Orange County Employees
Retirement System

Actuarial Experience Study

**Analysis of Actuarial Experience
During the Period
January 1, 2017 through December 31, 2019**

✶ Segal

August 6, 2020

Board of Retirement
Orange County Employees Retirement System
2223 Wellington Avenue
Santa Ana, CA 92701

Re: Review of Actuarial Assumptions for the December 31, 2020 Actuarial Valuation

Dear Members of the Board:

We are pleased to submit this report of our review of the actuarial experience for the Orange County Employees Retirement System. This study utilizes the census data for the period January 1, 2017 to December 31, 2019 and provides the proposed actuarial assumptions, both economic and demographic, to be used in the December 31, 2020 valuation.
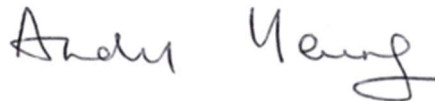
We are members of the American Academy of Actuaries and we meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion herein.

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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Segal

I. Introduction, Summary, and Recommendations

To project the cost and liabilities of the Retirement System, 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 when and to what extent the economy will rebound after the current crisis caused 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 economic and demographic actuarial assumptions and to compare the actual experience with that expected under the current assumptions during the three-year experience period from January 1, 2017 through December 31, 2019. 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 inflation, merit and promotion salary increases, retirement from active employment, retirement age for inactive vested members, percent of members assumed to go on to work for a reciprocal system, spouse or domestic partner age difference , pre-retirement mortality, post-retirement healthy and disabled life

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

mortality, termination (refunds and deferred vested retirements), disability (non-service connected and service connected) and additional cashouts.

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

Pg #	Actuarial Assumption Categories	Recommendation
13	**Inflation:** Future increases in the Consumer Price Index (CPI), which drives investment returns and active member salary. **Retiree Cost of Living Increases:** Future increases in the Cost of Living adjustment for Retirees.	Reduce the inflation assumption from 2.75% to 2.50% per annum as discussed in Section (III)(A). Maintain the retiree cost-of-living assumption at 2.75% per annum (based on our recommended inflation assumption of 2.50% plus a margin for adverse deviation of 0.25%) as discussed in Section (III)(A). Alternative: Reduce the retiree cost of living assumption from 2.75% per annum to 2.50% per annum (based on our recommended inflation assumption of 2.50% without a margin for adverse deviation) as discussed in Section (III)(A).
16	**Investment Return:** The estimated average future net rate of return on current and future assets of the System as of the valuation date. This rate is used to discount liabilities.	Maintain the current investment return assumption at 7.00% as discussed in Section (III)(B).
24	**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	Reduce the current inflationary salary increase assumption from 2.75% to 2.50% and maintain the current real "across the board" salary increase assumption at 0.50%. This means that the combined inflationary and real "across the board" salary increases will decrease from 3.25% to 3.00%. We recommend adjusting the merit and promotion rates of salary increase as developed in Section III(C) to reflect past experience. Future merit and promotion salary increases are higher in some service categories and lower in other service categories under the proposed assumptions. The recommended total rates of salary increase anticipate lower salary increases overall for General members and about the same salary increases overall for Safety members.

Pg #	Actuarial Assumption Categories	Recommendation
30	**Retirement Rates:** The probability of retirement at each age at which participants are eligible to retire. **Other Retirement Related Assumptions including:** • Percent married and spousal age differences for members not yet retired • Retirement age for deferred vested members • Future reciprocal members and reciprocal salary increases	We recommend adjusting the retirement rates to those developed in Section IV (A). For those tiers that have been adopted for the legacy members for a longer period of time, we are recommending separate sets of age-based retirement assumptions for those with less than 30 years of service at retirement and for those with 30 or more years of service at retirement. For active and deferred vested members, maintain the current percent married at retirement assumption at 75% for males and 55% for females. Maintain the spouse age difference assumption that male retirees are three years older than their spouses and revise the spouse age assumption that female retirees are three years younger than their spouses to two years younger than their spouses. For deferred vested members, maintain the deferred vested retirement assumption at age 59 for General members and revise the deferred vested retirement assumption from 53 to 54 for Safety Members. Maintain the current proportion of future deferred vested members expected to be covered by a reciprocal system at 15% for General members and decrease the assumption from 25% to 20% for Safety members. In addition, decrease the reciprocal salary increase assumption from 4.25% to 4.00% for General members and from 4.75% to 4.60% for Safety members.

Pg #	Actuarial Assumption Categories	Recommendation
53	**Mortality Rates:** The probability of dying at each age. Mortality rates are used to project life expectancies.	For pre-retirement mortality: Current base table: Headcount-Weighted RP-2014 Employee Mortality Table times 80%. Recommended base table for General Members: Pub-2010 General Employee Amount-Weighted Above-Median Mortality Table. Recommended base table for Safety Members: Pub-2010 Safety Employee Amount-Weighted Above-Median Mortality Table. For healthy General retirees: Current base table: Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table. Recommended base table: Pub-2010 General Healthy Retiree Amount-Weighted Above-Median Mortality Table with rates increased by 5%. For healthy Safety retirees: Current base table: Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table set back four years. Recommended base table: Pub-2010 Safety Healthy Retiree Amount-Weighted Above-Median Mortality Table. For all beneficiaries: Current base table: Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table. Recommended base table: Pub-2010 Contingent Survivor Amount-Weighted Above-Median Mortality Table with rates increased by 5%. For disabled General retirees: Current base table: Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table set forward five years. Recommended base table: Pub-2010 Non-Safety Disabled Retiree Amount-Weighted Mortality Table with rates decreased by 5%. For disabled Safety retirees: Current: Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table. Recommended base table: Pub-2010 Safety Disabled Retiree Amount-Weighted Mortality Table. All current tables are projected generationally with the two-dimensional mortality improvement scale MP-2016. All recommended tables are projected generationally with the two-dimensional mortality improvement scale MP-2019. For member contribution rates, optional forms and reserves: change the mortality rates to those developed in Section (IV)(B).
67	**Termination Rates:** The probability of leaving employment at each age and receiving either a refund of member contributions or a deferred vested retirement benefit.	We recommend adjusting the termination rates to those developed in Section IV (D) to reflect a slightly higher incidence of termination for General All Other (non-OCTA) members and Safety members, and a slightly lower incidence of termination for General OCTA members. In addition, a lower proportion of members is expected to elect a withdrawal of member contributions with a higher proportion electing instead to receive a deferred vested benefit under the recommended assumptions.

Pg #	Actuarial Assumption Categories	Recommendation
73	**Disability Incidence Rates:** The probability of becoming disabled at each age.	We recommend adjusting the disability rates to those developed in Section IV (E) to reflect slightly higher incidence of disability for General All Other, General OCTA and Safety Law and Fire members.
78	**Additional Cashouts:** Additional pay elements that are expected to be received during the member's final average earnings period.	We recommend adjusting the additional cashout assumptions to those developed in Section IV (F) to reflect recent years' experience.
		In determining the assumptions for the cashouts, we asked OCERS for directions on whether the recent California Supreme Court decision on compensation earnable is expected to have an impact on the pay elements that we have used in our analysis of the above assumptions. We were informed that in OCERS' opinion that decision does not apply to leave cash outs for Legacy members.

We have estimated the impact of all the recommended economic and demographic assumptions as if they were applied to the December 31, 2019 actuarial valuation. The table below shows the changes in the employer and member contribution rates due to the proposed assumption changes separately for the recommended economic assumption changes (as recommended in Section III of this report which include the recommended merit and promotion salary increases) and the recommended demographic assumption changes (as recommended in Section IV of this report).

Cost Impact of the Recommended Assumptions
Based on December 31, 2019 Actuarial Valuation

Impact on Employer Contribution Rates	
Decrease due to changes in economic assumptions	-0.29%
Increase due to changes in demographic assumptions	<u>0.98%</u>
Total increase in average employer rate	0.69%
Total estimated increase in annual dollar amount ($000s)	$11,711
Impact on Member Contribution Rates	
Decrease due to changes in economic assumptions	-0.26%
Increase due to changes in demographic assumptions	<u>0.25%</u>
Total decrease in average member rate	-0.01%
Total estimated decrease in annual dollar amount ($000s)	$(621)
Impact on UAAL and Funded Percentage	
Increase in UAAL	$38 million
Change in Funded Percentage	From 73.17% to 73.06%

Of the various assumption changes, the most significant employer cost impact (rate increase) for the General Rate Groups is from the change in the retirement assumptions while the most significant employer cost impact (rate reduction) for the Safety Rate Groups is from the change in the mortality assumptions.

Section III of this report includes a possible alternative to the recommended 2.75% retiree Cost-of-Living assumption that is consistent with prior practice relative to the recommended inflation assumption. The following table shows the estimated cost impact of adopting a 2.50% retiree Cost-of-Living assumption, <u>together with all the other assumption changes recommended in this report</u>.

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Cost Impact of the Alternative Assumptions
Based on December 31, 2019 Actuarial Valuation
(with 2.50% Retiree Cost-of-Living Assumption)

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Impact on Employer Contribution Rates	
Decrease due to changes in economic assumptions	-3.16%
Increase due to changes in demographic assumptions	<u>0.98%</u>
Total decrease in average employer rate	-2.18%
Total estimated decrease in annual dollar amount ($000s)	$(44,124)
Impact on Member Contribution Rates	
Decrease due to changes in economic assumptions	-0.70%
Increase due to changes in demographic assumptions	<u>0.25%</u>
Total decrease in average member rate	-0.45%
Total estimated decrease in annual dollar amount ($000s)	$(9,106)
Impact on UAAL and Funded Percentage	
Decrease in UAAL	$(557) million
Change in Funded Percentage	From 73.17% to 75.08%

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 Section III for the economic assumptions and Section IV for the demographic assumptions. The cost impact of the proposed changes is detailed in Section V.

II. Background and Methodology

In this report, we analyzed both economic and demographic ("non-economic") assumptions. The primary economic assumptions reviewed are inflation, investment return, and salary increases. 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, 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 or domestic partner, spousal age difference, percent of members assumed to go on to work for a reciprocal system, reciprocal salary increase and additional cashouts.

Economic Assumptions

Economic assumptions consist of:

- **Inflation:** Increases in the price of goods and services. The inflation assumption reflects the basic return that investors expect from securities markets. It also reflects the expected basic salary increase for active employees and drives increases in the allowances of retired members.

- **Investment Return:** Expected long-term rate of return on the System's investments after investment expenses. This assumption has a significant impact on contribution rates.

- **Salary Increases:** In addition to inflationary increases, it is assumed that salaries will also grow by real "across the board" pay increases in excess of price inflation. It is also assumed that employees will receive raises above these average increases as they advance in their careers. These are commonly referred to as merit and promotion increases. Payments to amortize any Unfunded Actuarial Accrued Liability (UAAL) are assumed to increase each year by the price inflation rate plus any real "across the board" pay increases that are assumed.

The setting of these economic assumptions is described in Section III.

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. Economic Assumptions

A. Inflation

Unless an investment grows at least as fast as prices increase, investors will experience a reduction in the inflation-adjusted value of their investment. There may be times when "riskless" investments return more or less than inflation, but over the long term, investment market forces will generally require an issuer of fixed income securities to maintain a minimum return which protects investors from inflation.

The inflation assumption is long term in nature, so our analysis begins with a review of historical information. Following is an analysis of 15 and 30 year moving averages of historical inflation rates:

Historical Consumer Price Index – 1930 to 2019[2]
(U.S. City Average - All Urban Consumers)

	25th Percentile	Median	75th Percentile
15-year moving averages	2.4%	3.3%	4.4%
30-year moving averages	2.9%	3.7%	4.8%

The average inflation rates have continued to decline gradually over the last several years due to the relatively low inflationary environment over the past two decades. Also, the later 15-year averages during the period are lower because they do not include the high inflation years of the mid-1970s and early 1980s.

Based on information found in the Public Plans Data website, which is produced in partnership with the National System of State Retirement Administrators (NASRA), the median inflation assumption used by 174 large public retirement funds in their 2018 fiscal year valuations was 2.65%.[3] In California, CalSTRS, Orange County and fourteen other 1937 Act CERL systems use an inflation assumption of 2.75%, two 1937 Act CERL systems use an inflation assumption of 2.50%, and the three other 1937 Act CERL systems currently use an inflation assumption of 3.00%. We note that OCERS was one of the first 1937 Act CERL systems, as well as of Segal's California public retirement system clients, to use the 2.75% inflation assumption when the Board lowered the 3.00% assumption to 2.75% at the last triennial experience study. CalPERS has lowered their inflation assumption from 2.75% to 2.50% over a three-year period.

OCERS' investment consultant, Meketa, anticipates an annual inflation rate of 2.60%, while the average inflation assumption provided by Meketa and six other investment advisory firms retained by Segal's California public sector clients was 2.33%. Note that, in general, investment consultants use a time horizon for this assumption that is shorter than the time horizon we use for the actuarial valuation.[4]

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[2] Source: Bureau of Labor Statistics – Based on CPI for All Items in U.S. city average, all urban consumers, not seasonally adjusted (Series ID: CUUR0000SA0).

[3] Among 188 large public retirement funds, the inflation assumption was not available for 14 of the public retirement funds in the survey data.

[4] The time horizon used by the seven investment consultants in our review generally ranges from 10 years to 30 years, and Meketa uses a 20-year horizon.

To find a forecast of inflation based on a longer time horizon, we referred to the Social Security Administration's (SSA) 2020 report on the financial status of the Social Security program.[5] The projected average increase in the Consumer Price Index (CPI) over the next 75 years under the intermediate cost assumptions used in that report was 2.40%. The SSA report also includes alternative projections using lower and higher inflation assumptions of 1.80% and 3.00%, respectively.

We also compared the yields on the thirty-year inflation indexed U.S. Treasury bonds to comparable traditional U.S. Treasury bonds.[6] As of June 2020, the difference in yields is about 1.55% which provides a measure of market expectations of inflation.

Based on all of the above information, we recommend that the current 2.75% annual inflation assumption be reduced to 2.50% for the December 31, 2020 actuarial valuation.

The setting of the inflation assumption using the information outlined above is a somewhat subjective process, and Segal does not apply a specific weight to each of the metrics in determining our recommended inflation assumption. Based on a consideration of all of the above metrics, we have generally been recommending a 0.25% decrease in the inflation assumption when we conduct experience studies for our other California public retirement system clients.

Retiree Cost-of-Living Increases

In our last experience study as of December 31, 2017, consistent with the 2.75% annual inflation assumption adopted by the Board for that valuation, the Board used a 2.75% cost-of-living adjustment for all retirees.**[7]**

In the last experience study, we set the recommended post-retirement cost-of-living adjustment (COLA) assumption to be equal to our recommended inflation assumption. However, we observed in the table below that during the most recent 5-year, 10-year and 20-year periods ending before December 31, 2019, the changes in the average annual CPI based on Los Angeles-Long Beach-Anaheim area used by the Board to set COLAs have exceeded those of the average annual CPI for the U.S. City Average. In order to reflect this experience and to mitigate actuarial losses which may arise from future COLA increases greater than the inflation assumption, we believe it is reasonable for the Board to consider adopting an extra margin above the general price inflation in anticipating future COLAs. **Our recommended COLA assumption of 2.75% includes a 0.25% margin above our recommended inflation assumption, which leaves the COLA assumption unchanged.**

We have also included for consideration an alternative 2.50% COLA assumption that does not include the 0.25% margin, which would be consistent with prior practice relative to the recommended inflation assumption.

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[5] Source: Social Security Administration: The 2020 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds

[6] Source: Board of Governors of the Federal Reserve System.

[7] For current retirees and beneficiaries, we would utilize the accumulated COLA banks to value annual 3.00% COLA increases as long as the COLA banks are available.

	Change in Average Annual CPI for Los Angeles-Long Beach-Anaheim Area	Change in Average Annual CPI for U.S. City Average
5-year period	2.49%	1.55%
10-year period	2.08%	1.77%
20-year period	2.54%	2.16%

In developing the COLA assumption, we also considered the results of a stochastic approach that would attempt to account for the possible impact of low inflation that could occur before COLA banks are able to be established for the member. Although the results of this type of analysis might justify the use of a lower COLA assumption, we are not recommending that at this time. The reasons for this conclusion include the following:

- The results of the stochastic modeling are significantly dependent on assuming that lower levels of inflation will persist in the early years of the projections. If this is not assumed, then the stochastic modeling will produce results similar to our proposed COLA assumptions.

- Using a lower long-term COLA assumption based on a stochastic analysis would mean that an actuarial loss would occur even when the inflation assumption is met in a year. We question the reasonableness of this result.

We do not see the stochastic possibility of COLAs averaging less than those predicted by the assumed rate of inflation as a reliable source of cost savings that should be anticipated in our COLA assumptions. Therefore, with this experience study, we recommend setting the COLA assumptions consistent with COLA assumption we have used in prior years.

B. Investment Return

The investment return assumption is comprised of two primary components, inflation and real rate of investment return, with adjustments for investment expenses and risk.

Real Rate of Investment Return

This component represents the portfolio's incremental investment market returns over inflation. Theory has it that as an investor takes a greater investment risk, the return on the investment is expected to also be greater, at least in the long run. This additional return is expected to vary by asset class and empirical data supports that expectation. For that reason, the real rate of return assumptions are developed by asset class. Therefore, the real rate of return assumption for a retirement System's portfolio will vary with the Board's asset allocation among asset classes.

The System's current target asset allocation and the assumed real rate of return assumptions by asset class are shown in the following table. The first column of real rate of return assumptions are determined by reducing Meketa's total or "nominal" 2020 return assumptions by their assumed 2.60% inflation rate. The second column of returns (except certain asset classes as noted in the table) represents the average of a sample of real rate of return assumptions. The sample includes the expected annual real rate of return provided to us by Meketa and six other investment advisory firms retained by Segal's public sector clients. We believe these averages are a reasonable consensus forecast of long-term future market returns in excess of inflation.[8]

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[8] Note that, just as for the inflation assumption, in general the time horizon used by the investment consultants in determining the real rate of return assumption is shorter than the time horizon encompassed by the actuarial valuation.

OCERS' Target Asset Allocation and Assumed Arithmetic Real Rate of Return Assumptions by Asset Class and for the Portfolio

Asset Class	Percentage of Portfolio	Meketa's Assumed Real Rate of Return[9]	Average Assumed Real Rate of Return from a Sample of Consultants to Segal's California Public Sector Clients[10]
Large Cap Equity	23.10%	6.25%	5.43%
Small Cap Equity	1.90%	6.25%	6.21%
International Developed Equity	13.00%	7.11%	6.67%
Emerging Markets Equity	9.00%	9.38%	8.58%
Core Bonds	9.00%	0.48%	1.10%
High Yield Bonds	1.50%	3.21%	2.91%
TIPS	2.00%	0.55%	0.65%
Emerging Market Debt	2.00%	2.51%	3.25%
Corporate Credit	1.00%	1.25%	0.53%
Long Duration Fixed Income	2.50%	1.32%	1.44%
Real Estate	3.01%	4.31%	4.42%
Private Equity	13.00%	10.16%	9.41%
Value Added Real Estate	3.01%	7.42%	7.42%[11]
Opportunistic Real Estate	0.98%	10.18%	10.18%[11]
Energy	2.00%	9.68%	9.68%[11]
Infrastructure (Core Private)	1.50%	5.08%	5.08%[11]
Infrastructure (Non-Core Private)	1.50%	8.92%	8.92%[11]
CTA - Trend Following	2.50%	2.38%	2.38%[11]
Global Macro	2.50%	2.13%	2.13%[11]
Private Credit	2.50%	5.47%	5.47%[11]
Alternative Risk Premia	2.50%	2.50%	2.50%[11]
Total	**100.0%**	**6.02%**	**5.67%**

The above are representative of "indexed" returns and do not include any additional returns ("alpha") from active management. This is consistent with the Actuarial Standard of Practice No. 27, Section 3.6.3.d, which states:

> "Investment Manager Performance - Anticipating superior (or inferior) investment manager performance may be unduly optimistic (or pessimistic). The actuary should not assume that superior or inferior returns will be achieved, net of investment expenses, from an active investment management strategy compared to a passive investment management strategy unless the actuary has reason to believe, based on relevant supporting data, that such superior or inferior returns represent a reasonable expectation over the long term."

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[9] Derived by reducing Meketa's nominal rate of return assumptions by their assumed 2.60% inflation rate.

[10] These are based on the projected arithmetic returns provided by Meketa and six other investment advisory firms serving the county retirement system of Orange and 16 other city and county retirement systems in California. These return assumptions are gross of any applicable investment expenses.

[11] For these asset classes, Meketa's assumption is applied in lieu of the average because there is a larger disparity in returns for these asset classes among the firms surveyed and using Meketa's assumption should more closely reflect the underlying investments made specifically for OCERS.

The following are some observations about the returns provided above:

1. The investment consultants to our California public sector clients have each provided us with their expected real rates of return for each asset class, over various future periods of time. However, in general, the returns available from investment consultants are projected over time periods that are much shorter than the durations of a retirement plan's liabilities.

2. Using a sample average of expected real rate of returns allows the System's investment return assumption to reflect a broader range of capital market information and should help reduce year to year volatility in the investment return assumption.

3. Therefore, we recommend that the 5.67% portfolio real rate of return be used to determine the System's investment return assumption. This is 0.40% higher than the return that was used three years ago in the review to prepare the recommended investment return assumption for the December 31, 2017 valuation. The difference is due to changes in the real rate of return assumptions provided to us by the investment advisory firms (+0.22% under the 2017 asset allocation) and changes in the System's target asset allocation (+0.18%).

System Expenses

For funding purposes, the real rate of return assumption for the portfolio needs to be adjusted for investment and administrative expenses expected to be paid from investment income. The following table provides the investment and administrative expenses in relation to the valuation value of assets for the five years ending December 31, 2019.

Administrative and Investment Expenses as a Percentage of Valuation Value of Assets (Dollars in 000's)

Plan Year	Valuation Value of Assets[12]	Administrative Expenses	Investment Expenses[13]	Administrative %	Investment %	Total %
2015	11,449,911	12,521	54,532	0.11	0.48	0.59
2016	12,228,009	16,870	80,810[14]	0.14	0.66	0.80[14]
2017	13,102,978	17,002	79,376	0.13	0.61	0.74
2018	14,197,125	18,284	101,408	0.13	0.71	0.84
2019	14,994,420	19,171	106,330	0.13	0.71	0.84
Five-Year Average				0.13	0.63	0.76
Three-Year Average				0.13	0.68	0.81
Current Assumption				0.15	0.65	0.80
Proposed Assumption				0.15	0.70	0.85

[12] As of beginning of plan year.

[13] Net of securities lending expenses. Because we do not assume any additional net return for this program, we effectively assume that any securities lending expenses will be offset by related income.

[14] Per OCERS, the increase in the investment expenses for plan year 2016 is primarily due to the reporting of the "at-source" investment management fees in the financial statement that were previously netted against the investment returns.

The average administrative and investment expenses percentage over this five-year period in the current experience study is 0.76% of the valuation value of assets. However, the total expenses percentage went up to 0.80% for plan year 2016 when the "at-source" investment managed fees started to be disclosed in the financial statements instead of being treated as a reduction in the investment returns. Taking into account how the investment expenses have been reported starting with the 2016 plan year, we believe that it is reasonable to increase the future expense component from 0.80% used in the last review in 2017 to 0.85%.

Note related to investment expenses paid to active managers – As cited above, under Section 3.6.3.d of ASOP No. 27, the effect of an active investment management strategy should be considered "net of investment expenses…unless the actuary believes, based on relevant data, that such superior or inferior returns represent a reasonable expectation over the measurement period." For OCERS, nearly all of the investment expenses were paid for expenses associated with active managers.

We have not performed a detailed analysis to measure how much of the investment expenses paid to active managers might have been offset by additional returns ("alpha") earned by that active management. For now, we will continue to use the current approach that any "alpha" that may be identified would be treated as an increase in the risk adjustment and corresponding confidence level. For example, 0.25% of alpha would increase the confidence level by 3% (see discussions that follow on definitions of risk adjustment and confidence level).

Risk Adjustment

The real rate of return assumption for the portfolio is adjusted to reflect the potential risk of shortfalls in the return assumptions. The System's asset allocation determines this portfolio risk, since risk levels are driven by the variability of returns for the various asset classes and the correlation of returns among those asset classes. This portfolio risk is incorporated into the real rate of return assumption through a risk adjustment.

The purpose of the risk adjustment (as measured by the corresponding confidence level) is to increase the likelihood of achieving the actuarial investment return assumption in the long term.[15] This is consistent with our experience that retirement plan fiduciaries would generally prefer that returns exceed the assumed rate more often than not.

The 5.67% expected real rate of return developed earlier in this report was based on expected mean or average arithmetic returns. In our model, the confidence level associated with a particular risk adjustment represents the relative likelihood that future investment earnings would equal or exceed the assumed earnings over a 15-year period on an expected value basis.[16] The 15-year time horizon represents an approximation of the "duration" of the fund's liabilities, where the duration of a liability represents the sensitivity of that liability to interest rate variations. Note that, based on the investment return assumptions recently adopted by systems that have been analyzed under this model, we observe a confidence level in the range of 50% to 55%.

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[15] This type of risk adjustment is referred to in the Actuarial Standards of Practice as a "margin for adverse deviation."

[16] If a retirement system uses the expected arithmetic average return as the discount rate in the funding valuation, that retirement system is expected to have no surplus or asset shortfall relative to its expected obligations assuming all actuarial assumptions are met in the future.

Three years ago, the Board adopted an investment return assumption of 7.00%. That return implied a risk adjustment of 0.22%, reflecting a confidence level of 53% that the actual average return over 15 years would not fall below the assumed return, assuming that the distribution of returns over that period follows the normal statistical distribution.[17]

If we use the same 53% confidence level from our last study to set this year's risk adjustment and the current long-term portfolio standard deviation of 13.60% provided by Meketa, the corresponding risk adjustment would be 0.23%. Together with the other investment return components, this would result in an investment return assumption of 7.09%, which is slightly higher than the current assumption of 7.00%.

Based on the general practice of using one-quarter percentage point increments for economic assumptions, we evaluated the effect on the confidence level of alternative investment return assumptions. In particular, a net investment return assumption of 7.00%, together with the other investment return components, would produce a risk adjustment of 0.32%, which corresponds to a confidence level of 54%. We believe this analysis supports maintaining the current assumption at 7.00%.

The table below shows OCERS' investment return assumptions and, for the years when this analysis was performed, the risk adjustments and corresponding confidence levels compared to the values for prior studies.

Historical Investment Return Assumptions, Risk Adjustments and Confidence Levels based on Assumptions Adopted by the Board

Year Ending December 31	Investment Return	Risk Adjustment	Corresponding Confidence Level
2004 - 2007	7.75%	0.39%	56%
2008 - 2010	7.75%	0.80%	61%
2011	7.75%	-0.23%	<50%
2012 - 2013	7.25%	0.34%	55%
2014 - 2016	7.25%	0.28%	53%
2017 - 2019	7.00%	0.22%	53%[18]
2020 (Recommended)	7.00%	0.32%	54%

As we have discussed in prior experience studies, the risk adjustment model and associated confidence level is most useful as a means for comparing how the System has positioned itself relative to risk over periods of time.[19] The use of a 54% confidence level under Segal's model should be considered in context with other factors, including:

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[17] Based on an annual portfolio return standard deviation of 13.00% provided by Meketa in 2017. Strictly speaking, future compounded long-term investment returns will tend to follow a log-normal distribution. However, we believe the normal distribution assumption is reasonable for purposes of setting this type of risk adjustment.

[18] This was based on the 2.75% inflation assumption adopted by the Board. In our December 31, 2017 triennial experience study report, we calculated a 55% confidence level based on an inflation assumption of 3.00%.

[19] In particular, it would not be appropriate to use this type of risk adjustment as a measure of determining an investment return rate that is "risk-free."

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- As noted above, the confidence level is more of a relative measure than an absolute measure, and so can be reevaluated and reset for future comparisons.

- The confidence level is based on the standard deviation of the portfolio that is determined and provided to us by Meketa. The standard deviation is a statistical measure of the future volatility of the portfolio and so is itself based on assumptions about future portfolio volatility and can be considered somewhat of a "soft" number.

- A confidence level of 54% is within the range of about 50% to 55% that corresponds to the risk adjustments used by most of Segal's other California public retirement system clients.

- We have not taken into account any additional returns ("alpha") that might be earned on active management. This means that if active management generates enough alpha to cover its related expenses, this would increase returns. This aspect of Segal's model is further evaluated below.

- As with any model, the results of the risk adjustment model should be evaluated for reasonableness and consistency. This is discussed in the later section on "Comparison with Other Public Retirement Systems."

Taking into account the factors above, our recommendation is to maintain the net investment return assumption at 7.00%. As noted above, this return implies a 0.32% risk adjustment and reflects a confidence level of 54%.

Recommended Investment Return Assumption

The following table summarizes the components of the investment return assumption developed in the previous discussion. For comparison purposes, we have also included similar values from the last study.

Calculation of Investment Return Assumption

Assumption Component	December 31, 2020 Recommended Value	December 31, 2017 Adopted Value
Inflation	2.50%	2.75%
Plus Portfolio Real Rate of Return	5.67%	5.27%
Minus Expense Adjustment	(0.85)%	(0.80%)
Minus Risk Adjustment	(0.32)%	(0.22%)
Total	**7.00%**	**7.00%**
Confidence Level	**54%**	**53%**

Based on this analysis, we recommend that the investment return assumption be maintained at 7.00% per annum.

Comparison with Alternative Model used to Review Investment Return Assumption

Since our appointment as actuary for OCERS in 2004, we have consistently reviewed investment return assumptions based on our model that incorporates expected arithmetic real returns for the different asset classes and for the entire portfolio as one component of that model.[20] The use of "forward looking expected arithmetic returns" is one of the approaches discussed for use in the Selection of Economic Assumptions for measuring Pension Obligations under Actuarial Standards of Practice (ASOP) No. 27.

Besides using forward looking expected arithmetic returns, ASOP No. 27 also discussed setting investment return assumptions using an alternative "forward looking expected geometric returns" approach.[21] Even though expected geometric returns are lower than expected arithmetic returns, those California public retirement systems that have set investment return assumptions using this alternative approach have in practice adopted investment return assumptions that are comparable to those adopted by the Board for OCERS. This is because under the model used by those retirement systems, their investment return assumptions are not reduced to anticipate future investment expenses.[22]

For comparison, we evaluated the recommended 7.00% assumption based on the expected geometric return for the entire portfolio, net of administrative and investment expenses. Under that model, over a 15-year period, there is a 59% likelihood that future average geometric returns will meet or exceed 7.00%.[23]

Comparing with Other Public Retirement Systems

One final test of the recommended investment return assumption is to compare it against those used by other public retirement systems, both in California and nationwide.

We note that an investment return of 7.00% or lower is becoming more common among California public sector retirement systems. In particular, of the twenty 1937 Act CERL systems, twelve use a 7.00% investment return assumption, two use 6.75%, and one uses 6.50%. The remaining five 1937 Act CERL systems currently use a 7.25% earnings assumption. Furthermore, both CalPERS and CalSTRS currently use a 7.00% earnings assumption, while the San Jose and San Diego City retirement systems use investment return assumptions of 6.75% and 6.50%, respectively.

The following table compares OCERS' recommended net investment return assumption against those of the 188 large public retirement funds in their 2018 fiscal year valuations based on

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[20] Again, as discussed in the footnote to "Risk Adjustment", if a retirement system uses the expected arithmetic average return as the discount rate in the funding valuation, that retirement system is expected to have no surplus or asset shortfall relative to its expected obligations assuming all actuarial assumptions are met in the future.

[21] If a retirement system uses the expected geometric average return as the discount rate in the funding valuation, that retirement system is expected to have an asset value that generally converges to the median accumulated value as the time horizon lengthens assuming all actuarial assumptions are met in the future.

[22] This means that if the model were to be applied to OCERS, the expected geometric return would not be adjusted for the approximately 0.70% investment expenses paid by OCERS.

[23] We performed this stochastic simulation using the capital market assumptions included in the 2019 survey prepared by Horizon Actuarial Services. That simulation was performed using 10,000 trial outcomes of future market returns, using assumptions from 20-year arithmetic returns, standard deviations and correlation matrix that were found in the 2019 survey that included responses from 34 investment advisors.

information found in the Public Plans Data website, which is produced in partnership with NASRA:[24]

Assumption	OCERS	Public Plans Data[25]		
		Low	Median	High
Net Investment Return	7.00%	4.50%	7.25%	8.00%

The detailed survey results show that more than 80% of the systems have an investment return assumption in the range of 6.75% to 7.50%. Also, about one-third of the systems have reduced their investment return assumption during the year. State systems outside of California tend to change their economic assumptions less frequently and so may lag behind emerging practices in this area.

In summary, we believe that both the risk adjustment model and other considerations support maintaining the current earnings assumption. The recommended assumption of 7.00% provides for a risk margin within the risk adjustment model and is consistent with OCERS' current practice relative to other public systems.

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[24] Among 188 large public retirement funds, the investment return assumption was not available for 6 of the public retirement funds in the survey data.

[25] Public Plans Data website – Produced in partnership with the National System of State Retirement Administrators (NASRA)

C. Salary Increase

Salary increases impact plan costs in two ways: (i) by increasing members' benefits (since benefits are a function of the members' highest average pay) and future normal cost collections; and (ii) by increasing total active member payroll which in turn generates lower UAAL contribution rates as a percent of payroll. These two impacts are discussed separately as follows:

As an employee progresses through his or her career, increases in pay are expected to come from three sources:

1. **Inflation:** Unless pay grows at least as fast as consumer prices grow, employees will experience a reduction in their standard of living. There may be times when pay increases lag or exceed inflation, but over the long term, labor market forces may require an employer to maintain its employees' standards of living.

    As discussed earlier in this report, we are recommending that the assumed rate of inflation be decreased from 2.75% to 2.50% per annum. This inflation component is used as part of the salary increase assumption.

2. **Real "Across the Board" Pay Increases:** These increases are typically termed productivity increases since they are considered to be derived from the ability of an organization or an economy to produce goods and services in a more efficient manner. As that occurs, at least some portion of the value of these improvements can provide a source for pay increases. These increases are typically assumed to extend to all employees "across the board". The State and Local Government Workers Employment Cost Index produced by the Department of Labor provides evidence that real "across the board" pay increases have averaged about 0.4% – 0.7% annually during the last ten to twenty years.

    We also referred to the annual report on the financial status of the Social Security program published in April 2020. In that report, real "across the board" pay increases are forecast to be 1.1% per year under the intermediate assumptions.

    The real pay increase assumption is generally considered a more "macroeconomic" assumption that is not necessarily based on individual plan experience. However, recent salary experience with public systems in California as well as anecdotal discussions with plans and plan sponsors indicate lower future real wage growth expectations for public sector employees. We note that for OCERS' active members, the actual average inflation plus "across the board" increase (i.e., wage inflation) over the three year period ending December 31, 2019 was 2.77%, which is less than the change in CPI of 3.22% during that same period:

Valuation Date	Actual Average Increase[26]	Actual Change in CPI[27]
December 30, 2017	3.21%	2.79%
December 30, 2018	2.52%	3.81%
December 30, 2019	2.58%	3.07%
Three Year Average	**2.77%**	**3.22%**

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[26] Reflects the increase in average salary for members at the beginning of the year versus those at the end of the year. It does not reflect the average salary increases received by members who worked the full year.

[27] Based on the change in the annual average CPI for the Los Angeles-Long Beach-Anaheim Area compared to the prior year. Prior to December 31, 2018, this was based on the change in the annual average CPI for Los Angeles- Riverside-Orange County Area.

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Considering these factors, we recommend maintaining the real "across the board" salary increase assumption at 0.50%. This means that the combined inflation and "across the board" salary increase assumption will decrease from 3.25% to 3.00%.

3. **Merit and Promotion Increases:** As the name implies, these increases come from an employee's career advances. This form of pay increase differs from the previous two, since it is specific to the individual. For OCERS, there are service-specific merit and promotion increases.

   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 separately for General and Safety 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 any decreases 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 total 3.00% assumed inflation and real "across the board" increases recommended in this study.

   Due to the high variability of the actual salary increases, we have analyzed this assumption using data for the past six 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 General members' actual average merit and promotion increases by years of service over the three-year period from January 1, 2017 through December 31, 2019 along with the actual average increases based on combining the current three-year period with the three-year period from the prior experience study. The current and proposed assumptions are also shown. The actual increases 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 experience period (2.57% on average for the most recent three-year period).

General

Years of Service	Rate (%)			
	Current Assumptions	Actual Average Increase from Current Study (Last 3 Years)	Actual Average Increase Current and Prior Two Studies (Last 6 Years)	Proposed Assumption
Less than 1	9.00	4.67	5.58	8.00
1 – 2	7.25	7.51	7.33	7.25
2 – 3	6.00	6.69	6.65	6.25
3 – 4	5.00	6.14	5.95	5.25
4 – 5	4.00	5.47	5.04	4.25
5 – 6	3.50	3.92	3.81	3.50
6 – 7	2.50	3.03	3.10	2.75
7 – 8	2.25	2.55	2.73	2.50
8 – 9	1.75	1.56	2.16	1.70
9 – 10	1.50	1.82	2.18	1.70
10 – 11	1.50	1.59	1.77	1.60
11 – 12	1.50	1.53	1.78	1.60
12 – 13	1.50	1.54	1.69	1.50
13 – 14	1.50	1.49	1.65	1.50
14 – 15	1.50	1.12	1.38	1.25
15 – 16	1.50	0.93	1.33	1.25
16 – 17	1.00	0.88	1.20	1.00
17 – 18	1.00	0.81	1.18	1.00
18 – 19	1.00	0.72	1.29	1.00
19 – 20	1.00	0.78	1.13	1.00
20 & Over	1.00	0.71	1.04	1.00

The following table shows the Safety members' actual average merit and promotion increases by years of service over the three-year period from January 1, 2017 through December 31, 2019 along with the actual average increases based on combining the current three-year period with the three-year period from the prior experience study. The current and proposed assumptions are also shown. The actual increases 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 experience period (3.01% on average for the most recent three-year period).

Safety

Years of Service	Rate (%)			
	Current Assumptions	Actual Average Increase from Current Study (Last 3 Years)	Actual Average Increase Current and Prior Two Studies (Last 6 Years)	Proposed Assumption
Less than 1	14.00	10.34	12.13	12.00
1 – 2	10.00	12.05	9.14	10.00
2 – 3	7.75	11.32	8.49	8.50
3 – 4	6.00	10.37	7.59	7.50
4 – 5	5.50	8.71	7.66	6.50
5 – 6	4.50	7.32	5.77	5.50
6 – 7	3.75	6.16	5.05	5.00
7 – 8	3.25	5.66	4.39	4.00
8 – 9	2.50	4.11	3.39	3.00
9 – 10	2.25	3.08	2.64	2.50
10 – 11	1.75	2.18	1.89	1.85
11 – 12	1.75	2.22	1.91	1.85
12 – 13	1.75	1.85	1.55	1.85
13 – 14	1.75	2.32	2.00	1.85
14 – 15	1.75	2.10	1.75	1.85
15 – 16	1.75	1.34	1.50	1.60
16 – 17	1.50	1.39	1.46	1.60
17 – 18	1.50	1.64	1.76	1.60
18 – 19	1.50	1.63	1.93	1.60
19 – 20	1.50	1.50	1.85	1.60
20 & Over	1.50	1.98	1.63	1.60

Chart 1 that follows later in the section compares actual experience with the current and proposed rates of actual merit and promotion increases for General members. Also shown is the actual merit and promotion increases based on an average of both the current and previous three-year experience periods.

Chart 2 compares actual experience with the current and proposed rates of actual merit and promotion increases for Safety members. Also shown is the actual merit and promotion increases based on an average of both the current and previous three-year experience periods.

Based on this experience, we are proposing changes in the merit and promotion salary increases for both General and Safety members, with increases in some service categories and decreases in other service categories. Overall, *merit and promotion* salary increases are assumed to be slightly lower for General members and higher for Safety members. The overall salary increase assumptions will decrease for General members and remain substantially the same for Safety members after taking into account the lower *inflation* component of the salary increase assumption.

Active Member Payroll

Projected active member payrolls are used to develop the UAAL contribution rate. Future values are determined as a product of the number of employees in the workforce and the average pay for all employees. The average pay for all employees increases only by inflation and real "across the board" pay increases. The merit and promotion increases are not an influence, because this average pay is not specific to an individual.

Under the Board's current practice, the UAAL contribution rate is developed by assuming that the total payroll for all active members will increase annually over the amortization periods at the same assumed rates of inflation plus real "across the board" salary increase assumptions as are used to project the members' future benefits.

We recommend that the active member payroll increase assumption be decreased from 3.25% to 3.00% annually, consistent with the combined inflation plus real "across the board" salary increase assumptions.

Chart 1: Merit and Promotion Salary Increase Rates
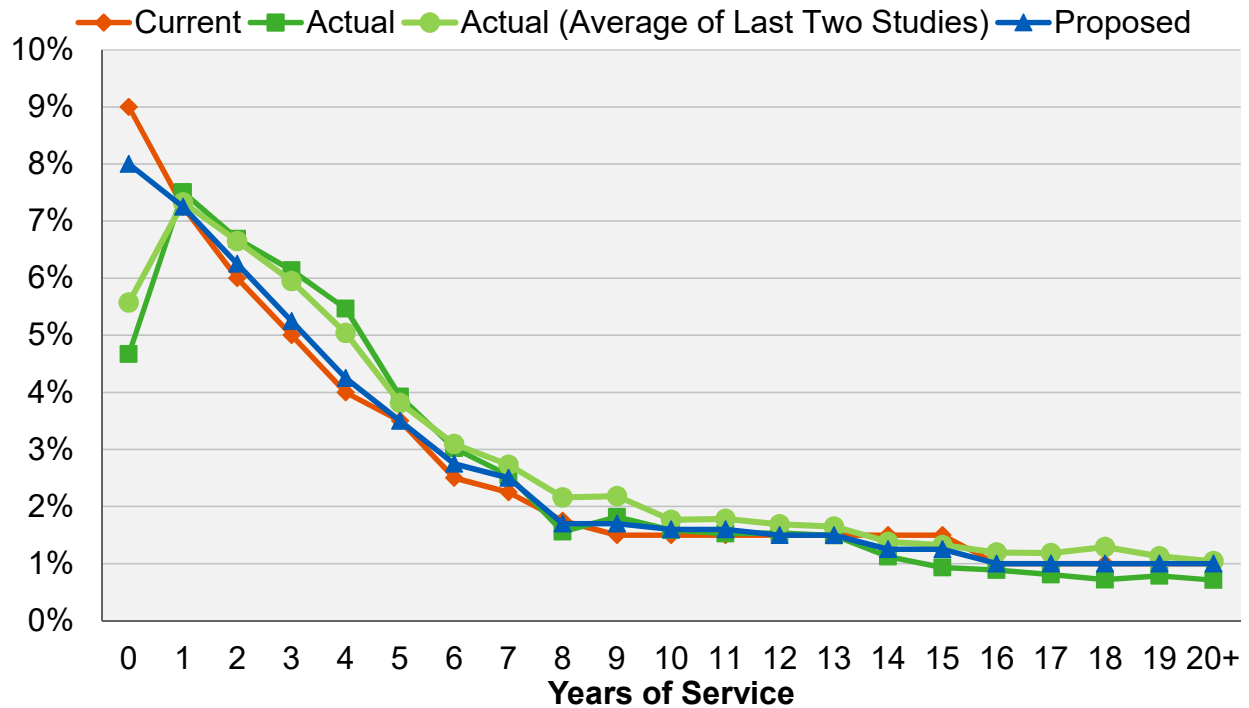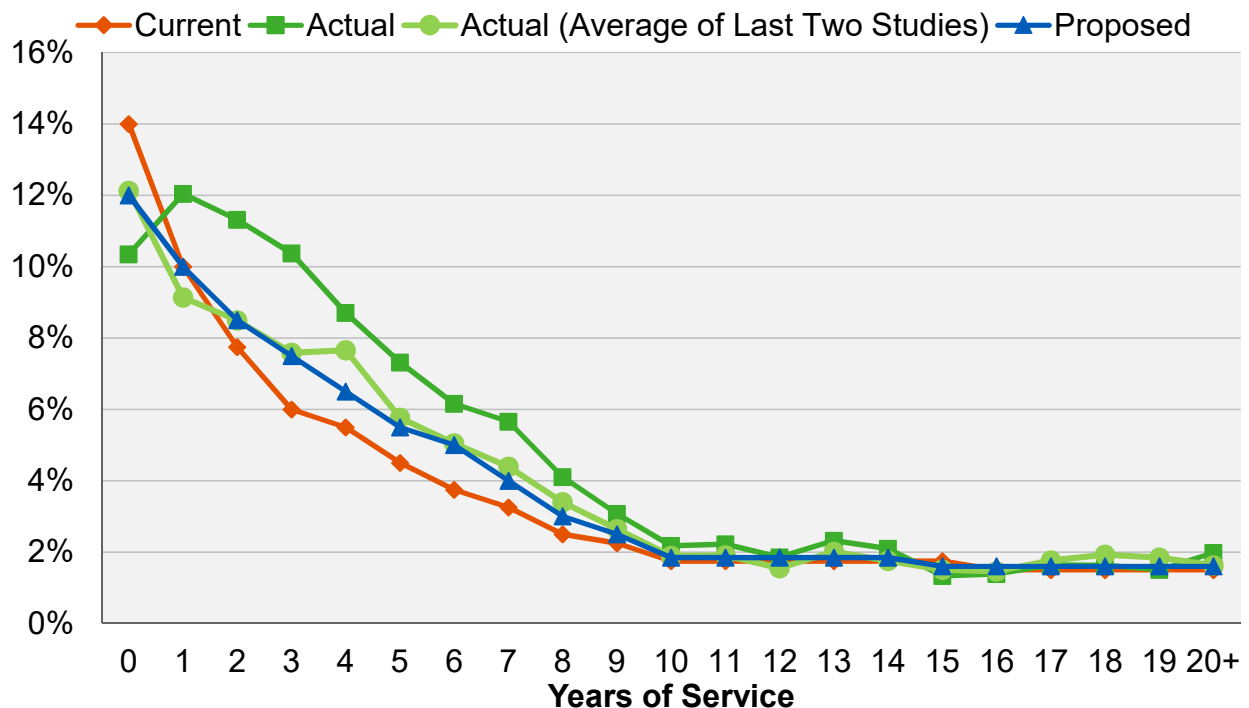## General Members

Chart 2: Merit and Promotion Salary Increase Rates
Safety Members

IV. Demographic Assumptions

A. 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.

The System's current retirement rates for the non-CalPEPRA Plans[28] are separated into:

(1) General Enhanced

(2) General Non-Enhanced[29]

(3) General SJC (2.0% @ 57 under §31676.12)

(4) Safety Law Enforcement (3.0% @ 50 under §31664.1)

(5) Safety Law Enforcement (3.0% @ 55 under §31664.2)

(6) Safety Fire (3.0% @ 50 under §31664.1)

(7) Safety Fire (3.0% @ 55 under §31664.2)

(8) Safety Probation (3.0% @ 50 under §31664.1)

For members who are covered under the CalPEPRA Plans, the retirement rates are separated into:

(1) CalPEPRA General

(2) CalPEPRA Safety Probation

(3) CalPEPRA Safety Law Enforcement

(4) CalPEPRA Safety Fire

Use of Age-Based Versus Service-Based Retirement Assumptions

Currently, the assumed retirement rates are a function of only the member's age. In the last experience study report, we reviewed but decided not to recommend assumptions based on age and years of service citing the need for more reliable experience especially if several sets of those assumptions had to be derived based on a large number of service categories. With this year's experience study, we have again analyzed recent years' retirement experience as a function of age and years of service but only using two service categories in relation to the probability of retirement. Our review concludes that the retirement rates generally correlate both with age and with years of service when we look at the experience of those members before and after attaining 30 years of service.

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[28] CalPEPRA or California Public Employees' Pension Reform Act of 2013 imposed lower benefit tiers for General and Safety members together with other changes.

[29] These assumptions are also used for the CalPEPRA 1.62% @ 65 formula (§31676.01).

The tables below separate out retirement experience for members with service either less than or greater than 30 as well as age either below or above 60 for each of the earlier legacy OCERS tiers. These tables show that there is a discernable pattern of higher rates of retirement for members with 30 or more years of service compared to those with less than 30 years of service in each group.

Rate of Retirement (%)			
General Enhanced			
Age	All Service	Less than 30 Years of Service	30 or More Years of Service
60 & Under	7.65	6.14	23.03
60 & Over	18.32	16.99	27.67
All Ages	11.01	9.47	24.85

Rate of Retirement (%)			
General Non-Enhanced			
Age	All Service	Less than 30 Years of Service	30 or More Years of Service
60 & Under	3.91	3.89	4.07
60 & Over	14.98	14.04	20.48
All Ages	8.35	7.77	13.49

Rate of Retirement (%)			
Safety Law Enforcement (3.0% @ 50 under §31664.1)			
Age	All Service	Less than 30 Years of Service	30 or More Years of Service
60 & Under	13.05	11.60	32.20
60 & Over	36.90	30.51	52.00
All Ages	14.19	12.29	35.66

Rate of Retirement (%)			
Safety Fire (3.0% @ 50 under §31664.1)			
Age	All Service	Less than 30 Years of Service	30 or More Years of Service
60 & Under	10.38	6.17	29.50
60 & Over	22.37	18.92	25.64
All Ages	11.45	6.88	28.65

Rate of Retirement (%)			
Safety Probation (3.0% @ 50 under §31664.1)			
Age	All Service	Less than 30 Years of Service	30 or More Years of Service
60 & Under	10.01	8.82	28.26
60 & Over	22.78	20.55	50.00
All Ages	11.23	9.92	30.77

Based on this observation, we recommend that retirement rates be structured as a function of both age and years of service for the legacy tiers that have been adopted for a longer period of time for which we have enough data to support proposing rates based on both age and service. The new structure of retirement assumptions for these tiers will apply different sets of age-based retirement assumptions for those with less than 30 years of service and for those with more than 30 years of service. For General San Juan Capistrano or SJC (2.0% @ 57 under §31676.12), Safety Law Enforcement (3.0% @ 55 under §31664.2), and Safety Fire (3.0% @ 55 under §31664.2), as well as the CalPEPRA Tiers, we continue to recommend that retirement rates be structured as a function of only age until more data on actual retirement experience is available to review the retirement rates based on both age and service.

The table on the following page shows the observed service retirement rates for General Enhanced members 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 assumed rates and the rates we propose.

General Enhanced

	Rate of Retirement (%)				
	All Service	Less than 30 Years of Service		30 or More Years of Service	
Age	Current Rate	Actual Rate	Proposed Rate	Actual Rate	Proposed Rate
49[30]	30.00	N/A	0.00	0.00	30.00
50	2.50	2.97	2.00	7.14	4.00
51	2.00	1.82	2.00	3.23	4.00
52	2.50	2.79	2.50	3.64	5.00
53	2.50	2.48	2.50	10.11	5.00
54	5.50	7.51	7.00	16.81	14.00
55	15.00	11.72	12.00	41.77	30.00
56	10.00	9.05	9.00	24.58	19.00
57	10.00	7.77	9.00	30.51	18.00
58	11.00	8.88	9.00	24.04	18.00
59	11.00	10.97	10.00	20.78	20.00
60	12.00	11.54	11.00	29.27	20.00
61	12.00	9.54	11.00	23.29	20.00
62	14.00	13.87	13.00	24.00	20.00
63	16.00	12.82	13.00	28.79	22.00
64	16.00	16.20	16.00	18.37	24.00
65	22.00	24.92	24.00	38.64	28.00
66	22.00	24.35	24.00	40.48	30.00
67	23.00	24.06	24.00	29.63	30.00
68	23.00	21.84	22.00	22.22	27.50
69	23.00	19.86	22.00	23.53	27.50
70	25.00	27.27	25.00	11.76	27.50
71	25.00	24.44	25.00	54.55	27.50
72	25.00	28.77	25.00	22.22	27.50
73	25.00	13.21	20.00	37.50	27.50
74	25.00	18.00	20.00	33.33	27.50
75 & Over	100.00	24.09	100.00	22.22	100.00

As shown above, we are recommending decreases in some of the retirement rates for General Enhanced members with less than 30 years of service and recommending increases in most of the retirement rates for General Enhanced members with 30 or more years of service.

Chart 3 that follows later in this section compares actual experience with the current and proposed rates of retirement for General Enhanced members with less than 30 years of service.

Chart 4 compares actual experience with the current and proposed rates of retirement for General Enhanced members with 30 or more years of service.

[30] These rates are applicable to General members with 30 or more years of service.

The following table shows the observed retirement rates for General Non-Enhanced members over the past three years. Also shown are the current rates assumed and the rates we propose:

General Non-Enhanced

	Rate of Retirement (%)				
	All Service	Less than 30 Years of Service		30 or More Years of Service	
Age	Current Rate	Actual Rate	Proposed Rate	Actual Rate	Proposed Rate
49[31]	25.00	N/A	0.00	N/A	25.00
50	2.00	3.73	3.00	N/A	3.00
51	2.00	3.31	3.00	0.00	3.00
52	2.00	0.68	2.00	0.00	2.00
53	2.75	5.44	3.50	0.00	3.50
54	2.75	1.30	2.75	0.00	2.75
55	3.25	4.38	3.25	0.00	3.25
56	3.50	2.82	3.50	5.56	3.50
57	5.50	4.19	5.00	4.35	5.00
58	5.50	5.59	5.50	9.09	5.50
59	6.50	7.80	6.50	4.17	6.50
60	9.25	10.60	9.00	13.33	13.50
61	12.00	7.52	9.00	15.15	13.50
62	16.00	7.69	9.00	24.14	18.00
63	16.00	7.00	9.50	15.79	19.00
64	18.00	9.28	10.00	25.00	20.00
65	22.00	21.13	22.00	38.46	26.40
66	28.00	25.00	25.00	30.00	30.00
67	24.00	18.00	25.00	40.00	30.00
68	24.00	35.29	30.00	0.00	27.50
69	20.00	40.00	30.00	0.00	27.50
70	20.00	26.67	20.00	0.00	27.50
71	25.00	9.52	20.00	0.00	27.50
72	25.00	4.35	20.00	N/A	27.50
73	25.00	30.77	20.00	N/A	27.50
74	25.00	18.18	20.00	0.00	27.50
75 & Over	100.00	26.67	100.00	N/A	100.00

As shown above, we are recommending decreases in some of the retirement rates for General Non-Enhanced members with less than 30 years of service and recommending increases in most of the retirement rates for General Non-Enhanced members with 30 or more years of service.

[31] These rates are applicable to General members with 30 or more years of service.

Chart 5 that follows later in this section compares actual experience with the current and proposed rates of retirement for General Non-Enhanced members with less than 30 years of service.

Chart 6 compares actual experience with the current and proposed rates of retirement for General Non-Enhanced members with 30 or more years of service.

The following table shows the observed retirement rates for Safety Law Enforcement (3.0% @ 50 under §31664.1) members over the past three years. Also shown are the current rates assumed and the rates we propose:

Safety Law Enforcement (3.0% @ 50 under §31664.1)

	Rate of Retirement (%)				
	All Service	Less than 30 Years of Service		30 or More Years of Service	
Age[32]	Current Rate[33]	Actual Rate	Proposed Rate	Actual Rate	Proposed Rate
45	0.00	1.27	1.00	N/A	16.00
46	0.00	0.91	1.00	N/A	16.00
47	0.00	2.38	1.00	N/A	16.00
48	0.00	0.00	1.00	N/A	16.00
49	12.00	10.53	11.00	N/A	16.00
50	18.00	16.00	16.00	20.00	16.00
51	18.00	14.65	16.00	16.67	16.00
52	17.00	17.29	17.00	9.09	16.00
53	17.00	19.59	19.00	37.50	30.00
54	22.00	25.88	24.00	40.00	30.00
55	22.00	23.08	24.00	29.41	30.00
56	20.00	22.50	22.00	41.18	30.00
57	20.00	23.53	22.00	20.00	30.00
58	20.00	23.81	22.00	50.00	40.00
59	26.00	20.00	22.00	50.00	40.00
60	35.00	30.77	30.00	25.00	40.00
61	35.00	38.46	30.00	50.00	40.00
62	40.00	10.00	30.00	50.00	40.00
63	40.00	33.33	30.00	60.00	40.00
64	40.00	20.00	30.00	60.00	40.00
65 & Over	100.00	41.67	100.00	66.67	100.00

As shown above, we are recommending changes (both decreases and increases) in most of the retirement rates for Safety Law Enforcement (3.0% @ 50 under §31664.1) members with less than 30 years of service and recommending increases in most of the retirement

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[32] For retirement ages below 50, the rates are applicable to Safety members with 20 or more years of service.

[33] Retirement rate is currently assumed at 100% after a Safety Law Enforcement member accrues a benefit of 100% of final average earnings.

rates for Safety Law Enforcement (3.0% @ 50 under §31664.1) members with 30 or more years of service.

Retirement rate is currently assumed at 100% after a Safety Law Enforcement member accrues a benefit of 100% of final average earnings. However, we are recommending removing this assumption under the new retirement assumption structure as a function of both age and years of service.

Chart 7 that follows later in this section compares actual experience with the current and proposed rates of retirement for Safety Law Enforcement (3.0% @ 50 under §31664.1) members with less than 30 years of service.

Chart 8 compares actual experience with the current and proposed rates of retirement for Safety Law Enforcement (3.0% @ 50 under §31664.1) members with 30 or more years of service.

The following table shows the observed retirement rates for Safety Fire (3.0% @ 50 under §31664.1) members over the past three years. Also shown are the current rates assumed and the rates we propose:

Safety Fire (3.0% @ 50 under §31664.1)

	Rate of Retirement (%)				
	All Service	Less than 30 Years of Service		30 or More Years of Service	
Age[34]	Current Rate	Actual Rate	Proposed Rate	Actual Rate	Proposed Rate
45	0.00	0.00	2.00	N/A	10.00
46	0.00	0.00	2.00	N/A	10.00
47	0.00	0.00	2.00	N/A	10.00
48	0.00	0.00	2.00	N/A	10.00
49	2.00	6.82	2.00	0.00	10.00
50	5.00	5.88	4.00	0.00	10.00
51	7.00	2.82	4.00	14.29	10.00
52	9.50	1.54	4.00	8.33	10.00
53	10.50	8.93	9.00	22.73	20.00
54	15.00	11.76	12.00	28.57	25.00
55	18.00	12.12	12.00	26.32	25.00
56	20.00	11.76	12.00	28.57	25.00
57	21.00	21.21	18.00	50.00	25.00
58	28.00	4.76	18.00	40.00	30.00
59	28.00	16.67	18.00	50.00	30.00
60	30.00	27.27	18.00	14.29	30.00
61	30.00	11.11	18.00	33.33	30.00
62	35.00	20.00	18.00	33.33	35.00
63	35.00	0.00	18.00	20.00	35.00
64	35.00	0.00	18.00	33.33	35.00
65 & Over	100.00	22.22	100.00	22.22	100.00

As shown above, we are recommending decreases in most of the retirement rates for Safety Fire (3.0% @ 50 under §31664.1) members with less than 30 years of service and recommending increases in most of the retirement rates for Safety Fire (3.0% @ 50 under §31664.1) members with 30 or more years of service.

Chart 9 that follows later in this section compares actual experience with the current and proposed rates of retirement for Safety Fire (3.0% @ 50 under §31664.1) members with less than 30 years of service.

Chart 10 compares actual experience with the current and proposed rates of retirement for Safety Fire (3.0% @ 50 under §31664.1) members with 30 or more years of service.

The following table shows the observed retirement rates for Safety Probation (3.0% @ 50 under §31664.1) members over the past three years. Also shown are the current rates assumed and the rates we propose:

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[34] For retirement ages below 50, the rates are applicable to Safety members with 20 or more years of service.

Safety Probation (3.0% @ 50 under §31664.1)

	Rate of Retirement (%)				
	All Service	Less than 30 Years of Service		30 or More Years of Service	
Age[35]	Current Rate[36]	Actual Rate	Proposed Rate	Actual Rate	Proposed Rate
45	0.00	0.00	3.00	N/A	5.00
46	0.00	3.64	3.00	N/A	5.00
47	0.00	5.56	3.00	N/A	5.00
48	0.00	5.56	3.00	N/A	5.00
49	0.00	3.64	3.00	N/A	5.00
50	3.25	18.68	9.00	N/A	12.00
51	3.25	5.63	7.00	N/A	10.00
52	4.25	5.26	5.00	0.00	9.00
53	4.25	11.36	7.00	0.00	9.00
54	7.00	5.56	7.00	25.00	12.00
55	12.00	9.09	12.00	57.14	30.00
56	12.00	19.23	18.00	57.14	30.00
57	18.00	31.58	25.00	0.00	30.00
58	18.00	20.00	25.00	42.86	30.00
59	18.00	16.67	18.00	0.00	30.00
60	20.00	21.43	20.00	0.00	40.00
61	20.00	15.38	20.00	50.00	40.00
62	25.00	15.38	20.00	100.00	40.00
63	40.00	20.00	20.00	N/A	40.00
64	40.00	16.67	20.00	100.00	40.00
65 & Over	100.00	29.41	100.00	N/A	100.00

As shown above, we are recommending increases in most of retirement rates for Safety Probation (3.0% @ 50 under §31664.1) members with less than 30 years of service and recommending increases in all of the retirement rates for Safety Probation (3.0% @ 50 under §31664.1) members with 30 or more years of service.

Retirement rate is currently assumed at 100% after a Safety Probation member accrues a benefit of 100% of final average earnings. However, we are recommending removing this assumption under the new retirement assumption structure as a function of both age and years of service.

Chart 11 compares actual experience with the current and proposed rates of retirement for Safety Probation (3.0% @ 50 under §31664.1) members with less than 30 years of service.

Chart 12 compares actual experience with the current and proposed rates of retirement for Safety Probation (3.0% @ 50 under §31664.1) members with 30 or more years of service.

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[35] For retirement ages below 50, the rates are applicable to Safety members with 20 or more years of service.
[36] Retirement rate is currently assumed at 100% after a Safety Probation member accrues a benefit of 100% of final average earnings.

For General SJC under (2.0% @ 57 under §31676.12), Safety Law Enforcement (3.0% @ 55 under §31664.2) and Safety Fire (3.0% @ 55 under §31664.2), we do not have credible experience from the past three years to propose new rates based on actual retirement from members of these newer plans. However, we are recommending revising some of the rates currently used for those plans to commensurate with the overall changes to the retirement rates that we observed and are recommending from the other older plans.

The following are the current and proposed rates of retirement for General SJC (31676.12), Safety Law Enforcement (31664.2), and Safety Fire (31664.2) members:

	Rate of Retirement (%)					
	General SJC (31676.12)		Safety Law Enforcement (31664.2)		Safety Fire (31664.2)	
Age	Current Rate	Proposed Rate	Current Rate[37]	Proposed Rate	Current Rate	Proposed Rate
50	3.00	4.00	11.50	11.50	8.00	8.00
51	3.00	4.00	12.00	12.00	10.00	9.00
52	3.00	4.00	12.70	12.70	11.00	10.00
53	3.00	4.00	17.90	17.90	12.00	12.00
54	3.00	4.00	18.80	18.80	14.00	14.00
55	4.00	4.00	30.70	35.00	24.00	23.00
56	5.00	5.00	20.00	25.00	23.00	22.00
57	6.00	6.00	20.00	25.00	27.00	25.00
58	7.00	7.00	25.00	25.00	27.00	25.00
59	9.00	9.00	30.00	30.00	36.00	35.00
60	11.00	10.00	40.00	40.00	40.00	40.00
61	13.00	12.00	40.00	40.00	40.00	40.00
62	15.00	13.00	40.00	40.00	40.00	40.00
63	15.00	13.00	40.00	40.00	40.00	40.00
64	20.00	19.00	40.00	40.00	40.00	40.00
65	20.00	20.00	100.00	100.00	100.00	100.00
66	24.00	25.00	100.00	100.00	100.00	100.00
67	24.00	25.00	100.00	100.00	100.00	100.00
68	24.00	25.00	100.00	100.00	100.00	100.00
69	24.00	25.00	100.00	100.00	100.00	100.00
70	50.00	45.00	100.00	100.00	100.00	100.00
71	50.00	45.00	100.00	100.00	100.00	100.00
72	50.00	45.00	100.00	100.00	100.00	100.00
73	50.00	45.00	100.00	100.00	100.00	100.00
74	50.00	45.00	100.00	100.00	100.00	100.00
75 & Over	100.00	100.00	100.00	100.00	100.00	100.00

[37] Retirement rate is currently assumed at 100% after a Safety Law Enforcement member accrues a benefit of 100% of final average earnings.

Retirement rate is currently assumed at 100% after a Safety Law Enforcement member accrues a benefit of 100% of final average earnings. Similar to what we proposed for the Safety Law Enforcement (3.0% @ 50 under §31664.1) members, we are recommending removing this assumption for the Safety Law Enforcement (3.0% @ 55 under §31664.2) members.

Chart 13 compares the current rates with the proposed rates of retirement for General SJC under (2.0% @ 57 under §31676.12).

Chart 14 compares the current rates with the proposed rates of retirement for Safety Law Enforcement (3.0% @ 55 under §31664.2).

Chart 15 compares the current rates with the proposed rates of retirement for Safety Fire (3.0% @ 55 under §31664.2).

On January 1, 2013, new CalPEPRA formulas were implemented for new General and Safety tiers. For these new formulas, we do not have credible experience from the past three years to propose new rates based on actual retirement from members of the newer plans. However, we have revised some of our recommended rates for CalPEPRA General and Safety formulas so that those rates will remain comparable to the proposed retirement rates we are recommending for the non-CalPEPRA General and Safety formulas.

	Rate of Retirement (%)							
	CalPEPRA – General		CalPEPRA – Safety Probation		CalPEPRA – Safety Law Enforcement		CalPEPRA – Safety Fire	
Age	Current Rate	Proposed Rate	Current Rate[38]	Proposed Rate	Current Rate[38]	Proposed Rate	Current Rate	Proposed Rate
50	0.00	0.00	2.50	3.00	11.00	11.00	6.00	6.00
51	0.00	0.00	2.50	3.00	11.50	11.50	7.00	6.50
52	4.00	6.00	3.00	3.50	12.00	12.00	9.00	8.00
53	1.50	2.00	3.00	3.50	16.00	16.00	10.00	10.00
54	1.50	2.00	5.50	6.00	17.00	17.00	11.50	11.50
55	2.50	2.50	10.00	12.00	28.00	29.00	21.00	20.00
56	3.50	3.50	10.00	12.00	18.00	19.00	20.00	19.00
57	5.50	5.50	15.00	15.00	17.50	19.00	22.00	21.00
58	7.50	7.50	20.00	25.00	22.00	23.00	25.00	24.00
59	7.50	7.50	20.00	25.00	26.00	26.00	30.00	30.00
60	7.50	7.50	40.00	40.00	40.00	40.00	40.00	40.00
61	7.50	7.50	40.00	40.00	40.00	40.00	40.00	40.00
62	14.00	14.00	40.00	40.00	40.00	40.00	40.00	40.00
63	14.00	14.00	40.00	40.00	40.00	40.00	40.00	40.00
64	14.00	14.00	40.00	40.00	40.00	40.00	40.00	40.00
65	18.00	20.00	100.00	100.00	100.00	100.00	100.00	100.00
66	22.00	22.00	100.00	100.00	100.00	100.00	100.00	100.00
67	23.00	23.00	100.00	100.00	100.00	100.00	100.00	100.00
68	23.00	23.00	100.00	100.00	100.00	100.00	100.00	100.00
69	23.00	23.00	100.00	100.00	100.00	100.00	100.00	100.00
70	25.00	25.00	100.00	100.00	100.00	100.00	100.00	100.00
71	25.00	25.00	100.00	100.00	100.00	100.00	100.00	100.00
72	25.00	25.00	100.00	100.00	100.00	100.00	100.00	100.00
73	25.00	25.00	100.00	100.00	100.00	100.00	100.00	100.00
74	25.00	25.00	100.00	100.00	100.00	100.00	100.00	100.00
75 & Over	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Retirement rate is currently assumed at 100% after a CalPEPRA Safety Probation member or a CalPEPRA Safety Law Enforcement member accrues a benefit of 100% of final average earnings. Similar to what we proposed for the Non-CalPEPRA Safety Probation and Non-CalPEPRA Safety Law Enforcement members, we are recommending removing this assumption for the CalPEPRA Safety Probation members and CalPEPRA Safety Law Enforcement members.

Chart 16 compares the current rates with the proposed rates of retirement for CalPEPRA General members.

[38] Retirement rate is currently assumed at 100% after a Safety Probation or Safety Law Enforcement member accrues a benefit of 100% of final average earnings.

Chart 17 compares the current rates with the proposed rates of retirement for CalPEPRA Safety Probation members.

Chart 18 compares the current rates with the proposed rates of retirement for CalPEPRA Safety Law Enforcement members.

Chart 19 compares the current rates with the proposed rates of retirement for CalPEPRA Safety Fire members.

Deferred Vested Members

In prior valuations, deferred vested General and Safety members were assumed to retire at age 59 and 53, respectively. The average age at retirement over the current three years period in this experience study was 59.5 for General and 54.4 for Safety. **We recommend maintaining the current assumption for General members at age 59 and increasing the current assumption for Safety members from age 53 to age 54.**

For members who terminate with less than five years of service after January 1, 2003 and are not vested, we assume they would retire at age 70 for both General and Safety if they decide to leave their contributions on deposit as permitted by §31629.5.

Reciprocity

Under the current assumptions, it is was assumed that 15% of General and 25% of Safety future deferred vested members would be covered under a reciprocal retirement system. For those covered under a reciprocal retirement system, a General member is assumed to receive 4.25% annual salary increases, while a Safety member is assumed to receive 4.75% annual salary increases from termination until their date of retirement. As of December 31, 2019, about 12.4% of the total General deferred vested members and 20.2% of the total Safety deferred vested members went on to be covered by a reciprocal retirement system.

We recommend maintaining the reciprocal assumption at 15% for General members and decreasing the assumption from 25% to 20% for Safety members. This recommendation takes into account the experience of all deferred vested members as of December 31, 2019 instead of just new deferred vested members during the three-year period. This is because there is usually a lag between a member's date of termination and the time that it is known if they have reciprocity with a reciprocal retirement system.

In addition, we recommend 4.00% and 4.60% annual salary increase assumptions for General and Safety members, respectively, be utilized to anticipate salary increases from the date of termination from OCERS to the expected date of retirement for deferred vested members covered by a reciprocal retirement system. These assumptions are based on the ultimate 1.00% and 1.60% merit and promotion salary increase assumptions for General and Safety members, respectively, together with the 2.50% inflation and 0.50% real "across the board" salary increase assumptions that are recommended earlier in Section III of this report.

Survivor Continuance under the Unmodified Option

In prior valuations, it was assumed that 75% of all active male members and 55% of all active female members who selected the unmodified option would be married or have an eligible domestic partner when they retired.

We reviewed experience for new retirees during the three-year period and determined the actual percentage of these new retirees that were married or had a domestic partner at retirement. The results of that analysis are shown below.

Year Ending December 31	New Retirees – Actual Percent with Eligible Spouse or Domestic Partner and Selected Unmodified Option	
	Male	Female
2017	76%	53%
2018	72%	51%
2019	71%	49%
Total	**73%**	**51%**

According to experience of members who retired during the last three years, about 73% of all male members and 51% of all female members who selected the unmodified option were married or had a domestic partner at retirement. We recommend maintaining the assumption at 75% for male members and 55% for female members.

Since the present value of the survivor's automatic continuance 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 most the survivors are actually of the opposite sex, even with the inclusion of domestic partners, **we will continue to assume that the survivor's sex is the opposite of the member.**

2. **We recommend maintaining the spouse age difference assumption that male retirees are three years older than their spouses and decreasing the spouse age difference assumption for female retirees from three years to two years younger than their spouses.** These assumptions will continue to be monitored in future experience studies.

	Spouse's Age as Compared to Member's Age	
	Male	Female
Current Assumption	3 years older	3 years younger
Actual OCERS Experience	2.6 years older	2.2 years younger
Proposed Assumption	3 years older	2 years younger

Chart 3: Retirement Rates
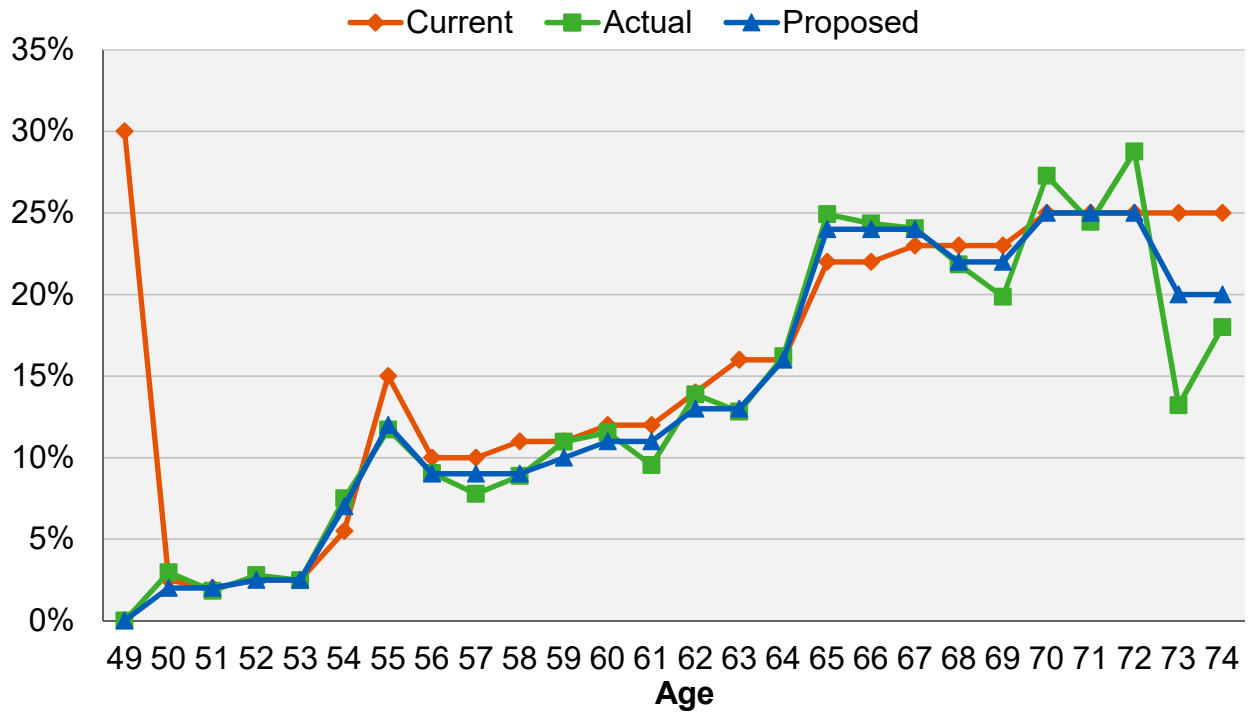## General Enhanced Members with Less than 30 Years of Service

Chart 4: Retirement Rates
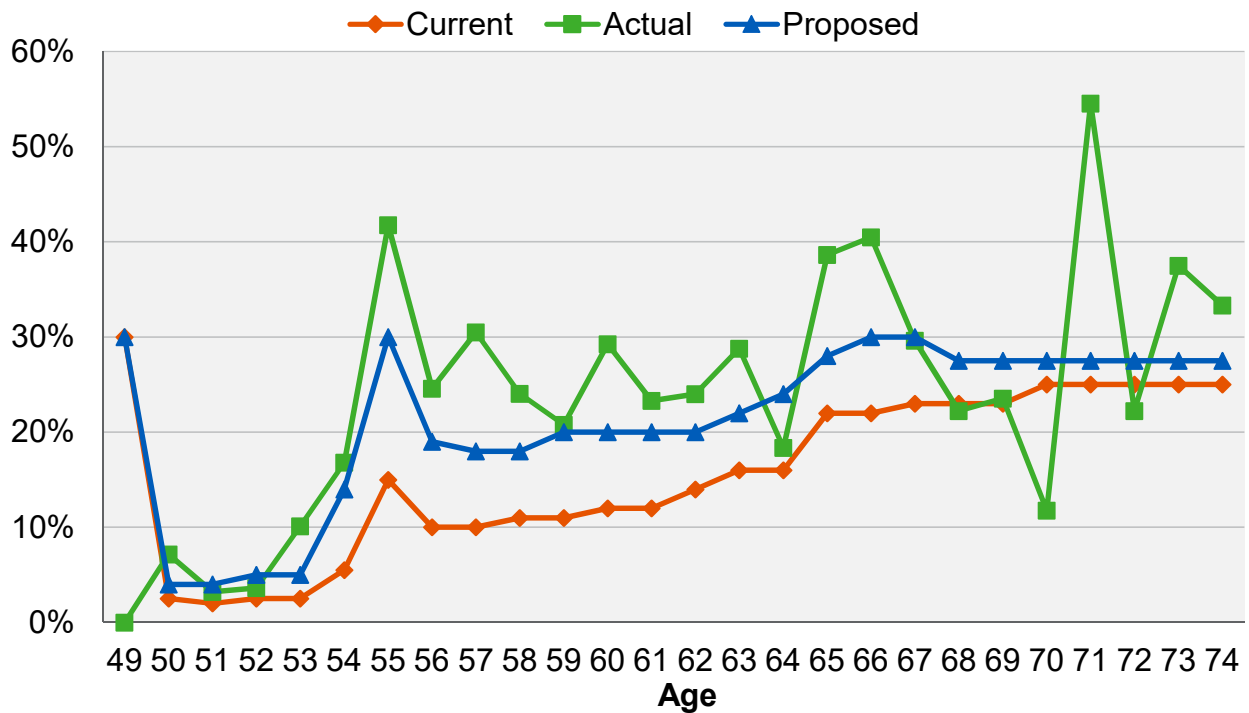## General Enhanced Members with More than 30 Years of Service

Chart 5: Retirement Rates
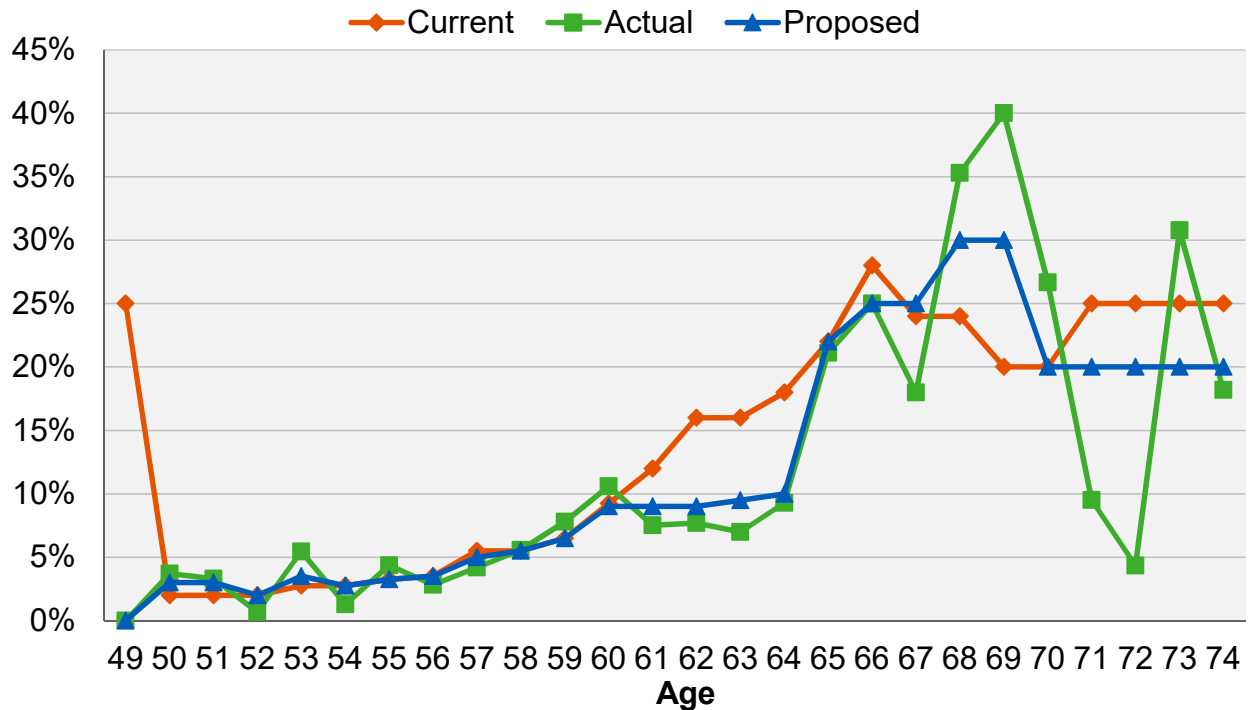## General Non-Enhanced Members with Less than 30 Years of Service

Chart 6: Retirement Rates
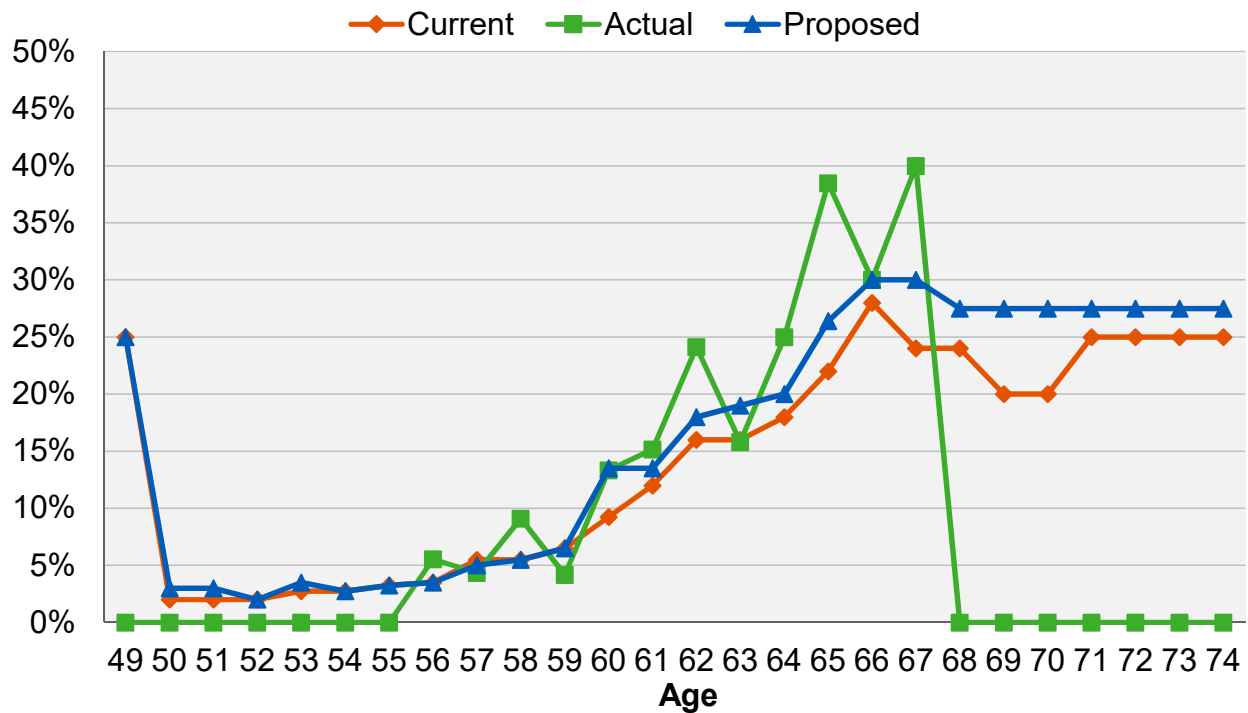## General Non-Enhanced Members with More than 30 Years of Service

Chart 7: Retirement Rates
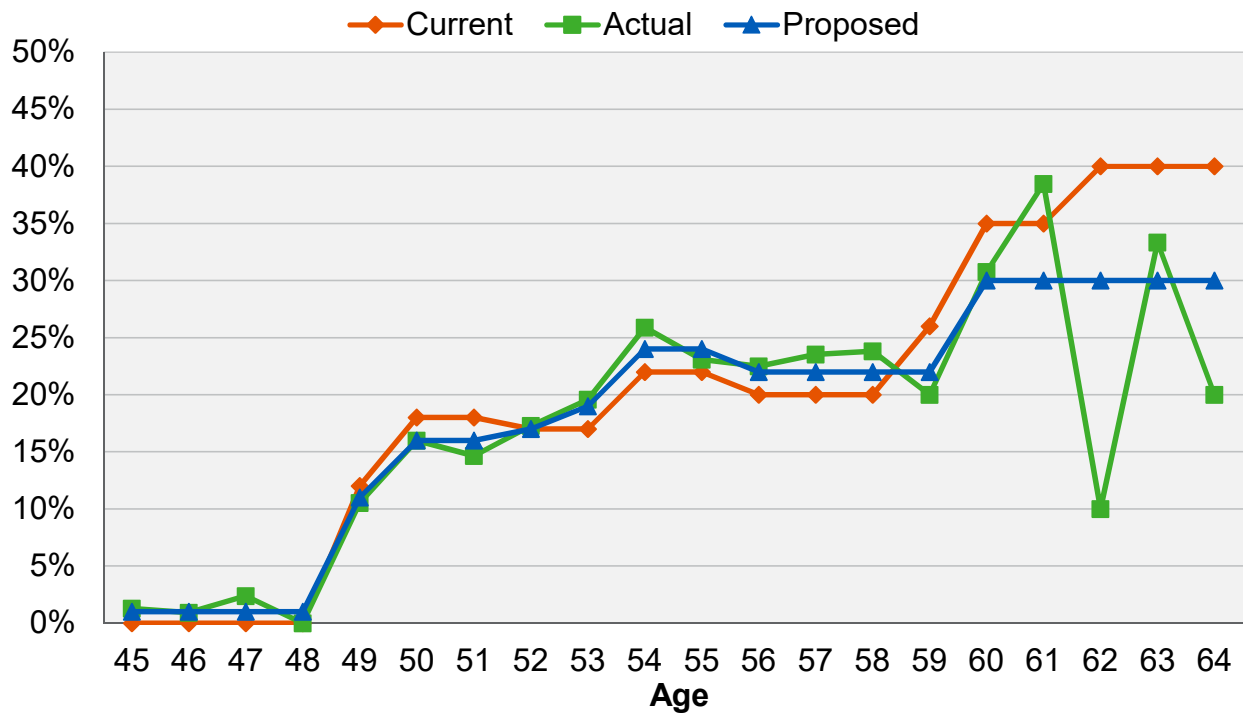## Safety Law Enforcement Members (31664.1) with Less than 30 Years of Service

Chart 8: Retirement Rates
Safety Law Enforcement Members (31664.1) with More than 30 Years of Service
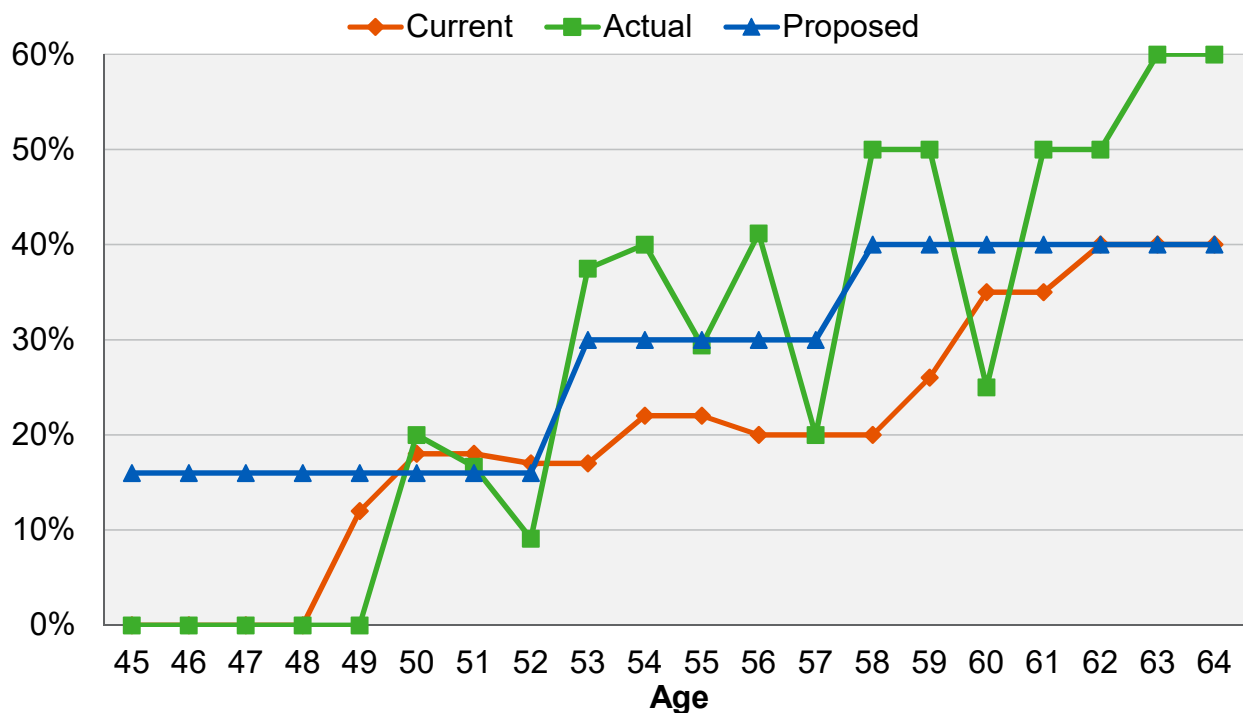
Chart 9: Retirement Rates
Safety Fire (3.0% @ 50 under §31664.1) with Less than 30 Years of Service

Chart 10: Retirement Rates
Safety Fire (3.0% @ 50 under §31664.1) with More than 30 Years of Service
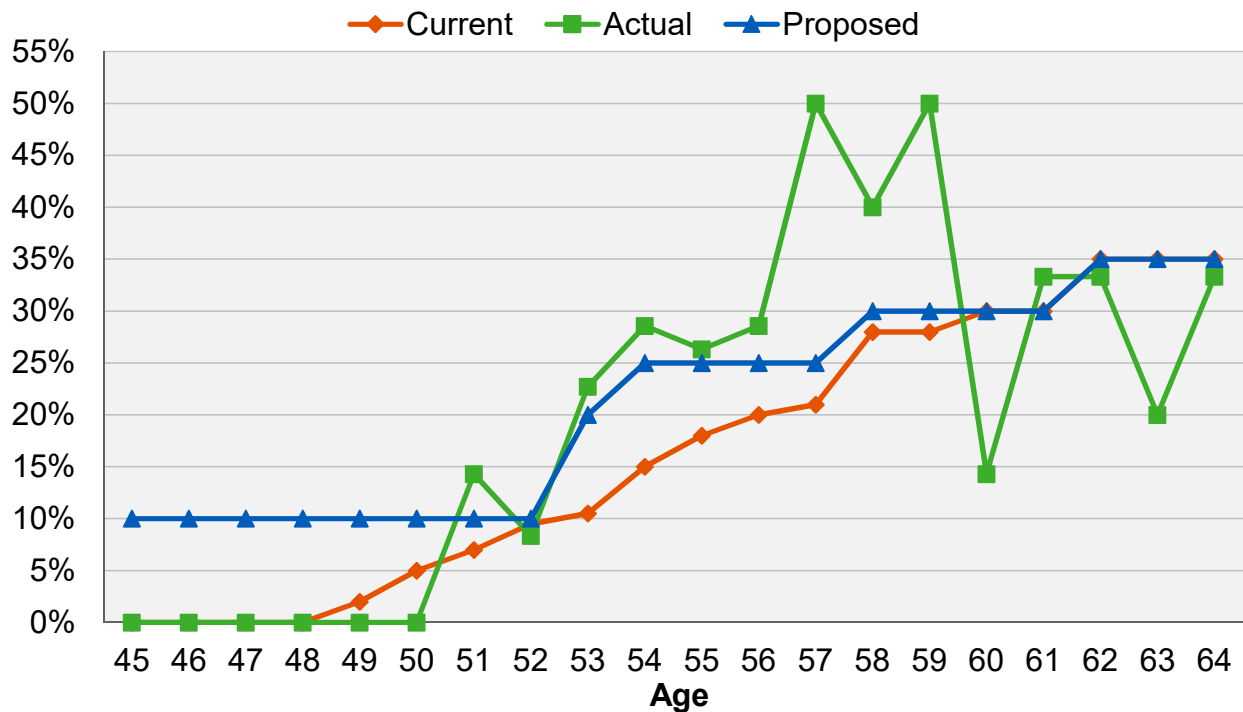
Chart 11: Retirement Rates
Safety Probation (3.0% @ 50 under §31664.1) with Less than 30 Years of Service

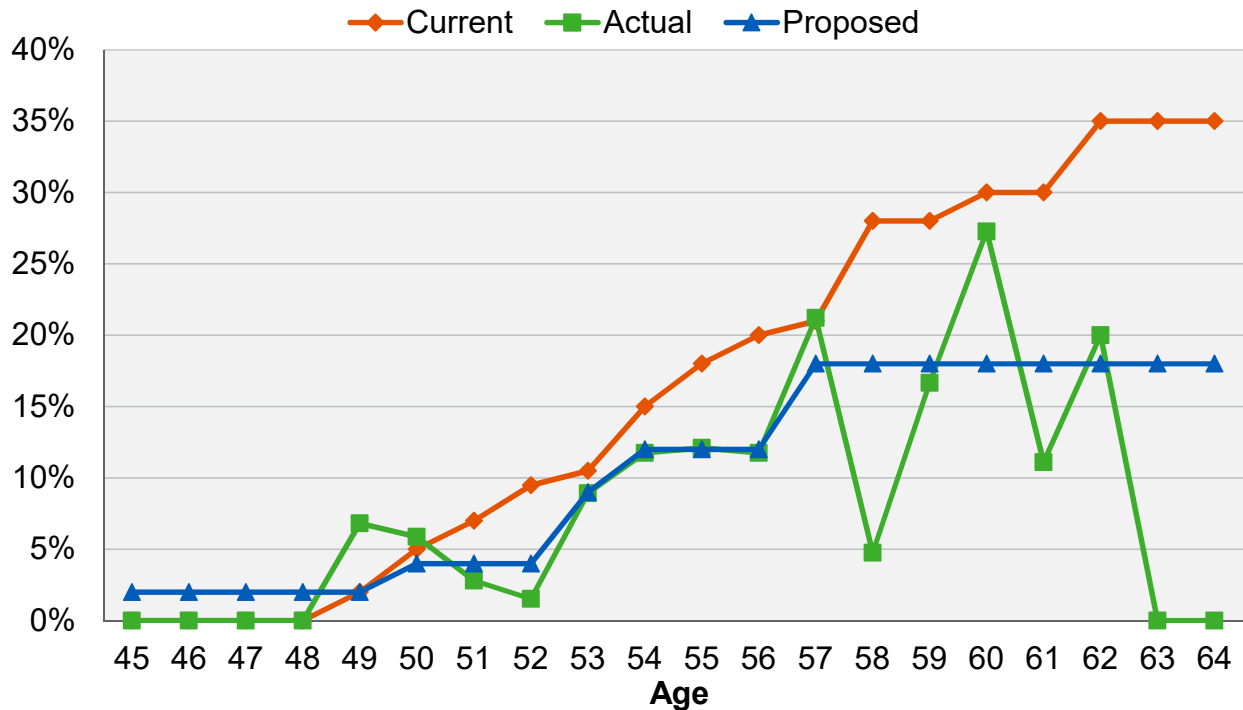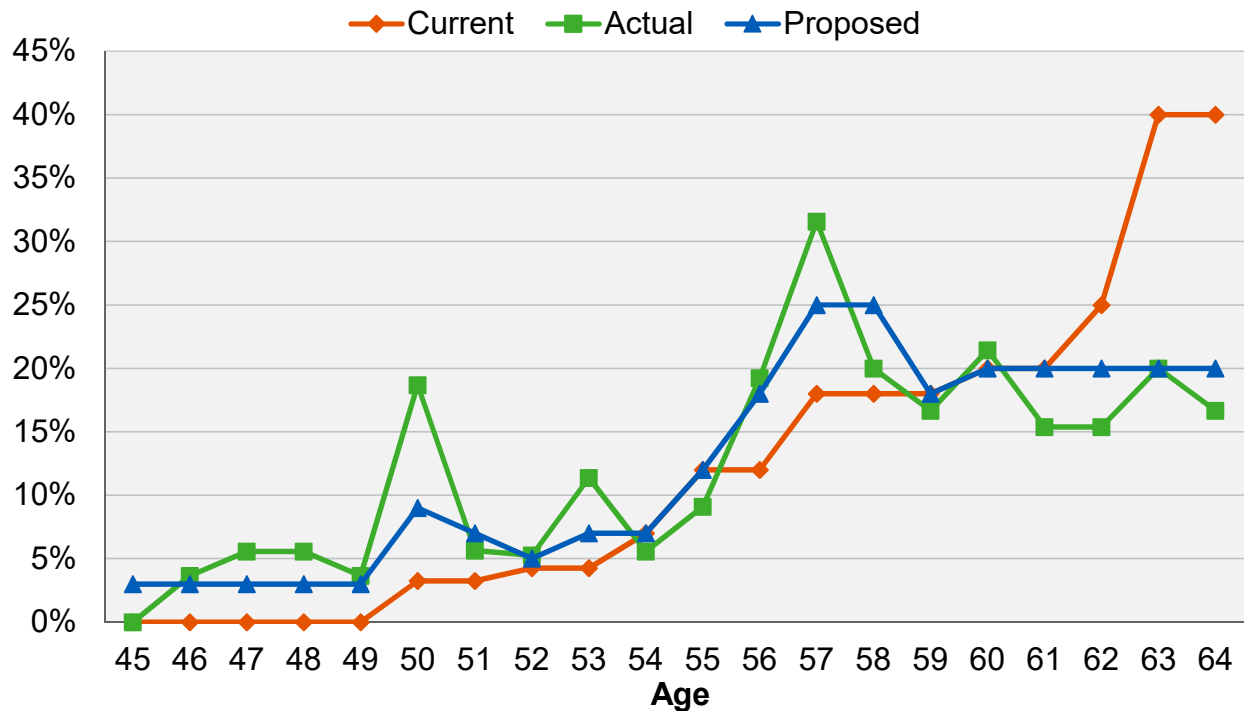# Chart 12: Retirement Rates
Safety Probation (3.0% @ 50 under §31664.1) with More than 30 Years of Service
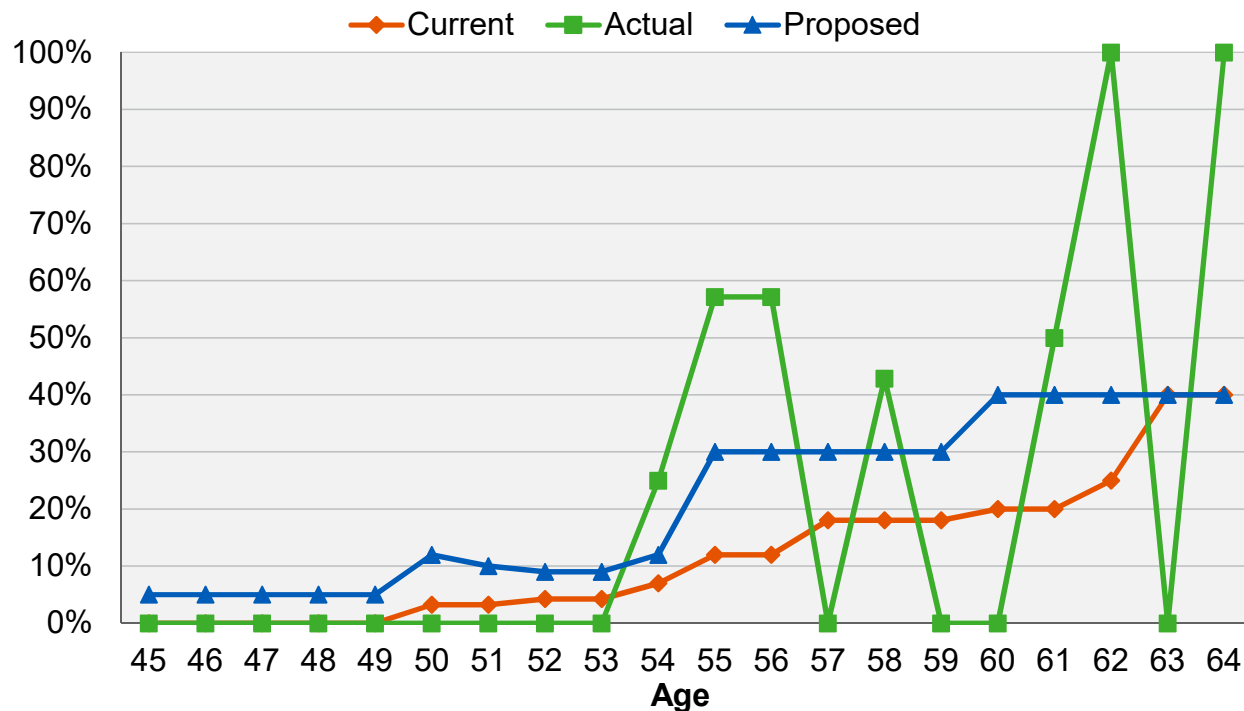
Chart 13: Retirement Rates
General SJC Members (31676.12)
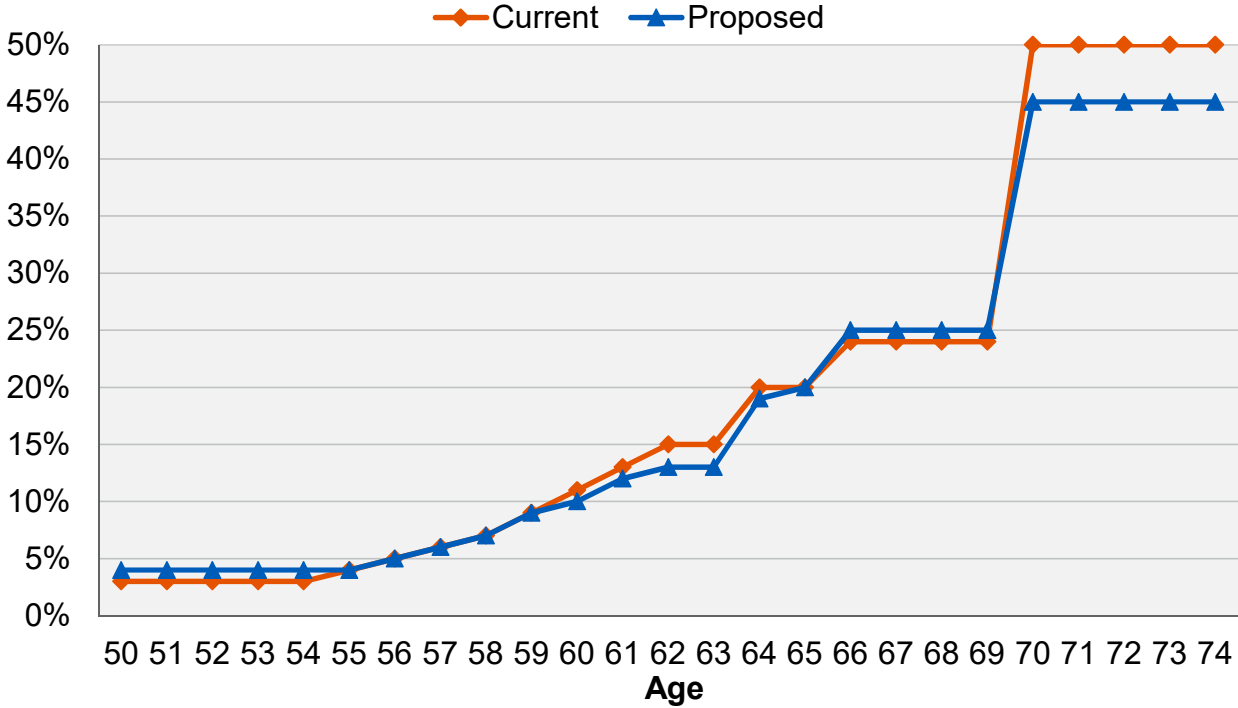
Chart 14: Retirement Rates
Safety Law Enforcement Members (31664.2)

Chart 15: Retirement Rates
Safety Fire Authority Members (31664.2)

Chart 16: Retirement Rates
CalPEPRA General Members

Chart 17: Retirement Rates
CalPEPRA Safety Probation Members

Chart 18: Retirement Rates
CalPEPRA Safety Law Enforcement Members

Chart 19: Retirement Rates
CalPEPRA Safety Fire Authority Members

B. 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 bef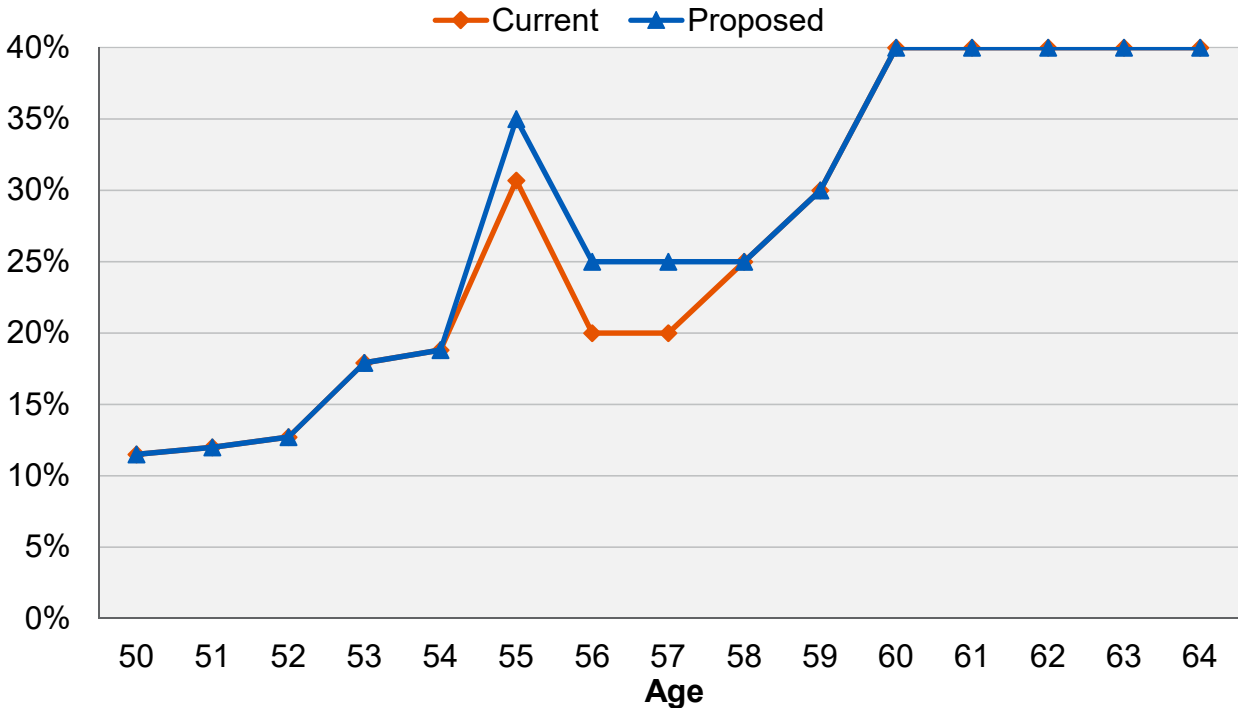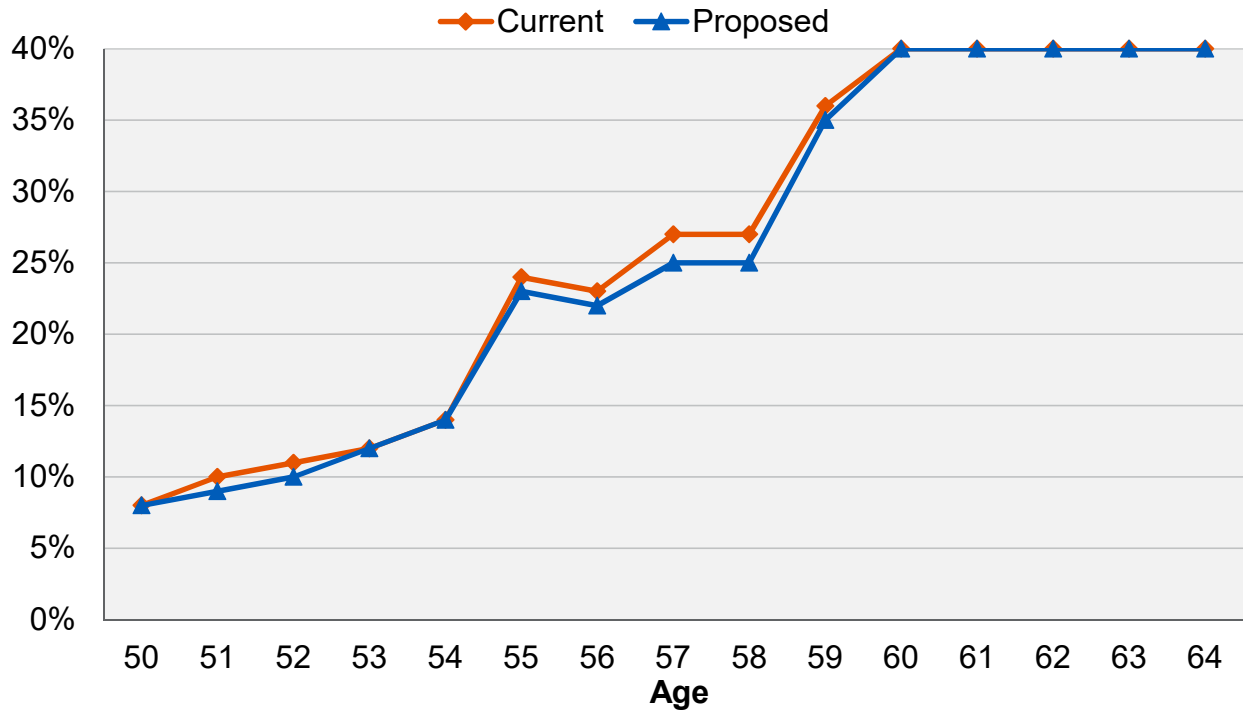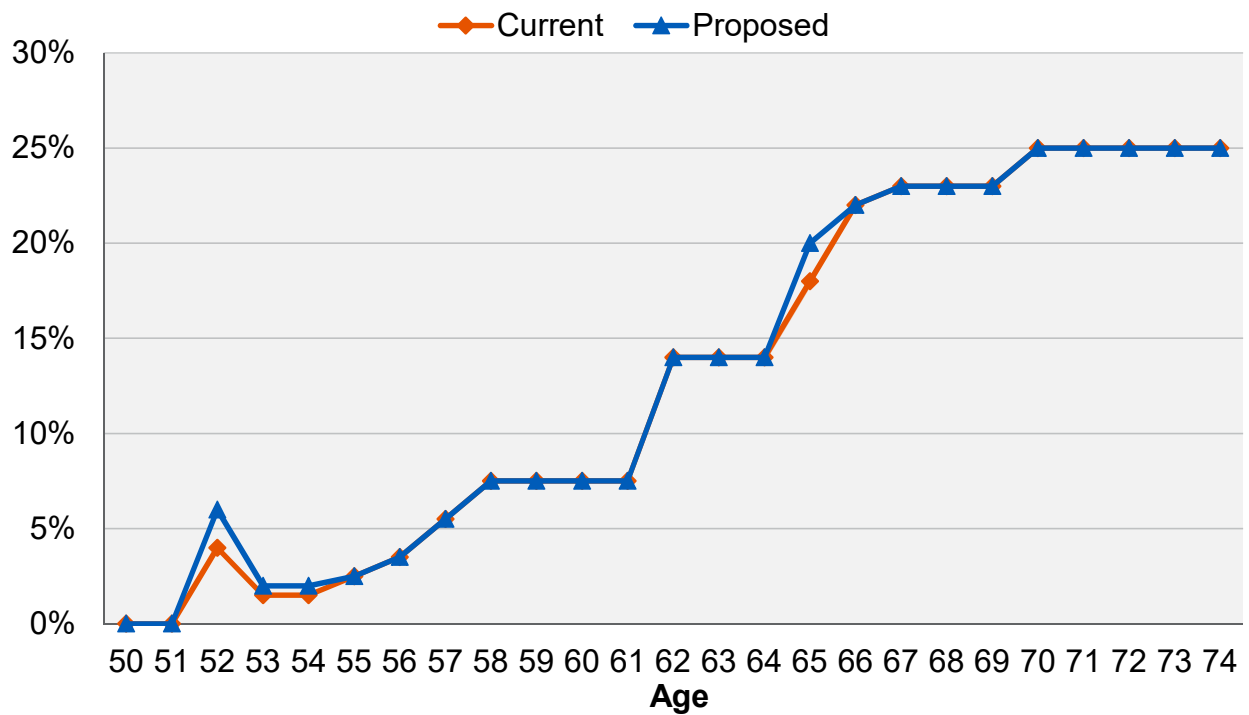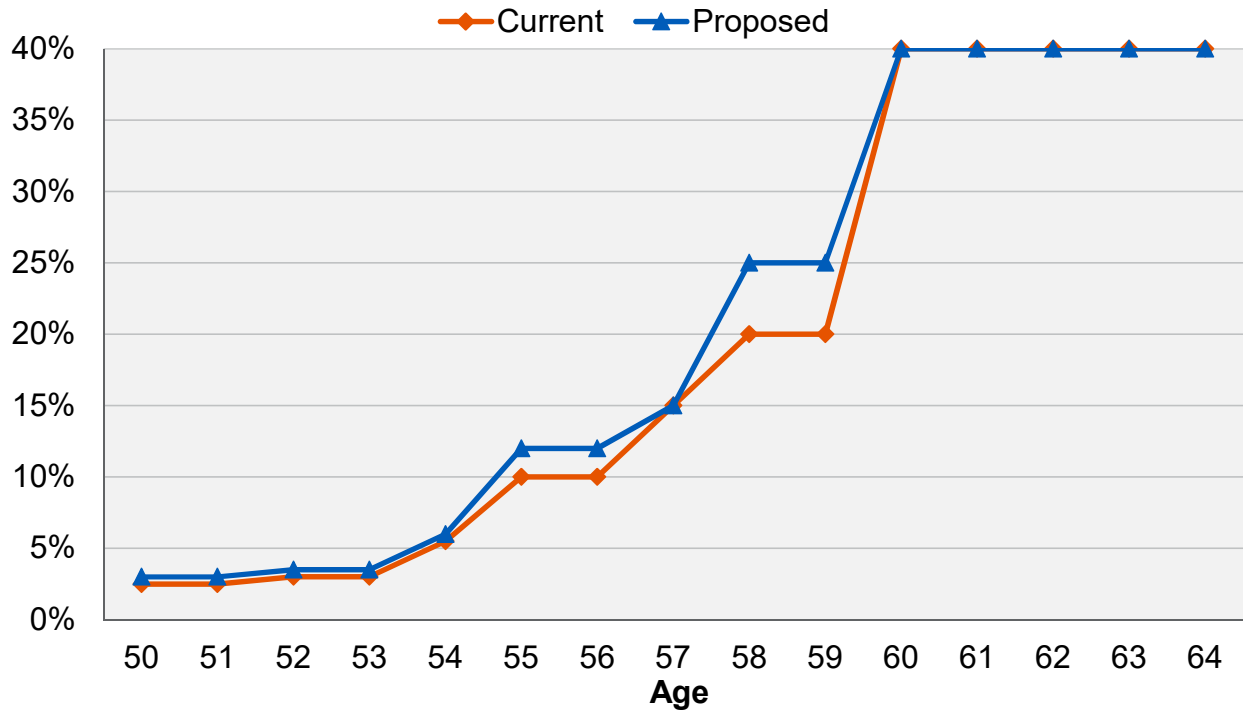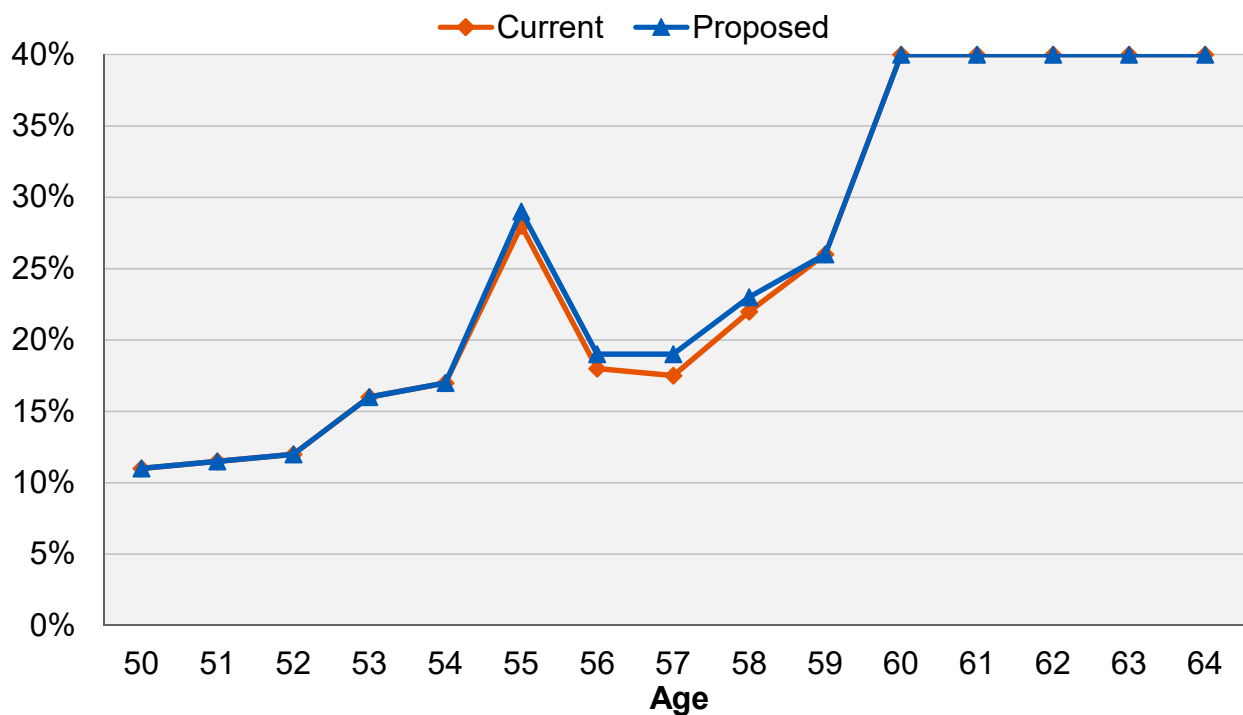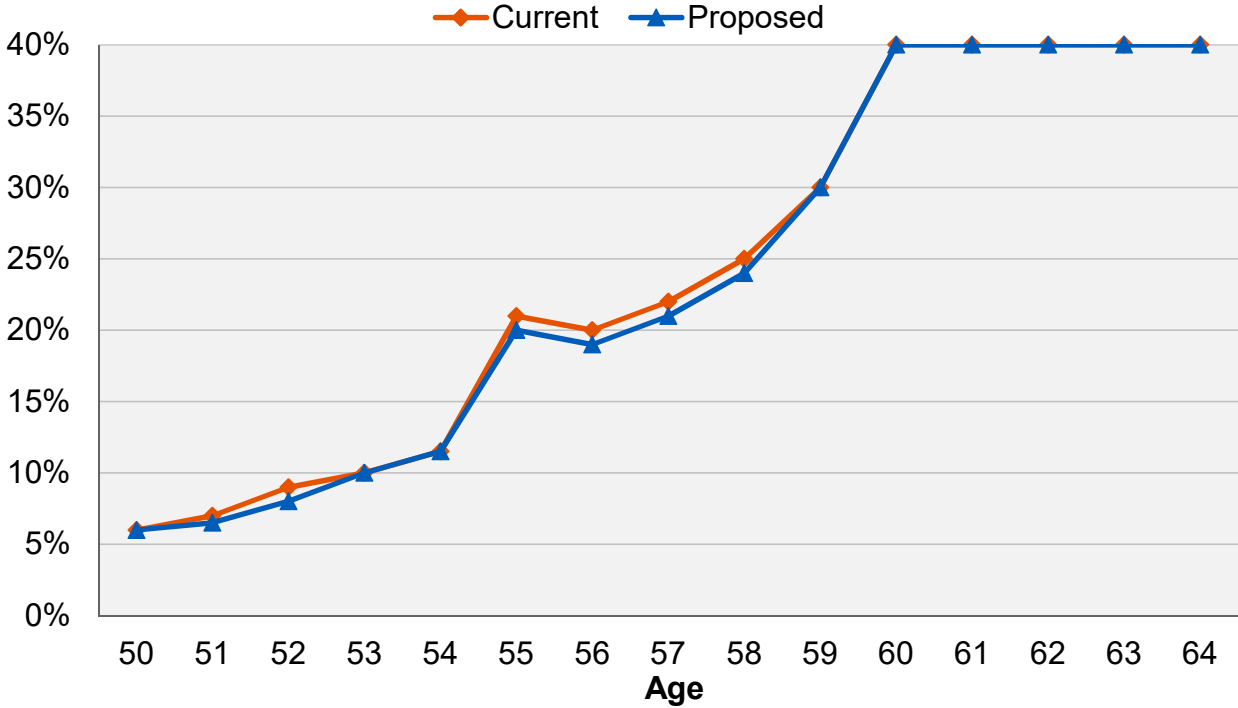ore retirement. For General members, the table currently being used for post-service retirement mortality rates is the Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table (separate tables for males and females) with no setback for males and females, projected generationally with the two-dimensional mortality improvement scale MP-2016. For Safety members, the table currently being used for post-service retirement mortality rates is the Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table (separate tables for males and females) with ages set back four years for males and females, projected generationally with the two-dimensional mortality improvement scale MP-2016. Beneficiaries are assumed to have the same mortality as a General Member of the opposite sex who is receiving a service (non-disability) retirement.

When we conducted the last experience study, we alerted the Board that we may recommend a switch from a Headcount-Weighted to a Benefit-Weighted table once the Society of Actuaries (SOA) provided mortality tables based on public sector experience comparable to the RP-2014 mortality tables developed using data collected from private and multi-employer pension plans.

The Retirement Plans Experience Committee (RPEC) of the SOA has published the Public Retirement Plans Mortality tables (Pub-2010). For the first time, the published 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 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 higher credibility assigned to experience from annuitants receiving larger 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 and Safety are as follows:

	Median Benefit Amounts ($) by Gender, Job Category, and Status			
	Males		Females	
Job Category	Employees	Retirees	Employees	Retirees
General	45,800	21,200	34,700	11,900
Safety	72,200	36,900	61,800	29,200

Note: Values shown as of 2010.

Even after we adjust the above amounts by a reasonable measure of U.S. price inflation from 2010 to 2019 for a total increase of around 30%, the benefit amounts (or salaries) paid to OCERS' members were generally greater than the adjusted median amounts shown above.

Therefore, we recommend that the above-median 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-2019 is the latest improvement scale available. We recommend that the Board adopt the Benefit-Weighted Above-Median Pub-2010 mortality table (adjusted for OCERS experience), and project the mortality improvement generationally using the MP-2019 mortality improvement scale.

In order to reflect more OCERS experience in our analysis, we have used experience for a nine-year period by using data from the current (from January 1, 2017 through December 31, 2019) and the last two (from January 1, 2014 to December 31, 2016 and from January 1, 2011 to December 31, 2013) experience study periods in order to analyze this assumption.

Even with the use of nine years of experience, based on standard statistical theory the data is only partially credible especially under the recommended benefit-weighted basis when dispersion of retirees' benefit amounts is taken into account particularly for the Safety cost groups. 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 fit OCERS' experience particularly for the Safety cost groups. In future experience studies, more data will be available which may further increase the credibility of the OCERS experience.

Pre-Retirement Mortality

For General and Safety members, the table currently being used for pre-retirement mortality rates is the Headcount-Weighted RP-2014 Employee Mortality Table (separate tables for males and females) times 80%, projected generationally with the two-dimensional scale MP-2016.

For General members, we recommend changing the pre-retirement mortality to follow the Pub-2010 General Employee Amount-Weighted Above-Median Mortality Table (separate tables for males and females), projected generationally with the two-dimensional mortality improvement scale MP-2019.

For Safety members, we recommend changing the pre-retirement mortality to follow the Pub-2010 Safety Employee Amount-Weighted Above-Median Mortality Table (separate tables for males and females), projected generationally with the two-dimensional mortality improvement scale MP-2019.

Currently, our assumption is that all General member pre-retirement deaths are non-service connected. For Safety, 90% of pre-retirement deaths are assumed to be non-service connected and the other 10% are assumed to be service connected. Based on actual experience during the last three years, we recommended maintaining the current assumption for both General and Safety members.[39]

Post-Retirement Mortality (Service Retirements)

Among all retired members, the actual deaths weighted by benefit amounts under the current assumptions for the last nine 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 OCERS, the volume of General member data makes it relatively credible. In contrast, there is much less Safety data, so it is given substantially less credibility. The proposed mortality tables (as shown in the table below) after adjustments for partial credibility have actual to expected ratios of 99% and 96% for General and Safety, respectively. In future years the ratio should remain around 99% and 96% for General and Safety, respectively, 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 nine years are as follows:

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[39] While it is possible that COVID-19 deaths for members in certain industries may be considered service connected, we do not recommend a change in our assumption to reflect this possible short-term increase in service connected deaths.

Gender	General Members – Healthy ($ in millions)			Safety Members – Healthy ($ in millions)		
	Current Expected Weighted Deaths	Actual Weighted Deaths	Proposed Expected Weighted Deaths	Current Expected Weighted Deaths	Actual Weighted Deaths	Proposed Expected Weighted Deaths
Male	47.47	39.46	40.43	12.21	10.87	10.85
Female	35.17	31.47	31.18	0.94	0.50	1.00
Total	**82.64**	**70.92**	**71.61**	**13.16**	**11.37**	**11.85**
Actual / Expected	86%		99%[40]	86%		96%

Notes: (1) Experience shown above is weighted by annual benefit amounts for deceased members instead of by headcounts.

(2) 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.

(3) Results may not add due to rounding.

For General members, we recommend updating the current table to the Pub-2010 General Healthy Retiree Amount-Weighted Above-Median Mortality Table (separate tables for males and females) with rates increased by 5%, projected generationally with the two-dimensional mortality improvement scale MP-2019. The recommended mortality table has an actual to expected ratio of 99%.[41]

For Safety members, we recommend updating the current table to the Pub-2010 Safety Healthy Retiree Amount-Weighted Above-Median Mortality Table (separate tables for males and females), projected generationally with the two-dimensional mortality improvement scale MP-2019. The recommended mortality table has an actual to expected ratio to 96%.

For informational purposes only, we have also provided in the table below the actual and expected deaths computed without weighting these by benefit amounts. This is similar to how actual and expected death ratios were developed based on the prior headcount approach.

[40] If we use the benchmark Pub-2010 General table without any adjustment, the proposed actual to expected ratio would be 104%.
[41] If we use the benchmark Pub-2010 General table without any adjustment, the proposed actual to expected ratio would be 104%.

Gender	General Members – Healthy			Safety Members – Healthy		
	Current Expected Weighted Deaths	Actual Weighted Deaths	Proposed Expected Weighted Deaths	Current Expected Weighted Deaths	Actual Weighted Deaths	Proposed Expected Weighted Deaths
Male	1,132	1,067	984	161	156	150
Female	1,240	1,207	1,137	15	10	16
Total	2,373	2,274	2,120	176	166	166
Actual / Expected	96%		107%	94%		100%

Notes: (1) Experience shown above is weighted by headcounts for deceased members instead of by annual benefit amounts.
(2) The proposed expected deaths are based on the Pub-2010 Amount-Weighted Above-Median Mortality Tables.
(3) Results may not total due to rounding.

Chart 20 that follows later in this section compares actual to expected deaths on a benefit-weighted basis for General members under the current and proposed assumptions over the past nine years.

Chart 21 compares actual to expected deaths on a benefit-weighted basis for Safety members under the current and proposed assumptions over the past nine years.

Chart 22 compares actual to expected deaths on a headcount-weighted basis for General members under the current and proposed assumptions over the past nine years provided for informational purposes only.

Chart 23 compares actual to expected deaths on a headcount-weighted basis for Safety members under the current and proposed assumptions over the past nine years provided for informational purposes only.

Chart 24 shows the life expectancies (i.e., expected future lifetime) under the current and the proposed tables for General members on a benefit-weighted basis. Life expectancies under the proposed generational mortality rates are based on age as of 2020. In practice, assumed life expectancies will increase as a result of the mortality improvement scale.

Chart 25 shows the life expectancies (i.e., expected future lifetime) under the current and the proposed tables for Safety members on a benefit-weighted basis.

Beneficiaries Mortality

In studying the mortality for all beneficiaries in our prior experience study, we reviewed the actual deaths compared to the expected deaths and recommended the same mortality tables for General retirees and all beneficiaries. However, Pub-2010 has separate mortality tables for healthy retirees and contingent annuitants.

The Pub-2010 Contingent Survivors Table is developed based only on contingent survivor data after the death of the retirees. This is consistent with the mortality experience that we have available for beneficiaries. The Pub-2010 contingent survivor mortality rates are comparable to OCERS' actual mortality experience for beneficiaries.

For all beneficiaries, we recommend changing the mortality assumption to follow the Pub-2010 Contingent Survivor Amount-Weighted Above-Median Mortality Table (separate tables for males and females) with rates increased by 5%, projected generationally with the two-dimensional mortality improvement scale MP-2019.

Mortality Table for Member Contributions, Optional Forms of Payment and Reserves

There are administrative reasons why a generational mortality table is more difficult to implement for determining member contributions for the legacy tiers, optional forms of payment and reserves. 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. We would recommend the use of this approximation for determining member contributions for employees in the legacy tiers.

For General members, we recommend that the mortality table used for determining contributions for General members be updated to a blended table based on the Pub-2010 General Healthy Retiree Amount-Weighted Above-Median 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-2019, weighted 40% male and 60% female.

For Safety members, we recommend that the mortality table used for determining contributions for Safety members be updated to a blended table based on the Pub-2010 Safety Healthy Retiree Amount-Weighted Above-Median Mortality Table (separate tables for males and females), projected 30 years (from 2010) with the two-dimensional mortality improvement scale MP-2019, weighted 80% male and 20% female.

For optional forms of payment and reserves, there are some administrative issues that we may need to resolve with OCERS 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 OCERS for use in reflecting mortality improvement for determining optional forms of payment after we have those discussions with OCERS and its vendor.

Chart 20: Post-Retirement Benefit-Weighted Deaths ($ In Millions) Non-Disabled General Members (January 1, 2011 through December 31, 2019)

Legend: ■ Expected - Current ■ Actual ■ Expected - Proposed

	Expected - Current	Actual	Expected - Proposed
Male	$47.47	$39.46	$40.43
Female	$35.17	$31.47	$31.18
Total	$82.64	$70.92	$71.61
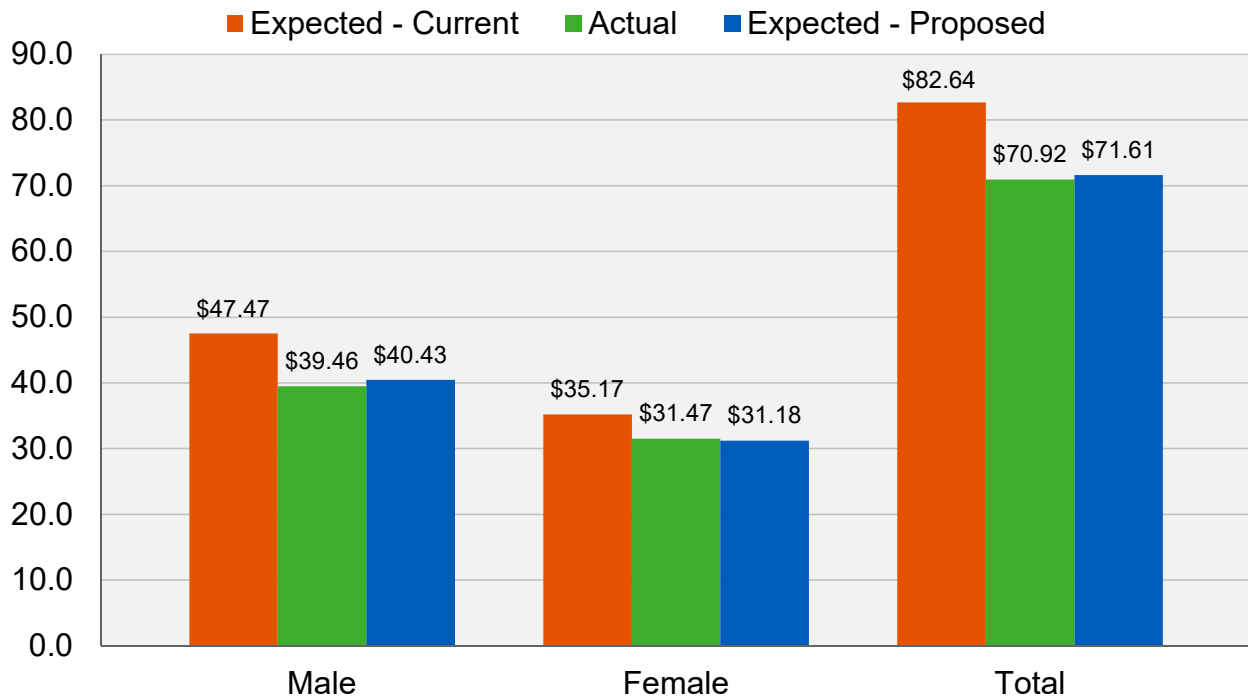
Chart 21: Post-Retirement Benefit-Weighted Deaths ($ In Millions) Non-Disabled Safety Members (January 1, 2011 through December 31, 2019)

Legend: ■ Expected - Current ■ Actual ■ Expected - Proposed

	Expected - Current	Actual	Expected - Proposed
Male	$12.21	$10.87	$10.85
Female	$0.94	$0.50	$1.00
Total	$13.16	$11.37	$11.85
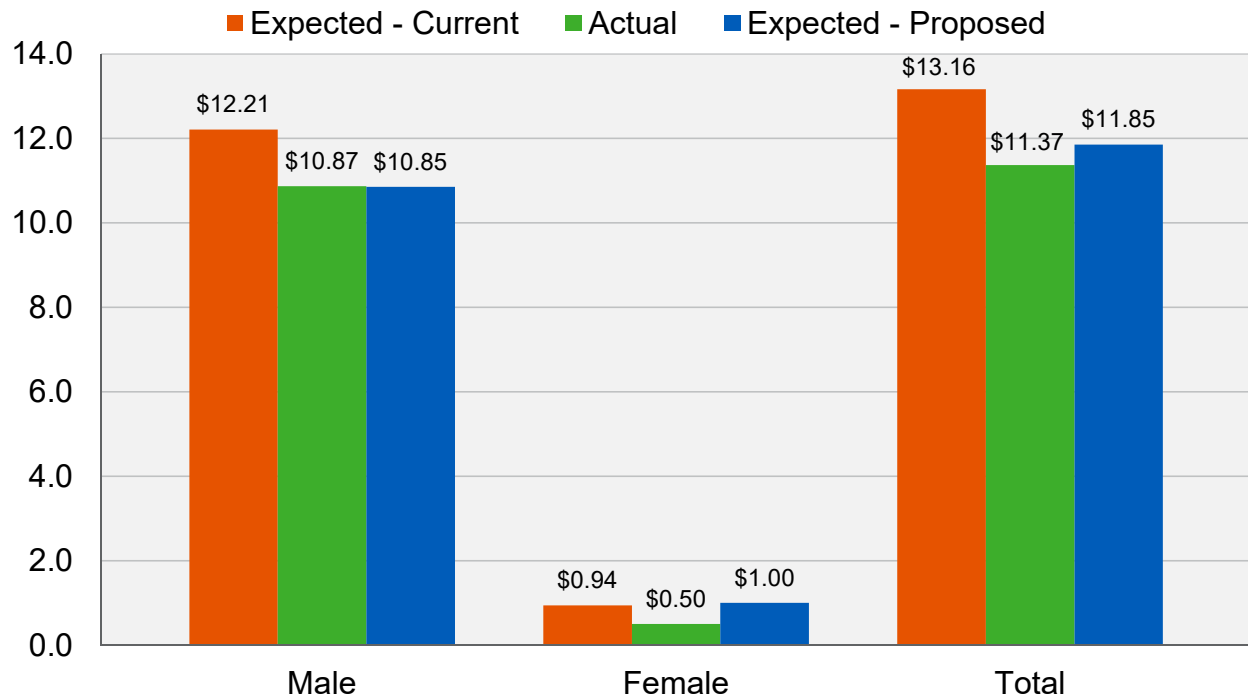
Chart 22: Post-Retirement Headcount-Weighted Deaths Non-Disabled General Members (January 1, 2011 through December 31, 2019) Provided for Informational Purposes Only

Legend: ■ Expected - Current ■ Actual ■ Expected - Proposed

	Expected - Current	Actual	Expected - Proposed
Male	1,132	1,067	984
Female	1,240	1,207	1,137
Total	2,373	2,274	2,120
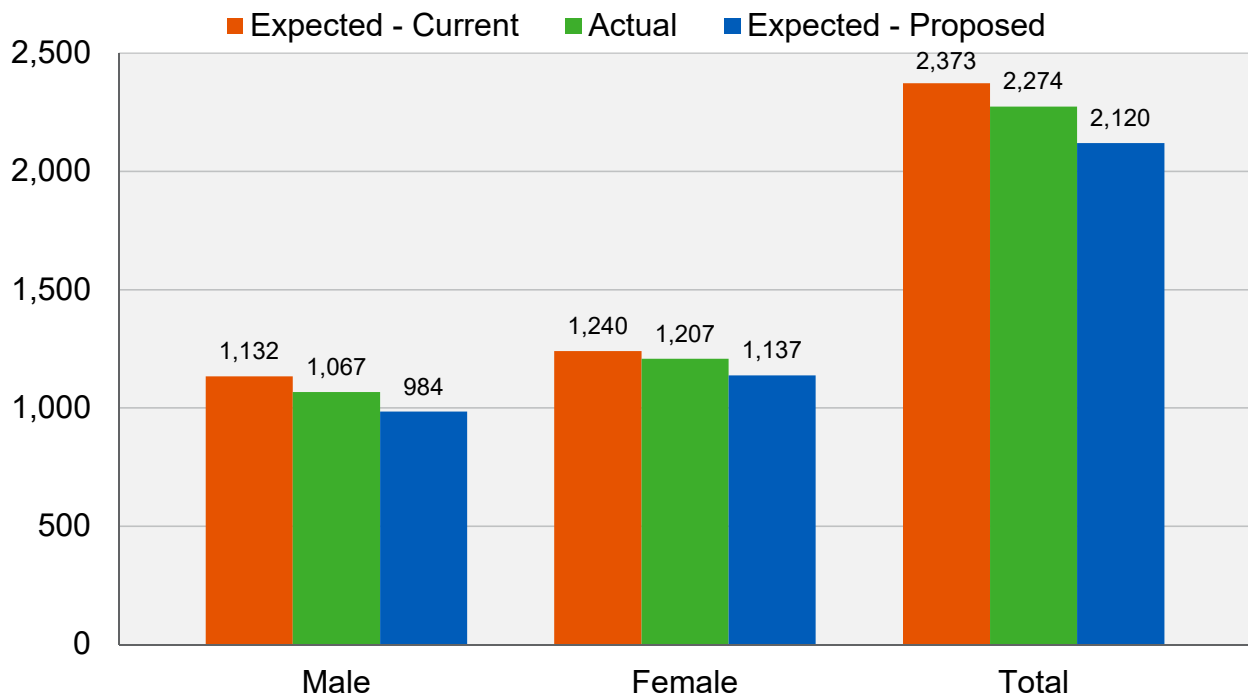
Chart 23: Post-Retirement Headcount-Weighted Deaths Non-Disabled Safety Members (January 1, 2011 through December 31, 2019) Provided for Informational Purposes Only

Legend: ■ Expected - Current ■ Actual ■ Expected - Proposed

	Expected - Current	Actual	Expected - Proposed
Male	161	156	150
Female	15	10	16
Total	176	166	166

Chart 24: Benefit-Weighted Life Expectancies
Non-Disabled General Members

Chart 25: Life Expectancies
Non-Disabled Safety Members
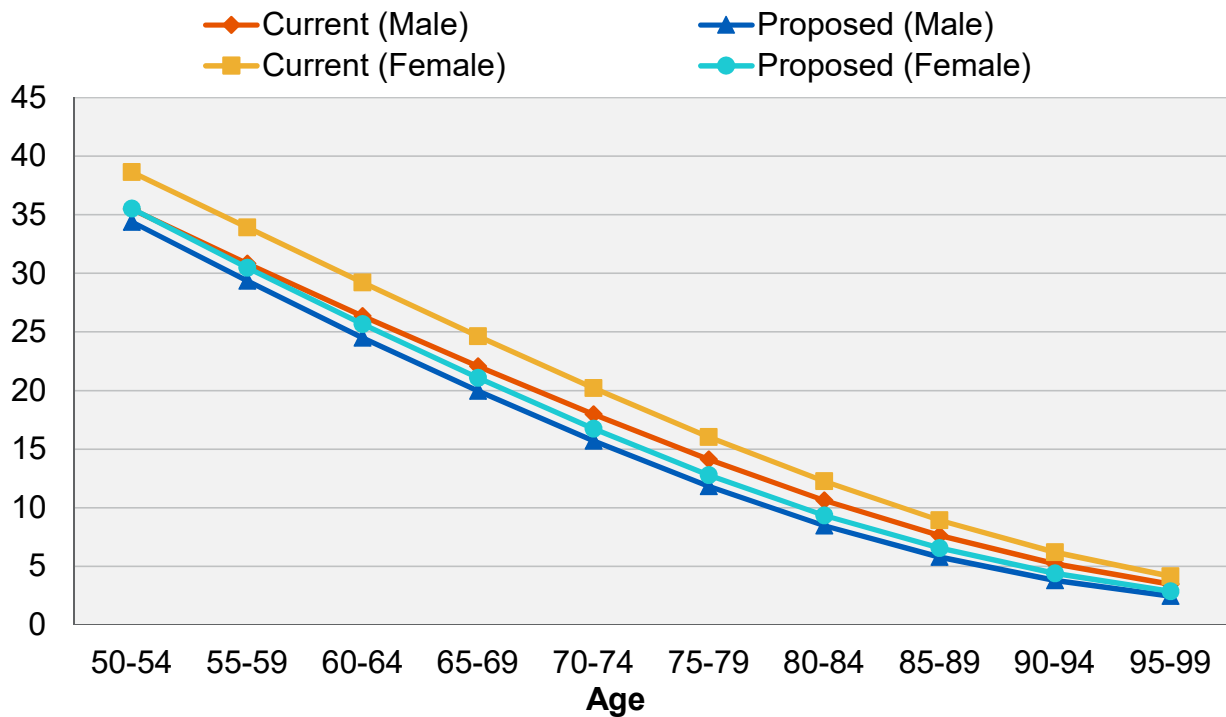
C. Mortality Rates - Disabled

Since mortality rates for disabled members can vary from those of healthy members, a different mortality assumption is often used. For General members, the table currently being used is the Headcount-Weighted RP-2014 Healthy Annuitant Table (separate tables for males and females) projected generationally with the two-dimensional mortality improvement scale MP-2016, set forward five years for males and females. For Safety members, the table currently being used is the Headcount-Weighted RP-2014 Healthy Annuitant Table (separate tables for males and females) projected generationally with the two-dimensional mortality improvement scale MP-2016, with no setback for males and females.

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 OCERS, there is far less data for disabled retirees, so it is given little credibility. The proposed mortality tables (as shown in the table below) after adjustments for partial credibility have actual to expected ratios of 87% and 92% for General and Safety, respectively. In future years the ratio should remain around 87% and 92% for General and Safety, respectively, 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 nine years are as follows:

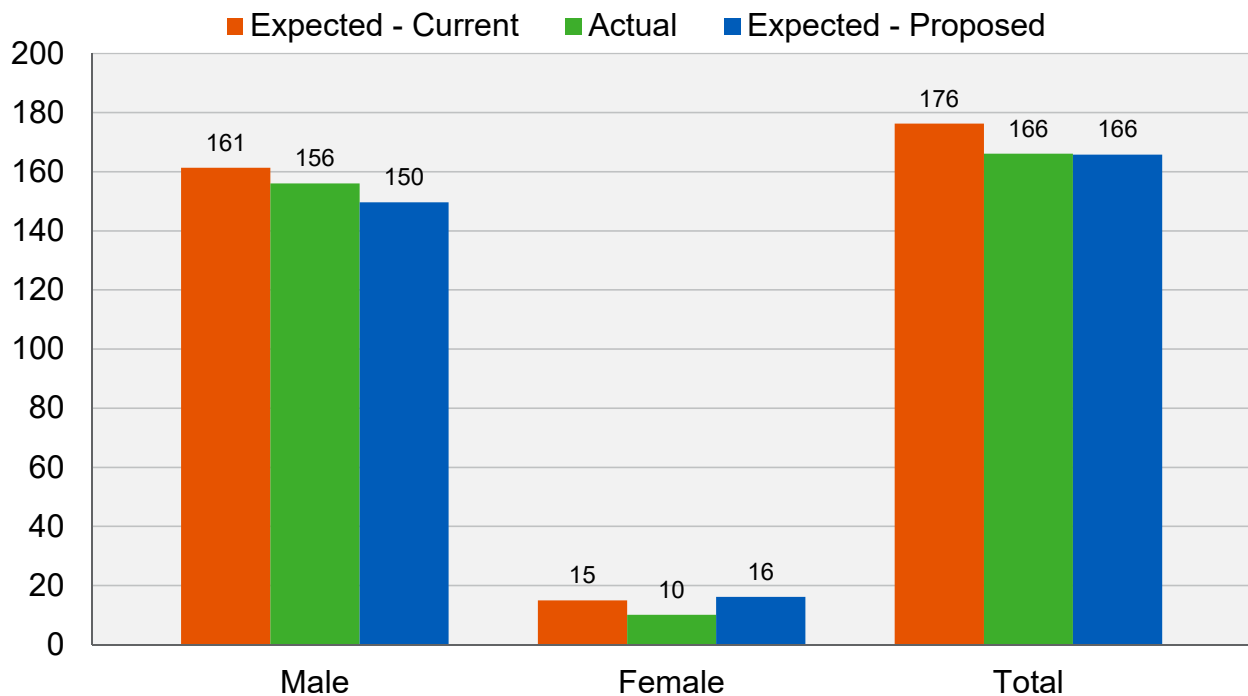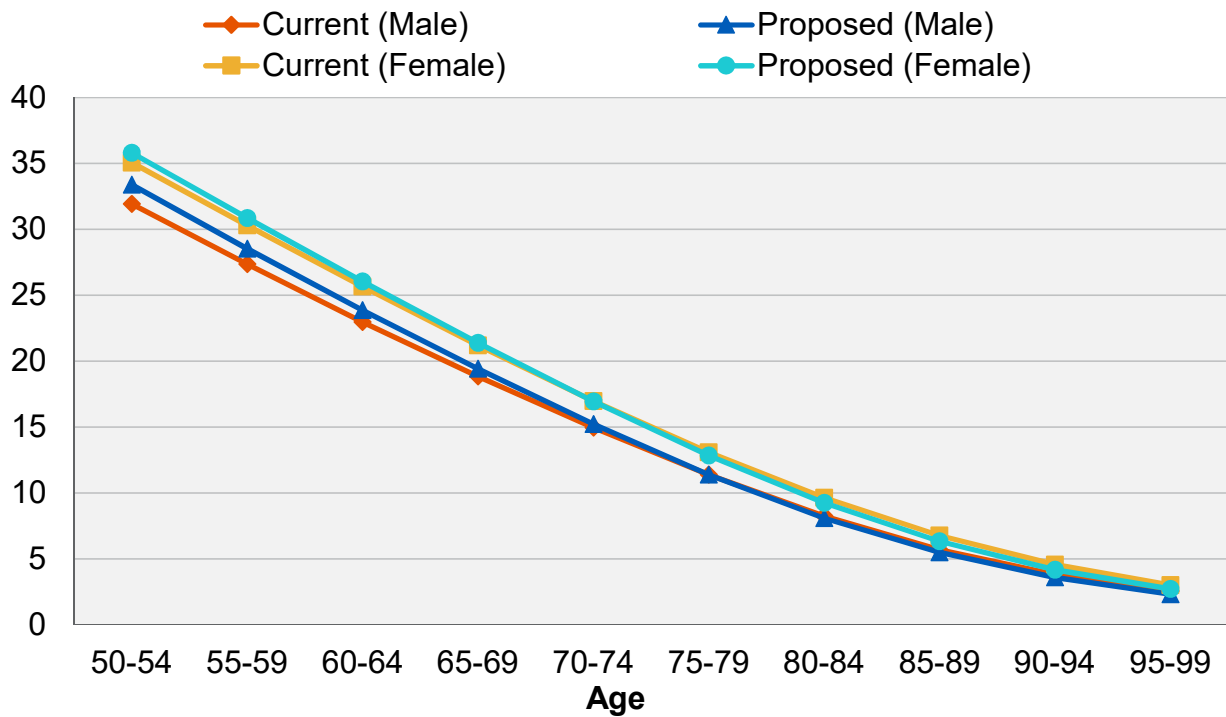| Gender	General Members – Disabled ($ in millions)			Safety Members – Disabled ($ in millions)		
	Current Expected Weighted Deaths	Actual Weighted Deaths	Proposed Expected Weighted Deaths	Current Expected Weighted Deaths	Actual Weighted Deaths	Proposed Expected Weighted Deaths
Male	3.82	3.42	4.07	3.42	3.09	3.22
Female	2.74	2.80	3.12	0.27	0.11	0.28
Total	6.56	6.22	7.19	3.69	3.20	3.49
Actual / Expected	95%		87%[42]	87%		92%

Notes: (1) Experience shown above is weighted by annual benefit amounts for deceased members instead of by headcounts.

(2) 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.

(3) Results may not add due to rounding.

The Pub-2010 family of mortality tables provides separate disabled retiree mortality tables for Non-Safety disabled retirees and Safety disabled retirees.

For General disabled members, we recommend updating the current table to the Pub-2010 Non-Safety Disabled Retiree Amount-Weighted Mortality Table (separate tables for males and females), decreased by 5%, projected generationally with the two-dimensional mortality improvement scale MP-2019. The recommended mortality table has an actual to expected ratio of 87%.

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[42] If we use the benchmark Pub-2010 Genera disabled table without any adjustment, the proposed actual to expected ratio would be 82%.

For Safety disabled members, we recommend updating the current table to the Pub-2010 Safety Disabled Retiree Amount-Weighted Mortality Table (separate tables for males and females), projected generationally with the two-dimensional mortality improvement scale MP-2019. The recommended mortality table has an actual to expected ratio of 92%.[43]

For informational purposes only, we have also provided in the table below the actual and expected deaths computed without weighting these by benefit amounts. This is similar to how actual and expected death ratios were developed based on the prior headcount approach.

Gender	General Members – Disabled			Safety Members – Disabled		
	Current Expected Weighted Deaths	Actual Weighted Deaths	Proposed Expected Weighted Deaths	Current Expected Weighted Deaths	Actual Weighted Deaths	Proposed Expected Weighted Deaths
Male	129	124	137	59	61	56
Female	107	115	120	6	2	6
Total	236	239	257	64	63	61
Actual / Expected	101%		93%	98%		103%

Notes: (1) Experience shown above is weighted by headcounts for deceased members instead of by annual benefit amounts.
(2) The proposed expected deaths are based on the Pub-2010 Amount-Weighted Above-Median Mortality Tables.
(3) Results may not add due to rounding.

Chart 26 compares actual to expected deaths on a benefit-weighted basis for disabled General members under the current and proposed assumptions over the past nine years.

Chart 27 compares actual to expected deaths on a benefit-weighted basis for disabled Safety members under the current and proposed assumptions over the past nine years.

Chart 28 compares actual to expected deaths on a headcount-weighted basis for disabled General members under the current and proposed assumptions over the past nine years provided for informational purposes only.

Chart 29 compares actual to expected deaths on a headcount-weighted basis for disabled Safety members under the current and proposed assumptions over the past nine years provided for informational purposes only.

Chart 30 shows the life expectancies (i.e., expected future lifetime) under the current and the proposed tables for disabled General members on a benefit-weighted basis. Life expectancies under the proposed generational mortality rates are based on age as of 2020. In practice, life expectancies will be assumed to increase based on applying the mortality improvement scale.

Chart 31 shows the life expectancies (i.e., expected future lifetime) under the current and the proposed tables for disabled Safety members on a benefit-weighted basis.

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[43] If we use the benchmark Pub-2010 General disabled table without any adjustment, the proposed actual to expected ratio would be 82%.

Chart 26: Post-Retirement Benefit-Weighted Deaths ($ In Millions) Disabled General Members (January 1, 2011 through December 31, 2019)

Legend: ■ Expected - Current ■ Actual ■ Expected - Proposed

	Male	Female	Total
Expected - Current	$3.82	$2.74	$6.56
Actual	$3.42	$2.80	$6.22
Expected - Proposed	$4.07	$3.12	$7.19
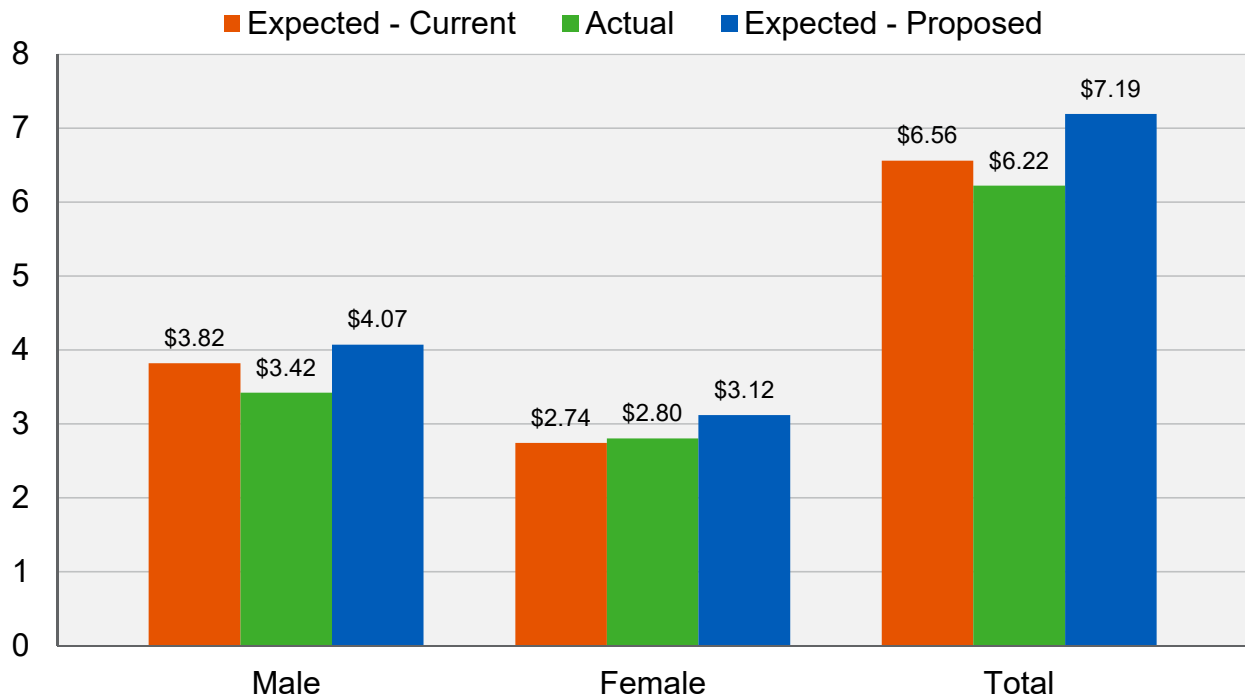
Chart 27: Post-Retirement Benefit-Weighted Deaths ($ In Millions) Disabled Safety Members (January 1, 2011 through December 31, 2019)

Legend: ■ Expected - Current ■ Actual ■ Expected - Proposed

	Male	Female	Total
Expected - Current	$3.42	$0.27	$3.69
Actual	$3.09	$0.11	$3.20
Expected - Proposed	$3.22	$0.28	$3.49
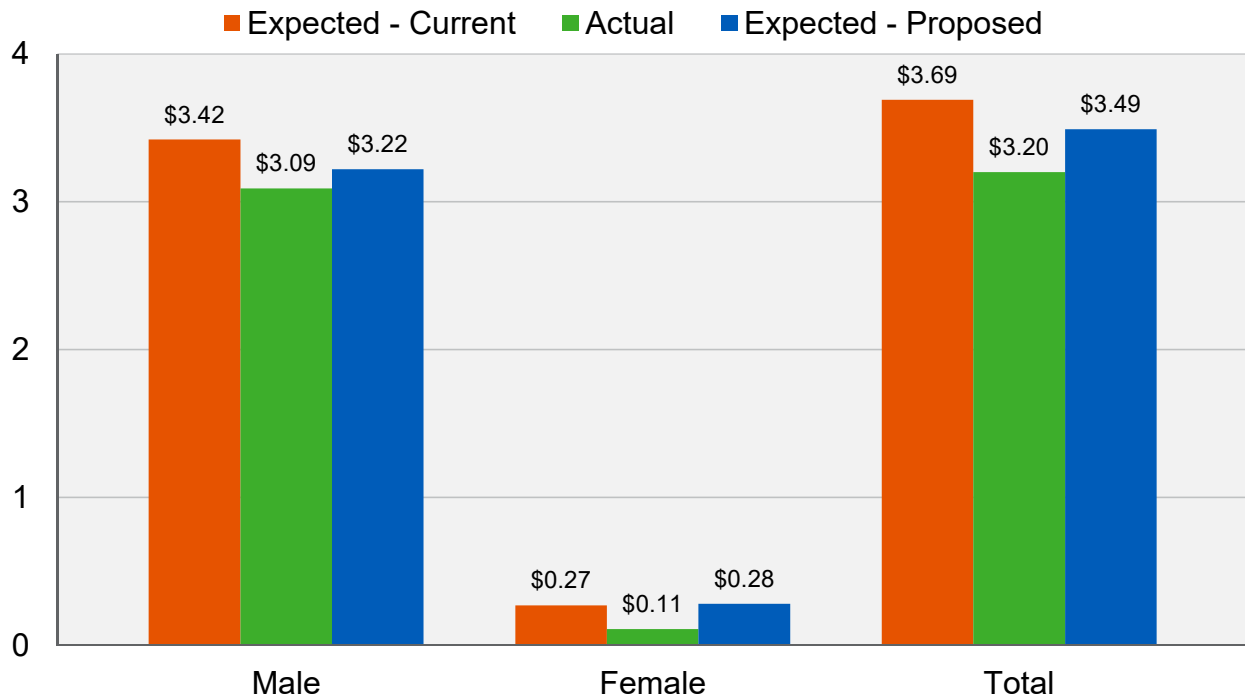
Chart 28: Post-Retirement Headcount-Weighted Deaths
Disabled General Members (January 1, 2011 through December 31, 2019)
Provided for Informational Purposes Only

Legend: ■ Expected - Current ■ Actual ■ Expected - Proposed

	Expected - Current	Actual	Expected - Proposed
Male	129	124	137
Female	107	115	120
Total	236	239	257
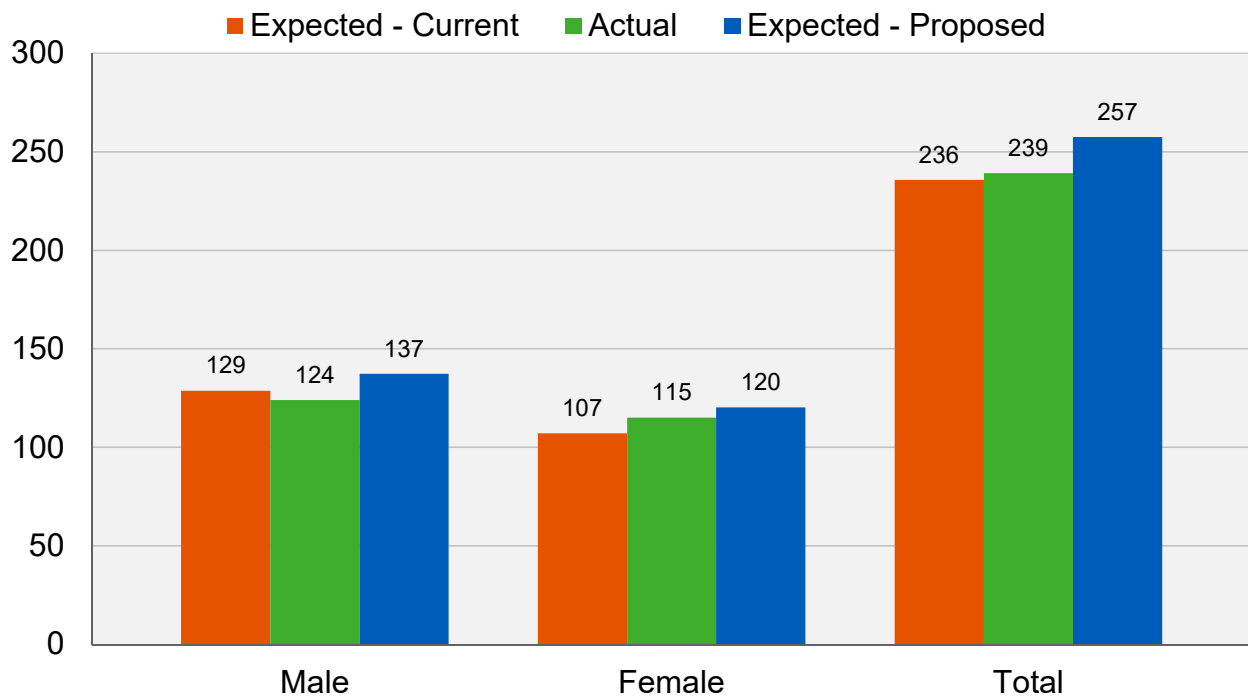
Chart 29: Post-Retirement Headcount-Weighted Deaths
Disabled Safety Members (January 1, 2011 through December 31, 2019)
Provided for Informational Purposes Only

Legend: ■ Expected - Current ■ Actual ■ Expected - Proposed

	Expected - Current	Actual	Expected - Proposed
Male	59	61	56
Female	6	2	6
Total	64	63	61

Chart 30: Benefit-Weighted Life Expectancies
Disabled General Members
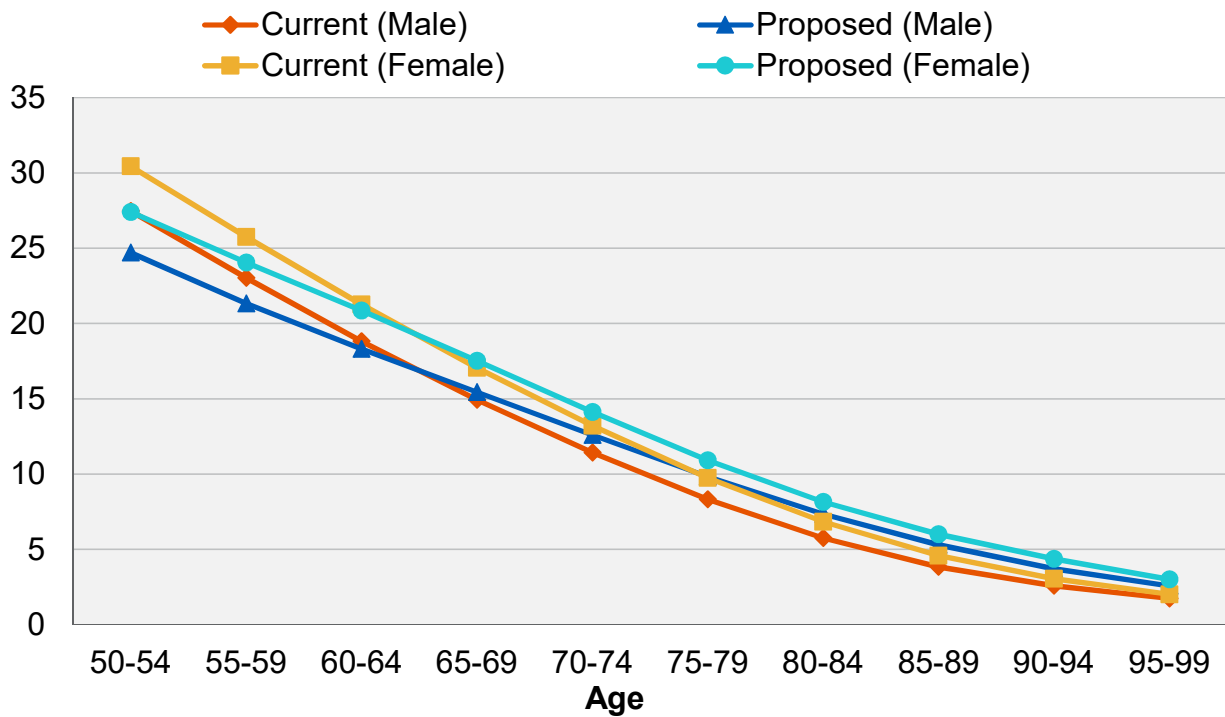
Chart 31: Life Expectancies
Disabled Safety Members
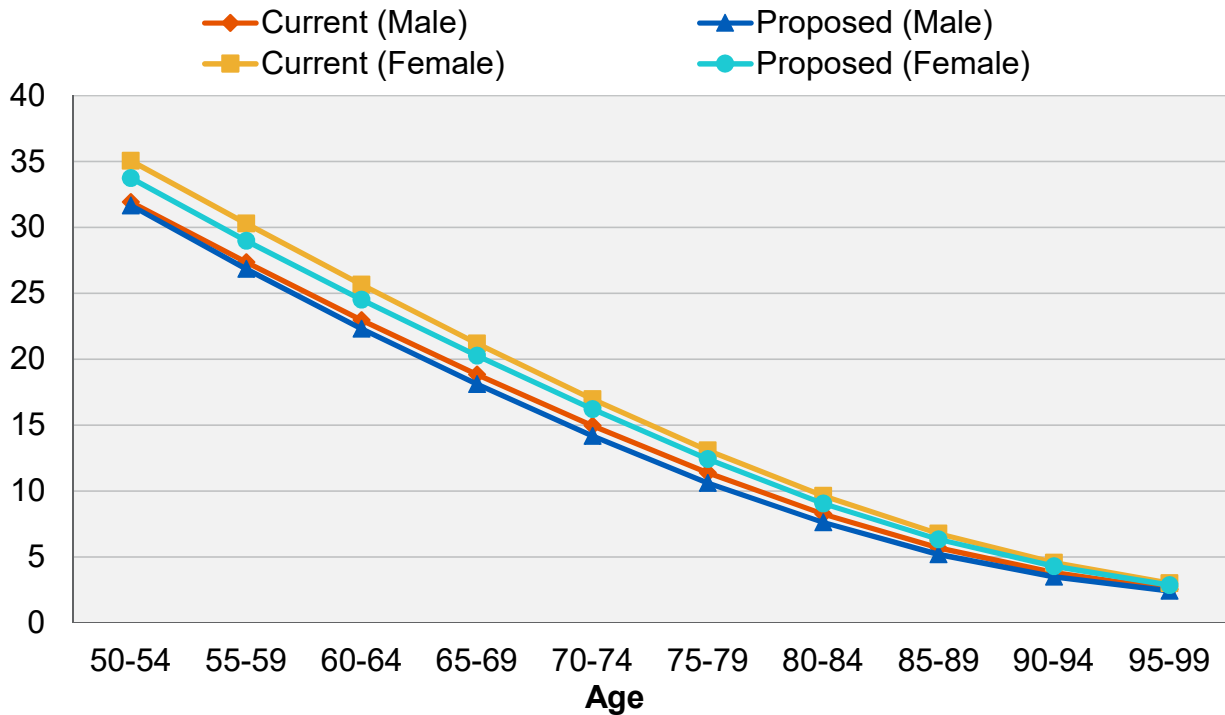
D. Termination Rates

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 assumptions, based on the plan membership and years of service. There is also another set of assumptions to anticipate the percentage of members who will withdraw their contributions and members who will leave their contributions on deposit and receive a deferred vested benefit.

We have developed rates for the following four groups: (1) General All Other, (2) General OCTA, (3) Safety Law Enforcement and Fire and (4) Safety Probation. The termination experience over the last three years is shown by years of service in the following tables. We also show the current and proposed assumptions.

Rates of Termination – General

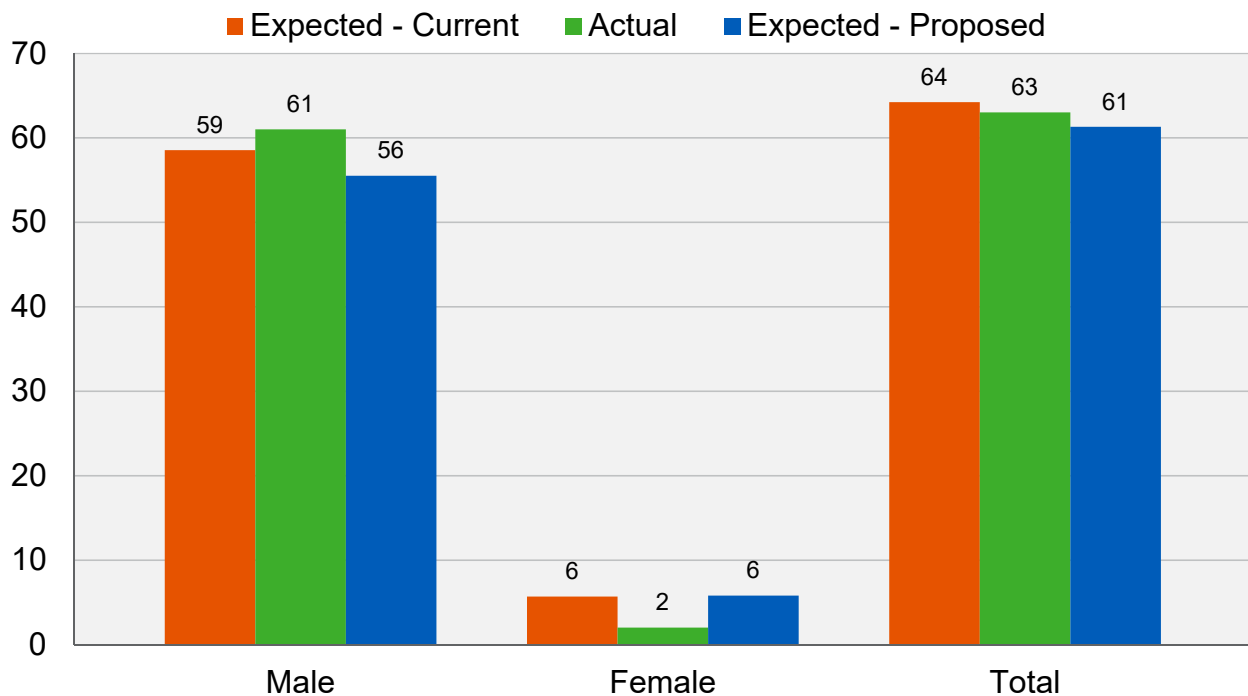| Years of Service | Termination Rate (%) | | | | | |
| | General All Other | | | General OCTA | | |
	Current Rate	Observed Rate	Proposed Rate	Current Rate	Observed Rate	Proposed Rate
Less than 1	11.00	11.29	11.00	17.50	16.30	17.00
1 – 2	7.50	7.17	7.25	11.00	12.43	11.50
2 – 3	6.50	6.66	6.50	9.00	9.43	9.00
3 – 4	5.00	6.20	5.50	8.50	8.57	8.50
4 – 5	4.50	5.39	5.00	7.50	11.31	8.00
5 – 6	4.25	4.74	4.50	7.00	5.76	7.00
6 – 7	3.75	4.37	4.00	4.50	1.22	4.25
7 – 8	3.25	5.03	3.50	4.00	8.62	4.00
8 – 9	3.00	3.72	3.25	3.50	2.86	3.25
9 – 10	2.75	3.11	3.00	3.00	1.75	3.00
10 – 11	2.50	2.62	2.50	3.00	2.45	2.75
11 – 12	2.00	2.07	2.00	3.00	2.14	2.50
12 – 13	2.00	1.76	2.00	3.00	0.00	2.50
13 – 14	1.75	2.17	2.00	2.50	1.44	2.25
14 – 15	1.50	1.42	1.50	2.50	1.30	2.25
15 – 16	1.40	1.25	1.40	2.50	3.80	2.25
16 – 17	1.30	1.64	1.30	2.00	3.80	2.00
17 – 18	1.20	1.21	1.20	1.80	0.69	1.80
18 – 19	1.10	0.91	1.10	1.60	2.44	1.60
19 – 20	1.00	0.84	1.00	1.40	0.00	1.40
20 & Over	0.90	0.32	0.75	1.20	0.62	1.20

Rates of Termination – Safety

Years of Service	Termination Rate (%)					
	Safety Law and Fire			Safety Probation		
	Current Rate	Observed Rate	Proposed Rate	Current Rate	Observed Rate	Proposed Rate
Less than 1	4.50	3.77	4.25	14.00	8.16	14.00
1 – 2	2.50	2.76	2.75	13.00	14.29	13.00
2 – 3	2.00	2.40	2.25	10.00	13.33	11.00
3 – 4	1.50	1.27	1.75	5.00	0.00	5.00
4 – 5	1.25	3.40	1.50	4.00	4.35	4.00
5 – 6	1.00	3.05	1.25	3.50	0.00	3.25
6 – 7	0.95	1.15	1.00	2.75	0.00	2.75
7 – 8	0.90	0.49	0.95	2.00	16.67	2.75
8 – 9	0.85	1.44	0.90	2.00	8.33	2.50
9 – 10	0.80	0.91	0.85	1.75	2.00	1.75
10 – 11	0.75	0.47	0.80	1.75	0.98	1.50
11 – 12	0.65	1.13	0.75	1.50	3.27	1.50
12 – 13	0.60	0.91	0.70	1.25	1.65	1.25
13 – 14	0.55	0.00	0.65	1.00	0.00	1.00
14 – 15	0.50	2.18	0.60	0.75	0.83	0.75
15 – 16	0.45	1.33	0.55	0.75	0.56	0.75
16 – 17	0.40	0.76	0.50	0.75	1.10	0.75
17 – 18	0.35	0.69	0.45	0.25	1.80	0.75
18 – 19	0.30	0.00	0.40	0.25	0.61	0.50
19 – 20	0.25	0.61	0.30	0.25	0.00	0.25
20 & Over	0.20	0.13	0.15	0.25	0.15	0.15

Based upon the recent experience, we have decreased the termination rates overall for General OCTA members while increasing the termination rates overall for General All Other members, Safety Law and Fire members and Safety Probation members.

The next two tables show the currently assumed, actual and proposed assumed percentages for members who withdraw their contributions. The assumed percentages for members who leave their contributions on deposit and receive a deferred vested benefit is equal to 100% minus the percentage of those assumed to withdraw.

Proportion of Total Termination Assumed to Withdraw Contributions – General

| Years of Service | Rates of Electing a Refund of Contributions upon Termination% | | | | | |
| | General All Other | | | General OCTA | | |
	Current Rate	Observed Rate	Proposed Rate	Current Rate	Observed Rate	Proposed Rate
Less than 5	35.00	20.00	30.00	40.00	36.70	40.00
5 – 9	30.00	17.67	25.00	35.00	22.22	30.00
10 – 14	25.00	24.41	25.00	30.00	14.29	25.00
15 & Over	20.00	17.86	17.50	20.00	12.00	15.00

Proportion of Total Termination Assumed to Withdraw Contributions – Safety

| Years of Service | Rates of Electing a Refund of Contributions upon Termination | | | | | |
| | Safety Law and Fire | | | Safety Probation | | |
	Current Rate	Observed Rate	Proposed Rate	Current Rate	Observed Rate	Proposed Rate
Less than 5	20.00	22.00	20.00	25.00	30.00	25.00
5 – 9	20.00	25.00	20.00	25.00	33.33	25.00
10 – 14	20.00	0.00	10.00	25.00	22.22	25.00
15 & Over	20.00	16.67	10.00	25.00	12.50	15.00

For both General and Safety members, the overall actual rates for electing a refund of contributions are lower than the current assumptions for the past three years. **For General All Other members, we recommend decreasing the rates of electing a refund of contributions for most service bands, as shown above. For General OCTA members, we recommend decreasing the rates of electing a refund of contributions over 5 years of service, as shown above. For Safety Law and Fire members, we recommend decreasing the rates of electing a refund of contributions over 10 years of service, as shown above. For Safety Probation members, we recommend decreasing the rates of electing a refund of contributions over 15 years of service, as shown above.**

Chart 32 compares actual to expected terminations over the past three years for both the current and proposed assumptions for General All Other, General OCTA, Safety Law Enforcement and Fire and Safety Probation members.

Chart 33 shows the actual termination rates over the past three years compared to the current and proposed assumptions for General All Other members.

Chart 34-36 shows the same information as Chart 33, but for General OCTA, Safety Law and Fire and Safety Probation members.

Chart 32: Actual Number of Terminations Compared to Expected
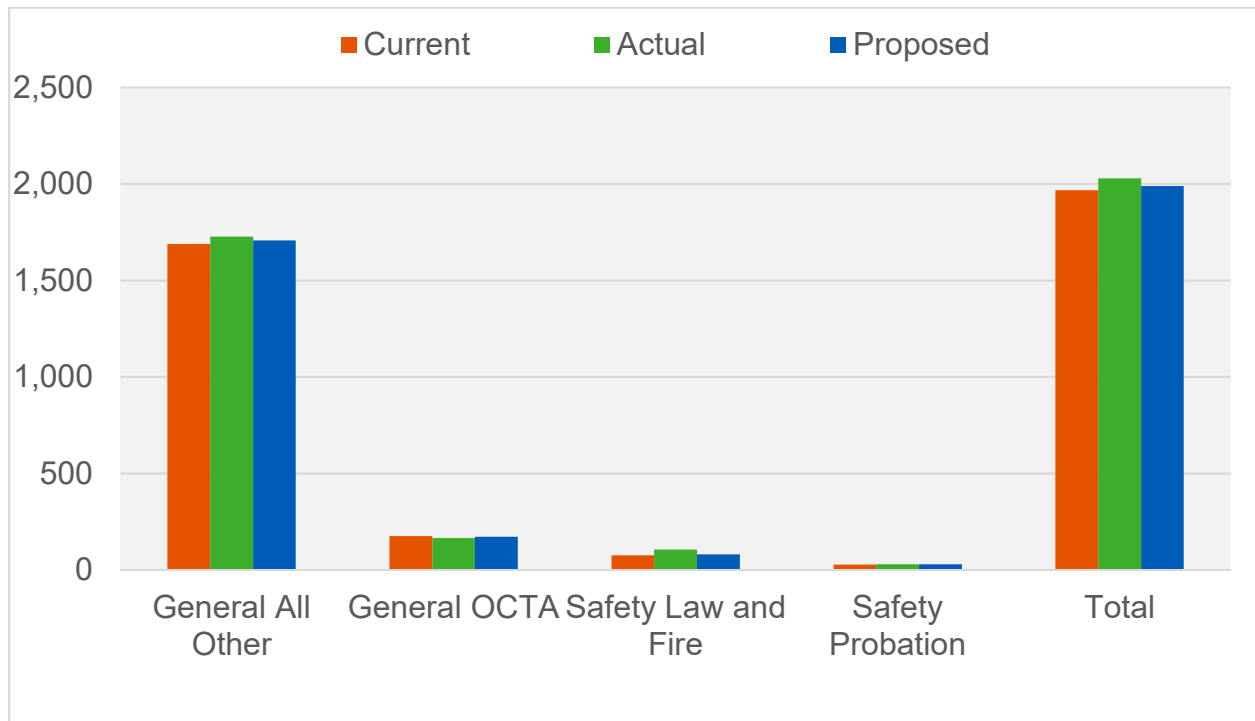

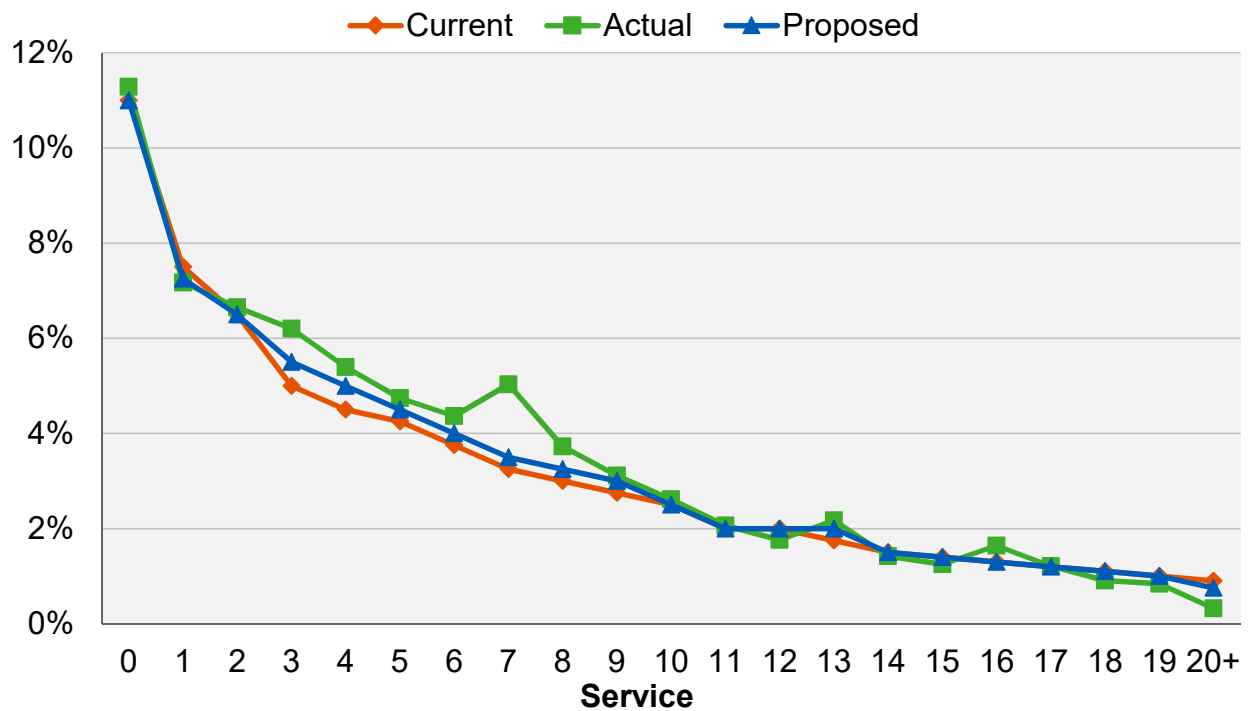## Chart 33: Termination Rates – General All Other Members

Chart 34: Termination Rates – General OCTA Members
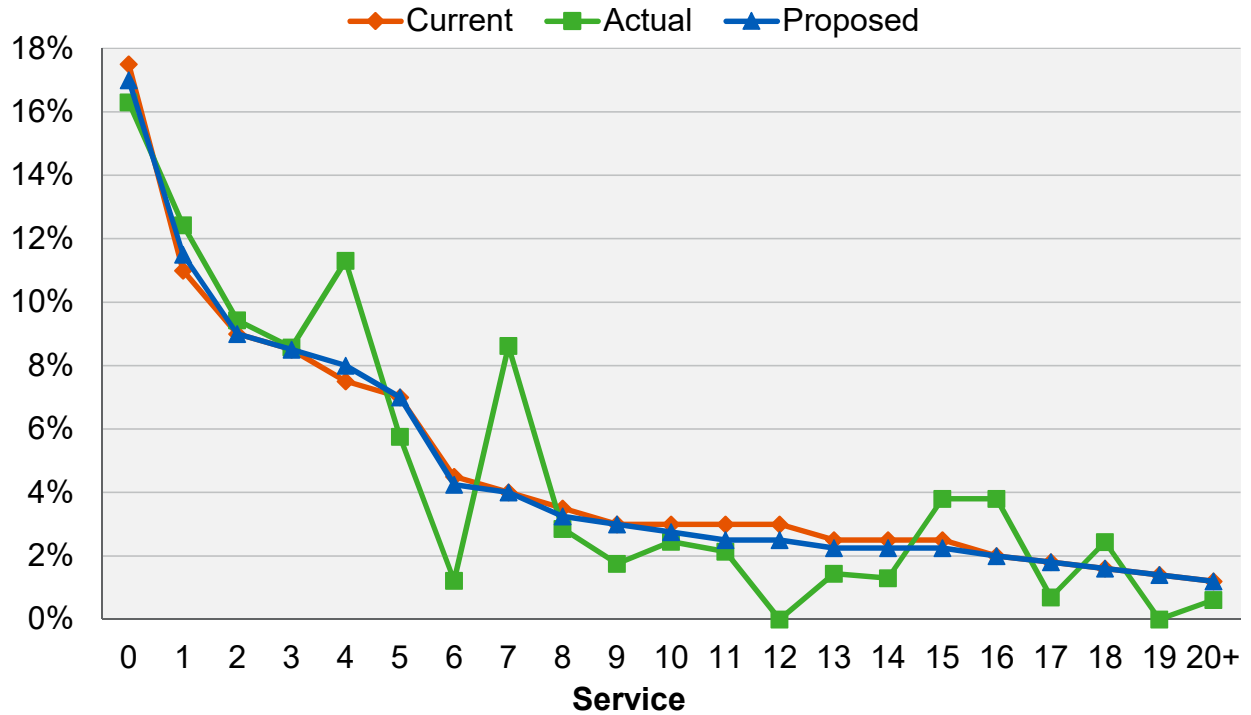
Chart 35: Termination Rates – Safety Law and Fire Members
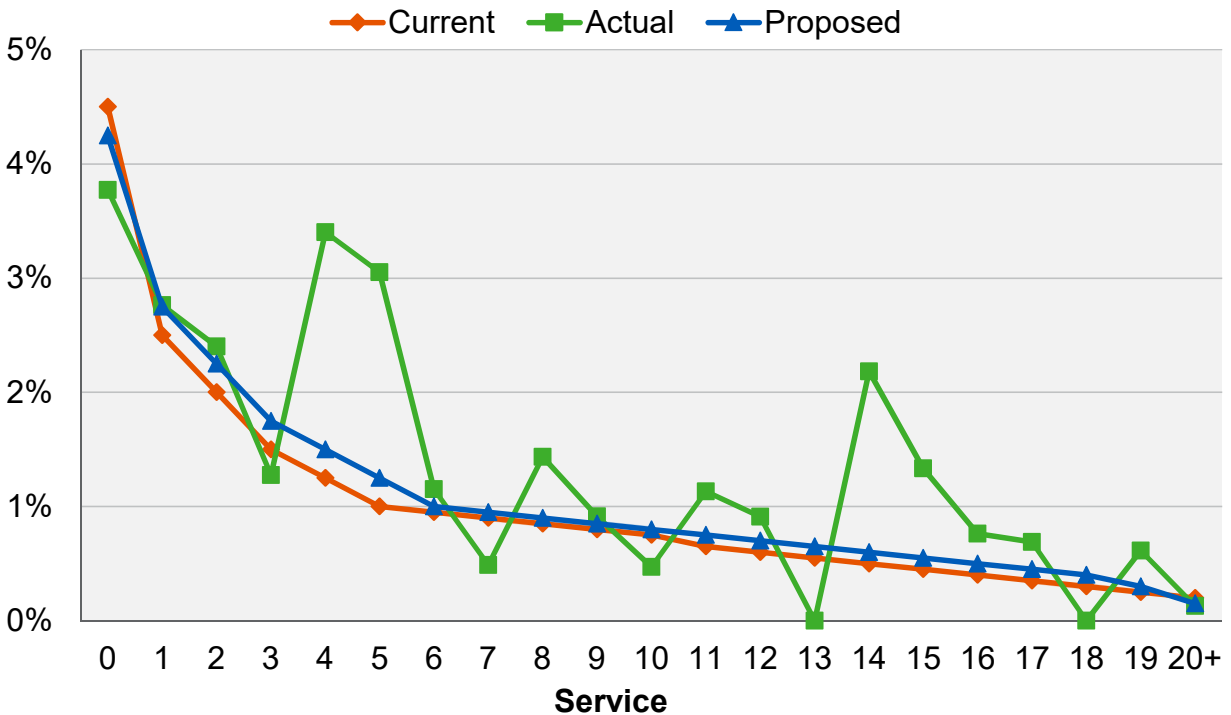
Chart 36: Termination Rates – Safety Probation Members
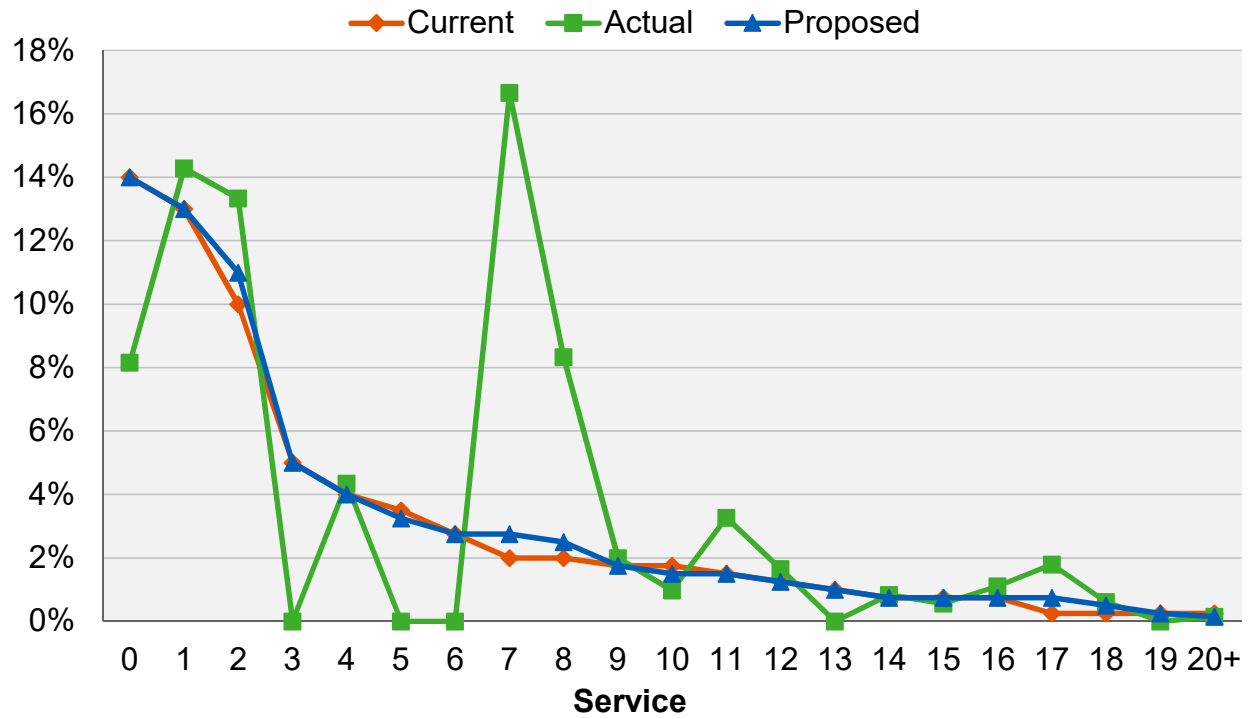
E. Disability Incidence Rates

When a member becomes disabled, he or she may be entitled to at least a 50% of pay pension (service connected disability), or a pension that depends upon the member's years of service (non-service connected disability).

The following summarizes the actual incidence of combined service and non-service connected disabilities over the past three years compared to the current and proposed assumptions for both service connected and non-service connected disability incidence:

	Disability Incidence Rate (%)					
	General All Other			General OCTA		
Age	Current Rate	Observed Rate	Proposed Rate	Current Rate	Observed Rate	Proposed Rate
20 – 24	0.00	0.00	0.00	0.00	0.00	0.00
25 – 29	0.00	0.00	0.00	0.00	0.00	0.00
30 – 34	0.01	0.00	0.01	0.05	0.00	0.05
35 – 39	0.05	0.06	0.05	0.30	0.00	0.30
40 – 44	0.10	0.09	0.10	0.40	0.47	0.45
45 – 49	0.15	0.19	0.16	0.45	0.73	0.50
50 – 54	0.20	0.24	0.22	0.50	0.59	0.55
55 – 59	0.25	0.34	0.30	0.75	0.90	0.80
60 – 64	0.35	0.32	0.35	1.60	1.19	1.50
65 – 69	0.35	0.50	0.35	1.60	2.19	1.75

	Disability Incidence Rate (%)					
	Safety Law and Fire			Safety Probation		
Age	Current Rate	Observed Rate	Proposed Rate	Current Rate	Observed Rate	Proposed Rate
20 – 24	0.00	0.00	0.00	0.00	0.00	0.00
25 – 29	0.02	0.00	0.02	0.05	0.00	0.05
30 – 34	0.05	0.29	0.10	0.10	0.00	0.10
35 – 39	0.20	0.36	0.25	0.10	0.00	0.10
40 – 44	0.25	0.57	0.35	0.15	0.15	0.15
45 – 49	0.50	0.26	0.50	0.25	0.54	0.25
50 – 54	1.50	1.48	1.50	0.30	0.31	0.30
55 – 59	3.00	4.41	3.50	0.50	0.00	0.50
60 – 64	6.00	4.41	6.00	0.00	0.00	0.00
65 – 69	7.00	13.21	8.00	0.00	5.56	0.00

Based upon the recent experience, we have increased the disability incidence rates overall for General All Other members, General OCTA members and Safety Law and Fire members while maintaining disability incidence rates for Safety Probation members.

Chart 37 compares the actual number of non-service connected and service connected disabilities over the past three years to that expected under both the current and proposed assumptions.

Chart 38 shows actual disablement rates, compared to the assumed and proposed rates for General All Other members. Charts 39-41 graph the same information as Chart 38, but for General OCTA, Safety Law and Fire and Safety Probation members.

The following table shows the currently assumed, actual and proposed assumed percentages for service versus non-service connected disability for the groups.

	Service vs. Non-Service Connected Disability			
	Disablements Receiving Service Connected Disability			Disablements Receiving Non-Service Connected Disability
	Current Assumption	Actual Percentage	Proposed Assumption	Proposed Assumption
General All Other	60%	77%	65%	35%
General OCTA	65%	87%	80%	20%
Safety Law and Fire	100%	99%	100%	0%
Safety Probation[44]	75%	100%	75%	25%

Based upon the recent experience, we have increased the assumed percentages for service connected disability for General All Other and General OCTA members while maintaining the assumed percentages for Safety Law and Fire and Safety Probation members.

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[44] In the last experience study, 67% of Safety Probation disablements were receiving service connected disability.

Chart 37: Actual Number of Service and Non-service Disability Retirements Compared to Expected

Legend: ■ Expected - Current ■ Actual ■ Expected - Proposed

Category	Expected - Current	Actual	Expected - Proposed
General All Other	72	83	77
General OCTA	28	31	29
Safety Law and Fire	73	89	79
Safety Probation	5	6	5
Total	178	209	190
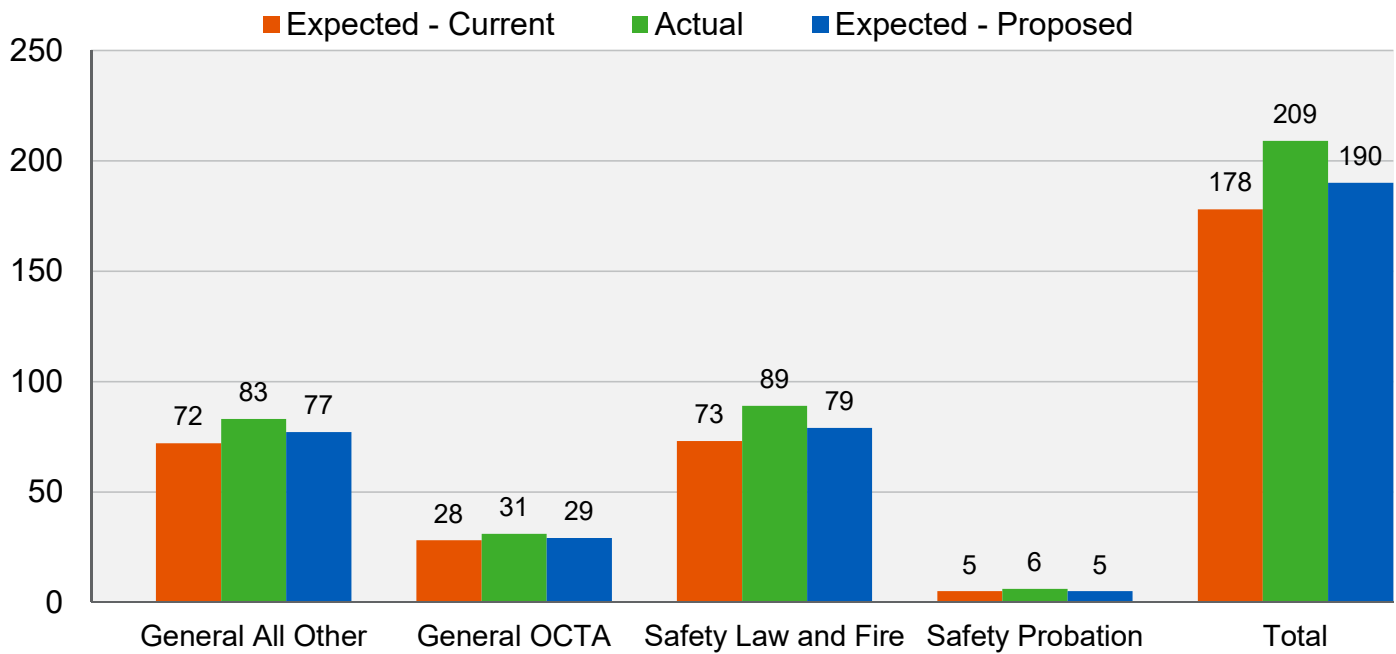
Chart 38: Disability Incidence Rates General All Other Members
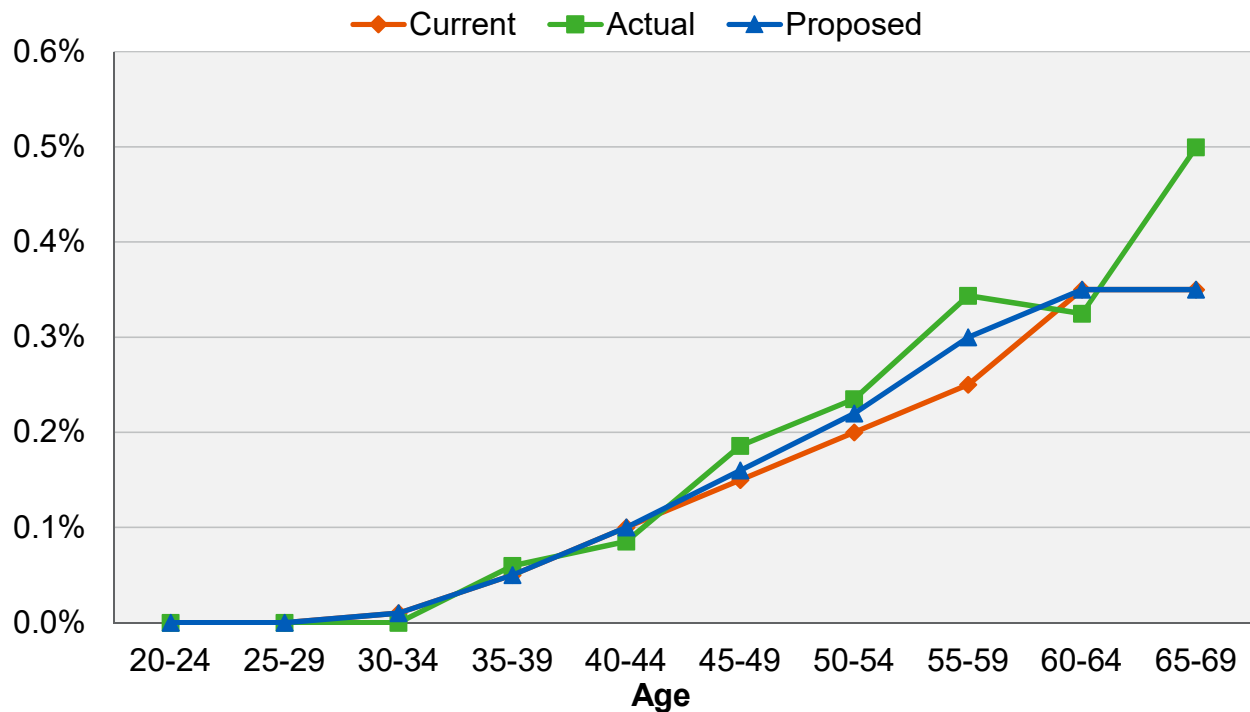

Legend: ◆ Current ■ Actual ▲ Proposed

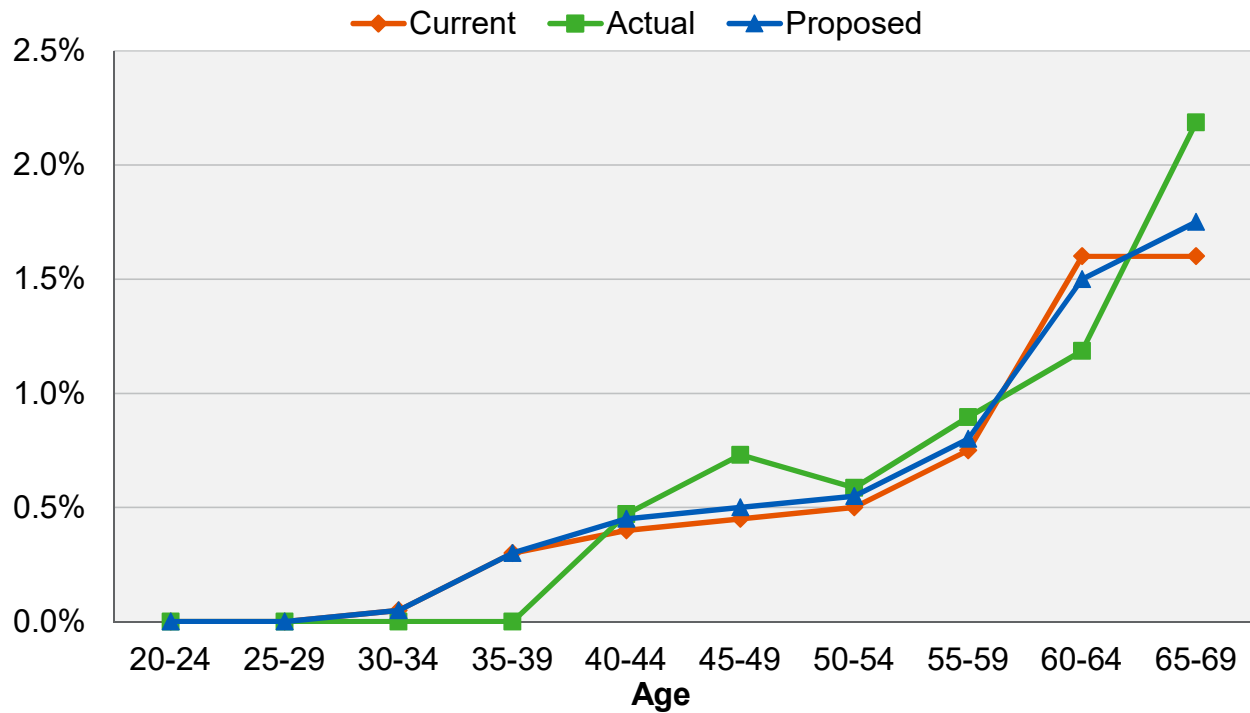# Chart 39: Disability Incidence Rates
General OCTA Members

Chart 40: Disability Incidence Rates
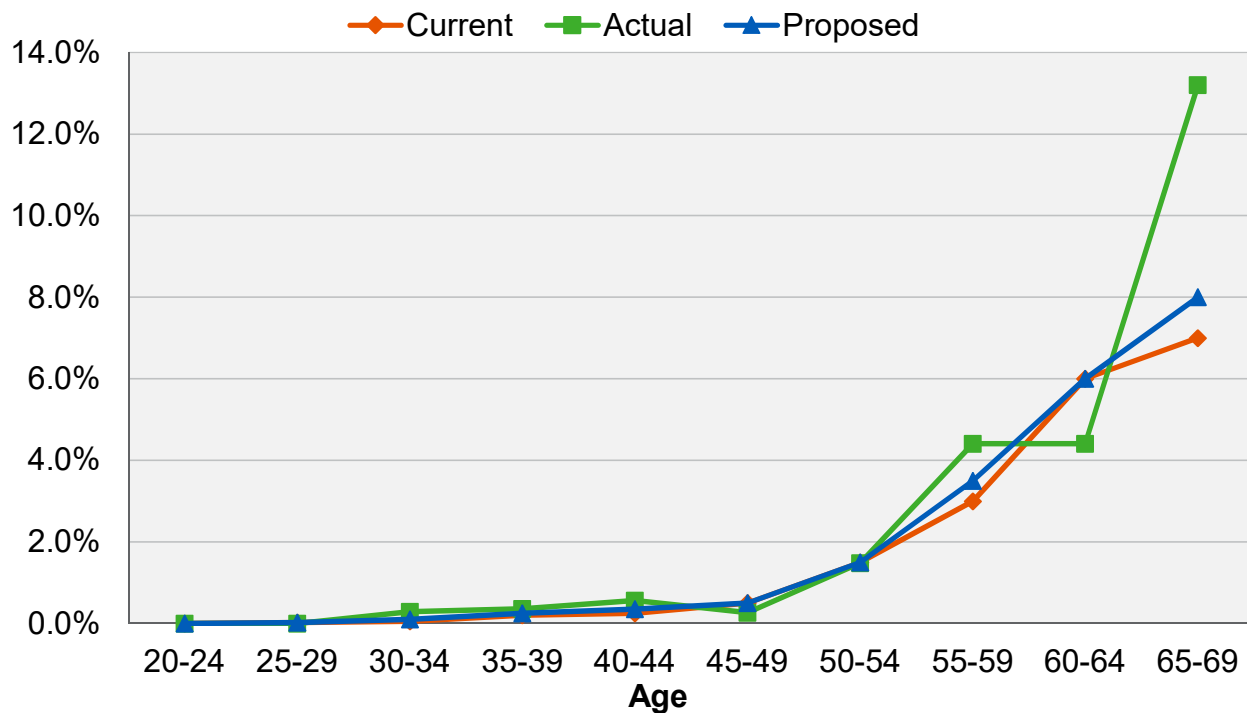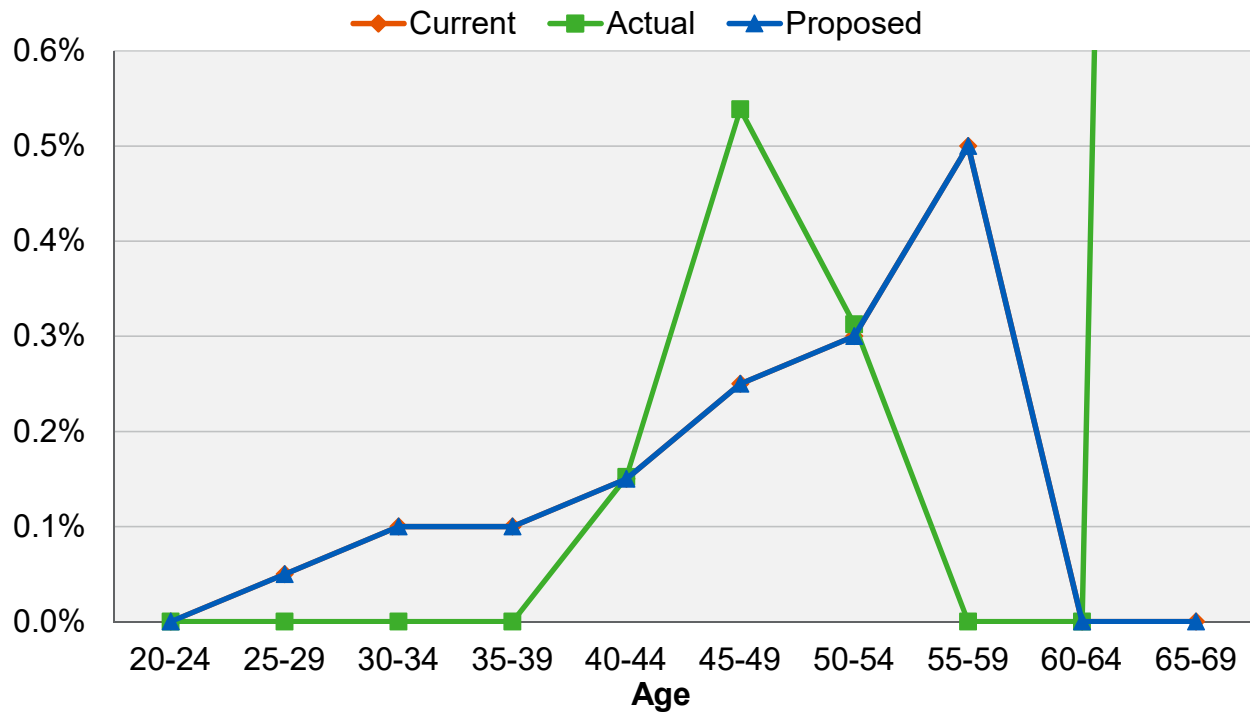## Safety Law and Fire Members

Chart 41: Disability Incidence Rates
Safety Probation Members

F. Additional Cashouts

Certain OCERS legacy members are eligible for additional cashouts on an annual basis. These cashouts are included as part of a member's Earnable Compensation at retirement. These additional pay elements fall into two categories:

- Ongoing Pay Elements – Those that are expected to be received relatively uniformly over a member's employment years; and

- Terminal Pay Elements – Those that are expected to be received only during the member's final average earnings pay period.

The first category is recognized in the actuarial calculations by virtue of being included in the current pay of active members. Any year to year fluctuation in the amount of additional cashouts would be incorporated in the salary scale assumptions discussed in the prior section of this report. The second category requires a separate actuarial assumption to anticipate its impact on a member's retirement benefit.

In this study, we have been provided with final average salaries determined by OCERS before ("FAS – Base")[45] as well as after ("FAS – Final")[46] including the terminal pay elements for members who retired during the last three years. We have studied the impact of including these pay elements by taking the ratio of "FAS – Final" to "FAS – Base". Members covered under CalPEPRA plans are not eligible to receive leave cashouts.

The current and recommended additional cashout assumptions are provided in the following table:

Membership	Final One Year Salary			Final Three Year Salary		
	Current Assumption	Actual Rate	Proposed Assumption	Current Assumption	Actual Rate	Proposed Assumption
General Members	3.00%	2.43%	3.00%	2.80%	2.90%	2.90%
Safety Probation	3.80%	4.32%	3.80%	3.40%	3.40%	3.40%
Safety Law Enforcement	5.20%	N/A	N/A	4.60%	6.88%	6.90%
Safety Fire	2.00%	N/A	N/A	1.70%	1.49%	1.50%

Note that the Safety Law Enforcement and Safety Fire Tiers 1 no longer have any active members.

Based on the above experience, we recommend revising some of the proposed cashout assumptions for the Final Three Year Salary tiers. The Safety Law Enforcement cashout load is increased by 50% as supported by the experience shown above and consistent with changes in MOUs that allow for maximum vacation and annual leave cashouts in a given year to increase from 40 hours to 120 hours effective September 16, 2016.

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[45] Per OCERS, this is calculated by the System using base earnable salary plus those reported pensionable pay items (regularly included in the annual actuarial valuation) based on the highest system-calculated FAS period.
[46] Per OCERS, this is equal to "FAS – Base" plus all eligible pensionable pay items that had not been formerly transmitted to OCERS from the employer.

In determining the assumptions for the cashouts, we have asked OCERS for directions on whether or not the recent California Supreme Court decision on compensation earnable is expected to have an impact on the pay elements that we have used in the analysis of the above assumptions. We were informed that in OCERS' opinion that decision does not apply to leave cash outs for Legacy members.

V. Cost Impact

We have estimated the impact of all the recommended demographic and economic assumptions as if they were applied to the December 31, 2019 actuarial valuation. The table below shows the changes in the employer and member contribution rates due to the proposed assumption changes separately for the recommended economic assumption changes (as recommended in Section III of this report which include the recommended merit and promotion salary increases) and the recommended demographic assumption changes (as recommended in Section IV of this report).

Cost Impact of the Recommended Assumptions
Based on December 31, 2019 Actuarial Valuation

Impact on Employer Contribution Rates	
Decrease due to changes in economic assumptions	-0.29%
Increase due to changes in demographic assumptions	0.98%
Total increase in average employer rate	0.69%
Total estimated increase in annual dollar amount ($000s)	$11,711
Impact on Member Contribution Rates	
Decrease due to changes in economic assumptions	-0.26%
Increase due to changes in demographic assumptions	0.25%
Total decrease in average member rate	-0.01%
Total estimated decrease in annual dollar amount ($000s)	$(621)
Impact on UAAL and Funded Percentage	
Increase in UAAL	$38 million
Change in Funded Percentage	From 73.17% to 73.06%

Of the various assumption changes, the most significant cost impact (rate increase) for General Rate Groups is from the change in the retirement assumptions while the most significant cost impact (rate reduction) for Safety Rate Groups is from the change in the mortality assumptions.

Assumption Change	Impact on Employer Contribution Rates	Impact on Member Contribution Rates	Impact on UAAL ($ millions)
Decrease due to changes in economic assumptions	**-0.29%**	**-0.26%**	**-106**
Increase/(decrease) due to change in mortality	-0.45%	0.11%	-97
Increase due to change in terminal pay	0.23%	0.04%	37
Increase due to change in retirement	0.96%	0.06%	171
Increase due to changes in all other demographic	0.24%	0.04%	32
Increase due to changes in demographic assumptions	**0.98%**	**0.25%**	**144**
Total increase/(decrease) due to all assumption changes	**0.69%**	**-0.01%**	**38**

Results may not add due to rounding.

Section III of this report includes a possible alternative to the recommended 2.75% retiree Cost-of-Living assumption that is consistent with prior practice relative to the recommended inflation assumption. The following table shows the estimated cost impact of adopting 2.50% retiree Cost-of-Living assumptions, together with all the other assumption changes recommended in this report.

Cost Impact of the Alternative Assumptions
Based on December 31, 2019 Actuarial Valuation
(with 2.50% Retiree Cost-of-Living Assumption)

Impact on Employer Contribution Rates	
Decrease due to changes in economic assumptions	-3.16%
Increase due to changes in demographic assumptions	0.98%
Total decrease in average employer rate	-2.18%
Total estimated decrease in annual dollar amount ($000s)	$(44,124)
Impact on Member Contribution Rates	
Decrease due to changes in economic assumptions	-0.70%
Increase due to changes in demographic assumptions	0.25%
Total decrease in average member rate	-0.45%
Total estimated decrease in annual dollar amount ($000s)	$(9,106)
Impact on UAAL and Funded Percentage	
Decrease in UAAL	$(557) million
Change in Funded Percentage	From 73.17% to 75.08%

We have also analyzed in the tables below the average employer and member contribution rate impacts for each cost group due to the recommended assumption changes as if they were applied to the December 31, 2019 actuarial valuation.

Employer Contribution Rate Increases/(Decreases) (% of Payroll) (Estimated Annual Dollar amounts in Thousands)				
	Normal Cost	UAAL	Total	Annual Amount[47]
Rate Group #1 – Plans A, B and U (non-OCTA, non-OCSD)	-0.24%	0.11%	-0.13%	$(169)
Rate Group #2 – Plans I, J, O, P, S, T, U and W (County et al.)	0.08%	1.86%	1.94%	21,258
Rate Group #3 – Plans B, G, H and U (OCSD)[48]	-0.04%	0.10%	0.06%	26
Rate Group #5 – Plans A, B and U (OCTA)	0.27%	0.79%	1.06%	1,090
Rate Group #9 – Plans M, N and U (TCA)	-0.15%	0.38%	0.23%	15
Rate Group #10 – Plans I, J, M, N and U (OCFA)	-0.05%	1.22%	1.17%	344
Rate Group #11 – Plans M and N, future service, and U (Cemetery)	0.14%	1.07%	1.21%	21
Rate Group #12 – Plans G, H, future service, and U (Law Library)	-0.14%	0.57%	0.43%	5
Rate Group #6 – Plans E, F and V (Probation)	0.42%	-3.58%	-3.16%	(2,044)
Rate Group #7 – Plans E, F, Q, R and V (Law Enforcement)	-0.09%	-1.68%	-1.77%	(4,553)
Rate Group #8 – Plans E, F, Q, R and V (OCFA)	-0.51%	-2.35%	-2.86%	(4,282)
Combined	**0.02%**	**0.67%**	**0.69%**	**$11,711**

Average Member Contribution Rate Increases/(Decreases) (% of Payroll) (Estimated Annual Dollar Amounts in Thousands)		
	Total	Annual Amount[47]
Rate Group #1 – Plans A, B and U (non-OCTA, non-OCSD)	-0.15%	$(163)
Rate Group #2 – Plans I, J, O, P, S, T, U and W (County et al.)	0.04%	140
Rate Group #3 – Plans B, G, H and U (OCSD)	0.02%	(5)
Rate Group #5 – Plans A, B and U (OCTA)	0.11%	91
Rate Group #9 – Plans M, N and U (TCA)	-0.01%	(3)
Rate Group #10 – Plans I, J, M, N and U (OCFA)	-0.02%	(18)
Rate Group #11 – Plans M and N, future service, and U (Cemetery)	-0.08%	(2)
Rate Group #12 – Plans G, H, future service, and U (Law Library)	0.13%	1
Rate Group #6 – Plans E, F and V (Probation)	-0.22%	(153)
Rate Group #7 – Plans E, F, Q, R and V (Law Enforcement)	-0.04%	(87)
Rate Group #8 – Plans E, F, Q, R and V (OCFA)	-0.27%	(422)
Combined	**-0.01%**	**$(621)**

[47] Based on December 31, 2020 projected annual payroll as determined under each set of assumptions.

[48] The UAAL for Rate Group #3 after reflecting the recommended assumptions has been partially offset by the OCSD UAAL Deferred Account of $12,057,000 as of December 31, 2019. If Rate Group #3 had not been overfunded prior to the changes in assumptions and if the OCSD UAAL Deferred Account was not available to offset the change in UAAL due to the changes in assumptions, the UAAL Contribution rate impact due to the changes in assumptions would have been 1.36% of payroll.

In addition, we have analyzed in the tables below the average employer and member contribution rate impacts for each cost group under the alternative assumptions (decreasing the retiree Cost of Living increases assumption from 2.75% to 2.50%). as if they were applied to the December 31, 2019 actuarial valuation.

Employer Contribution Rate Increases/(Decreases) (% of Payroll) (Estimated Annual Dollar amounts in Thousands)				
	Normal Cost	UAAL	Total	Annual Amount[49]
Rate Group #1 – Plans A, B and U (non-OCTA, non-OCSD)	-0.53%	-0.75%	-1.28%	$(1,204)
Rate Group #2 – Plans I, J, O, P, S, T, U and W (County et al.)	-0.27%	-0.43%	-0.70%	(9,240)
Rate Group #3 – Plans B, G, H and U (OCSD)[50]	-0.39%	0.00%	-0.39%	(313)
Rate Group #5 – Plans A, B and U (OCTA)	-0.06%	-1.10%	-1.16%	(1,409)
Rate Group #9 – Plans M, N and U (TCA)[50]	-0.47%	-0.39%	-0.86%	(65)
Rate Group #10 – Plans I, J, M, N and U (OCFA)	-0.40%	-0.72%	-1.12%	(379)
Rate Group #11 – Plans M and N, future service, and U (Cemetery)	-0.16%	-0.49%	-0.65%	(11)
Rate Group #12 – Plans G, H, future service, and U (Law Library)[50]	-0.59%	-0.19%	-0.78%	(9)
Rate Group #6 – Plans E, F and V (Probation)	-0.19%	-7.09%	-7.28%	(4,636)
Rate Group #7 – Plans E, F, Q, R and V (Law Enforcement)	-0.79%	-5.76%	-6.55%	(16,976)
Rate Group #8 – Plans E, F, Q, R and V (OCFA)	-1.18%	-5.48%	-6.66%	(9,882)
Combined	**-0.41%**	**-1.77%**	**-2.18%**	**$(44,124)**

Average Member Contribution Rate Increases/(Decreases) (% of Payroll) (Estimated Annual Dollar Amounts in Thousands)		
	Total	Annual Amount[47]
Rate Group #1 – Plans A, B and U (non-OCTA, non-OCSD)	-0.44%	$(425)
Rate Group #2 – Plans I, J, O, P, S, T, U and W (County et al.)	-0.31%	(3,911)
Rate Group #3 – Plans B, G, H and U (OCSD)	-0.34%	(280)
Rate Group #5 – Plans A, B and U (OCTA)	-0.23%	(292)
Rate Group #9 – Plans M, N and U (TCA)	-0.37%	(29)
Rate Group #10 – Plans I, J, M, N and U (OCFA)	-0.39%	(135)
Rate Group #11 – Plans M and N, future service, and U (Cemetery)	-0.36%	(7)
Rate Group #12 – Plans G, H, future service, and U (Law Library)	-0.32%	(4)
Rate Group #6 – Plans E, F and V (Probation)	-0.95%	(613)
Rate Group #7 – Plans E, F, Q, R and V (Law Enforcement)	-0.77%	(1,986)
Rate Group #8 – Plans E, F, Q, R and V (OCFA)	-0.95%	(1,424)
Combined	**-0.45%**	**$(9,106)**

[49] Based on December 31, 2020 projected annual payroll as determined under each set of assumptions.

[50] These Rate Groups are fully funded under the alternative assumptions so we have incorporated a net UAAL rate of 0.00% of payroll.

✦ Segal

Appendix A: Current Actuarial Assumptions

Economic Assumptions

Net Investment Return:	7.00%, net of investment expenses and administration expenses.
Member Contribution Crediting Rate:	5.00%, compounded semi-annually.
Consumer Price Index:	Increase of 2.75% per year, retiree COLA increases due to CPI subject to a 3.0% maximum change per year.
Payroll Growth:	Inflation of 2.75% per year plus "across the board" real salary increases of 0.50% per year.
Increase in Section 7522.10 Compensation Limit:	Increase of 2.75% per year from the valuation date.

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.

Annual Rate of Compensation Increase[51]

Years of Service	Rate (%)	
	General	Safety
Less than 1	9.00	14.00
1 – 2	7.25	10.00
2 – 3	6.00	7.75
3 – 4	5.00	6.00
4 – 5	4.00	5.50
5 – 6	3.50	4.50
6 – 7	2.50	3.75
7 – 8	2.25	3.25
8 – 9	1.75	2.50
9 – 10	1.50	2.25
10 – 11	1.50	1.75
11 – 12	1.50	1.75
12 – 13	1.50	1.75
13 – 14	1.50	1.75
14 – 15	1.50	1.75
15 – 16	1.50	1.75
16 – 17	1.00	1.50
17 – 18	1.00	1.50
18 – 19	1.00	1.50
19 – 20	1.00	1.50
20 & Over	1.00	1.50

[51] In addition to the individual salary increase assumptions, we have applied an average two hours of additional salary annually for leap-year salary adjustment.

Demographic Assumptions

Mortality Rates – Healthy

- **General Members:** Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table (separate tables for males and females), projected generationally with the two-dimensional MP-2016 projection scale

- **Safety Members:** Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table (separate tables for males and females) set back four years, projected generationally with the two-dimensional MP-2016 projection scale

Mortality Rates – Disabled

- **General Members:** Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table (separate tables for males and females) set forward five years, projected generationally with the two-dimensional MP-2016 projection scale

- **Safety Members:** Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table (separate tables for males and females), projected generationally with the two-dimensional MP-2016 projection scale

Mortality Rates – Beneficiaries

- **Beneficiaries:** Beneficiaries are assumed to have the same mortality as a General Member of the opposite sex who is receiving a service (non-disability) retirement

Mortality Rates - Member Contribution Rates

- **General Members:** Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table (separate tables for males and females), projected 20 years with the two-dimensional mortality improvement scale MP-2016, weighted 40% male and 60% female

- **Safety Members:** Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table (separate tables for males and females), projected 20 years with the two-dimensional mortality improvement scale MP-2016 set back four years, weighted 80% male and 20% female

The RP-2014 mortality tables and adjustments as shown above reflect the mortality experience as of the measurement date. The generational projection is a provision for future mortality improvement.

Mortality Rates – Pre-Retirement

- **General and Safety Members:** Headcount-Weighted RP-2014 Employee Mortality Table times 80%, projected generationally with the two-dimensional MP-2016 projection scale

Age	Rate (%)	
	Male	Female
25	0.05	0.02
30	0.05	0.02
35	0.05	0.03
40	0.06	0.04
45	0.10	0.07
50	0.17	0.11
55	0.27	0.17
60	0.45	0.24
65	0.78	0.36
70	1.27	0.59

Note that generational projections beyond the base year (2014) are not reflected in the above mortality rates.

All General pre-retirement deaths are assumed to be non-service connected. For Safety, 90% of pre-retirement deaths are assumed to be non-service connected. The other 10% are assumed to be service connected.

Disability Incidence Rates

Age	Rate (%)			
	General All Other[52]	General OCTA[53]	Safety Law & Fire[54]	Safety Probation[55]
20	0.00	0.00	0.00	0.00
25	0.00	0.00	0.01	0.03
30	0.01	0.03	0.04	0.08
35	0.03	0.20	0.14	0.10
40	0.08	0.36	0.23	0.13
45	0.13	0.43	0.40	0.21
50	0.18	0.48	1.10	0.28
55	0.23	0.65	2.40	0.42
60	0.31	1.26	4.80	0.20

[52] 60% of General All Other disabilities are assumed to be service connected disabilities. The other 40% are assumed to be non-service connected.

[53] 65% of General OCTA disabilities are assumed to be service connected disabilities. The other 35% are assumed to be non-service connected.

[54] 100% of Safety Law Enforcement and Fire disabilities are assumed to be service connected disabilities.

[55] 75% of Safety Probation disabilities are assumed to be service connected disabilities. The other 25% are assumed to be non-service connected.

Termination Rates

Years of Service	Rate (%)			
	General All Other	General OCTA	Safety Law and Fire	Safety Probation
Less than 1	11.00	17.50	4.50	14.00
1 – 2	7.50	11.00	2.50	13.00
2 – 3	6.50	9.00	2.00	10.00
3 – 4	5.00	8.50	1.50	5.00
4 – 5	4.50	7.50	1.25	4.00
5 – 6	4.25	7.00	1.00	3.50
6 – 7	3.75	4.50	0.95	2.75
7 – 8	3.25	4.00	0.90	2.00
8 – 9	3.00	3.50	0.85	2.00
9 – 10	2.75	3.00	0.80	1.75
10 – 11	2.50	3.00	0.75	1.75
11 – 12	2.00	3.00	0.65	1.50
12 – 13	2.00	3.00	0.60	1.25
13 – 14	1.75	2.50	0.55	1.00
14 – 15	1.50	2.50	0.50	0.75
15 – 16	1.40	2.50	0.45	0.75
16 – 17	1.30	2.00	0.40	0.75
17 – 18	1.20	1.80	0.35	0.25
18 – 19	1.10	1.60	0.30	0.25
19 – 20	1.00	1.40	0.25	0.25
20 & Over	0.90	1.20	0.20	0.25

Proportion of Total Termination Assumed to Withdraw Contributions

Years of Service	Rate (%)			
	General All Other	General OCTA	Safety Law and Fire	Safety Probation
Less than 5	35.00	40.00	20.00	25.00
5 – 9	30.00	35.00	20.00	25.00
10 – 14	25.00	30.00	20.00	25.00
15 & over	20.00	20.00	20.00	25.00

Retirement Rates

Age	Rate (%)[56]							
	General			Safety				
	Enhanced	Non-Enhance[57]	SJC (31676.12)	Law (31664.1)[58]	Law (31664.2)[58]	Fire (31664.1)	Fire (31664.2)	Probation[58]
48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
49	30.00	25.00	0.00	12.00	0.00	2.00	0.00	0.00
50	2.50	2.00	3.00	18.00	11.50	5.00	8.00	3.25
51	2.00	2.00	3.00	18.00	12.00	7.00	10.00	3.25
52	2.50	2.00	3.00	17.00	12.70	9.50	11.00	4.25
53	2.50	2.75	3.00	17.00	17.90	10.50	12.00	4.25
54	5.50	2.75	3.00	22.00	18.80	15.00	14.00	7.00
55	15.00	3.25	4.00	22.00	30.70	18.00	24.00	12.00
56	10.00	3.50	5.00	20.00	20.00	20.00	23.00	12.00
57	10.00	5.50	6.00	20.00	20.00	21.00	27.00	18.00
58	11.00	5.50	7.00	20.00	25.00	28.00	27.00	18.00
59	11.00	6.50	9.00	26.00	30.00	28.00	36.00	18.00
60	12.00	9.25	11.00	35.00	40.00	30.00	40.00	20.00
61	12.00	12.00	13.00	35.00	40.00	30.00	40.00	20.00
62	14.00	16.00	15.00	40.00	40.00	35.00	40.00	25.00
63	16.00	16.00	15.00	40.00	40.00	35.00	40.00	40.00
64	16.00	18.00	20.00	40.00	40.00	35.00	40.00	40.00
65	22.00	22.00	20.00	100.00	100.00	100.00	100.00	100.00
66	22.00	28.00	24.00	100.00	100.00	100.00	100.00	100.00
67	23.00	24.00	24.00	100.00	100.00	100.00	100.00	100.00
68	23.00	24.00	24.00	100.00	100.00	100.00	100.00	100.00
69	23.00	20.00	24.00	100.00	100.00	100.00	100.00	100.00
70	25.00	20.00	50.00	100.00	100.00	100.00	100.00	100.00
71	25.00	25.00	50.00	100.00	100.00	100.00	100.00	100.00
72	25.00	25.00	50.00	100.00	100.00	100.00	100.00	100.00
73	25.00	25.00	50.00	100.00	100.00	100.00	100.00	100.00
74	25.00	25.00	50.00	100.00	100.00	100.00	100.00	100.00
75	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

[56] The retirement rates only apply to members that are eligible to retire at the age shown.
[57] These assumptions are also used for the CalPEPRA 1.62% @ 65 formula (Plan T and Plan W).
[58] Retirement rate is 100% after a member accrues a benefit of 100% of final average earnings.

Retirement Rates (continued)

	Rate (%)[59]			
	General	Safety		
Age	CalPEPRA 2.5% @ 67	CalPEPRA Probation Formula[60]	CalPEPRA Law Formula[60]	CalPEPRA Fire Formula
50	0.00	2.50	11.00	6.00
51	0.00	2.50	11.50	7.00
52	4.00	3.00	12.00	9.00
53	1.50	3.00	16.00	10.00
54	1.50	5.50	17.00	11.50
55	2.50	10.00	28.00	21.00
56	3.50	10.00	18.00	20.00
57	5.50	15.00	17.50	22.00
58	7.50	20.00	22.00	25.00
59	7.50	20.00	26.00	30.00
60	7.50	40.00	40.00	40.00
61	7.50	40.00	40.00	40.00
62	14.00	40.00	40.00	40.00
63	14.00	40.00	40.00	40.00
64	14.00	40.00	40.00	40.00
65	18.00	100.00	100.00	100.00
66	22.00	100.00	100.00	100.00
67	23.00	100.00	100.00	100.00
68	23.00	100.00	100.00	100.00
69	23.00	100.00	100.00	100.00
70	25.00	100.00	100.00	100.00
71	25.00	100.00	100.00	100.00
72	25.00	100.00	100.00	100.00
73	25.00	100.00	100.00	100.00
74	25.00	100.00	100.00	100.00
75	100.00	100.00	100.00	100.00

[59] The retirement rates only apply to members that are eligible to retire at the age shown.
[60] Retirement rate is 100% after a member accrues a benefit of 100% of final average earnings

Retirement Age and Benefit for Deferred Vested Members	General Retirement Age: 59 Safety Retirement Age: 53 Future deferred vested members who terminate with less than five years of service and are not vested are assumed to retire at age 70 for both General and Safety if they decide to leave their contributions on deposit. 15% of future General and 25% of future Safety deferred vested members are assumed to continue to work for a reciprocal employer. For reciprocals, 4.25% and 4.75% compensation increases are assumed per annum for General and Safety, respectively.
Liability Calculation for Current Deferred Vested Members	Liability for a current deferred vested member is calculated based on salary (adjusted with the additional cashout assumptions for non-CalPEPRA members), service, and eligibility for reciprocal benefit as provided by the Retirement System. For those members without salary information that have 3 or more years of service, we used an average salary. For those members without salary information that have less than 3 years of service or for those members without service information, we assumed a refund of account balance.
Future Benefit Accruals	1.0 year of service per year of employment. There is no assumption to anticipate conversion of unused sick leave at retirement.
Unknown Data for Members	Same as those exhibited by members with similar known characteristics. If not specified, members are assumed to be male.
Definition of Active Member	All active members of OCERS as of the valuation date.
Form of Payment	All active and inactive members are assumed to elect the unmodified option at retirement.
Percent Married	For all active and inactive members, 75% of male members and 55% of female members are assumed to be married at pre-retirement death or retirement.
Age and Gender of Spouse	For all active and inactive members, male members are assumed to have a female spouse who is 3 years younger than the member and female members are assumed to have a male spouse who is 3 years older than the member.
Additional Cashout Assumptions	**Non-CalPEPRA Formulas** Additional compensation amounts are expected to be received during a member's final average earnings period. The percentages used in this valuation are:

	Final One Year Salary	Final Three Year Salary
General Members	3.00%	2.80%
Safety Probation	3.80%	3.40%
Safety Law Enforcement	5.20%	4.60%
Safety Fire	2.00%	1.70%

The additional terminal pay assumptions are the same for service and disability retirements.

CalPEPRA Formulas
- None

Appendix B: Proposed Actuarial Assumptions

Economic Assumptions

Net Investment Return:	7.00%, net of investment expenses and administration expenses.
Member Contribution Crediting Rate:	5.00%, compounded semi-annually.
Consumer Price Index:	Increase of 2.50% per year, retiree COLA increases of 2.75% per year under recommended assumption and 2.50% per year under alternative assumption.
Payroll Growth:	Inflation of 2.50% per year plus "across the board" real salary increases of 0.50% per year.
Increase in Section 7522.10 Compensation Limit:	Increase of 2.50% per year from the valuation date.

Salary Increases

Inflation: 2.50% per year; plus "across the board" real salary increases of 0.50% per year; plus the following merit and promotion increases.

Annual Rate of Compensation Increase[1]

Years of Service	Rate (%)	
	General	Safety
Less than 1	8.00	12.00
1 – 2	7.25	10.00
2 – 3	6.25	8.50
3 – 4	5.25	7.50
4 – 5	4.25	6.50
5 – 6	3.50	5.50
6 – 7	2.75	5.00
7 – 8	2.50	4.00
8 – 9	1.70	3.00
9 – 10	1.70	2.50
10 – 11	1.60	1.85
11 – 12	1.60	1.85
12 – 13	1.50	1.85
13 – 14	1.50	1.85
14 – 15	1.25	1.85
15 – 16	1.25	1.60
16 – 17	1.00	1.60
17 – 18	1.00	1.60
18 – 19	1.00	1.60
19 – 20	1.00	1.60
20 & Over	1.00	1.60

[1] In addition to the individual salary increase assumptions, we have applied an average two hours of additional salary annually for leap-year salary adjustment.

Demographic Assumptions

Mortality Rates – Healthy

- **General Members:** Pub-2010 General Healthy Retiree Amount-Weighted Above-Median Mortality Table (separate tables for males and females) with rates increased by 5%, projected generationally with the two-dimensional mortality improvement scale MP-2019

- **Safety Members:** Pub-2010 Safety Healthy Retiree Amount-Weighted Above-Median Mortality Table (separate tables for males and females), projected generationally with the two-dimensional mortality improvement scale MP-2019

Mortality Rates – Disabled

- **General Members:** 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-2019

- **Safety Members:** Pub-2010 Safety Disabled Retiree Amount-Weighted Mortality Table (separate tables for males and females), projected generationally with the two-dimensional mortality improvement scale MP-2019

Mortality Rates – Beneficiaries

- **Beneficiaries:** Pub-2010 General Contingent Survivor Amount-Weighted Above-Median Mortality Table (separate tables for males and females) with rates increased by 5%, projected generationally with the two-dimensional mortality improvement scale MP-2019

Mortality Rates - Member Contribution Rates

- **General Members:** Pub-2010 General Healthy Retiree Amount-Weighted Above-Median 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-2019, weighted 40% male and 60% female

- **Safety Members:** Pub-2010 Safety Healthy Retiree Amount-Weighted Above-Median Mortality Table (separate tables for males and females), projected 30 years (from 2010) with the two-dimensional mortality improvement scale MP-2019, weighted 80% male and 20% female

Mortality Rates – Pre-Retirement

- **General Members:** Pub-2010 General Employee Amount-Weighted Above-Median Mortality Table (separate tables for males and females), projected generationally with the two-dimensional mortality improvement scale MP-2019

- **Safety Members:** Pub-2010 Safety Employee Amount-Weighted Above-Median Mortality Table (separate tables for males and females), projected generationally with the two-dimensional mortality improvement scale MP-2019

	Rate (%)			
	General		**Safety**	
Age	**Male**	**Female**	**Male**	**Female**
25	0.02	0.01	0.03	0.02
30	0.03	0.01	0.04	0.02
35	0.04	0.02	0.04	0.03
40	0.06	0.03	0.05	0.04
45	0.09	0.05	0.07	0.06
50	0.13	0.08	0.10	0.08
55	0.19	0.11	0.15	0.11
60	0.28	0.17	0.23	0.14
65	0.41	0.27	0.35	0.20
70	0.61	0.44	0.66	0.39

All General pre-retirement deaths are assumed to be non-service connected. For Safety, 90% of pre-retirement deaths are assumed to be non-service connected. The other 10% are assumed to be service connected. Note that generational projections beyond the base year (2010) are not reflected in the above mortality rates.

Disability Incidence Rates

Age	Rate (%)			
	General All Other[1]	General OCTA[2]	Safety Law & Fire[3]	Safety Probation[4]
20	0.00	0.00	0.00	0.00
25	0.00	0.00	0.01	0.03
30	0.01	0.03	0.07	0.08
35	0.03	0.20	0.19	0.10
40	0.08	0.39	0.31	0.13
45	0.14	0.48	0.44	0.21
50	0.20	0.53	1.10	0.28
55	0.27	0.70	2.70	0.42
60	0.33	1.22	5.00	0.20

[1] 65% of General All Other disabilities are assumed to be service connected disabilities. The other 35% are assumed to be non-service connected.

[2] 80% of General OCTA disabilities are assumed to be service connected disabilities. The other 20% are assumed to be non-service connected.

[3] 100% of Safety Law Enforcement and Fire disabilities are assumed to be service connected disabilities.

[4] 75% of Safety Probation disabilities are assumed to be service connected disabilities. The other 25% are assumed to be non-service connected.

Termination Rates

Years of Service	General All Other	General OCTA	Safety Law and Fire	Safety Probation
Less than 1	11.00	17.00	4.25	14.00
1 – 2	7.25	11.50	2.75	13.00
2 – 3	6.50	9.00	2.25	11.00
3 – 4	5.50	8.50	1.75	5.00
4 – 5	5.00	8.00	1.50	4.00
5 – 6	4.50	7.00	1.25	3.25
6 – 7	4.00	4.25	1.00	2.75
7 – 8	3.50	4.00	0.95	2.75
8 – 9	3.25	3.25	0.90	2.50
9 – 10	3.00	3.00	0.85	1.75
10 – 11	2.50	2.75	0.80	1.50
11 – 12	2.00	2.50	0.75	1.50
12 – 13	2.00	2.50	0.70	1.25
13 – 14	2.00	2.25	0.65	1.00
14 – 15	1.50	2.25	0.60	0.75
15 – 16	1.40	2.25	0.55	0.75
16 – 17	1.30	2.00	0.50	0.75
17 – 18	1.20	1.80	0.45	0.75
18 – 19	1.10	1.60	0.40	0.50
19 – 20	1.00	1.40	0.30	0.25
20 & Over	0.75	1.20	0.15	0.15

(Table header: Rate (%))

Proportion of Total Termination Assumed to Withdraw Contributions

Years of Service	Rate (%)			
	General All Other	General OCTA	Safety Law and Fire	Safety Probation
Less than 5	30.00	40.00	20.00	25.00
5 – 9	25.00	30.00	20.00	25.00
10 – 14	25.00	25.00	10.00	25.00
15 & over	17.50	15.00	10.00	15.00

Retirement Rates

| Age | Enhanced | | Non-Enhanced[1] | | SJC (31676.12) |
	< 30 Years of Service	> 30 Years of Service	< 30 Years of Service	> 30 Years of Service	All Years of Service
49	0.00	30.00	0.00	25.00	0.00
50	2.00	4.00	3.00	3.00	4.00
51	2.00	4.00	3.00	3.00	4.00
52	2.50	5.00	2.00	2.00	4.00
53	2.50	5.00	3.50	3.50	4.00
54	7.00	14.00	2.75	2.75	4.00
55	12.00	30.00	3.25	3.25	4.00
56	9.00	19.00	3.50	3.50	5.00
57	9.00	18.00	5.00	5.00	6.00
58	9.00	18.00	5.50	5.50	7.00
59	10.00	20.00	6.50	6.50	9.00
60	11.00	20.00	9.00	13.50	10.00
61	11.00	20.00	9.00	13.50	12.00
62	13.00	20.00	9.00	18.00	13.00
63	13.00	22.00	9.50	19.00	13.00
64	16.00	24.00	10.00	20.00	19.00
65	24.00	28.00	22.00	26.40	20.00
66	24.00	30.00	25.00	30.00	25.00
67	24.00	30.00	25.00	30.00	25.00
68	22.00	27.50	30.00	27.50	25.00
69	22.00	27.50	30.00	27.50	25.00
70	25.00	27.50	20.00	27.50	45.00
71	25.00	27.50	20.00	27.50	45.00
72	25.00	27.50	20.00	27.50	45.00
73	20.00	27.50	20.00	27.50	45.00
74	20.00	27.50	20.00	27.50	45.00
75	100.00	100.00	100.00	100.00	100.00

[1] These assumptions are also used for the CalPEPRA 1.62% @ 65 formula (Plan T and Plan W).

Retirement Rates (continued)

	Rate (%)							
	Law (31664.1)		Law (31664.2)	Fire (31664.1)		Fire (31664.2)	Probation (31664.1)	
Age	< 30 Years of Service	> 30 Years of Service	All Years of Service	< 30 Years of Service	> 30 Years of Service	All Years of Service	< 30 Years of Service	> 30 Years of Service
45	1.00	16.00	0.00	2.00	10.00	0.00	3.00	5.00
46	1.00	16.00	0.00	2.00	10.00	0.00	3.00	5.00
47	1.00	16.00	0.00	2.00	10.00	0.00	3.00	5.00
48	1.00	16.00	0.00	2.00	10.00	0.00	3.00	5.00
49	11.00	16.00	0.00	2.00	10.00	0.00	3.00	5.00
50	16.00	16.00	11.50	4.00	10.00	8.00	9.00	12.00
51	16.00	16.00	12.00	4.00	10.00	9.00	7.00	10.00
52	17.00	16.00	12.70	4.00	10.00	10.00	5.00	9.00
53	19.00	30.00	17.90	9.00	20.00	12.00	7.00	9.00
54	24.00	30.00	18.80	12.00	25.00	14.00	7.00	12.00
55	24.00	30.00	35.00	12.00	25.00	23.00	12.00	30.00
56	22.00	30.00	25.00	12.00	25.00	22.00	18.00	30.00
57	22.00	30.00	25.00	18.00	25.00	25.00	25.00	30.00
58	22.00	40.00	25.00	18.00	30.00	25.00	25.00	30.00
59	22.00	40.00	30.00	18.00	30.00	35.00	18.00	30.00
60	30.00	40.00	40.00	18.00	30.00	40.00	20.00	40.00
61	30.00	40.00	40.00	18.00	30.00	40.00	20.00	40.00
62	30.00	40.00	40.00	18.00	35.00	40.00	20.00	40.00
63	30.00	40.00	40.00	18.00	35.00	40.00	20.00	40.00
64	30.00	40.00	40.00	18.00	35.00	40.00	20.00	40.00
65	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Retirement Rates (continued)

	Rate (%)			
	General	Safety		
Age	CalPEPRA 2.5% @ 67	CalPEPRA Probation Formula	CalPEPRA Law Formula	CalPEPRA Fire Formula
50	0.00	3.00	11.00	6.00
51	0.00	3.00	11.50	6.50
52	6.00	3.50	12.00	8.00
53	2.00	3.50	16.00	10.00
54	2.00	6.00	17.00	11.50
55	2.50	12.00	29.00	20.00
56	3.50	12.00	19.00	19.00
57	5.50	15.00	19.00	21.00
58	7.50	25.00	23.00	24.00
59	7.50	25.00	26.00	30.00
60	7.50	40.00	40.00	40.00
61	7.50	40.00	40.00	40.00
62	14.00	40.00	40.00	40.00
63	14.00	40.00	40.00	40.00
64	14.00	40.00	40.00	40.00
65	20.00	100.00	100.00	100.00
66	22.00	100.00	100.00	100.00
67	23.00	100.00	100.00	100.00
68	23.00	100.00	100.00	100.00
69	23.00	100.00	100.00	100.00
70	25.00	100.00	100.00	100.00
71	25.00	100.00	100.00	100.00
72	25.00	100.00	100.00	100.00
73	25.00	100.00	100.00	100.00
74	25.00	100.00	100.00	100.00
75	100.00	100.00	100.00	100.00

Retirement Age and Benefit for Deferred Vested Members	General Retirement Age: 59 Safety Retirement Age: 54 Future deferred vested members who terminate with less than five years of service and are not vested are assumed to retire at age 70 for both General and Safety if they decide to leave their contributions on deposit. 15% of future General and 20% of future Safety deferred vested members are assumed to continue to work for a reciprocal employer. For reciprocals, 4.00% and 4.60% compensation increases are assumed per annum for General and Safety, respectively.
Liability Calculation for Current Deferred Vested Members	Liability for a current deferred vested member is calculated based on salary (adjusted with the additional cashout assumptions for non-CalPEPRA members), service, and eligibility for reciprocal benefit as provided by the Retirement System. For those members without salary information that have 3 or more years of service, we used an average salary. For those members without salary information that have less than 3 years of service or for those members without service information, we assumed a refund of account balance.
Future Benefit Accruals	1.0 year of service per year of employment. There is no assumption to anticipate conversion of unused sick leave at retirement.
Unknown Data for Members	Same as those exhibited by members with similar known characteristics. If not specified, members are assumed to be male.
Definition of Active Member	All active members of OCERS as of the valuation date.
Form of Payment	All active and inactive members are assumed to elect the unmodified option at retirement.
Percent Married	For all active and inactive members, 75% of male members and 55% of female members are assumed to be married at pre-retirement death or retirement.
Age of Spouse	For all active and inactive members, male members are assumed to have a female spouse who is 3 years younger than the member and female members are assumed to have a male spouse who is 2 years older than the member.
Additional Cashout Assumptions	**Non-CalPEPRA Formulas** Additional compensation amounts are expected to be received during a member's final average earnings period. The percentages used in this valuation are:

	Final One Year Salary	Final Three Year Salary
General Members	3.00%	2.90%
Safety Probation	3.80%	3.40%
Safety Law Enforcement	N/A	6.90%
Safety Fire	N/A	1.50%

The additional cashout assumptions are the same for service and disability retirements.

CalPEPRA Formulas

- None