected
1	3,352	44,113	1,323.39	253.3%
2	7,301	153,106	4,593.18	159.0%
3	5,238	137,592	4,127.76	126.9%
Totals	15,891	334,811	10,044.33	158.2%

2016-2017 Experience, (\$000s)

Year	Males and Females			
	Actual Terminations	Exposure	Expected Terminations	Actual/Expected
1	3,707	40,020	1,200.60	308.8%
2	8,212	148,014	4,440.42	184.9%
3	2,541	164,492	4,934.76	51.5%
Totals	14,460	352,526	10,575.78	136.7%

Appendix – Detailed Experience Analysis

Terminations – First Three Years

2017-2018 Experience, (\$000s)

Year	Males and Females			
	Actual Terminations	Exposure	Expected Terminations	Actual/Expected
1	4,557	44,783	1,343.49	339.2%
2	5,784	153,408	4,602.24	125.7%
3	5,360	182,809	5,484.27	97.7%
Totals	15,701	381,000	11,430.00	137.4%

2018-2019 Experience, (\$000s)

Year	Males and Females			
	Actual Terminations	Exposure	Expected Terminations	Actual/Expected
1	4,798	34,317	1,029.51	466.0%
2	6,078	131,488	3,944.64	154.1%
3	3,860	158,217	4,746.51	81.3%
Totals	14,736	324,022	9,720.66	151.6%

Appendix – Detailed Experience Analysis Terminations – After Third Year

2015-2019 Experience, (\$000s)

Age Group	Males and Females			
	Actual Terminations	Exposure	Expected Terminations	Actual/ Expected
20-24	358	9,834	266.45	134.4%
25-29	14,042	513,645	11,923.37	117.8%
30-34	36,383	1,819,448	33,945.93	107.2%
35-39	48,244	2,817,934	39,572.75	121.9%
40-44	54,813	3,634,457	45,430.71	120.7%
45-49	56,929	4,833,865	60,423.31	94.2%
50-54	836	-	-	N/A
Totals	211,605	13,629,183	191,562.51	110.5%

Appendix – Detailed Experience Analysis

Terminations – After Third Year

2015-2016 Experience, (\$000s)

Age Group	Males and Females			
	Actual Terminations	Exposure	Expected Terminations	Actual/Expected
20-24	-	757	20.46	0.0%
25-29	3,767	110,047	2,533.64	148.7%
30-34	9,146	476,320	8,908.65	102.7%
35-39	10,211	685,017	9,609.52	106.3%
40-44	17,847	961,822	12,022.78	148.4%
45-49	12,516	1,154,465	14,430.81	86.7%
50-54	20	-	-	N/A
Totals	53,507	3,388,428	47,525.86	112.6%

2016-2017 Experience, (\$000s)

Age Group	Males and Females			
	Actual Terminations	Exposure	Expected Terminations	Actual/Expected
20-24	-	1,857	50.33	0.0%
25-29	1,728	107,656	2,498.42	69.2%
30-34	7,628	442,775	8,278.16	92.1%
35-39	11,217	655,121	9,210.17	121.8%
40-44	12,068	852,678	10,658.48	113.2%
45-49	16,171	1,159,321	14,491.51	111.6%
50-54	-	-	-	N/A
Totals	48,812	3,219,408	45,187.07	108.0%

Appendix – Detailed Experience Analysis

Terminations – After Third Year

2017-2018 Experience, (\$000s)

Age Group	Males and Females			
	Actual Terminations	Exposure	Expected Terminations	Actual/Expected
20-24	358	3,442	93.12	384.5%
25-29	4,637	142,758	3,322.51	139.6%
30-34	8,723	487,367	9,070.54	96.2%
35-39	16,109	767,885	10,790.08	149.3%
40-44	10,181	951,696	11,896.20	85.6%
45-49	14,357	1,339,029	16,737.86	85.8%
50-54	469	-	-	N/A
Totals	54,834	3,692,177	51,910.31	105.6%

2018-2019 Experience, (\$000s)

Age Group	Males and Females			
	Actual Terminations	Exposure	Expected Terminations	Actual/Expected
20-24	-	3,778	102.53	0.0%
25-29	3,910	153,184	3,568.80	109.6%
30-34	10,886	412,986	7,688.58	141.6%
35-39	10,707	709,911	9,962.97	107.5%
40-44	14,717	868,261	10,853.26	135.6%
45-49	13,885	1,181,050	14,763.13	94.1%
50-54	347	-	-	N/A
Totals	54,452	3,329,170	46,939.28	116.0%

Appendix – Detailed Experience Analysis Disability Retirements

2015-2019 Experience

Age Group	Males and Females			
	Actual Disabilities	Exposure	Expected Disabilities	Actual/ Expected
20-24	1	912	1.14	87.7%
25-29	9	4,548	6.41	140.5%
30-34	17	7,179	12.12	140.3%
35-39	47	7,916	17.05	275.6%
40-44	49	7,811	30.60	160.1%
45-49	69	8,426	61.72	111.8%
50-54	69	6,088	84.17	82.0%
55-59	21	75	1.55	1352.6%
60+	3	-	-	N/A
Totals	285	42,955	214.76	132.7%

Appendix – Detailed Experience Analysis Disability Retirements

2015-2016 Experience

Age Group	Males and Females			
	Actual Disabilities	Exposure	Expected Disabilities	Actual/Expected
20-24	-	186	0.23	0.0%
25-29	2	1,025	1.45	138.2%
30-34	3	1,840	3.10	96.7%
35-39	16	1,900	4.10	390.6%
40-44	14	2,069	8.15	171.8%
45-49	13	2,067	14.97	86.8%
50-54	18	1,412	19.39	92.8%
55-59	4	13	0.27	1498.1%
60+	-	-	-	N/A
Totals	70	10,512	51.66	135.5%

2016-2017 Experience

Age Group	Males and Females			
	Actual Disabilities	Exposure	Expected Disabilities	Actual/Expected
20-24	-	220	0.27	0.0%
25-29	1	1,101	1.55	64.6%
30-34	6	1,836	3.10	193.7%
35-39	9	1,957	4.21	213.6%
40-44	14	1,949	7.64	183.2%
45-49	17	2,140	15.57	109.2%
50-54	15	1,479	20.46	73.3%
55-59	5	18	0.37	1336.2%
60+	2	-	-	N/A
Totals	69	10,700	53.18	129.7%

Appendix – Detailed Experience Analysis Disability Retirements

2017-2018 Experience

Age Group	Males and Females			
	Actual Disabilities	Exposure	Expected Disabilities	Actual/Expected
20-24	1	253	0.32	315.3%
25-29	1	1,176	1.65	60.4%
30-34	4	1,774	3.00	133.5%
35-39	8	1,992	4.29	186.6%
40-44	8	1,890	7.35	108.9%
45-49	19	2,171	15.95	119.1%
50-54	11	1,544	21.47	51.2%
55-59	6	20	0.41	1446.9%
60+	-	-	-	N/A
Totals	58	10,820	54.44	106.5%

2018-2019 Experience

Age Group	Males and Females			
	Actual Disabilities	Exposure	Expected Disabilities	Actual/Expected
20-24	-	253	0.32	0.0%
25-29	5	1,246	1.76	284.8%
30-34	4	1,729	2.92	137.0%
35-39	14	2,067	4.46	314.2%
40-44	13	1,903	7.46	174.3%
45-49	20	2,048	15.23	131.3%
50-54	25	1,653	22.85	109.4%
55-59	6	24	0.50	1208.1%
60+	1	-	-	N/A
Totals	88	10,923	55.48	158.6%

Appendix – Detailed Experience Analysis Post-Retirement Mortality

2015-2019 Experience (\$000s)

Males					Females				
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/Expected
50-54	121	68,180	334.30	36.2%	50-54	-	12,067	40.13	0.0%
55-59	476	227,099	1,495.32	31.8%	55-59	18	29,937	137.98	13.0%
60-64	1,032	282,857	2,612.65	39.5%	60-64	125	21,889	147.16	84.9%
65-69	3,017	294,585	3,927.24	76.8%	65-69	-	9,284	93.19	0.0%
70-74	4,144	236,245	4,737.87	87.5%	70-74	74	3,017	46.33	159.7%
75-79	6,061	179,225	5,900.55	102.7%	75-79	-	2,278	62.23	0.0%
80-84	6,449	111,596	6,273.63	102.8%	80-84	67	2,026	93.68	71.5%
85-89	7,235	66,951	6,550.19	110.5%	85-89	50	1,195	99.42	50.3%
90-94	4,907	26,724	4,251.45	115.4%	90-94	140	914	128.74	108.7%
95+	1,254	4,309	1,079.23	116.2%	95+	3	100	21.99	13.6%
Totals	34,696	1,497,771	37,162.44	93.4%	Totals	477	82,707	870.86	54.8%

Appendix – Detailed Experience Analysis Post-Retirement Mortality

2015-2016 Experience (\$000s)

Age Group	Males				Age Group	Females			
	Actual Deaths	Exposure	Expected Deaths	Actual/Expected		Actual Deaths	Exposure	Expected Deaths	Actual/Expected
50-54	66	19,951	97.93	67.4%	50-54	-	3,778	12.30	0.0%
55-59	97	53,659	353.66	27.4%	55-59	-	6,561	29.53	0.0%
60-64	199	69,445	634.32	31.4%	60-64	-	4,373	28.68	0.0%
65-69	807	74,073	985.43	81.9%	65-69	-	1,739	17.62	0.0%
70-74	1,048	52,463	1,071.77	97.8%	70-74	-	483	7.94	0.0%
75-79	1,676	41,428	1,364.23	122.9%	75-79	-	638	17.38	0.0%
80-84	1,062	26,000	1,483.55	71.6%	80-84	-	444	19.91	0.0%
85-89	1,853	16,116	1,613.56	114.8%	85-89	20	323	26.64	75.1%
90-94	1,064	5,203	828.99	128.3%	90-94	26	201	26.60	97.7%
95+	454	1,145	296.30	153.2%	95+	-	23	4.51	0.0%
Totals	8,326	359,483	8,729.74	95.4%	Totals	46	18,563	191.10	24.1%

2016-2017 Experience (\$000s)

Age Group	Males				Age Group	Females			
	Actual Deaths	Exposure	Expected Deaths	Actual/Expected		Actual Deaths	Exposure	Expected Deaths	Actual/Expected
50-54	-	18,096	88.78	0.0%	50-54	-	3,313	10.97	0.0%
55-59	143	54,365	358.77	39.9%	55-59	-	6,707	30.50	0.0%
60-64	409	70,606	652.00	62.7%	60-64	125	5,322	35.51	352.0%
65-69	578	73,813	988.30	58.5%	65-69	-	1,941	19.73	0.0%
70-74	1,118	56,185	1,136.02	98.4%	70-74	-	611	9.43	0.0%
75-79	1,046	44,046	1,460.35	71.6%	75-79	-	608	16.83	0.0%
80-84	1,543	26,496	1,512.85	102.0%	80-84	39	497	23.76	164.1%
85-89	1,510	16,312	1,613.93	93.6%	85-89	30	270	23.44	128.0%
90-94	1,197	6,428	1,022.13	117.1%	90-94	14	212	29.60	47.3%
95+	192	857	222.64	86.2%	95+	-	24	5.10	0.0%
Totals	7,736	367,204	9,055.75	85.4%	Totals	208	19,505	204.87	101.5%

Appendix – Detailed Experience Analysis Post-Retirement Mortality

2017-2018 Experience (\$000s)

Age Group	Males				Age Group	Females			
	Actual Deaths	Exposure	Expected Deaths	Actual/Expected		Actual Deaths	Exposure	Expected Deaths	Actual/Expected
50-54	28	16,683	81.78	34.2%	50-54	-	2,879	9.77	0.0%
55-59	66	57,566	377.81	17.5%	55-59	-	7,729	35.90	0.0%
60-64	84	72,252	669.75	12.5%	60-64	-	5,489	36.87	0.0%
65-69	621	73,268	978.52	63.5%	65-69	-	2,728	26.95	0.0%
70-74	915	60,812	1,208.30	75.7%	70-74	45	850	13.10	343.6%
75-79	1,162	46,528	1,529.39	76.0%	75-79	-	464	12.49	0.0%
80-84	1,760	28,738	1,614.96	109.0%	80-84	28	567	25.57	109.5%
85-89	1,815	16,747	1,632.06	111.2%	85-89	-	300	24.68	0.0%
90-94	1,449	7,172	1,135.38	127.6%	90-94	41	238	34.60	118.5%
95+	377	1,152	282.83	133.3%	95+	-	24	5.51	0.0%
Totals	8,277	380,918	9,510.79	87.0%	Totals	114	21,268	225.43	50.6%

2018-2019 Experience (\$000s)

Age Group	Males				Age Group	Females			
	Actual Deaths	Exposure	Expected Deaths	Actual/Expected		Actual Deaths	Exposure	Expected Deaths	Actual/Expected
50-54	27	13,450	65.81	41.0%	50-54	-	2,097	7.08	0.0%
55-59	170	61,509	405.09	42.0%	55-59	18	8,940	42.06	42.8%
60-64	340	70,554	656.58	51.8%	60-64	-	6,705	46.10	0.0%
65-69	1,011	73,431	974.99	103.7%	65-69	-	2,876	28.89	0.0%
70-74	1,063	66,785	1,321.78	80.4%	70-74	29	1,073	15.87	182.7%
75-79	2,177	47,223	1,546.59	140.8%	75-79	-	568	15.53	0.0%
80-84	2,084	30,362	1,662.26	125.4%	80-84	-	518	24.44	0.0%
85-89	2,057	17,776	1,690.64	121.7%	85-89	-	302	24.67	0.0%
90-94	1,197	7,921	1,264.96	94.6%	90-94	59	263	37.95	155.5%
95+	231	1,155	277.46	83.3%	95+	3	29	6.88	43.6%
Totals	10,357	390,166	9,866.16	105.0%	Totals	109	23,371	249.47	43.7%

Appendix – Detailed Experience Analysis Pre-Retirement Mortality

2015-2019 Experience (\$000s)

Males					Females				
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/Expected
20-24	-	121,727	68.03	0.0%	20-24	-	23,078	4.23	0.0%
25-29	-	910,938	489.13	0.0%	25-29	-	144,734	31.55	0.0%
30-34	267	1,938,623	1,175.71	22.7%	30-34	-	247,401	73.08	0.0%
35-39	1,381	2,658,402	1,826.79	75.6%	35-39	-	360,261	141.99	0.0%
40-44	1,498	3,280,031	2,770.67	54.1%	40-44	-	436,850	240.31	0.0%
45-49	3,790	4,327,763	5,582.63	67.9%	45-49	-	546,370	455.65	0.0%
50-54	5,313	3,939,798	8,324.35	63.8%	50-54	553	399,675	534.03	103.6%
55-59	2,429	1,485,339	4,995.67	48.6%	55-59	909	147,779	301.48	301.5%
60-64	554	322,923	1,943.63	28.5%	60-64	-	21,388	64.13	0.0%
Totals	15,232	18,985,544	27,176.62	56.0%	Totals	1,462	2,327,536	1,846.45	79.2%

Appendix – Detailed Experience Analysis Pre-Retirement Mortality

2015-2016 Experience (\$000s)

Males					Females				
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/Expected
20-24	-	24,799	13.66	0.0%	20-24	-	3,646	0.66	0.0%
25-29	-	201,240	105.08	0.0%	25-29	-	31,074	6.61	0.0%
30-34	-	507,514	294.54	0.0%	30-34	-	65,771	18.66	0.0%
35-39	323	642,298	422.20	76.5%	35-39	-	89,692	34.10	0.0%
40-44	273	864,848	716.08	38.1%	40-44	-	118,384	64.35	0.0%
45-49	1,199	1,051,443	1,352.96	88.6%	45-49	-	116,281	94.75	0.0%
50-54	1,024	865,889	1,839.51	55.7%	50-54	-	95,981	126.76	0.0%
55-59	550	326,908	1,103.48	49.8%	55-59	-	29,795	60.69	0.0%
60-64	554	77,262	471.47	117.5%	60-64	-	4,258	12.75	0.0%
Totals	3,923	4,562,201	6,318.99	62.1%	Totals	-	554,882	419.31	0.0%

2016-2017 Experience (\$000s)

Males					Females				
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/Expected
20-24	-	29,788	16.56	0.0%	20-24	-	4,701	0.86	0.0%
25-29	-	211,901	113.05	0.0%	25-29	-	34,819	7.53	0.0%
30-34	267	471,995	283.00	94.3%	30-34	-	61,757	18.14	0.0%
35-39	452	624,084	422.99	106.9%	35-39	-	83,464	32.55	0.0%
40-44	636	770,282	646.18	98.4%	40-44	-	102,927	56.26	0.0%
45-49	-	1,034,187	1,329.92	0.0%	45-49	-	134,244	111.11	0.0%
50-54	-	909,910	1,923.98	0.0%	50-54	553	86,902	116.96	472.8%
55-59	492	358,980	1,214.74	40.5%	55-59	909	38,968	79.76	1139.7%
60-64	-	74,166	456.91	0.0%	60-64	-	6,036	18.40	0.0%
Totals	1,847	4,485,293	6,407.32	28.8%	Totals	1,462	553,818	441.57	331.1%

Appendix – Detailed Experience Analysis Pre-Retirement Mortality

2017-2018 Experience (\$000s)

Age Group	Males				Age Group	Females			
	Actual Deaths	Exposure	Expected Deaths	Actual/Expected		Actual Deaths	Exposure	Expected Deaths	Actual/Expected
20-24	-	34,973	19.67	0.0%	20-24	-	7,320	1.35	0.0%
25-29	-	254,390	137.82	0.0%	25-29	-	39,573	8.69	0.0%
30-34	-	518,389	320.24	0.0%	30-34	-	64,675	19.42	0.0%
35-39	606	724,312	504.90	120.0%	35-39	-	99,510	39.71	0.0%
40-44	589	863,189	732.12	80.5%	40-44	-	112,224	61.82	0.0%
45-49	2,074	1,188,993	1,531.72	135.4%	45-49	-	159,246	134.02	0.0%
50-54	1,474	1,071,045	2,263.09	65.1%	50-54	-	103,899	141.23	0.0%
55-59	-	384,631	1,293.34	0.0%	55-59	-	38,060	78.02	0.0%
60-64	-	85,023	504.51	0.0%	60-64	-	6,600	19.53	0.0%
Totals	4,743	5,124,945	7,307.43	64.9%	Totals	-	631,107	503.78	0.0%

2018-2019 Experience (\$000s)

Age Group	Males				Age Group	Females			
	Actual Deaths	Exposure	Expected Deaths	Actual/Expected		Actual Deaths	Exposure	Expected Deaths	Actual/Expected
20-24	-	32,167	18.14	0.0%	20-24	-	7,411	1.37	0.0%
25-29	-	243,407	133.18	0.0%	25-29	-	39,268	8.73	0.0%
30-34	-	440,725	277.93	0.0%	30-34	-	55,198	16.87	0.0%
35-39	-	667,708	476.69	0.0%	35-39	-	87,595	35.64	0.0%
40-44	-	781,712	676.30	0.0%	40-44	-	103,315	57.87	0.0%
45-49	517	1,053,140	1,368.03	37.8%	45-49	-	136,599	115.77	0.0%
50-54	2,815	1,092,954	2,297.76	122.5%	50-54	-	112,893	149.07	0.0%
55-59	1,387	414,820	1,384.12	100.2%	55-59	-	40,956	83.01	0.0%
60-64	-	86,472	510.74	0.0%	60-64	-	4,494	13.45	0.0%
Totals	4,719	4,813,105	7,142.87	66.1%	Totals	-	587,729	481.78	0.0%

Appendix – Detailed Experience Analysis Disabled Mortality

2015-2019 Experience (\$000s)

Males					Females				
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/Expected
40-44	31	7,427	17.80	174.1%	40-44	-	1,551	3.08	0.0%
45-49	23	13,562	44.85	51.3%	45-49	-	4,285	10.47	0.0%
50-54	215	20,037	94.63	227.2%	50-54	-	6,169	19.47	0.0%
55-59	163	24,578	160.60	101.5%	55-59	-	3,792	17.07	0.0%
60-64	383	34,821	323.23	118.5%	60-64	-	3,660	25.11	0.0%
65-69	436	48,461	651.31	66.9%	65-69	-	1,449	14.25	0.0%
70-74	855	35,212	697.72	122.5%	70-74	-	650	9.55	0.0%
75-79	835	14,747	473.46	176.4%	75-79	-	56	1.43	0.0%
80-84	500	5,937	327.47	152.7%	80-84	-	-	-	N/A
85-89	250	1,525	146.14	171.1%	85-89	-	-	-	N/A
90-94	126	796	122.91	102.5%	90-94	-	-	-	N/A
95-99	-	-	-	N/A	95-99	-	-	-	N/A
Totals	3,817	207,103	3,060.12	124.7%	Totals	-	21,612	100.44	0.0%

Appendix – Detailed Experience Analysis Disabled Mortality

2015-2016 Experience (\$000s)

Males					Females				
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/Expected
40-44	31	1,391	3.21	964.4%	40-44	-	352	0.69	0.0%
45-49	-	3,019	9.99	0.0%	45-49	-	1,081	2.65	0.0%
50-54	-	4,336	20.80	0.0%	50-54	-	1,370	4.33	0.0%
55-59	-	6,046	39.56	0.0%	55-59	-	754	3.49	0.0%
60-64	67	9,741	89.40	74.9%	60-64	-	874	5.83	0.0%
65-69	176	12,691	167.84	104.9%	65-69	-	256	2.82	0.0%
70-74	415	6,914	139.26	298.0%	70-74	-	45	0.60	0.0%
75-79	118	2,889	93.36	126.4%	75-79	-	14	0.31	0.0%
80-84	119	1,305	71.71	166.0%	80-84	-	-	-	N/A
85-89	145	377	44.23	327.9%	85-89	-	-	-	N/A
90-94	-	61	8.57	0.0%	90-94	-	-	-	N/A
95-99	-	-	-	N/A	95-99	-	-	-	N/A
Totals	1,071	48,770	687.93	155.7%	Totals	-	4,746	20.72	0.0%

2016-2017 Experience (\$000s)

Males					Females				
Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/Expected	Age Group	Actual Deaths	Exposure	Expected Deaths	Actual/Expected
40-44	-	1,984	4.75	0.0%	40-44	-	313	0.62	0.0%
45-49	-	3,088	10.35	0.0%	45-49	-	1,074	2.62	0.0%
50-54	123	4,906	23.33	527.2%	50-54	-	1,592	5.03	0.0%
55-59	96	6,406	42.51	225.8%	55-59	-	800	3.57	0.0%
60-64	29	8,619	80.56	36.0%	60-64	-	959	6.45	0.0%
65-69	142	12,909	174.15	81.5%	65-69	-	263	2.50	0.0%
70-74	100	7,948	159.44	62.7%	70-74	-	182	2.48	0.0%
75-79	111	3,327	110.57	100.4%	75-79	-	14	0.34	0.0%
80-84	85	1,252	71.46	118.9%	80-84	-	-	-	N/A
85-89	-	259	24.96	0.0%	85-89	-	-	-	N/A
90-94	-	185	26.77	0.0%	90-94	-	-	-	N/A
95-99	-	-	-	N/A	95-99	-	-	-	N/A
Totals	686	50,883	728.86	94.1%	Totals	-	5,197	23.62	0.0%

Appendix – Detailed Experience Analysis Disabled Mortality

2017-2018 Experience (\$000s)

Age Group	Males				Age Group	Females			
	Actual Deaths	Exposure	Expected Deaths	Actual/Expected		Actual Deaths	Exposure	Expected Deaths	Actual/Expected
40-44	-	2,133	5.14	0.0%	40-44	-	431	0.86	0.0%
45-49	-	3,528	11.64	0.0%	45-49	-	1,037	2.55	0.0%
50-54	44	5,325	24.97	176.2%	50-54	-	1,483	4.64	0.0%
55-59	41	6,170	40.50	101.2%	55-59	-	1,026	4.53	0.0%
60-64	176	8,506	79.79	220.6%	60-64	-	1,030	7.27	0.0%
65-69	88	11,857	161.01	54.7%	65-69	-	316	3.17	0.0%
70-74	150	9,362	183.98	81.5%	70-74	-	183	2.73	0.0%
75-79	274	3,891	122.49	223.7%	75-79	-	14	0.37	0.0%
80-84	166	1,771	96.84	171.4%	80-84	-	-	-	N/A
85-89	105	353	31.53	333.0%	85-89	-	-	-	N/A
90-94	-	248	38.21	0.0%	90-94	-	-	-	N/A
95-99	-	-	-	N/A	95-99	-	-	-	N/A
Totals	1,044	53,144	796.11	131.1%	Totals	-	5,520	26.13	0.0%

2018-2019 Experience (\$000s)

Age Group	Males				Age Group	Females			
	Actual Deaths	Exposure	Expected Deaths	Actual/Expected		Actual Deaths	Exposure	Expected Deaths	Actual/Expected
40-44	-	1,919	4.70	0.0%	40-44	-	455	0.91	0.0%
45-49	23	3,927	12.87	178.8%	45-49	-	1,093	2.65	0.0%
50-54	48	5,470	25.52	188.1%	50-54	-	1,724	5.46	0.0%
55-59	26	5,956	38.03	68.4%	55-59	-	1,212	5.48	0.0%
60-64	111	7,955	73.49	151.0%	60-64	-	797	5.56	0.0%
65-69	30	11,004	148.30	20.2%	65-69	-	614	5.76	0.0%
70-74	190	10,988	215.04	88.4%	70-74	-	240	3.74	0.0%
75-79	332	4,640	147.03	225.8%	75-79	-	14	0.41	0.0%
80-84	130	1,609	87.46	148.6%	80-84	-	-	-	N/A
85-89	-	536	45.42	0.0%	85-89	-	-	-	N/A
90-94	126	302	49.36	255.2%	90-94	-	-	-	N/A
95-99	-	-	-	N/A	95-99	-	-	-	N/A
Totals	1,016	54,306	847.22	119.9%	Totals	-	6,149	29.97	0.0%