



Los Angeles City Employees'  
Retirement System

# Actuarial Experience Study

**Analysis of Actuarial Experience  
During the Period**

**July 1, 2016 through June 30, 2019**

June 17, 2020

Board of Administration  
Los Angeles City Employees' Retirement System  
202 W. First Street, Suite 500  
Los Angeles, CA 90012-4401

**Re: Review of Actuarial Assumptions for the June 30, 2020 Actuarial Valuation**

Dear Members of the Board:

We are pleased to submit this report of our review of the actuarial experience for the Los Angeles City Employees' Retirement System. This study utilizes the census data for the period July 1, 2016 to June 30, 2019 and provides the proposed actuarial assumptions, both economic and demographic, to be used in the June 30, 2020 valuation.

Please note that our recommended assumptions unique to the health program (e.g., health care trend assumption) will be provided in a separate letter later this year.

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.

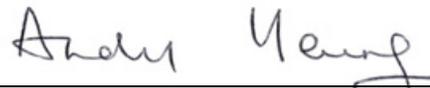
We look forward to reviewing this report with you and answering any questions you may have.

Sincerely,



---

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



---

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

ST/jl

# Table of Contents

I. Introduction, Summary, and Recommendations.....	4
II. Background and Methodology.....	8
Economic Assumptions .....	8
Demographic Assumptions .....	8
III. Economic Assumptions .....	10
A. Inflation .....	10
Crediting Rate for Employee Contributions .....	11
Retiree Cost-of-Living Increases .....	11
B. Investment Return .....	13
Real Rate of Investment Return .....	13
System Expenses .....	16
Risk Adjustment.....	17
Recommended Investment Return Assumption .....	20
Comparison with Alternative Model used to Review Investment Return Assumption.....	21
Comparison with Other Public Retirement Systems .....	21
C. Salary Increase .....	23
Active Member Payroll .....	26
IV. Demographic Assumptions .....	27
A. Retirement Rates .....	27
Tier 1 .....	28
Tier 1 Enhanced .....	29
Tier 3 .....	30
Deferred Vested Members .....	31
Reciprocity .....	31
Survivor Continuance under Unmodified Option .....	32
B. Mortality Rates - Healthy .....	36
C. Mortality Rates - Disabled .....	43
D. Termination Rates.....	46
E. Disability Incidence Rates .....	50
V. Cost Impact .....	52
Appendix A: Current Actuarial Assumptions.....	54
Appendix B: Proposed Actuarial Assumptions .....	61

# 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.<sup>1</sup> Changing assumptions reflects a basic change in thinking about the future, and it 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 July 1, 2016 through June 30, 2019. Note that our contract with the Board states that Segal will "Perform one actuarial experience study for the period of July 1, 2017 through June 30, 2019, to be conducted in 2020..." However, in our November 11, 2019 e-mail to LACERS, we asked the System to consider if we can extend that two-year period to include a third year (i.e., July 1, 2016 through June 30, 2017) that was already utilized in the prior study in order to include more actual experience herein. LACERS responded on November 14, 2019, directing Segal to base the experience study on the most recent three years of data (i.e., July 1, 2016 – June 30, 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

<sup>1</sup> An analysis of the ongoing impact of the COVID-19 pandemic is beyond the scope of the current experience study.

and expected future experience, we are recommending various changes in the current actuarial assumptions.

We are recommending changes in the assumptions for inflation, investment return, crediting rate for employee contributions, cost-of-living adjustments (COLA), merit and promotion salary increases, retirement from active employment, percentage of members with an eligible spouse or domestic partner, reciprocal salary increases, pre-retirement mortality, healthy life post-retirement mortality, beneficiary mortality, disabled life post-retirement mortality, termination, and disability incidence.

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

Pg #	Actuarial Assumption Categories	Recommendation
10	<p><b>Inflation:</b> Future increases in the Consumer Price Index (CPI), which drives investment returns and active member salary increases.</p> <p><b>Crediting Rate for Employee Contributions:</b> Future increases in the account balance of a member between the date of the valuation and the date of separation from active service.</p>	<p>Reduce the inflation assumption from 3.00% to 2.75% per annum as discussed in Section (III)(A).</p> <p>Reduce the interest crediting rate for employee contributions from 3.00% to 2.75% per annum as described in Section (III)(A).</p>
13	<p><b>Investment Return:</b> The estimated average net rate of return on current and future assets of the System as of the valuation date. This rate is used to discount liabilities.</p>	<p>Reduce the current investment return assumption from 7.25% to 7.00% per annum as discussed in Section (III)(B).</p>
23	<p><b>Individual Salary Increases:</b> 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:</p> <ul style="list-style-type: none"> <li>• Inflationary salary increases</li> <li>• Real “across the board” salary increases</li> <li>• Merit and promotion increases</li> </ul>	<p>Reduce the current inflationary salary increase assumption from 3.00% to 2.75% 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 3.50% to 3.25% per annum.</p> <p>We recommend adjusting the merit and promotion rates of salary increase as developed in Section (III)(C) to reflect past experience. Proposed merit and promotion salary increases are higher in all service categories.</p> <p>The recommended salary increases (taking into account all three components) anticipate higher salary increases overall.</p>
27	<p><b>Retirement Rates:</b> The probability of retirement at each age at which participants are eligible to retire.</p> <p><b>Other Retirement Related Assumptions including:</b></p> <ul style="list-style-type: none"> <li>• Retirement age for deferred vested members</li> <li>• Percent married/domestic partner and spousal age differences for members not yet retired</li> <li>• Future reciprocal members and reciprocal salary increases</li> </ul>	<p>Adjust the retirement rates to those developed in Section (IV)(A) to anticipate more retirements overall.</p> <p>Maintain the retirement age for deferred vested members of 59.</p> <p>For active and inactive members, maintain the percent married/domestic partner at retirement assumption for males at 76% and increase the assumption from 50% to 52% for females. For active and inactive members, maintain the assumption that male members are 3 years older than their female spouses and that female members are 2 years younger than their male spouses.</p> <p>For future deferred vested members, maintain the percent assumed to work at a reciprocal system at 5%. For all reciprocal members, increase the compensation increase assumption from 3.90% to 4.25% per annum.</p>



We have estimated the impact of all the recommended economic and demographic assumptions as if they were applied to the June 30, 2019 actuarial valuations. The table below shows the changes in the employer contribution rates due to the proposed assumption changes separately for the recommended inflation and investment return assumption changes (as recommended in Section III of this report) and all other recommended demographic assumption changes (the remaining economic assumptions recommended in Section III as well as the demographic changes recommended in Section IV of this report).

### Cost Impact of the Recommended Assumptions Based on June 30, 2019 Actuarial Valuations

Impact on Employer Contribution Rate	Retirement Plan	Health Plan	Total
Increase due to inflation & investment return assumptions	0.42%	0.61%	1.03%
Increase due to all other assumptions	2.99%	0.07%	3.06%
Total increase in average employer rate	3.41%	0.68%	4.09%

Of the economic assumption changes, the most significant cost impact is from the change in the investment return assumption from 7.25% to 7.00%. However, that increase in cost from the investment return assumption for the Retirement Plan is largely offset by the decrease in cost from the change in the inflation assumption from 3.00% to 2.75%. Of the remaining assumption changes for the Retirement Plan, about two thirds (2.10%) of the cost impact is from the change in the merit and promotional salary increase assumption, and about one sixth (0.50%) of the cost impact is from the change in the mortality assumption.

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, and reciprocal salary increases.

### 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 members 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 terminated during the year, we would say the probability of termination in that age group is  $50 \div 500$  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 of death 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<sup>2</sup>  
(U.S. City Average - All Urban Consumers)

	25 <sup>th</sup> Percentile	Median	75 <sup>th</sup> 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 period over the past two decades. Also, the later 15-year averages during the period are lower as 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 Association 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%.<sup>3</sup> In California, CalSTRS, Los Angeles 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%. CalPERS has lowered their inflation assumption from 2.75% to 2.50% over a three-year period.

LACERS’ investment consultant, New England Pension Consultants (NEPC), anticipates an annual inflation rate of 2.75%, while the average inflation assumption provided by NEPC and six other investment advisory firms retained by Segal’s California public sector clients was 2.36%. 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.<sup>4</sup>

<sup>2</sup> 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).

<sup>3</sup> Among 188 large public retirement funds, the inflation assumption was not available for 14 of the public retirement funds in the survey data.

<sup>4</sup> The time horizon used by the seven investment consultants in our review generally ranges from 10 years to 30 years and NEPC uses 30 years.

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.<sup>5</sup> 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%. This 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.<sup>6</sup> As of April 2020, the difference in yields is about 1.39% which provides a measure of market expectations of inflation.

**Based on all of the above information, we recommend that the current 3.00% annual inflation assumption be reduced to 2.75% for the June 30, 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 these metrics, since 2018 we have been recommending the same 2.75% inflation assumption in our experience for our California based public retirement system clients. We will continue to review this assumption in future experience studies.

## Crediting Rate for Employee Contributions

We note that the interest crediting rate for employee contributions is based on the average rates of a five-year U.S. Treasury Note. Currently, an assumption of 3.00% is used to approximate that crediting rate, and the 3.00% crediting rate assumption is tied to the current inflation assumption.

**In conjunction with our recommendation to lower the current 3.00% annual inflation assumption to 2.75% for the June 30, 2020 valuation, as discussed above, and assuming the Board wishes to maintain the linkage between the two, we would also recommend that the assumed interest crediting rate for employee contributions be lowered from 3.00% to 2.75%.**

## Retiree Cost-of-Living Increases

In our last experience study as of June 30, 2017, consistent with the 3.00% annual inflation assumption adopted by the Board, the Board maintained the 3.00% retiree cost-of-living adjustment for Tier 1 and a 2.00% retiree cost-of-living adjustment for Tier 3.

**Consistent with our recommended inflation assumption, we also recommend reducing the current assumption to value the post-retirement COLA benefit from 3.00% to 2.75% per year for Tier 1,<sup>7</sup> while maintaining the current assumption of 2.00% per year for Tier 3.**

<sup>5</sup> 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

<sup>6</sup> Source: Board of Governors of the Federal Reserve Association.

<sup>7</sup> For current retirees and beneficiaries, we would utilize the accumulated COLA banks to value annual 3.00% COLA increases to Tier 1 members as long as the COLA banks are available.

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 (applicable to Tier 1 only) 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 of 2.75% 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, we continue to recommend setting the COLA assumptions consistent with the long-term annual inflation assumption, as we have 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 following is the System's current target asset allocation and the assumed real rate of return assumptions by asset class. The first column of real rate of return assumptions are determined by reducing NEPC's total or "nominal" 2019 return assumptions by their assumed 2.75% inflation rate. The second column of returns (except for Emerging International Small Cap Equity, Emerging Market Debt (Local), Non-Core Real Estate, Private Equity, Private Credit/Debt, and REITS) 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 NEPC 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.

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

Asset Class	Percentage of Portfolio	NEPC's Assumed Real Rate of Return <sup>8</sup>	Average Assumed Real Rate of Return from a Sample of Consultants to Segal's California Public Sector Clients <sup>9</sup>
Large Cap U.S. Equity	15.01%	5.94%	5.54%
Small/Mid Cap U.S. Equity	3.99%	6.72%	6.25%
Developed Int'l Large Cap Equity	17.01%	6.81%	6.61%
Developed Int'l Small Cap Equity	2.97%	7.31%	6.90%
Emerging Int'l Large Cap Equity	5.67%	9.72%	8.74%
Emerging Int'l Small Cap Equity	1.35%	10.63%	10.63% <sup>10</sup>
Core Bonds	13.75%	1.79%	1.19%
High Yield Bonds	2.00%	4.45%	3.14%
Bank Loans	2.00%	3.12%	3.70%
TIPS	4.00%	1.45%	0.86%
Emerging Market Debt (External)	2.25%	4.26%	3.55%
Emerging Market Debt (Local)	2.25%	4.75%	4.75% <sup>10</sup>
Core Real Estate	4.20%	4.26%	4.60%
Non-Core Real Estate	2.80%	5.76%	5.76% <sup>10</sup>
Cash	1.00%	0.25%	0.03%
Commodities	1.00%	4.34%	3.33%
Private Equity	14.00%	10.81%	8.97% <sup>10</sup>
Private Credit/Debt	3.75%	6.00%	6.00% <sup>10</sup>
REITS	1.00%	5.98%	5.98% <sup>10</sup>
<b>Total</b>	<b>100.00%</b>	<b>6.07%</b>	<b>5.50%</b>

<sup>8</sup> Derived by reducing NEPC's nominal rate of return assumptions by their assumed 2.75% inflation rate. These returns are net of active management fees.

<sup>9</sup> These are based on the projected arithmetic returns provided by NEPC and six other investment advisory firms serving the city retirement system of Los Angeles and 16 other city and county retirement systems in California. These return assumptions are gross of any applicable investment expenses, except for NEPC's returns as noted in the footnote above.

<sup>10</sup> For these asset classes, NEPC'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 NEPC's assumption should more closely reflect the underlying investments made specifically for LACERS.

It is our understanding that between 2018 and 2019 NEPC changed their capital market assumptions methodology for the Private Equity asset class. Below is a comparison of NEPC's assumptions from 2018 and 2019 for that asset class:

Asset Class	Percentage of Portfolio	NEPC's Assumed Real Rate of Return
<b>2018 NEPC Assumption Provided for 2018 Experience Study</b>		
Private Equity	14.00%	8.97%
<b>2019 NEPC Assumption Provided for 2020 Experience Study</b>		
Private Equity	14.00%	10.81%

Even though the allocation to this asset class did not change, the change in NEPC's capital market assumptions for this single asset class between the two years would lead to a 0.26% increase in the assumed total portfolio real rate of return. As discussed later in this section, in this study we have used the 2018 assumption of 8.97% for Private Equity in developing the real rate of return component of the recommended investment return assumption.

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.”

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 rates of return 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. As we note in footnote (10) above, as used in the prior experience study NEPC’s assumed real rate of return assumption for the Private Equity asset class was 8.97% for 2018. This assumption has increased to 10.81% for 2019, as shown above. Since LACERS’ target allocation includes 14.00% allocated to the Private Equity class, this increase in this single NEPC capital market assumption would lead to a 0.26% increase in the total portfolio assumed real rate of return.

The two primary reasons Segal uses the survey approach in developing the real rate of return assumption for the more common asset classes are (1) to avoid any over weighted influence of one investment consultant’s capital market assumptions on the real rate of return component of the investment return assumption and (2) to reduce the volatility in the return assumptions for each asset class. Consistent with those reasons, we have continued to use NEPC’s 2018 Private Equity capital market assumption of 8.97% in developing the real return component of our recommended investment return assumption. As will be discussed further in the development of the risk adjustment component of the investment return assumption, this allows for a more consistent measure of confidence level in Segal’s risk adjustment model. If the Private Equity asset class does show higher returns than previously assumed, any such superior returns will be recognized as they materialize in future annual actuarial valuations.

4. Therefore, we recommend that the 5.50% portfolio real rate of return developed above be used to determine the System’s investment return assumption. This is 0.13% higher than the return that was used two years ago in the review of the recommended investment return assumption for the June 30, 2018 valuation. The difference is due to changes in the System’s target asset allocation (+0.07%) and changes in the other real rate of return assumptions provided to us by the investment advisory firms (+0.06%).

## System Expenses

For funding purposes, the real rate of return assumption for the portfolio needs to be adjusted for administrative and investment expenses expected to be paid from investment income. We understand that NEPC capital market assumptions for Private Equity are net of active management fees. Accordingly, we have netted out the Private Equity management fees and expenses in evaluating the expense component of the investment return assumption.

On a net of active management fees basis, the following table provides the administrative and investment expenses in relation to the actuarial value of assets for the five-year period ending June 30, 2019.

### Administrative and Investment Expenses as a Percentage of Actuarial Value of Assets Net of Active Management Fees (Dollars in 000's)

Year Ending June 30	Actuarial Value of Assets <sup>11</sup>	Administrative Expenses <sup>12</sup>	Investment Expenses <sup>13</sup>	Administrative %	Investment %	Total %
2015	\$13,895,589	\$19,878	\$42,278	0.14%	0.30%	0.44%
2016	14,752,103	19,727	39,926	0.13	0.27	0.40
2017	15,686,973	20,244	40,006	0.13	0.26	0.39
2018	16,687,908	20,778	43,292	0.12	0.26	0.38
2019	17,711,462	22,905	45,306	0.13	0.26	0.39
<b>Five-Year Average</b>				<b>0.13</b>	<b>0.27</b>	<b>0.40</b>
<b>Current Assumption</b>				<b>0.15</b>	<b>0.25</b>	<b>0.40</b>
<b>Proposed Assumption</b>				<b>0.15</b>	<b>0.25</b>	<b>0.40</b>

**Based on this experience, we have maintained the system expenses component of the investment return assumption at 0.40%.**

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” when determining whether “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.” For LACERS, about 1/3 of the investment expenses were paid for expenses associated with active managers, during the year ended June 30, 2019.

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 methodology that any “alpha”

<sup>11</sup> As of end of plan year.

<sup>12</sup> Note that some California public retirement systems (including LAFPP) have taken the approach of including an explicit charge for administrative expenses instead of a reduction in the investment return assumption to implicitly defray the administrative expenses.

<sup>13</sup> Includes investment management expenses and investment related administrative expense, net of expenses associated with private equity.

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 about 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.<sup>14</sup> This is consistent with our experience that retirement plan fiduciaries would generally prefer that returns exceed the assumed rate more often than not.

The 5.50% 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.<sup>15</sup> 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 60%, with LACERS being at the higher end of that range.

Two years ago, the Board adopted an investment return assumption of 7.25%. That return implied a risk adjustment of 0.72%, reflecting a confidence level of 58% 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.<sup>16</sup>

If we use the same 58% confidence level from our last study to set this year's risk adjustment, based on the current long-term portfolio standard deviation of 13.33% provided by NEPC for this study, the corresponding risk adjustment would be 0.73%. Together with the other investment return components, this would result in an investment return assumption of 7.12%, which is lower than the current assumption of 7.25%.

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 analyses of the investment return assumption, including the effect of the Private Equity capital market assumption (PE CMA). Those alternatives are summarized in the table below, which shows all the components of the investment return assumption under Segal's risk adjustment model:

<sup>14</sup> This type of risk adjustment is referred to in the Actuarial Standards of Practice as a "margin for adverse deviation."

<sup>15</sup> 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.

<sup>16</sup> Based on an annual portfolio return standard deviation of 13.13% provided by NEPC in 2018. 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.

## Comparative Calculations of Investment Return Assumption

Assumption Component	(A) June 30, 2018 Adopted PE CMA = 8.97%	(B) June 30, 2020 Recommended PE CMA = 8.97%	(C) June 30, 2020 Recommended PE CMA = 10.81%
Inflation	3.00%	2.75%	2.75%
Plus Portfolio Real Rate of Return	5.37%	5.50%	5.76%
Minus Expense Adjustment	(0.40)%	(0.40)%	(0.40)%
Minus Risk Adjustment	(0.72)%	(0.85)%	(1.11)%
<b>Total Return</b>	<b>7.25%</b>	<b>7.00%</b>	<b>7.00%</b>
<b>Confidence Level</b>	<b>58%</b>	<b>59%</b>	<b>62%</b>

In this study, the determination of a consistent measure of confidence level is complicated by the extraordinary increase in a single asset class capital market assumption from LACERS' investment consultant, which we understand resulted from a change in methodology. Column A above shows the components of the investment return assumption adopted by LACERS two years ago. That analysis used NEPC's 2018 real return Private Equity Capital Market Assumption (PE CMA) of 8.97%.

In the current study, absent any material changes in the other components, the lower inflation component recommended earlier in this report would lead directly to a lower total return assumption of 7.00%, just as was recommended in Segal's report two years ago. One way to think of this is that the net real return is the nominal return of 7.25% minus 3.00% inflation, or 4.25%. So if inflation is now expected to be 0.25% lower, unless you increase the net real return (from 4.25% to 4.50%) the nominal return will also decrease by 0.25%.

In practice, for the current study, Column B shows that if we reflect the modest changes in asset allocation and capital market assumptions other than Private Equity, that same 7.00% assumption would now have a somewhat higher risk adjustment and confidence level, due to the modest increase in portfolio real return. However the net real return remains unchanged at 4.25%. In the simplest terms, this is the basis for Segal's recommended investment return assumption of 7.00%: absent any material change in asset allocation or broad indicators of capital market expectations, the net real return should remain at 4.25%, with the lower inflation component then leading to a lower nominal return of 7.00%.

For discussion purposes, Column C shows that if we were to reflect NEPC's 2019 PE CMA of 10.81% then as discussed in footnote 10 the portfolio real return would increase by 0.26% to 5.76%. Because we do not believe that this change in this capital market assumption justifies a higher net real return, in our component model we would treat this potential increase in assumed portfolio real return as an increase in the risk adjustment and confidence level, rather than as an increase in the net real return. As shown in Column C, this would produce a risk adjustment of 1.11%, which corresponds to a confidence level of 62%. As shown in a subsequent table, even this 62% confidence level would be generally consistent with some

historical confidence levels implicit in the investment return assumptions adopted by the Board. However, because the 62% confidence is the direct result of the extraordinary increase in a single asset class capital market assumption, we believe the 59% confidence level shown in Column B is a more consistent measure.

In effect, by recommending a 7.00% investment return we are recommending that even if the Private Equity asset class does show higher returns than previously assumed, any such superior returns would be recognized only as they materialize in future annual actuarial valuations. In our model that recommendation would be represented by using any such higher assumed returns to increase the confidence level so as to have a greater margin in case those higher returns are not achieved.

For reference, the table below shows the recommended investment return assumption, the risk adjustment, and the corresponding confidence level just discussed compared to the values from prior studies.

Year Ending June 30	Investment Return	Risk Adjustment	Corresponding Confidence Level
2005	8.00%	1.14%	65%
2008	8.00%	1.29%	66%
2011	7.75%	0.57%	57%
2014 (Alternative)	7.75%	0.69%	58%
2014 (Adopted)	7.50%	0.94%	61%
2014 (Adopted Value with Restated Expense Adjustment)	7.50%	0.74%	59%
2017 (Recommended)	7.00%	0.87%	60%
2017 (Alternative; Adopted)	7.25%	0.62%	57%
2018 (Recommended, with 2.75% inflation)	7.00%	0.72%	58%
2018 (Adopted, with 3.00% inflation)	7.25%	0.72%	58%
2020 Recommended	7.00%	0.85%	59%

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.<sup>17</sup> The use of the 59% confidence level associated with the recommended 7.00% assumption under Segal’s model should be considered in context with other factors, including:

- 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 NEPC. The standard deviation is a statistical measure of the future

<sup>17</sup> 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.”

volatility of the portfolio and so is itself based on assumptions about future portfolio volatility and can be considered somewhat of a “soft” number.

- 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, we have developed our recommended investment return assumption for LACERS’ consideration. Our recommendation is to reduce the net investment return assumption from 7.25% to 7.00%, based on the recommended lower inflation expectation. As discussed above, this return implies a risk adjustment of 0.85% and a confidence level of 59%.

## Recommended Investment Return Assumption

The following table summarizes the components of the recommended 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	June 30, 2020 Recommended	June 30, 2018 Adopted Value
Inflation	2.75%	3.00%
Plus Portfolio Real Rate of Return	5.50%	5.37%
Minus Expense Adjustment	(0.40)%	(0.40)%
Minus Risk Adjustment	(0.85)%	(0.72)%
<b>Total</b>	<b>7.00%</b>	<b>7.25%</b>
<b>Confidence Level</b>	<b>59%</b>	<b>58%</b>

**Based on this analysis, we recommend that the investment return assumption be decreased from 7.25% to 7.00% per annum.**

## Comparison with Alternative Model used to Review Investment Return Assumption

Since our appointment as actuary for LACERS, 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.<sup>18</sup> 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.<sup>19</sup> 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 LACERS. This is because under the model used by those retirement systems, their investment return assumptions are not reduced to anticipate future investment expenses.<sup>20</sup>

For comparison, we evaluated the recommended 7.00% assumption based on the expected geometric average return for the entire portfolio, but net of only administrative 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%.<sup>21</sup>

## Comparison 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, eleven use a 7.00% investment return assumption, two use 6.75%, and one uses 6.50%. The remaining six 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. Both LADWP and LAFPP have adopted a 7.00% assumption.

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

<sup>18</sup> 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.

<sup>19</sup> 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.

<sup>20</sup> This means that if the model were to be applied to LACERS, the expected geometric return would not be adjusted for the approximately 0.40% administrative and investment expenses paid by LACERS.

<sup>21</sup> 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.

on information found in the Public Plans Data website, which is produced in partnership with NASRA:<sup>22</sup>

Assumption	LACERS	Public Plans Data <sup>23</sup>		
		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 indicate a lower earnings assumption. The recommended assumption of 7.00% provides for a risk margin within the risk adjustment model and is consistent with LACERS' current practice relative to other public systems.

<sup>22</sup> Among 188 large public retirement funds, the investment return assumption was not available for 6 of the public retirement funds in the survey data.

<sup>23</sup> Public Plans Data website – Produced in partnership with the National Association 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. 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 reduced from 3.00% to 2.75% 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 LACERS' active members, the actual average inflation plus "across the board" increase (i.e., wage inflation) over the three year period ending June 30, 2019 was 1.25%, which is less than the change in CPI during that same period. In addition, we have reviewed the average wage inflation compared to the average change in CPI over the last eight years ending June 30, 2019 and while the average wage inflation is still lower than the average change in CPI, the gap is significantly less.

Valuation Date	Actual Average Increase <sup>24</sup>	Actual Change in CPI <sup>25</sup>
June 30, 2012	1.35%	2.04%
June 30, 2013	3.50%	1.08%
June 30, 2014	4.61% <sup>26</sup>	1.35%
June 30, 2015	0.99%	0.91%
June 30, 2016	0.87%	1.89%
<b>Five Year Average</b>	<b>2.26%</b>	<b>1.45%</b>
June 30, 2017	0.59%	2.79%
June 30, 2018	3.22%	3.81%
June 30, 2019	(0.07)%	3.07%
<b>Three Year Average</b>	<b>1.25%</b>	<b>3.22%</b>
<b>Eight Year Average</b>	<b>1.88%</b>	<b>2.12%</b>

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 3.50% to 3.25%.

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 LACERS, 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. This is accomplished by:

- a. Measuring each continuing member’s actual salary increase over each year of the experience period on a salary-weighted basis, with higher weights assigned to experience from members with larger salaries;
- b. Excluding any members with increases of more than 50% or decreases of more than 10% during any particular year;
- c. Categorizing these increases into groups by years of service;
- 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 3.25% assumed inflation and real “across the board” increases recommended in this study.

<sup>24</sup> 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.

<sup>25</sup> Based on the change in the annual average CPI for the Los Angeles-Long Beach-Anaheim Area compared to the prior year.

<sup>26</sup> Restated after the June 30, 2014 valuation data is finalized.

The following table shows the actual average merit and promotion increases by years of service over the three-year period from July 1, 2016 through June 30, 2019. 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 (1.25% on average for the three-year period).

As shown in the table below, the proposed increases in the merit and promotion assumptions are relatively larger at the higher service categories. Note that for informational purposes, we have also included in the table the proposed assumptions from the prior study, which were not adopted by the Board. This information is being provided to show that the increase in the proposed rates for this study would have been somewhat mitigated if the prior assumptions were adopted.

Lastly, to get a sense on how merit and promotion increases have progressed after the recovery from the last economic downturn in 2008/2009, we have also looked at the actual experience based on combining results from current three year-period (i.e., July 1, 2016 – June 30, 2019) with the five years included in the prior two studies (i.e., July 1, 2011 - June 30, 2016, excluding July 1, 2016 – June 30, 2017 to avoid double counting that year’s experience). The combined eight year results are provided in the table below.

Years of Service	Rate (%)				
	Current Assumption	Proposed Assumption from Prior Study	Actual Average Increase from Current Study	Actual Average Increase from Current and Prior Two Studies	Proposed Assumption
0 – 1	6.50	6.50	7.06	6.14	6.70
1 – 2	6.20	6.40	8.32	7.47	6.50
2 – 3	5.10	5.50	7.25	6.22	5.80
3 – 4	3.10	3.30	5.65	4.28	4.00
4 – 5	2.10	2.40	4.98	3.44	3.00
5 – 6	1.10	1.50	4.53	2.61	2.20
6 – 7	1.00	1.30	4.17	2.15	2.00
7 – 8	0.90	1.20	3.51	1.85	1.80
8 – 9	0.70	1.00	3.49	1.77	1.60
9 – 10	0.60	0.90	3.09	1.72	1.40
10 & Over	0.40	0.60	2.46	1.35	1.00

Chart 1 compares actual experience with the current and proposed rates of merit and promotion increases. The proposed rates from the prior study and the actual experience including the current and prior two studies are also included as a comparison.

**Based on this experience, we are proposing changes in the merit and promotion salary increases, with increases in all service categories. Overall, total salary increases are assumed to be higher under the proposed assumptions.**

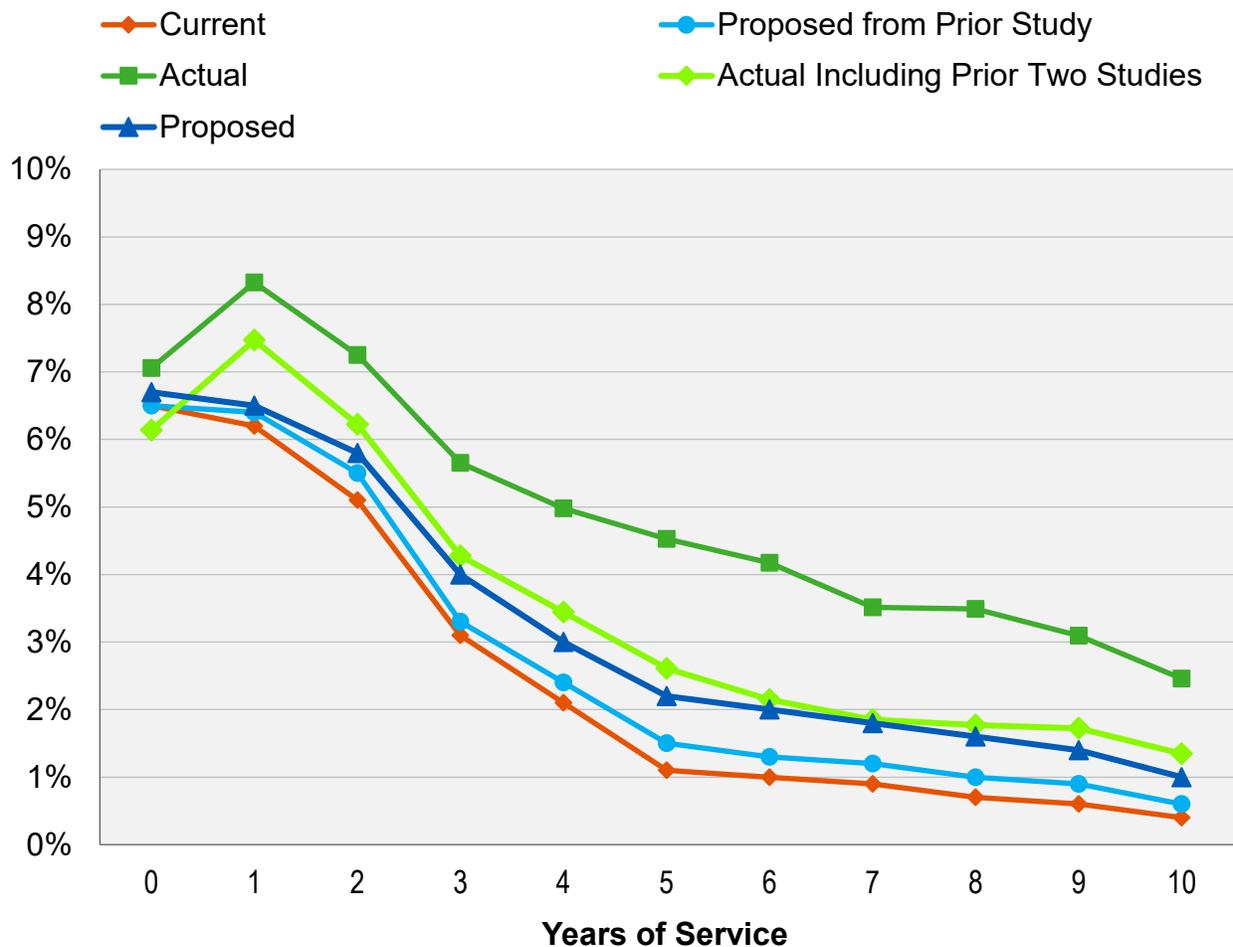
## Active Member Payroll

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 member’s future benefits.

**We recommend that the active member payroll increase assumption be reduced from 3.50% to 3.25% annually, consistent with the combined inflation plus real “across the board” salary increase assumptions.**

Chart 1: Merit and Promotion Salary Increase Rates



# IV. Demographic Assumptions

## A. Retirement Rates

The age at which a member retires from service (i.e., who does 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 retirement experience during the current three-year period indicated that there were more actual retirements than expected. In this study, we have adjusted the retirement probabilities to reflect the current three-year experience, as well as prior experience as represented by the current retirement assumptions for members in Tier 1.

All Tier 1 Airport Peace Officers (including certain fire fighters) appointed to their positions before January 7, 2018 who elected to remain at LACERS after January 6, 2018 and who paid their mandatory additional contribution of \$5,700 to LACERS before January 8, 2019, or prior to their retirement date, whichever was earlier, are designated as Tier 1 Enhanced. As there was a need to come up with the retirement rates for these members before any actual retirement experience would become available, we estimated that Tier 1 Enhanced members would retire earlier compared to members in Tier 1 (based on comparisons of the benefit level) by applying the rates used for Tier 1 members after increasing those rates by 1% before age 70.

For this study, retirement experience for Tier 1 Enhanced members is only starting to emerge. In setting the proposed retirement rates for Tier 1 Enhanced, we have looked at the actual experience over the full 3-year period ending June 30, 2019, though the available experience would only cover about 1-1/2 years (i.e., from January 2018 through June 2019). As there were a lot more retirements in the first six-month period immediately after the Tier 1 Enhanced benefit was adopted, we believe it would not be unreasonable to assume that some Tier 1 Enhanced members might have been waiting to retire in anticipation of receiving an enhanced benefit after the new plan provisions were adopted, so we have looked only at the experience for the period from July 1, 2018 through June 30, 2019 in setting the proposed Tier 1 Enhanced assumptions. This was done to try to eliminate the effect of possible short-term fluctuation in retirement experience when setting long-term retirement assumptions, although very little experience over that period was available after we excluded retirements in the first six-month period.

Even though there is no actual experience available for Tier 3, we are recommending adjustments in the Tier 3 retirement assumptions to maintain consistency with the changes we are recommending for Tier 1, as the rates for Tier 3 were initially developed based, in part, on the benefit level comparisons to Tier 1.

The tables on the following two pages show the observed service retirement rates for Tier 1 and Tier 1 Enhanced members, respectively, based on the actual experience over the past three years. The observed service retirement rates were determined by comparing those members who actually retired from service to those eligible to retire from service. This same methodology is followed throughout this report and was described in Section II. Also shown are the current rates assumed and the rates we propose.

## Tier 1

Age	Rate of Retirement (%)					
	Current Rate		Actual Rate		Proposed Rate	
	Non-55/30	55/30	Non-55/30	55/30	Non-55/30	55/30
50	6.0	0.0	2.5	0.0	5.0	0.0
51	3.0	0.0	3.8	0.0	3.0	0.0
52	3.0	0.0	0.9	0.0	3.0	0.0
53	3.0	0.0	2.6	0.0	3.0	0.0
54	17.0	0.0	20.4	0.0	18.0	0.0
55	6.0	24.0	5.6	30.3	6.0	27.0
56	6.0	16.0	5.9	20.6	6.0	18.0
57	6.0	16.0	5.5	18.7	6.0	18.0
58	6.0	16.0	4.8	20.0	6.0	18.0
59	6.0	16.0	5.4	21.8	6.0	18.0
60	7.0	16.0	7.5	20.9	7.0	18.0
61	7.0	16.0	7.1	18.6	7.0	18.0
62	7.0	16.0	8.6	17.8	7.0	18.0
63	7.0	16.0	7.4	17.5	7.0	18.0
64	7.0	16.0	8.2	21.6	7.0	18.0
65	13.0	20.0	12.8	26.0	14.0	21.0
66	13.0	20.0	16.4	22.5	14.0	21.0
67	13.0	20.0	14.3	20.5	14.0	21.0
68	13.0	20.0	15.6	17.4	14.0	21.0
69	13.0	20.0	16.9	25.0	14.0	21.0
70	100.0	100.0	13.9	21.6	100.0	100.0

As shown above, we are recommending overall increases in the retirement rates for Tier 1 members.

## Tier 1 Enhanced

Age	Rate of Retirement (%)					
	Current Rate		Actual Rate		Proposed Rate	
	Non-55/30	55/30	Non-55/30	55/30	Non-55/30	55/30
50	7.0	0.0	0.0	0.0	7.0	0.0
51	4.0	0.0	0.0	0.0	5.0	0.0
52	4.0	0.0	0.0	0.0	5.0	0.0
53	4.0	0.0	0.0	0.0	5.0	0.0
54	18.0	0.0	33.3	0.0	20.0	0.0
55	7.0	25.0	9.1	62.5	8.0	30.0
56	7.0	17.0	0.0	33.3	8.0	22.0
57	7.0	17.0	7.1	0.0	8.0	22.0
58	7.0	17.0	15.4	66.7	8.0	22.0
59	7.0	17.0	25.0	80.0	8.0	22.0
60	8.0	17.0	40.0	42.9	9.0	22.0
61	8.0	17.0	33.3	40.0	9.0	22.0
62	8.0	17.0	50.0	0.0	9.0	22.0
63	8.0	17.0	0.0	0.0	9.0	22.0
64	8.0	17.0	0.0	100.0	9.0	22.0
65	14.0	21.0	0.0	50.0	16.0	26.0
66	14.0	21.0	100.0	0.0	16.0	26.0
67	14.0	21.0	0.0	0.0	16.0	26.0
68	14.0	21.0	0.0	100.0	16.0	26.0
69	14.0	21.0	0.0	100.0	16.0	26.0
70	100.0	100.0	0.0	0.0	100.0	100.0

As shown above, we are recommending overall increases in the retirement rates for Tier 1 Enhanced members.

## Tier 3

Age	Rate of Retirement (%)			
	Current Rate		Proposed Rate	
	Non-55/30	55/30	Non-55/30	55/30
50	6.0	0.0	5.0	0.0
51	3.0	0.0	3.0	0.0
52	3.0	0.0	3.0	0.0
53	3.0	0.0	3.0	0.0
54	16.0	0.0	17.0	17.0
55	0.0 <sup>(1)</sup>	23.0	0.0 <sup>(1)</sup>	26.0
56	0.0 <sup>(1)</sup>	15.0	0.0 <sup>(1)</sup>	17.0
57	0.0 <sup>(1)</sup>	15.0	0.0 <sup>(1)</sup>	17.0
58	0.0 <sup>(1)</sup>	15.0	0.0 <sup>(1)</sup>	17.0
59	0.0 <sup>(1)</sup>	15.0	0.0 <sup>(1)</sup>	17.0
60	6.0	15.0	6.0	17.0
61	6.0	15.0	6.0	17.0
62	6.0	15.0	6.0	17.0
63	6.0	15.0	6.0	17.0
64	6.0	15.0	6.0	17.0
65	12.0	19.0	13.0	20.0
66	12.0	19.0	13.0	20.0
67	12.0	19.0	13.0	20.0
68	12.0	19.0	13.0	20.0
69	12.0	19.0	13.0	20.0
70	100.0	100.0	100.0	100.0

<sup>(1)</sup> Not eligible to retire under the provisions of the Tier 3 plan.

**As shown above, we are recommending overall increases in the retirement rates for Tier 3 members.**

Chart 2 compares actual experience with the current and proposed rates of retirement for Tier 1 members younger than age 55 or with less than 30 years of service. Chart 3 shows the same information for Tier 1 members at least age 55 with at least 30 years of service.

Charts 4 and 5 show the same information as Charts 2 and 3, respectively, for Tier 1 Enhanced members.

Chart 6 compares the current and proposed rates of retirement for Tier 3 members younger than age 55 or with less than 30 years of service. Chart 7 shows the same information for Tier 3 members at least age 55 with at least 30 years of service.

## Deferred Vested Members

In prior valuations, deferred vested members were assumed to retire at age 59. The average age at retirement over the current three-year experience study period was 59.7 for all deferred vested members.

**We recommend maintaining the assumed retirement age at age 59 for deferred vested participants.**

## Reciprocity

Based on data available from current inactive vested participants, there is a much lower incidence of members who went to work for a reciprocal system when compared to that observed at our other California public retirement systems. We have observed that as of June 30, 2019, about 4% of all the inactive vested membership has worked for a reciprocal system. In addition, less than 1% of members who left active service and terminated from the System over the 3-year experience study period established reciprocity with another entity. We do not recommend using the less than 1% proportion of only newly terminated employees to set this assumption because it may be the case that not all members had yet reported their reciprocal status. Therefore, we recommend maintaining the reciprocity assumption of 5% for the June 30, 2020 valuation. We will continue to monitor this assumption in future valuations.

For reciprocal members, we recommend increasing the compensation increase assumption from 3.90% to 4.25% per annum, consistent with the recommended salary increase assumptions for active members discussed earlier, and reflecting the recommended promotional and merit increase assumption for members with 10 or more years of service.

# Survivor Continuance under Unmodified Option

In prior Retirement Plan valuations, it was assumed that 76% of all active and inactive male members and 50% of all active and inactive female members would be married or have an eligible domestic partner upon retirement. We reviewed experience for new retirees during the three-year period and determined the actual percent of these new retirees that had an eligible spouse or eligible domestic partner at the time of retirement. The results of that analysis are shown below.

New Retirees – Actual Percent with Eligible Spouse or Domestic Partner		
Year Ending June 30	Male	Female
2017	75%	49%
2018	78%	59%
2019	74%	56%
<b>Total</b>	<b>76%</b>	<b>55%</b>

**Based on the above, we recommend maintaining the percent married assumption at 76% for male members and increasing the percent married assumption from 50% to 52% for female members.**

Since the value of the survivor’s 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 and studies done for other retirement systems, we recommend the following:

1. Since almost all of the spouses are actually the opposite sex, we will continue to assume that for all active and inactive members, the survivor’s sex is the opposite of the member.
2. The current and proposed assumptions for the age of the survivor for all active and inactive members are shown below. These assumptions will continue to be monitored in future experience studies.

	Member’s Age as Compared to Spouse’s Age	
	Male Member	Female Member
Current Assumption	3 years older	2 years younger
Actual LACERS Experience	3.0 years older	2.0 years younger
Proposed Assumption	3 years older	2 years younger

**As shown above, we recommend maintaining the age difference that male members are 3 years older than their spouse, and the age difference that female members are 2 years younger than their spouse.**

Chart 2: Retirement Rates  
Tier 1 – “Non-55/30”

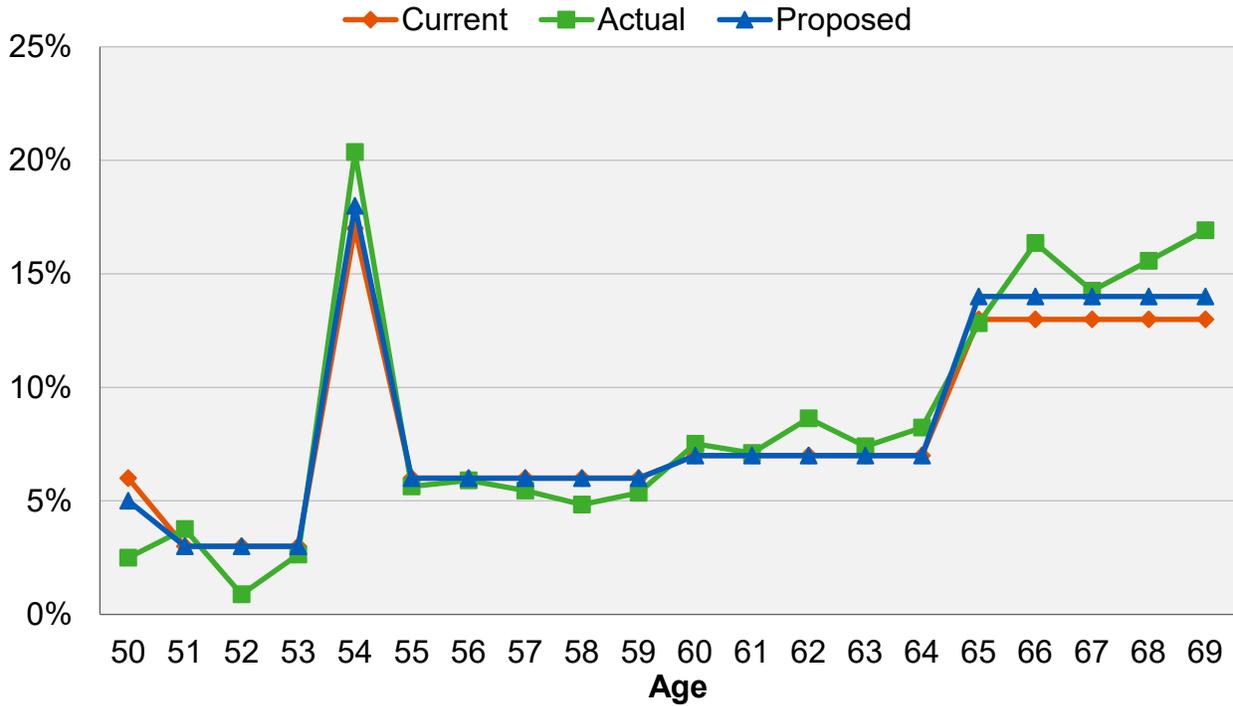


Chart 3: Retirement Rates  
Tier 1 – “55/30”

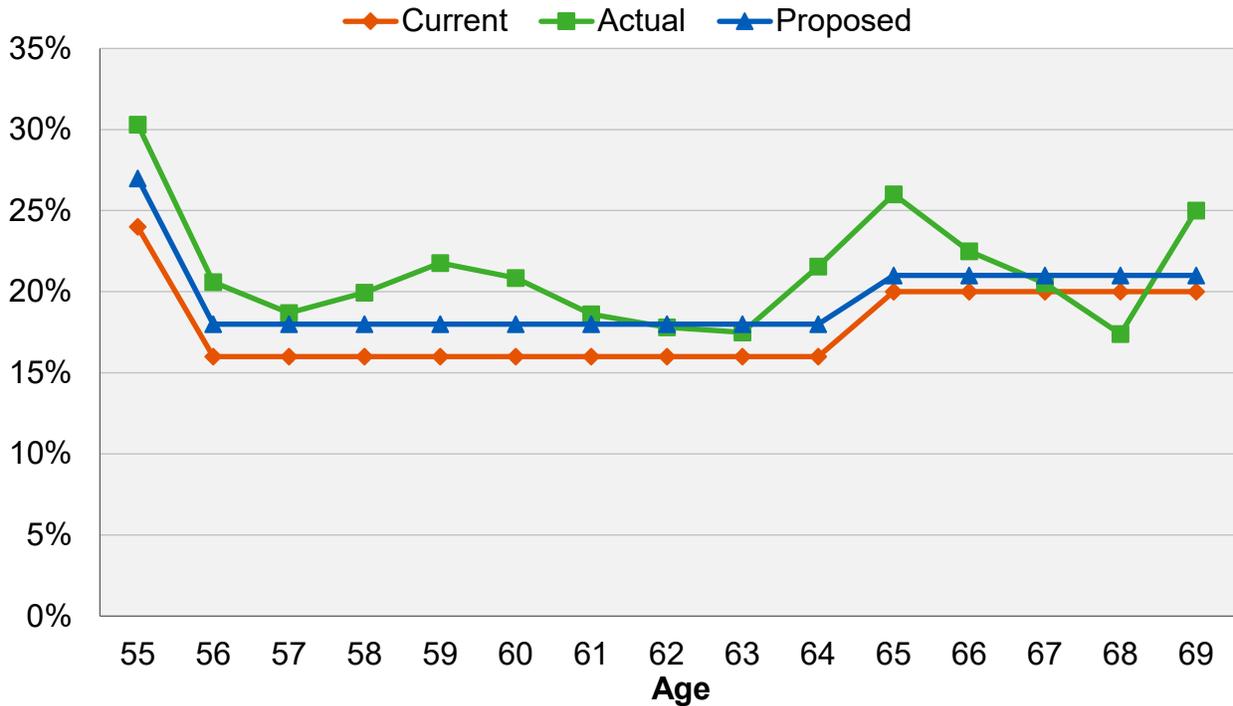


Chart 4: Retirement Rates  
Tier 1 Enhanced – “Non-55/30”

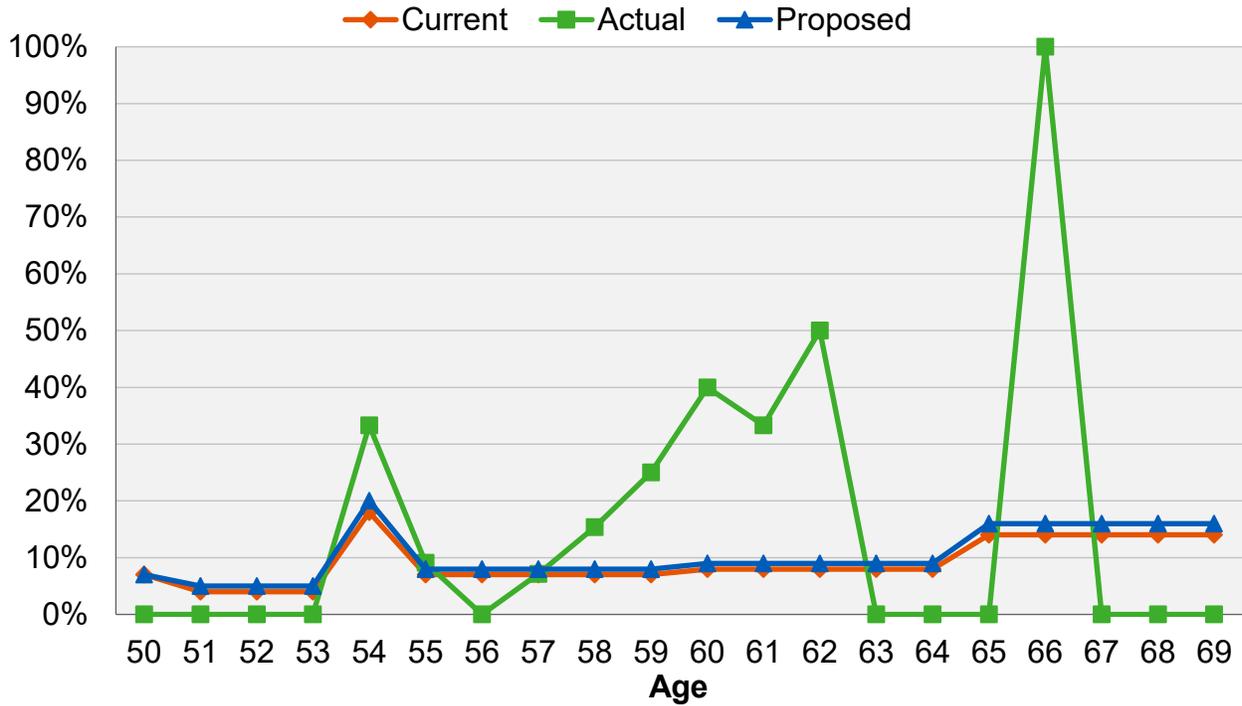


Chart 5: Retirement Rates  
Tier 1 Enhanced – “55/30”

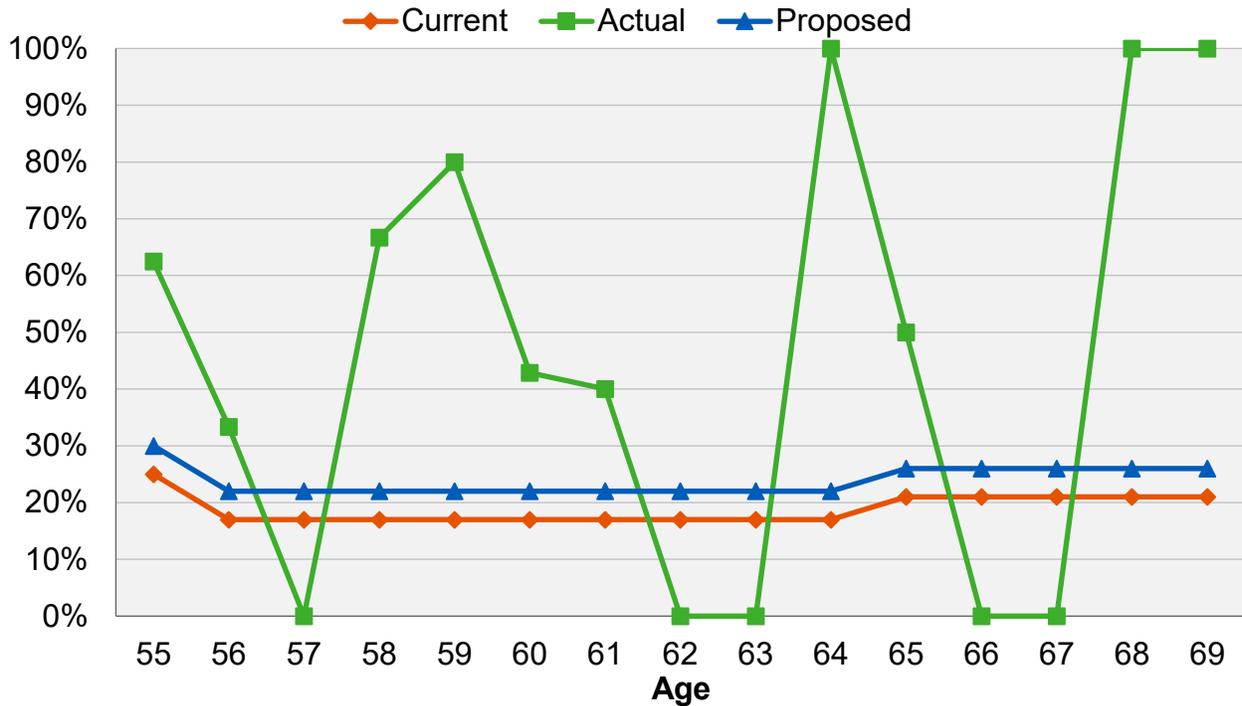


Chart 6: Retirement Rates  
Tier 3 – “Non-55/30”

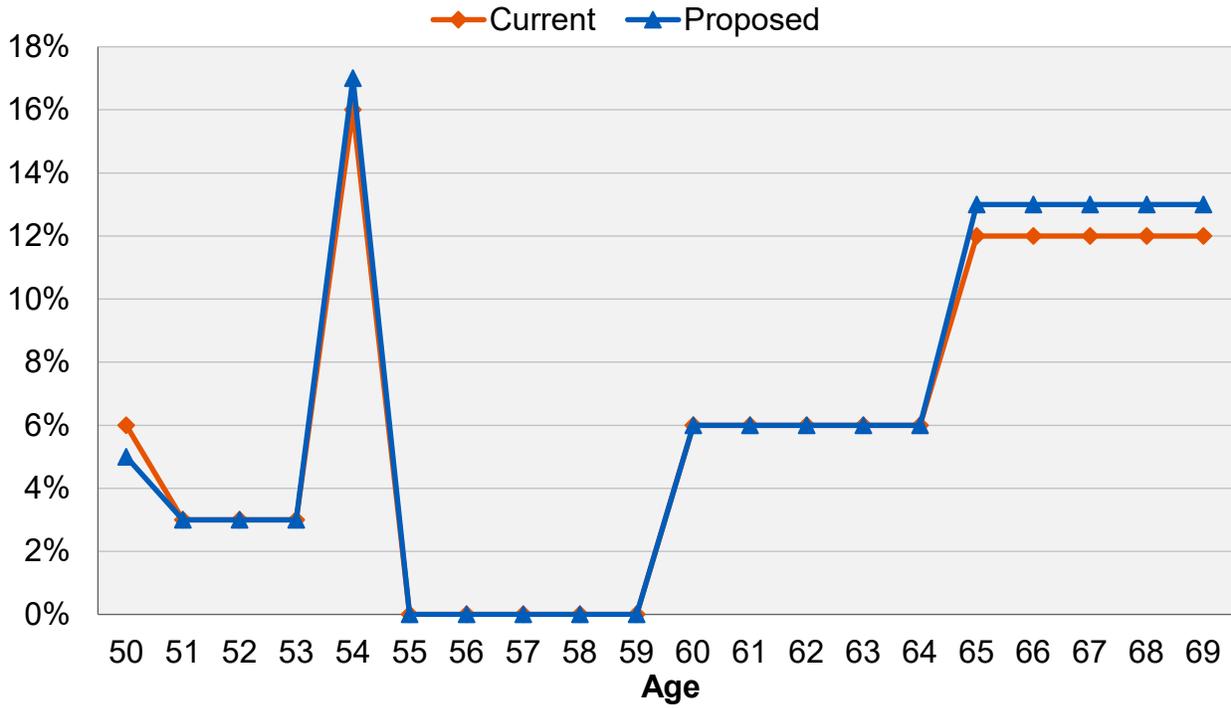
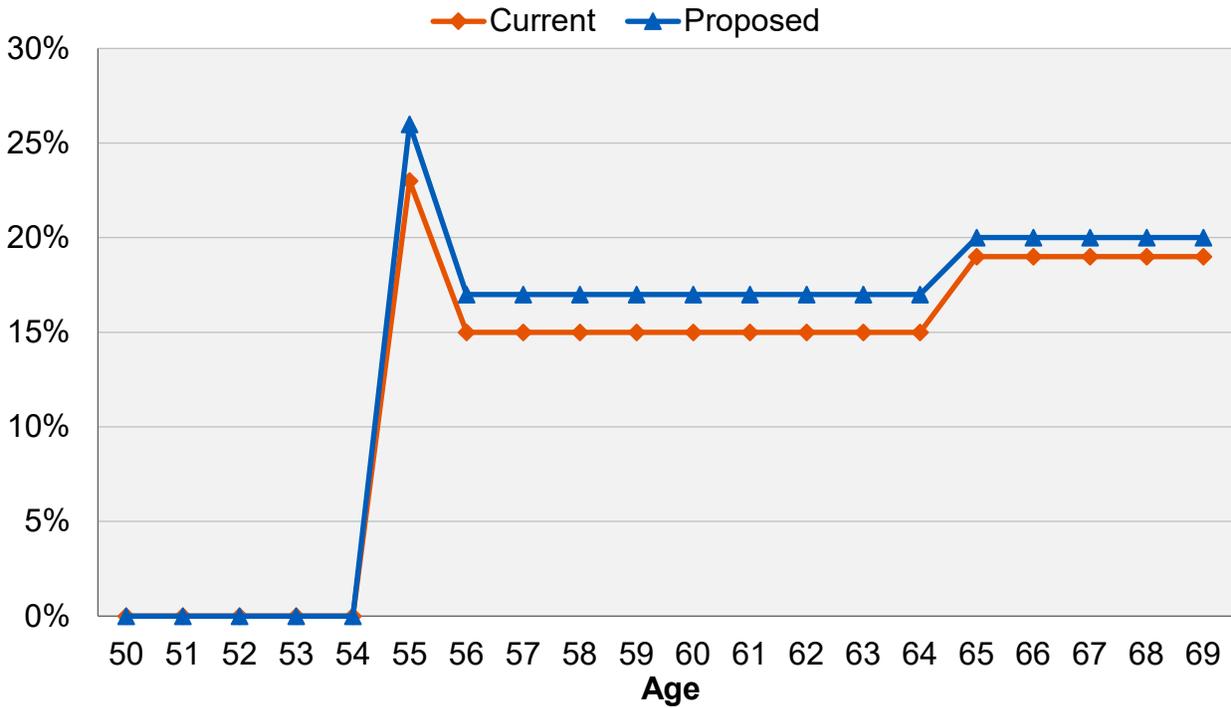


Chart 7: Retirement Rates  
Tier 3 – “55/30”



# 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 before retirement. The tables currently being used for post-service retirement mortality rates are the Headcount-Weighted RP-2014 Healthy Annuitant Mortality Tables (separate tables for males and females) projected generationally with the two-dimensional mortality improvement scale MP-2017. All beneficiaries are assumed to have the same mortality of a member of the opposite sex who has taken a service (non-disabled) retirement.

When we conducted the last experience study, we alerted the Board that for the Retirement Plan we may recommend a switch from a Headcount-Weighted to a Benefit-Weighted table, but only after the Society of Actuaries (SOA) provides 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 recently published the Pub-2010 Public Retirement Plans Mortality Tables (Pub-2010). For the first time, the Pub-2010 mortality tables are based exclusively on public sector pension plan experience in the United States. Within the Pub-2010 family of mortality tables, there are separate tables by job categories of General, Safety, and Teachers. Included with the mortality tables is the analysis prepared by RPEC that continues to observe that benefit amounts 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 are as follows:

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

*Note: Values shown as of 2010.*

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 LACERS’ members were generally higher than the adjusted median amounts shown above. Therefore, we recommend that the above-median version of the General mortality tables be used for the Retirement Plan.

As for the mortality improvement scales, they can be applied in one of two ways. Historically, the more common application is to use a “static” approach to anticipate a fixed level of mortality improvement for all annuitants receiving benefits from a retirement plan. This is in contrast to a “generational” approach where each future year has its own mortality table that reflects the forecasted improvements, using the published improvement scales. While the static approach is still used by some of Segal’s California public system clients, as well as CalPERS, the generational approach is now the established practice within the actuarial profession. LACERS currently uses the generational approach.

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. This is in contrast to updating a static mortality assumption with each experience study.

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 given the trend in the retirement industry to move towards generational mortality, it would be reasonable for the Board to adopt the Benefit-Weighted Pub-2010 mortality table (adjusted for LACERS experience), and project the mortality improvement generationally using the MP-2019 mortality improvement scale.

In the prior experience study, we recommended a single mortality table for all members and beneficiaries. However, the Pub-2010 tables have separate tables for General, Safety, and Contingent (survivor) groups, so we are therefore recommending separate tables for members<sup>27</sup> and beneficiaries.

In order to use more LACERS experience in our analysis, we have used experience for an eight-year period by using data from the current (from July 1, 2016 through June 30, 2019) and the last two (from July 1, 2014 to June 30, 2017 and from July 1, 2011 to June 30, 2014) experience study periods in order to analyze this assumption.

With the use of eight years of experience, based on standard statistical theory the data is generally credible. 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 generally adjusted the Pub-2010 mortality tables to fit LACERS’ experience.

<sup>27</sup> For the members, we have used the Pub-2010 tables provided for the General group. This is the case even for the Airport Peace Officer (APO) members receiving benefits under the Tier 1 Enhanced formula where we have a total of about 500 APO members and about 40 have retired during the last two years. This is not enough mortality experience to determine specifically if the Pub-2010 tables provided for the Safety group may be more suitable for the APO members. Furthermore, since the APO group is a closed group, it is anticipated that future mortality experience will continue to be combined with the experience for the other members of LACERS.

## Pre-Retirement Mortality

The table currently being used for pre-retirement mortality rates are the Headcount-Weighted RP-2014 Employee Mortality Tables (separate tables for males and females), multiplied by 90%, projected generationally with the two-dimensional mortality improvement scale MP-2017.

**For members in the Retirement Plan valuation, we recommend changing the pre-retirement mortality assumption to follow the Pub-2010 General Employee Amount-Weighted Above-Median Mortality Table (separate tables for males and females) with rates increased by 10%, projected generationally with the two-dimensional mortality improvement scale MP-2019. For members in the Health Plan valuation, we recommend changing the pre-retirement mortality assumption to follow the Pub-2010 General Employee Headcount-Weighted Above-Median Mortality Table (separate tables for males and females) with rates increased by 10%, projected generationally with the two-dimensional mortality improvement scale MP-2019.**

## Post-Retirement Mortality (Service Retirements)

Among all retired members, the actual deaths weighted by benefit amounts under the current assumptions for the last eight years are shown in the table below. We also show the deaths weighted by benefit amount under the proposed assumptions. As noted above, we are recommending the use of a generational mortality table rather than a static mortality table. A generational mortality table 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.

Also, the proposed mortality table reflects current experience to the extent that the experience is credible based on standard statistical theory. The proposed mortality table (as shown in the table below) after adjustments for credibility has an actual to expected ratio of 99%. In future years the ratio should remain around 99%, 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<sup>28</sup> for the last eight years are as follows:

<sup>28</sup> The results in the table are “benefit weighted deaths” which are measured in dollar amounts. For instance, there were 2,594 healthy male retiree deaths over the last eight years, as shown on the table on the next page, and the total monthly benefits for those members amounted to \$9.19 million, which is shown in the next table.

	Members – Healthy (\$ in millions)		
Gender	Current Expected Weighted Deaths	Actual Weighted Deaths	Proposed Expected Weighted Deaths
Male	\$10.03	\$9.19	\$9.35
Female	\$2.50	\$2.12	\$2.10
<b>Total</b>	<b>\$12.54</b>	<b>\$11.31</b>	<b>\$11.45</b>
Actual / Expected	90%		99%

- Notes: (1) Experience shown above is weighted by monthly benefit amounts for deceased members instead of by headcounts.  
(2) Expected amounts 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 members in the Retirement Plan valuation, we recommend updating the current tables to the Pub-2010 General Healthy Retiree Amount-Weighted Above-Median Mortality Tables (separate tables for males and females) with rates increased by 10% for males, projected generationally with the two-dimensional mortality improvement scale MP-2019. The recommended mortality tables will have an actual to expected ratio of 99%.**

For the purpose of setting the assumptions for the Health Plan valuation, 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.

	Members – Healthy		
Gender	Current Expected Weighted Deaths	Actual Weighted Deaths	Proposed Expected Weighted Deaths
Male	2,608	2,594	2,459
Female	869	810	758
<b>Total</b>	<b>3,477</b>	<b>3,404</b>	<b>3,217</b>
Actual / Expected	98%		106%

- Notes: (1) Experience shown above is weighted by headcounts for deceased members instead of by monthly benefit amounts.  
(2) The proposed expected deaths are based on the Pub-2010 Amount-Weighted Mortality Tables.

**For members in the Health Plan valuation, we recommend updating the current tables to the Pub-2010 General Healthy Retiree Headcount-Weighted Above-Median Mortality Tables (separate tables for males and females) with rates increased by 10% for males, projected generationally with the two-dimensional mortality improvement scale MP-2019. The recommended mortality tables will have an actual to expected ratio of 106%.**

Chart 8 compares actual to expected deaths on a benefit-weighted basis for members under the current and proposed assumptions over the past eight years.

Chart 9 compares actual to expected deaths on a headcount-weighted basis for members under the current and proposed assumptions over the past eight years.

Chart 10 shows the life expectancies (i.e., expected future lifetime) under the current and the proposed tables for 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.

## **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 healthy 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 only based 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 LACERS' actual mortality experience for beneficiaries.

**For all beneficiaries in the Retirement Plan valuation, we recommend changing the mortality assumption to follow the Pub-2010 Contingent Survivor Amount-Weighted Above-Median Mortality Tables (separate tables for males and females) with rates increased by 10%, projected generationally with the two-dimensional mortality improvement scale MP-2019. For all beneficiaries in the Health Plan valuation, we recommend changing the mortality assumption to follow the Pub-2010 Contingent Survivor Headcount-Weighted Above-Median Mortality Tables (separate tables for males and females) with rates increased by 10%, projected generationally with the two-dimensional mortality improvement scale MP-2019.**

## **Mortality Table for Determining Actuarial Equivalences**

Given that our current and recommended post-retirement mortality assumptions include a generational mortality improvement scale, there are some administrative issues that need to be resolved with LACERS and its vendor maintaining the pension administration software before we could recommend a comparable generational scale to anticipate future mortality improvement. We have already been directed by LACERS to engage in such discussions with the vendor. We will provide a recommendation to LACERS for use in reflecting mortality improvement for determining actuarial equivalences after we conclude those discussions with the vendor.

Chart 8: Post-Retirement Benefit-Weighted Deaths (In Millions)  
 Healthy Members (July 1, 2011 through June 30, 2019)

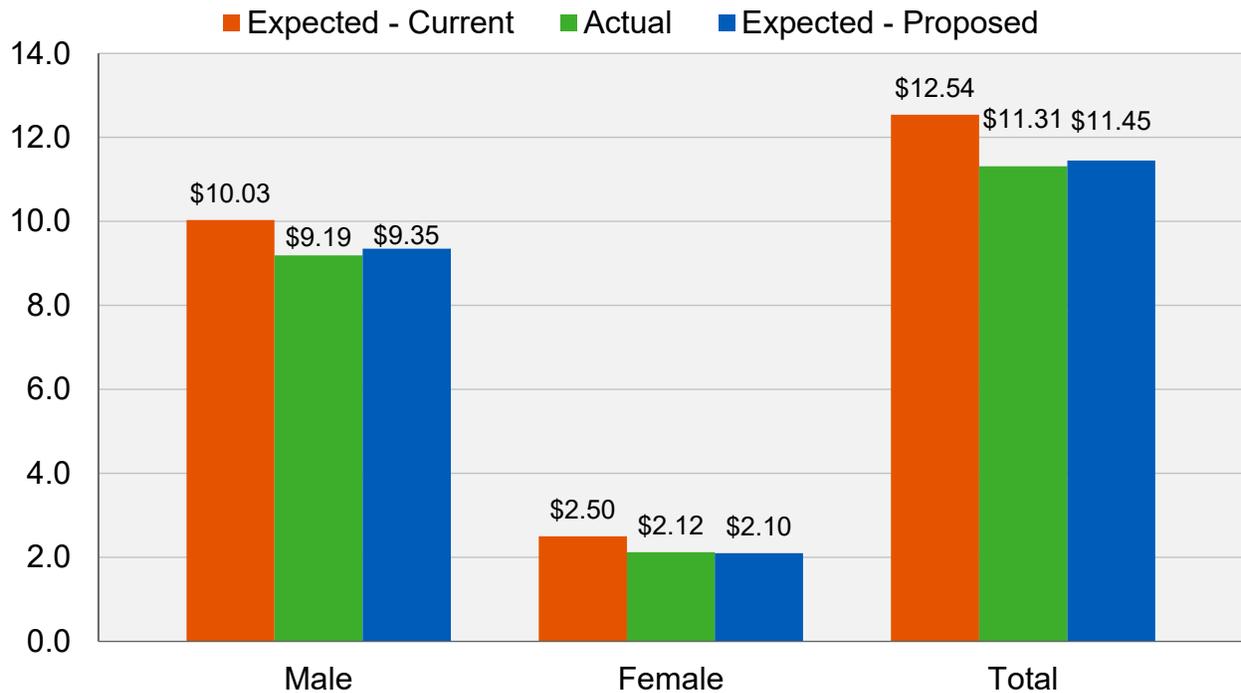


Chart 9: Post-Retirement Headcount-Weighted Deaths  
 Healthy Members (July 1, 2011 through June 30, 2019)

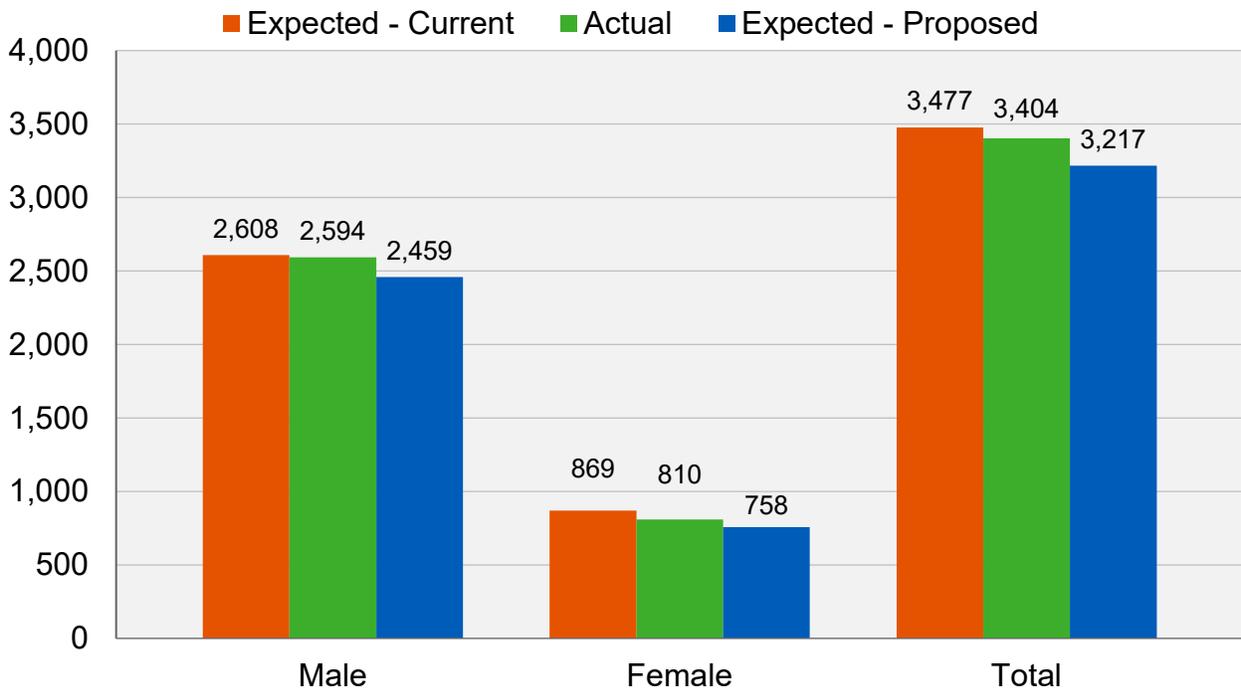
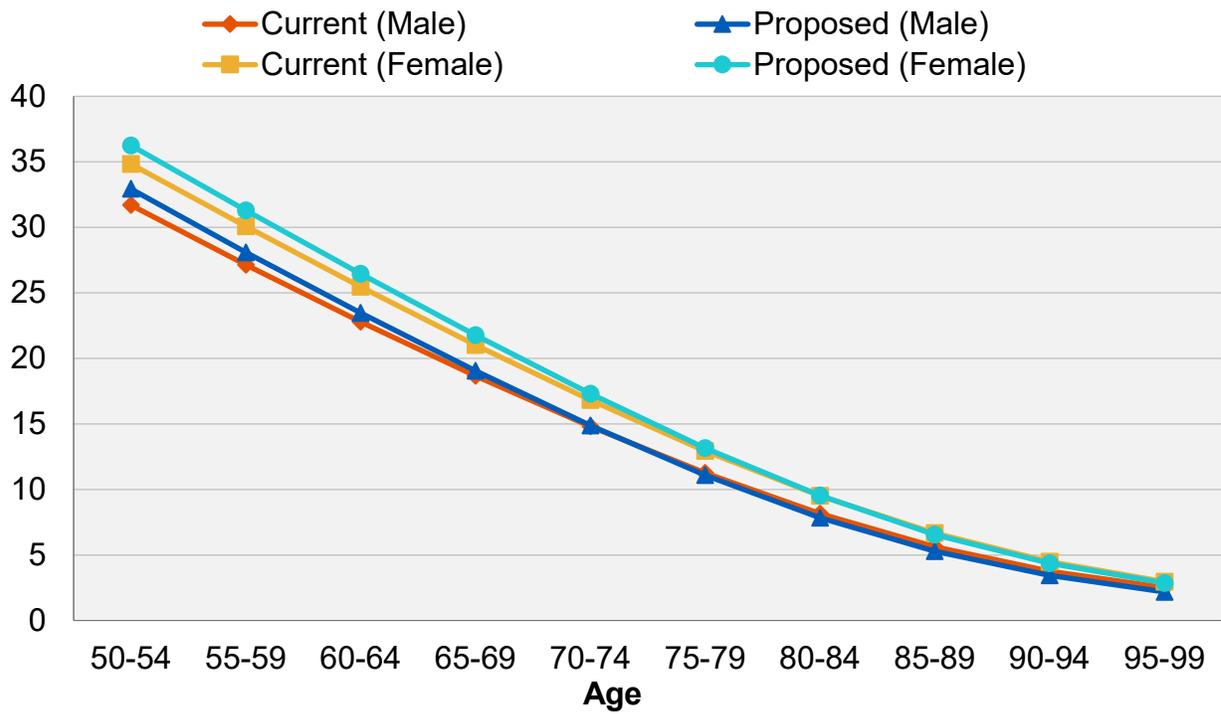


Chart 10: Benefit-Weighted Life Expectancies  
Healthy Members



## C. Mortality Rates - Disabled

Since mortality rates for disabled members can vary from those of healthy members, a different mortality assumption is often used. The tables currently being used are the Headcount-Weighted RP-2014 Disabled Retiree Tables (separate tables for males and females) projected generationally with the two-dimensional mortality improvement scale MP-2017.

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

Gender	Members – Disabled (\$ in millions)		
	Current Expected Weighted Deaths	Actual Weighted Deaths	Proposed Expected Weighted Deaths
Male	\$0.31	\$0.30	\$0.30
Female	\$0.09	\$0.09	\$0.10
<b>Total</b>	<b>\$0.40</b>	<b>\$0.39</b>	<b>\$0.39</b>
Actual / Expected	98%		100%

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

(2) Expected amounts 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 disabled members in the Retirement Plan valuation, we recommend updating the current tables to the Pub-2010 Non-Safety Disabled Retiree Amount-Weighted Mortality Tables (separate tables for males and females) with rates increased by 10% for males and decreased by 5% for females, projected generationally with the two-dimensional mortality improvement scale MP-2019. The recommended mortality tables will have an actual to expected ratio of 100%.**

For the purpose of setting the assumptions for the Health Plan valuation, 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	Members – Disabled		
	Current Expected Weighted Deaths	Actual Weighted Deaths	Proposed Expected Weighted Deaths
Male	202	193	195
Female	65	65	66
<b>Total</b>	<b>267</b>	<b>258</b>	<b>261</b>
Actual / Expected	97%		99%

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

(2) The proposed expected deaths are based on the Pub-2010 Amount-Weighted Mortality Tables.

For disabled members in the Health Plan valuation, we recommend updating the current tables to the Pub-2010 Non-Safety Disabled Retiree Headcount-Weighted Mortality Tables (separate tables for males and females) with rates increased by 10% for males and decreased by 5% for females, projected generationally with the two-dimensional mortality improvement scale MP-2019. The recommended mortality tables will have an actual to expected ratio of 99%.

Chart 11 compares actual to expected deaths on a benefit-weighted basis for disabled members under the current and proposed assumptions over the past eight years.

Chart 12 compares actual to expected deaths on a headcount-weighted basis for disabled members under the current and proposed assumptions over the past eight.

Chart 13 shows the life expectancies (i.e., expected future lifetime) under the current and the proposed tables for disabled members on a benefit-weighted basis. Life expectancies under the proposed generational mortality rates are based on age as of 2020. In practice, life expectancies will be assumed to increase based on applying the mortality improvement scale.

Chart 11: Post-Retirement Benefit-Weighted Deaths (In Millions)  
Disabled Members (July 1, 2011 through June 30, 2019)

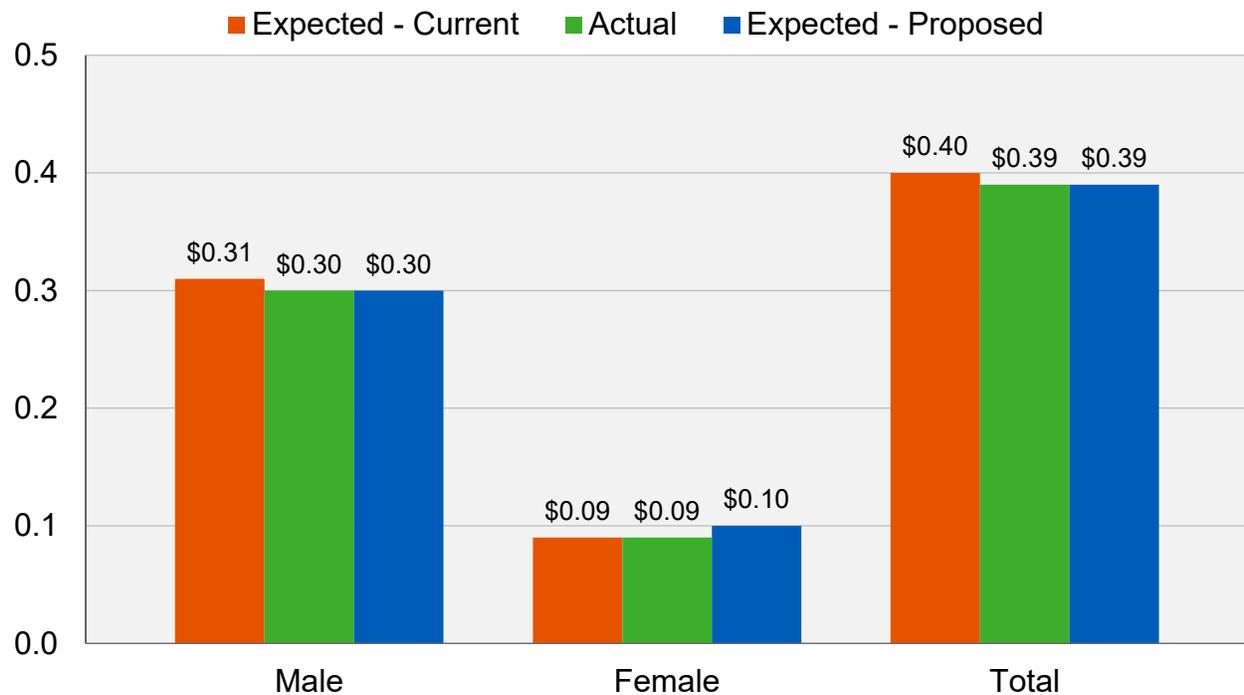


Chart 12: Post-Retirement Headcount-Weighted Deaths Disabled Members (July 1, 2011 through June 30, 2019)

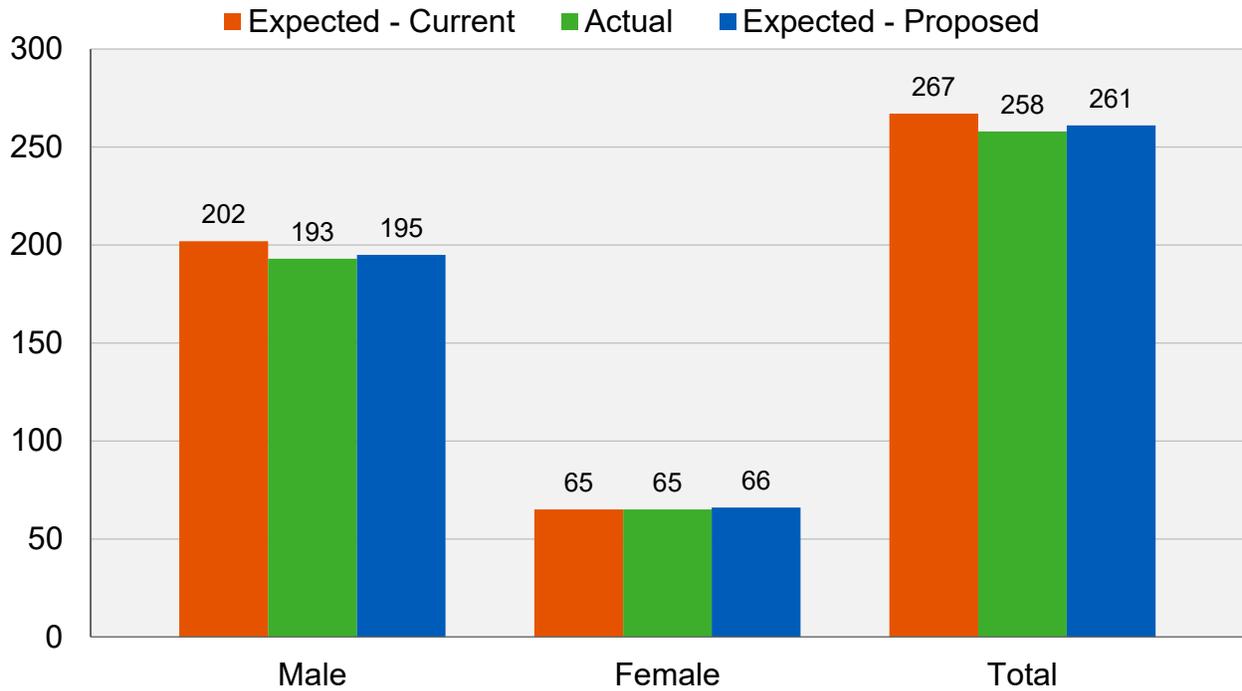
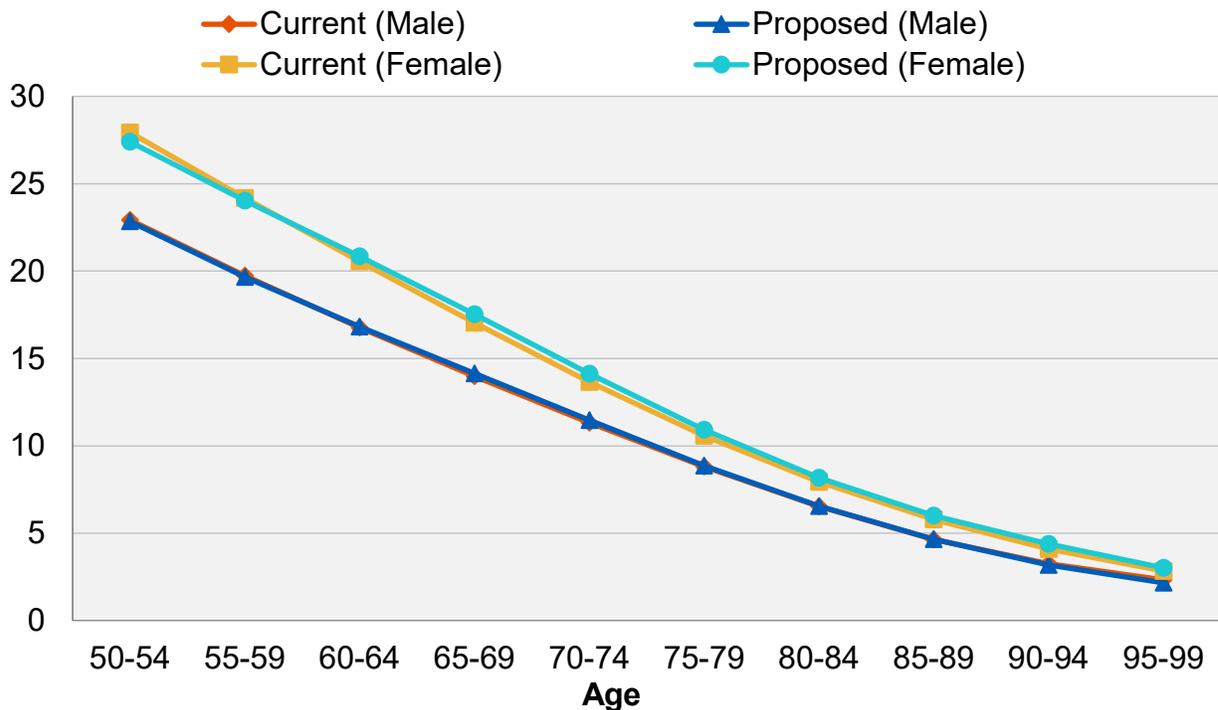


Chart 13: Benefit-Weighted Life Expectancies Disabled Members



## D. Termination Rates

Termination rates include all terminations for reasons other than death, disability, or retirement. Under the current assumptions all members who terminate with less the five years of service are assumed to receive a refund of contributions. For members who terminate with over five years of service, the member is assumed to choose between a refund of contributions or a deferred vested benefit, whichever option is more valuable.

The current termination rates for members with five or more years of service are a function of the members' ages. During this experience study, we reviewed termination experience based on ages and on years of service. We determined that the termination rates correlate well with both ages and years of service for members with five or more years of service. Therefore, we recommend maintaining the termination rates as a function of members' ages for those with five or more years of service.

As we note in the next Subsection E regarding disability incidence rates, the observed disability experience includes members who went from inactive (i.e., terminated) status to disability status. In order to remove the effect of double counting members as both terminations one year and disabilities a subsequent year, we have removed an equal number of inactive to disability records over the experience study period from the active to termination experience herein.

The termination experience over the last three years separated between those members with less than five years of service and those with five or more years of service is shown below. Please note that we have excluded any members that were eligible for retirement.

### Rates of Termination – Less than Five Years of Service

Years of Service	Rates of Termination (%)		
	Current Rate	Observed Rate	Proposed Rate
Less than 1	12.00	10.79	11.50
1 – 2	10.00	10.10	10.00
2 – 3	9.00	7.99	8.50
3 – 4	8.25	7.29	7.75
4 – 5	7.75	6.62	7.00

**As shown above, we are recommending overall decreases to the assumed termination rates for members with less than 5 years of service.**

## Rates of Termination – Five or More Years of Service

Age	Rates of Termination <sup>29</sup> (%)		
	Current Rate	Observed Rate	Proposed Rate
20 – 24	7.00	0.00	7.00
25 – 29	7.00	10.31	7.00
30 – 34	7.00	5.47	6.50
35 – 39	4.50	4.12	4.50
40 – 44	3.50	3.01	3.25
45 – 49	3.00	2.64	3.00
50 – 54	2.50	2.08	3.00
55 – 59	2.50	16.63 <sup>30</sup>	3.00
60 – 64	2.50	14.20 <sup>28</sup>	3.00

**As shown above, we are recommending decreases at some younger ages and increases at some older ages for members with 5 or more years of service.**

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

We will continue to assume that termination rates are zero at any age where members are assumed to retire. In other words, at those ages, members will either retire in accordance with the retirement rate assumptions or continue working, rather than terminate and defer their benefit.

Chart 14 compares actual to expected total terminations (withdrawals plus vested terminations) over the past three years for both the current and proposed assumptions.

Chart 15 shows the current and proposed termination rates for members with less than five years of service. Chart 16 shows the current and proposed termination rates for members with five or more years of service.

<sup>29</sup> At central age in age range shown.

<sup>30</sup> We assume that termination rates are zero at any age where members are assumed to retire. When excluding members that were eligible for retirement from the observed terminations, the observed rates become 3.63% for the age 55-59 category and 4.06% for the age 60-64 category.

Chart 14: Actual Number of Terminations Compared to Expected

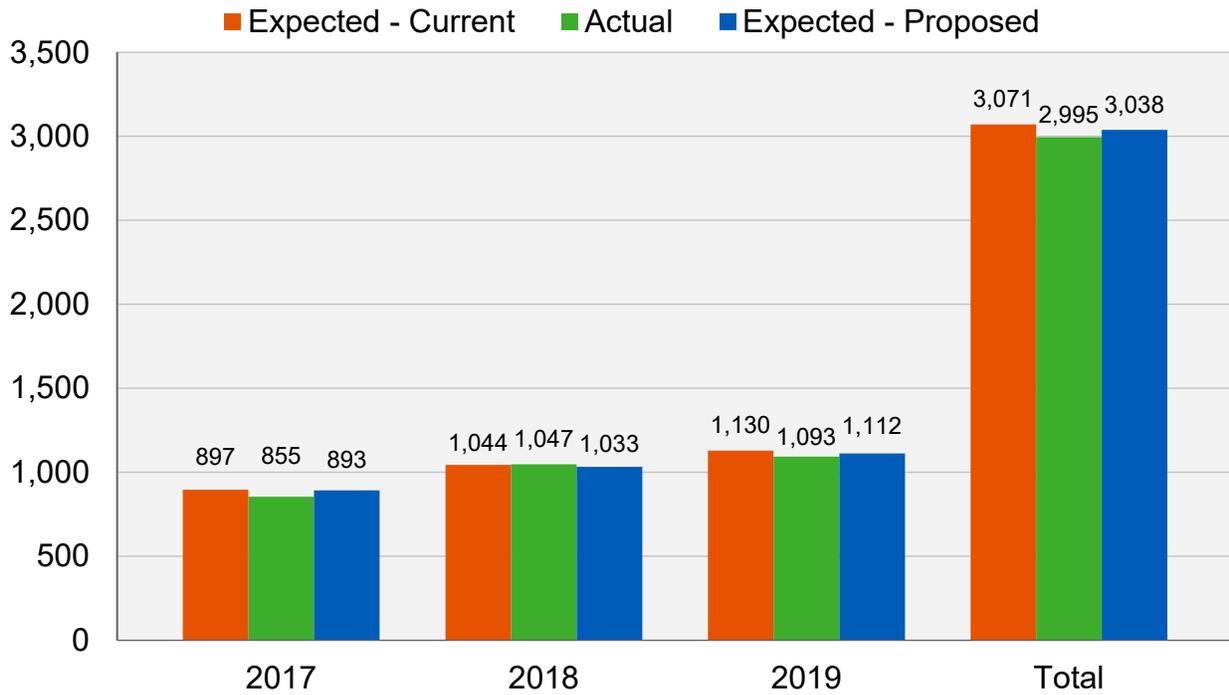


Chart 15: Termination Rates Less Than Five Years of Service

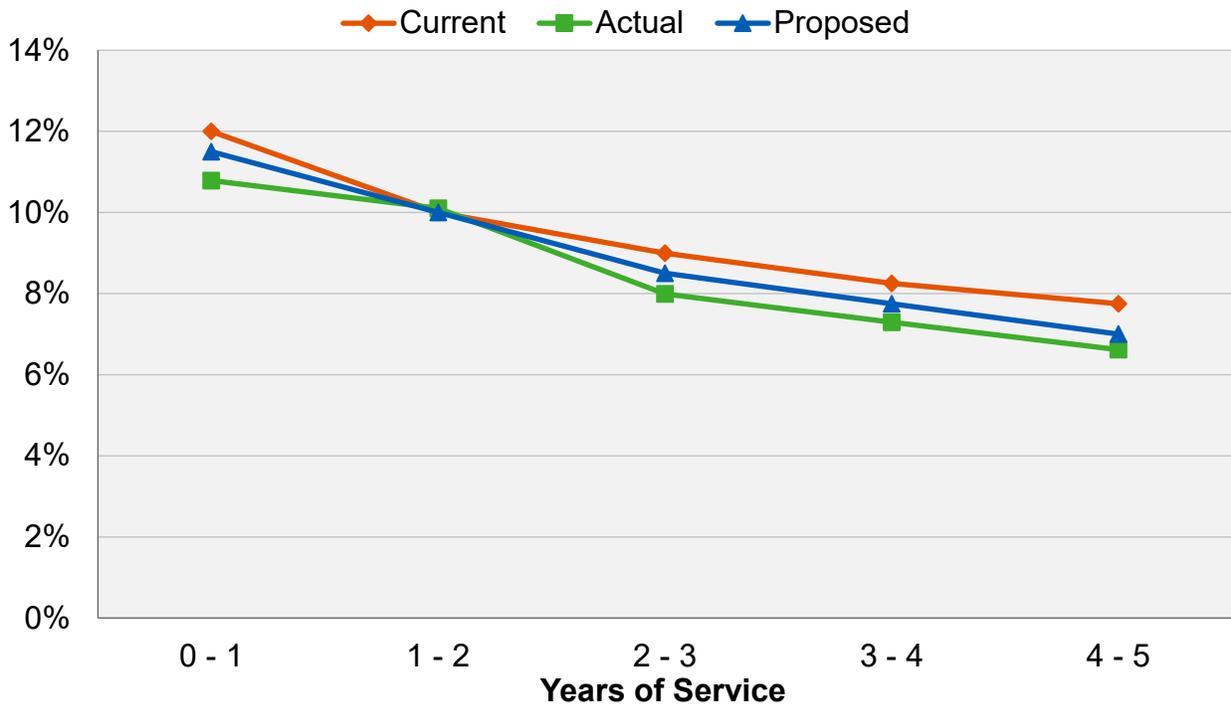
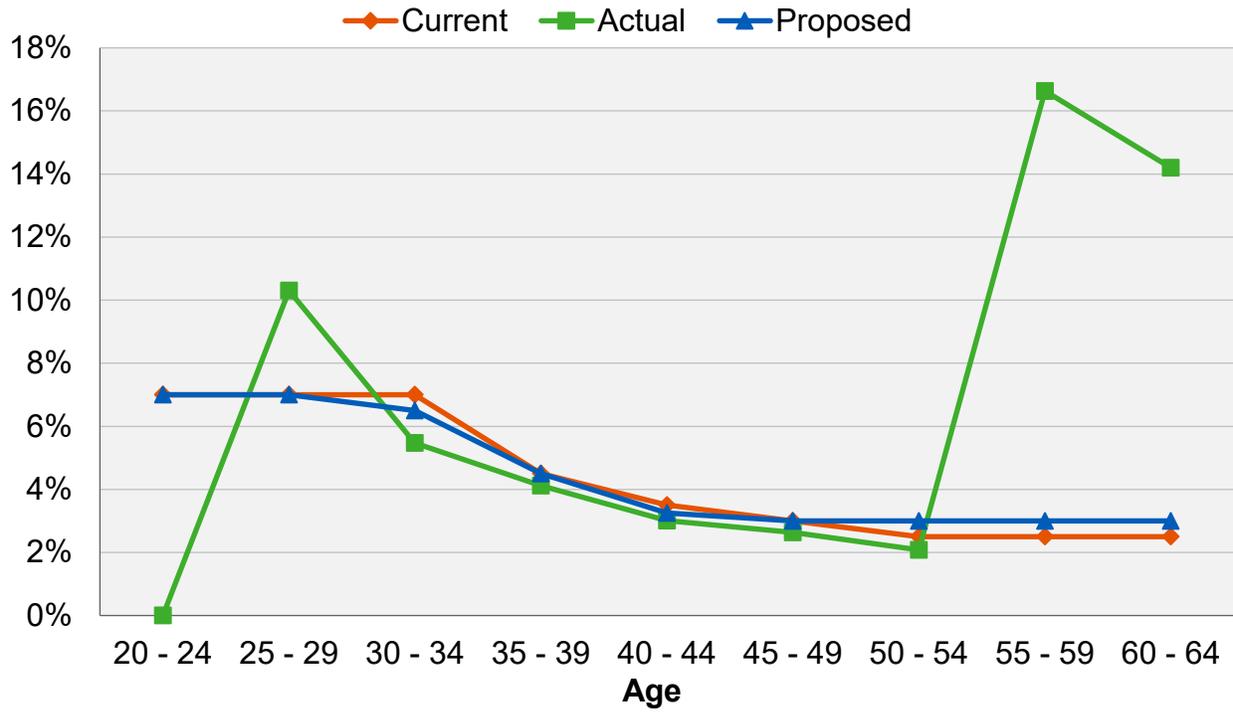


Chart 16: Termination Rates  
Five or More Years of Service



# E. Disability Incidence Rates

When a member becomes disabled, he or she is generally entitled to a monthly benefit equal to 1/3 of their final average monthly compensation.

The following summarizes the actual incidence of Tier 1 disabilities over the past three years compared to the current and proposed assumptions:<sup>31</sup>

## Rates of Disability Incidence

Age	Disability Incidence Rate <sup>32</sup> (%)		
	Current Rate	Observed Rate	Proposed Rate
20 – 24	0.00	0.00	0.00
25 – 29	0.01	0.00	0.01
30 – 34	0.03	0.00	0.03
35 – 39	0.06	0.02	0.04
40 – 44	0.08	0.07	0.08
45 – 49	0.17	0.10	0.14
50 – 54	0.20	0.15	0.18
55 – 59	0.20	0.09	0.18
60 – 64	0.20	0.19	0.18
65 – 69	0.20	0.37	0.25

As shown above, we are recommending overall decreases to the assumed disability rates.

For Tier 1 Enhanced members, their disability benefits will be different based on the type of disability as well as the severity of disability. We recommend maintaining the current assumptions as listed below until we have more actual experience from those members.

For Tier 1 Enhanced, 90% of disability retirements are assumed to be service-connected with service-connected disability benefits based on years of service, as follows:

Service-Connected Disability Benefits	Years of Service	Benefit
	Less than 20	55% of Final Average Monthly Compensation
20 - 30	65% of Final Average Monthly Compensation	
More than 30	75% of Final Average Monthly Compensation	

For Tier 1 Enhanced, 10% of disability retirements are assumed to be nonservice-connected with nonservice-connected disability benefits equal to 40% of Final Average Monthly Compensation

Chart 17 compares the actual number of disabilities over the past three years to that expected under both the current and proposed assumptions. Chart 18 shows the actual disability incidence rates, compared to the assumed and proposed rates.

<sup>31</sup> The Tier 1 experience shown above reflects actual disabilities from the prior years' status of mostly inactive membership. Note that there was no disability experience for Tier 3 members over the experience study period.

<sup>32</sup> At central age in age range shown.

Chart 17: Actual Number of Disabilities Compared to Expected

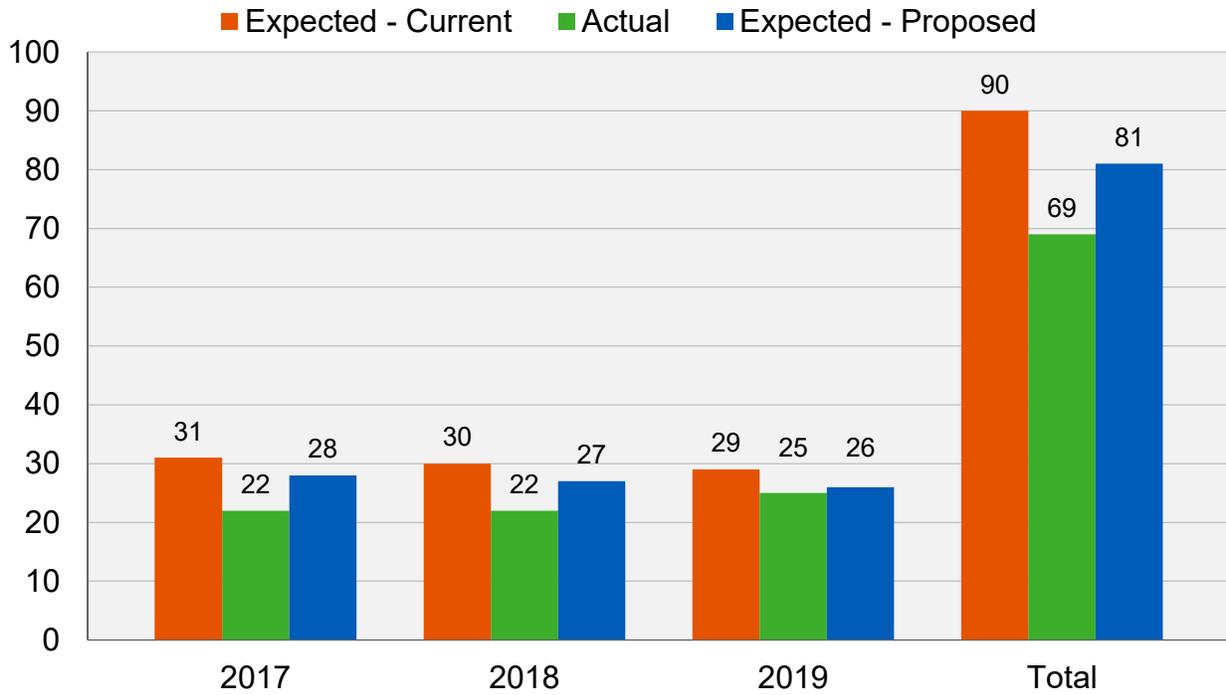
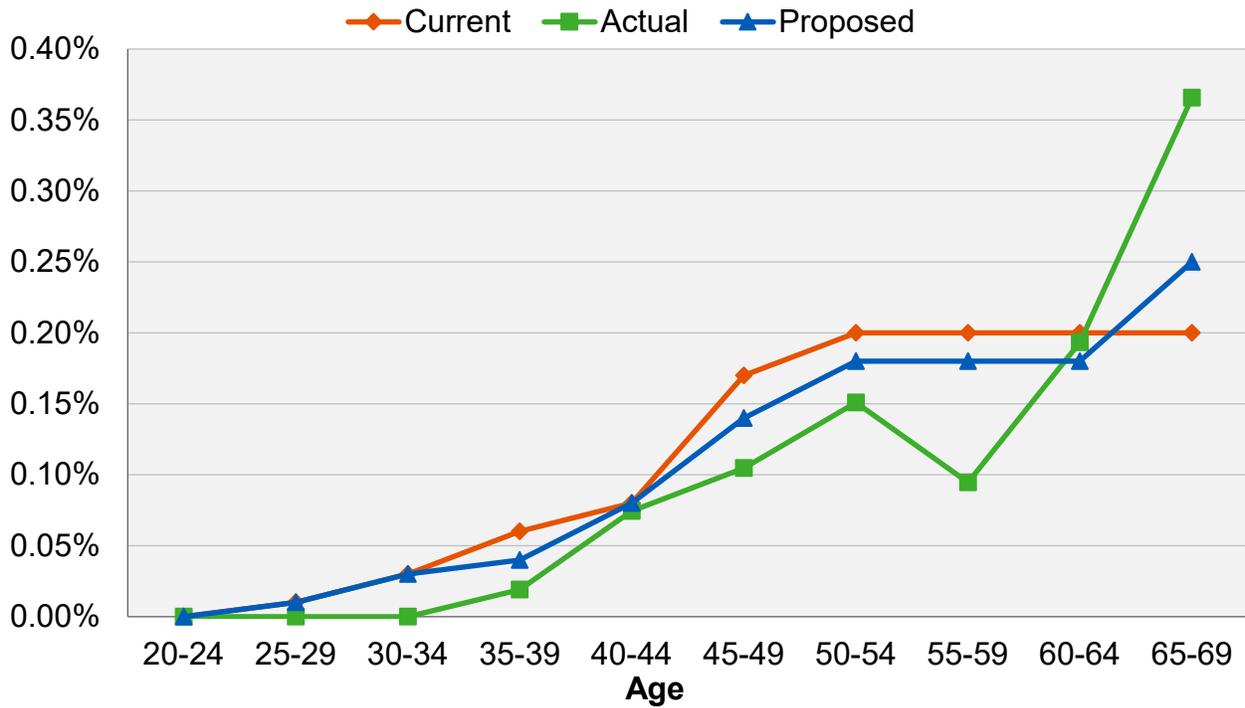


Chart 18: Disability Incidence Rates



# V. Cost Impact

We have estimated the impact of all the recommended demographic and economic assumptions as if they were applied to the June 30, 2019 actuarial valuations.

## Retirement Plan

The table below shows the changes in the total normal cost and actuarial accrued liability for the Retirement Plan due to the proposed assumption changes, as if they were applied in the June 30, 2019 actuarial valuation. If all of the proposed assumption changes (both economic and demographic) were implemented, the total normal cost for the Retirement Plan would have increased by about \$40.0 million and the actuarial accrued liability would have increased by about \$505.7 million. The funded percentage would have decreased from 71.3% to 69.6%.

	Change in Plan Liabilities as of June 30, 2019		
	Current Assumptions	Proposed Assumptions	Increase / (Decrease)
Total Normal Cost	\$374,967,243	\$414,953,447	\$39,986,204
Actuarial Accrued Liability	\$20,793,421,143	\$21,299,153,880	\$505,732,737

If all of the proposed assumption changes (both economic and demographic) were implemented, the aggregate beginning-of-the-year employer contribution rate would have increased by 3.41% of payroll.

Employer Contribution Rate Impact (% of Payroll at Beginning of the Year)	
Contributions	Proposed Assumptions Total
Normal Cost	1.81%
UAAL	1.60%
<b>Total</b>	<b>3.41%</b>

## Health Plan

The table below shows the changes in the total normal cost and actuarial accrued liability for the Health Plan due to the proposed assumption changes, as if they were applied in the June 30, 2019 actuarial valuation. If all of the proposed assumption changes (both economic and demographic) were implemented, the total normal cost for the Health Plan would have increased by about \$8.3 million and the actuarial accrued liability would have increased by about \$94.3 million. The funded percentage would have decreased from 84.4% to 82.0%.

Change in Plan Liabilities as of June 30, 2019			
	Current Assumptions	Proposed Assumptions	Increase / (Decrease)
Total Normal Cost	\$76,422,769	\$84,753,308	\$8,330,539
Actuarial Accrued Liability	\$3,334,298,549	\$3,428,626,759	\$94,328,210

If all of the proposed assumption changes (both economic and demographic) were implemented, the aggregate beginning-of-the-year employer contribution rate would have increased by 0.68% of payroll.

Employer Contribution Rate Impact (% of Payroll at Beginning of the Year)	
Contributions	Proposed Assumptions Total
Normal Cost	0.38%
UAAL	0.30%
<b>Total</b>	<b>0.68%</b>

# Appendix A: Current Actuarial Assumptions

## Economic Assumptions

<b>Net Investment Return</b>	7.25%; net of administrative and investment expenses. Expected administrative and investment expenses represent about 0.60% of the Market Value of Assets.
<b>Member Contribution Crediting Rate:</b>	Based on average of 5-year Treasury note rate. An assumption of 3.00% is used to approximate that crediting rate.
<b>Consumer Price Index:</b>	Increase of 3.00% per year, benefit increases due to CPI subject to 3.00% maximum for Tier 1 and 2.00% maximum for Tier 3.
<b>Payroll Growth:</b>	Inflation of 3.00% per year plus real “across the board” salary increases of 0.50% per year, used to amortize the Unfunded Actuarial Accrued Liability as a level percentage of payroll.
<b>Increase in Internal Revenue Code Section 401(a)(17) Compensation Limit</b>	Increase of 3.00% per year from the valuation date.

# Salary Increases

The annual rate of compensation increase includes: inflation at 3.00%, plus real “across the board” salary increases of 0.50% per year, plus the following merit and promotion increases:

Merit and Promotion Increases	
Years of Service	Rate (%)
Less than 1	6.50
1 – 2	6.20
2 – 3	5.10
3 – 4	3.10
4 – 5	2.10
5 – 6	1.10
6 – 7	1.00
7 – 8	0.90
8 – 9	0.70
9 – 10	0.60
10 & Over	0.40

# Demographic Assumptions

## Mortality Rates – Healthy

- Headcount-Weighted RP-2014 Healthy Annuitant Mortality Tables (separate tables for males and females), with no setback for males and females, projected generationally with the two-dimensional mortality improvement scale MP-2017.

## Mortality Rates – Disabled

- Headcount-Weighted RP-2014 Disabled Retiree Mortality Tables (separate tables for males and females), with no setback for males and females, projected generationally with the two-dimensional mortality improvement scale MP-2017.

## Mortality Rates – Beneficiary

- Headcount-Weighted RP-2014 Healthy Annuitant Mortality Tables (separate tables for males and females), with no setback for males and females, projected generationally with the two-dimensional mortality improvement scale MP-2017.

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

## Mortality Rates – Pre-Retirement

- Headcount-Weighted RP-2014 Employee Mortality Tables (separate tables for males and females), with no setback for males and females, multiplied by 90%, projected generationally with the two-dimensional mortality improvement scale MP-2017.

Age	Rate (%)	
	Male	Female
20	0.05	0.02
25	0.06	0.02
30	0.05	0.02
35	0.06	0.03
40	0.07	0.04
45	0.11	0.07
50	0.19	0.12
55	0.31	0.19
60	0.51	0.27
65	0.88	0.40

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

For Tier 1 Enhanced, 100% of pre-retirement death benefits are assumed to be service-connected.

## Disability Incidence Rates

Disability Incidence	
Age	Rate (%)
25	0.01
30	0.02
35	0.05
40	0.07
45	0.13
50	0.19
55	0.20
60	0.20
65	0.20

For Tier 1 Enhanced, 90% of disability retirements are assumed to be service-connected with service-connected disability benefits based on years of service, as follows:

Service-Connected Disability Benefits	Years of Service		Benefit
	Less than 20	55%	of Final Average Monthly Compensation
	20 - 30	65%	of Final Average Monthly Compensation
	More than 30	75%	of Final Average Monthly Compensation

For Tier 1 Enhanced, 10% of disability retirements are assumed to be nonservice-connected with nonservice-connected disability benefits equal to 40% of Final Average Monthly Compensation

## Termination Rates – Less than Five Years of Service

Termination (<5 Years of Service)	
Years of Service	Rate (%)
Less than 1	12.00
1 – 2	10.00
2 – 3	9.00
3 – 4	8.25
4 – 5	7.75

## Termination Rates – Five or More Years of Service

Termination (5+ Years of Service)	
Age	Rate (%)
25	7.00
30	7.00
35	5.50
40	3.90
45	3.20
50	2.70
55	2.50
60	2.50

No termination is assumed after a member is eligible for retirement (as long as a retirement rate is present).

## Retirement Rates

Age	Rate (%)					
	Tier 1		Tier 1 Enhanced		Tier 3	
	Non-55/30	55/30	Non-55/30	55/30	Non-55/30	55/30
50	6.0	0.0	7.0	0.0	6.0	0.0
51	3.0	0.0	4.0	0.0	3.0	0.0
52	3.0	0.0	4.0	0.0	3.0	0.0
53	3.0	0.0	4.0	0.0	3.0	0.0
54	17.0	0.0	18.0	0.0	16.0	0.0
55	6.0	24.0	7.0	25.0	0.0 <sup>(1)</sup>	23.0
56	6.0	16.0	7.0	17.0	0.0 <sup>(1)</sup>	15.0
57	6.0	16.0	7.0	17.0	0.0 <sup>(1)</sup>	15.0
58	6.0	16.0	7.0	17.0	0.0 <sup>(1)</sup>	15.0
59	6.0	16.0	7.0	17.0	0.0 <sup>(1)</sup>	15.0
60	7.0	16.0	8.0	17.0	6.0	15.0
61	7.0	16.0	8.0	17.0	6.0	15.0
62	7.0	16.0	8.0	17.0	6.0	15.0
63	7.0	16.0	8.0	17.0	6.0	15.0
64	7.0	16.0	8.0	17.0	6.0	15.0
65	13.0	20.0	14.0	21.0	12.0	19.0
66	13.0	20.0	14.0	21.0	12.0	19.0
67	13.0	20.0	14.0	21.0	12.0	19.0
68	13.0	20.0	14.0	21.0	12.0	19.0
69	13.0	20.0	14.0	21.0	12.0	19.0
70 & Over	100.0	100.0	100.0	100.0	100.0	100.0

<sup>(1)</sup> Not eligible to retire under the provisions of the Tier 3 plan.

<b>Retirement Age and Benefit for Inactive Vested Members</b>	Pension benefit paid at the later of age 59 or the current attained age. For reciprocals, 3.90% compensation increases per annum.
<b>Other Reciprocal Service</b>	5% of future inactive vested members will work at a reciprocal system.
<b>Service</b>	Employment service is used for eligibility determination purposes. Benefit service is used for benefit calculation purposes.
<b>Future Benefit Accruals</b>	1.0 year of service credit per year.
<b>Unknown Data for Members</b>	Same as those exhibited by members with similar known characteristics. If not specified, members are assumed to be male.
<b>Form of Payment</b>	All active and inactive Tier 1 and Tier 3 members who are assumed to be married or with domestic partners at retirement are assumed to elect the 50% Joint and Survivor Cash Refund Annuity. For Tier 1 Enhanced, the continuance percentage is 70% for service retirement and nonservice-connected disability, and 80% for service-connected disability. Those members who are assumed to be un-married or without domestic partners are assumed to elect the Single Cash Refund Annuity.
<b>Percent Married/Domestic Partner</b>	For all active and inactive members, 76% of male members and 50% of female members are assumed to be married or with domestic partner at pre-retirement death or retirement.
<b>Age and Gender of Spouse</b>	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.

# Appendix B: Proposed Actuarial Assumptions

## Economic Assumptions

<b>Net Investment Return</b>	Recommended: 7.00%; net of administrative and investment expenses. Expected administrative and investment expenses represent about 0.40% of the Actuarial Value of Assets.
<b>Member Contribution Crediting Rate:</b>	Based on average of 5-year Treasury note rate. An assumption of 2.75% is used to approximate that crediting rate.
<b>Consumer Price Index:</b>	Increase of 2.75% per year, benefit increases due to CPI subject to 2.75% maximum for Tier 1 and 2.00% maximum for Tier 3. (For Tier 1 members with a sufficient COLA bank, withdrawals from the bank can be made to increase the retiree COLA up to 3% per year.)
<b>Payroll Growth:</b>	Inflation of 2.75% per year plus real “across the board” salary increases of 0.50% per year, used to amortize the Unfunded Actuarial Accrued Liability as a level percentage of payroll.
<b>Increase in Internal Revenue Code Section 401(a)(17) Compensation Limit</b>	Increase of 2.75% per year from the valuation date.

## Salary Increases

The annual rate of compensation increase includes: inflation at 2.75%, plus real “across the board” salary increases of 0.50% per year, plus the following merit and promotion increases:

Merit and Promotion Increases	
Years of Service	Rate (%)
Less than 1	6.70
1 – 2	6.50
2 – 3	5.80
3 – 4	4.00
4 – 5	3.00
5 – 6	2.20
6 – 7	2.00
7 – 8	1.80
8 – 9	1.60
9 – 10	1.40
10 & Over	1.00

## Demographic Assumptions

### Mortality Rates – Healthy

- For the Retirement Plan - Pub-2010 General Healthy Retiree Amount-Weighted Above-Median Mortality Table with rates increased by 10% for males, projected generationally with the two-dimensional mortality improvement scale MP-2019.
- For the Health Plan - Pub-2010 General Healthy Retiree Headcount-Weighted Above-Median Mortality Table with rates increased by 10% for males, projected generationally with the two-dimensional mortality improvement scale MP-2019.

### Mortality Rates – Disabled

- For the Retirement Plan - Pub-2010 Non-Safety Disabled Retiree Amount-Weighted Mortality Table with rates increased by 10% for males and decreased by 5% for females, projected generationally with the two-dimensional mortality improvement scale MP-2019.
- For the Health Plan - Pub-2010 Non-Safety Disabled Retiree Headcount-Weighted Mortality Table with rates increased by 10% for males and decreased by 5% for females, projected generationally with the two-dimensional mortality improvement scale MP-2019.

## Mortality Rates – Beneficiary

- For the Retirement Plan - Pub-2010 Contingent Survivor Amount-Weighted Above-Median Mortality Table with rates increased by 10% for males and females, projected generationally with the two-dimensional mortality improvement scale MP-2019.
- For the Health Plan - Pub-2010 Contingent Survivor Headcount-Weighted Above-Median Mortality Table with rates increased by 10% for males and females, projected generationally with the two-dimensional mortality improvement scale MP-2019.

The Pub-2010 mortality tables and adjustments as shown above reasonably reflect the mortality experience as of the measurement date. These mortality tables were adjusted to future years using the generational projection to reflect future mortality improvement between the measurement date and those years.

## Mortality Rates – Pre-Retirement

- For the Retirement Plan - Pub-2010 General Employee Amount-Weighted Above-Median Mortality Table with rates increased by 10%, projected generationally with the two-dimensional mortality improvement scale MP-2019.

Age	Rate (%)	
	Male	Female
20	0.04	0.01
25	0.03	0.01
30	0.03	0.01
35	0.05	0.02
40	0.06	0.04
45	0.09	0.06
50	0.14	0.08
55	0.21	0.12
60	0.30	0.19
65	0.45	0.30

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

For Tier 1 Enhanced, 100% of pre-retirement death benefits are assumed to be service-connected.

For the Health Plan - Pub-2010 General Employee Headcount-Weighted Above-Median Mortality Table with rates increased by 10%, projected generationally with the two-dimensional mortality improvement scale MP-2019.

## Disability Incidence Rates

Disability Incidence	
Age	Rate (%)
25	0.01
30	0.02
35	0.04
40	0.06
45	0.12
50	0.16
55	0.18
60	0.18
65	0.22

For Tier 1 Enhanced, 90% of disability retirements are assumed to be service-connected with service-connected disability benefits based on years of service, as follows:

Service-Connected Disability Benefits	Years of Service		Benefit
	Less than 20	55%	of Final Average Monthly Compensation
	20 - 30	65%	of Final Average Monthly Compensation
	More than 30	75%	of Final Average Monthly Compensation

For Tier 1 Enhanced, 10% of disability retirements are assumed to be nonservice-connected with nonservice-connected disability benefits equal to 40% of Final Average Monthly Compensation

## Termination Rates – Less than Five Years of Service

Termination (<5 Years of Service)	
Years of Service	Rate (%)
Less than 1	11.50
1 – 2	10.00
2 – 3	8.50
3 – 4	7.75
4 – 5	7.00

## Termination Rates – Five or More Years of Service

Termination (5+ Years of Service)	
Age	Rate (%)
25	7.00
30	6.70
35	5.30
40	3.75
45	3.10
50	3.00
55	3.00
60	3.00

No termination is assumed after a member is eligible for retirement (as long as a retirement rate is present).

## Retirement Rates

Age	Rate (%)					
	Tier 1		Tier 1 Enhanced		Tier 3	
	Non-55/30	55/30	Non-55/30	55/30	Non-55/30	55/30
50	5.0	0.0	7.0	0.0	5.0	0.0
51	3.0	0.0	5.0	0.0	3.0	0.0
52	3.0	0.0	5.0	0.0	3.0	0.0
53	3.0	0.0	5.0	0.0	3.0	0.0
54	18.0	0.0	20.0	0.0	17.0	0.0
55	6.0	27.0	8.0	30.0	0.0 <sup>(1)</sup>	26.0
56	6.0	18.0	8.0	22.0	0.0 <sup>(1)</sup>	17.0
57	6.0	18.0	8.0	22.0	0.0 <sup>(1)</sup>	17.0
58	6.0	18.0	8.0	22.0	0.0 <sup>(1)</sup>	17.0
59	6.0	18.0	8.0	22.0	0.0 <sup>(1)</sup>	17.0
60	7.0	18.0	9.0	22.0	6.0	17.0
61	7.0	18.0	9.0	22.0	6.0	17.0
62	7.0	18.0	9.0	22.0	6.0	17.0
63	7.0	18.0	9.0	22.0	6.0	17.0
64	7.0	18.0	9.0	22.0	6.0	17.0
65	14.0	21.0	16.0	26.0	13.0	20.0
66	14.0	21.0	16.0	26.0	13.0	20.0
67	14.0	21.0	16.0	26.0	13.0	20.0
68	14.0	21.0	16.0	26.0	13.0	20.0
69	14.0	21.0	16.0	26.0	13.0	20.0
70 & Over	100.0	100.0	100.0	100.0	100.0	100.0

<sup>(1)</sup> Not eligible to retire under the provisions of the Tier 3 plan at these ages with less than 30 years of service. If a member has at least 30 years of service at these ages, they would be subject to the "55/30" rates.

<b>Retirement Age and Benefit for Inactive Vested Members</b>	Pension benefit paid at the later of age 59 or the current attained age. For reciprocals, 4.25% compensation increases per annum.
<b>Other Reciprocal Service</b>	5% of future inactive vested members will work at a reciprocal system.
<b>Service</b>	Employment service is used for eligibility determination purposes. Benefit service is used for benefit calculation purposes.
<b>Future Benefit Accruals</b>	1.0 year of service credit per year.
<b>Unknown Data for Members</b>	Same as those exhibited by members with similar known characteristics. If not specified, members are assumed to be male.
<b>Form of Payment</b>	All active and inactive Tier 1 and Tier 3 members who are assumed to be married or with domestic partners at retirement are assumed to elect the 50% Joint and Survivor Cash Refund Annuity. For Tier 1 Enhanced, the continuance percentage is 70% for service retirement and nonservice-connected disability, and 80% for service-connected disability. Those members who are assumed to be un-married or without domestic partners are assumed to elect the Single Cash Refund Annuity.
<b>Percent Married/Domestic Partner</b>	For all active and inactive members, 76% of male members and 52% of female members are assumed to be married or with domestic partner at pre-retirement death or retirement.
<b>Age and Gender of Spouse</b>	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.