City of Fresno Employees
Retirement System

Actuarial Experience Study

Analysis of Actuarial Experience
During the Period
July 1, 2018 through June 30, 2021

Segal

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May 3, 2022

Board of Retirement
City of Fresno Employees Retirement System
2828 Fresno Street, Suite 201
Fresno, CA 93721-1327

Re: Review of Actuarial Assumptions for the June 30, 2022 Actuarial Valuation

Dear Members of the Board:

We are pleased to submit this report of our review of the actuarial experience for the City of Fresno Employees Retirement System. This study utilizes the census data for the period July 1, 2018 to June 30, 2021 and provides the proposed actuarial assumptions to be used in the June 30, 2022 valuation.

The review of the economic assumptions for use in the June 30, 2022 valuation is provided in a separate report.

We are members of the American Academy of Actuaries and we meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion herein.

We look forward to reviewing this report with you and answering any questions you may have.

Sincerely,

Paul Angelo, FSA, MAAA, FCA, EA
Senior Vice President and Actuary

Andy Yeung, ASA, MAAA, FCA, EA
Vice President and Actuary

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I. Introduction, Summary, and Recommendations

To project the cost and liabilities of the pension plan, assumptions are made about all future events that could affect the amount and timing of the benefits to be paid and the assets to be accumulated. Each year actual experience is compared against the projected experience, and to the extent there are differences, the future contribution requirement is adjusted.

If assumptions are modified, contribution requirements are adjusted to take into account a change in the projected experience in all future years. There is a great difference in both philosophy and cost impact between recognizing the actuarial deviations as they occur annually and changing the actuarial assumptions. Taking into account one year's gains or losses without making a change in the assumptions means that year's experience is treated as temporary and that, over the long run, experience will return to what was originally assumed. For example, it is impossible to determine how and to what extent the economy and future mortality rates will be affected by the COVID-19 pandemic.[1] Changing assumptions reflects a basic change in thinking about the future, and has a much greater effect on the current contribution requirements than recognizing gains or losses as they occur.

The use of realistic actuarial assumptions is important in maintaining adequate funding, while paying the promised benefit amounts to participants already retired and to those near retirement. The actuarial assumptions used do not determine the "actual cost" of the plan. The actual cost is determined solely by the benefits and administrative expenses paid out, offset by investment income received. However, it is desirable to estimate as closely as possible what the actual cost will be so as to permit an orderly method for setting aside contributions today to provide benefits in the future, and to maintain equity among generations of participants and taxpayers.

This study was undertaken in order to review the demographic actuarial assumptions and to compare the actual experience with that expected under the current assumptions during the three-year experience period from July 1, 2018 through June 30, 2021. The study was performed in accordance with Actuarial Standard of Practice (ASOP) No. 27 "Selection of Economic Assumptions for Measuring Pension Obligations" and ASOP No. 35 "Selection of Demographic and Other Non-Economic Assumptions for Measuring Pension Obligations." These Standards of Practice provide guidance for the selection of the various actuarial assumptions utilized in a pension plan actuarial valuation. Based on the study's results and expected future experience, we are recommending various changes in the current actuarial assumptions.

We are recommending changes in the assumptions for merit and promotion salary increases, retirement from active employment, DROP election, pre-retirement mortality, healthy life post-retirement mortality, disabled life post-retirement mortality, termination (refund and deferred vested retirement), disability, and election of optional forms of benefit at retirement.

[1] An analysis of the ongoing impact of the COVID-19 pandemic is beyond the scope of the current experience study.

Our recommendations for the major actuarial assumption categories are as follows:

Pg #	Actuarial Assumption Categories	Recommendation
7	**Individual Salary Increases:** Increases in the salary of a member between the date of the valuation to the date of separation from active service. This assumption has three components: • Inflationary salary increases • Real "across the board" salary increases • Merit and promotion increases	We recommend adjusting the merit and promotion rates of salary increase as developed in Section (III)(B) to reflect past experience. Future merit and promotion salary increases are slightly higher in most service categories under the proposed assumption. The review of the inflationary and real "across-the-board" increase components of the salary increase assumption is provided as part of our review of economic actuarial assumptions for the June 30, 2022 actuarial valuation.
10	**Retirement Rates:** The probability of retirement at each age at which participants are eligible to retire. **Other Retirement Related Assumptions including:** • Retirement age for deferred vested members • Future reciprocal members and reciprocal salary increases • Percent married and spousal age differences for members not yet retired • Election of optional forms of benefit at retirement	For active members, adjust the current retirement rates to those developed in Section (III)(C). For deferred vested members, increase the assumed retirement age from 55 to 56. Maintain the salary increase assumption at 3.75% for those deferred vested reciprocal members who elect to leave their contributions on deposit (based on expected salary increase assumptions for active members with 15 or more years of service). For active and deferred vested members, maintain the percent married at retirement assumption at 80% males and 55% for females. Maintain the spouse age difference assumption that male retirees are three years older than their spouses and female retirees are two years younger than their spouses. Adjust the percentages of married male and female members assumed to elect the Unmodified Option, Option 2 (A/B), and Option 3 (A/B) at retirement or DROP entry.

Pg #	Actuarial Assumption Categories	Recommendation
16	**Mortality Rates:** The probability of dying at each age. Mortality rates are used to project life expectancies.	**For pre-retirement mortality:** Current and recommended base table: Pub-2010 General Employee Amount-Weighted Mortality Table. **For Healthy retirees:** Current and recommended base table: Pub-2010 General Healthy Retiree Amount-Weighted Mortality Table with rates increased by 5%. **For Beneficiaries:** Current base table: Pub-2010 General Healthy Retiree Amount-Weighted Mortality Table with rates increased by 5%. Recommended base table for current beneficiaries of surviving members: Pub-2010 General Healthy Retiree Amount-Weighted Mortality Table with rates increased by 5% (unchanged). Recommended base table for beneficiaries upon actual death of members (i.e., for all beneficiaries in pay status as of the valuation date): Pub-2010 Contingent Survivor Amount-Weighted Mortality Table with rates increased by 5%. When calculating the liability for the continuance to a beneficiary of a surviving member we recommend that the General Healthy Retiree mortality tables (as stated above) be used for beneficiary mortality both before and after the expected death of the member. **For Disabled Retirees:** Current base table: Pub-2010 Non-Safety Disabled Retiree Amount-Weighted Mortality Table. Recommended base table: Pub-2010 Non-Safety Disabled Retiree Amount-Weighted Mortality Table with rates decreased by 5%. **All current tables** are projected generationally with the two-dimensional mortality improvement scale MP-2018. **All recommended tables** are projected generationally with the two-dimensional mortality improvement scale MP-2021. **For member contribution rates and optional forms**: change the mortality rates to those developed in Section (III)(D).
24	**Termination Rates:** The probability of leaving employment at each age and receiving either a refund of member contributions or a deferred vested retirement benefit.	Adjust the current termination rates to those developed in Section (III)(F). The recommended assumptions will anticipate lower terminations.
28	**Disability Incidence Rates:** The probability of becoming disabled at each age.	Adjust the current disability rates to those developed in Section (III)(G). The recommended assumption will anticipate more disability retirements.
31	**DROP Assumptions:** The probability of electing to enter DROP at each age at which participants are eligible and the duration of DROP participation.	Adjust the current DROP election rates to those developed in Section (III)(H). Maintain the current assumption that members remain in DROP for 6 years.

We have estimated the impact of all the recommended demographic and economic assumptions and the alternative investment return assumption as if they were applied to the June 30, 2021 actuarial valuation. The tables below show the changes in the employer and member normal cost rates due to the proposed assumption changes separately for the recommended demographic assumption changes (as recommended in Section III of this report) and the recommended and alternative economic assumption changes (as recommended in the separate report).

Cost Impact
(Without Considering Any Impact on Surplus Distribution)
Based on June 30, 2021 Actuarial Valuation

	Recommended (6.75% Return and Other Recommended Assumptions)	Alternative (6.50% Return and Other Recommended Assumptions)
Impact on Average Employer Normal Cost Rate		
Change due to demographic assumptions	0.18%	0.18%
Change due to economic assumptions	0.70%	1.45%
Total increase in average employer normal cost rate	0.88%	1.62%
Total estimated increase in annual dollar normal cost amount ($000s)[1]	$1,439	$2,636
Impact on Average Member Normal Cost Rate		
Change due to demographic assumptions	(0.07%)	(0.07%)
Change due to economic assumptions	0.25%	0.88%
Total increase in average member rate	0.18%	0.82%
Total estimated increase in annual dollar member amount ($000s)[2]	$273	$1,152
Impact on UAAL and Funded Percentage		
Increase/(Decrease) in UAAL	$(6.8) million[3,4]	$27.0 million[5]
Change in Funded Percentage	From 116.0% to 116.7%	From 116.0% to 113.4%

Section II provides some background on the basic principles and methodology used for the experience study and for the review of the economic and demographic actuarial assumptions. A detailed discussion of each assumption and reasons for the proposed changes are found in the separate report for the economic assumptions and Section III for the demographic assumptions. The cost impact of the proposed changes is detailed in Section IV.

[1] Calculated using payroll for all active employees (including employees in DROP)
[2] Calculated using payroll for active non-DROP employees
[3] Although there is a decrease in liabilities for non-actives, there is an increase in liabilities for actives (both for those in DROP and not in DROP).
[4] If the Retirement System were not overfunded, this change in the UAAL would decrease the employer's UAAL rate by 0.25% of payroll. This is based on using an amortization period of 25 years for assumption changes in accordance with the System's amortization policy.
[5] If the Retirement System were not overfunded, this change in the UAAL would increase the employer's UAAL rate by 1.20% of payroll. This is based on using an amortization period of 25 years for assumption changes in accordance with the System's amortization policy.

II. Background and Methodology

In this report, we analyzed the demographic ("non-economic") assumptions. Our analysis of the "economic" assumptions for the June 30, 2022 valuation is provided in a separate report. Demographic assumptions include the probabilities of certain events occurring in the population of members, referred to as "decrements," e.g., termination from service, disability retirement, service retirement, DROP election, and death before and after retirement. In addition to decrements, other demographic assumptions reviewed in this study include the percentage of members with an eligible spouse, domestic partner or beneficiary, spousal age difference, merit and promotion salary increases, and election of optional forms of benefit at retirement.

Demographic Assumptions

In order to determine the probability of an event occurring, we examine the "decrements" and "exposures" of that event. For example, taking termination from service, we compare the number of employees who actually terminate in a certain age and/or service category (i.e., the number of "decrements") with those who could have terminated (i.e., the number of "exposures"). For example, if there were 500 active employees in the 20-24 age group at the beginning of the year and 50 of them left during the year, we would say the probability of termination in that age group is 50 ÷ 500 or 10%.

The reliability of the resulting probability is highly dependent on both the number of decrements and the number of exposures. For example, if there are only a few people in a high age category at the beginning of the year (number of exposures), we would not lend as much credibility to the probability of termination developed for that age category, especially if it is out of line with the pattern shown for the other age groups. Similarly, if we are considering the death decrement, there may be a large number of exposures in, say, the age 20-24 category, but very few decrements (actual deaths); therefore, we would not be able to rely heavily on the probability developed for that category.

One reason we use several years of experience for such a study is to have more exposures and decrements, and therefore more statistical reliability. Another reason for using several years of data is to smooth out fluctuations that may occur from one year to the next. However, we also calculate the rates on a year-to-year basis to check for any trend that may be developing in the later years.

III. Actuarial Assumptions

A. Economic Assumptions

The economic assumptions are reviewed in a separate reported titled “Review of Economic Actuarial Assumptions for the June 30, 2022 Actuarial Valuation.”

B. Merit and Promotion Salary Increases

The System’s retirement benefits are determined in large part by a member’s compensation just prior to retirement or election to participate in the DROP. For that reason, it is important to anticipate salary increases that employees will receive over their careers. These salary increases are made up of three components:

1. **Inflationary increases;**
2. **Real “across the board” Pay Increases**; and
3. **Merit and Promotion Increases.**

   The inflationary increases are assumed to follow the recommended general annual inflation assumption of 2.50% discussed in our separate economic assumptions report. We also discussed in that report our recommended assumption of an annual 0.50% “across the board” pay increase. Therefore, the total annual inflation and real “across the board” pay increases of 3.00% is used as the assumed annual rate of payroll growth at which payments to the UAAL or Prefunded Actuarial Accrued Liability are assumed to increase.

   The annual merit and promotion increases are determined by measuring the actual increases received by members over the experience period, net of the inflationary and real “across the board” pay increases. Increases are measured for all current active non-DROP and DROP members. This is accomplished by:

   a. Measuring each continuing member’s actual salary increase over each year of the experience period on a salary-weighted basis, with higher weights assigned to experience from members with larger salaries;
   b. Excluding any members with increases of more than 50% or decreases of more than 10% during any particular year;
   c. Categorizing these increases according to member demographics;
   d. Removing the wage inflation component from these increases (assumed to be equal to the increase in the members’ average salary during the year);
   e. Averaging these annual increases over the experience period; and
   f. Modifying current assumptions to reflect some portion of these measured increases reflective of their “credibility.”

   To be consistent with the other economic assumptions, these merit and promotion assumptions should be used in combination with the recommended 3.00% assumed inflation and real “across the board” increases.

Due to the high variability of the actual salary increases, we have analyzed this assumption using data for the past nine years. We believe that when the experience from the current and prior studies is combined, it provides a more reasonable representation of potential future merit and promotion salary increases over the long term.

The following table shows the actual average merit and promotion increases by years of service over the three-year period from July 1, 2018 through June 30, 2021 along with the actual average increases based on combining the current three-year period with the six-year period from the prior two experience studies (recalculated for all active non-DROP and DROP members on a salary-weighted basis). The current and proposed assumptions are also shown. The actual increases for the most recent nine-year period were reduced by the actual average inflation plus "across the board" increase (i.e., wage inflation, estimated as the increase in average salaries) for each year during the nine-year experience period.

	Rate (%)				
Years of Service	**Current Assumptions**	**2018-2021 Actual Average Increase (Last 3 Years)**	**2015-2021 Actual Average Increase (Last 6 Years)**	**2012-2021 Actual Average Increase (Last 9 Years)**	**Proposed Assumption**
Less than 1	8.00	10.88	9.74	9.63	8.50
1 – 2	6.00	5.89	6.61	6.55	6.25
2 – 3	4.50	5.02	5.22	5.24	4.75
3 – 4	3.75	4.70	4.81	4.80	4.25
4 – 5	3.00	4.46	4.46	4.29	3.50
5 – 6	2.00	3.08	3.48	3.22	2.50
6 – 7	1.25	1.90	2.28	2.30	1.75
7 – 8	1.00	1.86	2.61	2.11	1.50
8 – 9	1.00	3.75	4.24	3.28	1.50
9 – 10	1.00	2.61	2.58	2.44	1.50
10 – 11	0.75	3.16	2.55	2.05	1.25
11 – 12	0.75	1.02	2.05	1.97	1.25
12 – 13	0.75	1.01	1.87	1.73	1.25
13 – 14	0.75	1.51	1.83	1.75	1.25
14 – 15	0.75	2.14	2.53	2.11	1.25
15 – 16	0.50	2.34	2.38	2.09	1.00
16 – 17	0.50	1.57	2.19	1.89	1.00
17 – 18	0.50	1.01	1.70	1.46	1.00
18 – 19	0.50	1.00	1.36	1.37	1.00
19 – 20	0.50	1.19	1.51	1.44	1.00
20 & Over	0.50	1.12	1.39	1.33	0.75

Chart 1 provides a graphical comparison of the actual merit and promotion increases, compared to the proposed and current assumptions. The chart also shows the actual merit and promotion increases based on averages over the current three-year period as well as

over a nine-year period, including the previous two three-year experience periods. This is discussed below.

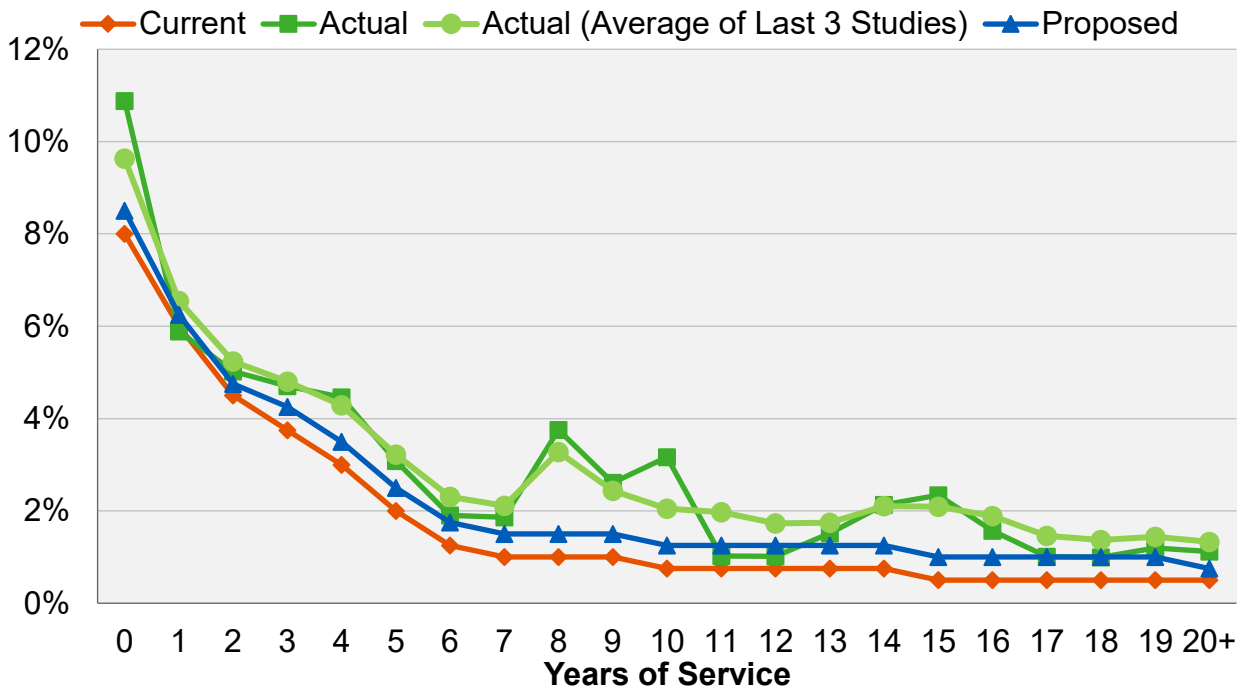
The System has had a mix of salary gains and losses during the past nine valuations, meaning that salaries have increased both less and more than assumed, respectively, in various years. Consistent with prior practice, we examined the merit and promotion increases from the most recent three-year experience period together with the experience from the prior two experience studies for a combined total of nine-year experience. We believe that the combined experience provides a more reasonable representation of potential future merit and promotion salary increases over the long term.

In proposing changes, we considered whether experience has been consistently one-sided, i.e. trending toward losses or gains, for particular service bands. For example, for members with less than 1 year of service, our assumption of 8.00% has been consistently below experience, whether we look at the 3-year, 6-year, or 9-year average. Generally, if experience has been consistently and significantly different than our assumption, we recommend a change. Conversely, if we see experience both above and below our assumption, we are likely to preserve the current assumption.

Another consideration is that as we have continued to lower the inflation assumption in the last three experience studies, we believe adopting a more conservative set of merit and promotion salary increase assumptions would be warranted.

Based on this experience, we are recommending across-the-board increases in the merit and promotion salary increases. The overall salary increase assumptions will be partially offset after taking into account the lower inflation component of the salary increase assumption.

Chart 1: Merit and Promotion Salary Increase Rates



C. Retirement Rates

The age at which a member retires from service (i.e., who did not retire on a disability pension) will affect both the amount of the benefits that will be paid to that member as well as the period over which funding must take place.

Currently, the assumed retirement rates are a function of only member's age. Our experience review analyzed recent years' retirement experience both as a function of age and years of service in relation to the probability of retirement. Our review concludes that the retirement rates correlate with age but less so with years of service. Therefore, we continue to recommend that retirement rates continue to be structured as a function age only.

The table on the following page shows the observed service retirement rates based on the actual experience over the past three years. The observed service retirement rates were determined by comparing those members who actually retired from service to those eligible to retire from service. This same methodology is followed throughout this report and was described in Section II. Also shown are the current rates assumed and the rates we propose.

Consistent with the prior experience study, for actives over age 55, the actual retirement experience was only a reflection of those members who never elected to participate in the DROP. However, effective January 28, 2008, actives may retire or participate in the DROP as early as age 50 with an actuarially reduced early retirement benefit.

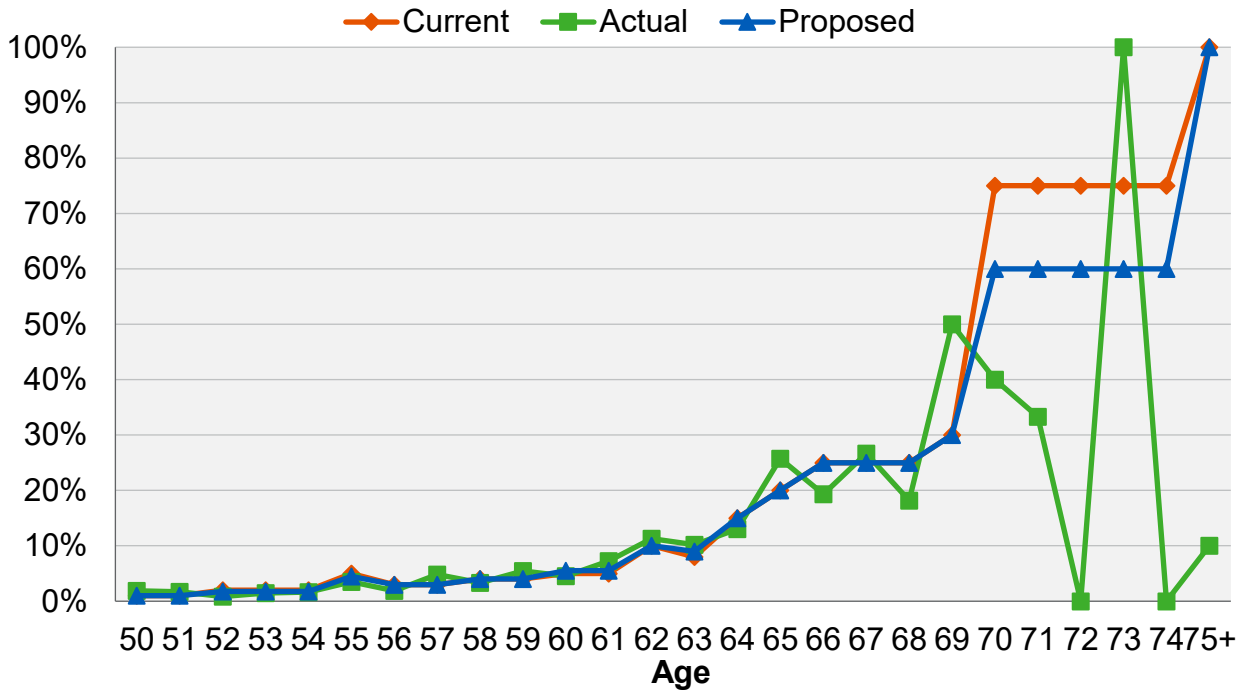
Consistent with the prior experience study, we are excluding experience for actives who elected the DROP before age 55 when setting the retirement rates for members between 50 and 54. This is because, unlike with retirement rates, we found a significant relationship between DROP election rates and years of service, and believe this experience is better reflected by the age and service-based rate structure we are proposing for DROP elections discussed later in this report.

	Rate of Retirement (%)		
Age	Current Rate	Actual Rate	Proposed Rate
50	1.00	1.90	1.00
51	1.00	1.71	1.00
52	2.00	0.83	1.75
53	2.00	1.50	1.75
54	2.00	1.65	1.75
55	5.00	3.48	4.50
56	3.00	1.90	3.00
57	3.00	4.85	3.00
58	4.00	3.33	4.00
59	4.00	5.48	4.00
60	5.00	4.55	5.50
61	5.00	7.27	5.50
62	10.00	11.32	10.00
63	8.00	10.20	9.00
64	15.00	13.04	15.00
65	20.00	25.71	20.00
66	25.00	19.35	25.00
67	25.00	26.67	25.00
68	25.00	18.18	25.00
69	30.00	50.00	30.00
70	75.00	40.00	60.00
71	75.00	33.33	60.00
72	75.00	N/A	60.00
73	75.00	100.00	60.00
74	75.00	0.00	60.00
75 & Over	100.00	10.00	100.00

As shown above, we are recommending decreases in the retirement rates at certain ages.

Chart 2 on the following page compares actual experience with the current and proposed rates of retirement.

Chart 2: Retirement Rates



Deferred Vested Members

In the prior experience study, deferred vested members were assumed to retire at age 55. Over the last three years, 37 members retired from deferred vested status with an average age of 57.1. In the last study, there were 46 members who retired from deferred vested status with an average age of 55.9.

We recommend increasing the assumed retirement age to 56.

Reciprocity

Due to the distinctive design of the plan which requires that the salary rate from the most recent salary resolution prior to the date of retirement be used in determining final average salary for deferred vested members, in effect there is already an implicit assumption in the valuation that 100% of all deferred vested members will receive benefits as though they were on reciprocity. For that reason, an explicit reciprocity assumption is not necessary.

The annual salary increase assumption is based on the ultimate merit and promotion salary increase assumptions together with the 2.50% inflation and 0.50% real “across the board” salary increase assumptions that are recommended in a separate report. This assumption is utilized to anticipate salary increases from termination from the System to the expected date of retirement.

We recommend maintaining the annual salary increase assumption for current and future deferred vested members of 3.75% (i.e., 2.50% inflation plus 0.50% “across the board” plus 0.75% merit and promotion).

Survivor Continuance and Optional Forms of Benefit

In prior valuations, it was assumed that 80% of all active and inactive male members and 55% of all active and inactive (non-retired) female members would be married or have an eligible domestic partner or beneficiary when they retired. We reviewed experience for members who retired or entered DROP during the three-year period and determined the actual percentage of these new retirees that had an eligible spouse or eligible domestic partner or beneficiary at the time of retirement. The results of that analysis are shown below.

	New Retirees – Actual Percent with Eligible Spouse or Domestic Partner or Beneficiary and Selected Option with Continuance	
Year Ending June 30	**Male**	**Female**
2019	74%	49%
2020	79%	52%
2021	87%	62%
Total	**80%**	**53%**

According to experience of members who retired during the last three years, about 80% of all male members and 53% of all female members who selected the unmodified option were married or had a domestic partner at retirement. We recommend maintaining the assumption for both males and females members at 80% and 55%, respectively.

Pursuant to Section 3-554 of the Municipal Code, a member may elect to receive an optional form of benefit at retirement that is the actuarial equivalent of his or her unmodified retirement allowance in the form of a lesser retirement allowance payable throughout life, with one of the six options stipulated in the Code. It has been the System's longstanding practice to use only the current investment return and mortality assumptions, and without considering the value of the future COLA benefits as stipulated in the Code, in determining the actuarially equivalent optional forms of benefit.

The code section requirement of excluding the COLA assumption in calculating benefit amounts under optional forms of payment results in higher benefit amounts payable under Options 2A, 2B, 3A and 3B[2] as compared to the benefit amount that would result if the COLA assumption were included. This is because the value of the future COLAs expected to be paid over both the lives of the member and the beneficiary are proportionately greater than the value of the future COLAs expected to be paid over just the member's life. Since members (and their survivors) actually do receive COLAs, this Code requirement results in a slight subsidy to members whenever they elect those options.

As we pointed out in setting the contribution rates starting in the June 30, 2018 valuation, the Code requirement of excluding the COLA assumption in the optional forms of benefit calculations means that there would be a small actuarial loss when a member retires and elects one of the options mentioned and starts collecting COLA benefits. Since it would be preferable

[2] Option 2A and Option 3A provide 100% and 50% continuance, respectively, of the member's modified allowance, payable to the designated beneficiary upon the member's death. Option 2B and Option 3B provide 100% and 75% continuance, respectively, of the member's modified allowance, payable to the spouse/domestic partner upon the member's death.

to avoid known actuarial losses by anticipating such elections, in the June 30, 2018 valuation we introduced an assumption to anticipate election of the different optional forms of benefit at retirement.

The following tables show the observed percentages of election of optional forms of benefit for male and female members with survivors over the last three years. Also shown are the current percentages assumed and the percentages we propose.

	Male Members with Survivor Election of Optional Forms of Benefit At Retirement		
Optional Form:	**Current Assumption**	**Actual System Experience**	**Proposed Assumption**
Unmodified	30%	43.0%	35%
Option 2 (A/B)	50%	40.3%	45%
Option 3 (A/B)	20%	16.7%	20%

	Female Members with Survivor Election of Optional Forms of Benefit At Retirement		
Optional Form:	**Current Assumption**	**Actual System Experience**	**Proposed Assumption**
Unmodified	65%	74.0%	70%
Option 2 (A/B)	25%	16.0%	20%
Option 3 (A/B)	10%	10.0%	10%

We recommend changing the percentages of married male members assumed to elect the Unmodified Option and Option 2 (A/B) while maintaining the percentage assumed to elect Option 3 (A/B) at retirement or DROP entry. For married female members, we recommend changing the percentages assumed to elect the Unmodified Option and Option 2 (A/B) while maintaining the percentage assumed to elect Option 3 (A/B) at retirement or DROP entry.

For non-married members, it is assumed that they will elect the unmodified option. We recommend no change to this assumption based on 100% of unmarried members electing the unmodified option over the last three years.

Since the present value of the survivor's benefit is dependent on the survivor's age and sex, we must also have assumptions for the age and sex of the survivor. Based on the experience for members who retired during the current three-year period (results shown in the table below) and studies done for other retirement systems, **we recommend the following:**

1. Since more than 85% of the survivors are actually the opposite sex, even with the inclusion of domestic partners, and other eligible beneficiaries, **we will continue to assume that for all active and inactive members, the survivor's sex is the opposite of the member.**
2. The current and proposed assumption for the age of the survivor for all active and inactive members are shown below. These assumptions will continue to be monitored in future experience studies.

	Survivor's Age as Compared to Member's Age		
Member Sex	**Current Assumption**	**Actual System Experience**	**Proposed Assumption**
Male	3 years older	2.4 years older	3 years older
Female	2 years younger	1.7 years younger	2 years younger

We recommend maintaining the spouse age difference assumptions and that the spouse is the opposite sex of the member.

D. Mortality Rates - Healthy

The "healthy" mortality rates project the life expectancy of a member who retires from service (i.e., who did not retire on a disability pension). Also, the "healthy" pre-retirement mortality rates project what proportion of members will die before retirement. The table currently being used for post-service retirement mortality rates is the Pub-2010 General Healthy Retiree Amount-Weighted Mortality Table (separate tables for males and females) increased by 5%, projected generationally with the two-dimensional mortality improvement scale MP-2018. Beneficiaries are assumed to have the same mortality as members who have taken a service (non-disability) retirement.

The Pub-2010 mortality tables are based exclusively on public sector pension plan experience in the United States. Within the Pub-2010 family of mortality tables, there are separate tables by job categories of General, Safety and Teachers. Included with the mortality tables is the analysis prepared by Retirement Plan Experience Committee (RPEC) that continues to observe that benefit amount for healthy retirees and salary for employees are the most significant predictors of mortality differences within the job categories. Therefore, Pub-2010 includes mortality rates developed for annuitants on a "benefit" weighted basis, with greater weight given to experience from annuitants receiving larger benefits to reflect that retirees with larger benefits generally live longer than those with lower benefits.

As the Pub-2010 study shows that benefit (or salary for employees) is a significant predictor of mortality difference, the Pub-2010 family of mortality tables also includes mortality rates based on population with above-median benefit amount (or salary for employees), below-median benefit amount (or salary for employees) and total population within each job category. The median benefit amounts used to determine the above-median and below-median mortality rates as shown in the Pub-2010 report for General members are as follows:

	Median Amounts ($) by Gender, Job Category, and Status			
	Males		Females	
Job Category	Employees	Retirees	Employees	Retirees
General	45,800	21,200	34,700	11,900

Note: Values shown as of 2010.

After adjusting the above amounts by a measure of U.S. price inflation from 2010 to 2021 for a total increase of about 38%, a substantial portion of the benefit amounts (or salaries) paid to the System's members were both above and below those adjusted median amounts. In other words, the benefit amounts (or salaries) paid to the System's members were not disproportionately above or below the median. Therefore, we recommend that the total population version of the mortality tables for each job category be used.

We continue to recommend that the mortality improvement scale be applied generationally where each future year has its own mortality table that reflects the forecasted improvements, using the published improvement scales. The "generational" approach is now the established practice within the actuarial profession.

A generational mortality table provides dynamic projections of mortality experience for each cohort of retirees. For example, the mortality rate for someone who is 65 next year will be

slightly less than for someone who is 65 this year. In general, using generational mortality anticipates increases in the cost of the Plan over time as participants' life expectancies are projected to increase.

We understand that RPEC intends to publish annual updates to their mortality improvement scales. Improvement scale MP-2021 is the latest improvement scale available. We recommend that the Board continue to use the Amount-Weighted Pub-2010 mortality table (adjusted for the System's experience), and project the mortality improvement generationally using the MP-2021 mortality improvement scale.

In order to reflect more actual System experience in our analysis, we have used experience for a twelve-year period by using data from the current (from July 1, 2018 through June 30, 2021 and the last three (from July 1, 2015 through June 30, 2018; from July 1, 2012 through June 30, 2015; and from July 1, 2009 through June 30, 2012) experience study periods in order to analyze this assumption.

Even with the use of twelve years of experience, based on standard statistical theory the data is only partially credible especially under the recommended amount-weighted basis when dispersion of retirees' benefit amounts is taken into account. In 2008 the SOA published an article recommending that mortality assumptions include an adjustment for credibility. Under this approach, the number of deaths needed for full credibility for a headcount-weighted mortality table is just over 1,000, where full credibility means a 90% confidence that the actual experience will be within 5% of the expected value. Therefore, in our recommended assumptions, we have only partially adjusted the Pub-2010 mortality tables to the System's experience. In future experience studies, more data will be available which may further increase the credibility of the System's experience.

Pre-Retirement Mortality

The table currently being used for pre-retirement mortality rates is the Pub-2010 General Employee Amount-Weighted Mortality Table (separate tables for males and females), projected generationally with the two-dimensional mortality improvement scale MP-2018. We have observed that there have only been a total of 13 pre-retirement deaths in the System in the most recent three years, and therefore there is not enough data to perform a credible analysis.

We recommend maintaining the current table, i.e. the Pub-2010 General Employee Amount-Weighted Mortality Table (separate tables for males and females), while updating the two-dimensional generational mortality improvement scale from MP-2018 to MP-2021.

Post-Retirement Mortality (Service Retirements)

Among all retired members, the actual deaths weighted by benefit amounts under the current assumptions for the last twelve years are shown in the table below. We also show the deaths weighted by benefit amount under the proposed assumptions. We continue to recommend the use of a generational mortality table, which incorporates a more explicit assumption for future mortality improvement. Accordingly, the goal is to start with a mortality table that closely matches the current experience (without a margin for future mortality improvement), and then reflect mortality improvement by projecting lower mortality rates in future years.

The proposed mortality table also reflects current experience to the extent that the experience is credible based on standard statistical theory. For the System, the volume of member data makes it only partially credible.

That is why, as shown in the table below, the proposed mortality table (which includes an adjustment to the base table to reflect current experience) has an actual to expected ratio of 101% rather than 100%. In future years, we would expect the actual to expected ratio to be around 100% as long as actual mortality improves at the same rates as anticipated by the generational mortality tables.

The number of actual deaths compared to the number expected under the current and proposed assumptions weighted by benefit amounts for the last twelve years are as follows:

	Healthy Retirees ($ in thousands)		
Gender	**Current Expected Weighted Deaths[3]**	**Actual Weighted Deaths**	**Proposed Expected Weighted Deaths**
Male	$820.9	$820.6	$822.1
Female	147.1	161.1	147.2
Total[4]	**$968.0**	**$981.7**	**$969.3**
Actual / Expected	101%		101%[5]

We recommend maintaining the current table using the Pub-2010 General Healthy Retiree Amount-Weighted Mortality Table (separate tables for males and females) with rates increased by 5%, while updating the two-dimensional generational mortality improvement scale from MP-2018 to MP-2021. The recommended mortality table has an actual to expected ratio of 101%.[4]

Chart 3 compares actual to expected deaths on a benefit-weighted basis under the current and proposed assumptions over the past twelve years.

Chart 4 shows the life expectancies (i.e., expected future lifetime) under the current and the proposed tables on a benefit-weighted basis. Life expectancies under the proposed generational mortality rates are based on age as of 2022. In practice, assumed life expectancies will increase as a result of the mortality improvement scale.

Beneficiaries Mortality

In our prior experience study, we recommended the mortality tables for beneficiaries be set equal to the General Healthy Retiree Amount-Weighted Mortality Tables. The Pub-2010 General Healthy Retiree Table has been developed based on mortality rates for beneficiaries before the death of the retirees. According to analysis provided by RPEC, the mortality rates for the beneficiaries could be somewhat understated after the death of the retirees if we continue to use the Pub-2010 General Healthy Retiree Table instead of the Pub-2010 Contingent Survivor Table. Accordingly, we are recommending that the Pub-2010 Contingent Survivor Table be

[3] Expected amounts under the proposed generational mortality table are based on mortality rates from the base year projected with mortality improvements to the experience study period.

[4] Results may not add due to rounding.

[5] If we use the benchmark Pub-2010 General table without any adjustment, the proposed actual to expected ratio would be 106%.

used for beneficiaries after the death of the retirees. The Pub-2010 Contingent Survivors Table is developed based only on contingent survivor data after the death of the retirees. However, there is much less data available to study deaths for beneficiaries.

That is why, as shown in the table below, the proposed mortality table (which includes an adjustment to the base table to reflect current experience) has an actual to expected ratio of 104% rather than 100%. In future years, we would expect the actual to expected ratio to be around 100% as long as actual mortality improves at the same rates as anticipated by the generational mortality tables.

The number of actual deaths compared to the number expected under the current and proposed assumptions weighted by benefit amounts for the last twelve years are as follows:

	Beneficiaries ($ in thousands)		
Gender	Current Expected Weighted Deaths[6]	Actual Weighted Deaths	Proposed Expected Weighted Deaths
Male	$267.8	$288.7	$276.1
Female	8.4	8.1	9.8
Total	**$276.2**	**$296.8**	**$285.9**
Actual / Expected	107%		104%[7]

For all beneficiaries, we recommend changing the mortality assumption to follow the Pub-2010 Contingent Survivor Amount-Weighted Mortality Table (separate tables for males and females) with rates increased by 5%, projected generationally with the two-dimensional mortality improvement scale MP-2021. The recommended mortality table has an actual to expected ratio of 104%.

As stated above, the Contingent Survivor mortality tables are developed based on contingent survivor data only after the death of the retirees (i.e., it does not reflect any contingent survivor data before the death of the retirees). If we use the Contingent Survivor mortality table for the beneficiary before the death of the retiree, the mortality rates may be overstated as the Contingent Survivor mortality tends to be higher than retiree mortality. Therefore, for the purposes of the actuarial valuations (for funding and financial reporting), when calculating the liability for the continuance to a beneficiary of a surviving member, we recommend that the General Healthy Retiree mortality tables be used for beneficiary mortality both before and after the expected death of the retiree. Upon the actual death of the member (i.e., for all beneficiaries in pay status as of the valuation date), we recommend for the purposes of the actuarial valuations that we use the Contingent Survivor mortality tables as stated above. We note that the use of different mortality tables (before and after the death of the member) has been found by the RPEC to be reasonable.

[6] Expected amounts under the proposed generational mortality table are based on mortality rates from the base year projected with mortality improvements to the experience study period.

[7] If we use the benchmark Pub-2010 Contingent Survivor table without any adjustment, the proposed actual to expected ratio would be 109%.

Mortality Table for Member Contributions and Optional Forms of Payment

There are administrative reasons why a generational mortality table is more difficult to implement for determining member contributions, optional forms of payment. For determining member contributions, one emerging practice is to approximate the use of a generational mortality table by the use of a static table with projection of the mortality improvement from the measurement year over a period that is close to the duration of the benefit payments for active members. Similarly, for optional forms of payment, a generational mortality table could be approximated by static projection over a period that is close to the duration of the benefit payments for new retirees. We would recommend the use of these approximations for determining member contributions and optional forms of payment.

We recommend that the mortality tables used for determining contributions be updated to a blended table based on the Pub-2010 General Healthy Retiree Amount-Weighted Mortality Table (separate tables for males and females) with rates increased by 5%, projected 30 years (from 2010) with the two-dimensional mortality improvement scale MP-2021, weighted 65% male and 35% female for the member, and to a blended table based on the Pub-2010 General Healthy Retiree Amount-Weighted Mortality Table (separate tables for males and females) with rates increased by 5%, projected 30 years (from 2010) with the two-dimensional mortality improvement scale MP-2021, weighted 35% male and 65% female for the beneficiary.

For optional forms of payment, there are some administrative issues that we may need to resolve with the System and its vendor maintaining the pension administration software before we would recommend a comparable generational scale to anticipate future mortality improvement. We will provide a recommendation to the System for use in reflecting mortality improvement for determining optional forms of payment after we have those discussions with the System and its vendor.

For optional forms of payment and reserves, we would apply a similar methodology for the members' mortality tables. Furthermore, as there are complications associated with using different mortality tables for the beneficiaries before and after the death of the retiree, we recommend that the General Health Retiree mortality tables be used for the beneficiaries in determining optional forms of payment and reserves for retirees.

Chart 3: Post-Retirement Benefit-Weighted Deaths ($ In Thousands)
Non-Disabled Members (July 1, 2009 through June 30, 2021)

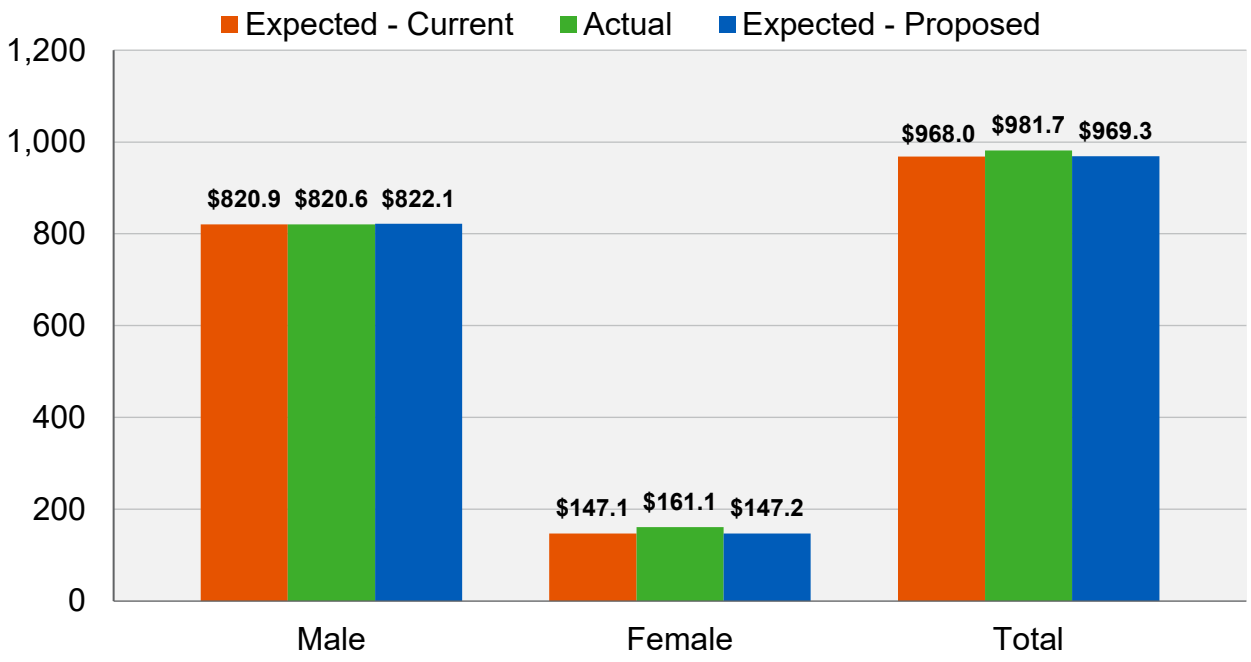
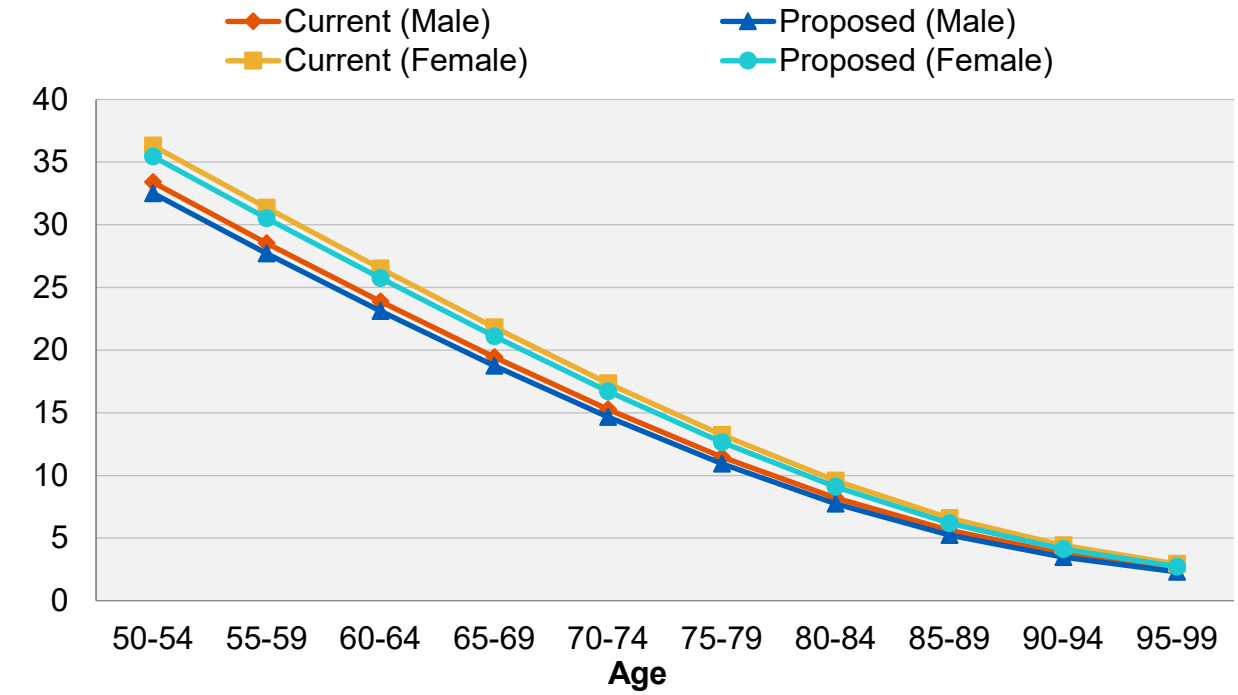


Chart 4: Benefit-Weighted Life Expectancies
Non-Disabled Members



E. Mortality Rates - Disabled

Since mortality rates for disabled members can vary from those of healthy members, a different mortality assumption is often used. The table currently being used is the Pub-2010 Non-Safety Disabled Retiree Amount-Weighted Mortality Table (separate tables for males and females), projected generationally with the two-dimensional mortality improvement scale MP-2018.

Similar to mortality rates for service retirees, the proposed mortality table reflects current experience to the extent that the experience is credible based on standard statistical theory. For the System, there is far less data for disabled retirees, so it is given little credibility.

That is why, as shown in the table below, the proposed mortality table (which includes an adjustment to the base table to reflect current experience) has an actual to expected ratio of 85% rather than 100%. In future years, we would expect the actual to expected ratio to be around 100% as long as actual mortality improves at the same rates as anticipated by the generational mortality tables.

The number of actual deaths compared to the number expected under the current and proposed assumptions weighted by benefit amounts for the last twelve years are as follows:

	Disabled Retirees ($ in thousands)		
Gender	**Current Expected Weighted Deaths[8]**	**Actual Weighted Deaths**	**Proposed Expected Weighted Deaths**
Male	$127.3	$103.8	$120.9
Female	11.1	7.4	10.5
Total	**$138.4**	**$111.2**	**$131.4**
Actual / Expected	80%		85%[9]

We recommend updating the current table to the Pub-2010 Non-Safety Disabled Retiree Amount-Weighted Mortality Table (separate tables for males and females), with rates decreased by 5%, projected generationally with the two-dimensional mortality improvement scale MP-2021. The recommended mortality table has an actual to expected ratio of 85%.

Chart 5 compares actual to expected deaths on a benefit-weighted basis for disabled General members under the current and proposed assumptions over the past twelve years.

Chart 6 shows the life expectancies (i.e., expected future lifetime) under the current and the proposed tables for disabled members on a benefit-weighted basis. Life expectancies under the proposed generational mortality rates are based on age as of 2022. In practice, life expectancies will be assumed to increase based on applying the mortality improvement scale.

[8] Expected amounts under the proposed generational mortality table are based on mortality rates from the base year projected with mortality improvements to the experience study period.

[9] If we use the benchmark Pub-2010 Non-Safety Disabled table without any adjustment, the proposed actual to expected ratio would be 80%.

Chart 5: Post-Retirement Benefit-Weighted Deaths ($ In Thousands)
Disabled Members (July 1, 2009 through June 30, 2021)

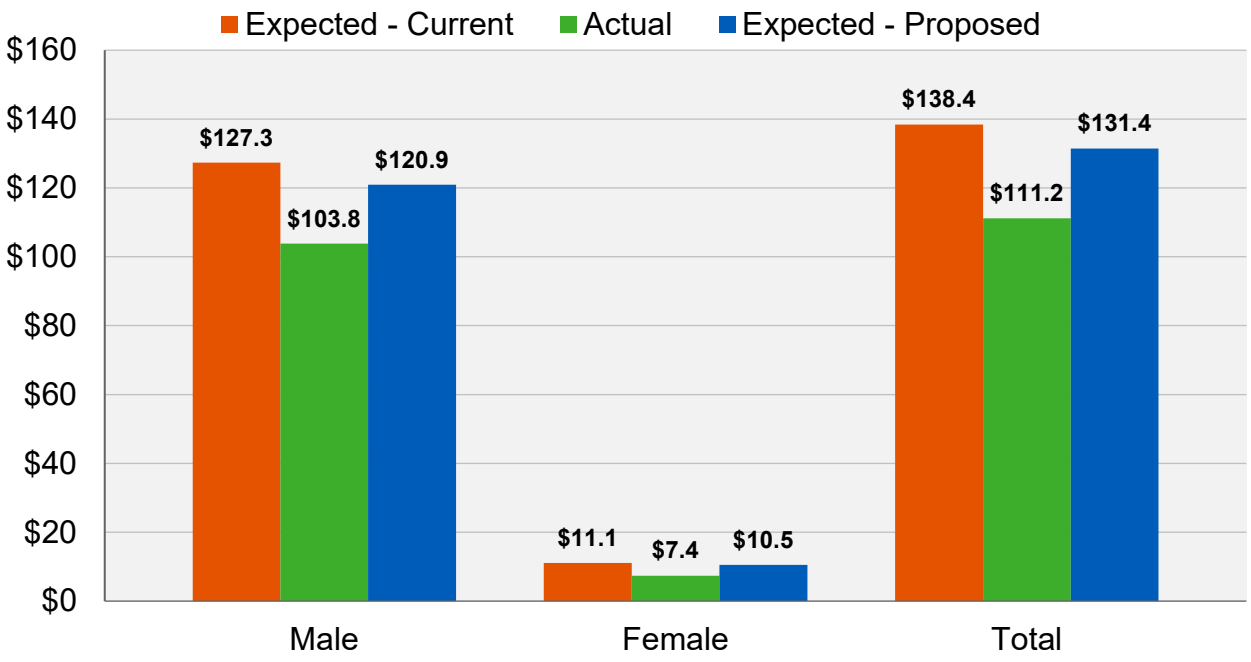
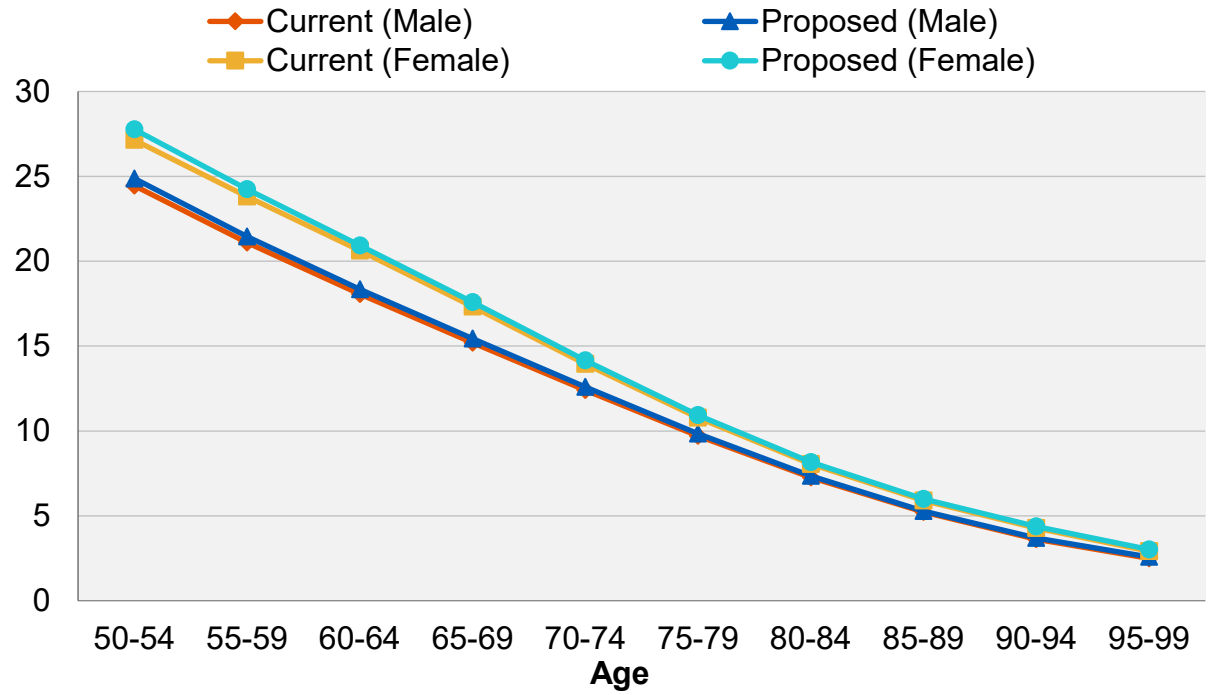


Chart 6: Benefit-Weighted Life Expectancies
Disabled Members



F. Termination Rates

Termination rates include all terminations for reasons other than death, disability, or retirement. Under the current assumptions there is an overall incidence of termination assumed, combined with a separate assumption for the percent of members who would elect to withdraw their contributions (ordinary withdrawal) versus a deferred retirement benefit (vested termination). With this study, we continue to recommend that this same assumption structure be used.

Currently, the assumed termination rates are a function of both a member's age and service for members with fewer than five years of service, and a function of a member's age for members with five or more years of service. We continue to believe that termination rates correlate better with age and service for members with fewer than five years of service and correlate well with age for members with five or more years of service.

The current termination rates, termination experience (total) over the last three years, and proposed termination rates are shown in the following tables. Please note that we have excluded any members that were eligible for retirement.

Rates of Termination

	Current Rates of Termination (%)					
	Years of Service					
Age	**0 – 1**	**1 – 2**	**2 – 3**	**3 – 4**	**4 – 5**	**5+**
20 – 24	15.00	15.00	12.00	12.00	12.00	12.00
25 – 29	13.00	11.00	10.00	10.00	10.00	9.00
30 – 34	13.00	8.00	8.00	7.00	7.00	7.00
35 – 39	13.00	8.00	6.00	5.00	5.00	5.00
40 – 44	13.00	8.00	6.00	5.00	3.00	3.00
45 – 50	13.00	8.00	6.00	5.00	3.00	3.00
50+	13.00	8.00	6.00	5.00	3.00	Not Calculated

	Actual Rates of Termination (%)					
	Years of Service					
Age	**0 – 1**	**1 – 2**	**2 – 3**	**3 – 4**	**4 – 5**	**5+**
20 – 24	10.34	15.79	14.29	0.00	Not Observed	Not Observed
25 – 29	7.69	9.17	9.09	12.28	9.09	0.00
30 – 34	11.64	8.94	6.43	6.80	5.26	8.18
35 – 39	18.70	6.61	6.56	6.03	4.55	5.36
40 – 44	12.66	0.00	4.49	4.00	1.82	1.68
45 – 50	10.87	1.69	1.64	4.00	2.63	4.16
50+	16.88	8.49	3.39	4.13	3.19	Not Observed

	Proposed Rates of Termination (%)					
	Years of Service					
Age	0 – 1	1 – 2	2 – 3	3 – 4	4 – 5	5+
20 – 24	15.00	15.00	13.00	12.00	12.00	12.00
25 – 29	13.00	10.00	10.00	10.00	10.00	8.00
30 – 34	13.00	8.00	7.00	7.00	6.00	6.00
35 – 39	13.00	7.00	6.00	6.00	5.00	5.00
40 – 44	13.00	6.00	5.00	5.00	3.00	3.00
45 – 50	13.00	6.00	5.00	5.00	3.00	3.00
50+	13.00	6.00	5.00	5.00	3.00	Not Calculated

It is important to note that not every age and service category has enough exposures and/or decrements to make the results in that category statistically credible.

We will also continue to assume that termination rates are zero at any age where members are eligible to retire. In other words, at those ages, members will either retire in accordance with the retirement rate assumptions or continue working, rather than terminate and defer their benefit. This mainly applies at the highest age categories since most members in those categories are eligible to retire and so have been excluded from our review of this experience.

We have adjust the termination rates at certain years of service and ages. Overall, the termination rates have decreased slightly.

Chart 7 compares actual to expected terminations over the past three years for both the current and proposed assumptions.

Chart 8 shows the average by years of service of actual termination rates over the past three years compared to the current and proposed assumptions.

Chart 9 shows the average by age of actual termination rates over the past three years compared to the current and proposed assumptions.

Based upon the recent experience, we have adjusted the termination rates accordingly.

In addition, we recommend the following assumptions for the percent of members who would elect a refund of contributions versus those who would leave their contributions on deposit and receive a deferred vested benefit.

	Proportion of Total Termination Assumed to Receive Refunds (%)		
Years of Service	Current Rate	Actual Rate	Proposed Rate
0 – 4	85.0	95.7	90.0
5 or more	45.0	33.3	40.0

Chart 7: Actual Number of Terminations Compared to Expected

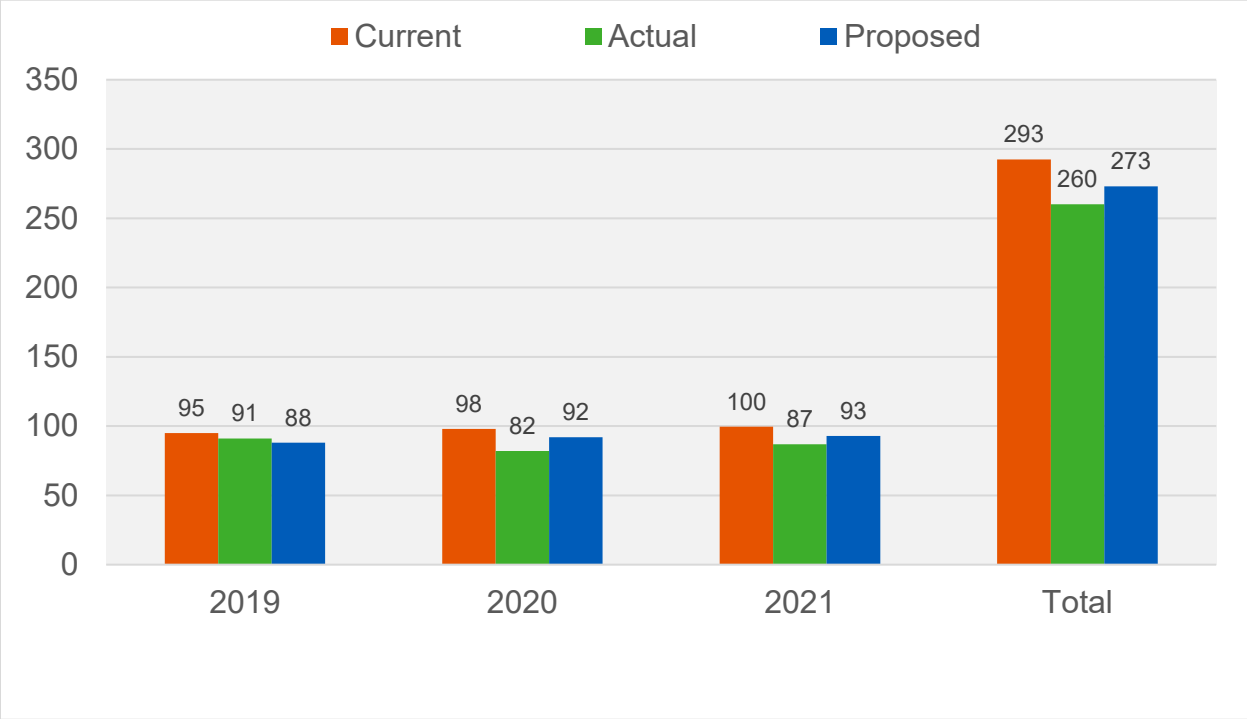


Chart 8: Average Termination Rates By Years of Service

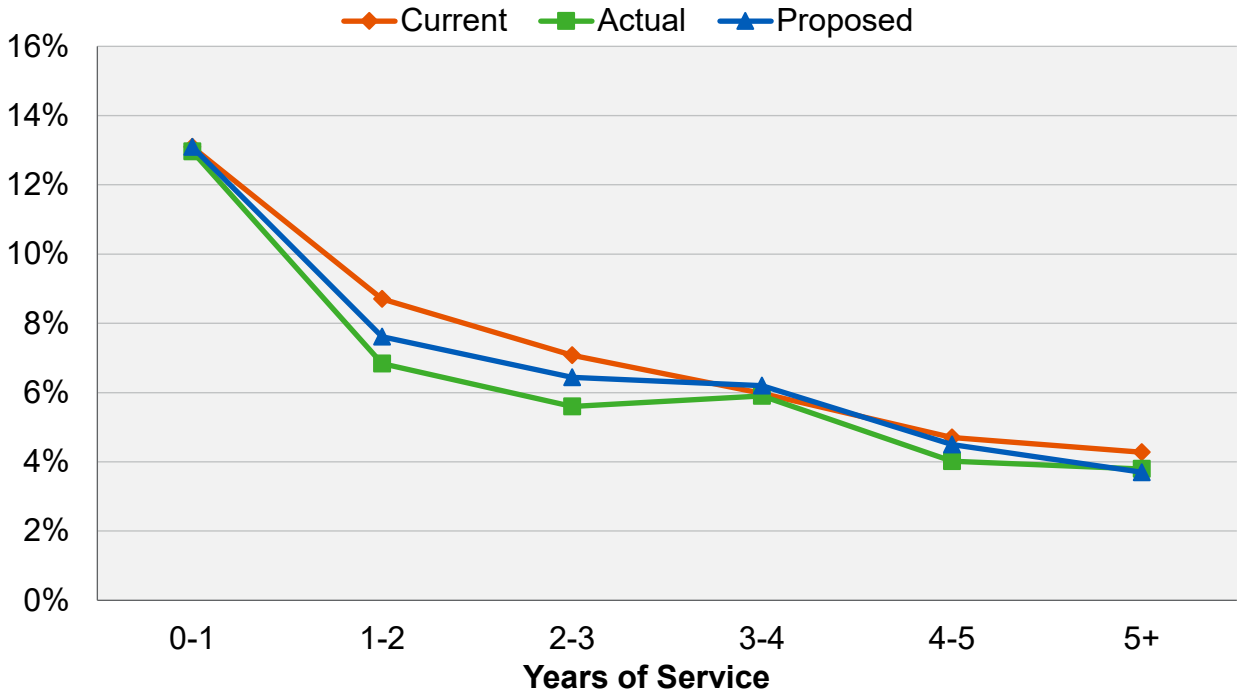
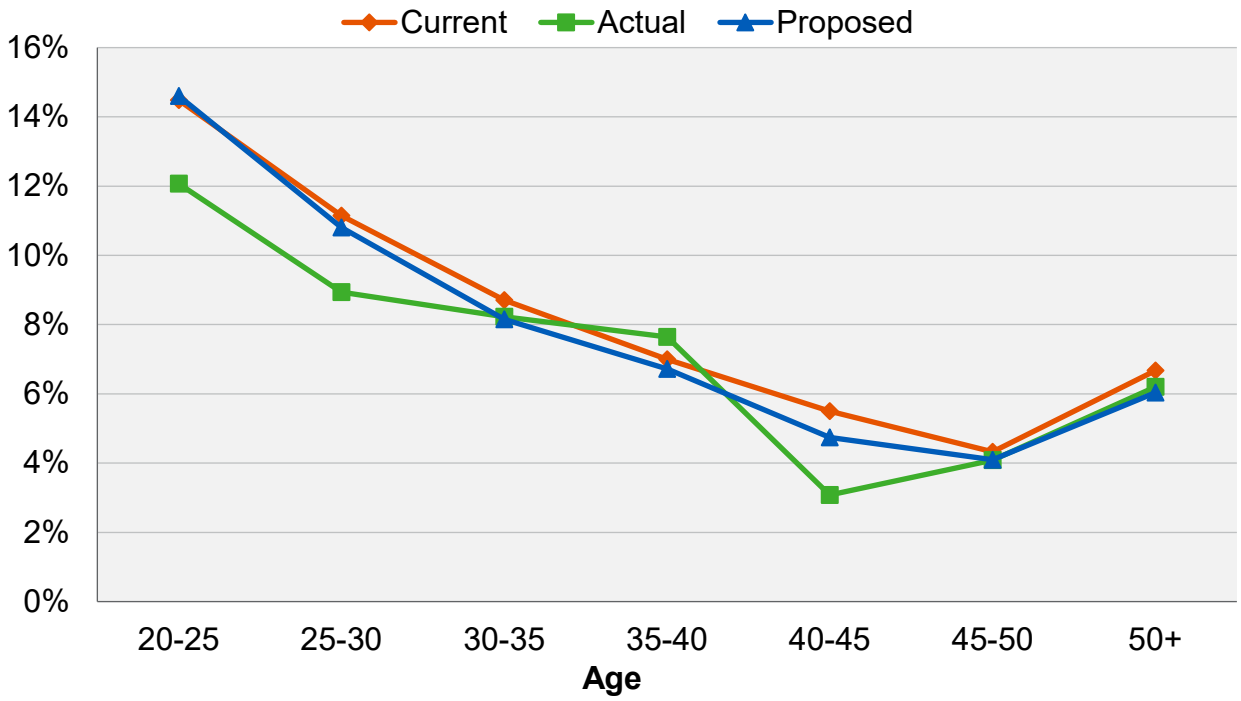


Chart 9: Average Termination Rates By Age



G. Disability Incidence Rates

When a member becomes disabled, he or she may be entitled to a pension that may not depend on the member's years of service. We have determined the rates of disability incidence by comparing by age the actual disability incidence to the number of actives who could have become disabled, excluding actives who have not yet met the eligibility requirement of ten years of service, since these members would either receive a refund of contributions or a deferred service retirement benefit.

The following summarizes the actual incidence of disabilities over the past three years compared to the current and proposed assumptions for disability incidence:

Rates of Disability Incidence

	Disability Incidence Rate (%)		
Age	**Current Rate**	**Actual Rate**	**Proposed Rate**
20 – 24	0.00	Not observed	0.00
25 – 29	0.00	Not observed	0.00
30 – 34	0.00	0.00	0.00
35 – 39	0.00	0.69	0.30
40 – 44	0.10	0.00	0.30
45 – 49	0.40	0.23	0.30
50 – 54	0.40	0.97	0.70
55 – 59	1.20	1.24	1.20
60 – 64	2.60	3.62	3.10
65 – 69	3.90	1.25	3.10
70 & Over	3.90	18.75	7.00

Based upon the recent experience, we have increased the rates at some ages while decreasing rates overall at other ages. The disability incidence rates have increased overall.

In preparing our prior experience studies, we included in the actual rates those members who changed status from vested terminated or service retirement to disability retirement regardless of whether their actual dates of disabilities would have fallen during the three-year period within those prior experience studies. That was done in order to capture the lag in processing the disability application.

However, we understand from our discussions with the System that the higher rates of observed disability incidence are due in part to the processing of a backlog of disability applications leading to the hiring of two additional counselors in fiscal year 2016.

We believe with the new staffing, we should consider excluding some of the disabilities reported from vested terminated or service retirement to disability retirement if the disability was granted before a certain date. Below is a table which summarizes the number of such disabilities that we considered excluding based on one-year, two-ear and a three-year lag:

Number of Members to be Excluded		
One-Year Lag (With Date of Retirement prior to July 1, 2017)	Two-Year Lag (With Date of Retirement prior to July 1, 2016)	Three-Year Lag (With Date of Retirement prior to July 1, 2015)
5	4	4

We continue to believe despite the additional staffing it would be prudent to assume that there would still be a two-year lag in the disability application process until more data is available in future experience studies. As a result, we have only reduced the actual incidence of disability reported to us by 4.

Chart 10 compares actual to expected disabilities for over the past three years for the current and proposed assumptions.

Chart 11 shows the actual disability incidence rates over the past three years compared to the current and proposed assumptions.

Chart 10: Actual Number of Disabilities Compared to Expected

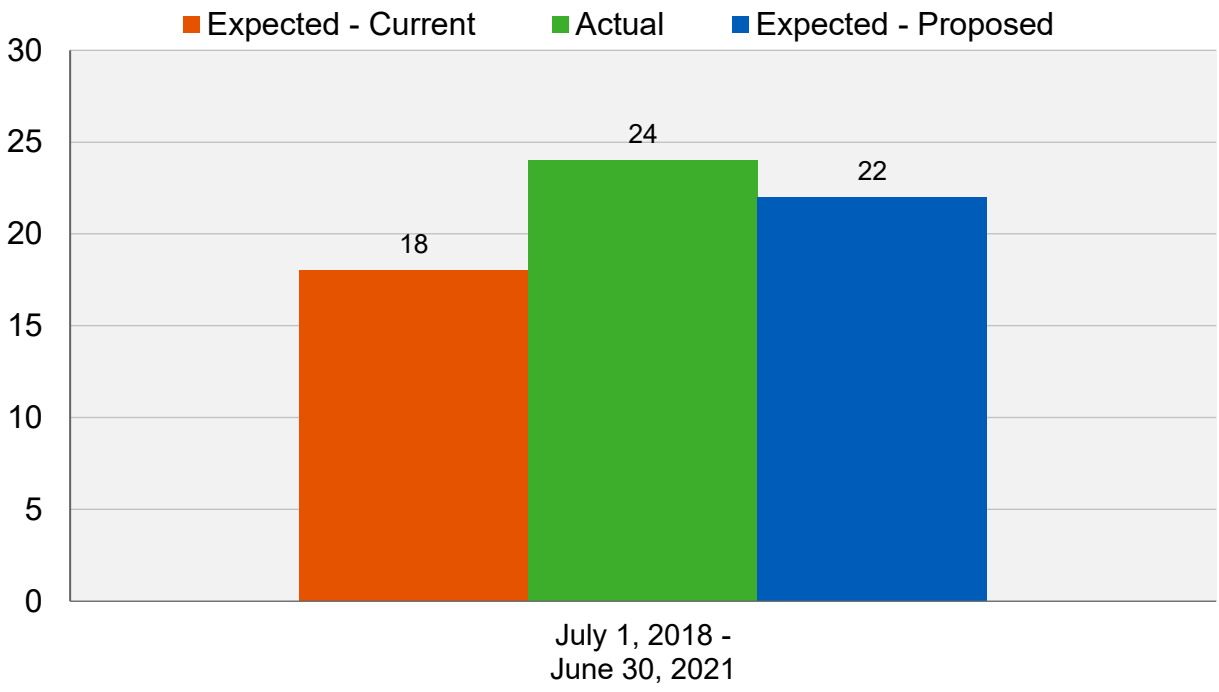
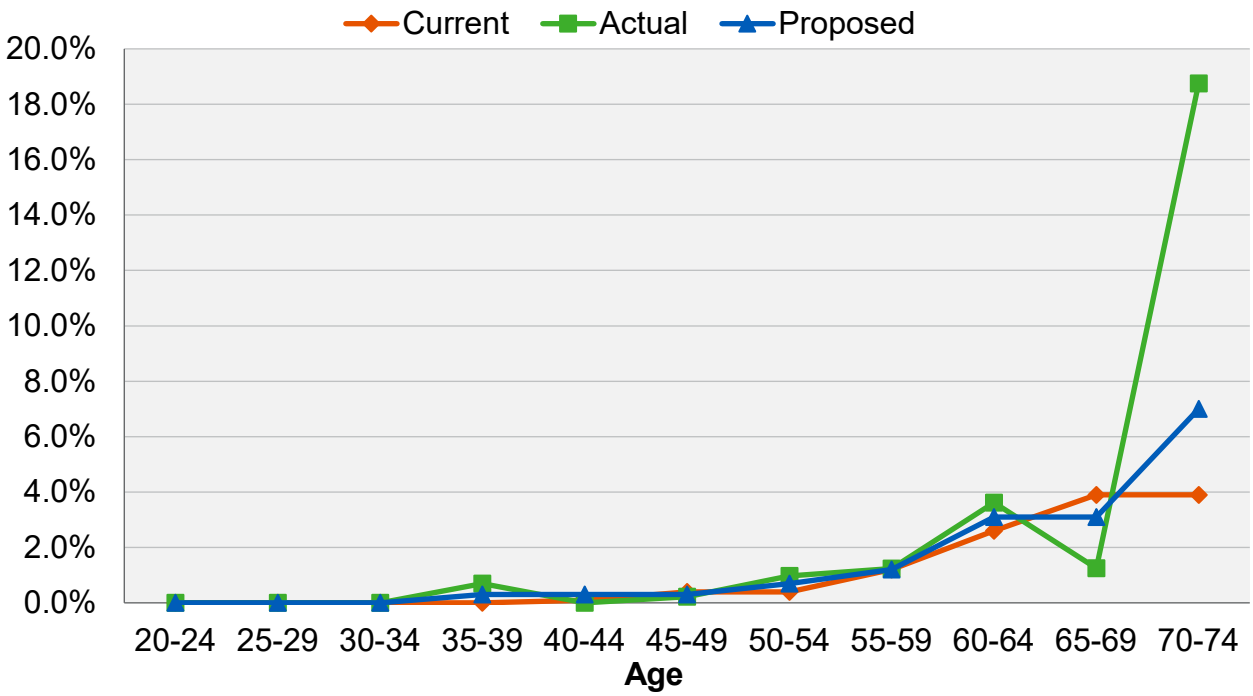


Chart 11: Disability Incidence Rates


Current
Actual
Proposed
20.0%
18.0%
16.0%
14.0%
12.0%
10.0%
8.0%
6.0%
4.0%
2.0%
0.0%
20-24
25-29
30-34
35-39
40-44
45-49
50-54
55-59
60-64
65-69
70-74
Age

H. DROP Election Rates

With the last experience study, we concluded that the DROP election rates correlate better with age and years of service rather years since first eligible for participation in the DROP. Therefore, we introduced a new structure in the last experience study that applies different sets of rates for those in different age and service bands. With this study, we continue to recommend that this same assumption structure be used.

The tables below show the current drop election rates, the actual rates observed over the last 3 years, and the proposed rates for the various service bands.

	DROP Election Rates (%) For 5 to 9 Years of Service		
Age	**Current Rate**	**Actual Rate**	**Proposed Rate**
50	0.00	0.00	0.00
51	0.00	0.00	0.00
52	0.00	0.00	0.00
53	0.00	0.00	0.00
54	0.00	0.00	0.00
55	1.50	0.00	1.00
56	1.50	0.00	1.00
57	1.50	0.00	1.00
58	1.50	0.00	1.00
59	1.50	0.00	1.00
60	1.50	0.00	1.00
61	1.50	0.00	1.00
62	1.50	0.00	1.00
63	1.50	0.00	1.00
64	1.50	0.00	1.00
65	1.50	0.00	1.00
66	1.50	0.00	1.00
67	1.50	0.00	1.00
68	1.50	0.00	1.00
69	1.50	Not observed	1.00
70	1.50	0.00	1.00
71 & Over	0.00	0.00	0.00

	DROP Election Rates (%) For 10 to 14 Years of Service		
Age	**Current Rate**	**Actual Rate**	**Proposed Rate**
50	0.00	0.00	0.00
51	0.00	0.00	0.00
52	0.00	0.00	0.00
53	0.00	0.00	0.00
54	0.00	0.00	0.00
55	15.00	2.44	10.00
56	7.50	4.17	5.00
57	7.50	4.55	5.00
58	7.50	2.70	5.00
59	7.50	3.23	5.00
60	7.50	3.23	5.00
61	7.50	0.00	5.00
62	7.50	10.53	5.00
63	7.50	0.00	5.00
64	7.50	0.00	5.00
65	7.50	0.00	5.00
66	7.50	11.11	5.00
67	7.50	0.00	5.00
68	7.50	0.00	5.00
69	7.50	0.00	5.00
70	7.50	0.00	5.00
71 & Over	0.00	0.00	0.00

	DROP Election Rates (%) For 15 to 19 Years of Service		
Age	**Current Rate**	**Actual Rate**	**Proposed Rate**
50	1.50	0.00	1.50
51	1.50	0.00	1.50
52	1.50	0.00	1.50
53	1.50	0.00	1.50
54	10.00	6.45	10.00
55	35.00	31.03	35.00
56	25.00	9.09	20.00
57	25.00	22.73	20.00
58	25.00	18.18	20.00
59	18.00	18.75	18.00
60	18.00	27.27	18.00
61	18.00	13.33	18.00
62	10.00	5.88	10.00
63	10.00	15.38	10.00
64	10.00	27.27	10.00
65	10.00	0.00	10.00
66	10.00	25.00	10.00
67	10.00	0.00	10.00
68	10.00	Not Observed	10.00
69	10.00	0.00	10.00
70	10.00	100.00	10.00
71 & Over	0.00	0.00	0.00

	DROP Election Rates (%) For 20 to 24 Years of Service		
Age	**Current Rate**	**Actual Rate**	**Proposed Rate**
50	2.50	0.00	2.50
51	2.50	0.00	2.50
52	5.00	9.52	5.00
53	5.00	8.33	5.00
54	40.00	3.33	30.00
55	45.00	39.13	40.00
56	35.00	46.15	35.00
57	35.00	33.33	30.00
58	35.00	16.67	30.00
59	35.00	0.00	30.00
60	35.00	28.57	30.00
61	35.00	0.00	30.00
62	15.00	20.00	15.00
63	15.00	20.00	15.00
64	15.00	0.00	15.00
65	10.00	0.00	10.00
66	10.00	0.00	10.00
67	10.00	0.00	10.00
68	10.00	0.00	10.00
69	10.00	Not Observed	10.00
70	10.00	0.00	10.00
71 & Over	0.00	0.00	0.00

	DROP Election Rates (%) For 25+ Years of Service		
Age	Current Rate	Actual Rate	Proposed Rate
50	2.50	0.00	2.50
51	2.50	12.50	2.50
52	15.00	8.33	15.00
53	15.00	30.00	15.00
54	45.00	35.71	45.00
55	50.00	50.00	50.00
56	35.00	14.29	35.00
57	35.00	16.67	30.00
58	35.00	0.00	30.00
59	15.00	0.00	10.00
60	15.00	0.00	10.00
61	15.00	0.00	10.00
62	15.00	0.00	10.00
63	15.00	0.00	10.00
64	15.00	0.00	10.00
65	10.00	0.00	10.00
66	10.00	50.00	10.00
67	10.00	Not Observed	10.00
68	10.00	Not Observed	10.00
69	10.00	0.00	10.00
70	10.00	0.00	10.00
71 & Over	0.00	0.00	0.00

We have adjusted the DROP Retirement rates at certain ages for the various service bands. Overall, the DROP Retirement rates have decreased slightly.

Chart 12 compares actual to expected DROP elections over the past three years for both the current and proposed assumptions.

Chart 13 shows the average actual DROP election rates by age for the service band from 5 to 9 years of service over the past three years compared to the current and proposed assumptions.

Chart 14 shows the average actual DROP election rates by age for the service band from 10 to 14 years of service over the past three years compared to the current and proposed assumptions.

Chart 15 shows the average actual DROP election rates by age for the service band for 15 to 19 years of service over the past three years compared to the current and proposed assumptions.

Chart 16 shows the average actual DROP election rates by age for the service band from 20 to 24 years of service over the past three years compared to the current and proposed assumptions.

Chart 17 shows the average actual DROP election rates by age for the service band for 25 years of service and above over the past three years compared to the current and proposed assumptions.

We have adjusted the DROP Retirement rates at certain ages for the various service bands. Overall, the DROP Retirement rates have decreased slightly.

It is currently assumed that members remain in DROP for 6 years. Based on the experience of members who retired from the DROP during the past six years, the average number of years of participation in the DROP was 6.3. We recommend maintaining the current DROP participation period of 6 years.

Chart 12: Actual Number of DROP Elections Compared to Expected

(July 1, 2018 through June 30, 2021)

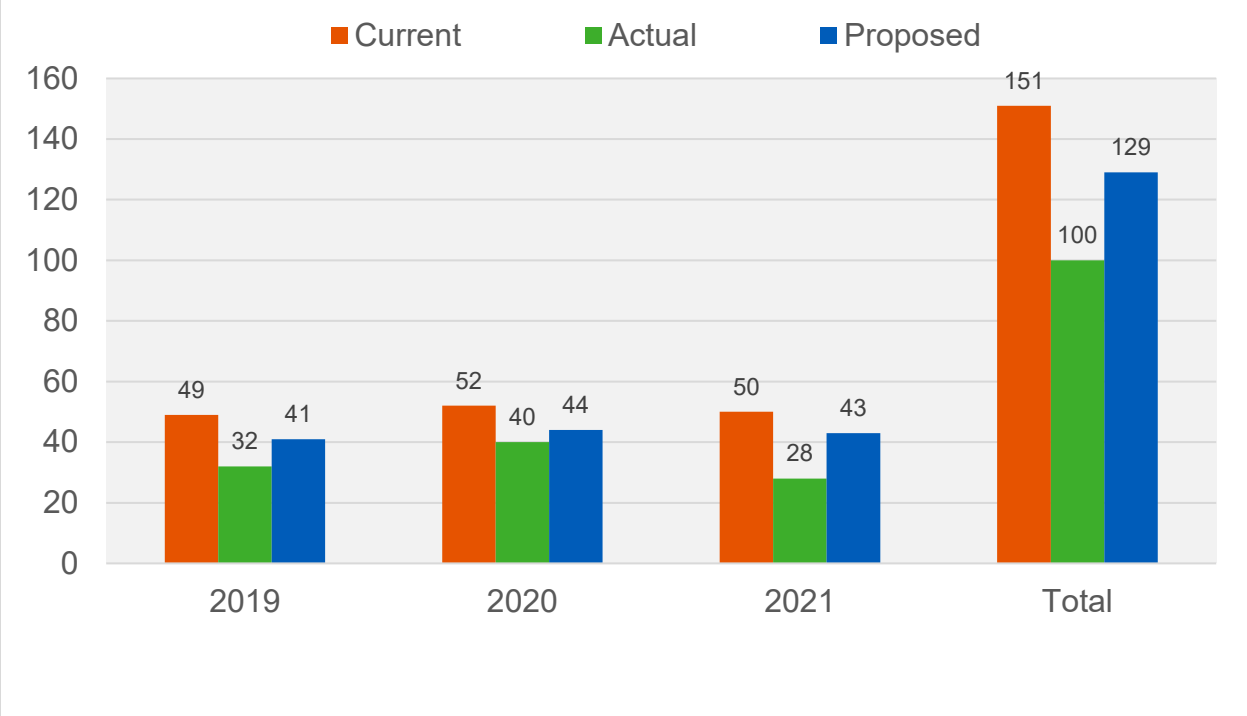


Chart 13: Average DROP Election Rates For 5 to 9 Years of Service

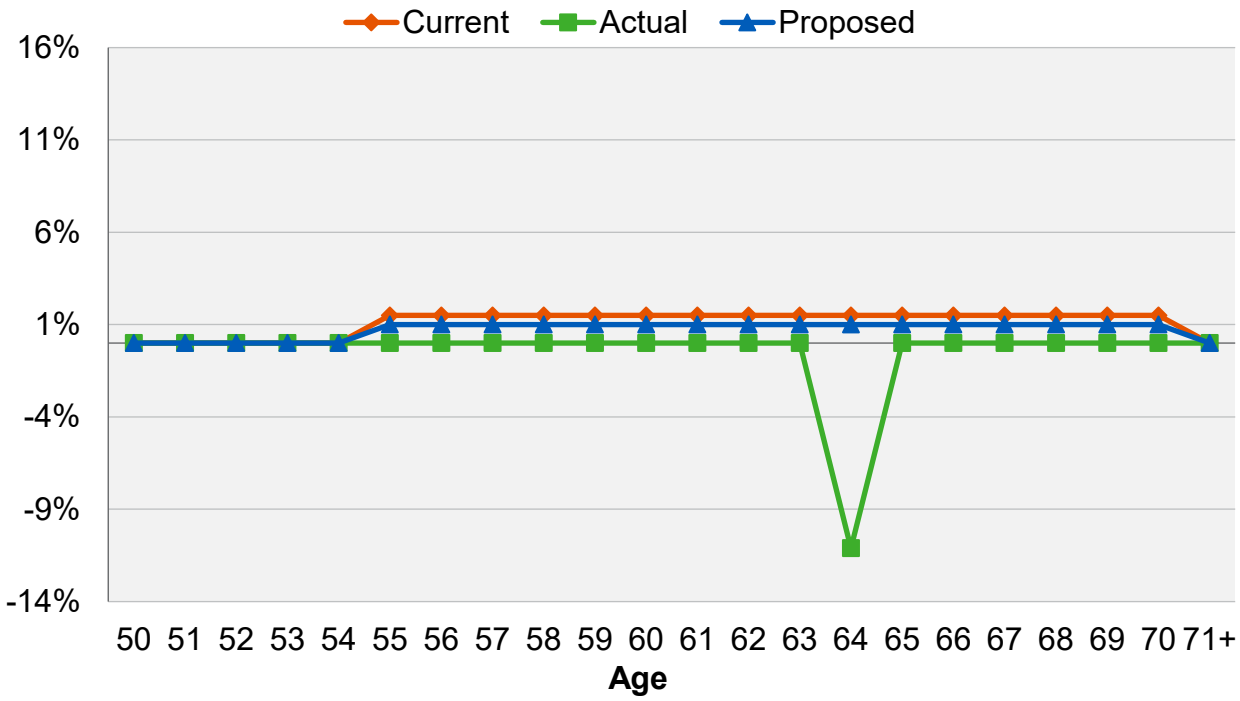


Chart 14: Average DROP Election Rates For 10 to 14 Years of Service

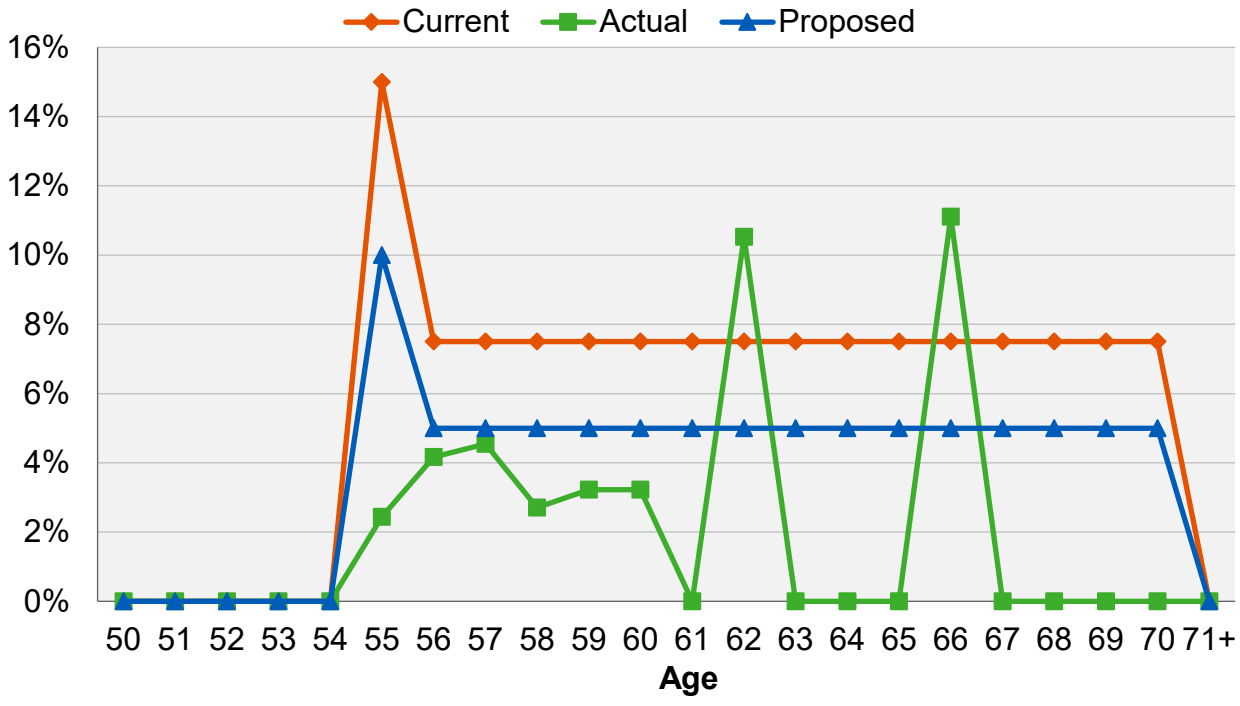


Chart 15: Average DROP Election Rates For 15 to 19 Years of Service

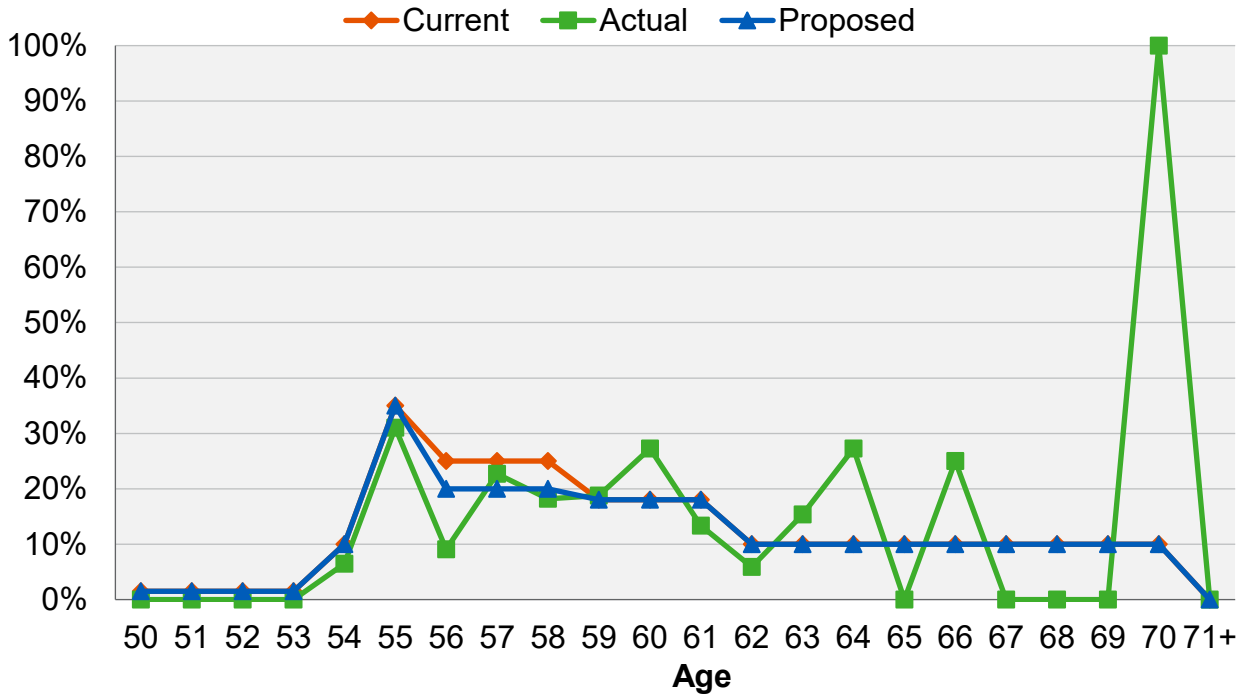


Chart 16: Average DROP Election Rates For 20 to 24 Years of Service

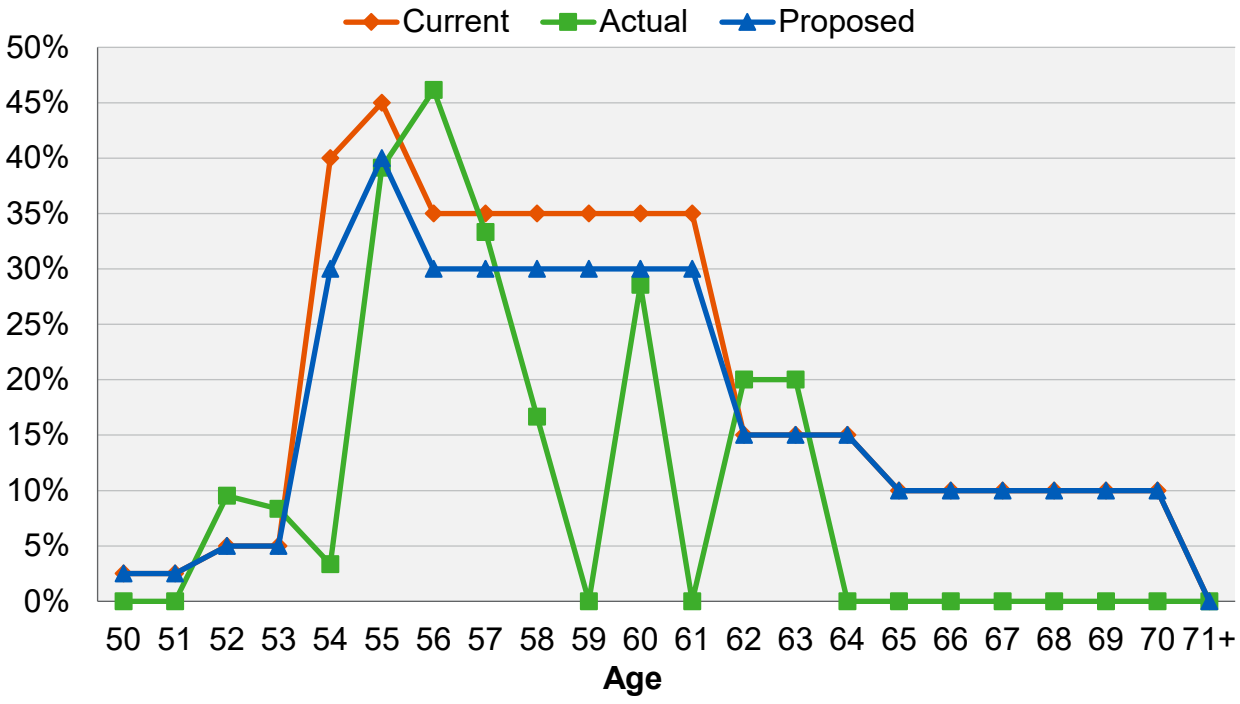
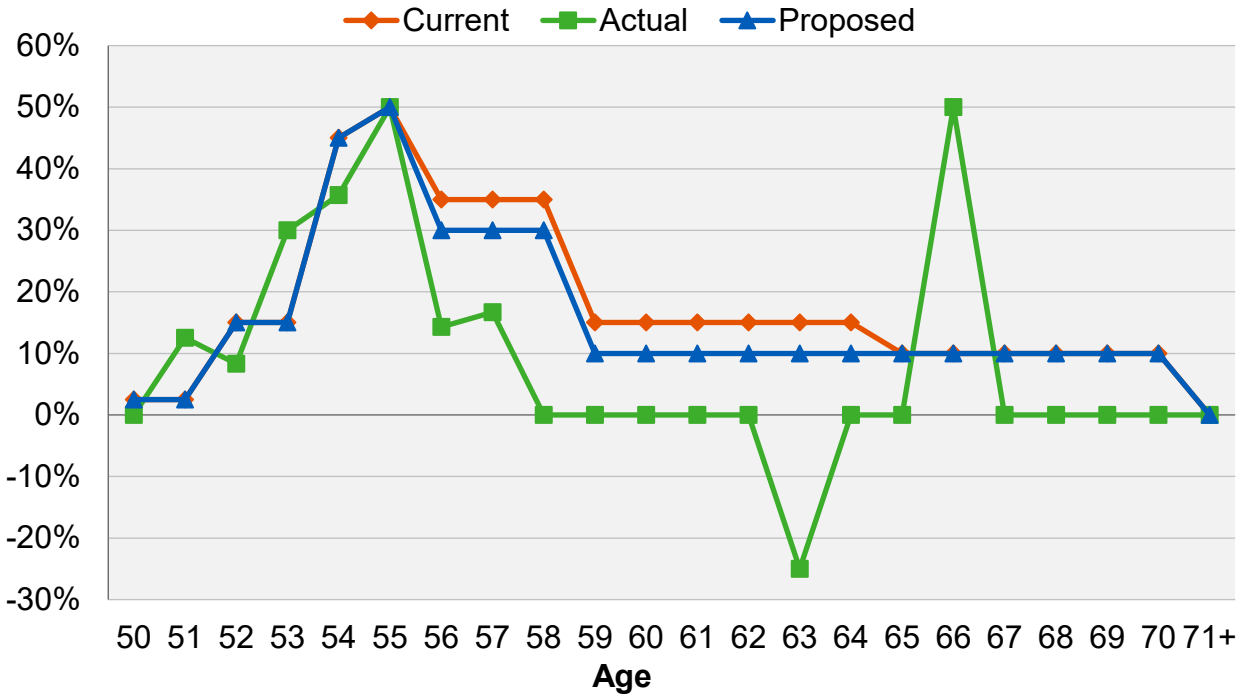


Chart 17: Average DROP Election Rates For 25+ Years of Service



IV. Cost Impact

We have estimated the impact of all the recommended demographic and economic assumptions and the alternative investment return assumption as if they were applied to the June 30, 2021 actuarial valuation. The tables below show the changes in the employer and member contribution rates due to the proposed assumption changes separately for the recommended demographic assumption changes (as recommended in Section III of this report) and the recommended and alternative economic assumption changes (as recommended in the separate report).

Cost Impact
(Without Considering Any Impact on Surplus Distribution)
Based on June 30, 2021 Actuarial Valuation

	Recommended (6.75% Return and Other Recommended Assumptions)	Alternative (6.50% Return and Other Recommended Assumptions)
Impact on Average Employer Normal Cost Rate		
Change due to demographic assumptions	0.18%	0.18%
Change due to economic assumptions	0.70%	1.45%
Total increase in average employer normal cost rate	0.88%	1.62%
Total estimated increase in annual dollar normal cost amount ($000s)[1]	$1,439	$2,636
Impact on Average Member Normal Cost Rate		
Change due to demographic assumptions	(0.07%)	(0.07%)
Change due to economic assumptions	0.25%	0.88%
Total increase in average member rate	0.18%	0.82%
Total estimated increase in annual dollar member amount ($000s)[2]	$273	$1,152
Impact on UAAL and Funded Percentage		
Increase/(Decrease) in UAAL	$(6.8) million[3,4]	$27.0 million[5]
Change in Funded Percentage	From 116.0% to 116.7%	From 116.0% to 113.4%

[1] Calculated using payroll for all active employees (including employees in DROP)
[2] Calculated using payroll for active non-DROP employees
[3] Although there is a decrease in liabilities for non-actives, there is an increase in liabilities for actives (both for those in DROP and not in DROP).
[4] If the Retirement System were not overfunded, this change in the UAAL would decrease the employer's UAAL rate by 0.25% of payroll. This is based on using an amortization period of 25 years for assumption changes in accordance with the System's amortization policy.
[5] If the Retirement System were not overfunded, this change in the UAAL would increase the employer's UAAL rate by 1.20% of payroll. This is based on using an amortization period of 25 years for assumption changes in accordance with the System's amortization policy.

Appendix A: Current Actuarial Assumptions

Economic Assumptions

Merit and Promotion Salary Increases

Inflation: 2.75% per year; plus "across the board" real salary increases of 0.50% per year; plus the following merit and promotion increases.

Years of Service	Annual Increase (%)	Years of Service	Annual Increase (%)
Less than 1	8.00	8 – 9	1.00
1 – 2	6.00	9 – 10	1.00
2 – 3	4.50	10 – 11	0.75
3 – 4	3.75	11 – 12	0.75
4 – 5	3.00	12 – 13	0.75
5 – 6	2.00	13 – 14	0.75
6 – 7	1.25	14 – 15	0.75
7 – 8	1.00	15 & over	0.50

Demographic Assumptions

Mortality Rates – Healthy

- **Healthy Members and Beneficiaries:** Pub-2010 General Healthy Retiree Amount-Weighted Mortality Table (separate tables for males and females) with rates increased by 5%, projected generationally with the two-dimensional mortality improvement scale MP-2018.

Mortality Rates – Disabled

- Pub-2010 Non-Safety Disabled Retiree Amount-Weighted Mortality Table (separate tables for males and females), projected generationally with the two-dimensional mortality improvement scale MP-2018.

Employee Contribution Rates

- **Healthy Members:** Pub-2010 General Healthy Retiree Amount-Weighted Mortality Table (separate tables for males and females) with rates increased by 5%, projected 30 years with the two-dimensional mortality improvement scale MP-2018, weighted 65% male and 35% female

Optional Forms of Benefit

- **Healthy Members:** Pub-2010 General Healthy Retiree Amount-Weighted Mortality Table (separate tables for males and females) with rates increased by 5%, projected 20 years with the two-dimensional mortality improvement scale MP-2018, weighted 65% male and 35% female.
- **Beneficiaries:** Pub-2010 General Healthy Retiree Amount-Weighted Mortality Table (separate tables for males and females) with rates increased by 5%, projected 20 years with the two-dimensional mortality improvement scale MP-2018, weighted 35% male and 65% female
- **Disabled Members:** Pub-2010 Non-Safety Disabled Retiree Amount-Weighted Mortality Table (separate tables for males and females), projected 20 years with the two-dimensional mortality improvement scale MP-2018, weighted 65% male and 35% female.

Mortality Rates – Pre-Retirement

- Pub-2010 General Employee Amount-Weighted Mortality Table (separate tables for males and females), projected generationally with the two-dimensional mortality improvement scale MP-2018.

	Rate (%)	
Age	**Male**	**Female**
25	0.03	0.01
30	0.04	0.01
35	0.05	0.02
40	0.07	0.04
45	0.10	0.06
50	0.15	0.08
55	0.22	0.12
60	0.32	0.19
65	0.47	0.30
70	0.70	0.49

Note that generational projections beyond the base year (2010) are not reflected in the above mortality rates.

Disability Incidence Rates

Age	Rate (%)
20	0.00
25	0.00
30	0.00
35	0.00
40	0.06
45	0.28
50	0.40
55	0.88
60	2.04
65	3.38
70	3.90

Termination Rates

	Rate (%)					
	Years of Service					
Age	Less Than 1	1	2	3	4	5 & Above
20-24	15.00	15.00	12.00	12.00	12.00	13.20
25-29	13.00	11.00	10.00	10.00	10.00	10.20
30-34	13.00	8.00	8.00	7.00	7.00	7.80
35-39	13.00	8.00	6.00	5.00	5.00	5.80
40-44	13.00	8.00	6.00	5.00	3.00	3.80
45-49	13.00	8.00	6.00	5.00	3.00	3.00
50+	13.00	8.00	6.00	5.00	3.00	0.00

- **Members with less than five years of service:** 85% of members are assumed to elect a withdrawal of contributions. The remaining members are assumed to elect a deferred vested benefit. No termination is assumed after a member is assumed to retire.
- **Members with five or more years of service:** 45% of members are assumed to elect a withdrawal of contributions. The remaining members are assumed to elect a deferred vested benefit. No termination is assumed after a member is assumed to retire.

Retirement Rates

Age	Rate (%)	Age	Rate (%)	Age	Rate (%)
50	1.00	59	4.00	68	25.00
51	1.00	60	5.00	69	30.00
52	2.00	61	5.00	70	75.00
53	2.00	62	10.00	71	75.00
54	2.00	63	8.00	72	75.00
55	5.00	64	15.00	73	75.00
56	3.00	65	20.00	74	75.00
57	3.00	66	25.00	75 and Above	100.00
58	4.00	67	25.00		

DROP Assumptions

	Rate (%)				
	Years of Service				
Age	5 – 9	10 – 14	15 – 19	20 – 24	25 and Above
50	0.0	0.0	1.5	2.5	2.5
51	0.0	0.0	1.5	2.5	2.5
52	0.0	0.0	1.5	5.0	15.0
53	0.0	0.0	1.5	5.0	15.0
54	0.0	0.0	10.0	40.0	45.0
55	1.5	15.0	35.0	45.0	50.0
56	1.5	7.5	25.0	35.0	35.0
57	1.5	7.5	25.0	35.0	35.0
58	1.5	7.5	25.0	35.0	35.0
59	1.5	7.5	18.0	35.0	15.0
60	1.5	7.5	18.0	35.0	15.0
61	1.5	7.5	18.0	35.0	15.0
62	1.5	7.5	10.0	15.0	15.0
63	1.5	7.5	10.0	15.0	15.0
64	1.5	7.5	10.0	15.0	15.0
65	1.5	7.5	10.0	10.0	10.0
66	1.5	7.5	10.0	10.0	10.0
67	1.5	7.5	10.0	10.0	10.0
68	1.5	7.5	10.0	10.0	10.0
69	1.5	7.5	10.0	10.0	10.0
70	1.5	7.5	10.0	10.0	10.0
71 and Over	0.0	0.0	0.0	0.0	0.0

- Members are assumed to remain in DROP for 6 years.

<table>
<tr><td>Retirement Age and Benefit for Deferred Vested Members</td><td>For current deferred vested members, the retirement assumption is age 55.
We assume that no future deferred vested members will continue to work for a reciprocal employer. However, we assume there will be a 3.75% compensation increase per annum.</td></tr>
<tr><td>Future Benefit Accruals</td><td>1.0 year of service per year.</td></tr>
<tr><td>Unknown Data for Members</td><td>Same as those exhibited by members with similar known characteristics. If not specified, members are assumed to be male.</td></tr>
<tr><td>Inclusion of Deferred Vested Members</td><td>All deferred vested members are included in the valuation.</td></tr>
<tr><td>Percent with Survivor</td><td>80% of male members and 55% of female members.</td></tr>
<tr><td>Age of Spouse</td><td>Male members are three years older than their spouses.
Female members are two years younger than their spouses.</td></tr>
<tr><td>Election of Optional Forms of Benefit at Retirement</td><td>
<table>
<tr><th></th><th colspan="2">Members with Survivor</th><th rowspan="2">Members without Survivor</th></tr>
<tr><th></th><th>Male</th><th>Female</th></tr>
<tr><td>Unmodified</td><td>30%</td><td>65%</td><td>100%</td></tr>
<tr><td>Option 2 (A/B)</td><td>50%</td><td>25%</td><td></td></tr>
<tr><td>Option 3 (A/B)</td><td>20%</td><td>10%</td><td></td></tr>
</table>
</td></tr>
</table>

Appendix B: Proposed Actuarial Assumptions

Economic Assumptions

Merit and Promotion Salary Increases

Inflation: 2.75% per year; plus "across the board" real salary increases of 0.50% per year; plus the following merit and promotion increases.

Years of Service	Annual Increase (%)	Years of Service	Annual Increase (%)
Less than 1	8.50	11 – 12	1.25
1 – 2	6.25	12 – 13	1.25
2 – 3	4.75	13 – 14	1.25
3 – 4	4.25	14 – 15	1.25
4 – 5	3.50	15 – 16	1.00
5 – 6	2.50	16 – 17	1.00
6 – 7	1.75	17 – 18	1.00
7 – 8	1.50	18 – 19	1.00
8 – 9	1.50	19 – 20	1.00
9 – 10	1.50	20 & over	0.75
10 – 11	1.25		

Demographic Assumptions

Mortality Rates – Healthy

- Pub-2010 General Healthy Retiree Amount-Weighted Mortality Table (separate tables for males and females) with rates increased by 5%, projected generationally with the two-dimensional mortality improvement scale MP-2021.

Mortality Rates – Disabled

- Pub-2010 Non-Safety Disabled Retiree Amount-Weighted Mortality Table (separate tables for males and females with rates decreased by 5%, projected generationally with the two-dimensional mortality improvement scale MP-2021.

Mortality Rates – Beneficiaries not currently in Pay Status

- Pub-2010 General Healthy Retiree Amount-Weighted Mortality Table (separate tables for males and females) with rates increased by 5%, projected generationally with the two-dimensional mortality improvement scale MP-2021.

Mortality Rates – Beneficiaries in Pay Status

- Pub-2010 General Contingent Survivor Amount-Weighted Mortality Table (separate tables for males and females) with rates increased by 5%, projected generationally with the two-dimensional mortality improvement scale MP-2021.

Employee Contribution Rates

- **Healthy Members:** Pub-2010 General Healthy Retiree Amount-Weighted Mortality Table (separate tables for males and females) with rates increased by 5%, projected 30 years with the two-dimensional mortality improvement scale MP-2021, weighted 65% male and 35% female

Optional Forms of Benefit

- **Healthy Members:** Pub-2010 General Healthy Retiree Amount-Weighted Mortality Table (separate tables for males and females) with rates increased by 5% , weighted 65% male and 35% female, with the mortality improvement methodology to be determined.[1]
- **Beneficiaries:** Pub-2010 General Healthy Retiree Amount-Weighted Mortality Table (separate tables for males and females) with rates increased by 5%, weighted 35% male and 65% female, with the mortality improvement methodology to be determined.1
- **Disabled Members:** Pub-2010 Non-Safety Disabled Retiree Amount-Weighted Mortality Table (separate tables for males and females), weighted 65% male and 35% female, with the mortality improvement methodology to be determined.[1]

[1] There are some administrative issues that we may need to resolve with the System and its vendor maintaining the pension administration software before we would recommend a comparable generational scale to anticipate future mortality improvement. We will provide a recommendation to the System for use in reflecting mortality improvement for determining optional forms of payment after we have those discussions with the System and its vendor.

Mortality Rates – Pre-Retirement

- Pub-2010 General Employee Amount-Weighted Mortality Table (separate tables for males and females), projected generationally with the two-dimensional mortality improvement scale MP-2021.

	Rate (%)	
Age	**Male**	**Female**
25	0.03	0.01
30	0.04	0.01
35	0.05	0.02
40	0.07	0.04
45	0.10	0.06
50	0.15	0.08
55	0.22	0.12
60	0.32	0.19
65	0.47	0.30
70	0.70	0.49

Note that generational projections beyond the base year (2010) are not reflected in the above mortality rates.

Disability Incidence Rates

Age	Rate (%)
20	0.00
25	0.00
30	0.00
35	0.30
40	0.30
45	0.30
50	0.70
55	1.20
60	3.10
65	3.10
70	7.00

Termination Rates

	Rate (%)					
	Years of Service					
Age	Less Than 1	1	2	3	4	5 & Above
20-24	15.00	15.00	13.00	12.00	12.00	12.00
25-29	13.00	10.00	10.00	10.00	10.00	8.00
30-34	13.00	8.00	7.00	7.00	6.00	6.00
35-39	13.00	7.00	6.00	6.00	5.00	5.00
40-44	13.00	6.00	5.00	5.00	3.00	3.00
45-49	13.00	6.00	5.00	5.00	3.00	3.00
50+	13.00	6.00	5.00	5.00	3.00	Not Calculated

- **Members with less than five years of service:** 90% of members are assumed to elect a withdrawal of contributions. The remaining members are assumed to elect a deferred vested benefit. No termination is assumed after a member is assumed to retire.
- **Members with five or more years of service:** 40% of members are assumed to elect a withdrawal of contributions. The remaining members are assumed to elect a deferred vested benefit. No termination is assumed after a member is assumed to retire.

Retirement Rates

Age	Rate (%)	Age	Rate (%)	Age	Rate (%)
50	1.00	59	4.00	68	25.00
51	1.00	60	5.50	69	30.00
52	1.75	61	5.50	70	60.00
53	1.75	62	10.00	71	60.00
54	1.75	63	9.00	72	60.00
55	4.50	64	15.00	73	60.00
56	3.00	65	20.00	74	60.00
57	3.00	66	25.00	75 and Above	100.00
58	4.00	67	25.00		

DROP Assumptions

	Rate (%)				
	Years of Service				
Age	5 – 9	10 – 14	15 – 19	20 – 24	25 and Above
50	0.0	0.0	1.50	2.50	2.50
51	0.0	0.0	1.50	2.50	2.50
52	0.0	0.0	1.50	5.00	15.00
53	0.0	0.0	1.50	5.00	15.00
54	0.0	0.0	10.00	30.00	45.00
55	1.00	10.00	35.00	40.00	50.00
56	1.00	5.00	20.00	35.00	35.00
57	1.00	5.00	20.00	30.00	30.00
58	1.00	5.00	20.00	30.00	30.00
59	1.00	5.00	18.00	30.00	10.00
60	1.00	5.00	18.00	30.00	10.00
61	1.00	5.00	18.00	30.00	10.00
62	1.00	5.00	10.00	15.00	10.00
63	1.00	5.00	10.00	15.00	10.00
64	1.00	5.00	10.00	15.00	10.00
65	1.00	5.00	10.00	10.00	10.00
66	1.00	5.00	10.00	10.00	10.00
67	1.00	5.00	10.00	10.00	10.00
68	1.00	5.00	10.00	10.00	10.00
69	1.00	5.00	10.00	10.00	10.00
70	1.00	5.00	10.00	10.00	10.00
71 and Over	0.0	0.0	0.00	0.00	0.00

- Members are assumed to remain in DROP for 6 years.

<table>
<tr><td>Retirement Age and Benefit for Deferred Vested Members</td><td>For current deferred vested members, the retirement assumption is age 56.
We assume that no future deferred vested members will continue to work for a reciprocal employer. However, we assume there will be a 3.50% compensation increase per annum.</td></tr>
<tr><td>Future Benefit Accruals</td><td>1.0 year of service per year.</td></tr>
<tr><td>Unknown Data for Members</td><td>Same as those exhibited by members with similar known characteristics. If not specified, members are assumed to be male.</td></tr>
<tr><td>Inclusion of Deferred Vested Members</td><td>All deferred vested members are included in the valuation.</td></tr>
<tr><td>Percent with Survivor</td><td>80% of male members and 55% of female members.</td></tr>
<tr><td>Age of Spouse</td><td>Male members are three years older than their spouses.
Female members are two years younger than their spouses.</td></tr>
<tr><td>Election of Optional Forms of Benefit at Retirement</td><td>
<table>
<tr><th></th><th colspan="2">Members with Survivor</th><th rowspan="2">Members without Survivor</th></tr>
<tr><th></th><th>Male</th><th>Female</th></tr>
<tr><td>Unmodified</td><td>35%</td><td>70%</td><td>100%</td></tr>
<tr><td>Option 2 (A/B)</td><td>45%</td><td>20%</td><td></td></tr>
<tr><td>Option 3 (A/B)</td><td>20%</td><td>10%</td><td></td></tr>
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