Segal Consulting

Los Angeles City Employees' Retirement System

ACTUARIAL EXPERIENCE STUDY

Analysis of Actuarial Experience
During the Period
July 1, 2014 through June 30, 2017

June 29, 2018

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, 2018 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, 2014 to June 30, 2017 and provides the proposed actuarial assumptions, both economic and demographic, to be used in the June 30, 2018 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

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Actuarial Experience Study
Analysis of Actuarial Experience
During the Period July 1, 2014 through June 30, 2017

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. 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, 2014 through June 30, 2017. 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 put forth guidelines for the selection of the various actuarial assumptions utilized in a pension plan actuarial valuation. Based on the study's results and expected future experience, we are recommending various changes in the current actuarial assumptions.

We are recommending changes in the assumptions for inflation, investment return, crediting rate for employee contributions, cost-of-living adjustments (COLA), promotional and merit salary increases, retirement from active employment, spouse age differences, retirement age for deferred vested members, reciprocal salary increases, pre-retirement mortality, healthy life post-retirement mortality, disabled life post-retirement mortality, termination, and disability. We are also recommending, subject to legal review, introduction of an assumption to reflect COLA benefits in determining actuarial equivalence when a member elects an optional form of benefit at retirement.

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

Pg #	Actuarial Assumption Categories	Recommendation
9	**Inflation:** Future increases in the Consumer Price Index (CPI) which drives investment returns and active member salary increases, as well as cost-of-living adjustments (COLAs) for retirees. **Crediting Rate for Employee Contributions:** Future increases in the account balance of a member between the date of the valuation and the date of separation from active service.	Reduce the inflation assumption from 3.00% to 2.75% per annum as discussed in Section III(A). (For Tier 3 retirees, the COLA assumption would remain at 2.00% per annum.) Reduce the interest crediting rate for employee contributions from 3.00% to 2.75% per annum as discussed in Section III(A).
12	**Investment Return:** 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.	Reduce the investment return assumption from 7.25% to 7.00% per annum as discussed in Section III(B).
21	**Individual Salary Increases:** Increases in the salary of a member between the date of the valuation to the date of separation from active service. This assumption has three components: • Inflationary salary increases • Real "across the board" salary increases • Promotional and merit increases	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%. Change the promotional and merit increases to those developed in Section III(C). Future promotional and merit salary increases are higher under the proposed assumptions. The total salary increases (taking into account all three components) are slightly lower under the proposed assumptions.
25	**Retirement Rates:** The probability of retirement at each age at which participants are eligible to retire. **Other Retirement Related Assumptions including:** • Percent married and spousal age differences for members not yet retired • Retirement age for inactive vested members • Future reciprocal members and reciprocal salary increases	For active members, adjust the current retirement rates to those developed in Section IV(A). Overall, the recommended assumptions will anticipate earlier retirements for active members. For active and inactive members, decrease the current assumption that male retirees are four years older than their female spouses to a three-year age difference, and maintain the current age difference assumption for female retirees. For inactive vested members, increase the assumed retirement age from 58 to 59. For future inactive vested members, maintain the percentage assumed to work at a reciprocal system at 5%. For all reciprocal members, lower the compensation increase assumption from 3.90% to 3.85% per annum.

Pg #	Actuarial Assumption Categories	Recommendation
29 35	**Mortality Rates:** The probability of dying at each age. Mortality rates are used to project life expectancies.	For healthy pensioners and all beneficiaries, change from the RP-2000 Combined Healthy Mortality Table projected statically with Scale BB to 2020, with a one-year setback for males and with no setback for females, to the Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table projected generationally with the two-dimensional mortality improvement scale MP-2017.
		For disabled pensioners, change from the RP-2000 Combined Healthy Mortality Table projected statically with Scale BB to 2020, with a seven-year set forward for males and an eight-year set forward for females, to the Headcount-Weighted RP-2014 Disabled Retiree Mortality Table projected generationally with the two-dimensional mortality improvement scale MP-2017.
		For pre-retirement mortality, change from the current post-retirement mortality tables to the Headcount-Weighted RP-2014 Employee Mortality Table times 90%, projected generationally with the two-dimensional mortality improvement scale MP-2017.
		The recommended assumptions will anticipate longer life expectancy.
		Introduce an assumption to reflect COLA benefits in determining actuarial equivalence when a member elects an optional form of benefit at retirement.
37	**Termination Rates:** The probability of leaving employment at each age and receiving either a refund of contributions or a deferred vested retirement benefit.	Adjust the current termination rates to those developed in Section IV(D). The recommended assumption will anticipate slightly less terminations for members with fewer than five years of employment service, and more terminations for members with five or more years of employment service.
40	**Disability Incidence Rates:** The probability of becoming disabled at each age.	Adjust the current disability incidence rates to those developed in Section IV(E). The recommended assumption will anticipate slightly less disablements.

We have estimated the impact of the proposed assumption changes as if they were applied to the June 30, 2017 actuarial valuation. In particular, if all of the proposed assumption changes were implemented, the aggregate employer rate would have increased by 2.42% of payroll for the Retirement Plan and 0.98% of payroll for the Health Plan (based on contribution rates payable at the beginning of the year). Of the various assumption changes, the most significant cost impact is from the investment return assumption change and the mortality assumption change.

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 employees and drives increases in the allowances of retired members.

> **Investment Return:** Expected long-term rate of return on the System's investments after administrative and 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 "across the board" real 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 promotional and merit increases. Payments to amortize any Unfunded Actuarial Accrued Liability (UAAL) are assumed to increase each year by the price inflation rate plus any "across the board" real 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 terminate during the year, we would say the probability of termination in that age group is 50 ÷ 500 or 10%.

The reliability of the resulting probability is highly dependent on both the number of decrements and the number of exposures. For example, if there are only a few people in a high age category

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

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

III. Economic Assumptions

A. Inflation

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

The inflation assumption is long term in nature, so our analysis included 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 2017[1]
(U.S. City Average - All Urban Consumers)

	25th Percentile	Median	75th Percentile
15-year moving averages	2.4%	3.4%	4.5%
30-year moving averages	3.0%	3.8%	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 of the 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 168 large public retirement funds[2] in their 2016 fiscal year valuations was 3.00%. In California, CalPERS, CalSTRS, Contra Costa County, Los Angeles County, Orange County and three other 1937 Act CERL systems use an inflation assumption of 2.75%, one other 1937 Act CERL system uses an inflation assumption of 2.90%, two other 1937 Act CERL systems use an inflation assumption of 2.50%, and eleven other 1937 Act CERL systems use an inflation assumption of 3.00%.

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[3] for this assumption that is shorter than the time horizon of the actuarial valuation.

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[1] 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)

[2] Among 168 large public retirement funds, the inflation assumption was not available for 14 of the public retirement funds in the survey data.

[3] The time horizon used by the seven investment consultants included 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 2017 report on the financial status of the Social Security program.[4] 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 2.60%. Besides projecting the results under the intermediate cost assumptions using an inflation assumption of 2.60%, alternative projections were also made using a lower and a higher inflation assumption of 2.00% and 3.20%, respectively.

We also compared the yields on the thirty-year inflation indexed U.S. Treasury bonds to comparable traditional U.S. Treasury bonds.[5] As of April 2018, the difference in yields is about 2.14%, 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, 2018 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, we have recently been recommending the same 2.75% inflation assumption in our experience studies for our California based public retirement system clients. As discussed on the previous page of this report, several large California public retirement systems have recently adopted a 2.75% inflation assumption in their valuations, including six county retirement systems.

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, 2018 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 June 30, 2017 economic assumptions study, consistent with the 3.00% annual inflation assumption adopted by the Board for that valuation, 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.

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4   Source: Social Security Administration – The 2017 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Federal Disability Insurance Trust Funds

5   Source: Board of Governors of the Federal Reserve System

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,[6] while maintaining the current assumption of 2.00% per year for Tier 3.

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 COLA benefit assumption lower than 2.75%, 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 based on the long-term annual inflation assumption, as we have in prior years.

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6   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.

B. Investment Return

The investment return assumption is comprised of two primary components, inflation and real rate of investment return, with adjustments for administrative and 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" 2018 return assumptions by their assumed 2.75% inflation rate. The second column of returns (except for Additional Public Real Assets, Real Estate Investment Trust (REIT), Private Debt, and Private Equity) 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.[7]

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

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[8]	Average Assumed Real Rate of Return from a Sample of Consultants to Segal's California Public Sector Clients[9]
U.S. Large Cap Equity	14.00%	6.08%	5.32%
U.S. Small Cap Equity	5.00%	6.89%	6.07%
Developed Int'l Large Cap Equity	17.00%	6.89%	6.67%
Developed Int'l Small Cap Equity	3.00%	7.31%	7.14%
Emerging Market Equity	7.00%	9.72%	8.87%
Core Bond	13.75%	1.17%	1.04%
High Yield Bond	2.00%	3.51%	3.09%
Bank Loan	2.00%	3.12%	3.00%
TIPS	3.50%	1.20%	0.97%
Emerging Market Debt (External)	4.50%	3.01%	3.44%
Real Estate	7.00%	5.10%	4.68%
Cash	1.00%	0.00%	0.01%
Commodities	1.00%	4.34%	3.36%
Additional Public Real Assets	1.00%	4.76%	4.76%[10]
Real Estate Investment Trust (REIT)	0.50%	5.91%	5.91%[10]
Private Debt	3.75%	5.50%	5.50%[10]
Private Equity	14.00%	8.97%	8.97%[10]
Total	**100.00%**	**5.68%**	**5.37%**

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 3.8.3.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 believes, based on relevant supporting data, that such superior or inferior returns represent a reasonable expectation over the measurement period."

The following are some observations about the returns provided above:

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[8] 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.

[9] 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.

[10] 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.

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 shorter than the durations of a retirement plan's liabilities.

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

3. Therefore, we recommend that the 5.37% portfolio real rate of return be used to determine the System's investment return assumption. This is 0.10% lower than the return that was used one year ago in the review to prepare the recommended investment return assumption for the June 30, 2017 valuation. The difference is primarily due to changes in the System's target asset allocation.

System Expenses

For funding purposes, the real rate of return assumption for the portfolio needs to be adjusted for investment and administrative expenses expected to be paid from investment income. We understand that as a result of a prior internal audit at LACERS, starting with fiscal year ended June 30, 2014, two items (i.e., Real Estate management fees and expenses, and Private Equity management fees and expenses) have been reclassified by LACERS and are now included as part of the investment management fees. Additionally, in preparing our June 30, 2017 economic assumptions report, we understand NEPC returns to be gross of active management fees. On a gross of active management fees basis, the following table provides these expenses in relation to the actuarial value of assets for the four years ending June 30, 2017, for informational purposes only.

ADMINISTRATIVE AND INVESTMENT EXPENSES AS A PERCENTAGE OF ACTUARIAL VALUE OF ASSETS GROSS OF ACTIVE MANAGEMENT FEES (Dollars in 000's)

Year Ending June 30	Actuarial Value of Assets[11]	Administrative Expenses[12]	Investment Expenses[13]	Administrative %	Investment %	Total %
2014	$12,935,503	$15,765	56,189	0.12%	0.43%	0.55%
2015	13,895,589	19,878[14]	62,595	0.14	0.45	0.59
2016	14,752,103	19,727[14]	66,540	0.13	0.45	0.58
2017	15,686,973	20,244	71,844	0.13	0.46	0.59
					Four-Year Average:	0.58%

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[11] At end of plan year.

[12] 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.

[13] Includes investment management expenses and investment related administrative expense, gross of expenses associated with private equity.

[14] Includes LACERS' share of the City's pension contributions of approximately $2.9 million for the year ended June 30, 2015 and $3.3 million for the year ended June 30, 2016.

Based on updated information provided by NEPC for this study and for another public retirement system client that uses NEPC as their investment consultant, we understand that the capital market assumptions for Private Equity is already net of active management fees. Accordingly, we have netted out the Private Equity management fees and expenses from the table above and the results are provided on the table below.

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[15]	Administrative Expenses[16]	Investment Expenses[17]	Administrative %	Investment %	Total %
2014	$12,935,503	$15,765	$36,045	0.12%	0.28%	0.40%
2015	13,895,589	19,878[18]	42,278	0.14	0.30	0.44
2016	14,752,103	19,727[18]	39,926	0.13	0.27	0.40
2017	15,686,973	20,244[18]	40,006	0.13	0.26	0.39
Four-Year Average				0.13%	0.28%	0.41%
Recommendation				0.15%	0.25%	0.40%

Based on this experience, we recommend that the System's future expense component of the investment return assumption be decreased from 0.60% to 0.40%.

Note related to investment expenses paid to active managers – As cited above, under Section 3.8.3.d of ASOP No. 27, the effect of an active investment management strategy should be considered "net of investment expenses…unless the actuary believes, based on relevant supporting data, that such superior or inferior returns represent a reasonable expectation over the measurement period." For LACERS, about 1/3 of the investment expenses were paid for expenses associated with active managers, during the year ended June 30, 2017.

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, nor are we aware of any study done by NEPC to quantify such alpha.

As noted above, we have excluded investment expenses associated with private equity. We could work with the LACERS' staff to determine whether future studies might potentially further exclude additional investment expenses for active managers that are expected to be offset by investment returns. For now, we will continue to use the current approach that any "alpha" that may be identified would be treated as an increase in the risk adjustment and corresponding

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[15] At end of plan year.

[16] 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.

[17] Includes investment management expenses and investment related administrative expense, net of expenses associated with private equity.

[18] Includes LACERS' share of the City's pension contributions of approximately $2.9 million for the year ended June 30, 2015, $3.3 million for the year ended June 30, 2016, and $3.2 million for the year ended June 30, 2017.

confidence level. For example, 0.25% of alpha would increase the confidence level by 3% (see discussions that follow on definitions of risk adjustment and confidence level).

Risk Adjustment

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

The purpose of the risk adjustment (as measured by the corresponding confidence level) is to increase the likelihood of achieving the actuarial investment return assumption in the long term.[19] This is consistent with our experience that retirement plan fiduciaries would generally prefer that returns exceed the assumed rate more often than not.

The 5.37% 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 likelihood that future investment earnings would equal or exceed the assumed earnings over a 15-year period on an expected value basis.[20] For example, if we set our real rate of return assumption using a risk adjustment that produces a confidence level of 60%, then there would be a 60% chance (6 out of 10) that the actual earnings over 15 years will be equal to or greater than the expected earnings. 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 generally in the range of 50% to 60%.

Last year the Board opted to lower the investment return assumption from 7.50% to 7.25%, which implied a risk adjustment of 0.62%. Together with an annual portfolio standard deviation of 13.2% (provided by NEPC in 2017), this reflected a confidence level of about 57% that the actual earnings over 15 years would not be less than the expected earnings, assuming that the distribution of returns over that period follows the normal statistical distribution.[21]

If we use the same 57% confidence level from our last study to set this year's risk adjustment, based on the current long-term portfolio standard deviation of 13.13% provided by NEPC in 2018, the corresponding risk adjustment would be 0.62%. Together with the other investment return components, this would result in an investment return assumption of 7.10%, 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 a 7.00% investment return assumption. In particular, a net investment return

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[19] This type of risk adjustment is sometimes referred to as a "margin for adverse deviation."

[20] 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 were met in the future.

[21] 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.

assumption of 7.00%, together with the other investment return components, would produce a risk adjustment of 0.72%, which when rounded corresponds to a confidence level of 58%. This is a slightly higher confidence level implicit in the investment return assumption adopted by the Board in the last study. For comparison, the confidence level associated with a 7.25% investment return assumption is 55%.

The table below shows LACERS' investment return assumptions, the risk adjustments and corresponding confidence levels for the current and prior studies.

HISTORICAL INVESTMENT RETURN ASSUMPTIONS, RISK ADJUSTMENTS AND CONFIDENCE LEVELS BASED ON ASSUMPTIONS ADOPTED BY THE BOARD

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)	7.00%	0.72%	58%

As we have discussed in prior years, 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.[22] The use of a confidence level of 58% should be considered in context with other factors, including:

➤ The confidence level is more of a relative measure than an absolute measure, and so can be reevaluated and reset for future comparisons.

➤ A lower level of inflation should reduce the overall risk of failing to meet the investment return assumption.

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

➤ While a confidence level of 58% is at the upper end of the range of about 50% to 60% that corresponds to the risk adjustments used by most of Segal's other California public

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[22] 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."

retirement system clients, the level is in-line with how LACERS' has positioned itself historically.

> Most public retirement systems that have recently reviewed their investment return assumptions have seen decreases in their confidence level even though they adopted more conservative investment return assumptions for their valuations.

> 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".

Recommended Investment Return Assumption

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%. As noted above, this return implies a risk adjustment of 0.72%, reflecting a confidence level of 58% that the actual arithmetic average return over 15 years would not fall below the assumed return. This reduction in the net investment return assumption from 7.25% to 7.00% reflects the 0.25% lower inflation expectation, the 0.10% decrease in the portfolio's real rate of return, the 0.20% "saving" as a result of a decrease in the expense assumption resulting from a clarification received from NEPC that their assumed returns provided are net of active management fees,[23] and a 0.10% increase in the risk adjustment.

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

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[23]   In preparing our June 30, 2017 economic assumptions report, NEPC returns were assumed to be gross of active management fees.

CALCULATION OF INVESTMENT RETURN ASSUMPTION

Assumption Component	June 30, 2018 Recommended Value	June 30, 2017 Adopted Value	June 30, 2014 Adopted Value With Restated Expense Adjustment	June 30, 2014 Adopted Value
Inflation	2.75%	3.00%	3.25%	3.25%
Plus Portfolio Real Rate of Return	5.37%	5.47%	5.59%	5.59%
Minus Expense Adjustment	(0.40%)	(0.60%)	(0.60%)	(0.40%)
Minus Risk Adjustment	(0.72%)	(0.62%)	(0.74%)	(0.94%)
Total	**7.00%**	**7.25%**	**7.50%**	**7.50%**
Confidence Level	**58%**	**57%**	**59%**	**61%**

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

We also recommend that the same investment return assumption that is adopted by the Board for funding purposes be used for GASB financial reporting purposes. For GASB financial reporting purposes, the investment return assumption would be considered net of investment expenses only, which would increase the risk adjustment.

Comparing with Other Public Retirement Systems

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

We note that a 7.00% investment return assumption is becoming more common among California public sector retirement systems. In particular, seven County employees' retirement systems (Contra Costa, Fresno, Marin, Mendocino, Orange, Sacramento, and Santa Barbara) use a 7.00% earnings assumption. Furthermore, the CalPERS Board has approved a reduction in the earnings assumption to 7.00%. In addition, CalSTRS recently adopted a 7.00% earnings assumption for the 2017 valuation. With the exception of the retirement systems stated above, most of the public sector retirement systems in California are using a 7.25% earnings assumption. Both LADWP and LAFPP have adopted a 7.25% assumption.

The following table compares LACERS' recommended net investment return assumption against those of the nationwide public retirement systems that participated in the National Association of State Retirement Administrators (NASRA) 2017 Public Fund Survey for 168 large public retirement funds[24] in their 2016 fiscal year valuations:

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[24] Among 168 large public retirement funds, the investment return assumption was not available for 12 of the public retirement funds in the survey data.

Assumption	LACERS	NASRA 2016 Public Fund Survey[25]		
		Low	Median	High
Net Investment Return	7.00%	6.50%	7.50%	8.50%

The detailed survey results show that more than one-half of the systems have an investment return assumption in the range of 6.75% to 7.50%, and over half of those systems have used an assumption of 7.50%. The survey also notes that several plans have reduced their investment return assumption during the last 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% is consistent with the System's current practice.

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[25] 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. The components of the salary increase assumptions are discussed below:

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 0.6% - 0.8% 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 July 2017. In that report, real "across the board" pay increases are forecast to be 1.2% 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 six-year period ending June 30, 2017 was 1.99%.

Valuation Date	Actual Average Increase[26]	Actual Change in CPI[27]
June 30, 2012	1.35%	2.67%
June 30, 2013	3.50%	2.04%
June 30, 2014	4.61%[28]	1.08%
Three-Year Average	**3.15%**	**1.93%**
June 30, 2015	0.99%	1.35%
June 30, 2016	0.87%	0.91%
June 30, 2017	0.59%	1.89%
Three-Year Average	**0.82%**	**1.38%**
Six-Year Average	**1.99%**	**1.66%**

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. **Promotional and Merit 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 promotional and merit increases.

The annual promotional and merit 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;

b. Excluding any members with increases of more than 50% or decreases of more than 10% during any particular year;

c. Categorizing these increases according to member demographics;

d. Removing the wage inflation component from these increases (assumed to be equal to the increase in the members' average salary during the year);

e. Averaging these annual increases over the experience period; and

f. Modifying current assumptions to reflect some portion of these measured increases reflective of their "credibility."

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

[27] Based on the change in the annual average CPI for the Los Angeles-Riverside-Orange County Area compared to the prior year. Note that in January 2018, the Bureau of Labor Statistics introduced a new geographic area sample for the CPI, and as part of the new sample, Los Angeles (Los Angeles-Long Beach-Anaheim Area) and Riverside have separate indexes.

[28] Restated after the June 30, 2014 valuation data was finalized.

To be consistent with the other economic assumptions, these promotional and merit assumptions should be used in combination with the 3.25% assumed inflation and 0.50% real "across the board" increases.

The following table shows the actual average promotional and merit increases by years of service over the three-year period from July 1, 2014 through June 30, 2017 along with the actual average increases based on combining the current three-year period with the three years from the prior experience study covering July 1, 2011 through June 30, 2014. The current and proposed assumptions are also shown. The actual increases for the most recent three-year period were reduced by the actual average inflation plus "across the board" increase (i.e., wage inflation, estimated as the increase in average salaries) for each year over the current three-year experience period (0.82% on average).[29]

PROMOTIONAL AND MERIT INCREASES

Years of Service	Rate (%)			
	Current Assumption	Actual Average Increase (Last 3 Years)	Actual Average Increase from Current and Prior Study	Proposed Assumption
Less than 1	6.50	7.69	6.09	6.50
1	6.20	8.15	7.28	6.40
2	5.10	7.22	6.05	5.50
3	3.10	4.74	3.70	3.30
4	2.10	3.75	2.82	2.40
5	1.10	2.97	2.08	1.50
6	1.00	2.52	1.73	1.30
7	0.90	2.18	1.56	1.20
8	0.70	2.16	1.41	1.00
9	0.60	2.15	1.34	0.90
10 & Over	0.40	1.71	0.98	0.60

Chart 1 provides a graphical comparison of the actual promotional and merit increases, compared to the proposed and current assumptions. The chart also show the actual promotional and merit increases based on an average of both the current and previous three-year experience periods. This is discussed below.

We realize that the most recent three-year experience period may not be typically indicative of future long-term promotional and merit salary increases. Therefore, we also examined the promotional and merit salary experience from the prior experience study. We believe that when the experience from the last two studies are combined into an average result, it provides a more reasonable representation of potential future promotional and merit salary increases over the long term. Nevertheless, in our proposed changes to promotional and merit salary increases, we have still given relatively less weight, roughly one-third, to the actual average increases during the last two studies.

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[29] The actual increases for the prior three-year period were reduced by 3.15% each year, on average.

Based on this experience, we are proposing increases overall in the promotional and merit salary increases. The recommended promotional and merit salary increases range from 6.50% to 0.60%. When combined with the recommended inflation and real "across the board" pay increase assumptions herein, the recommended promotional and merit salary increases result in a slight reduction in the total salary increases, based on the demographics of active members as of June 30, 2017.

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 promotional increases are not an influence, because this average pay is not specific to an individual.

We recommend that the active member payroll increase assumption be decreased from 3.50% to 3.25% annually, consistent with the recommended inflation plus real "across the board" salary increase assumptions.

CHART 1: PROMOTIONAL AND MERIT SALARY INCREASE RATES
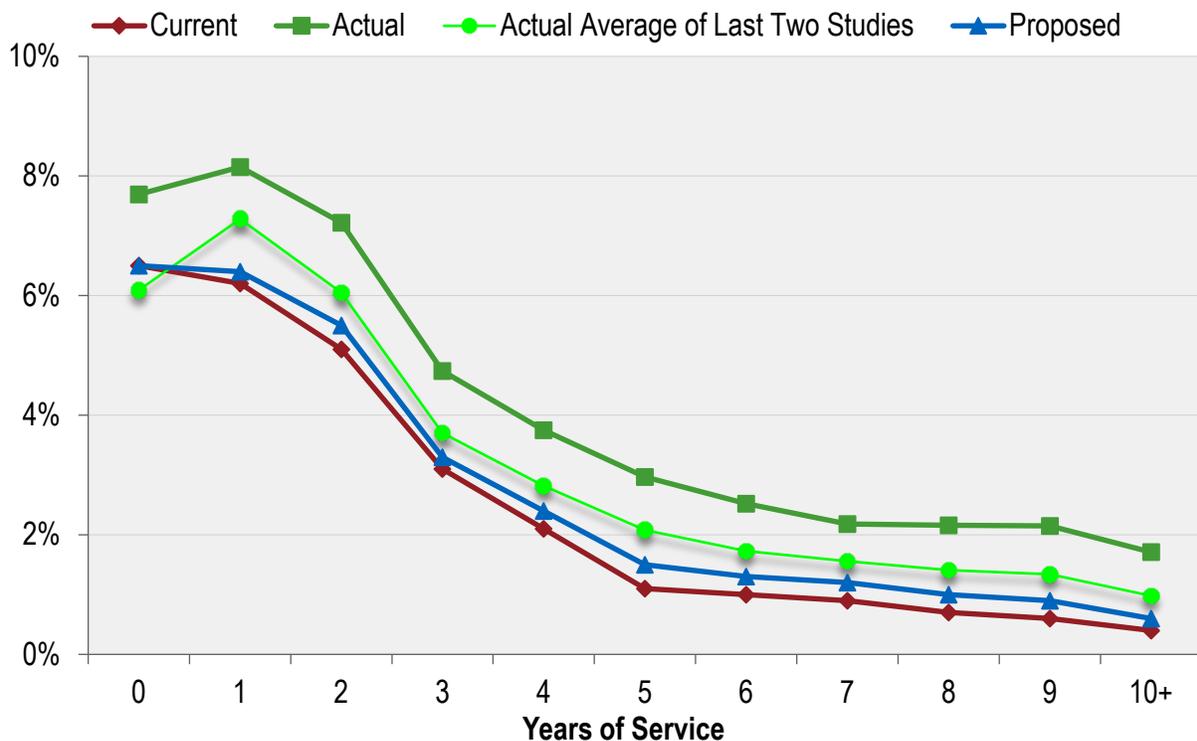
IV. Demographic Assumptions

A. Retirement Rates

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

Tier 1

The following table shows the observed retirement rates based on the actual experience during Fiscal Years 2014/2015, 2015/2016 and 2016/2017, for Tier 1 only. Also shown are the current assumed rates, plus the rates we propose to the Board.

Based on the observed experience, the proposed retirement rates for Tier 1 have been increased from the current rates to reflect earlier retirements.

	Rate of Retirement (%)					
	Current Rate of Retirement		Actual Rate of Retirement		Proposed Rate of Retirement	
Age	Non-55/30	55/30	Non-55/30	55/30	Non-55/30	55/30
50	6.0	0.0	6.4	0.0	6.0	0.0
51	3.0	0.0	1.5	0.0	3.0	0.0
52	3.0	0.0	2.2	0.0	3.0	0.0
53	3.0	0.0	2.8	0.0	3.0	0.0
54	16.0	0.0	18.8	0.0	17.0	0.0
55	6.0	20.0	6.1	28.2	6.0	24.0
56	6.0	14.0	5.5	17.7	6.0	16.0
57	6.0	14.0	5.6	16.9	6.0	16.0
58	6.0	14.0	4.9	18.5	6.0	16.0
59	6.0	14.0	5.5	20.3	6.0	16.0
60	6.0	14.0	7.6	16.1	7.0	16.0
61	6.0	14.0	6.7	10.0	7.0	16.0
62	7.0	15.0	9.4	15.8	7.0	16.0
63	7.0	15.0	8.1	17.0	7.0	16.0
64	7.0	16.0	5.5	18.5	7.0	16.0
65	12.0	17.0	12.9	31.3	13.0	20.0
+66	12.0	17.0	12.6	23.8	13.0	20.0
67	12.0	17.0	14.3	20.8	13.0	20.0
68	12.0	17.0	16.0	11.6	13.0	20.0
69	12.0	17.0	18.7	19.6	13.0	20.0
70	100.0	100.0	12.5	16.9	100.0	100.0

Tier 3

Adjustments have been made to the rates for Tier 3 even though there have been no retirements from Tier 3. The rates for this tier were initially developed based, in part, on the benefit level comparisons to Tier 1, and the Tier 1 retirement rates have been changed significantly enough in this report to warrant a change to the Tier 3 rates. The proposed rates are as follows:

	Rate of Retirement (%)			
	Current Rate of Retirement		Proposed Rate of Retirement	
Age	Non-55/30	55/30	Non-55/30	55/30
50	6.0	0.0	6.0	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	15.0	0.0	16.0	0.0
55	0.0[1]	19.0	0.0[1]	23.0
56	0.0[1]	13.0	0.0[1]	15.0
57	0.0[1]	13.0	0.0[1]	15.0
58	0.0[1]	13.0	0.0[1]	15.0
59	0.0[1]	13.0	0.0[1]	15.0
60	5.0	13.0	6.0	15.0
61	5.0	13.0	6.0	15.0
62	6.0	14.0	6.0	15.0
63	6.0	14.0	6.0	15.0
64	6.0	15.0	6.0	15.0
65	11.0	16.0	12.0	19.0
66	11.0	16.0	12.0	19.0
67	11.0	16.0	12.0	19.0
68	11.0	16.0	12.0	19.0
69	11.0	16.0	12.0	19.0
70	100.0	100.0	100.0	100.0

[1] *Not eligible to retire under the provisions of the Tier 3 plan.*

Chart 2 compares actual experience with the current and proposed rates of retirement, for Tier 1 members with less than 30 years of service or less than age 55.

Chart 3 compares actual experience with the current and proposed rates of retirement for Tier 1 members with at least 30 years of service and at least age 55.

Deferred Vested Members

In prior valuations, inactive vested members were assumed to retire at age 58. The average age at retirement over the current three-year experience study period was 59.0, while the average age for the prior three-year experience study period was 59.5. We recommend increasing the assumed retirement age for inactive vested participants from 58 to 59.

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, at the end of the experience study period as of June 30, 2017, about 4% of the inactive vested membership has worked for a reciprocal system. Therefore, we recommend maintaining the reciprocity assumption of 5% for the June 30, 2018 valuation. We will continue to monitor this assumption in future valuations.

For reciprocal members, we recommend lowering the compensation increase assumption slightly from 3.90% to 3.85% 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 the Unmodified Option

In prior Retirement Plan valuations, it was assumed that 76% of all active male members and 50% of all active female members would be married or have a domestic partner eligible for the 50% automatic retirement continuance benefit when they retired from Tier 1. According to the experience of members who retired during the last three years, about 77% of all male members and 51% of all female members were married at retirement. We recommend maintaining the current marriage/domestic partner assumptions for Tier 1 and using the same assumption for Tier 3.

Observed experience for members who retired during the last three years indicates that female spouses were about two years younger than their male-member spouses, and male spouses were about three years older than their female-member spouses, on average. On this basis, we recommend maintaining the current assumption that female spouses are two years younger than their male-member spouses and decreasing the current assumption that male spouses are four years older than their female-member spouses to a three-year age difference. Spouses are assumed to be of the opposite sex to the member.

CHART 2: RETIREMENT RATES – TIER 1
"NON-55/30"
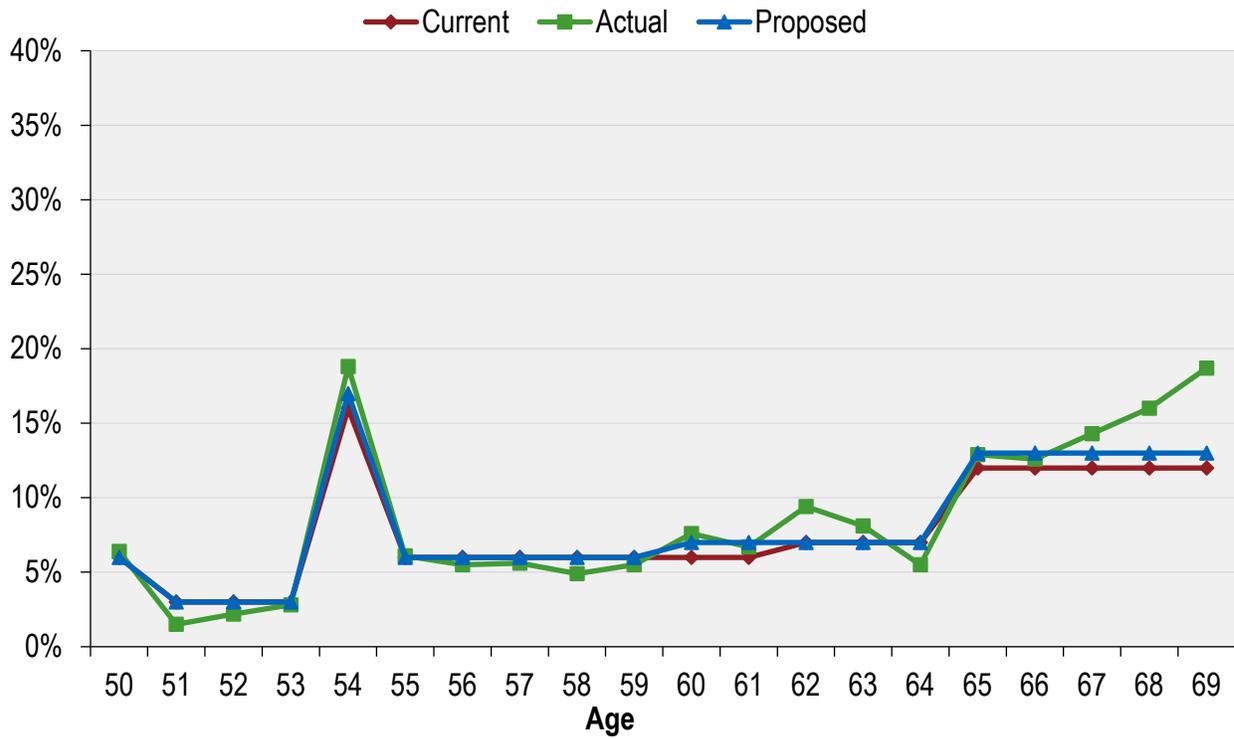
CHART 3: RETIREMENT RATES – TIER 1
"55/30"

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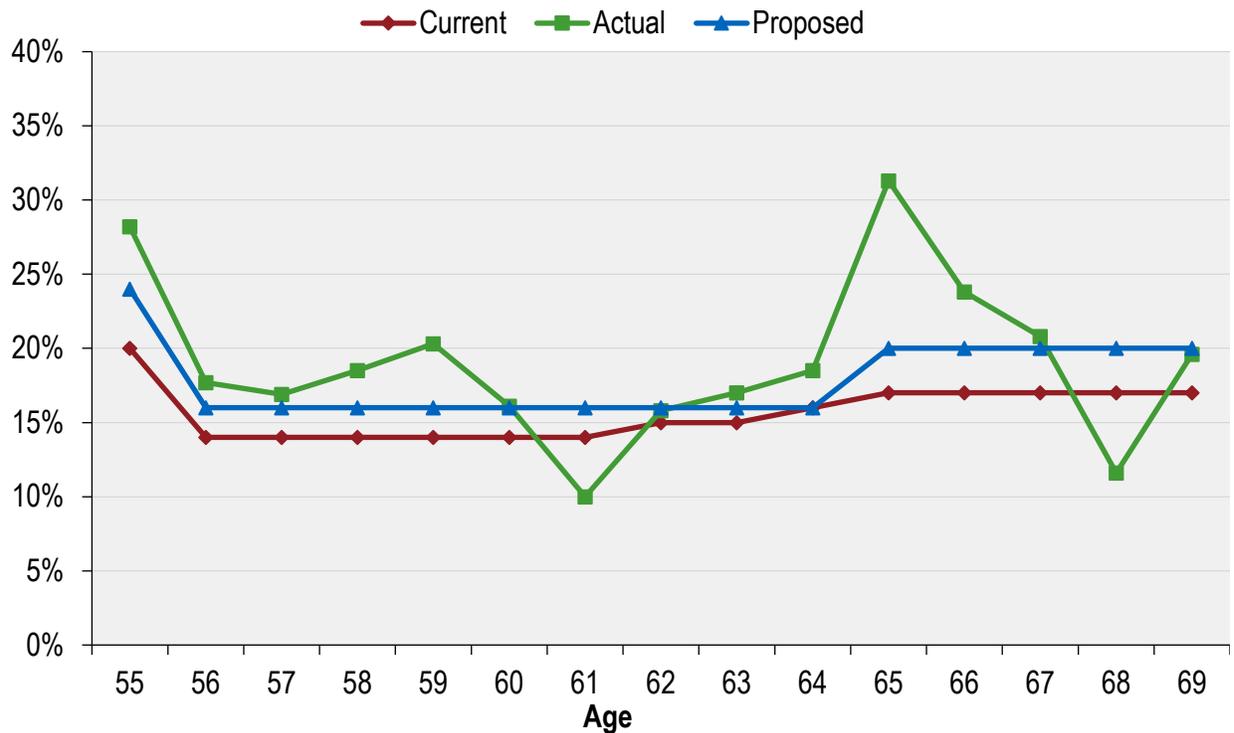
B. Mortality Rates - Healthy

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 table currently being used for post-service retirement mortality rates is the RP-2000 Combined Healthy Mortality Table projected statically with Scale BB to 2020, set back one year for males and with no setback for females. Beneficiaries are assumed to have the same mortality of a member of the opposite sex who has taken a service (non-disabled) retirement.

The Society of Actuaries (SOA) has published the RP-2014 family of mortality tables and associated mortality improvement scales. Within that family of mortality tables, there are mortality rates developed for annuitants on a "headcount" weighted basis that weight all retirees at the same age the same way without regard to the level of benefits those annuitants are receiving from a retirement plan. Mortality rates are also developed for annuitants on a "benefit" weighted basis, with higher credibility assigned to experience from annuitants receiving larger benefits. However, we note that the RP-2014 benefit-weighted mortality table was prepared without any data from public and multi-employer pension plans. As a result, the headcount-weighted basis is the approach currently used by Segal for its California public system clients (including LACERS).

The SOA is in the process of collecting data from public sector plans so that they can develop mortality tables based on public sector experience comparable to the RP-2014 mortality tables developed using data collected from private and multi-employer plans. It is our understanding that those mortality tables will be available in 2018/2019. We will include a discussion with the Board on whether to consider the benefit-weighted mortality rates in the next experience study after those public sector experience mortality tables become available.

As for the mortality improvement scales, they can be applied in one of two ways. Historically, the more common application has been 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 the emerging practice within the actuarial profession.

A generational mortality table provides dynamic projections of mortality experience for each cohort of retirees. For example, the mortality rate for someone who is 65 next year will be slightly less than for someone who is 65 this year. In general, using generational mortality anticipates increases in the cost of the Plan over time as participants' life expectancies are projected to increase. This is in contrast to updating a static mortality assumption with each experience study as we have proposed in prior experience studies.

We understand that the Retirement Plans Experience Committee of the Society of Actuaries (RPEC) intends to publish annual updates to their mortality improvement scales. Improvement scale MP-2017 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 Headcount-Weighted RP-2014 mortality table (adjusted for LACERS'

experience), and project the mortality improvement generationally using the MP-2017 mortality improvement scale.

As an illustration of the relative impact of these approaches, we have provided in the table below the approximate change in the total employer contribution rate for the Retirement Plan only based on the different approaches to build in margin for future mortality improvements.

	Employer Contribution Rate Impact
Headcount Weighted RP-2014 Family of Tables – Static Approach With Increased Margin[30]	1.70% of payroll
Benefit Weighted RP-2014 Family of Tables – Static Approach Without Increased Margin	1.80% of payroll
Headcount Weighted RP-2014 Family of Tables – Generational Approach	**1.76% of payroll**
Benefit Weighted RP-2014 Family of Tables – Generational Approach	3.12% of payroll

In order to provide more credibility to our analysis, we have used experience for a six-year period by using data from the current (from July 1, 2014 to June 30, 2017) and the last demographic experience study (from July 1, 2011 to June 30, 2014) to analyze this assumption.

Pre-Retirement Mortality

In prior experience studies, the pre-retirement mortality rates for active members were set equal to the post-retirement mortality rates for retirees since the actual number of deaths among active members was generally not large enough to provide a statistically creditable analysis. However, this approach is not compatible with our current proposal because the post-retirement RP-2014 Healthy Annuitant tables do not include rates for ages below 50.

From the RP-2014 family of tables, we recommend that pre-retirement mortality follow the Headcount-Weighted RP-2014 Employee Mortality Table (separate tables for males and females) times 90%, projected generationally with the two-dimensional improvement scale MP-2017. The 90% scaling factor is to account for the lower incidences of observed pre-retirement death on the workforce relative to the standard table.

Post-Retirement Mortality (Service Retirements)

Our analysis starts with a table that shows, among all retired members, the actual deaths compared to the expected deaths under the current assumptions for the last six years. We also show the deaths under proposed assumptions. In prior years we have generally set the mortality assumption using a static mortality improvement projection so that actual deaths will be at least 10% greater than those assumed. As noted above, we are recommending the use of a generational mortality table rather than static approach. 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

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[30] Includes an increased margin of 20% instead of a margin of 10% that we have used in our experience studies in the past.

future mortality improvement), and then reflect mortality improvement by projecting lower mortality rates in future years. That is why the current actual to expected ratio shown in the table below for healthy pensioners and all beneficiaries is 101%. In future years, these ratios would remain around 101%, as long as actual mortality improves at the same rate as anticipated in the generational mortality improvement scale. The actual deaths compared to the expected deaths under the current and proposed assumptions for the last six years are as follows:

	Healthy Pensioners		
	Current Expected Deaths	Actual Deaths	Proposed Expected Deaths
Male	1,673	1,929	1,931
Female	590	575	624
Total	**2,263**	**2,504**	**2,555**
Actual / Expected	111%		98%

The experience from the last six years including healthy retirees and all beneficiaries is as follows:

	Healthy Pensioners and All Beneficiaries		
	Current Expected Deaths	Actual Deaths	Proposed Expected Deaths
Male	1,742	2,020	2,011
Female	1,581	1,672	1,657
Total	**3,323**	**3,692**	**3,668**
Actual / Expected	111%		101%

The ratio of actual to current expected deaths was 111%. We recommend updating the current table to the Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table (separate tables for males and females) projected generationally with the two-dimensional mortality improvement scale MP-2017. These changes will bring the actual to expected ratio to 101%.

All of this is consistent with ASOP 35 as we anticipate expected future improvement in life expectancy using the generational approach.

Chart 4 compares actual to expected deaths under the current and proposed assumptions over the past six years. Experience shows that there were more deaths than predicted by the current table.

Chart 5 shows the life expectancies (i.e., expected future lifetime) under the current and the proposed tables.

The expected deaths and life expectancies under the proposed generational mortality table are based on mortality rates from 2014, which is the base year of the table. In practice, life expectancies will be increased after applying the mortality improvement scale.

CHART 4: POST-RETIREMENT DEATHS
HEALTHY PENSIONERS AND ALL BENEFICIARIES
(JULY 1, 2011 THROUGH JUNE 30, 2017)

Legend:
- ■ Expected - Current
- ■ Actual
- ■ Expected - Proposed (2014 Base Year Rates)

	Expected - Current	Actual	Expected - Proposed
Male	1,742	2,020	2,011
Female	1,581	1,672	1,657
Total	3,323	3,692	3,668
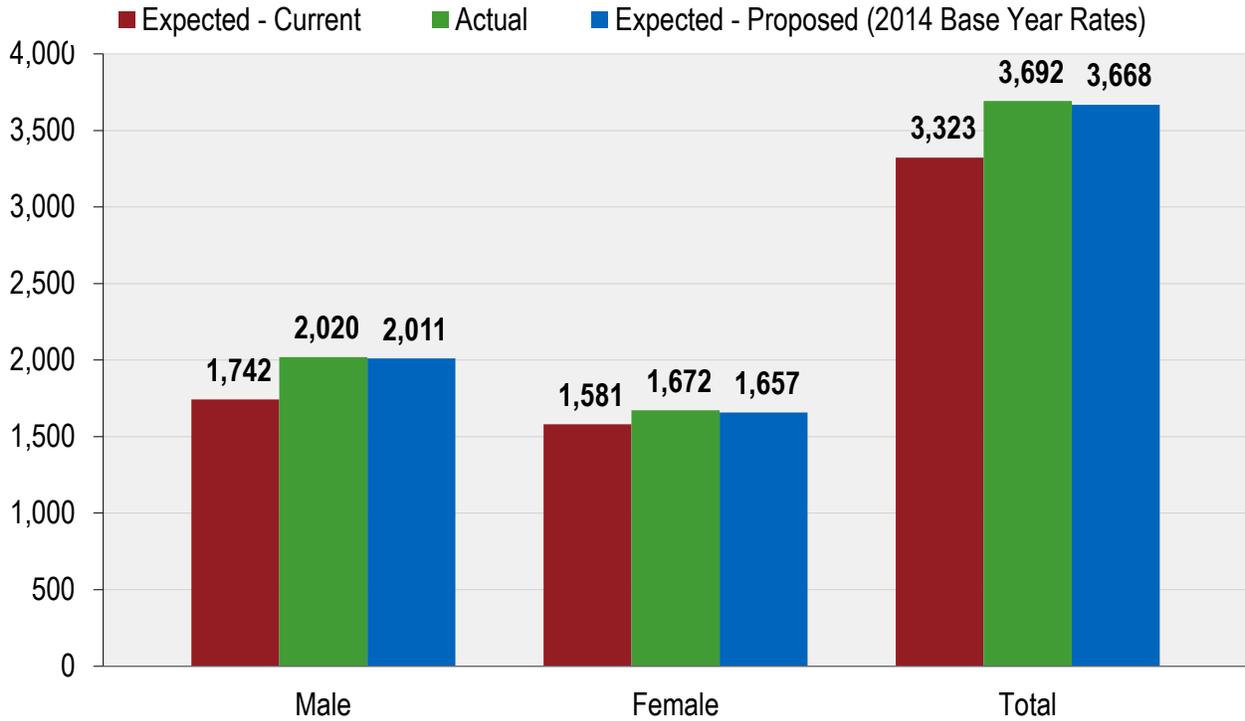
CHART 5: LIFE EXPECTANCIES
HEALTHY PENSIONERS AND ALL BENEFICIARIES

Legend:
- ◆ Current (Male)
- ■ Proposed (Male) 2014 Base Year Rates
- ▲ Current (Female)
- ● Proposed (Female) 2014 Base Year Rates

X-axis: Age (50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80-84, 85-89, 90-94, 95-99)

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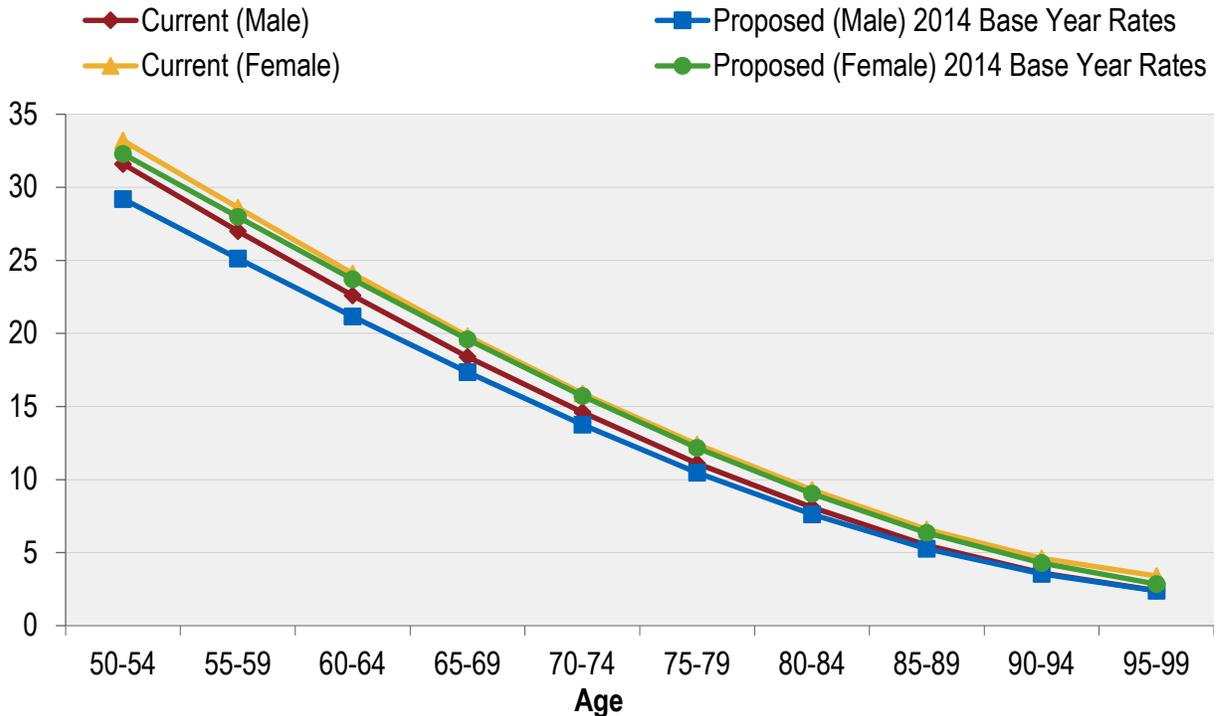
Post-Service Retirement Mortality for Determining Actuarial Equivalences

For purposes of determining actuarial equivalences, such as for determining optional forms of benefits, the System is currently using the following mortality tables:

Service Retirement

> Members: RP-2000 Combined Healthy Mortality Table projected with Scale BB to 2020, set back one year for males and with no setback for females, weighted 60% male and 40% female

> Beneficiaries: RP-2000 Combined Healthy Mortality Table projected with Scale BB to 2020, set back one year for males and with no setback for females, weighted 40% male and 60% female

Disability Retirement

> Members: RP-2000 Combined Healthy Mortality Table projected with Scale BB to 2020, set forward seven years for males and set forward eight years for females, weighted 60% male and 40% female

> Beneficiaries: RP-2000 Combined Healthy Mortality Table projected with Scale BB to 2020, set back one year for males and with no setback for females, weighted 40% male and 60% female

In prior experience studies, for determining actuarial equivalences, our recommendation for mortality tables was based on the post-retirement mortality we recommended for service retirement and disability retirement with a static scale to anticipate future mortality improvement. However, given that our current recommendation for post-retirement mortality now includes a generational mortality improvement scale, there are some administrative issues that we may need to resolve with LACERS and its vendor maintaining the pension administration software before we would recommend a comparable generational scale to anticipate future mortality improvement. We will provide a recommendation to LACERS for use in reflecting mortality improvement for determining actuarial equivalences after we have those discussions with LACERS and its vendor.

Recommended Introduction of an Assumption to Reflect COLA Benefits when a Member Elects an Optional Form of Benefit

Based on current practice, the investment return and mortality assumptions approved for this experience study will be used effective July 1, 2019 to determine the benefits payable under an optional form of benefit. For instance, a married member may choose an actuarially reduced benefit so that he/she can provide a larger continuance (such as 100%) instead of the 50% continuance payable by LACERS under the unmodified option.

Under current practice, we understand that the benefits calculated under an optional form do not include an assumption to reflect the plan's provision that provides a cost-of-living adjustment benefit. This means that the unmodified retirement allowance and the optional form of benefit are only actuarially equivalent assuming no COLA benefits are paid under either form. As far as

we know, this has always been the practice for LACERS. We understand that it is the current practice for most of the retirement systems covered under California's 1937 Act County Employees Retirement Law.[31]

The current practice of excluding the COLA assumption in calculating benefit amounts under optional forms of payment results in higher benefit amounts payable under an optional retirement allowance as compared to the benefit amount that would result if the COLA assumption were included. This is because the value of the future COLAs expected to be paid over both the lives of the member and the beneficiary are proportionately greater than the value of the future COLAs expected to be paid over just the member's life. Since members (and their survivors) actually do receive COLAs, this policy results in a slight subsidy to members whenever they elect an optional retirement allowance.

For the annual actuarial valuation, the current practice of excluding the COLA assumption in the optional forms of benefit calculations means that there would be a small actuarial loss when a member retires and elects one of the optional forms and starts collecting COLA benefits. For the valuation, these actuarial losses are currently being recognized as they occur.

It should be noted that absent any contrary legal guidance based on the length of time the current practice has been in place, if the Board wants to eliminate these specific losses related to COLAs and optional forms of payment, then the most direct way would be to include a COLA assumption in the optional form calculations that matches the COLA assumption used in the actuarial valuation.

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[31] It is our general observation that there are far fewer participants in the 1937 Act counties electing an optional form of benefit. This is because those participants would generally have to forfeit the value of the 60% automatic continuance provided to their spouse/domestic partner.

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 table currently being used is the RP-2000 Combined Healthy Mortality Table (separate tables for males and females) projected statically with Scale BB to 2020, set forward seven years for males and set forward eight years for females.

The number of actual deaths compared to the number expected under the current and proposed assumption for the last six years are as provided in the table below.

	Disabled Pensioners		
	Current Expected Deaths	Actual Deaths	Proposed Expected Deaths
Male	136	142	150
Female	46	52	47
Total	**182**	**194**	**197**
Actual / Expected	107%		98%

Based on the actual experience, we recommend changing the mortality table for disabled members to the Headcount-Weighted RP-2014 Disabled Retiree Mortality Table (separate tables for males and females), projected generationally with the two-dimensional mortality improvement scale MP-2017. This will bring the actual to expected ratio to 98%.

Chart 6 compares actual to expected deaths under both the current and proposed assumptions for disabled members over the last six years. Experience shows that there were more deaths than predicted by the current table.

Chart 7 shows the life expectancies under both the current and proposed tables for disabled members.

CHART 6: POST-RETIREMENT DEATHS
DISABLED MEMBERS
(JULY 1, 2011 THROUGH JUNE 30, 2017)

Legend: ■ Expected - Current ■ Actual ■ Expected - Proposed (2014 Base Year Rates)

	Male	Female	Total
Expected - Current	136	46	182
Actual	142	52	194
Expected - Proposed (2014 Base Year Rates)	150	47	197
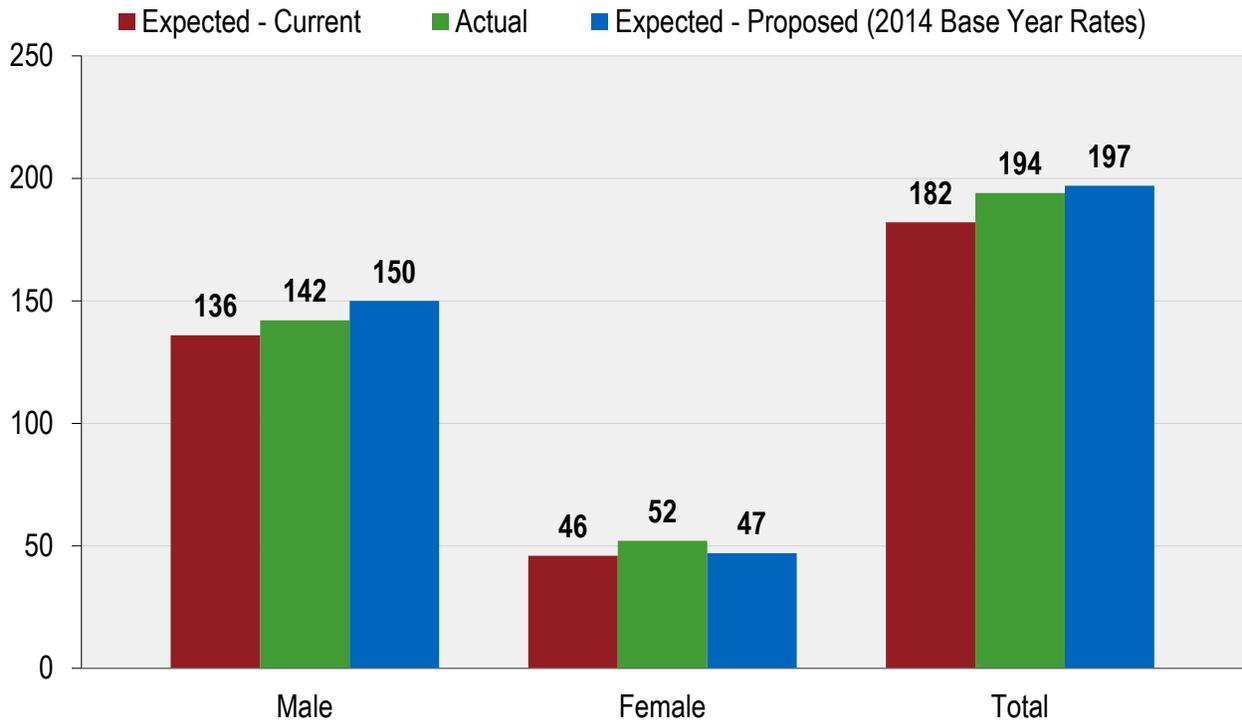
CHART 7: LIFE EXPECTANCIES
DISABLED MEMBERS

Legend: ◆ Current (Male)　■ Proposed (Male) 2014 Base Year Rates　▲ Current (Female)　● Proposed (Female) 2014 Base Year Rates

Age
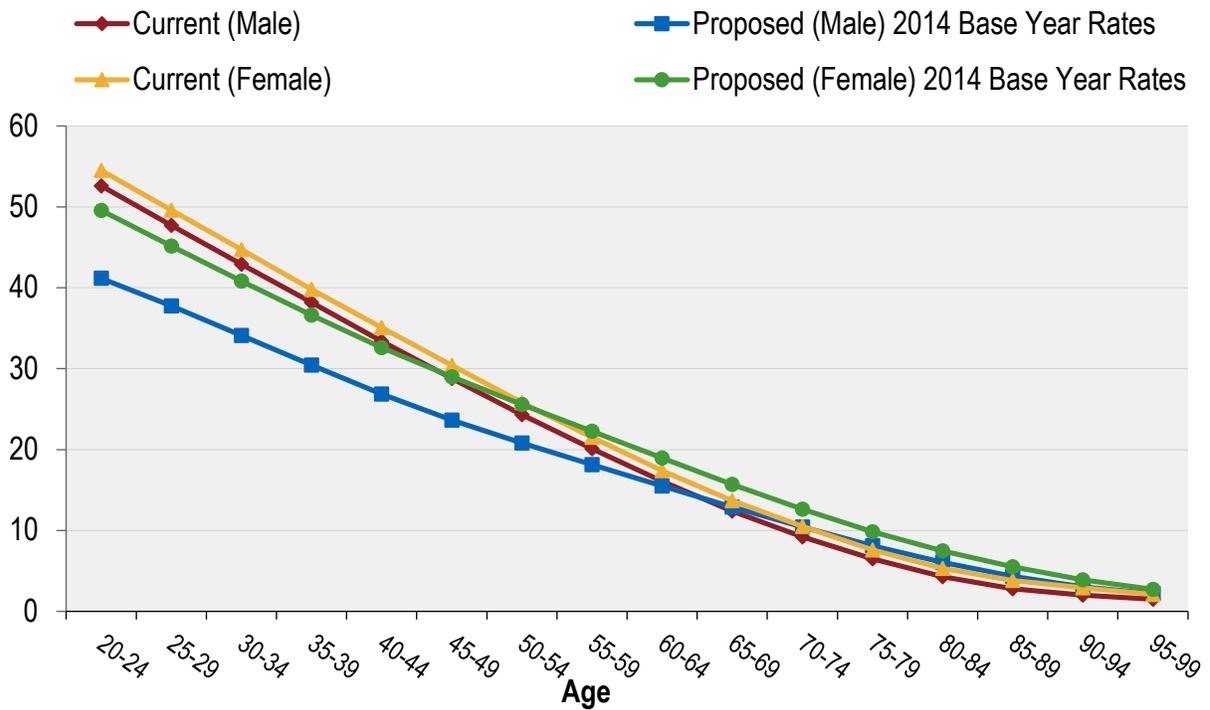
D. Termination Rates

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 termination experience over Fiscal Years 2014/2015, 2015/2016, and 2016/2017 between those members with under five years of service and those with five or more years of service is shown below:

Rates of Termination – Under Five Years of Service

Years of Service	Termination Rate (%)		
	Current Rate	Actual Rate	Proposed Rate
Less than 1	13.25	10.84	12.00
1	11.00	9.28	10.00
2	8.75	9.43	9.00
3	7.25	9.35	8.25
4	5.75	9.99	7.75

Rates of Termination – Five or More Years of Service

Age	Termination Rate (%)*		
	Current Rate	Actual Rate	Proposed Rate
20 – 24	5.75	0.00	7.00
25 – 29	5.75	10.92	7.00
30 – 34	5.75	7.55	7.00
35 – 39	4.25	5.02	4.50
40 – 44	3.00	3.76	3.50
45 – 49	2.50	2.70	3.00
50 – 54	2.50	2.29	2.50
55 – 59	2.25	10.87	2.50
60 – 64	2.25	10.20	2.50

At central age in age range shown.

Chart 8 compares actual to expected terminations of the past three years for both the current and proposed assumptions.

Chart 9 shows the current and proposed termination rates for members with less than five years of service. Chart 10 shows the current and proposed termination rates for members with five or more years of service.

Based upon the recent experience, the proposed termination rates have been increased at most service and age categories.

Note that we have also studied termination rates based on service only rather than the current structure of age-based rates after five years of service (and service-based rates before then), and we have determined that either basis is reasonable. We propose that the current structure of age-based rates after five years of service be retained for the June 30, 2018 valuation, but we will continue to monitor this assumption in the future.

We continue to assume that members who terminate with over five years of service will choose between a refund of contributions and a deferred vested benefit, whichever is more valuable. We also continue to assume that all termination rates are zero for all members eligible and assumed to retire, that is, members eligible to retire at termination will retire rather than defer their benefit.

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.

CHART 8: ACTUAL NUMBER OF TERMINATIONS COMPARED TO EXPECTED
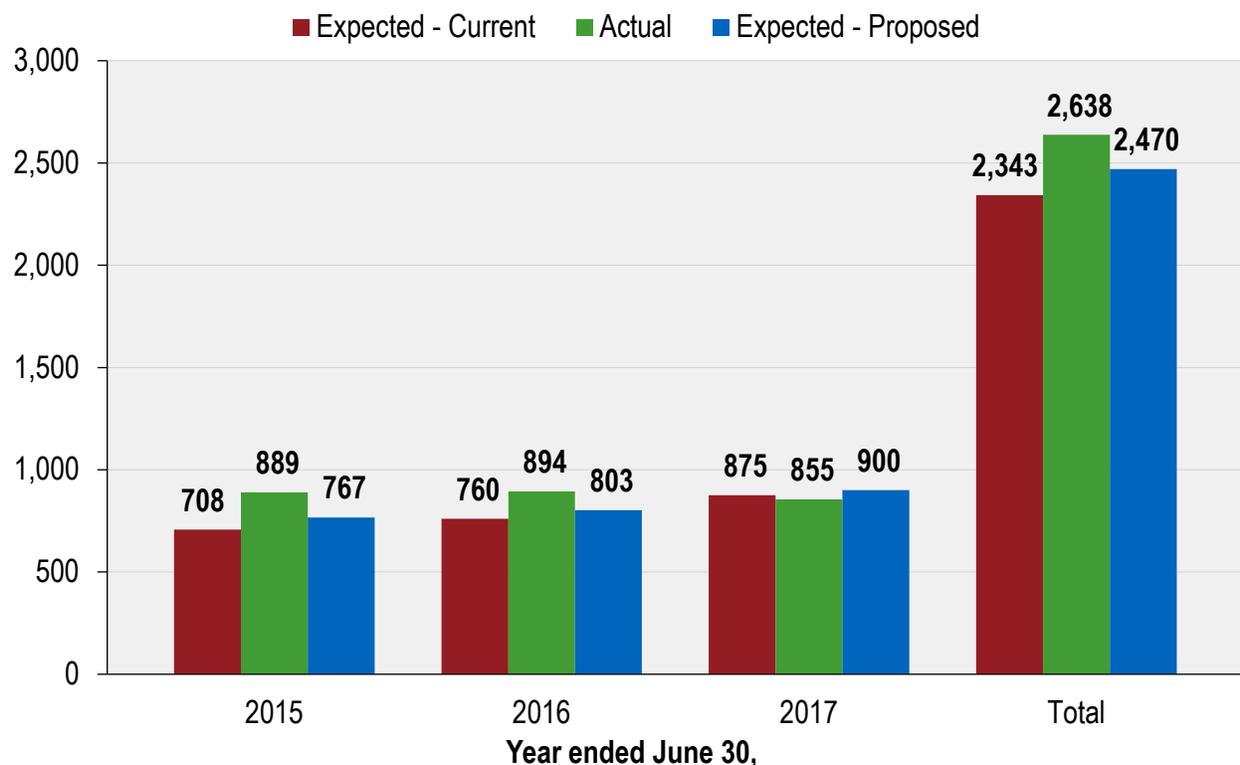
CHART 9: TERMINATION RATES
(UNDER FIVE YEARS OF SERVICE)
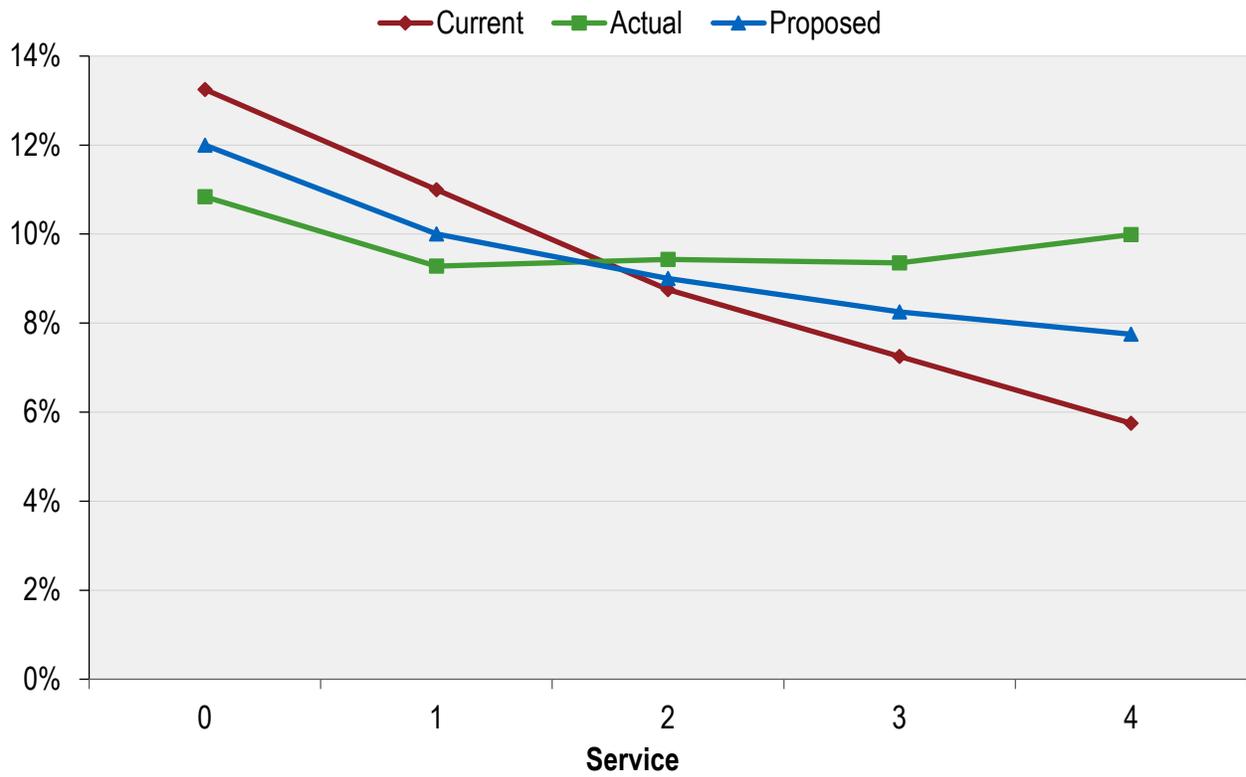
CHART 10: TERMINATION RATES
(FIVE OR MORE YEARS OF SERVICE)
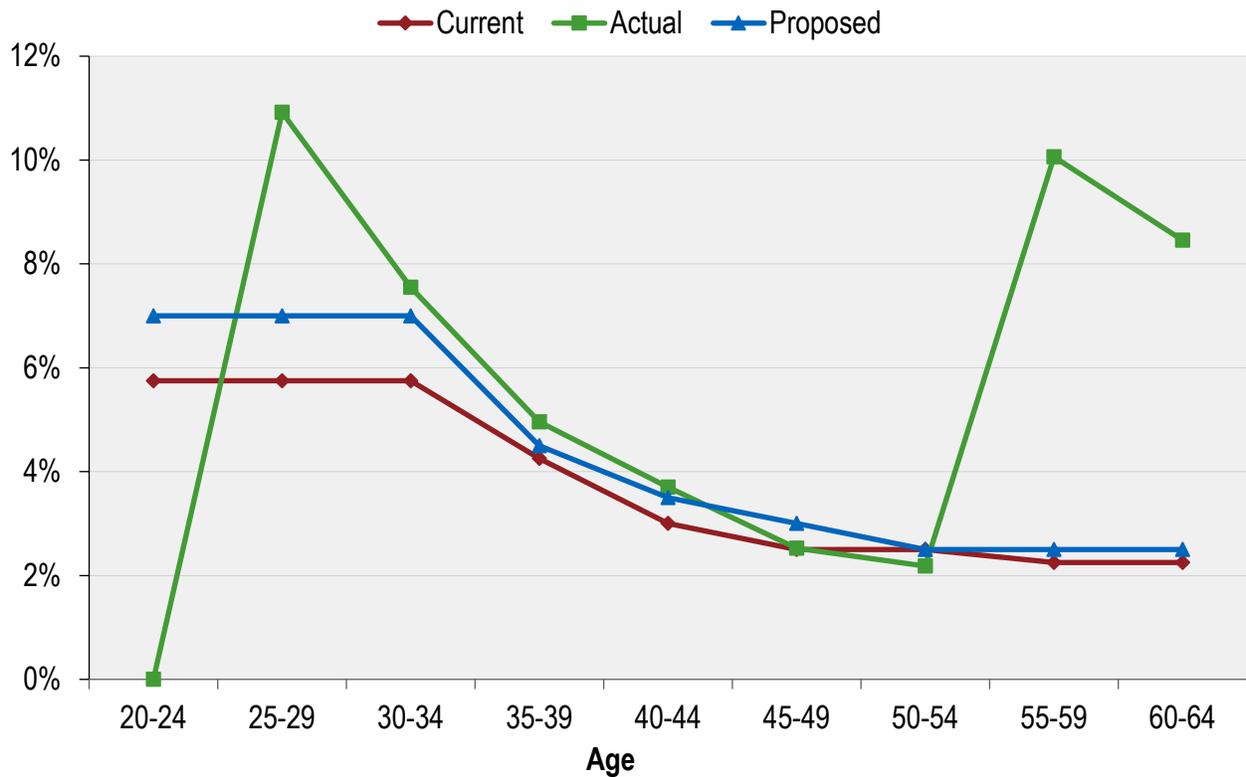
E. Disability Incidence Rates

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:[32]

Rates of Disability Incidence

Age	Disability Incidence Rate* (%)		
	Current Rate	Observed Rate	Proposed Rate
20 – 24	0.00	0.00	0.00
25 – 29	0.01	0.00	0.01
30 – 34	0.04	0.00	0.03
35 – 39	0.06	0.06	0.06
40 – 44	0.11	0.05	0.08
45 – 49	0.17	0.18	0.17
50 – 54	0.20	0.10	0.20
55 – 59	0.20	0.15	0.20
60 – 64	0.20	0.32	0.20
65 – 69	0.20	0.43	0.20

*   At central age in age range shown.

Proposed rates for age ranges after 45-49 have been developed, in part, by aggregating experience for ages 50-69.

Chart 11 compares the actual number of disabilities over the past three years to that expected under both the current and proposed assumptions. The proposed disability rates were lowered slightly, since the observed experience over the past three years was lower than the expected experience.

Chart 12 shows actual disablement rates, compared to the assumed and proposed rates for all members.

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[32]   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.

CHART 11: ACTUAL NUMBER OF DISABILITIES COMPARED TO EXPECTED

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

Year Ended June 30,	Expected - Current	Actual	Expected - Proposed
2015	33	29	32
2016	32	41	32
2017	32	22	31
Total	97	92	95

Year Ended June 30,
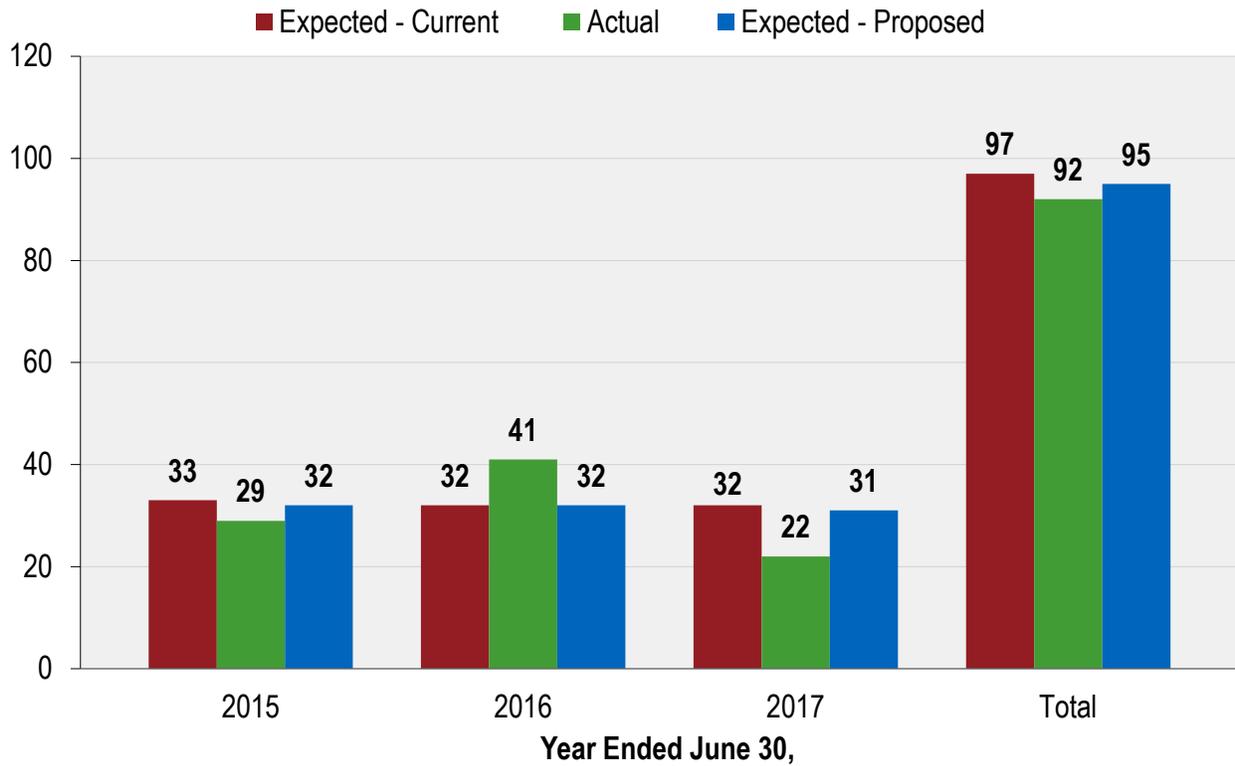
CHART 12: DISABILITY INCIDENCE RATES

Legend: ◆ Current ■ Actual ▲ Proposed

(Line chart: Disability incidence rates by Age from 20-24 to 65-69, y-axis 0.0% to 0.6%)

Age
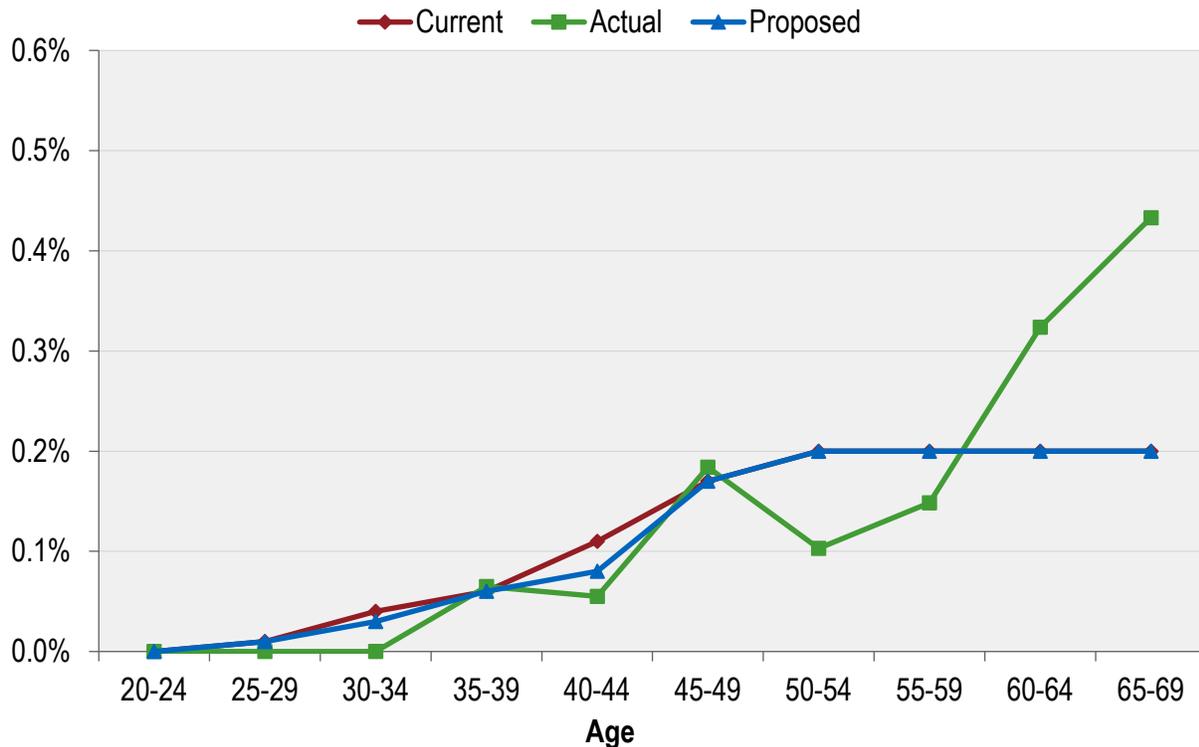
V. Cost Impact

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, 2017 actuarial valuation. If all of the proposed assumption changes were implemented, the total normal cost for the Retirement Plan would have increased by about $13.8 million and the actuarial accrued liability would have increased by about $513.5 million. The funded percentage would have decreased from 71.40% to 69.46%.

	Change in Plan Liabilities as of June 30, 2017		
	Current Assumptions	Recommended Assumptions	Increase / (Decrease)
Total Normal Cost	$352,282,612	$366,080,573	$13,797,961
Actuarial Accrued Liability	$18,458,187,953	$18,971,707,930	$513,519,977

If all of the proposed assumption changes were implemented, the aggregate beginning-of-the-year employer contribution rate would have increased by 2.42% of payroll under the recommended assumptions.

	Employer Contribution Rate Impact (% of Payroll at Beginning of the Year)
Contributions	Recommended Assumptions
Normal Cost	0.68%
UAAL	1.74%
Total	**2.42%**

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, 2017 actuarial valuation. If all of the proposed assumption changes were implemented, the total normal cost for the Health Plan would have increased by about $8.6 million and the actuarial accrued liability would have increased by about $188.8 million. The funded percentage would have decreased from 81.12% to 76.33%.

	Change in Plan Liabilities as of June 30, 2017		
	Current Assumptions	Recommended Assumptions	Increase / (Decrease)
Total Normal Cost	$74,610,881	$83,240,895	$8,630,014
Actuarial Accrued Liability	$3,005,806,234	$3,194,589,163	$188,782,929

If all of the proposed assumption changes were implemented, the aggregate beginning-of-the year employer contribution rate would have increased by 0.98% of payroll under the recommended assumptions.

Contributions	Employer Contribution Rate Impact (% of Payroll at Beginning of the Year)
	Recommended Assumptions
Normal Cost	0.43%
UAAL	0.55%
Total	**0.98%**

Appendix A: Current Actuarial Assumptions

Economic Assumptions

Net Investment Return:	7.25%, net of investment and administrative expenses.
Consumer Price Index:	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.
Employee Contribution Crediting Rate:	Based on average of 5-year Treasury note rate. An assumption of 3.00% is used to approximate that crediting rate.
Payroll Growth:	Inflation of 3.00% per year plus "across the board" real salary increases of 0.50% per year.
Increases in Internal Revenue Code Section 401(a)(17) Compensation Limit:	Increase of 3.00% per year from the valuation date.

Individual Salary Increases

Annual Rate of Compensation Increase (%)	
Inflation: 3.00% per year; plus "across the board" real salary increases of 0.50% per year; plus the following promotional and merit increases:	
Years of Service	**Percentage Increase**
Less than 1	6.50
1	6.20
2	5.10
3	3.10
4	2.10
5	1.10
6	1.00
7	0.90
8	0.70
9	0.60
10 and Over	0.40

Appendix A: Current Actuarial Assumptions

Demographic Assumptions

Mortality Rates – Healthy

➤ RP-2000 Combined Healthy Mortality Table projected with Scale BB to 2020, set back one year for males and with no setback for females.

Mortality Rates – Disabled

➤ RP-2000 Combined Healthy Mortality Table projected with Scale BB to 2020, set forward seven years for males and set forward eight years for females.

Mortality Rates – Beneficiaries

➤ RP-2000 Combined Healthy Mortality Table projected with Scale BB to 2020, set back one year for males and with no setback for females.

Mortality Rates Before Retirement

➤ RP-2000 Combined Healthy Mortality Table projected with Scale BB to 2020, set back one year for males and with no setback for females.

The above mortality tables contain about a 10% margin, based on actual to expected deaths, as a provision to reflect future mortality improvement, based on a review of mortality experience as of the measurement date.

Disability Incidence Rates

	Rate (%)
Age	Disability Rate
25	0.01
30	0.03
35	0.05
40	0.09
45	0.15
50	0.19
55	0.20
60	0.20

Appendix A: Current Actuarial Assumptions

Termination Rates

Years of Service	Rate (%)
	Less than 5 Years of Service
Less than 1	13.25
1	11.00
2	8.75
3	7.25
4	5.75

Age	Rate (%)
	5 of More Years of Service*
25	5.75
30	5.75
35	4.85
40	3.50
45	2.70
50	2.50
55	2.35
60	2.25

* Termination rates are zero for members eligible and assumed to retire.

Appendix A: Current Actuarial Assumptions

Retirement Rates

Age	Rate (%) Tier 1 Non-55/30	Tier 1 55/30	Tier 3 Non-55/30	Tier 3 55/30
50	6.0	0.0	6.0	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	15.0	0.0
55	6.0	20.0	0.0[1]	19.0
56	6.0	14.0	0.0[1]	13.0
57	6.0	14.0	0.0[1]	13.0
58	6.0	14.0	0.0[1]	13.0
59	6.0	14.0	0.0[1]	13.0
60	6.0	14.0	5.0	13.0
61	6.0	14.0	5.0	13.0
62	7.0	15.0	6.0	14.0
63	7.0	15.0	6.0	14.0
64	7.0	16.0	6.0	15.0
65	12.0	17.0	11.0	16.0
66	12.0	17.0	11.0	16.0
67	12.0	17.0	11.0	16.0
68	12.0	17.0	11.0	16.0
69	12.0	17.0	11.0	16.0
70	100.0	100.0	100.0	100.0

[1] *Not eligible to retire under the provisions of the Tier 3 plan.*

Retirement Age and Benefit for Inactive Vested Participants:	Pension benefit paid at the later of age 58 or the current attained age. For reciprocals, 3.90% compensation increases per annum.
Exclusion of Inactive Members:	All inactive participants are included in the valuation.
Unknown Data for Members:	Same as those exhibited by members with similar known characteristics. If not specified, members are assumed to be male.
Percent Married/Domestic Partner:	76% of male members; 50% of female members.

Appendix A: Current Actuarial Assumptions

Age of Spouse:	Male retirees are assumed to be 4 years older than their female spouses. Female retirees are assumed to be 2 years younger than their male spouses.
Benefit Election:	Married participants are assumed to elect the 50% Joint and Survivor Cash Refund Annuity and non-married participants are assumed to elect the Single Life Cash Refund Annuity.
Service:	Employment service is used for eligibility determination purposes. Benefit service is used for benefit calculation purposes.
Future Benefit Accruals:	1.0 year of service per year.
Other Reciprocal Service:	5% of future inactive vested members are assumed to work at a reciprocal system.

Appendix B: Proposed Actuarial Assumptions

Economic Assumptions

Net Investment Return:	7.00%, net of investment and administrative expenses.
Consumer Price Index:	Increase of 2.75% per year; benefit increases due to CPI subject to 3.00% maximum for Tier 1 and 2.00% maximum for Tier 3.
Employee Contribution Crediting Rate:	Based on average of 5-year Treasury note rate. An assumption of 2.75% is used to approximate that crediting rate.
Payroll Growth:	Inflation of 2.75% per year plus "across the board" real salary increases of 0.50% per year.
Increases in Internal Revenue Code Section 401(a)(17) Compensation Limit:	Increase of 2.75% per year from the valuation date.

Individual Salary Increases

Annual Rate of Compensation Increase (%)	
Inflation: 2.75% per year; plus "across the board" real salary increases of 0.50% per year; plus the following promotional and merit increases:	
Years of Service	**Percentage Increase**
Less than 1	6.50
1	6.40
2	5.50
3	3.30
4	2.40
5	1.50
6	1.30
7	1.20
8	1.00
9	0.90
10 and Over	0.60

Appendix B: Proposed Actuarial Assumptions

Demographic Assumptions

Mortality Rates – Healthy

> Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table (separate tables 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 Table (separate tables for males and females) projected generationally with two-dimensional mortality improvement scale MP-2017.

Mortality Rates – Beneficiaries

> Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table (separate tables for males and females) projected generationally with the two-dimensional mortality improvement scale MP-2017.

Mortality Rates Before Retirement

> Headcount-Weighted RP-2014 Employee Mortality Table (separate tables for males and females) times 90%, projected generationally with the two-dimensional improvement scale MP-2017.

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

Appendix B: Proposed Actuarial Assumptions

Disability Incidence Rates

Age	Rate (%) Disability 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

Termination Rates

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

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

Termination rates are zero for members eligible and assumed to retire.

Appendix B: Proposed Actuarial Assumptions

Retirement Rates

	Rate (%)			
	Tier 1		**Tier 3**	
Age	**Non-55/30**	**55/30**	**Non-55/30**	**55/30**
50	6.0	0.0	6.0	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	17.0	0.0	16.0	0.0
55	6.0	24.0	0.0[1]	23.0
56	6.0	16.0	0.0[1]	15.0
57	6.0	16.0	0.0[1]	15.0
58	6.0	16.0	0.0[1]	15.0
59	6.0	16.0	0.0[1]	15.0
60	7.0	16.0	6.0	15.0
61	7.0	16.0	6.0	15.0
62	7.0	16.0	6.0	15.0
63	7.0	16.0	6.0	15.0
64	7.0	16.0	6.0	15.0
65	13.0	20.0	12.0	19.0
66	13.0	20.0	12.0	19.0
67	13.0	20.0	12.0	19.0
68	13.0	20.0	12.0	19.0
69	13.0	20.0	12.0	19.0
70	100.0	100.0	100.0	100.0

[1] *Not eligible to retire under the provisions of the Tier 3 plan.*

Retirement Age and Benefit for Inactive Vested Participants:	Pension benefit paid at the later of age 59 or the current attained age. For reciprocals, 3.85% compensation increases per annum.
Exclusion of Inactive Members:	All inactive participants are included in the valuation.
Unknown Data for Members:	Same as those exhibited by members with similar known characteristics. If not specified, members are assumed to be male.
Percent Married/Domestic Partner:	76% of male members; 50% of female members.

Appendix B: Proposed Actuarial Assumptions

Age of Spouse:	Male retirees are assumed to be 3 years older than their female spouses. Female retirees are assumed to be 2 years younger than their male spouses.
Benefit Election:	For married participants, 50% are assumed to elect the 50% Joint and Survivor Cash Refund Annuity and the other 50% are assumed to elect an 85% Joint and Survivor Cash Refund Annuity. For non-married participants, 100% are assumed to elect the Single Life Cash Refund Annuity.
Service:	Employment service is used for eligibility determination purposes. Benefit service is used for benefit calculation purposes.
Future Benefit Accruals:	1.0 year of service per year.
Other Reciprocal Service:	5% of future inactive vested members are assumed to work at a reciprocal system.