Marin County Employees' Retirement Association

Actuarial Experience Study for July 1, 2014 through June 30, 2017

Produced by Cheiron

December 2017

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Board of Retirement
Marin County Employees' Retirement Association
1 McInnis Parkway, Suite 100
San Rafael, CA 94903-2764

Dear Members of the Board:

The purpose of this report is to provide the results of an Actuarial Experience Study of the Marin County Employees' Retirement Association (MCERA) covering actuarial experience from July 1, 2014 through June 30, 2017. This report is for the use of the MCERA Retirement Board in selecting assumptions to be used in actuarial valuations beginning June 30, 2017.

In preparing our report, we relied on information (some oral and some written) supplied by MCERA. This information includes, but is not limited to, the plan provisions, employee data, and financial information. We performed an informal examination of the obvious characteristics of the data for reasonableness and consistency in accordance with Actuarial Standard of Practice No. 23.

To the best of our knowledge, this report and its contents have been prepared in accordance with generally recognized and accepted actuarial principles and practices that are consistent with the Code of Professional Conduct and applicable Actuarial Standards of Practice set out by the Actuarial Standards Board. Furthermore, as credentialed actuaries, we meet the Qualification Standards of the American Academy of Actuaries to render the opinion contained in this report. This report does not address any contractual or legal issues. We are not attorneys and our firm does not provide any legal services or advice.

This report was prepared for the Retirement Board of MCERA for the purposes described herein. Other users of this report are not intended users as defined in the Actuarial Standards of Practice, and Cheiron assumes no duty or liability to any other user.

If you have any questions about the report or would like additional information, please let us know.

Sincerely,
Cheiron

Graham A. Schmidt, ASA, EA, FCA, MAAA
Consulting Actuary

William R. Hallmark, ASA, EA, FCA, MAAA
Consulting Actuary

SECTION I – EXECUTIVE SUMMARY

Actuarial assumptions (economic and demographic) are intended to be long-term in nature, and should be both individually reasonable and consistent in the aggregate. The purpose of this experience study is to evaluate whether or not the current assumptions adequately reflect the long-term expectations for MCERA, and if not, to recommend adjustments. It is important to note that frequent and significant changes in the actuarial assumptions are not typically recommended, unless there are known fundamental changes in expectations of the economy, or with respect to MCERA's membership or assets that would warrant such frequent or significant changes.

SUMMARY OF ECONOMIC ASSUMPTION ANALYSIS

The specific economic assumptions analyzed in this report are price inflation, wage inflation, COLA growth, and the discount rate. These assumptions have a significant impact on the contribution rates in the short-term and the risk of negative outcomes in the long-term.

The economic assumptions recently adopted by the Retirement Board include a 7.00% long-term rate of return on Plan assets, an annual increase in prices measured by the Consumer Price Index (CPI) of 2.75%, annual wage increases of 3.00%, and a post-retirement COLA average growth rate of 1.9%, 2.6%, or 2.7%, for the 2.0%, 3.0% and 4.0% COLA caps, respectively.

The real return expectation for this set of assumptions is consistent with the 10-year capital market expectations of Callan, the Plan's investment consultant, and slightly more conservative than the long-term expectations (20 years or longer) of other investment consultants. Other data presented in this report indicate that the inflation and wage growth expectations adopted by the Board are also reasonable.

However, the nominal return assumption is higher than the expectations provided by Callan, as well as the expectations from a broader survey over a 10-year time horizon. If the current asset target is maintained and these projections are realized, the Board can expect a pattern of actuarial asset losses in the near term. However, these projections also assume a lower inflation and if these projections are also realized, the asset losses would be at least partially offset by liability gains on COLAs and possibly on wages.

SUMMARY OF DEMOGRAPHIC ASSUMPTION ANALYSIS

This experience study specifically analyzes and makes the following recommendations for the demographic assumptions.

- **Retirement rates** – Adjustments to Miscellaneous and Safety rates at most service levels. No change to the approach recommended for PEPRA tiers.
- **Termination rates** – No change to the Miscellaneous or Safety rates.
- **Disability rates** – Adjustments to the Miscellaneous and Safety rates.
- **Mortality rates** – Adjusted CalPERS 2017 mortality tables prior to mortality improvement projection, with generational improvement for all members based on MP-2017 projection scale.

SECTION I – EXECUTIVE SUMMARY

- **Merit salary increases** – Increase Miscellaneous rates at most service points, and modest adjustments for Safety rates at lower and mid-service points.
- **Other assumptions** – Adjustments to other assumptions, including family composition, the deferred retirement commencement ages, and the rates of withdrawal, deferred vested termination, and reciprocal transfers.

The body of this report provides additional detail and support for our conclusions and recommendations.

COST OF ECONOMIC AND DEMOGRAPHIC ASSUMPTION CHANGES

The changes to the economic assumptions have the largest impact. Among the demographic assumptions, the recommended changes to retirement rates have the largest impact on contribution rates. Table I-1 summarizes the estimated cost impact of the recommended changes to economic and demographic assumptions contained in this report in the next year, while Table I-2 summarizes the estimated cost after the UAL rate increases have been recognized over a three-year ramp up period.

Table I-1

	Normal Cost Rate			1st Year UAL Rate Increase			1st Year Total Contribution Increase		
Estimated First Year Impact on Total Contribution Rates from Assumption Changes **(Based on June 30, 2016 Valuation Results)**									
Description	**County**	**Novato**	**San Rafael**	**County**	**Novato**	**San Rafael**	**County**	**Novato**	**San Rafael**
New Economic Assumptions									
(7.00% Discount Rate, 3.00% Salary)	1.3%	2.3%	1.8%	0.5%	1.1%	0.6%	1.8%	3.4%	2.4%
Proposed Demographic Assumptions									
Mortality Rates	(0.2%)	0.1%	(0.1%)	(0.3%)	(0.0%)	(0.2%)	(0.5%)	0.1%	(0.3%)
Merit Salary Scale Increases	0.3%	0.9%	0.5%	0.0%	(0.1%)	(0.0%)	0.3%	0.8%	0.4%
Retirement Rates	(0.2%)	(0.4%)	(0.4%)	(0.0%)	(0.1%)	(0.2%)	(0.2%)	(0.5%)	(0.6%)
Disability Rates	(0.0%)	0.6%	0.2%	(0.0%)	(0.1%)	(0.0%)	(0.0%)	0.5%	0.1%
Withdrawal and Reciprocity	0.2%	0.2%	0.2%	(0.0%)	(0.0%)	(0.0%)	0.2%	0.1%	0.2%
Family Composition	0.0%	0.2%	0.1%	0.0%	0.1%	0.0%	0.0%	0.3%	0.1%
Vested Term Deferral Age	(0.2%)	(0.1%)	(0.5%)	(0.1%)	0.0%	(0.1%)	(0.3%)	(0.1%)	(0.6%)
Total (Demographic Assumptions)	(0.1%)	1.5%	(0.1%)	(0.4%)	(0.3%)	(0.5%)	(0.6%)	1.2%	(0.7%)
Total (All Proposed Changes)	1.2%	3.8%	1.7%	0.1%	0.8%	0.1%	1.2%	4.6%	1.7%

SECTION I – EXECUTIVE SUMMARY

Table I-2

	Normal Cost Rate			3rd Year UAL Rate Increase			3rd Year Total Contribution Increase		
Estimated Third Year Impact on Total Contribution Rates from Assumption Changes (Based on June 30, 2016 Valuation Results)									
Description	County	Novato	San Rafael	County	Novato	San Rafael	County	Novato	San Rafael
New Economic Assumptions									
(7.00% Discount Rate, 3.00% Salary)	1.3%	2.3%	1.8%	1.9%	4.2%	3.1%	3.2%	6.5%	4.9%
Proposed Demographic Assumptions									
Mortality Rates	(0.2%)	0.1%	(0.1%)	(0.9%)	(0.0%)	(0.6%)	(1.1%)	0.0%	(0.7%)
Merit Salary Scale Increases	0.3%	0.9%	0.5%	(0.0%)	(0.4%)	(0.1%)	0.2%	0.5%	0.3%
Retirement Rates	(0.2%)	(0.4%)	(0.4%)	(0.1%)	(0.3%)	(0.6%)	(0.3%)	(0.7%)	(1.0%)
Disability Rates	(0.0%)	0.6%	0.2%	(0.0%)	(0.3%)	(0.1%)	(0.0%)	0.3%	0.1%
Withdrawal and Reciprocity	0.2%	0.2%	0.2%	(0.0%)	(0.1%)	(0.1%)	0.1%	0.1%	0.2%
Family Composition	0.0%	0.2%	0.1%	0.0%	0.2%	0.1%	0.1%	0.4%	0.1%
Vested Term Deferral Age	(0.2%)	(0.1%)	(0.5%)	(0.2%)	0.0%	(0.2%)	(0.4%)	(0.1%)	(0.7%)
Total (Demographic Assumptions)	(0.1%)	1.5%	(0.1%)	(1.3%)	(1.0%)	(1.6%)	(1.4%)	0.5%	(1.7%)
Total (All Proposed Changes)	1.2%	3.8%	1.7%	0.6%	3.2%	1.5%	1.8%	7.0%	3.2%

The economic assumptions used in actuarial valuations are intended to be long-term in nature, and should be both individually reasonable and consistent with each other. The specific assumptions analyzed in this report are:

- **Price inflation** – used indirectly as an underlying component of other economic assumptions.
- **Wage inflation** – across the board wage growth used to project benefits and to amortize the unfunded liability as a level percentage of expected payroll.
- **COLA growth** – rate at which inflation-linked post-retirement COLAs are expected to change.
- **Discount rate** – used both to project long-term asset growth and to discount future cash flows in calculating the liabilities and costs of the Plan.

In order to develop recommendations for each of these assumptions, we considered historical data, both nationally and for the Plan, and expectations for the future, as expressed by the Plan's and other external investment consultants and the Board.
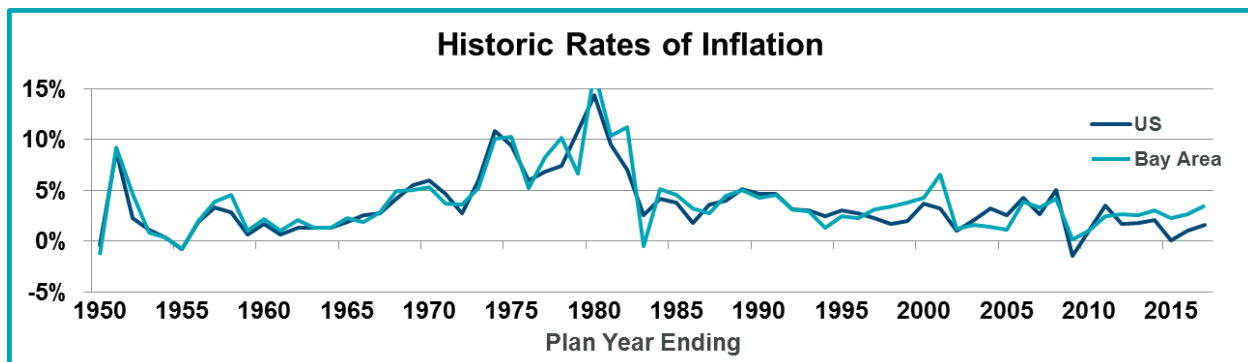
PRICE INFLATION

Long-term price inflation rates are the foundation of other economic assumptions. In a growing economy, wages, and investments are expected to grow at the underlying inflation rate plus some additional real growth rate, whether it reflects productivity in terms of wages or risk premiums in terms of investments.

Historical Data

Chart II-1 below shows inflation (CPI-U) for the U.S. and for the Bay Area by Plan year (ending June 30) since 1950.

**Chart II-1**

SECTION II – ECONOMIC ASSUMPTIONS
PRICE INFLATION

Over the 50 years ending June 2017, the geometric average inflation rate for the U.S. has been about 4.1%, but this average is heavily influenced by the high inflation rates in the 1970s and early 1980s. Over the last 30 years, the geometric average inflation rate has been 2.6%. The inflation rate for the Bay Area – which affects post-retirement COLAs and active member wage increases, but not necessarily overall investment returns – has generally tracked U.S. inflation reasonably closely, but has been somewhat higher in recent years.

Future Expectations

A measure of the market consensus of expected future inflation rates is the difference in yields between conventional treasury bonds and Treasury Inflation-Protected Securities (TIPS) at the same maturity. Chart II-2 shows the changes in the break-even inflation rate over the past ten years. Break-even inflation is the level of inflation needed for an investment in TIPS to "break even" with an investment in conventional treasury bonds of the same maturity.

Chart II-2
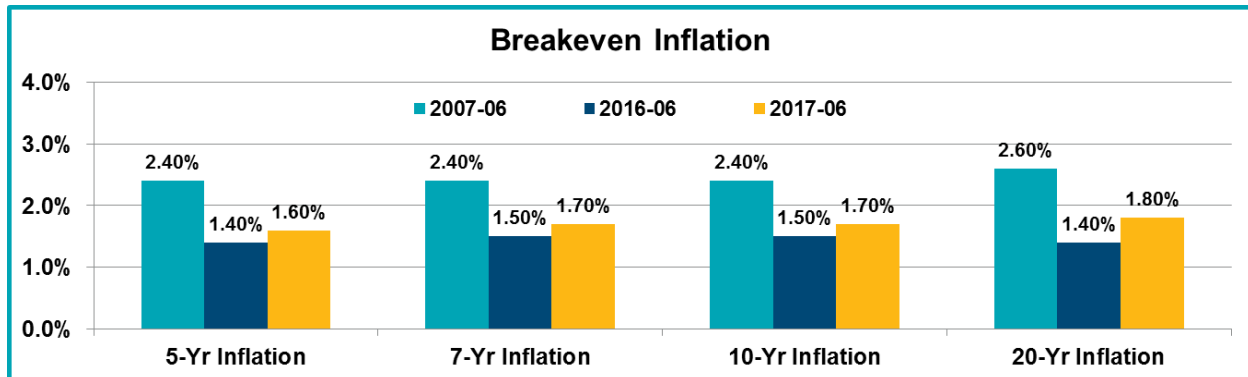
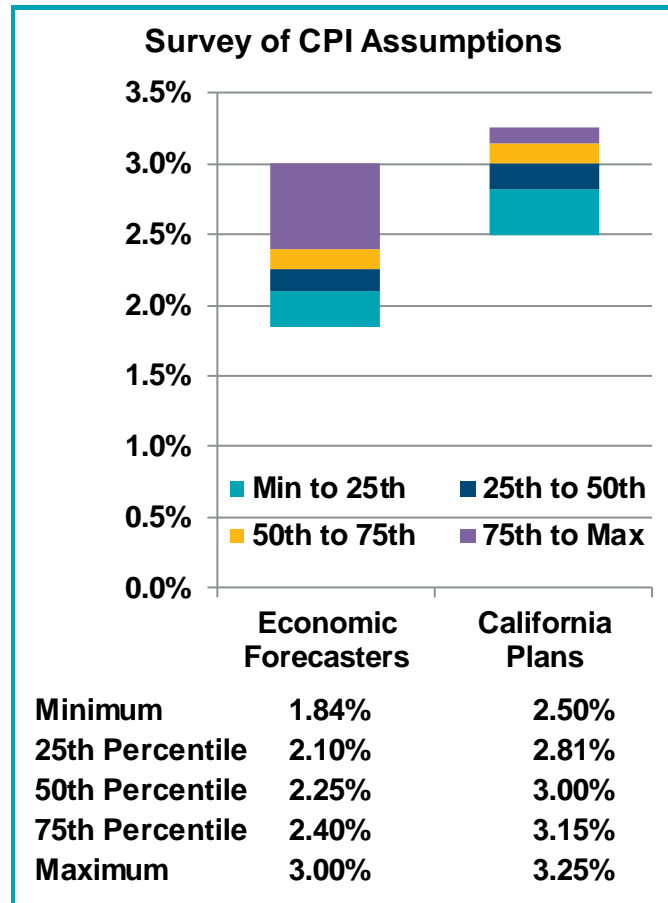Data Source Federal Reserve, Constant Maturity Yields, Monthly Series

The Federal Reserve Bank of Philadelphia publishes a quarterly survey of professional economic forecasters that includes their forecasts of inflation over the next 10 years. The survey for the third quarter of 2017 shows a median inflation forecast of 2.25%; a minimum forecast of about 1.8% and a maximum forecast of 3.0%.

Chart II-3 on the next page shows the distribution of the current 10-year forecasts for CPI-U from the professional survey published by the Federal Reserve Bank of Philadelphia compared to the assumptions used by California public pension plans. The most common assumption in California public pension plans is 3.00% (used by 13 of the 35 systems in the survey). We note that all of the inflation assumptions used by California public pension plans are in or above the top quartile of the 10-year forecast published by the Federal Reserve.

SECTION II – ECONOMIC ASSUMPTIONS
PRICE INFLATION

Chart II-3

Survey of CPI Assumptions

	Economic Forecasters	California Plans
Minimum	1.84%	2.50%
25th Percentile	2.10%	2.81%
50th Percentile	2.25%	3.00%
75th Percentile	2.40%	3.15%
Maximum	3.00%	3.25%

Finally, Callan, the Board's investment consultant, uses an inflation assumption of 2.25%, similar to that of many other investment consultants.

Based on all of these considerations, we believe a reasonable range for long-term price inflation for use in the Plan's actuarial valuations is between 2.00% and 3.00%. Therefore, the Board's recent action to maintain the assumption of 2.75% is reasonable. If, at the time of the next review of economic assumptions, the markets and forecasters continue to indicate lower expectations of future inflation, further reductions in the assumption could be considered.
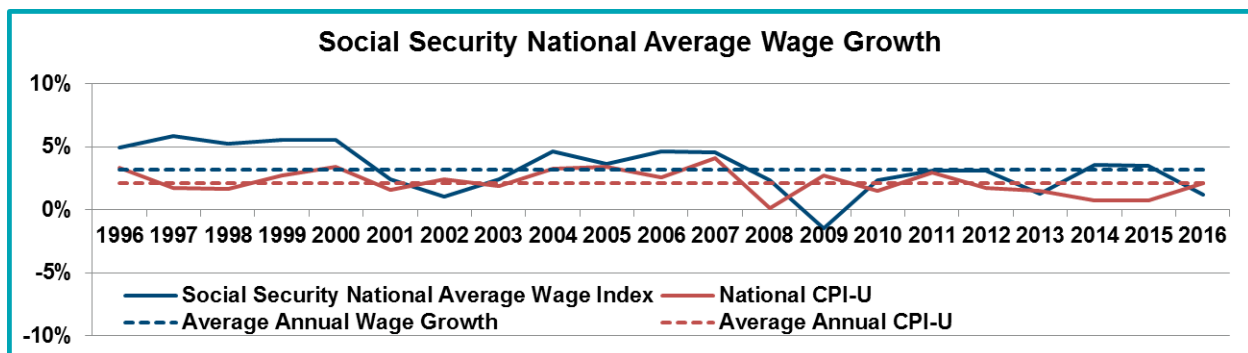
WAGE INFLATION

Wage inflation can be thought of as the annual across-the-board increase in wages. Individuals often receive salary increases in excess of the wage inflation rate, and we study these increases as a part of the merit salary scale assumption. Wage inflation generally exceeds price inflation by some margin reflecting the history of increased purchasing power.

Wage inflation is used in the actuarial valuation as the minimum expected salary increase for an individual and, for purposes of amortizing the Unfunded Actuarial Liability, the rate at which payroll is expected to grow over the long term, assuming a stable active member population.

Chart II-4 shows the increase in national average wages (as reported by the Social Security Administration) compared to inflation from 1996 through 2016.

Chart II-4

Over this period, national wage inflation averaged approximately 3.2% compared to annual price inflation of 2.1%. Note the significant drop in 2008 and 2009 as well as the recent decline in national average wage growth in 2013.

Since 1990, mean wage growth (as measured by the Social Security Administration) averaged 1.13% per year. However, over the same time period the increase in the median real wage was only 0.77% per year, as much of the growth in wages was clustered at the top end of the wage scale. In addition, real median weekly wages for local government employees have increased by only 0.36% from 2000-2016, based on the Bureau of Labor Statistics (BLS) Current Population Survey.

It is common to assume some additional level of base payroll increase beyond general inflation. There is a long history of wage growth exceeding inflation, and the BLS Quarterly Census of Employment and Wages reports an average real wage growth of 0.6% over the past 10 years for local governments. Potential reasons contributing to the increase may include the presence of strong union representation in the collective bargaining process, competition in hiring among other similar employers, and regional factors – such as the local inflation index exceeding the national average, as has sometimes proven the case in parts of California. Also, the Social

SECTION II – ECONOMIC ASSUMPTIONS
WAGE INFLATION

Security Administration projects real wage growth of 0.6% – 1.8% going forward in their Social Security solvency projections.

However, governmental entities remain under financial stress, and other areas of employee compensation – most notably health care costs and pension contributions – have continued to increase faster than the CPI. The Board's recent action to maintain a small real wage growth assumption of 0.25% annually is consistent with our recommendations. This increase will be applied to all continuing active members, and to starting pay for new entrants when projections of future populations are required. This increase will also be used in the calculation of the unfunded liability amortization payment as a level percentage of payroll.

COLA GROWTH

Most members of MCERA are eligible to receive automatic Cost-of-Living Adjustments (COLAs), based on the growth in the Bay Area Consumer Price Index (CPI-U) and reflecting various caps on the annual COLA increase. These caps depend on the Tier of the member, and can be 2%, 3% or 4% annually. Any increase in the CPI above the maximum increase can be banked for future years in which the change in the CPI is below the maximum increase.

It is necessary to determine an assumed rate of COLA growth, reflecting both inflation (i.e., the growth in the CPI), and the interaction of the CPI with the COLA cap and banking mechanism. Simulations of inflation show us that the average growth in the COLA is expected to be below the cap, even if the expected increase in the CPI is equal to or higher than the cap itself. This is because if there is not a significant bank already in existence (such as in the early years of retirement) and there are years in which inflation is below the cap, this shortfall will not be made up in future years.

We have produced statistical simulations of inflation and then modeled how the COLA maxima and the banking process interact with the changes in CPI. For a given long-term estimate of inflation, we used a 30% autocorrelation factor with 1.5% annual inflation volatility. A starting inflation level of 3.50% was used in the simulations, to reflect the most recent level of Bay Area inflation.

Based on the results of these simulations, and using the 2.75% inflation assumption adopted by the Board, which we believe to be reasonable, we recommended the COLA growth assumptions of 1.9%, 2.6%, and 2.7%, for the 2%, 3%, and 4% COLA cap groups, respectively that were recently adopted by the Board.

DISCOUNT RATE

The discount rate assumption is generally the most significant of all the assumptions employed in actuarial valuations. The discount rate is based on the long-term expected return on plan investments. In the short-term, a higher discount rate results in lower expected contributions. However, over the long term, actual contributions will depend on actual investment returns and not the discount rate (or expected investment returns). If actual investment returns are lower than expected, contribution rates will increase in the future. It is important to set a realistic discount rate so that projections of future contributions for budgeting purposes will not be significantly biased, particularly to be too low.

Other Large Public Retirement Plans

Based on the Public Fund Survey, developed by the National Association of State Retirement Administrators (NASRA) covering most of the largest public retirement systems in the country, there has been a general movement over at least the last decade to reduce the discount rate used in actuarial valuations. Chart II-5 on the next page shows the change in the distribution of assumptions since 2001. The median assumption is now 7.50% and the number of plans using a discount rate of 7.0% or lower has increased significantly.

SECTION II – ECONOMIC ASSUMPTIONS
DISCOUNT RATE

Chart II-5

Public Fund Survey,
NASRA Feb-17

*preliminary
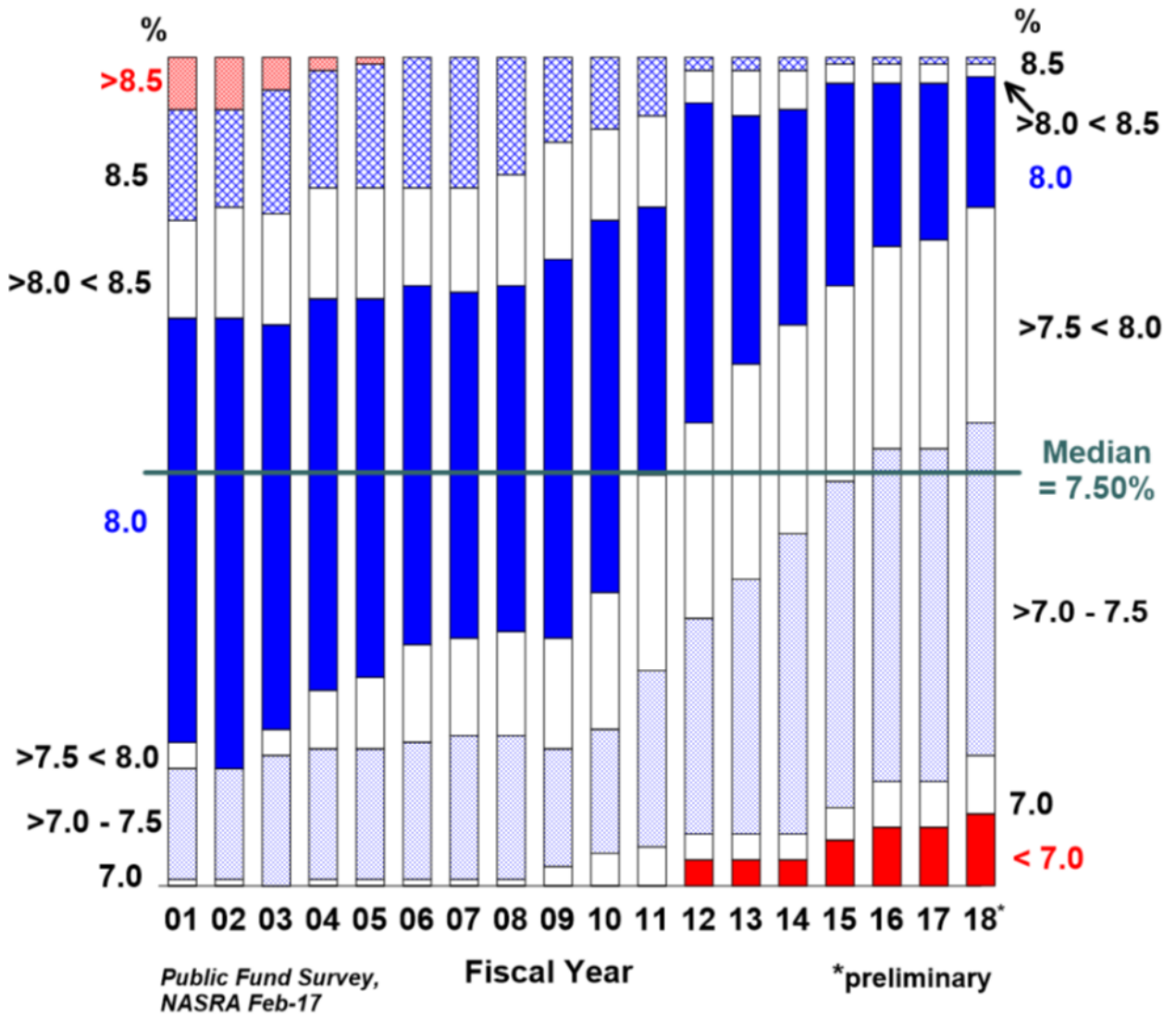
In our survey of California retirement systems, the median assumption is even lower at 7.25 percent with 13 of the 35 systems using the median rate. Chart II-6 on the following page shows the change in discount rate assumptions for California systems from 2013 to 2016.

SECTION II – ECONOMIC ASSUMPTIONS
DISCOUNT RATE

Chart II-6

Distribution of Discount Rates
Cheiron Survey of California Systems

Target Asset Allocation and Future Expectations

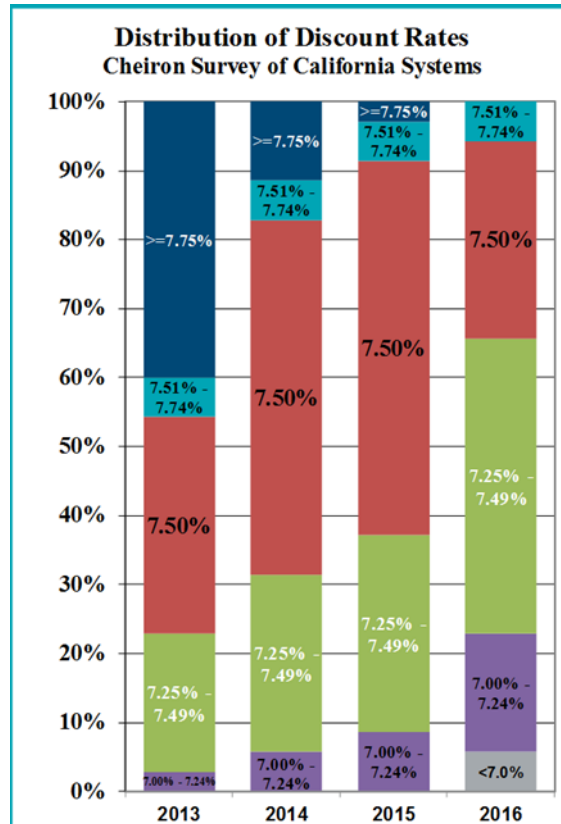The nominal expected return on assets depends on the allocation of assets to different asset classes (e.g., stocks, bonds, etc.) and the capital market assumptions for each of the asset classes.

Table II-1 on the next page shows the expected nominal geometric return based on the Board's current target asset allocation and the capital market assumptions provided by the Plan's investment consultant (Callan), and those from several other investment consultants active in California public plans, as well as a survey of multiple investment consultants published by Horizon Actuarial Services. The table also shows the underlying inflation assumption used by each investment consultant in the development of their capital market assumptions and computes the expected real rate of return (investment return in excess of inflation). The table divides the expectations into short-to-medium expectations (Capital market assumption (CMA) periods of 5-10 years) versus longer-term assumptions (CMA periods of 20-30 years).

SECTION II – ECONOMIC ASSUMPTIONS
DISCOUNT RATE

Table II-1

MCERA Portfolio Return Expectations					
	CMA	**Geometric Mean**			**Standard**
Consultant	**Period**	**Nominal**	**Inflation**	**Real**	**Deviation**
Callan	10.0	6.49%	2.25%	4.24%	14.29%
Horizon	10.0	6.50%	2.24%	4.26%	12.59%
NEPC	6.0	6.06%	2.50%	3.56%	12.96%
RVK	10.0	6.05%	2.50%	3.55%	12.52%
<u>Verus</u>	<u>10.0</u>	<u>6.18%</u>	<u>2.10%</u>	<u>4.08%</u>	<u>12.60%</u>
Short-Term Average	9.2	6.26%	2.32%	3.94%	12.99%
Horizon	20.0	7.59%	2.44%	5.15%	12.59%
Meketa	20.0	7.38%	2.60%	4.78%	13.61%
NEPC	<u>30.0</u>	<u>7.55%</u>	<u>2.75%</u>	<u>4.80%</u>	<u>12.96%</u>
Long-Term Average	23.3	7.50%	2.60%	4.91%	13.05%
		Duration-Weighted Average			
MCERA Approx Duration	**15.0**	6.77%	2.43%	4.34%	

We calculated an average expected geometric real return (i.e., the return above inflation) of 4.91% percent under the long-term assumptions, but only a 3.94% real return under the shorter-term expectations. The average real return taken across both time periods (weighted based on the approximate duration of MCERA's liabilities for current members) is 4.34%, which is slightly above the Board's recently adopted real return assumption of 4.25%.

The returns above were modeled based on the expected returns of the portfolio benchmark indices, which are expected to have minimal expenses. The actuarial standards on selecting a return assumption (ASOP 27) state that in general superior or inferior returns (net of fees) should not be assumed for active versus passive management, therefore we do not recommend a significant adjustment to the modeled returns for the fees of the asset managers. However, a slight margin is appropriate to reflect the investment-related expenses other than those of the investment managers, which would include the investment advisor and custodian.

The recently adopted discount rate of 7.00% is consistent with the real return expectations of the Board's investment consultant, and is more conservative than the long-term assumptions shown in the broader survey above. We therefore find the discount rate of 7.00% to be a reasonable assumption. However, there are a number of factors that suggest that the near-term expected rate of return should be discussed.

- Many investment consultants expect poor rates of return in the immediate and near-term future. They reason that there is little in the way of yields on fixed income, and that the equity markets are fully valued.

SECTION II – ECONOMIC ASSUMPTIONS
DISCOUNT RATE

- If Callan and much of the investment community are correct in their projections, we can expect returns below the 7.00% assumed rate for a number of years. This will result in actuarial losses and increases in employer contribution rates. However, these losses may be partially offset by gains on the liabilities from wage or COLA growth below the assumed levels.

- We believe that near- and mid-term return projections should be considered along with long-term projections. Fund performance is usually measured over five to 10 years; longer measurement periods are often considered less relevant because of the potential for changes in the economy and in the investment markets.

As a result, the prospect of several years of actuarial losses, in line with the shorter-term Callan and other assumptions, and the resulting impact on the contribution rates should be communicated to MCERA and the employers for use in planning.

We recommend that the Board and staff continue to conduct at least a brief discussion of this assumption annually, in consultation with the Plan's actuary and investment consultant, to determine if further changes are appropriate.

SECTION III – DEMOGRAPHIC ASSUMPTIONS
MERIT SALARY INCREASES

Demographic assumptions are used to predict membership behavior, including rates of retirement, termination, disability, and mortality. These assumptions are based primarily on the historical experience of MCERA, with some adjustments where future experience is expected to differ from historical experience and with deference to standard tables where MCERA experience is not fully credible and a standard table is available. For purposes of this study, merit salary increases and administrative expenses are also considered demographic assumptions because the assumptions are based primarily on MCERA's historical experience.

MERIT SALARY INCREASES

Salary increases consist of three components: Increases due to cost-of-living maintenance (inflation), increases related to non-inflationary pressures on base pay (such as productivity increases), and increases in individual pay due to merit, promotion, and longevity. Increases due to cost-of-living and non-inflationary base pay factors were addressed in an earlier section of this report.

The merit salary increase assumption is analyzed by employee group and by service. Generally, newer employees are more likely to earn a longevity increase or receive a promotion, so their salary increases tend to be greater than those for longer service employees. Two different approaches may be used to analyze the merit increases: a *longitudinal* study and a *transverse* study.

A *longitudinal* study reviews the average increase in pay for each level of service. To analyze the merit component, we subtracted the Plan's real wage growth – as measured by the base wage increases reflected in the most recent collective bargaining agreements covering most employees – from the total pay increases experienced by each member during the experience study period. Longitudinal studies, which use changes in pay collected over several years need to consider the effects of inflation, collective bargaining, and management decisions during the term of the study in order to be reliable.

In a *transverse* study, salaries are examined at one point in time (the valuation date), as opposed to being observed over a number of years under a longitudinal study. A transverse study serves as a reliable way to assess average increases in pay due to merit. With a homogeneous group of any size at all, the pattern of promotions and longevity increases during the career of an average employee is clearly visible in this analysis.

Charts III-1 and III-2 on the following pages illustrate the results of the *longitudinal* study. It analyzes the pay patterns for Miscellaneous and Safety members, respectively. Our charts will generally show the current assumption (red line) compared to the actual experience (blue line) and the proposed assumption (yellow line). We backed out the wage growth in order to isolate the merit, promotion, and longevity component. We have combined the experience of the past three years with that of the prior three-year period in order to have a more robust dataset to review.

SECTION III – DEMOGRAPHIC ASSUMPTIONS
MERIT SALARY INCREASES

We recommend reducing the merit assumption at lower service points for Miscellaneous, and increasing it at mid-service points for both Miscellaneous and Safety.
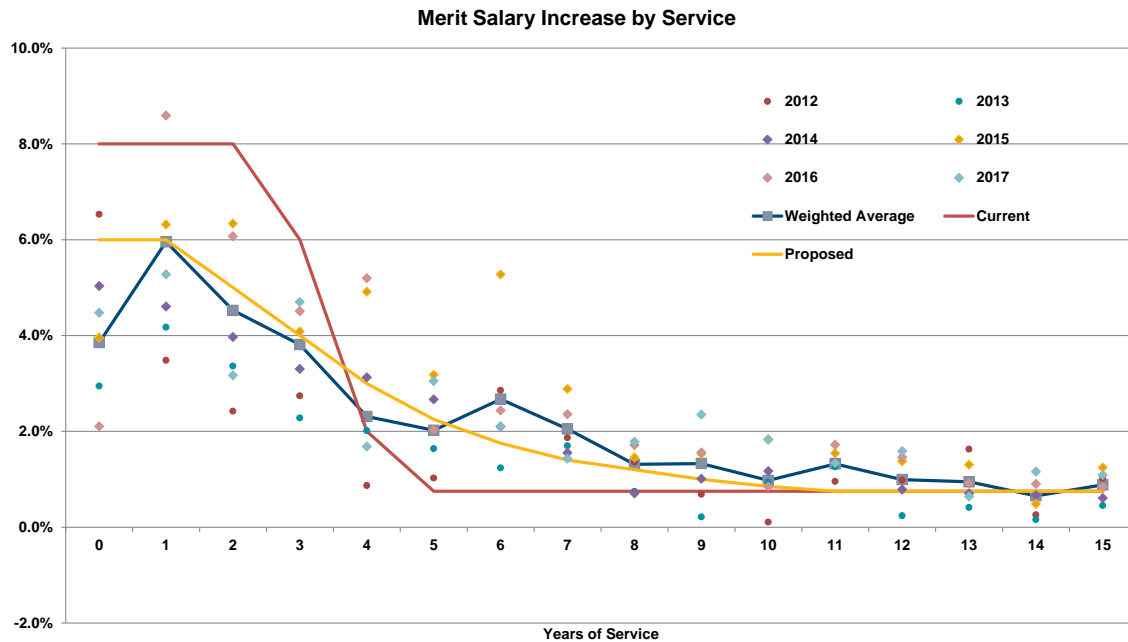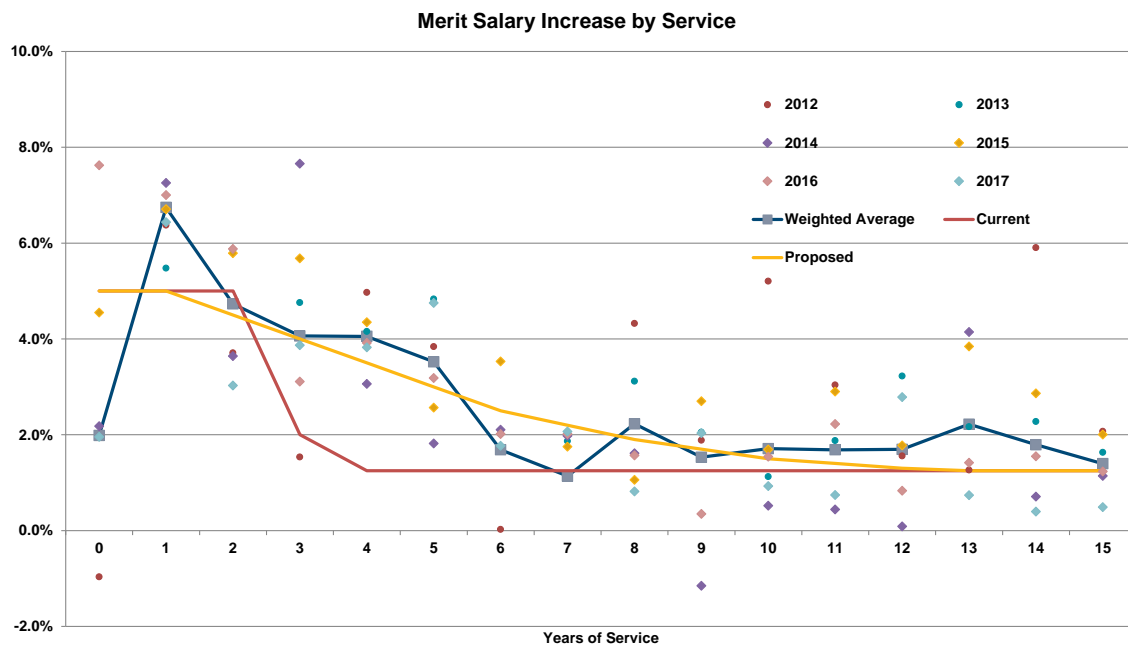
Chart III-1: Miscellaneous

Chart III-2: Safety

SECTION III – DEMOGRAPHIC ASSUMPTIONS

ANALYSIS OF OTHER DEMOGRAPHIC ASSUMPTIONS

For most of the remaining demographic assumptions, we determined the ratio of the actual number of decrements for each membership group compared to the expected number of decrements (A/E ratio or actual-to-expected ratio). If the assumption is perfect, this ratio will be 100%. Otherwise, any recommended assumption change should move from the current A/E ratio towards 100% unless future experience is expected to be different than the experience during the period of study.

In addition, we calculated the 90% confidence interval, which represents the range within which the true decrement rate during the experience study period fell with 90% confidence. If there is insufficient data to calculate a confidence interval, the confidence interval is shown as the entire range of the graph. We generally propose assumption changes when the current assumption is outside the 90% confidence interval of the observed experience. However, adjustments are made to account for differences between future expectations and historical experience, to account for the past experience represented by the current assumption, and to maintain a neutral to slight conservative bias in the selection of the assumption. For disability and mortality rates, we compare MCERA's experience to that of a benchmark table and adjust the tables to bring the proposed assumption closer to an A/E ratio of 100% taking into account the level and credibility of MCERA's experience.

To track how well the assumption fits the pattern of the data, we calculate the percentage of the assumptions that fall within the 90 percent confidence interval, and we calculate an r-squared statistic for each assumption. R-squared can be thought of as the percentage of the variation in actual data explained by the assumption. Ideally, all of the assumptions would fall within the 90 percent confidence interval and r-squared would equal 100 percent although this is never the case. Any proposed assumption change should increase the percentage of assumptions within the confidence interval and should increase the r-squared compared to the current assumption making it closer to 100 percent unless the pattern of future decrements is expected to be different from the pattern experienced during the period of study.

RETIREMENT RATES

The current retirement rates vary by group, age, and service and are applied to all members who are eligible to retire. We have combined the experience of the past three years with that of the prior three-year period in order to have a more robust dataset to review.

Generally, at any given age, members with more service are more likely to retire than members with fewer years of service. We reviewed the MCERA actual retirement rates based on service groupings since MCERA is not large enough to justify assumptions for each age and service combination.

We recommend separate assumptions by age for the following service groups for Miscellaneous and Safety members: 1) members with 10-19 years of service, 2) members with 20-29 years of service, and 3) members with 30 or more years of service. Additionally, we have continued to analyze the retirement data separately for those Safety members with the 3% at age 50 versus 3% at age 55 benefit formulas.

We recommend the continued use of the same assumptions for all Miscellaneous PEPRA members as the other Miscellaneous members, with the exception that retirement rates are not applied until age 52 for PEPRA Miscellaneous members. In addition, we recommend the continued use of the 3% at age 55 retirement assumptions for PEPRA Safety members. There is some expectation that PEPRA members may retire later than those in other tiers due to their lower benefit levels. However, there is no data yet that exists regarding these members' retirement behavior and our initial analysis of the PEPRA normal cost rates showed little impact if the retirement rates were adjusted to assume later retirements.

SECTION III – DEMOGRAPHIC ASSUMPTIONS
RETIREMENT RATES

Table III-R1 shows the calculation of actual-to-expected ratios and the r-squared statistic for Miscellaneous members with 10 to 19 years of service. Chart III-R1 shows the information graphically along with the 90% confidence interval.

The data shows lower actual retirement rates than expected under the current assumption. The proposed assumption decreased the aggregate assumed rate of retirement and increases the aggregate A/E ratio from 85% to 107%. The r-squared statistic increases from 59.3% to 80.2%.

Table III-R1 – Miscellaneous

Miscellaneous Retirement Rates For 10 to 19 Years of Service						
			Retirements		A/E Ratios	
Age	Exposures	Actual	Current	Proposed	Current	Proposed
50-54	812	39	32	31	120%	126%
55-59	794	43	45	40	96%	108%
60-64	703	69	104	68	66%	101%
65-69	342	59	68	56	86%	105%
70-74	100	17	20	20	85%	85%
75-79	13	6	3	3	185%	231%
80	0	0	0	0	0%	0%
Total	2,764	233	273	218	85%	107%
R-squared			59.3%	80.2%		

Chart III-R1 – Miscellaneous

Miscellaneous Retirement Rates For 10 to 19 Years of Service

SECTION III – DEMOGRAPHIC ASSUMPTIONS
RETIREMENT RATES

Table III-R2 shows the calculation of actual-to-expected ratios and the r-squared statistic for Miscellaneous members with 20 to 29 years of service. Chart III-R2 shows the information graphically along with the 90% confidence interval.

The data shows higher actual retirement rates than expected under the current assumption. The proposed assumption increases the aggregate assumed rate of retirement and decreases the aggregate A/E ratio from 112% to 95%. The r-squared statistic increases from 74.6% to 87.9%.

Table III-R2 – Miscellaneous

Miscellaneous Retirement Rates For 20 to 29 Years of Service						
		Retirements			**A/E Ratios**	
Age	**Exposures**	**Actual**	**Current**	**Proposed**	**Current**	**Proposed**
50-54	399	10	16	15	63%	66%
55-59	383	37	29	38	128%	97%
60-64	320	52	49	49	106%	106%
65-69	139	39	28	38	140%	104%
70-74	46	11	9	14	120%	80%
75-79	14	3	4	4	86%	71%
80	2	0	2	2	0%	0%
Total	**1,303**	**152**	**136**	**160**	**112%**	**95%**
R-squared			**74.6%**	**87.9%**		

Chart III-R2 – Miscellaneous

Miscellaneous Retirement Rates For 20 to 29 Years of Service

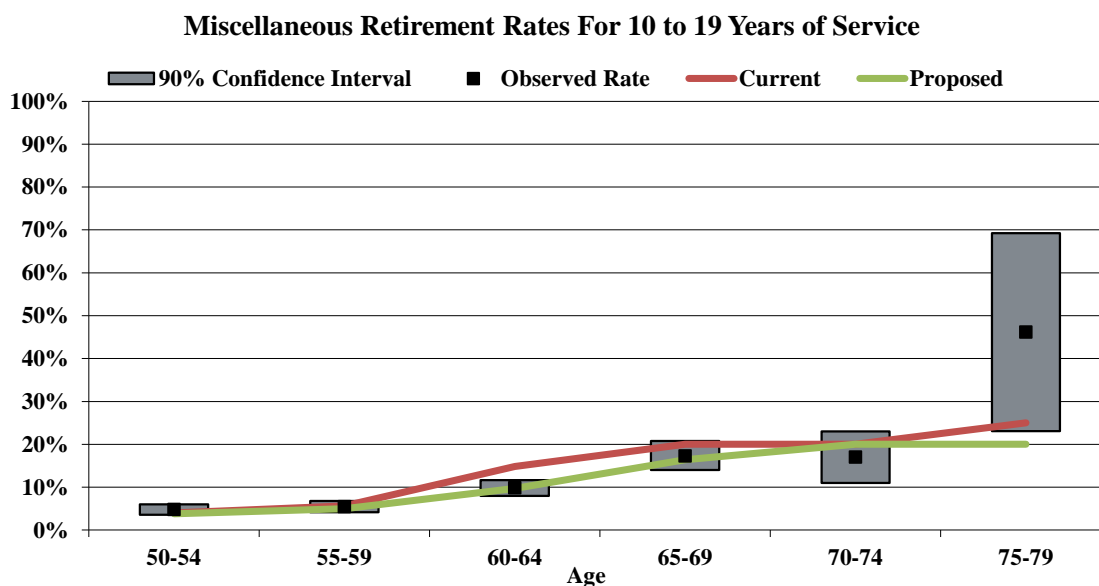## SECTION III – DEMOGRAPHIC ASSUMPTIONS
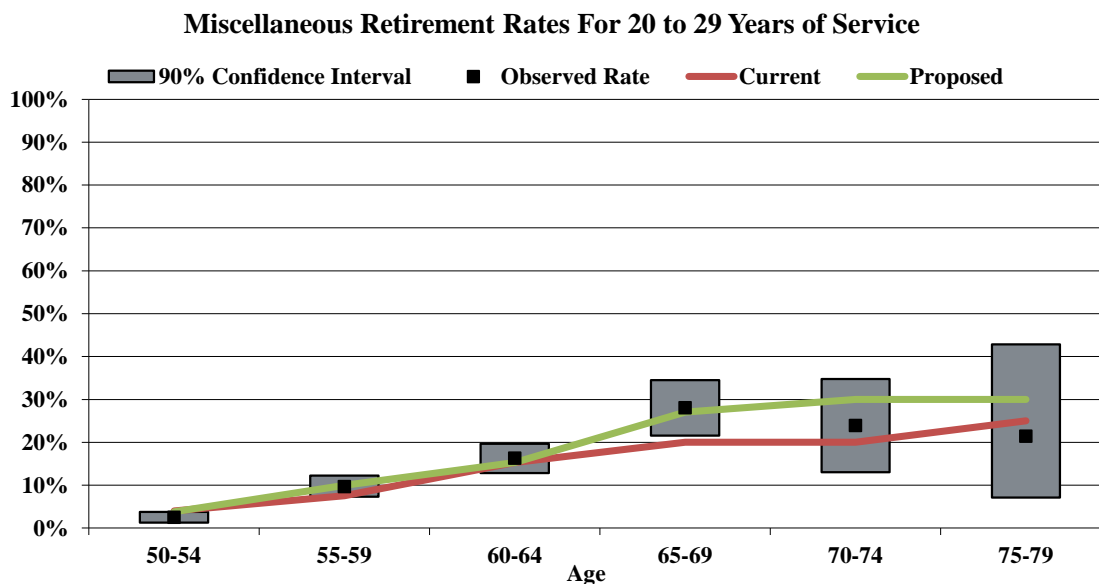### RETIREMENT RATES

Table III-R3 shows the calculation of actual-to-expected ratios and the r-squared statistic for Miscellaneous members with 30 or more years of service. Chart III-R3 shows the information graphically along with the 90% confidence interval.

The data shows lower actual retirement rates than expected under the current assumption. The proposed assumption decreases the aggregate assumed rate of retirement and increases the aggregate A/E ratio from 76% to 95%. The r-squared statistic increases from 80.9% to 89.4%.

See Appendices A and B for a full listing of the proposed and prior retirement rates for Miscellaneous members. The ultimate retirement age remains at 80.

Table III-R3 – Miscellaneous

Miscellaneous Retirement Rates For 30 or More Years of Service						
		Retirements			**A/E Ratios**	
Age	**Exposures**	**Actual**	**Current**	**Proposed**	**Current**	**Proposed**
50-54	72	6	3	6	208%	100%
55-59	137	20	34	21	58%	97%
60-64	103	31	36	31	86%	100%
65-69	48	10	17	14	60%	69%
70-74	5	3	2	2	171%	200%
75-79	1	0	0	0	0%	0%
80	1	1	1	1	100%	100%
Total	**367**	**71**	**93**	**75**	**76%**	**95%**
R-squared			**80.9%**	**89.4%**		

Chart III-R3 – Miscellaneous

Miscellaneous Retirement Rates For 30 or More Years of Service

SECTION III – DEMOGRAPHIC ASSUMPTIONS
RETIREMENT RATES

Table III-R4 shows the calculation of actual-to-expected ratios and the r-squared statistic for Safety members with the 3% at age 50 benefit formula and 10 to 19 years of service. Chart III-R4 shows the information graphically along with the 90% confidence interval.
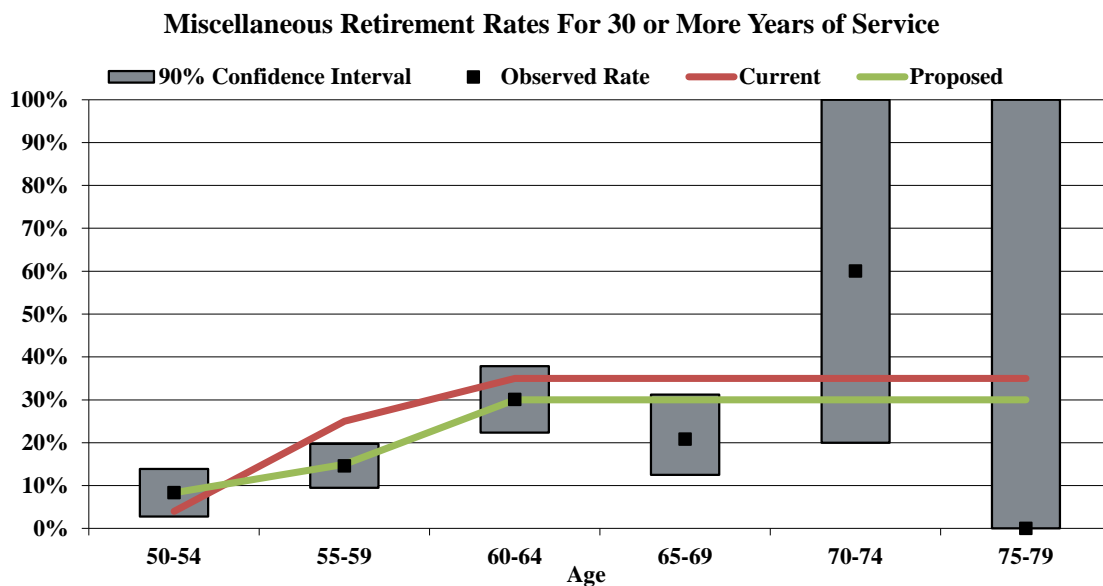
The data shows lower retirement rates than expected under the current assumption. The proposed assumption decreases the aggregate assumed rate of retirement and increases the aggregate A/E ratio from 61% to 111%. The r-squared statistic increases from 16.2% to 57.3%.

Table III-R4 – Safety, 3% at age 50

Safety (age 50) Retirement Rates For 10 to 19 Years of Service						
			Retirements		A/E Ratios	
Age	Exposures	Actual	Current	Proposed	Current	Proposed
40-44	15	0	0	0	0%	0%
45-49	22	1	0	0	0%	0%
50-54	88	7	12	6	60%	121%
55-59	16	0	4	2	0%	0%
60-64	5	3	3	3	120%	120%
65	0	0	0	0	0%	0%
Total	**146**	**11**	**18**	**10**	**61%**	**111%**
R-squared			**16.2%**	**57.3%**		

Chart III-R4 – Safety, 3% at age 50

Safety (age 50) Retirement Rates For 10 to 19 Years of Service

SECTION III – DEMOGRAPHIC ASSUMPTIONS
RETIREMENT RATES

Table III-R5 shows the calculation of actual-to-expected ratios and the r-squared statistic for Safety members with the 3% at age 50 benefit formula and 20 to 29 years of service. Chart III-R5 shows the information graphically along with the 90% confidence interval.

The data shows higher actual retirement rates than expected under the current assumption. The proposed assumption increases the aggregate assumed rate of retirement and decreases the aggregate A/E ratio from 108% to 98%. The r-squared statistic increases from 36.8% to 83.7%.

Table III-R5 – Safety, 3% at age 50

		Retirements			A/E Ratios	
Age	Exposures	Actual	Current	Proposed	Current	Proposed
40-44	57	2	2	2	117%	117%
45-49	176	11	5	9	208%	116%
50-54	136	12	18	15	66%	79%
55-59	51	18	13	16	141%	113%
60-64	7	2	4	4	57%	57%
65	0	0	0	0	0%	0%
Total	**427**	**45**	**41**	**46**	**108%**	**98%**
R-squared			**36.8%**	**83.7%**		

Chart III-R5 – Safety, 3% at age 50

Safety (age 50) Retirement Rates For 20 to 29 Years of Service

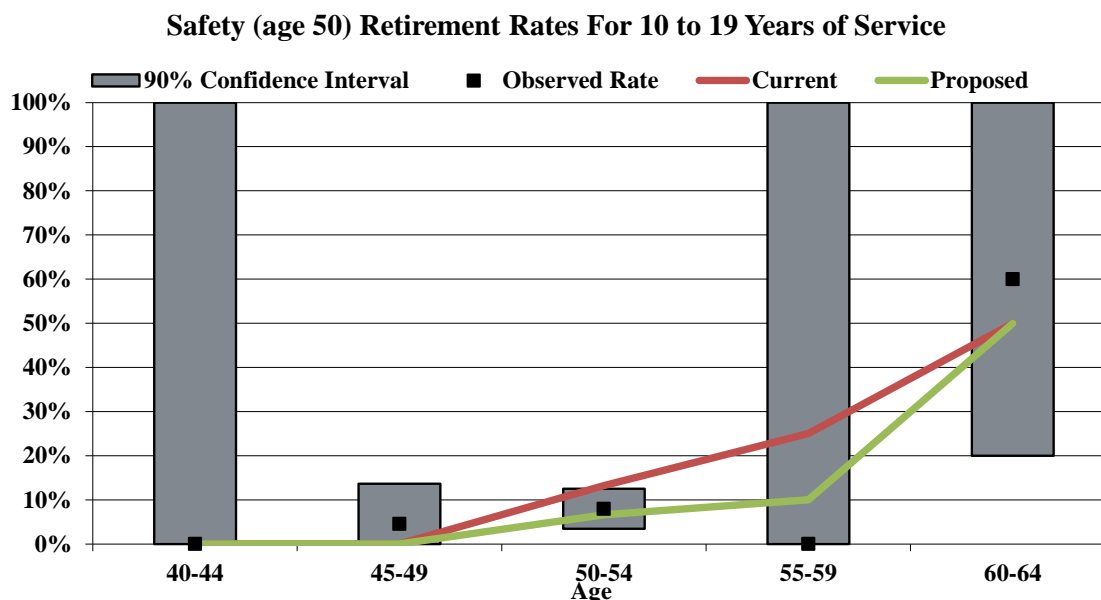## SECTION III – DEMOGRAPHIC ASSUMPTIONS
RETIREMENT RATES

Table III-R6 shows the calculation of actual-to-expected ratios and the r-squared statistic for Safety members with the 3% at age 50 benefit formula and 30 or more years of service. Chart III-R6 shows the information graphically along with the 90% confidence interval.

The data shows actual retirement rates that are close to expected in aggregate under the current assumption. Given the limited experience and the aggregate A/E ratios, we propose no change in assumptions.

Table III-R6 – Safety, 3% at age 50

Safety (age 50) Retirement Rates For 30 or More Years of Service						
		Retirements			A/E Ratios	
Age	Exposures	Actual	Current	Proposed	Current	Proposed
40-44	0	0	0	0	0%	0%
45-49	0	0	0	0	0%	0%
50-54	13	6	3	3	207%	207%
55-59	13	3	7	7	46%	46%
60-64	2	1	1	1	100%	100%
65	0	0	0	0	0%	0%
Total	**28**	**10**	**10**	**10**	**96%**	**96%**
R-squared			**13.4%**	**13.4%**		

Chart III-R6 – Safety, 3% at age 50

Safety (age 50) Retirement Rates For 30 or More Years of Service

SECTION III – DEMOGRAPHIC ASSUMPTIONS
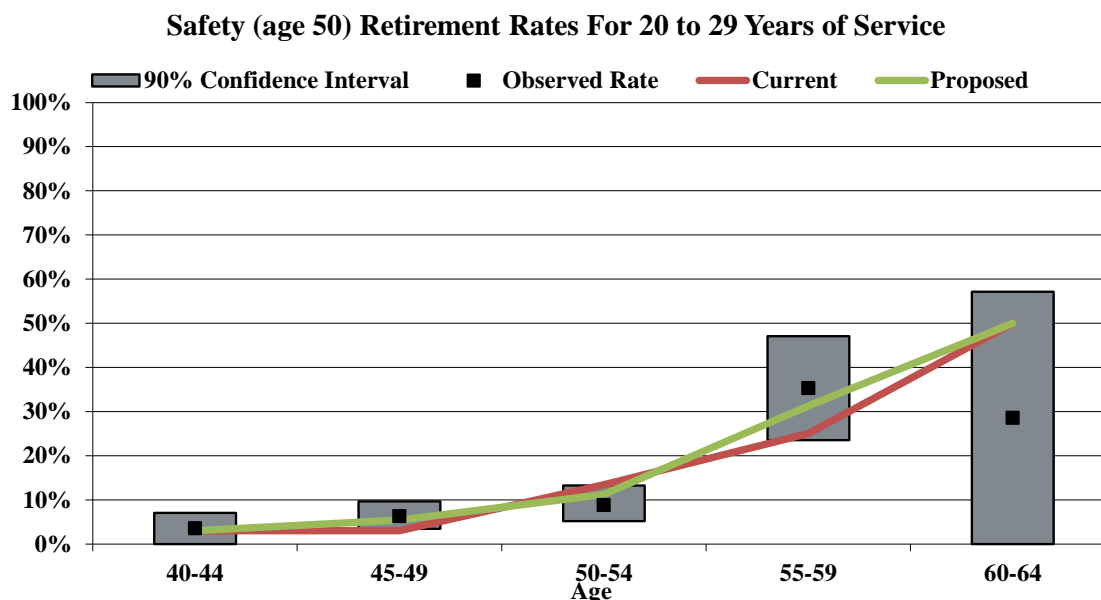### RETIREMENT RATES

Table III-R7 shows the calculation of actual-to-expected ratios and the r-squared statistic for Safety members with the 3% at age 55 benefit formula and 10 to 19 years of service. Chart III-R7 shows the information graphically along with the 90% confidence interval.

The data shows lower actual retirement rates than expected under the current assumption. Given the limited experience, however, we are only proposing a minor change in the assumption. The proposed assumption decreases the aggregate assumed rate of retirement and increases the aggregate A/E ratio from 40% to 49%. The r-squared statistic increases slightly from 0.1% to 1.5%.

Table III-R7 – Safety, 3% at age 55

Safety (age 55) Retirement Rates For 10 to 19 Years of Service						
		Retirements			A/E Ratios	
Age	Exposures	Actual	Current	Proposed	Current	Proposed
40-44	12	1	0	0	0%	0%
45-49	22	0	0	0	0%	0%
50-54	32	1	2	2	63%	63%
55-59	14	1	2	2	59%	59%
60-64	19	0	6	4	0%	0%
65	1	1	1	1	100%	100%
Total	**100**	**4**	**10**	**8**	**40%**	**49%**
R-squared			**0.1%**	**1.5%**		

Chart III-R7 – Safety, 3% at age 55

Safety (age 55) Retirement Rates For 10 to 19 Years of Service

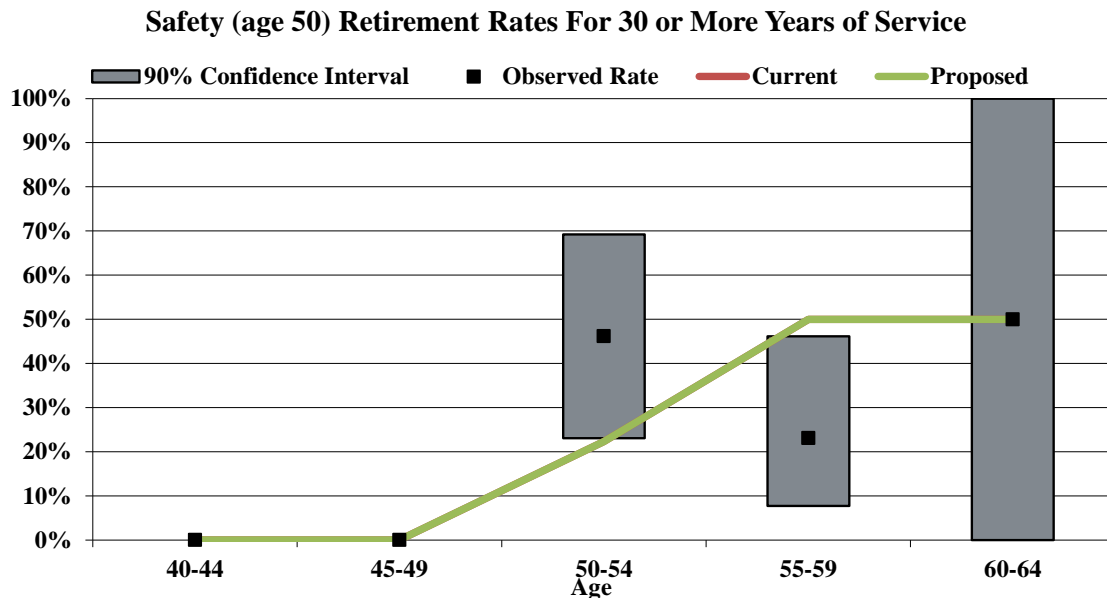## SECTION III – DEMOGRAPHIC ASSUMPTIONS
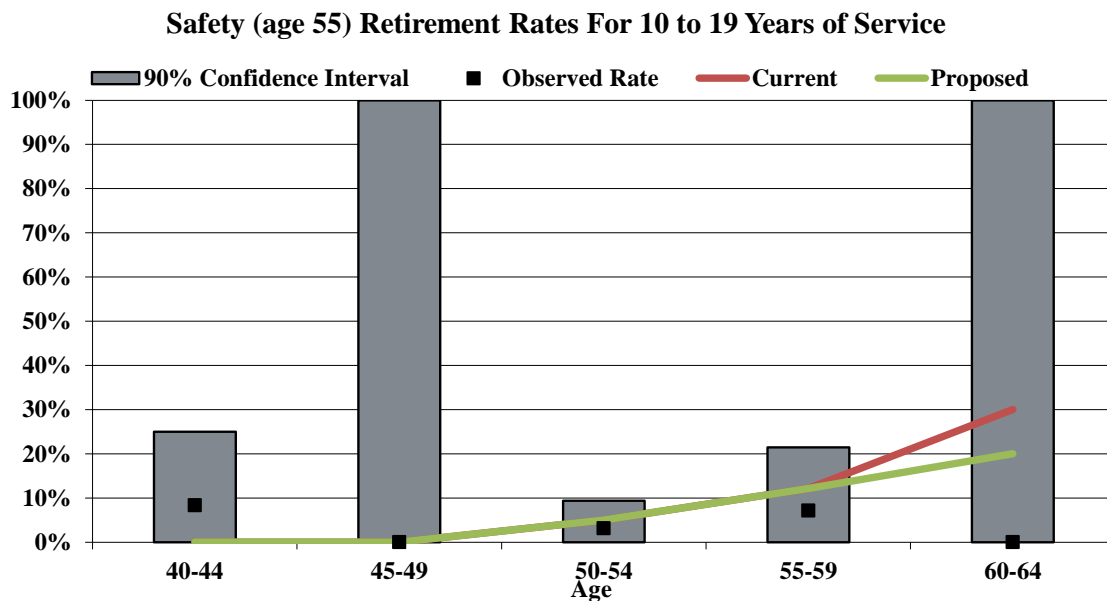### RETIREMENT RATES

Table III-R8 shows the calculation of actual-to-expected ratios and the r-squared statistic for Safety members with the 3% at age 55 benefit formula and 20 to 29 years of service. Chart III-R8 shows the information graphically along with the 90% confidence interval.

The data shows higher actual retirement rates than expected under the current assumption. The proposed assumption increases the aggregate assumed rate of retirement and decreases the aggregate A/E ratio from 131% to 113%. The r-squared statistic increases from 60.9% to 73.5%.

Table III-R8 – Safety, 3% at age 55

Safety (age 55) Retirement Rates For 20 to 29 Years of Service						
			Retirements		A/E Ratios	
Age	Exposures	Actual	Current	Proposed	Current	Proposed
40-44	22	0	0	0	0%	0%
45-49	83	5	1	4	602%	120%
50-54	79	10	5	8	187%	127%
55-59	36	12	11	9	109%	128%
60-64	10	1	3	2	33%	50%
65	1	0	1	1	0%	0%
Total	**231**	**28**	**21**	**25**	**131%**	**113%**
R-squared			**60.9%**	**73.5%**		

Chart III-R8 – Safety, 3% at age 55

Safety (age 55) Retirement Rates For 20 to 29 Years of Service

SECTION III – DEMOGRAPHIC ASSUMPTIONS
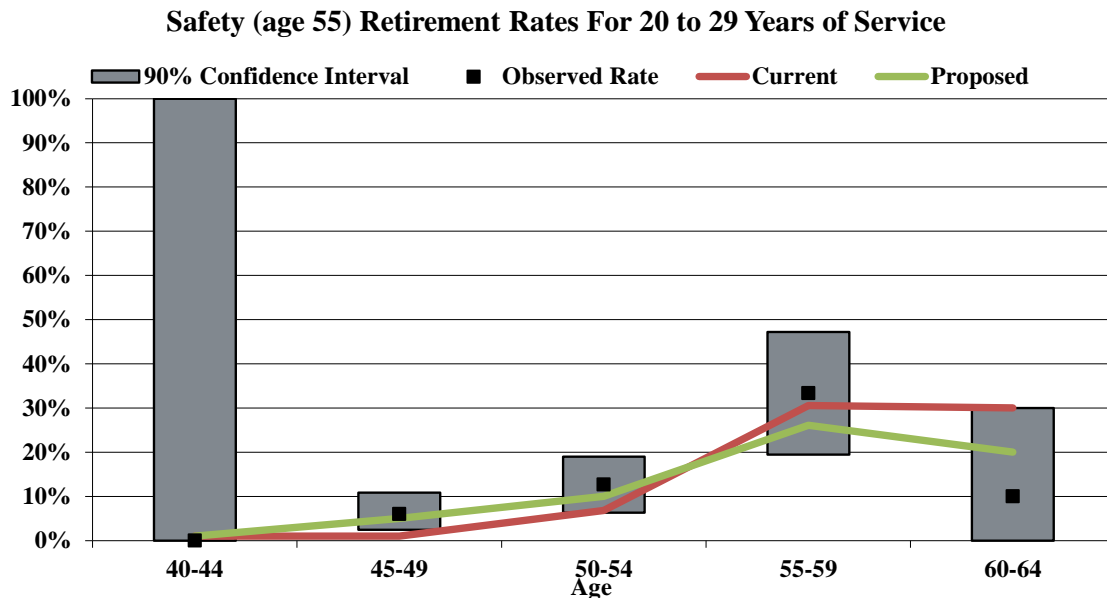### RETIREMENT RATES

Table III-R9 shows the calculation of actual-to-expected ratios and the r-squared statistic for Safety members with the 3% at age 55 benefit formula and 30 or more years of service. Chart III-R9 shows the information graphically along with the 90% confidence interval.

The data shows lower actual retirement rates than expected under the current assumption. The proposed assumption decreases the aggregate assumed rate of retirement and increases the aggregate A/E ratio from 71% to 83%. The r-squared statistic increases slightly from 42.2% to 43.7%.

See Appendices A and B for a full listing of the proposed and prior retirement rates for safety members. The ultimate retirement age remains at 65.

Table III-R9 – Safety, 3% at age 55

Safety (age 55) Retirement Rates For 30 or More Years of Service						
		Retirements			A/E Ratios	
Age	Exposures	Actual	Current	Proposed	Current	Proposed
40-44	0	0	0	0	0%	0%
45-49	2	1	0	0	5000%	1000%
50-54	25	6	8	8	80%	80%
55-59	12	3	6	4	50%	83%
60-64	2	1	1	1	100%	100%
65	1	0	1	1	0%	0%
Total	**42**	**11**	**16**	**13**	**71%**	**83%**
R-squared			**42.2%**	**43.7%**		

Chart III-R9 – Safety, 3% at age 55

Safety (age 55) Retirement Rates For 30 or More Years of Service
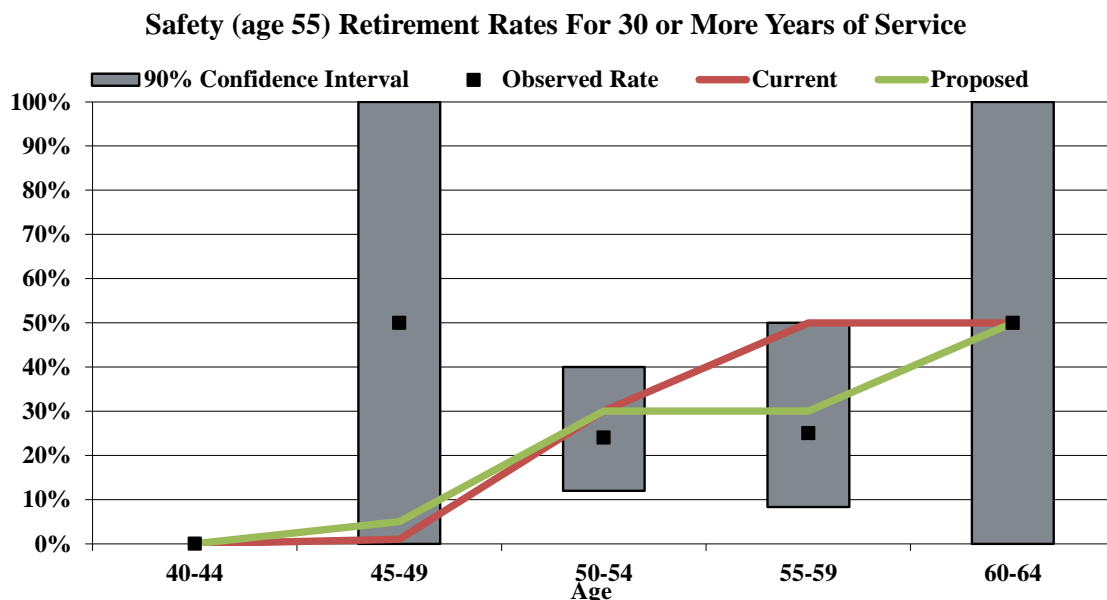
TERMINATION RATES

Termination rates reflect the frequency at which active members leave employment for reasons other than retirement, death, or disability. Currently, the termination rates are based on age and service for both Safety and Miscellaneous members. Termination rates for Miscellaneous members also vary by gender. Basing termination rates on both age and years of service avoids under-weighting the liabilities that can occur if using age-based rates only. The termination rates do not apply once members are eligible for a service retirement benefit.

To make the best use of the available member data, we study all terminations together – vested terminations, terminating members who withdraw their contributions, and members who transfer to a reciprocal pension plan – to determine an overall termination rate. We then analyze the percentages of terminating members who withdraw their contributions, transfer, or are eligible for a vested benefit. Additionally, we have combined the experience of the past three years with that of the prior three-year period in order to have a more robust dataset to review.

Based on this data, we believe the current termination rates are reasonable, and recommend no changes.

SECTION III – DEMOGRAPHIC ASSUMPTIONS
TERMINATION RATES

Table III-T1 shows the calculation of actual-to-expected ratios and the r-squared statistic for Miscellaneous male members, Table III-T2 shows the same for Miscellaneous female members and Table III-T3 shows the same for Safety members. Charts III-T1 through III-T3 show the information graphically along with the 90% confidence intervals.

The data shows that in all cases the actual termination rates are slightly higher in aggregate, but the A/E ratio is close to 100%, so we are comfortable recommending no change to the assumptions.

See Appendices A and B for a sample listing of the proposed and prior rates (which are identical).

Table III-T1 – Miscellaneous Male

		Terminations			A/E Ratios	
Service	**Exposures**	**Actual**	**Current**	**Proposed**	**Current**	**Proposed**
0-5	954	92	85	85	108%	108%
5-10	967	48	40	40	120%	120%
10-15	475	19	16	16	119%	119%
15-20	207	4	4	4	105%	105%
20-25	75	0	1	1	0%	0%
25-30	75	0	1	1	0%	0%
Total	**2,753**	**163**	**147**	**147**	**111%**	**111%**
R-squared			**90.7%**	**90.7%**		

Chart III-T1 – Miscellaneous Male
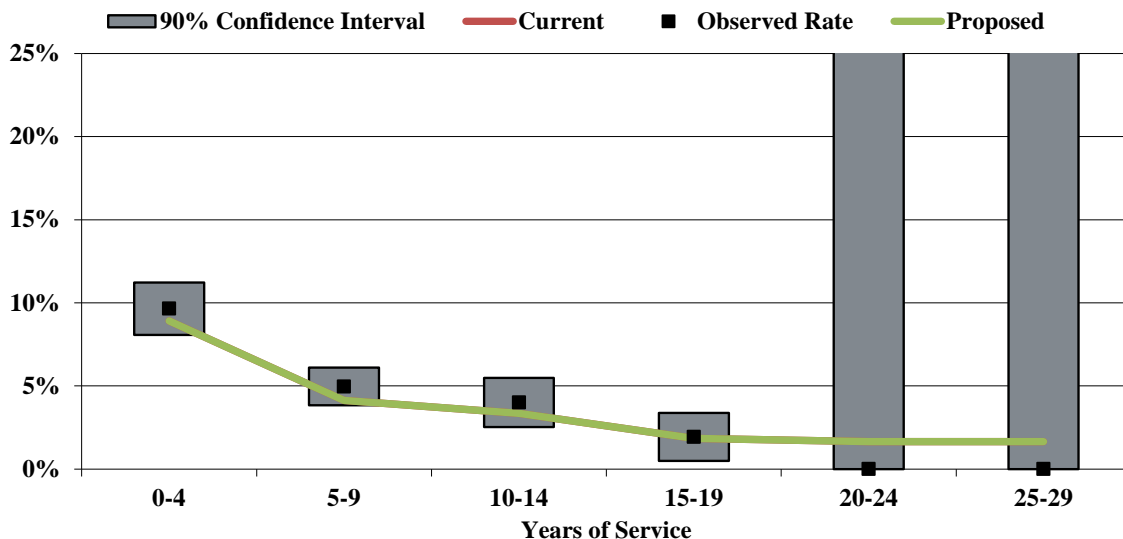
Miscellaneous Male Termination Rates

SECTION III – DEMOGRAPHIC ASSUMPTIONS
TERMINATION RATES

Table III-T2 – Miscellaneous Female

Miscellaneous Female Termination Rates						
		Terminations			**A/E Ratios**	
Service	**Exposures**	**Actual**	**Current**	**Proposed**	**Current**	**Proposed**
0-4	1,609	176	158	158	111%	111%
5-9	1,507	97	77	77	126%	126%
10-14	601	23	20	20	112%	112%
15-19	277	6	5	5	117%	117%
20-24	84	2	1	1	142%	142%
25-29	84	2	1	1	142%	142%
Total	**4,162**	**306**	**264**	**264**	**116%**	**116%**
R-squared			**94.4%**	**94.4%**		

Chart III-T2 – Miscellaneous Female
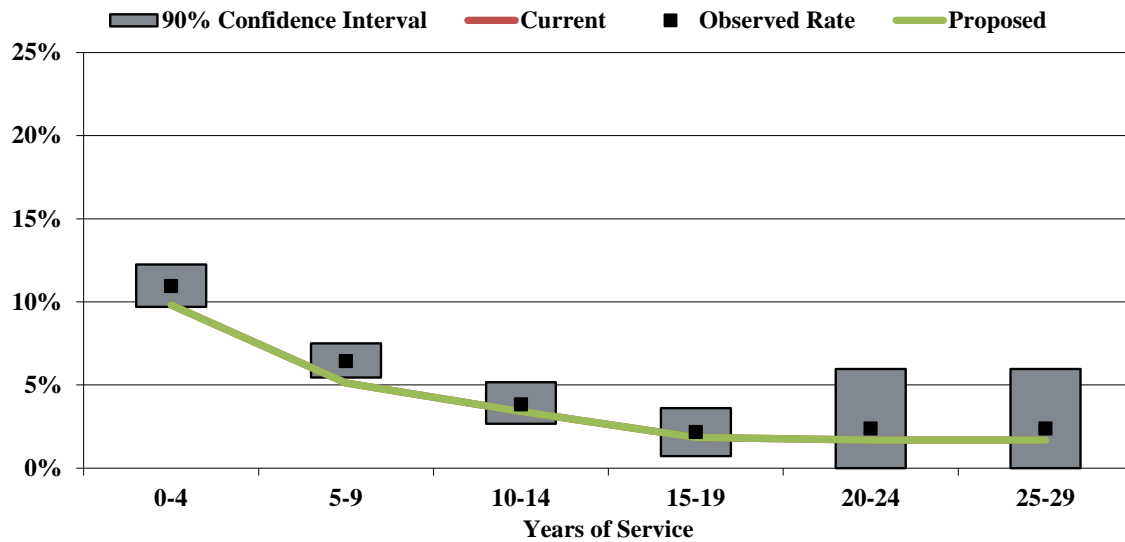
Miscellaneous Female Termination Rates

SECTION III – DEMOGRAPHIC ASSUMPTIONS
TERMINATION RATES

Table III-T3 – Safety

Safety Termination Rates						
		Terminations			A/E Ratios	
Service	Exposures	Actual	Current	Proposed	Current	Proposed
0-4	679	39	34	34	116%	116%
5-9	713	25	18	18	136%	136%
10-14	763	11	15	15	74%	74%
15-19	355	2	5	5	41%	41%
Total	**2,510**	**77**	**72**	**72**	**107%**	**107%**
R-squared			**76.0%**	**76.0%**		

Chart III-T3 – Safety

Safety Termination Rates
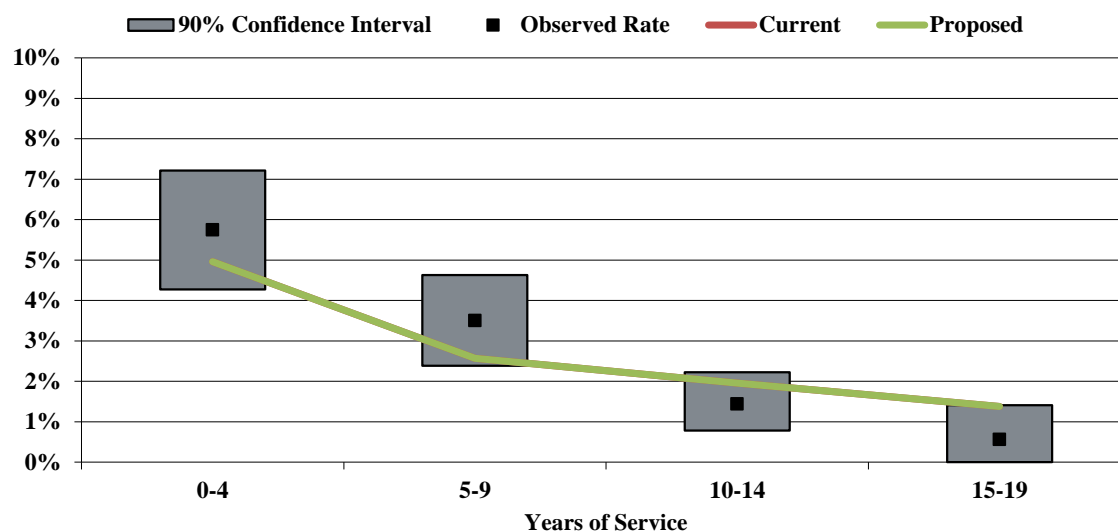
SECTION III – DEMOGRAPHIC ASSUMPTIONS
TERMINATION RATES

TYPES OF TERMINATION

When a vested member terminates employment, the member has the option of receiving a refund of contributions with interest or a deferred annuity. If an employee terminates employment and works for a reciprocal employer (also referred to as a transfer), the employees' retirement benefit is based on the employee's service with MCERA and Final Compensation based on employment with the reciprocal employer.

Tables III-T4 and III-T5 show the results of our analysis of terminations for Miscellaneous and Safety members, as well as our recommendations regarding rates of withdrawal, vested termination, and transfer.

We note that the actual rates of vested terminations and transfers are based on the information reported to Cheiron as part of the actuarial valuation data in the year after the member has terminated. However, many members do not report that they have established reciprocity with another system until they actually submit a retirement application. Therefore, if we relied only on the actual rates shown below to develop a reciprocity assumption, we would likely underestimate the ultimate number of transfers.

Accordingly, we also reviewed the number of members who went from a deferred status to service retirement during the study period, and determined which of those members had established reciprocity with another system prior to retirement. We found that nearly 60% of the Miscellaneous members had worked for a reciprocal employer, and over 80% of Safety members had done so. Therefore, our recommended rates of transfer shown in Tables III-4 and III-5 are higher than would have been indicated just by the actual rates reported at the time of termination.

Table III-T4 – Miscellaneous

Types of Termination for Miscellaneous Members			
Service and Type	Actual	Expected	Recommended
0 Years of Service			
Withdrawal	60.61%	30.00%	50.00%
Transfer	0.00%	14.00%	15.00%
Vested Termination	39.39%	56.00%	35.00%
1 Year of Service			
Withdrawal	37.36%	30.00%	40.00%
Transfer	3.30%	14.00%	18.00%
Vested Termination	59.34%	56.00%	42.00%
2 Years of Service			
Withdrawal	27.27%	30.00%	20.00%
Transfer	9.09%	14.00%	24.00%
Vested Termination	63.64%	56.00%	56.00%
3 Years of Service			
Withdrawal	14.71%	30.00%	20.00%

SECTION III – DEMOGRAPHIC ASSUMPTIONS
TERMINATION RATES

Transfer	8.82%	14.00%	24.00%
Vested Termination	76.47%	56.00%	56.00%
4 Years of Service			
Withdrawal	15.15%	30.00%	20.00%
Transfer	3.03%	14.00%	24.00%
Vested Termination	81.82%	56.00%	56.00%
5+ Years of Service			
Withdrawal	8.47%	15.00%	10.00%
Transfer	20.97%	17.00%	27.00%
Vested Termination	70.56%	68.00%	63.00%

Table III-T5 – Safety

Types of Termination for Safety Members			
Service and Type	Actual	Expected	Recommended
0-9 Years of Service			
Withdrawal	24.59%	25.00%	25.00%
Transfer	27.87%	30.00%	45.00%
Vested Termination	47.54%	45.00%	30.00%
10+ Years of Service			
Withdrawal	22.22%	5.00%	15.00%
Transfer	16.67%	38.00%	51.00%
Vested Termination	61.11%	57.00%	34.00%

RECIPROCAL PAY INCREASE

If a member terminates employment and works for a reciprocal employer, the member's retirement benefit is ultimately computed using the highest Final Compensation based on employment with the reciprocal employer. We recommend that the assumption used to project pay during employment with the reciprocal employer be based on the wage growth assumption, increased by the ultimate merit pay increase assumption described earlier in this report. Therefore, the recommended total pay growth assumption for members in reciprocal status is 3.75% (3.00% + 0.75%) for Miscellaneous members and 4.25% (3.00% + 1.25%) for Safety members.

DISABILITY RATES

This section analyzes the incidence of disability by the age of the employee. We have combined the experience of the past three years with that of the prior three-year period in order to have a more robust dataset to review. The amount of disability experience is still fairly limited; only 33 disabilities have occurred during the last six years for Safety and Miscellaneous members combined.

All disabilities for members with less than five years of service are assumed to be service-related. In the last six years, 55% of disabilities with five or more years of service were service-related for Miscellaneous members, and 92% were service-related for Safety members. We recommend assuming that 50% of future disabilities are service-related for Miscellaneous members, and 95% are service-related for Safety members.

Table III-D1 shows the calculation of actual-to-expected ratios and the r-squared statistic for all disabilities for Miscellaneous male members, and Chart III-D1 shows the information graphically.

The data shows that actual disability rates are lower than expected for Miscellaneous members in aggregate. We recommend adopting a new standard disability table: the just-released 2017 CalPERS Public Agency Miscellaneous Ordinary Disability rates for males.

See Appendices A and B for a sample listing of the proposed and prior rates.

SECTION III – DEMOGRAPHIC ASSUMPTIONS
DISABILITY RATES

Table III-D1 – Miscellaneous Male

Miscellaneous Male Disability Incidence Rates								
Age Band	Exposures	Disabilities			Average Disability Rates			A/E Ratios	
		Actual	Current	Proposed	Actual	Current	Proposed	Current	Proposed
20 - 34	539	0	0	0	0.000%	0.060%	0.024%	0%	0%
35 - 39	462	0	0	0	0.000%	0.095%	0.059%	0%	0%
40 - 44	537	0	1	1	0.000%	0.131%	0.126%	0%	0%
45 - 49	651	0	1	1	0.000%	0.172%	0.157%	0%	0%
50 - 54	799	2	2	1	0.250%	0.217%	0.158%	115%	158%
55 - 59	795	1	2	1	0.126%	0.270%	0.158%	47%	80%
60 +	923	1	3	1	0.108%	0.340%	0.135%	32%	80%
Total	**4,706**	**4**	**10**	**6**	**0.085%**	**0.204%**	**0.125%**	**42%**	**68%**
R-squared			**10.9%**	**9.6%**					

Chart III-D1 – Miscellaneous Male
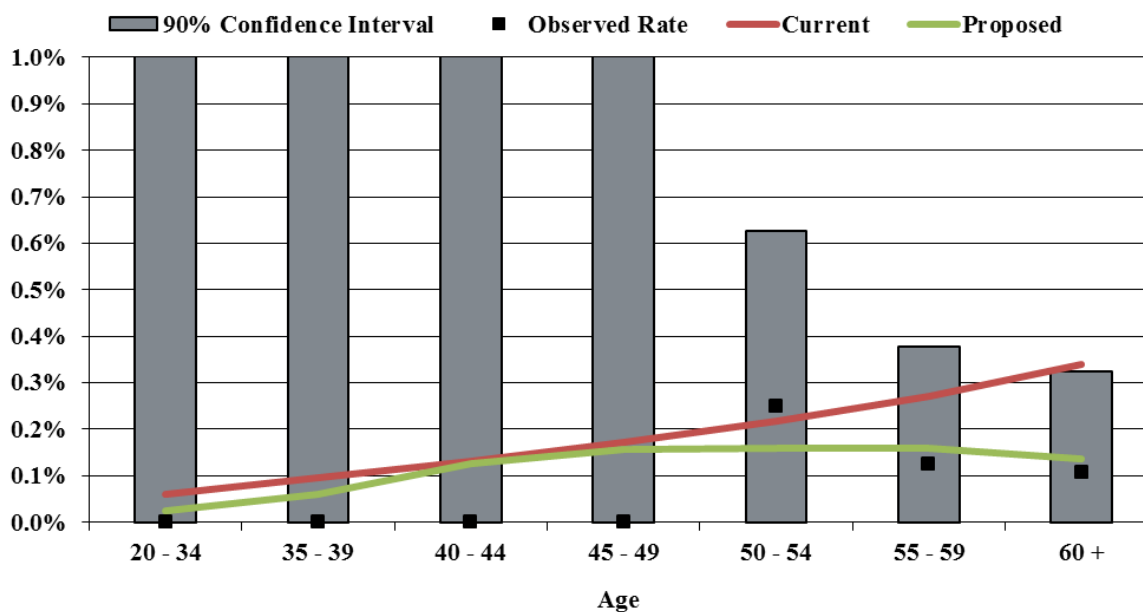
Miscellaneous Male Disability Incidence Rates

SECTION III – DEMOGRAPHIC ASSUMPTIONS
DISABILITY RATES

Table III-D2 shows the calculation of actual-to-expected ratios and the r-squared statistic for all disabilities for Miscellaneous female members, and Chart III-D2 shows the information graphically.

The data shows that actual disability rates are lower than the expected disability rates in aggregate. We recommend adopting a new standard disability table: the 2017 CalPERS Public Agency Miscellaneous Ordinary Disability rates for females without adjustment.

See Appendices A and B for a sample listing of the proposed and prior rates.

Table III-D2 – Miscellaneous Female

Miscellaneous Female Disability Incidence Rates								
Age		Disabilities			Average Disability Rates			A/E Ratios	
Band	Exposures	Actual	Current	Proposed	Actual	Current	Proposed	Current	Proposed
20 - 34	816	0	0	0	0.000%	0.033%	0.034%	0%	0%
35 - 39	721	0	0	1	0.000%	0.052%	0.095%	0%	0%
40 - 44	826	0	1	1	0.000%	0.073%	0.156%	0%	0%
45 - 49	946	2	1	2	0.211%	0.101%	0.199%	209%	106%
50 - 54	1,111	1	2	2	0.090%	0.137%	0.182%	66%	50%
55 - 59	1,138	0	2	1	0.000%	0.182%	0.130%	0%	0%
60 +	1,524	2	4	1	0.131%	0.248%	0.093%	53%	142%
Total	**7,082**	**5**	**10**	**9**	**0.071%**	**0.135%**	**0.128%**	**52%**	**55%**
R-squared			**4.9%**	**7.3%**					

Chart III-D2 – Miscellaneous Female
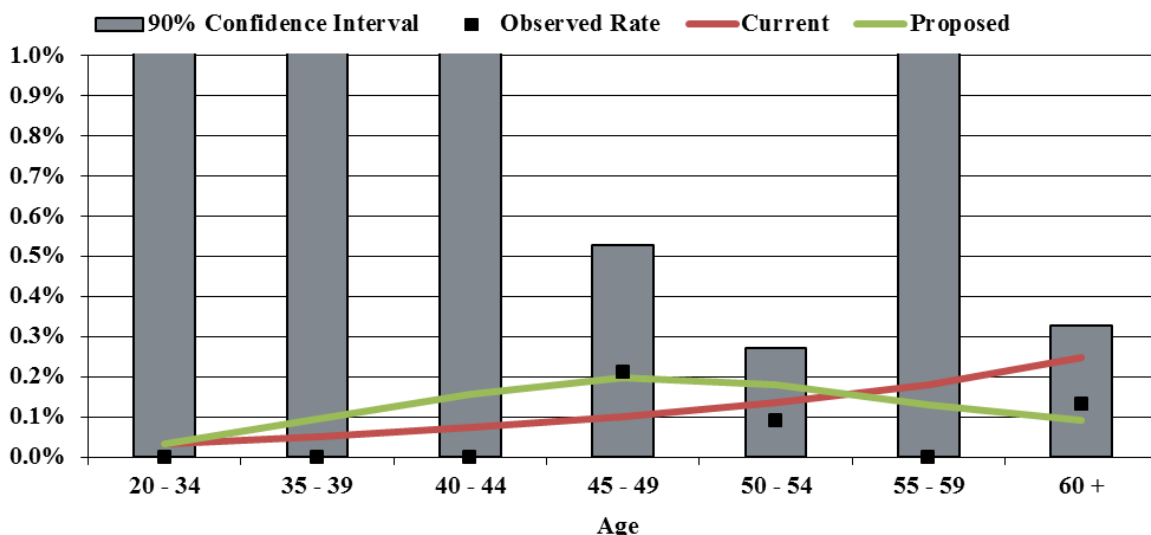
Miscellaneous Female Disability Incidence Rates

SECTION III – DEMOGRAPHIC ASSUMPTIONS
DISABILITY RATES

Table III-D3 shows the calculation of actual-to-expected ratios and the r-squared statistic for all disabilities for Safety members, and Chart III-D3 shows the information graphically.

The data shows that actual disability rates are lower than the expected disability rates in aggregate. We recommend adopting a standard disability table and adjusting it for MCERA experience: 2017 CalPERS Public Agency Police Unisex Industrial and Ordinary Disability rates, multiplied by 0.6, and with a maximum rate of 1.25%.

See Appendix A or B for a sample listing of the rates.

Table III-D3 – Safety

Safety Disability Incidence Rates								
Age Band	Exposures	Disabilities			Average Disability Rates			A/E Ratios	
		Actual	Current	Proposed	Actual	Current	Proposed	Current	Proposed
20 - 34	880	3	2	3	0.341%	0.278%	0.301%	123%	113%
35 - 39	656	4	3	4	0.610%	0.511%	0.569%	119%	107%
40 - 44	727	2	5	6	0.275%	0.732%	0.763%	38%	36%
45 - 49	614	9	7	6	1.466%	1.060%	0.953%	138%	154%
50 - 54	409	4	6	5	0.978%	1.348%	1.230%	73%	80%
55 - 59	175	1	6	2	0.571%	3.194%	1.250%	18%	46%
60 +	76	1	0	1	1.316%	0.000%	1.250%	0%	105%
Total	**3,537**	**24**	**29**	**26**	**0.679%**	**0.812%**	**0.733%**	**84%**	**93%**
R-squared			**15.1%**	**23.0%**					

Chart III-D3 – Safety

Safety Disability Incidence Rates
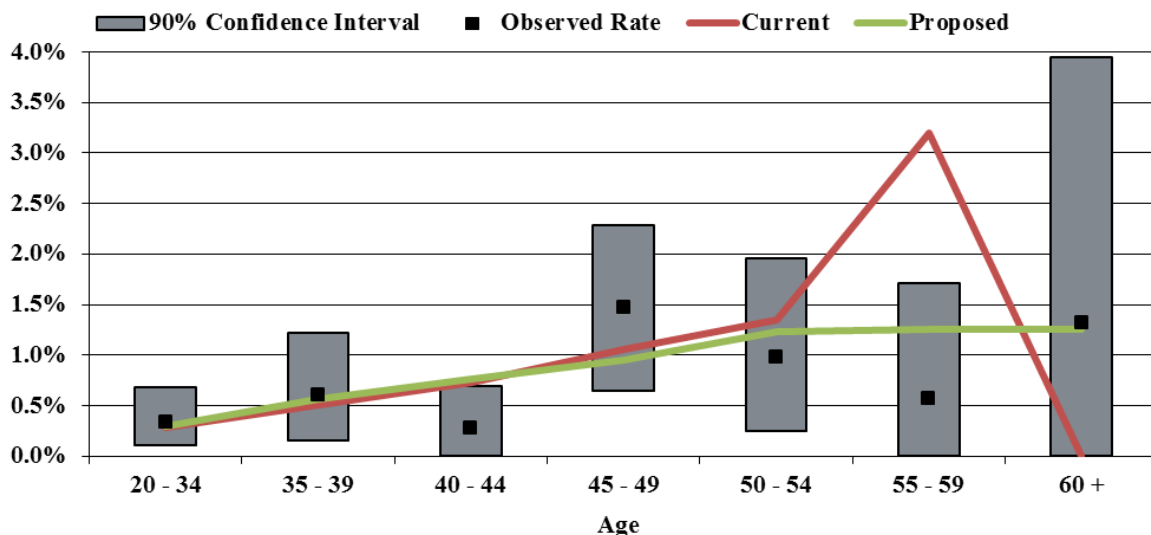
SECTION III – DEMOGRAPHIC ASSUMPTIONS
MORTALITY RATES

Post-retirement mortality assumptions are typically developed separately by gender for both healthy annuitants and disabled annuitants. Pre-retirement mortality assumptions are developed separately for males and females. Unlike most of the other demographic assumptions that rely exclusively on the experience of the plan, for mortality, standard mortality tables and projection scales serve as the primary basis for the assumption.

The Society of Actuaries recently updated their mortality improvement projection scale, the most recent of which is named the MP-2017 scale. CalPERS also recently released a set of mortality tables based on CalPERS experience. We used these tables as the basis for our analysis.

The steps in our analysis are as follows:
1. Select an appropriate standard mortality improvement projection scale to apply to the base mortality table.
2. Select a standard mortality table that is, based on experience, most closely matching the anticipated experience of MCERA.
3. Compare actual MCERA experience to what would have been predicted by the selected standard table adjusted by the mortality improvement projection scale for the period of the experience study.
4. Adjust the standard table either fully or partially depending on the level of credibility for MCERA experience. This adjusted table is called the base table.

In general we propose assumption changes when the Actual-to-Expected (A/E) ratio for the current assumption is significantly different than 100%. However, for those groups that do not have sufficient experience, we may recommend replacement tables based on the experience of the groups that have more credible data. For example, there is very little mortality experience among active members, so we have recommended that MCERA use standard tables for those members, without adjustment to reflect MCERA's experience. We note that the pre-retirement mortality assumptions have very little impact on the liability estimates, because of the very low rates of decrement.

SECTION III – DEMOGRAPHIC ASSUMPTIONS
MORTALITY RATES

In the prior study MCERA elected to use the following mortality tables.

Active members
- CalPERS 2014 Pre-Retirement Non-Industrial Death rates (plus Duty-Related Death rates for Safety members), with the 20-year static projection used by CalPERS replaced by generational improvements from a base year of 2009 using Scale MP-2014.

Healthy retirees and beneficiaries
- CalPERS 2014 Post-Retirement Mortality rates, multiplied by 110% for Safety Males and 95% for Safety Females and Miscellaneous Males and Females with the 20-year static projection used by CalPERS replaced by generational improvements from a base year of 2009 using Scale MP-2014.

Disabled members
- CalPERS 2014 Disability Mortality rates (Non-Industrial rates for Miscellaneous members and Industrial Disability rates for Safety members), multiplied by 90% for Males and Females (Miscellaneous and Safety) with the 20-year static projection used by CalPERS replaced by generational improvements from a base year of 2009 using Scale MP-2014.

Since the prior study, the Society of Actuaries' Retirement Plans Experience Committee (RPEC) has released a new mortality improvement scale, Scale MP-2017, which reflects four additional years of data (2011-2015) than was used in the development of Scale MP-2014. As a result, it reflects lower expected improvement rates in the near term than Scale MP-2014, based on the lower levels of mortality improvement observed during the four most recent years in the data.

MP-2017, similar to MP-2014, represents the Society of Actuaries most advanced actuarial methodology in incorporating mortality improvement trends with actual recent mortality rates, by using rates that vary not only by age but also by calendar year – known as a two-dimensional approach to projecting mortality improvements. Scale MP-2017 was designed with the intent of being applied to mortality on a generational basis. The effect of this is to build in an automatic expectation of future improvements in mortality.

The Society of Actuaries most recent mortality rate tables, the RP-2014 tables, were developed exclusively based on private plan data. They are in the process of developing mortality rate tables based on public plan data, but those tables are not yet available. Consequently, we recommend the continued use of CalPERS base mortality tables, which were recently updated based on experience from June 30, 2012 through June 30, 2015. MCERA's experience over the past six years matches well with the new CalPERS rates, after removing the improvement projections included by CalPERS and adjusting them with the new MP-2017 mortality improvement projections from the mid-point of CalPERS study (2014) to the mid-point of the six-year study period for MCERA (2013). Even with the use of six years of data (2011-2017), the MCERA experience is only partially credible, based on standard statistical theory.

SECTION III – DEMOGRAPHIC ASSUMPTIONS
MORTALITY RATES

Rather than weighting the experience based on the number of members living and dying, we have weighted the experience based on benefit size. This approach has been recommended by RPEC, since members with larger benefits are expected to live longer, and a benefit-weighted approach helps avoid underestimating the liabilities.

Based on this information, we are recommending the following base mortality table assumptions:

Active members
- CalPERS 2017 Pre-Retirement Non-Industrial Death rates (plus Duty-Related Death rates for Safety members), with the static projection used by CalPERS replaced by generational improvements from a base year of 2014 using Scale MP-2017.

Healthy retirees and beneficiaries
- CalPERS 2017 Post-Retirement Mortality rates, multiplied by 90% for Males (Miscellaneous and Safety) with the static projection used by CalPERS replaced by generational improvements from a base year of 2014 using Scale MP-2017.

Disabled members
- CalPERS 2017 Disability Mortality rates (Non-Industrial rates for Miscellaneous members and Industrial Disability rates for Safety members), adjusted by 90% for Males (Miscellaneous and Safety) and 90% for Miscellaneous Females with the static projection used by CalPERS replaced by generational improvements from a base year of 2014 using Scale MP-2017.

Tables III-M1 through III-M8 on the following pages show the calculation of actual-to-expected death ratios for Non-Annuitant male, Non-Annuitant female, Healthy Annuitant male, Healthy Annuitant female, Disabled Annuitant Miscellaneous male, Disabled Annuitant Miscellaneous female, Disabled Annuitant Safety male, and Disabled Annuitant Safety female members, respectively. Charts III-M1 through III-M8 show the information graphically along with the 90% confidence intervals.

SECTION III – DEMOGRAPHIC ASSUMPTIONS
MORTALITY RATES

Table III-M1 – Non-Annuitant Male

Non-Annuitant Mortality - Base Table for Males								
Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths			A/E Ratio	
				Actual	Current	Proposed	Current	Proposed
20 - 29	472	1	472	1	0	0	442%	553%
30 - 39	1,790	1	1,790	1	1	1	83%	106%
40 - 49	2,370	3	2,370	3	3	2	117%	137%
50 - 59	2,092	6	2,092	6	5	4	126%	151%
60 - 69	904	4	904	4	4	3	102%	125%
70 +	63	0	63	0	0	1	0%	0%
Total	7,691	15	7,691	15	13	11	114%	136%

Chart III-M1 – Non-Annuitant Male

Male Non-Annuitant Mortality
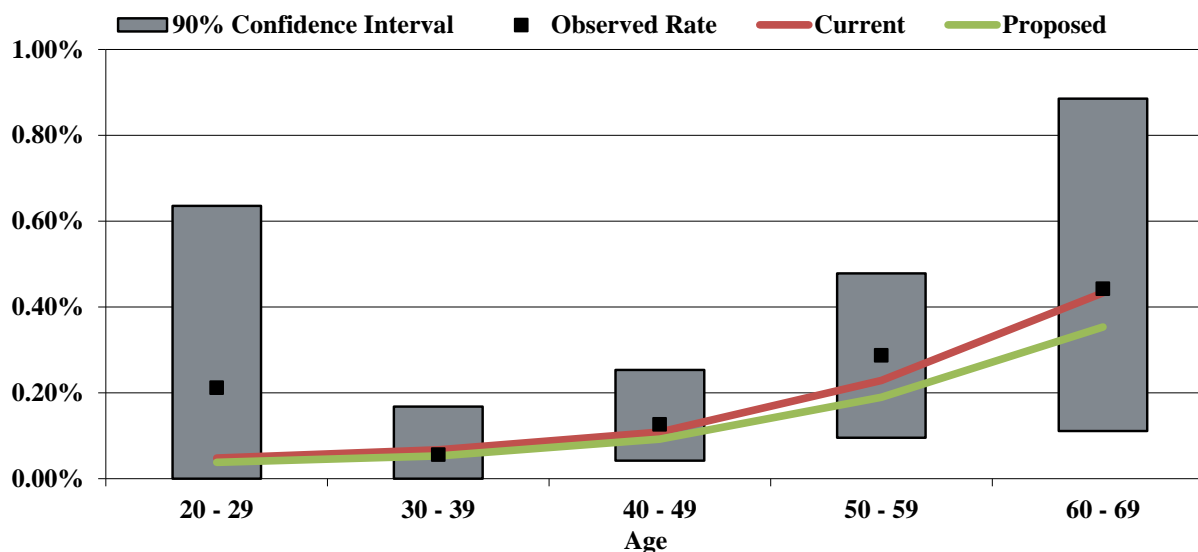
SECTION III – DEMOGRAPHIC ASSUMPTIONS
MORTALITY RATES

Table III-M2 – Non-Annuitant Female

Non-Annuitant Mortality - Base Table for Females								
Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths			A/E Ratio	
				Actual	Current	Proposed	Current	Proposed
20 - 29	350	0	350	0	0	0	0%	0%
30 - 39	1,462	0	1,462	0	1	0	0%	0%
40 - 49	1,931	2	1,931	2	1	1	145%	172%
50 - 59	2,335	1	2,335	1	3	3	29%	34%
60 - 69	1,411	6	1,411	6	4	3	156%	183%
70 +	145	0	145	0	1	1	0%	0%
Total	**7,634**	**9**	**7,634**	**9**	**10**	**9**	**89%**	**104%**

Chart III-M2 – Non-Annuitant Female

Female Non-Annuitant Mortality
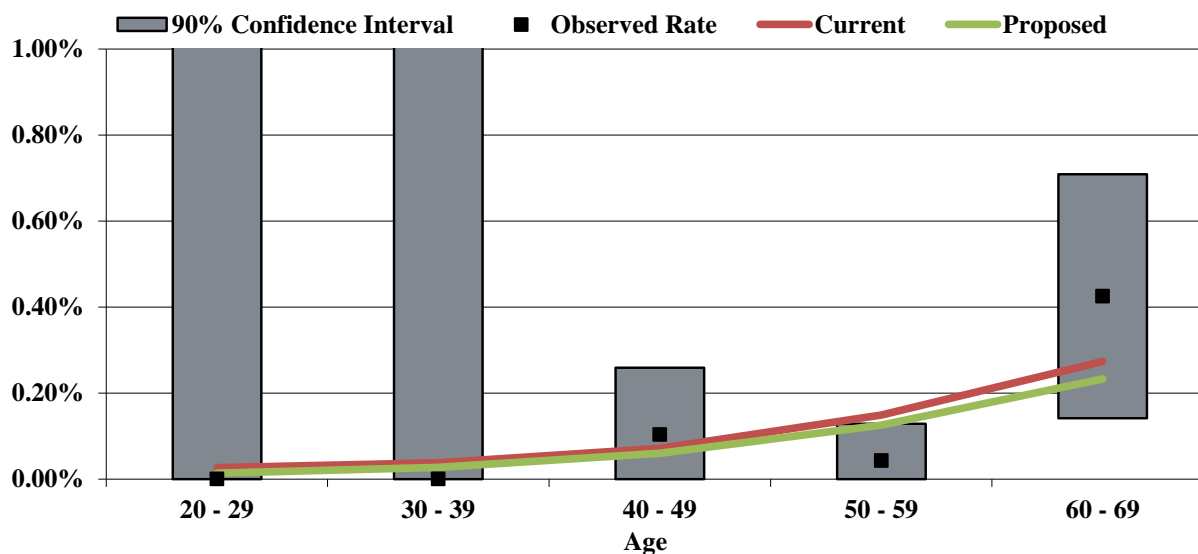
SECTION III – DEMOGRAPHIC ASSUMPTIONS
MORTALITY RATES

Table III-M3 – Healthy Annuitant Male

Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths Actual	Weighted Deaths Current	Weighted Deaths Proposed	A/E Ratios Current	A/E Ratios Proposed
50 - 54	236	-	11,634,716	-	68,056	51,154	0%	0%
55 - 59	773	3	49,428,309	129,070	358,650	264,743	36%	49%
60 - 64	1,087	3	72,100,169	101,643	655,956	557,143	15%	18%
65 - 69	1,244	12	71,214,008	507,341	879,458	747,923	58%	68%
70 - 74	1,049	20	58,459,678	862,854	1,195,445	1,003,089	72%	86%
75 - 79	673	16	31,848,304	629,375	1,066,949	941,081	59%	67%
80 - 84	490	32	18,591,069	930,366	1,129,147	971,150	82%	96%
85 - 89	220	24	7,431,171	1,059,706	756,904	669,056	140%	158%
90 - 94	89	16	1,516,090	248,031	265,803	243,450	93%	102%
95 +	21	5	571,721	142,500	150,580	142,646	95%	100%
Total	**5,882**	**131**	**322,795,236**	**4,610,888**	**6,526,948**	**5,591,436**	**71%**	**82%**

Chart III-M3 – Healthy Annuitant Male
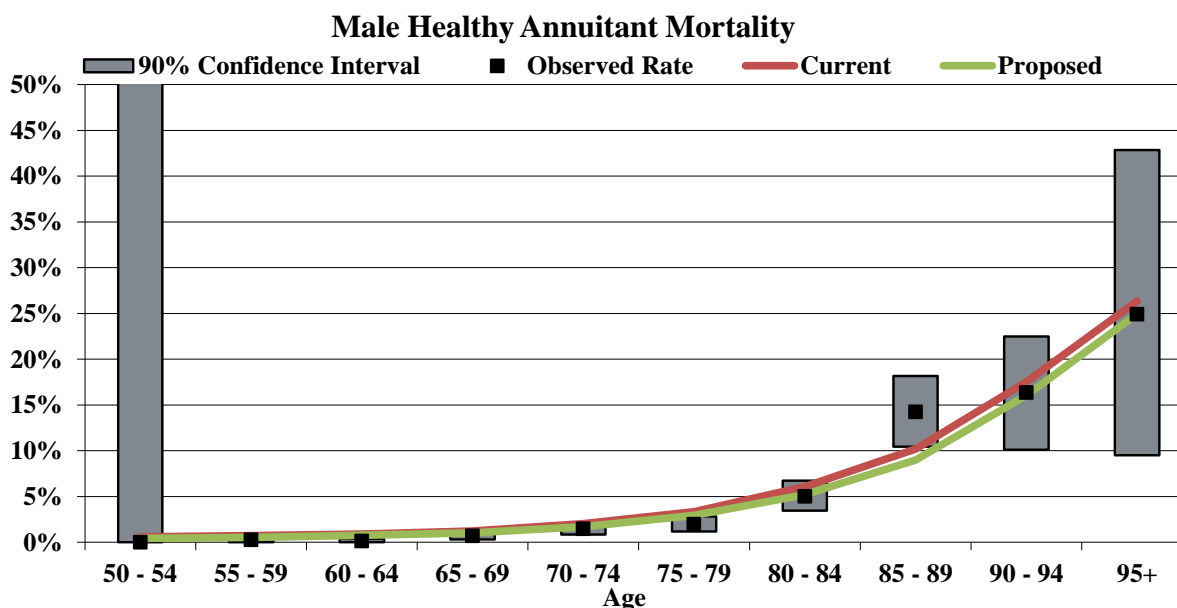
Male Healthy Annuitant Mortality

SECTION III – DEMOGRAPHIC ASSUMPTIONS
MORTALITY RATES

Table III-M4 – Healthy Annuitant Female

Healthy Annuitant Mortality - Base Table for Females							
Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths			A/E Ratios	
				Actual	Current	Proposed	Current	Proposed
50 - 54	266	1	6,656,001	42,583	30,695	28,526	139%	149%
55 - 59	629	3	16,342,004	85,895	71,138	76,671	121%	112%
60 - 64	1,118	7	33,863,277	242,697	182,064	202,126	133%	120%
65 - 69	1,700	14	57,580,216	561,300	461,831	479,281	122%	117%
70 - 74	1,430	18	44,968,268	466,210	608,074	597,894	77%	78%
75 - 79	1,070	8	30,528,533	202,843	714,296	751,091	28%	27%
80 - 84	849	36	20,563,871	1,114,751	825,434	898,305	135%	124%
85 - 89	682	67	14,038,660	1,388,716	1,026,386	1,104,000	135%	126%
90 - 94	405	55	8,172,491	1,052,819	1,069,823	1,156,472	98%	91%
95 +	149	39	2,850,691	856,822	620,528	669,020	138%	128%
Total	8,298	248	235,564,012	6,014,636	5,610,269	5,963,386	107%	101%

Chart III-M4 – Healthy Annuitant Female
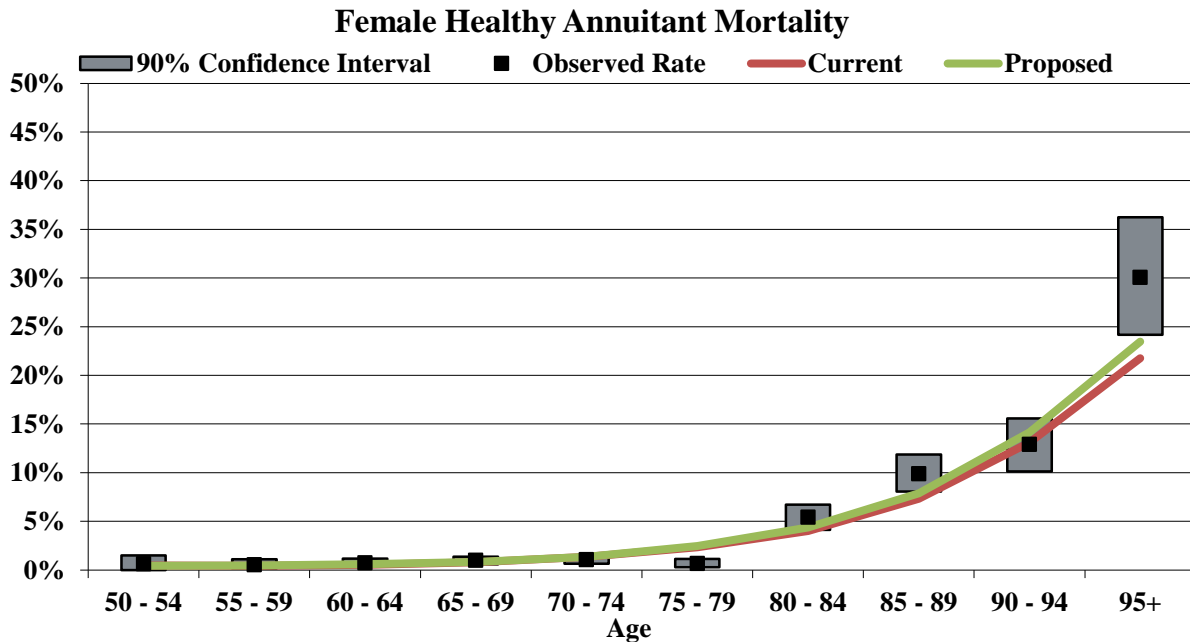
Female Healthy Annuitant Mortality

SECTION III – DEMOGRAPHIC ASSUMPTIONS
MORTALITY RATES

Table III-M5 – Disabled Annuitant Miscellaneous Male

Disabled Annuitant Mortality - Base Table for Males								
Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths			A/E Ratios	
				Actual	Current	Proposed	Current	Proposed
50 - 54	30	-	1,034,351	-	16,528	14,993	0%	0%
55 - 59	40	-	1,356,761	-	27,156	25,187	0%	0%
60 - 64	55	1	1,783,385	21,230	43,958	42,363	48%	50%
65 - 69	64	1	1,833,825	80,129	52,318	55,013	153%	146%
70 - 74	58	-	1,972,120	-	71,030	74,676	0%	0%
75 - 79	37	5	2,338,588	183,322	119,561	120,986	153%	152%
80 - 84	6	1	184,506	23,298	14,174	13,916	164%	167%
85 - 89	5	-	94,262	-	12,757	12,467	0%	0%
90 - 94	5	1	58,464	27,987	9,278	9,367	302%	299%
95 +	2	1	71,629	36,517	17,054	18,040	214%	202%
Total	302	10	10,727,890	372,481	383,814	387,008	97%	96%

Chart III-M5 – Disabled Annuitant Miscellaneous Male
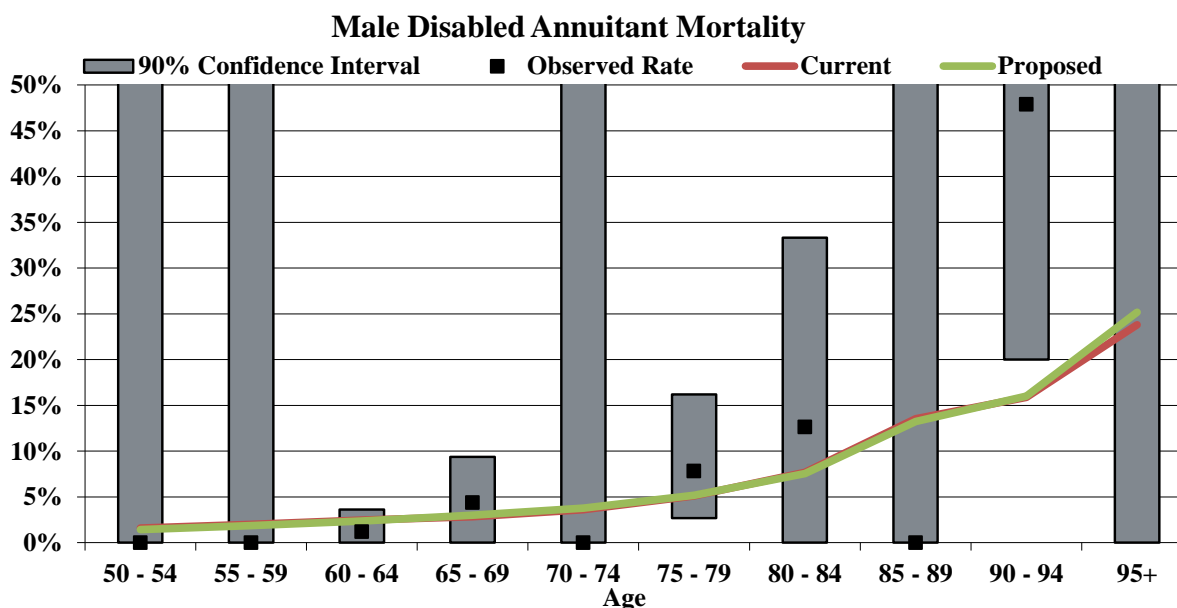
Male Disabled Annuitant Mortality

SECTION III – DEMOGRAPHIC ASSUMPTIONS
MORTALITY RATES

Table III-M6 – Disabled Annuity Miscellaneous Female

Disabled Annuitant Mortality - Base Table for Females							
Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths			A/E Ratios	
				Actual	Current	Proposed	Current	Proposed
50 - 54	31	-	817,714	-	9,088	9,277	0%	0%
55 - 59	58	2	1,519,466	46,401	17,784	18,882	261%	246%
60 - 64	123	1	3,717,898	12,246	52,894	56,500	23%	22%
65 - 69	119	1	3,394,342	45,837	64,107	65,638	72%	70%
70 - 74	83	1	2,214,024	22,965	57,088	56,411	40%	41%
75 - 79	45	-	1,141,320	-	41,563	41,048	0%	0%
80 - 84	24	1	349,874	15,064	19,965	19,688	75%	77%
85 - 89	8	-	286,705	-	28,243	28,616	0%	0%
90 - 94	4	1	101,338	16,239	13,955	14,329	116%	113%
95 +	-	-	-	-	-	-	0%	0%
Total	**495**	**7**	**13,542,681**	**158,752**	**304,687**	**310,389**	**52%**	**51%**

Chart III-M6 – Disabled Annuitant Miscellaneous Female
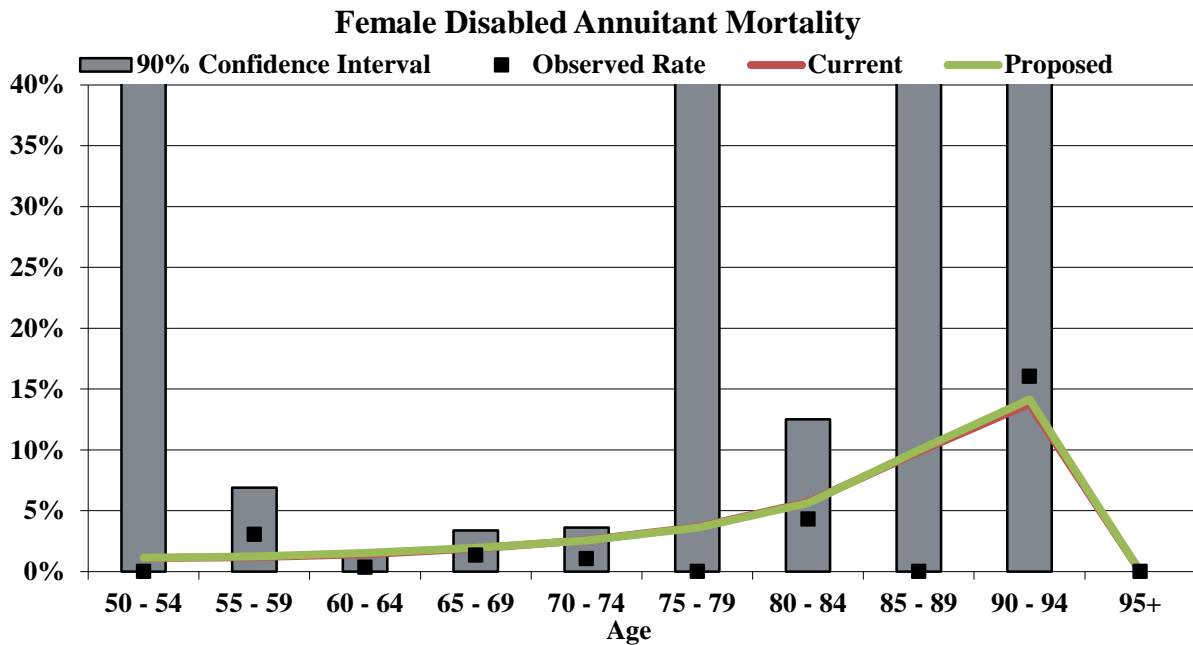
Female Disabled Annuitant Mortality

SECTION III – DEMOGRAPHIC ASSUMPTIONS
MORTALITY RATES

Table III-M7 – Disabled Annuitant Safety Male

Disabled Annuitant Mortality - Base Table for Males								
Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths			A/E Ratios	
				Actual	Current	Proposed	Current	Proposed
50 - 54	106	-	4,711,960	-	22,562	20,328	0%	0%
55 - 59	120	1	7,726,124	55,617	48,600	41,949	114%	133%
60 - 64	208	1	13,958,146	32,520	131,170	126,141	25%	26%
65 - 69	231	2	14,235,586	94,476	201,759	180,876	47%	52%
70 - 74	192	1	10,881,117	33,175	236,423	216,763	14%	15%
75 - 79	78	4	3,243,537	156,958	121,937	113,850	129%	138%
80 - 84	25	2	946,981	89,017	58,445	56,565	152%	157%
85 - 89	12	1	398,323	44,606	39,561	43,750	113%	102%
90 - 94	1	0	29,434	0	3,928	4,383	0%	0%
95 +	-	-	-	-	-	-	0%	0%
Total	**973**	**12**	**56,131,208**	**506,369**	**864,385**	**804,604**	**59%**	**63%**

Chart III-M7 – Disabled Annuitant Safety Male
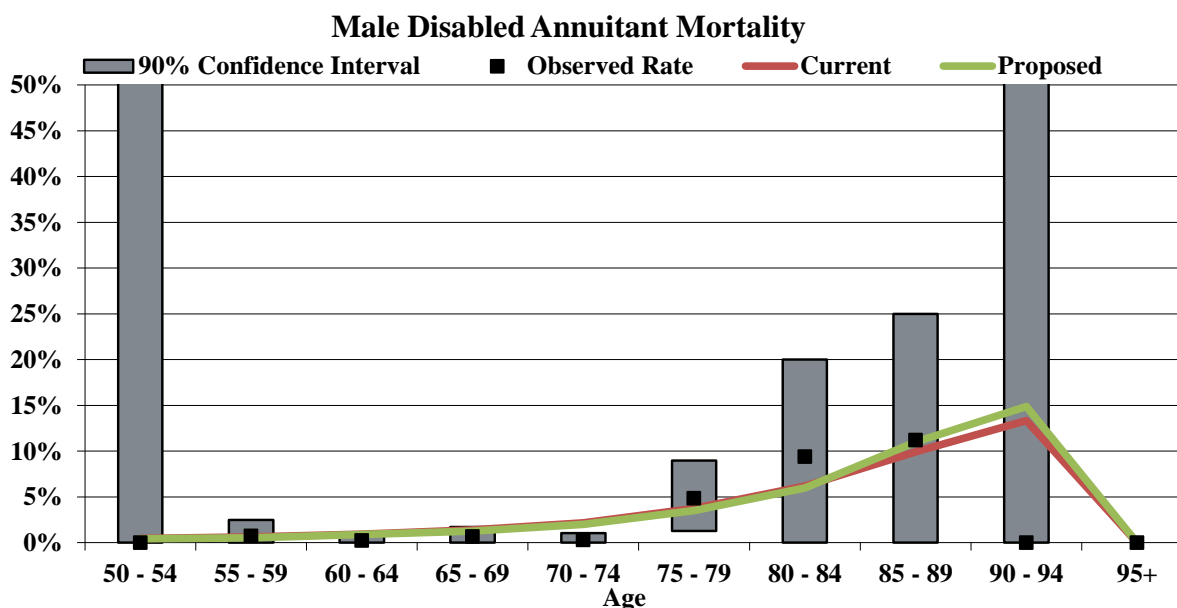
Male Disabled Annuitant Mortality

SECTION III – DEMOGRAPHIC ASSUMPTIONS
MORTALITY RATES

Table III-M8 – Disabled Annuity Safety Female

Age Band	Exposures	Actual Deaths	Weighted Exposures	Weighted Deaths Actual	Weighted Deaths Current	Weighted Deaths Proposed	A/E Ratios Current	A/E Ratios Proposed
50 - 54	40	1	1,559,843	32,535	6,842	6,619	475%	492%
55 - 59	32	-	1,171,383	-	4,893	5,409	0%	0%
60 - 64	20	-	612,104	-	3,936	4,073	0%	0%
65 - 69	5	-	131,328	-	1,479	1,358	0%	0%
70 - 74	12	-	343,770	-	6,252	5,656	0%	0%
75 - 79	3	-	104,798	-	2,844	2,769	0%	0%
80 - 84	5	1	149,674	32,328	7,554	8,064	428%	401%
85 - 89	-	-	-	-	-	-	0%	0%
90 - 94	0	0	0	0	0	0	0%	0%
95 +	-	-	-	-	-	-	0%	0%
Total	**117**	**2**	**4,072,900**	**64,862**	**33,800**	**33,947**	**192%**	**191%**

Chart III-M8 – Disabled Annuitant Safety Female
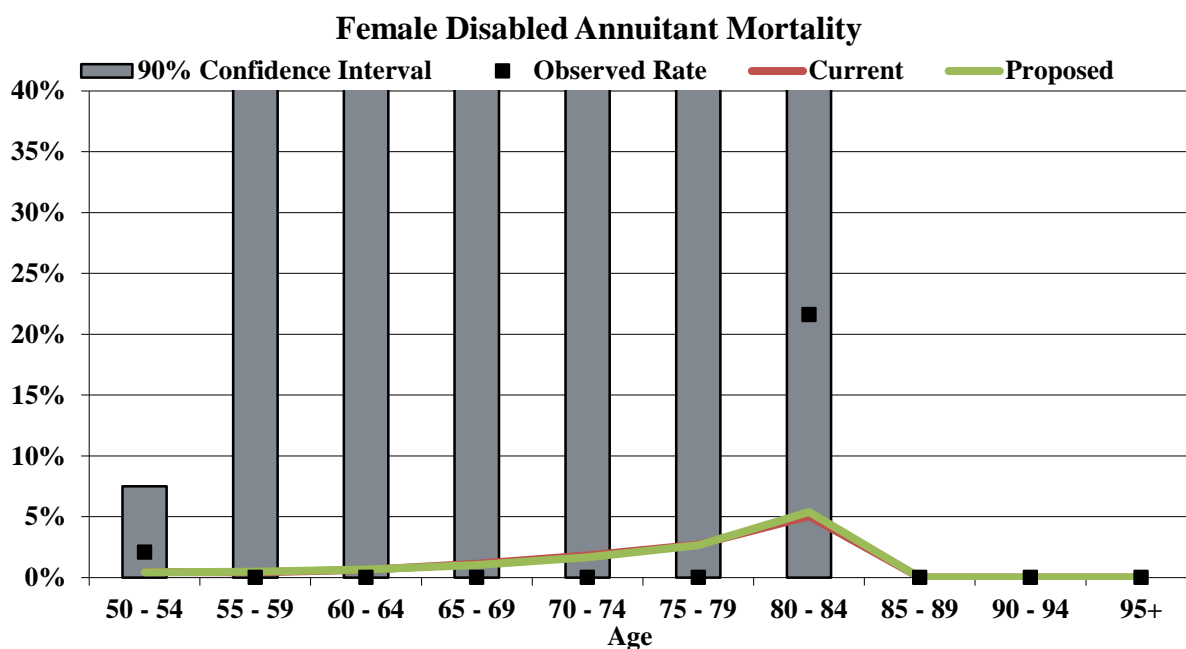
Female Disabled Annuitant Mortality

SECTION III – DEMOGRAPHIC ASSUMPTIONS
MORTALITY RATES

Mortality Assumptions for Employee Contribution Rates

For purposes of determining employee contribution rates, the use of generational mortality improvements is impractical from an administrative perspective. Therefore, we recommend using the base mortality tables described above (various CalPERS tables with adjustments) projected using Scale MP-2017 from 2014 to 2033. These static projections are intended to approximate generational mortality improvements.

The projection periods are based upon the duration of active liabilities for the respective impacted groups, and the period during which the associated employee contribution rates will be in use. The employee contribution rates are also blended using a male/female weighting of 40%/60% for Miscellaneous Members and 85%/15% for Safety members.

We anticipate that these mortality assumptions will be used to determine the employee contribution rates in effect for the period of July 1, 2018 through June 30, 2021. We also anticipate that the mortality assumptions for this purpose will be updated again after the next experience study covering the period from July 1, 2017 through June 30, 2020.

SECTION III – DEMOGRAPHIC ASSUMPTIONS
OTHER DEMOGRAPHIC ASSUMPTIONS

FAMILY COMPOSITION

Members who are married at the time of retirement are entitled to an unreduced 60% joint and survivor annuity.

An analysis of all members who retired within the last six years showed that 76% of males are married and 56% of females are married. However, among the males the rates of marriage were higher for the Safety members (85%) than the Miscellaneous members (71%). The rates of marriage for the Miscellaneous and Safety females were both higher than the current assumption (50%), though there was very little Safety female experience. We recommend reducing the assumption for future male Miscellaneous retirees from 80% to 75%, increasing the assumption for male Safety retirees from 80% to 85%, and increasing the assumption for all future female retirees from 50% to 55%.

An analysis of all retired Miscellaneous members showed that male members are 2.5 years older than their spouses and female members are 1.8 years younger than their spouses. Similarly, an analysis of all retired Safety members showed that male members are 1.9 years older than their spouses and female members are 1.8 years younger than their spouses. We recommend maintaining the current assumption that male members are three years older than their spouses are and female members are one year younger than their spouses.

DEFERRED RETIREMENT AGE

An analysis of all terminated members with a vested right to a benefit, who retired in the last six years is shown below in Table III-V1. The analysis shows that on average Miscellaneous members retire at age 60.8 and Safety members retire at age 54.5. However, we note that the average age at commencement for the 3% at 55 members exceeds that of the 3% at 50 members. Therefore, we recommend changing the assumption for Miscellaneous members from 55 to 58, the assumption for the Safety 3% at 55 members from 50 to 55, and leaving the assumption for the Safety 3% at 50 members at age 50.

Table III-V1 – Deferred Retirement Age

| | Deferred Retirement Age 2011-2017 Retirements | | | |
	Count	Member	Current Assumption	Proposed Assumption
Miscellaneous	137	60.8	55.0	58.0
Safety				
3% at Age 50	19	53.3	50.0	50.0
3% at Age 55	17	55.3	50.0	55.0

SECTION III – DEMOGRAPHIC ASSUMPTIONS
OTHER DEMOGRAPHIC ASSUMPTIONS

ADMINISTRATIVE EXPENSES

The returns discussed in the economic assumption section are expected to be net of investment expenses; administrative expenses are not addressed. According to Article 31580.2 of the '37 Act, administrative expenses (excluding certain technology expenses) may not exceed 0.21% of the accrued liabilities of the retirement system.

Effective with the June 30, 2013 actuarial valuation, MCERA began to include an additional cost item for expected annual administrative expenses in the actuarial cost calculation. For the valuation as of June 30, 2017, we recommend maintaining the current administrative expense assumption (expected to be $4.917 million, based on the prior year assumption of $4.774 million, increased by the wage growth assumption of 3%).

Table III-AE1 – Analysis of Administrative Expenses

FYE	Pension		
	Administrative Expenses	Adjustment to FYE 2018	Expense / Member
2017	4,404,191	1.0300	4,536,317
2016	4,379,760	1.0609	4,646,487
2015	4,654,623	1.0927	5,086,232
2014	4,503,845	1.1255	5,069,117
		Average Expense	4,834,538
		Current Assumption	4,917,272

APPENDIX A – SUMMARY OF PROPOSED ASSUMPTIONS

The recommended assumptions will be presented to the Board at their December 13, 2017 meeting. The assumptions are based on an experience study covering the period from July 1, 2014 through June 30, 2017.

1. **Rate of Return**

   Assets are assumed to earn 7.00% net of investment and administrative expenses.

2. **Administrative Expenses**

   Administrative expenses are assumed to be $4.917 million for the next year, to be split between employees and employers based on their share of the overall contributions. Administrative expenses are assumed to increase by 3.0% per year.

3. **Cost-of-Living**

   The cost-of-living as measured by the Consumer Price Index (CPI) will increase at the rate of 2.75% per year.

4. **Post Retirement COLA**

   Post retirement COLAs are assumed at the rate of 2.7% for members with a 4% COLA cap, 2.6% for members with a 3% COLA cap, and 1.9% for members with a 2% COLA cap.

5. **Internal Revenue Code Section 415 Limit**

   The Internal Revenue Code Section 415 maximum benefit limitations are not reflected in the valuation for funding purposes. Any limitation is reflected in a member's benefit at the time of retirement.

6. **Internal Revenue Code Section 401(a)(17)**

   The Internal Revenue Code Section 401(a)(17) maximum compensation limitation is reflected in the valuation to project compensation and benefits. The limit is expected to increase by 2.75% in future years.

7. **PEPRA Compensation Limit**

   The PEPRA Pensionable Compensation Limit (GC 7522.10) is reflected in the valuation to project compensation and benefits for PEPRA members. The limit is expected to increase by 2.75% in future years.

8. **Interest on Member Contributions**

   The annual credited interest rate on member contributions is assumed to be 7.00%.

APPENDIX A – SUMMARY OF PROPOSED ASSUMPTIONS

9. Family Composition

Percentage married for all active members who retire, become disabled, or die during active service is shown in the table below. Male members are assumed to be three years older than their spouses and female members are assumed to be one year younger than their spouses.

Percentage Married	
Class and Gender	**Percentage**
Miscellaneous Males	75%
Miscellaneous Females	55%
Safety Males	85%
Safety Females	55%

10. Increases in Pay

Wage inflation component: 3.00%

Additional longevity and promotion component:

Service	Miscellaneous	Safety
0	6.00%	5.00%
1	6.00%	5.00%
2	5.00%	4.50%
3	4.00%	4.00%
4	3.00%	3.50%
5	2.25%	3.00%
6	1.75%	2.50%
7	1.40%	2.20%
8	1.20%	1.90%
9	1.00%	1.70%
10	0.85%	1.50%
11	0.75%	1.40%
12	0.75%	1.30%
13+	0.75%	1.25%

APPENDIX A – SUMMARY OF PROPOSED ASSUMPTIONS

11. Rates of Termination (All Types)

Sample rates of termination are shown in the following tables below. Note that termination rates do not apply once a member is eligible for retirement.

	Miscellaneous		Safety
Service	**Male**	**Female**	**Safety**
0	15.00%	15.00%	8.00%
1	9.00%	10.00%	5.00%
2	7.00%	8.00%	4.00%
3	7.00%	8.00%	4.00%
4	7.00%	8.00%	4.00%

	Miscellaneous						Safety
	Male			**Females**			
Age	**5-9 Years of Service**	**10-14 Years of Service**	**15-29 Years of Service**	**5-9 Years of Service**	**10-14 Years of Service**	**15-29 Years of Service**	**5-19 Years of Service**
20	7.00%	5.30%	3.00%	7.75%	5.30%	3.00%	2.06%
25	7.00%	5.30%	3.00%	7.75%	5.30%	3.00%	2.24%
30	7.00%	5.30%	3.00%	7.75%	5.30%	3.00%	3.53%
35	6.75%	4.50%	2.50%	7.75%	4.50%	2.50%	3.41%
40	4.80%	3.20%	2.00%	5.80%	3.20%	2.00%	1.14%
45	3.75%	2.50%	1.70%	4.75%	2.50%	1.70%	1.70%
50	2.10%	0.00%	0.00%	3.10%	0.00%	0.00%	0.27%
55	1.20%	0.00%	0.00%	2.20%	0.00%	0.00%	0.10%
60	1.20%	0.00%	0.00%	2.20%	0.00%	0.00%	0.00%

APPENDIX A – SUMMARY OF PROPOSED ASSUMPTIONS

12. Withdrawal, Reciprocal Transfers, and Vested Termination

The following rates apply to active members who terminate their employment. Members, who withdraw their member contributions, forfeit entitlement to future Plan benefits.

Service	Miscellaneous			Safety		
	Withdrawal	Reciprocal	Vested Term	Withdrawal	Reciprocal	Vested Term
0	50.00%	15.00%	35.00%	25.00%	45.00%	30.00%
1	40.00%	18.00%	42.00%	25.00%	45.00%	30.00%
2	20.00%	24.00%	56.00%	25.00%	45.00%	30.00%
3	20.00%	24.00%	56.00%	25.00%	45.00%	30.00%
4	20.00%	24.00%	56.00%	25.00%	45.00%	30.00%
5	10.00%	27.00%	63.00%	25.00%	45.00%	30.00%
6	10.00%	27.00%	63.00%	25.00%	45.00%	30.00%
7	10.00%	27.00%	63.00%	25.00%	45.00%	30.00%
8	10.00%	27.00%	63.00%	25.00%	45.00%	30.00%
9	10.00%	27.00%	63.00%	25.00%	45.00%	30.00%
10+	10.00%	27.00%	63.00%	15.00%	51.00%	34.00%

13. Rates of Disability

The rates of disability for Miscellaneous members are based on the 2017 CalPERS Public Agency Miscellaneous Ordinary Disability rates for males and females without adjustment.

The rates of disability for Safety members are based on adjusted 2017 CalPERS Public Agency Police Unisex Industrial and Ordinary Disability rates (multiplied by 0.6, and with a maximum rate of 1.25%).

50% of all Miscellaneous and 95% of all Safety disabilities are assumed to be service-connected. Sample *service-connected* disability rates of active participants are shown below.

Age	Miscellaneous		Safety
	Male	Female	
20	0.0085%	0.0050%	0.0057%
25	0.0085%	0.0050%	0.0998%
30	0.0095%	0.0120%	0.2827%
35	0.0195%	0.0355%	0.4663%
40	0.0510%	0.0675%	0.6498%
45	0.0755%	0.0940%	0.8333%
50	0.0790%	0.0995%	1.0978%
55	0.0790%	0.0745%	2.8016%
60	0.0765%	0.0525%	3.5477%
65	0.0640%	0.0440%	4.2619%

APPENDIX A – SUMMARY OF PROPOSED ASSUMPTIONS

Sample *non service-connected* disability rates of active participants are shown below.

	Miscellaneous		Safety
Age	Male	Female	
20	0.0085%	0.0050%	0.0003%
25	0.0085%	0.0050%	0.0053%
30	0.0095%	0.0120%	0.0149%
35	0.0195%	0.0355%	0.0245%
40	0.0510%	0.0675%	0.0342%
45	0.0755%	0.0940%	0.0439%
50	0.0790%	0.0995%	0.0578%
55	0.0790%	0.0745%	0.1475%
60	0.0765%	0.0525%	0.1867%
65	0.0640%	0.0440%	0.2243%

14. Rates of Mortality for Active Lives

Rates of mortality for active Members are specified by CalPERS 2017 Pre-Retirement Non-Industrial Death rates (plus Duty-Related Death rates for Safety Members), with the 20-year static projection used by CalPERS replaced by generational improvements from a base year of 2013 using Scale MP-2017.

15. Rates of Mortality for Retired Healthy Lives

Rates of mortality for retired Members and their beneficiaries are given by CalPERS 2017 Post-Retirement Healthy Mortality rates, adjusted by 90% for Males (Miscellaneous and Safety), with the 20-year static projection used by CalPERS replaced by generational improvements from a base year of 2014 using Scale MP-2017.

16. Rates of Mortality for Retired Disabled Lives

Rates of mortality among disabled Members are given by CalPERS 2017 Disability Mortality rates (Non-Industrial rates for Miscellaneous members and Industrial Disability rates for Safety members), adjusted by 90% for Males (Miscellaneous and Safety) and 90% for Miscellaneous Females, with the 20-year static projection used by CalPERS replaced by generational improvements from a base year of 2014 using Scale MP-2017.

17. Mortality Improvement

Mortality is assumed to improve in future years in accordance with the MP-2017 generational improvement tables.

APPENDIX A – SUMMARY OF PROPOSED ASSUMPTIONS

18. Rates of Retirement

Rates of retirement are based on age according to the following tables below.

PEPRA: For New Members we assume that the current retirement rates will apply, but that no Non-Safety members will retire before age 52.

Miscellaneous Rates

Age	<20 Years of Service	20-29 Years of Service	30+ Years of Service
50-52	3.00%	3.00%	3.00%
53	5.00%	5.00%	10.00%
54	5.00%	5.00%	15.00%
55-59	5.00%	10.00%	15.00%
60	5.00%	10.00%	30.00%
61	10.00%	10.00%	30.00%
62-63	10.00%	20.00%	30.00%
64-65	15.00%	20.00%	30.00%
66-67	15.00%	30.00%	30.00%
68-79	20.00%	30.00%	30.00%
80	100.00%	100.00%	100.00%

Safety Rates

Age	3% @ 50 <20 Years of Service	3% @ 50 20-29 Years of Service	3% @ 50 30+ Years of Service	3% @ 55 <20 Years of Service	3% @ 55 20-29 Years of Service	3% @ 55 30+ Years of Service
40-44	0.00%	3.00%	3.00%	0.00%	1.00%	1.00%
45-48	0.00%	3.00%	3.00%	0.00%	5.00%	5.00%
49	0.00%	15.00%	3.00%	0.00%	5.00%	5.00%
50	5.00%	15.00%	50.00%	5.00%	10.00%	30.00%
51-52	5.00%	10.00%	20.00%	5.00%	10.00%	30.00%
53-54	10.00%	10.00%	20.00%	5.00%	10.00%	30.00%
55	10.00%	25.00%	50.00%	20.00%	30.00%	30.00%
56	10.00%	30.00%	50.00%	10.00%	30.00%	30.00%
57	10.00%	35.00%	50.00%	10.00%	20.00%	30.00%
58	10.00%	40.00%	50.00%	10.00%	20.00%	30.00%
59	10.00%	45.00%	50.00%	10.00%	20.00%	30.00%
60-64	50.00%	50.00%	50.00%	20.00%	20.00%	50.00%
65	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

APPENDIX B – SUMMARY OF PRIOR ASSUMPTIONS

The assumptions and methods used in the June 30, 2016 actuarial valuation reflect the results of an Experience Study performed by Cheiron covering the period from July 1, 2011 through June 30, 2014 and adopted by the Board.

1. **Rate of Return**

   Assets are assumed to earn 7.25% net of investment and administrative expenses.

2. **Administrative Expenses**

   Administrative expenses are assumed to be $4.917 million for the next year, to be split between employees and employers based on their share of the overall contributions. Administrative expenses are assumed to increase by 3.0% per year.

3. **Cost-of-Living**

   The cost-of-living as measured by the Consumer Price Index (CPI) will increase at the rate of 2.75% per year.

4. **Post Retirement COLA**

   Post retirement COLAs are assumed at the rate of 2.7% for members with a 4% COLA cap, 2.6% for members with a 3% COLA cap, and 1.9% for members with a 2% COLA cap.

5. **Internal Revenue Code Section 415 Limit**

   The Internal Revenue Code Section 415 maximum benefit limitations are not reflected in the valuation for funding purposes. Any limitation is reflected in a member's benefit at the time of retirement.

6. **Internal Revenue Code Section 401(a)(17)**

   The Internal Revenue Code Section 401(a)(17) maximum compensation limitation is reflected in the valuation to project compensation and benefits. The limit is expected to increase by 2.75% in future years.

7. **PEPRA Compensation Limit**

   The PEPRA Pensionable Compensation Limit (GC 7522.10) is reflected in the valuation to project compensation and benefits for PEPRA members. The limit is expected to increase by 2.75% in future years.

8. **Interest on Member Contributions**

   The annual credited interest rate on member contributions is assumed to be 7.25%.

9. Sick Leave Service Credit Upon Retirement

Active members' benefits are adjusted by a percentage, in accordance with the table below, for anticipated conversions of sick leave or other terminal earnings to retirement service credit or final compensation.

	Rate
Marin County	1.20%
Marin Courts	1.20%
Marin Special Districts	1.20%
Novato Fire Protection District	3.00%
City of San Rafael	2.50%

10. Family Composition

Percentage married for all active members who retire, become disabled, or die during active service is shown in the table below. Male members are assumed to be three years older than their spouses and female members are assumed to be one year younger than their spouses.

Percentage Married	
Gender	Percentage
Males	80%
Females	50%

11. Increases in Pay

Wage inflation component: 3.00%

Additional longevity and promotion component:

Service	Miscellaneous	Safety
0	8.00%	5.00%
1	8.00%	5.00%
2	8.00%	5.00%
3	6.00%	2.00%
4	2.00%	1.25%
5+	0.75%	1.25%

APPENDIX B – SUMMARY OF PRIOR ASSUMPTIONS

12. Rates of Termination (All Types)

Sample rates of termination are shown in the following tables below. Note that termination rates do not apply once a member is eligible for retirement.

	Miscellaneous		Safety
Service	Male	Female	Safety
0	15.00%	15.00%	8.00%
1	9.00%	10.00%	5.00%
2	7.00%	8.00%	4.00%
3	7.00%	8.00%	4.00%
4	7.00%	8.00%	4.00%

	Miscellaneous						Safety
	Male			Females			
Age	5-9 Years of Service	10-14 Years of Service	15-29 Years of Service	5-9 Years of Service	10-14 Years of Service	15-29 Years of Service	5-19 Years of Service
20	7.00%	5.30%	3.00%	7.75%	5.30%	3.00%	2.06%
25	7.00%	5.30%	3.00%	7.75%	5.30%	3.00%	2.24%
30	7.00%	5.30%	3.00%	7.75%	5.30%	3.00%	3.53%
35	6.75%	4.50%	2.50%	7.75%	4.50%	2.50%	3.41%
40	4.80%	3.20%	2.00%	5.80%	3.20%	2.00%	1.14%
45	3.75%	2.50%	1.70%	4.75%	2.50%	1.70%	1.70%
50	2.10%	0.00%	0.00%	3.10%	0.00%	0.00%	0.27%
55	1.20%	0.00%	0.00%	2.20%	0.00%	0.00%	0.10%
60	1.20%	0.00%	0.00%	2.20%	0.00%	0.00%	0.00%

APPENDIX B – SUMMARY OF PRIOR ASSUMPTIONS

13. Withdrawal

Rates of withdrawal apply to active Members who terminate their employment and withdraw their member contributions, forfeiting entitlement to future Plan benefits.

30% of all Miscellaneous Member terminations with less than five years of service are assumed to take a refund of contributions, as well as 15% of those with five or more years of service.

25% of all Safety Member terminations with less than 10 years of service are assumed to take a refund of contributions, and 5% of those with 10 or more years are assumed to take a refund.

14. Vested Termination and Reciprocal Transfers

Rates of vested termination apply to active Members who terminate their employment and leave their member contributions on deposit with the Plan.

70% of all Miscellaneous Member terminations with less than five years of service are assumed to leave their contributions on deposit, as well as 85% of those with five or more years of service.

75% of all Safety Member terminations with less than 10 years of service are assumed to leave their contributions on deposit, as well as 95% of those with 10 or more years of service.

No vested terminations or transfers are assumed to occur with 30 years of service. Vested terminated Miscellaneous Members are assumed to begin receiving benefits at age 55; terminated Safety Members are assumed to begin receiving benefits at age 50.

20% of vested terminated Miscellaneous members and 40% of vested terminated Safety Members are assumed to be reciprocal.

APPENDIX B – SUMMARY OF PRIOR ASSUMPTIONS

15. Rates of Service-Connected Disability

Sample service-connected disability rates of active participants are shown below.

	Miscellaneous		
Age	Male	Female	Safety
20	0.0250%	0.0125%	0.0605%
25	0.0400%	0.0200%	0.0825%
30	0.0650%	0.0325%	0.1980%
35	0.0800%	0.0400%	0.3025%
40	0.1050%	0.0525%	0.6490%
45	0.1300%	0.0650%	0.6270%
50	0.1550%	0.0775%	0.7040%
55	0.1650%	0.0825%	2.1450%
60	0.1850%	0.0925%	0.0000%
65	0.1950%	0.0975%	0.0000%

16. Rates of Non Service-Connected Disability

Sample non service-connected disability rates of active participants are shown below.

Age	Miscellaneous	Safety
20	0.0000%	0.0200%
25	0.0030%	0.0300%
30	0.0050%	0.0500%
35	0.0080%	0.0700%
40	0.0130%	0.1600%
45	0.0220%	0.2600%
50	0.0450%	0.3600%
55	0.0780%	0.4600%
60	0.1280%	0.0000%
65	0.1970%	0.0000%

17. Rates of Mortality for Active Lives

Rates of mortality for active Members are specified by CalPERS 2014 Pre-Retirement Non-Industrial Death rates (plus Duty-Related Death rates for Safety Members), with the 20-year static projection used by CalPERS replaced by generational improvements from a base year of 2009 using Scale MP-2014.

APPENDIX B – SUMMARY OF PRIOR ASSUMPTIONS

18. Rates of Mortality for Retired Healthy Lives

Rates of mortality for retired Members and their beneficiaries are given by CalPERS 2014 Post-Retirement Healthy Mortality rates, adjusted by 110% for Safety Males and 95% for Miscellaneous and Safety Females, with the 20-year static projection used by CalPERS replaced by generational improvements from a base year of 2009 using Scale MP-2014.

19. Rates of Mortality for Retired Disabled Lives

Rates of mortality among disabled Members are given by CalPERS 2014 Disability Mortality rates (Non-Industrial rates for Miscellaneous members and Industrial Disability rates for Safety members), adjusted by 90% for Males and Females (Miscellaneous and Safety) with the 20-year static projection used by CalPERS replaced by generational improvements from a base year of 2009 using Scale MP-2014.

20. Mortality Improvement

Mortality is assumed to improve in future years in accordance with the MP-2014 generational improvement tables.

APPENDIX B – SUMMARY OF PRIOR ASSUMPTIONS

21. Rates of Retirement

Rates of retirement are based on age according to the following tables below.

PEPRA: For New Members we assume that the current retirement rates will apply, but that no Non-Safety members will retire before age 52.

Miscellaneous Rates

Age	<20 Years of Service	20-29 Years of Service	30+ Years of Service
50-54	4.00%	4.00%	4.00%
55	8.00%	10.00%	25.00%
56	4.00%	4.00%	25.00%
57	4.00%	6.00%	25.00%
58	4.00%	8.00%	25.00%
59	8.00%	10.00%	25.00%
60-61	8.00%	10.00%	35.00%
62-74	20.00%	20.00%	35.00%
75-79	25.00%	25.00%	35.00%
80	100.00%	100.00%	100.00%

Safety Rates

Age	3% @ 50 <20 Years of Service	3% @ 50 20-29 Years of Service	3% @ 50 30+ Years of Service	3% @ 55 <20 Years of Service	3% @ 55 20-29 Years of Service	3% @ 55 30+ Years of Service
40-49	0.00%	3.00%	3.00%	0.00%	1.00%	1.00%
50	25.00%	25.00%	50.00%	5.00%	5.00%	30.00%
51-53	10.00%	10.00%	20.00%	5.00%	5.00%	30.00%
54	10.00%	10.00%	20.00%	5.00%	15.00%	30.00%
55	25.00%	25.00%	50.00%	20.00%	40.00%	50.00%
56	25.00%	25.00%	50.00%	10.00%	30.00%	50.00%
57-59	25.00%	25.00%	50.00%	10.00%	20.00%	50.00%
60-64	50.00%	50.00%	50.00%	30.00%	30.00%	50.00%
65	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%