Board of Retirement Regular Meeting
Sacramento County Employees' Retirement System

Agenda Item 10

MEETING DATE: October 18, 2017

SUBJECT: Actuarial Audit Report

SUBMITTED FOR: ___ Consent   _X_ Deliberation and Action   ___ Receive and File

RECOMMENDATION

Staff recommends the Board receive and file the Actuarial Review of June 30, 2016 Actuarial Valuation and Actuarial Experience Study (Actuarial Audit Report) prepared by Cheiron and consider the observations, suggestions, and recommendations in the actuarial audit report.

Staff further recommends the Board consider Segal Consulting's response to the observations, suggestions, and recommendations in the actuarial audit report and determine whether or not to provide any guidance to Segal prior to the presentation of the Actuarial Valuation and Review as of June 30, 2017.

PURPOSE

The goals of an actuarial audit are:

1) To verify that assumptions, methods, calculations, and experience used in SCERS' valuation are in compliance with generally accepted actuarial principles and practices, the 1937 Act, and SCERS' regulations and policies;

2) To verify the actuarial methods and assumptions are being applied properly in computing SCERS' benefits and actuarial liabilities, funded status, unfunded liabilities, reserve accounts, and required contribution rates, and that the calculations related to such matters are accurate;

3) To verify that the valuation results are actuarially sound, reasonable, and consistent with industry standards; and

4) To determine that the valuation reflects information required to be disclosed under required reporting standards.

DISCUSSION

It is understood and acknowledged that there can be differences among actuaries regarding approaches and methodologies which can result in some variance. The ultimate goal is to adequately analyze the reasons for the variances and to determine that the variances do not exceed accepted actuarial practice tolerances.

The scope of the actuarial audit services performed this year is broader than the audit performed for SCERS in 2012. In addition to performing a complete independent replication of SCERS June 30, 2016 actuarial valuation, Cheiron also reviewed the appropriateness and accuracy of the assumptions, methodologies, and funding methods used by SCERS' consulting actuary.

As noted in the Executive Summary of the report, Cheiron has:

- Confirmed that the liabilities and costs computed by Segal in the SCERS valuation as of June 30, 2016 are reasonably accurate and computed in accordance with generally accepted accounting principles;

- Reviewed the economic and demographic assumptions recommended in SCERS' most recent Actuarial Experience Study prepared by Segal and have found them to be reasonable and in accordance with generally accepted actuarial principles; and

- Recommended Segal review Cheiron's recommendations regarding rates of retirement and mortality and determine whether additional analysis is merited.

A comprehensive discussion of Cheiron's audit results and recommendations is presented in the attached audit report.

Staff appreciates that Cheiron shared an advance copy of its Actuarial Audit Report with SCERS and our actuaries at Segal Consulting. Cheiron, Segal and staff have jointly discussed the audit results and recommendations in preparation for today's meeting.

Graham Schmidt will present Cheiron's key findings and recommendations discussed in the Audit Report. Paul Angelo and Andy Yeung of Segal Consulting will attend the meeting and be available at to comment. The auditing and consulting actuaries will address the Board and respond to any questions.

BACKGROUND

It is prudent to conduct an actuarial audit on a periodic basis. The Government Finance Officers Association (GFOA) recommends performing an actuarial audit every five years. SCERS last had an actuarial audit on the June 30, 2011 Actuarial Valuation, which was presented to the Board in August 2012.

ATTACHMENTS

Actuarial Review of SCERS June 30, 2016 Actuarial Valuation and Actuarial Experience Study Prepared by Cheiron October 2017

SCERS Actuarial Experience Study for the Period July 1, 2013 Through June 30, 2016 Prepared by Segal Consulting, May 2017

Prepared by: Reviewed by:

/S/   /S/
_____   _____
Kathryn T. Regalia   Annette St. Urbain
Chief Operations Officer   Interim Chief Executive Officer

Sacramento County Employees' Retirement System

Actuarial Review of June 30, 2016 Actuarial Valuation and Actuarial Experience Study

Produced by Cheiron

October 2017

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Via Electronic Mail

October 11, 2017

Board of Trustees
Sacramento County Employees' Retirement System
980 9th Street, Suite 1900
Sacramento, CA 95814

Members of the Board:

Cheiron is pleased to present the results of our actuarial audit of the June 30, 2016 actuarial valuation of the Sacramento County Employees' Retirement System (SCERS) and Actuarial Experience Study covering the period from July 1, 2013 to June 30, 2016, performed by Segal Consulting (Segal). We would like to thank Segal for providing us with information and explanations that facilitated the actuarial audit process and ensured that our findings are accurate and benefit SCERS.

We direct your attention to the executive summary section of our report which highlights the key findings of our review. The balance of the report provides details in support of these findings along with supplemental data, background information, and discussion of the process used in the evaluation of the work performed by Segal.

In preparing our report, we relied on information (some oral and some written) supplied by SCERS and Segal. This information includes, but is not limited to, actuarial assumptions and methods adopted by SCERS, the plan provisions, employee data, and financial information. We performed an informal examination of the obvious characteristics of the data for reasonableness in accordance with Actuarial Standard of Practice No. 23. A detailed description of all information provided for this review is provided in the body of our report.

We hereby certify that, 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 which 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.

Board of Trustees
Sacramento County Employees' Retirement System
October 11, 2017

This report was prepared exclusively for the Sacramento County Employees' Retirement System for the purpose described herein. This report is not intended to benefit any third party, and Cheiron assumes no duty or liability to any such party.

Sincerely,
Cheiron

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

David Holland, FSA, FCA, EA, MAAA
Consulting Actuary

Jonathan Chipko, FSA, FCA, EA, MAAA
Consulting Actuary

SECTION I - EXECUTIVE SUMMARY

Key Findings and Recommendations

The main findings of our review are as follows:

1. As a result of our efforts, we are able to confirm that the liabilities and costs computed in the valuation as of June 30, 2016 are reasonably accurate and were computed in accordance with generally accepted actuarial principles.

2. We have reviewed the economic and demographic assumptions recommended in the most recent Actuarial Experience Study presented by Segal. In general, we have found them to be reasonable and in accordance with generally accepted actuarial principles. However, we recommend that Segal review the recommendations in two areas – rates of retirement and mortality – and determine whether additional analysis is merited.

Our primary recommendations are related to the assumptions, and are summarized as follows:

- Cheiron determined the non-economic actuarial assumptions proposed in Segal's Experience Study to be generally reasonable and in compliance with acceptable standards of actuarial practice. In particular, we support their recommendation of a change to use generational mortality assumptions. However, as noted above, we believe Segal should review the methodology used to analyze the mortality and retirement assumptions:

  o In addition to examining the mortality experience based on the number of members who lived and died, we recommend analyzing the experience by the *benefit amounts*. Actuaries - ourselves included - have found that members with higher benefit amounts tend to live longer, on average. As a result, mortality assumptions based only on the number of deaths potentially understate SCERS liabilities.

  o As a related issue, since Segal recommends the use of base mortality tables derived from the most recent Society of Actuaries pension study (the RP-2014 Mortality Tables Report), we recommend they consider the use of the standard (benefit-weighted) RP-2014 tables, rather than the RP-2014 Headcount-Weighted versions.

  o We recommend that Segal consider how much credibility to assign to the mortality experience of the last six years in developing proposed adjustments to the standard base tables, in particular for Safety service-retired members.

  o We recommend that Segal review the service retirement rates by both the age **and** service of the members in relation to the probability of leaving employment. The last experience study only showed the analysis using age-related rates. Based on our review of additional data provided by Segal, the number of years of service a member has earned affects the probabilities of retirement, which is consistent with our experience at other systems.

SECTION I - EXECUTIVE SUMMARY

- Overall, the economic assumptions proposed in Segal's review represent a reasonable set of assumptions. However, we recommend that Segal clarify the meaning of their "risk adjustment" in developing the investment return assumption. The table in the report showing the "confidence level" over 15 years may be misleading because it overstates the probability of achieving the return on a compound basis.

Scope of Assignment

Cheiron performed a complete independent replication of SCERS June 30, 2016 actuarial valuation and reviewed the actuarial methods underlying that valuation. We reviewed the census data provided by SCERS staff, and compared to the information used by Segal in their valuation. We then performed a full parallel valuation, including the calculation of the projected benefits, accrued liability, and normal cost for all SCERS members, and compared the results to those shown in Segal's actuarial valuation report.

Additionally, Cheiron performed a review of the assumptions recommended by Segal for the June 30, 2017 valuation, as reflected in the actuarial experience study covering the period from July 1, 2013 through June 30, 2016. This review did not constitute a full replication of the experience study; it was focused on a review of the recommendations and communications from Segal, based on the information provided within the study.

This audit provides SCERS confirmation that:

- The results reported by Segal can be relied upon,
- Segal's actuarial valuation report, assumptions, and methods comply with Actuarial Standards of Practice (ASOPs),
- The communication of the actuarial valuation results is complete and reasonable, and
- The Board and Segal have considered recommendations and communications that may improve the valuation and experience study.

In a few areas, alternative assumptions should be considered based on review of trends that would be effective in anticipating future experience and could have a material impact on the liabilities and cost of the Plan going forward.

SECTION II - SUMMARY OF REVIEW AND RECOMMENDATIONS

This section summarizes our review of the actuarial valuation and experience study and our recommendations.

Valuation Procedures

Overall, we find that the June 30, 2016 actuarial valuation procedures applied in the reporting of the funded status and the determination of the funding requirements based on the current funding policies and adopted assumptions are technically reasonable and conform to the ASOPs. This is based on our review of: the valuation report, the census data used in the valuation and our parallel valuation using the information described above.

Valuation Results

Our independent replication of the June 30, 2016 actuarial valuation found no material difference in calculations of plan liabilities, actuarial value of assets, and overall contribution rates from the amounts calculated by Segal based on the adopted assumptions and methods. For the scope of this audit, materiality means the results in the aggregate were within industry standards of plus or minus 5%. Consequently, we conclude that the valuation prepared by Segal for SCERS as of June 30, 2016 is reasonable and can be relied on by the Board for its intended purpose. Our replication of the measures of plan liabilities and costs is summarized in Table II-1 below.

Table II-1 Summary of Valuation Results as of June 30, 2016 ($ in millions)			
	Segal	**Cheiron**	**Ratio**
Present Value of Future Benefits	$ 10,887	$ 10,787	99%
Actuarial Accrued Liability	$ 9,436	$ 9,348	99%
Actuarial Value of Assets	8,236	8,231	100%
Unfunded Actuarial Accrued Liability (UAAL)	$ 1,200	$ 1,117	93%
Funded Percentage	87.3%	88.1%	101%
Contribution Rate by Component			
Employer Normal Cost Rate	11.31%	11.10%	98%
UAAL Rate	9.82%	9.19%	94%
Total Employer Contribution	21.13%	20.29%	96%

Although the difference in the unfunded liability estimate is larger than 5%, we note that differences in the unfunded liability amounts are leveraged by the assets. Imagine a plan which is

SECTION II - SUMMARY OF REVIEW AND RECOMMENDATIONS

measured as 100% funded (assets exactly equal to actuarial liabilities) by the Plan's actuary. If the auditing actuary were to determine an actuarial liability 0.1% greater than the Plan's actuary, the differences would clearly be minor. However, the relative size of the unfunded liability measures would be infinitely different, as the Plan's actuary's estimate of the UAL would be $0 while the auditing actuary's estimate would be a positive number.

Our replication of the employer contribution rates by Tier is shown below in Table II-2. We note that the total contribution rate and most of the contribution rates by Tier are within the 5% threshold.

Table II-2 Comparison of Employer Contribution Rates			
	Segal	**Cheiron**	**Ratio**
Employer Contribution Rates			
Miscellaneous Tier 1	16.33%	15.48%	95%
Miscellaneous Tier 2	14.45%	13.27%	92%
Miscellaneous Tier 3	16.69%	15.85%	95%
Miscellaneous Tier 4	15.01%	14.33%	95%
Miscellaneous Tier 5	14.44%	13.38%	93%
Safety Tier 1	41.30%	40.01%	97%
Safety Tier 2	37.44%	36.70%	98%
Safety Tier 3	36.51%	37.22%	102%
Safety Tier 4	34.11%	33.36%	98%
All Employers Combined	21.13%	20.29%	96%

Several figures fall outside of the normal 5% industry standard; however, none of these raise material concerns with respect to the reasonableness of Segal's results. The difference in the Miscellaneous Tier 2 cost is driven by the difference in the normal cost rate for a small group (62 actives) with high levels of service (over 25 years on average). It is not unusual to see differences in the normal cost rates between valuation systems for members nearing retirement, as they sometimes treat the pay expected to be received in the final year of service differently. We note that our estimate of the total present value of benefits for Tier 2 is within 2% of Segal's.

For Miscellaneous Tier 5, the current active members have very low levels of service on average (1.4 years), which can lead to larger differences in the actuarial liability and normal cost. As with the issue related to members nearing retirement, it is not unusual to see larger differences in accrued liability and normal cost for newer groups, as a result of minor differences in how valuation systems apply various elements used in the allocation of costs between past and future service, such as the rounding of entry ages. As with Tier 2, our estimate of the total present value

SECTION II - SUMMARY OF REVIEW AND RECOMMENDATIONS

of benefits for the members in Miscellaneous Tier 5 is within 2% of Segal's. As the size of the PEPRA population grows, and as these members accumulate more service, the percentage differences between different valuation systems should decline significantly.

In determining the unfunded actuarial liability, Segal relies on reserve balances provided by SCERS, as well as information related to the liabilities associated with the withdrawal calculations for individual employers provided outside of the actuarial valuation report. Our review did not include an audit of these additional sources of information.

Employee Contribution Rates

As part of the audit, we replicated the calculations of the individual employee contribution rates based on the applicable provisions of the County Employees Retirement Law (the CERL) and our understanding of additional cost-sharing as described in the valuation report. For the Non-PEPRA (Legacy) tiers, we understand the employee contribution rates to be made up of the following components:

- A Basic rate providing for an annuity equal to
  - 1/240th (Miscellaneous Tiers 1, 2, and 3) Final Average Compensation at a retirement age of 55, or
  - 1/120th (Miscellaneous Tier 4) Final Average Compensation at a retirement age of 60, or
  - 1/100th (Safety Tiers 1, 2, and 3) Final Average Compensation at a retirement age of 50.
- A COLA rate providing for one-half of the cost of the COLA for Miscellaneous Tiers 1, 3 and 4 and Safety Tiers 1, 2, and 3.

For the PEPRA members, the employee contribution rates are equal to 50% of the total normal cost rates for each group. In addition, many of the Legacy members are also now paying 50% of the total normal cost.

We have verified the calculations of the individual employee contribution rates based on the applicable provisions of the CERL and generally have found these rates to be correct. Our Basic (non-COLA) rates were within 0.01% of Segal's rates for all Legacy tiers. The total normal cost rates computed for the new tiers (Miscellaneous Tier 5 and Safety Tier 4) match within a 5% margin, as do the total normal cost rates for the other tiers, used as the basis for computing the additional cost-sharing amounts for these tiers reflected in the current valuation.

The only group where the total normal cost difference is slightly greater than 5% is Miscellaneous Tier 2, for whom we have a total normal cost rate approximately 6% greater than Segal's and there are fewer than 40 members subject to the additional cost sharing provisions. We do not believe this represents a significant discrepancy.

We also reviewed the average entry ages used to determine the contribution rates for members not in Tier 1 hired on or after January 1, 1975, who contribute based on a single rate for each tier. SCERS has adopted several sections of the CERL – 31621.11 and 31639.26 – that allow for

the use of single member contribution rates for Miscellaneous and Safety members, respectively. Segal applies these sections by calculating a contribution rate using the standard entry-age based methodology, and then using the rate determined for the average entry-age for each group: currently age 35 for Miscellaneous members and age 29 for Safety members. Segal reviewed the demographics of the current population to confirm these average entry-ages as part of their recent experience study, and we have confirmed that these estimates appear accurate based on the data we received.

We also reviewed the methodology used by Segal to determine the employee COLA contribution rates – i.e. adding a tier-based load to the Basic rates – and found it to be reasonable and accurately applied. Our calculation of the load for one group – Safety Tier 1 – was more than 5% different than the results presented by Segal. However, the number of affected members is small, and all members of this group are currently subject to the additional cost-sharing contributions. Therefore, their actual contribution is not dependent on the load factor.

The Segal methodology is commonly used by '37 Act systems, and appears to meet the requirement that "*Any increases in contribution shall be shared equally between the county or district and the contributing members*" (CERL 31873). However, we have previously shared with Segal's consultants an alternative methodology for determining employee COLA contribution rates, which involves calculating a distinct COLA rate for each individual entry-age, rather than applying a certain percentage load to the Basic rates. This methodology has the advantage of avoiding annual changes to the COLA contribution rates; the COLA rates will only change if there is a modification to the benefit provisions or actuarial assumptions.

Census Data

Both the SCERS Staff and Segal provided us with the data that was used in the June 30, 2016 actuarial valuations. We reviewed the information in both files, and reviewed the data questions provided to SCERS by Segal and the SCERS responses.

We find that the data used in the valuation is valid, complete and contains the necessary data elements for purposes of performing the actuarial valuation of SCERS. In Table II-3 on the next page we include an exhibit comparing the raw June 30, 2016 data file - as modified appropriately based on the SCERS responses to Segal's questions, as noted in Segal's report and in follow-up communications for issues such as annualization of pay - to Segal's processed file. Any discrepancies between these files are minor and are not expected to have a significant impact on the valuation results. We also find that the methods and requirements provided in the Actuarial Standard of Practice #23 *Data Quality* have been adhered to, to the extent applicable for the valuation of pension plan obligations.

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	Segal		**Cheiron**		**Ratio**	
	Count	**Monthly Benefit/ Annual Pay**	**Count**	**Monthly Benefit/ Annual Pay**	**Count**	**Monthly Benefit/ Annual Pay**
Total Vested Terminated	3,301	N/A	3,301	N/A	100%	N/A
In Receipt						
Retired	8,710	$ 29,884,232	8,710	$ 29,886,035	100%	100%
Disabled	717	1,931,428	717	1,931,215	100%	100%
Beneficiaries	1,533	2,774,717	1,534	2,776,630	100%	100%
Total In Receipt	**10,960**	**$ 34,590,377**	**10,961**	**$ 34,593,880**	**100%**	**100%**
Actives						
Miscellaneous Tier 1	83	$ 6,591,339	83	$ 6,591,330	100%	100%
Miscellaneous Tier 2	62	4,375,098	62	4,375,094	100%	100%
Miscellaneous Tier 3	7,746	578,615,519	7,746	577,589,675	100%	100%
Miscellaneous Tier 4	328	23,965,104	328	23,911,966	100%	100%
Miscellaneous Tier 5	2,144	109,881,536	2,144	110,438,687	100%	101%
Safety Tier 1	218	28,634,501	218	28,643,672	100%	100%
Safety Tier 2	1,337	149,123,940	1,337	148,968,971	100%	100%
Safety Tier 3	102	9,767,462	102	9,767,463	100%	100%
Safety Tier 4	373	27,600,372	373	27,555,041	100%	100%
Total Actives	**12,393**	**$ 938,554,871**	**12,393**	**$ 937,841,898**	**100%**	**100%**
Total	**23,353**		**23,354**		**100%**	

Table II-3
Summary of Counts, Benefits and Pay as of July 1, 2016

Plan Provisions

We compared the summary of plan provisions shown in Section 4, Exhibit IV of Segal's June 30, 2016 valuation report to the benefits as summarized in the member handbooks shown on the SCERS website. In general, the plan provisions shown in the exhibit match what is in the handbooks, and based on our close match of the Segal liabilities as part of our parallel valuation, we conclude that Segal has appropriately reflected these provisions in the actuarial valuation.

Actuarial Assumptions

The June 30, 2017 actuarial valuation will be based on the assumptions ultimately adopted by the SCERS Board, based on recommendations made by Segal in the Actuarial Experience Study covering the three-year period ending June 30, 2016. As part of our actuarial audit review we

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have performed a peer review of this study and have the following comments and recommendations:

<u>**Mortality**</u>

Segal recommended that SCERS adopt a new approach for developing mortality assumptions based on the generational projection of mortality improvements. Segal suggested the following steps, which are consistent with those used by other actuaries:

1. Select a standard mortality table based on experience most closely matching the anticipated experience of the System.
2. Compare the actual experience of the System to that predicted by the selected standard table for the period of the experience study.
3. Adjust the standard table, either fully or partially, depending on the level of credibility for the System's experience. This adjusted table is called the base table.
4. Select an appropriate standard mortality improvement projection scale and apply it to the base table.

We strongly support the recommended change to the generational mortality approach. However, we have issues with the application of steps #1-3 in Segal's experience study.

Benefit vs. Headcount-Weighted

Our issues with steps #1 and #2 are related, and have to do with the fact that mortality studies in the U.S. have consistently shown that higher income individuals have longer life expectancies than lower income individuals. Because higher income individuals also typically have higher pension benefit amounts, it is important for a pension plan to use assumptions that are weighted to reflect the impact on liability. Otherwise, the mortality assumptions could accurately predict the number of deaths at each age, but still underestimate the liabilities, if the higher-benefit members are outliving the lower-benefit members.

Segal briefly mentioned the benefit-weighted approach in their experience study report, but then stated that the "head-count basis is the more common practice currently and is the approach used by Segal in the past for its California public system clients (including SCERS) and by other public sector actuaries in California." Segal included no other justification in their report for using the Headcount-Weighted RP-2014 Tables as the standard mortality table upon which to base their recommendations (step #1 above), as opposed to the standard RP-2014 Tables, which are benefit-weighted.

However, the report published by the Retirement Plans Experience Committee (RPEC) that accompanied the release of the RP-2014 tables clearly states, "*For the measurement of most pension obligations, tables weighted by benefit amount generally produce the most appropriate results.*" The report also describes a number of applications in which headcount-weighted tables may produce more accurate results, including estimates of average age at death, projections of retirement populations, and the measurement of OPEB plan obligations; the list of exceptions did not include the measurement of liabilities in traditional pay-related defined benefit plans.

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One reason that RPEC recommends the use of the benefit-weighted tables for pension applications is that the behavior of the two tables are quite different: the mortality rates for the headcount-weighted tables are considerably higher at earlier ages, but gradually converge with the benefit-weighted rates at the highest ages. Using a headcount-weighted table will tend to overstate mortality rates in the early years of retirement, and understate it in later years, assuming the overall actual-to-expected ratio is close to 100% based on the number of deaths. Unless Segal has sufficient evidence to indicate that the pattern of mortality for SCERS looks closer to the headcount-weighted tables (measured on a liability-weighted basis), we believe the default should be to use a benefit-weighted table when a choice between such tables is available.

In addition to selecting the headcount-weighted RP-2014 tables as the standard table, Segal only reviewed the SCERS actual mortality experience on a headcount basis (step #2). When asked in a follow-up email to clarify which public sector actuaries in California were using a headcount-weighted approach to review mortality experience, Segal responded that they were referring to the CalPERS actuaries and, that based on informal discussions with the CalPERS actuaries, CalPERS had concluded that the CalPERS actuaries "have not found enough evidence to convince them to use the benefit-weighted basis."

While it is true that the most recent mortality tables adopted by CalPERS were developed on a headcount-weighted basis, our own informal discussions with the CalPERS actuaries indicated that this approach was not selected because of a lack of evidence to support a benefit-weighted approach, but rather because their systems are not currently set up to review mortality experience on a benefit-weighted basis.

We at Cheiron have made it a standard practice to at least review the mortality experience by both benefit amount and headcount in our studies for SACRS systems, and it is our understanding that the other actuarial consulting firm providing actuarial valuation services to non-Segal clients in the '37 Act systems (Milliman) has also been reviewing the experience on both bases in their recent experience studies.

In our experience with most (but not all) of the SACRS plans and other public plans we work with in California, we have found a significant difference in the actual-to-expected ratios calculated on a headcount-weighted basis compared to a benefits-weighted basis, though the amount of the difference does vary between plans and employee populations. We note that in the experience study that Milliman recently completed for the Oregon Public Employee Retirement System (http://www.oregon.gov/pers/Documents/2016-Exp-Study.pdf), the difference between the benefit- and headcount-weighted actual-to-expected ratios averaged about 10% for both males/females and Miscellaneous/Safety members, which is consistent with the level we have found in some systems and represents a material difference.

Credibility

Very few pension plans have sufficient experience to develop their own mortality tables. Most plans instead adjust a standard table (step #3). However, with approximately 1000 deaths necessary for full credibility (defined by a 90% probability that the observed rate is within 5% of the true rate) and actual mortality rates quite low at most ages, many plans lack sufficient data to

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perform even a full adjustment to a standard table (i.e. adjust the tables so the actual-to-expected ratio based on the plan's data is close or equal to 100%).

Segal's experience study report includes a table (page 33) that indicates the number of deaths included in the six-year extended study period. The number of actual Miscellaneous deaths is over 1000, so it is reasonable to consider this experience fully credible and appropriate to propose an adjustment to the standard tables that results in an active-to-expected ratio close to 100%. However, the amount of Safety mortality experience is much smaller, with less than 100 deaths reported over the six-year period. This amount of data should not be considered to be fully credible, and caution should be used in applying significant adjustments to the standard tables, which Segal has done in their recommendation to apply a four-year setback to the ages for Safety members.

In particular, caution should be used when the experience has been different in prior years (as Segal indicated had been the case in their report) and when the proposed assumptions represent an unusual difference in assumptions from other groups. In this case, Segal has proposed mortality assumptions for the SCERS Safety members that are significantly more conservative (i.e. expecting longer lifespans, for members of the same gender) than those for the Miscellaneous members.

Historically, public pension plans have generally assumed shorter lifespans for Safety members, and though that practice has been changing recently in some places, we have not seen a significant amount of experience that demonstrates the tables have completely turned. For example, in the Oregon PERS study referenced above, Milliman indicated that there was still a margin of somewhere between 5-9% between the actual-to-expected ratios for the Miscellaneous and Safety male experience, with the Safety members continuing to exhibit higher rates of mortality.

Similarly, we question whether a 50% adjustment to the Headcount-Weighted RP-2014 Employee table is appropriate for the active members. The Segal report does not include any information related to the number of active deaths, but we feel comfortable in assuming it was well under 1000 during the study period. Finally, we recommend that Segal consider whether the RP-2014 Disabled Mortality tables are more appropriate than the significantly-adjusted Headcount-Weighted RP-2014 Healthy Annuity Table recommended in the report, based on the limited amount of disability mortality experience.

In summary, we recommend that Segal:

- Reconsider whether the RP-2014 Headcount-Weighted tables are the most appropriate to use as the basis of the SCERS-specific assumptions,
- Review whether an analysis of the SCERS actual experience on a benefit-weighted basis would have an impact on their recommended assumptions, and
- Review whether the level of credibility assigned to the actual mortality experience of the subpopulations of SCERS - in particular the populations of Safety service retirees, and all

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disabled and active members – is appropriate, given the numbers of exposures and deaths in these populations, as well as prior behavioral differences.

We note that the mortality assumptions are of particular importance in the measurement of Plan liabilities, since they are used to determine both the member and employer rates, for both Legacy and PEPRA members.

Retirement

Segal proposed rates that vary by age and Tier. We focused our analysis on Segal's recommendations related to the Miscellaneous Tiers 2 and 3 and Safety Tiers 1 and 2, because those were the groups with the most observed experience.

The rates recommended by Segal appear reasonable based on the experience presented in their report, if the comparison of the actual and expected number of retirements *looks only at the member's age at retirement*. However, the appropriateness of the assumptions appears quite different when reviewing the experience by looking at both the age and service of the members in relation to the probability of retirement.

We requested – and Segal provided – a summary of the service retirement decrements and exposures by five-year age *and* service bands. In Chart II-1 below, we summarize this information for Miscellaneous Tiers 2 and 3, based on grouping the experience into separate categories for those with less than or greater than 30 years of service. The black squares represent the actual percentage of members within each band who retired during the study period. The gray bars represent the 90% confidence interval for the decrement rate (i.e. there is a 90% likelihood that the underlying rate lies within the band).
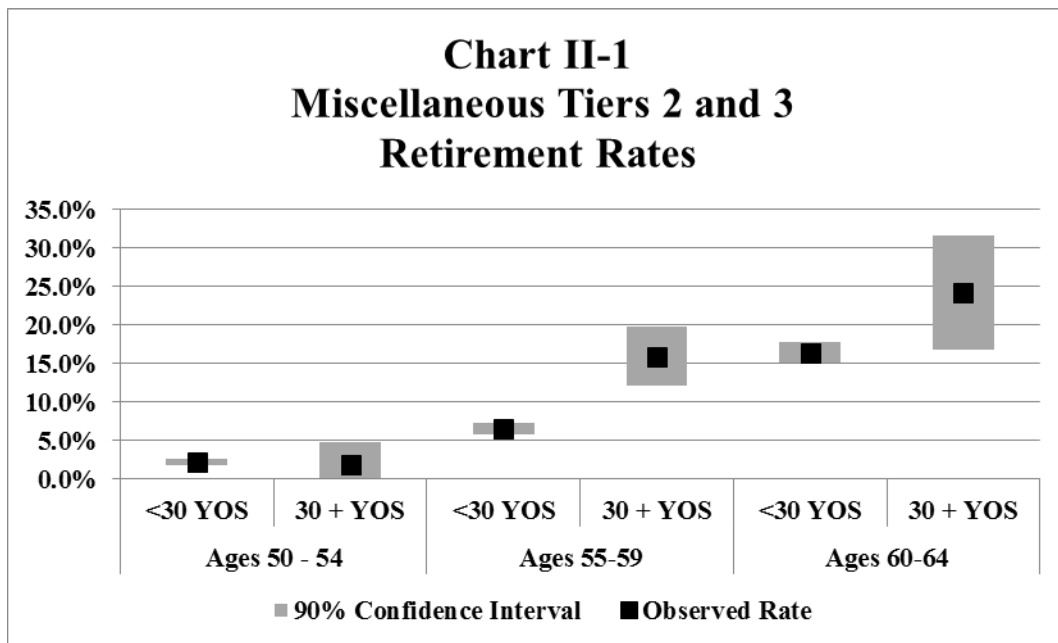
Chart II-1
Miscellaneous Tiers 2 and 3
Retirement Rates

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As seen in this graph, a large difference exists between both the observed rates and the 90% confidence intervals at the selected service levels, at least from ages 55-64 (there are relatively few individuals younger than age 55 with at least 30 years of service). This discrepancy in the rates matters, because all other things being equal, the liabilities will be more heavily weighted towards those with higher levels of service (and thus higher benefits). If the retirement rates accurately predict the number of retirements by age, but overestimate the number of retirements for those with low levels of service and underestimate the number of retirements for those with high levels of service, it is likely that the assumptions will underestimate – potentially significantly – the future liabilities of the Plan.

In the following graph, we show a similar breakdown in the Safety retirement experience for Tiers 1 and 2, for those with less than or greater than 25 years of service.
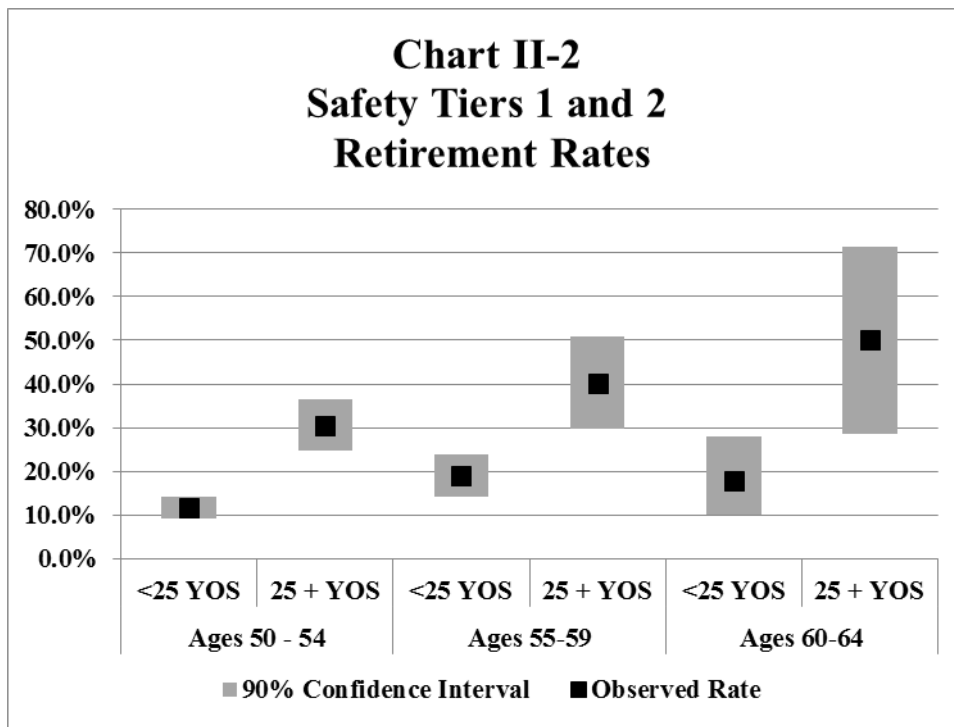
These differences in behavior make sense on an intuitive level as it is reasonable to assume that, for two members of the same age, the one with the higher level of service will be more likely to retire, if for no other reason than the higher-service member is more likely to have achieved their desired level of post-retirement replacement income.

In response to a follow up question on this issue, Segal responded that they did not look at retirement experience by age and service in their study for SCERS, but they had done so recently for another (larger) '37 Act system, and concluded that they did not have enough reliable experience to develop credible assumptions by age and service.

While it is true that the amount of experience may make it difficult to generate reliable assumptions at *each* age and service combination, it is certainly possible to develop reasonable assumptions that distinguish between higher and lower service levels. Segal has used this approach themselves for other clients: for the University of California Retirement System Staff members, they have recommended that their base retirement rates be multiplied by 70% for those

SECTION II - SUMMARY OF REVIEW AND RECOMMENDATIONS

with less than 10 years of service and by 160% for those with more than 20 years of service. A similar adjustment could certainly be developed for SCERS, especially given that the level of experience necessary to develop credible retirement assumptions is much less than that needed to develop fully-credible mortality assumptions (since the frequency of retirement is much higher than that of death).

In Segal's response, they also accurately noted that CalPERS produces and utilizes retirement rates that vary by age and service. As an alternative to developing a set of broad service-based adjustment factors based on SCERS experience, Segal could review whether the relative differences in retirement rates at various service levels used by CalPERS for similar benefit formulas provide a reasonable fit to the SCERS data, and then adjust those rates as necessary to bring the overall level of expected retirements into closer alignment with the SCERS experience at each age.

For example, if the CalPERS rate of retirement for a 2% @ 55 Miscellaneous member (similar to the 31676.14 CERL formula for the SCERS members) at age 55 with 30 years of service is approximately double that of an individual of the same age but with only 10 years of service, Segal could develop a set of retirement rates for SCERS that reflect the same relationship between these service levels, but provide a more accurate fit to the overall number of members expected to retire at each age (based on the SCERS data). This table could then be reviewed to determine whether it provides a better fit (measured by age and service) to the actual SCERS experience than the current age-only based rates.

Regardless of the approach taken, we recommend that Segal review the retirement experience for SCERS by age and service, and determine whether their recommended age-based retirement rates could be expected to materially underestimate the liabilities if the recent patterns of behavior by age and service continue to present themselves.

Economic Assumptions

Overall, the economic assumptions proposed in Segal's review represent a reasonable set of assumptions. In particular, we agree with Segal's recommendation to reduce the assumed rate of price inflation from 3.25% to 3.00%, and to reduce the investment return assumption from 7.50% to 7.00%, reflecting a 0.25% reduction in both the inflation rate and the real return.

We have comments, however, on the "risk adjustment" that Segal used in developing their return recommendation, as well as several other aspects of the economic assumptions.

Risk Adjustment

In their experience study report, Segal spends a significant amount of time discussing the concept of a "risk adjustment" – also referred to as a margin for adverse deviation. The following language is from their experience study report (page 12):

> *In our model, the confidence level associated with a particular risk adjustment represents the likelihood that the actual average return would equal or exceed the assumed value over a 15-year period. For example, if we set our real rate of return assumption using a risk adjustment that produces a confidence level of 60%, then there would be a 60%*

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chance (6 out of 10) that the average return over 15 years will be equal to or greater than the assumed value.

Later in their report, they note that they anticipate a 0.50% offset to the investment return assumption to be a sufficient "risk adjustment" to provide a confidence level of 57%. However, this does **not** mean that there is a 57% chance of achieving the return assumption, **when compounded over a 15-year period**. Average annual returns and average compound returns are different concepts, and the Board should focus on achieving an average compound return equal to or greater than the assumed rate of return.

To illustrate the difference between these concepts, consider an extreme example: if your return is 100% one year (i.e. you doubled your money) and -100% the following (i.e. you lost all your money), then the arithmetic average annual return is 0%, but the average compound return is -100% (i.e. you still don't have any money!). At the end of the day, most investors care about the geometric or compound rate. In the extreme example above, an investor would gladly agree to hide their money under a mattress and earn nothing for two years, versus double their money and then lose it all the next year (but still earn the same arithmetic return!).

As stated above, Segal's "confidence level" model provided SCERS with the likelihood that the arithmetic average investment return will exceed the assumption over a 15-year period. However, the likelihood that the geometric or compound average return will exceed the assumption is considerably less. In fact, rather than a 57% chance, there is roughly a 50% chance that the compound return will equal or exceed 7.00%. The expected return would need to be lowered to around 6.50% to obtain a 57% confidence level on a compound basis.

Investment Expenses

A frequent assumption used in setting return assumptions is that the additional returns earned due to active management will offset the higher level of expenses associated with active management. Instead of this approach, Segal assumes that additional expenses for active management simply reduce the return, which is a more conservative assumption but implies that - all other things being equal - Segal's model would result in a higher recommended return assumption if the Board were invested passively instead of using active managers. While there is much debate about this question among investment professionals, we prefer to remain neutral, assuming no advantage or disadvantage to active management.

We appreciate that Segal has explicitly spelled out the impact of active versus passive management on the historical returns and expenses of the Plan, and identified the issue for further study with Staff. We also note that the conservatism included in this approach may enhance the likelihood that the investment return assumption could be achieved on a compound basis, thus offsetting a portion of the impact from the risk adjustment issue identified above.

Inflation

We support Segal's recommendation to reduce the inflation assumption from 3.25% to 3.00%. We note that the average inflation assumption for the investment consultants cited by Segal

SECTION II - SUMMARY OF REVIEW AND RECOMMENDATIONS

(2.3%), as well as the inflation forecasts used by Social Security (2.6%) and derived from 30-year Treasury bonds (2.10%) are all still significantly below the recommended rate.

While we understand that large and sudden changes in long-term assumptions can be disruptive to the employers and members, and we acknowledge that a 3% inflation assumption still represents a reasonable long-term expectation given historical rates, we recommend that Segal and the Board continue to monitor this assumption and consider further reductions if market-based inflation expectations remain low.

Actuarial Methods

Actuarial methods relate to the application of actuarial assumptions in the determination of Plan liabilities and contributions. These methods include the actuarial cost method, amortization policy, actuarial asset smoothing, and cost-sharing methodologies. The questions guiding our review of the actuarial methods were the following:

- Are the methods acceptable and appropriate for the intended purpose?
- Do the methods comply with relevant accounting and actuarial standards?

Actuarial Cost Method

The individual Entry Age actuarial cost method is used in the June 30, 2016 actuarial valuation. Under this method, the expected cost of benefits for each individual member is allocated over that member's career as a level percentage of that member's expected salary. The normal cost for the plan is the sum of the individual normal costs calculated for each member. We concur with this methodology and note that it is a "Model Practice" based on the guidance issued by the California Actuarial Advisory Panel (CAAP), and a "Best Practice" based on guidance issued by the Government Finance Officers Association. Segal has also applied this method in a manner which complies with the disclosure requirements under GASB Statements 67 and 68.

Asset Smoothing Method

The actuarial (or smoothed) value of assets is determined using a seven-year period for gains and losses. The Board has adopted a corridor around the market value of assets of 30%. We have confirmed that the Segal report applies the actuarial smoothing method as described.

In our opinion, this method satisfies the Actuarial Standard of Practice which governs asset valuation methods (ASOP #44), which requires that the actuarial asset value should fall within a "reasonable range around the corresponding market value" and that differences between the actuarial and the market value should be "recognized within a reasonable period of time."

We commend Segal for including the funded ratio and unfunded liability using both the market value and smoothed value of assets in their report. These disclosures are included in the "Model Disclosure Elements for Actuarial Valuation Reports" adopted by the CAAP.

SECTION II - SUMMARY OF REVIEW AND RECOMMENDATIONS

Amortization Policy

The current Amortization Policy for SCERS is a layered amortization policy, with the balance of the unfunded liability as of June 30, 2012 amortized as a level percentage of payroll over a closed 23-year period (19 years remaining as of June 30, 2016), with the exception of the UAAL established as a result of an early retirement incentive for LEMA members, which is being amortized over a 10 year declining period beginning June 30, 2010. Each subsequent year's unfunded liability attributable to experience gains or losses, assumption changes, and cost method changes is amortized as a level percentage of payroll over a new closed 20-year period. Plan amendments are amortized over closed 15-year periods and early retirement incentive programs will be amortized over 5 years.

We have confirmed that the Segal report applies the amortization method as described. This amortization method is in accordance with the recent funding policy guidance issued by the CAAP, GFOA, and the Conference of Consulting Actuaries Public Plans Community. This amortization policy also meets the minimum standards of the '37 Act.

Cost-Sharing Methods

SCERS is a cost-sharing plan, wherein the assets of the Plan are available to fund the benefits of all members. This is different from an approach in which specific asset pools are tracked and held separately for each employer. As a result, methods and assumptions must be used to assign portions of the unfunded accrued liability to the different employment groups (i.e. County vs. District, Miscellaneous vs. Safety), including adjustments made to various groups' cost calculations as a result of specific circumstances or policies.

Segal has included some limited information to describe a number of these adjustments. For example, the description of the UAAL amortization method on page 13 of the report briefly mentions an addition to the Miscellaneous UAAL rate for the County to reflect a payment to cover a portion of the net withdrawal liability for the Library Authority and Air Quality Districts, and this line item is shown in the calculation of the overall UAAL schedule as shown on page 82 of the report.

However, Segal's report does not mention or describe the largest adjustment to an individual group's contribution rates: the application of an additional amortization base to the District's UAAL payments, in order to assign sole credit to the County for the previously issued Pension Obligation Bond (POB). We requested additional information from Segal on this adjustment, and we were thereby able to verify the differences between the County versus District UAAL payments as shown in their report.

However, as this is a sizable adjustment – an adjustment of over 8% of payroll for the District's cost – it deserves mention in the valuation report. In general, it would be helpful to include a thorough description – either within the valuation report itself or by reference – to how the POB and other credits or special reserves are determined and maintained (such as the member COLA offset and the reserves for withdrawn employers), including a description of the origin and basis for the credits, and how they are to be allocated among different employment groups.

Contents of the Reports

We find the actuarial valuation and experience study reports to be in compliance with Actuarial Standards of Practice. We have already mentioned several areas in which we believe each of the reports could be enhanced – such as clarifying the risk adjustment factor in the experience study report, and adding a description of the UAAL adjustment related to the POB in the valuation report.

We also encourage Segal to consider whether a demonstration of future expected funding progress and contribution rates and/or additional statements regarding risk should be contained within the actuarial valuation report. This report represents to the public the current financial condition of SCERS, and as such, we recommend it include a prospective view.

We note that Segal provided SCERS with projections of the employer contribution rate for the next several years, in a separate document, to assist the Board in understanding the impact of a decision to phase-in the cost impact of changes to the assumptions for the employers. We believe that a longer projection can also be helpful to the Board, and we typically include such projections as part of our actuarial valuation reports. For example, such a projection could show the Board how the costs are expected to be affected by the interplay of the assumptions changes *and* the deferred losses currently reflected in the smoothed value of assets.

With respect to risk, although Segal does briefly describe some common volatility ratios in the Section 2 of their report, there is no mention of these ratios or any other discussion of volatility in the Executive Summary. Also, there is no discussion regarding positive or negative cash flow and the risks associated with these situations. We note that the Actuarial Standards Board is currently reviewing a potential new Standard of Practice related to the disclosure of risk for pension plans, the content of which may be useful to Segal and the Board in assessing whether additional risk disclosures could add value to the valuation report.

APPENDIX A - GLOSSARY OF TERMS

1. Actuarial Assumptions

Estimates of future experience with respect to rates of mortality, disability, turnover, retirement, investment income, and salary increases. Demographic assumptions (rates of mortality, disability, turnover, and retirement) are generally based on past experience, often modified for projected changes in conditions. Economic assumptions (salary increases and investment income) consist of an underlying rate in an inflation-free environment plus a provision for a long-term average rate of inflation.

2. Actuarial Gain (Loss)

The difference between actual experience and actuarial assumption anticipated experience during the period between two actuarial valuation dates, as determined in accordance with a particular actuarial funding method.

3. Actuarial Liability

The Actuarial Liability is the present value of all benefits accrued as of the valuation date using the methods and assumptions of the valuation. It is also referred to by some actuaries as the "accrued liability" or "actuarial accrued liability."

4. Actuarial Present Value

The amount of funds currently required to provide a payment or series of payments in the future. It is determined by discounting future payments at predetermined rates of interest, and by probabilities of payment.

5. Actuarial Value of Assets

The Actuarial Value of Assets equals the Market Value of Assets adjusted according to the smoothing method. The smoothing method is intended to smooth out the short-term volatility of investment returns in order to stabilize contribution rates and the funded status.

6. Actuarial Cost Method

A mathematical budgeting procedure for allocating the dollar amount of the "actuarial present value of future plan benefits" between the actuarial present value of future normal costs and the actuarial liability. It is sometimes referred to as the "actuarial funding method."

APPENDIX A - GLOSSARY OF TERMS

7. Funded Status

The Actuarial Value of Assets divided by the Actuarial Liability. The Funded Status can also be calculated using the Market Value of Assets.

8. Governmental Accounting Standards Board

The Governmental Accounting Standards Board (GASB) defines the accounting and financial reporting requirements for governmental entities. GASB Statement No. 67 defines the plan accounting and financial reporting for governmental pension plans, and GASB Statement No. 68 defines the employer accounting and financial reporting for participating in a governmental pension plan.

9. Market Value of Assets

The fair value of the Plan's assets assuming that all holdings are liquidated on the measurement date.

10. Normal Cost

The annual cost assigned, under the actuarial funding method, to current and subsequent plan years. It is sometimes referred to as "current service cost." Any payment toward the unfunded actuarial liability is not part of the normal cost.

11. Present Value of Future Benefits

The estimated amount of assets needed today to pay for all benefits promised in the future to current members of the Plan, assuming all Actuarial Assumptions are met.

12. Present Value of Future Normal Costs

The Actuarial Present Value of retirement system benefits allocated to future years of service.

13. Unfunded Actuarial Liability (UAL)

The difference between the Actuarial Liability and the Actuarial Value of Assets. This is sometimes referred to as the "unfunded accrued liability."

Sacramento County Employees' Retirement System

Analysis of Actuarial Experience
During the Period
July 1, 2013 through June 30, 2016

May 8, 2017

Board of Retirement
Sacramento County Employees' Retirement System
980 9th Street, Suite 1900
Sacramento, CA 95814

Re: Review of Actuarial Assumptions for the June 30, 2017 Actuarial Valuation

Dear Members of the Board:

We are pleased to submit this report of our review of the actuarial experience for the Sacramento County Employees' Retirement System. This study utilizes the census data for the period July 1, 2013 to June 30, 2016 and provides the proposed actuarial assumptions, both economic and demographic, to be used in the June 30, 2017 valuation.

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

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

Sincerely,

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

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

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Actuarial Experience Study
Analysis of Actuarial Experience
During the Period July 1, 2013 through June 30, 2016

I. Introduction, Summary, and Recommendations

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

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

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

This study was undertaken in order to review the economic and demographic actuarial assumptions and to compare the actual experience with that expected under the current assumptions during the three-year experience period from July 1, 2013 through June 30, 2016. The study was performed in accordance with Actuarial Standard of Practice (ASOP) No. 27 "Selection of Economic Assumptions for Measuring Pension Obligations" and ASOP No. 35 "Selection of Demographic and Other Non-Economic Assumptions for Measuring Pension Obligations." These Standards of Practice put forth guidelines for the selection of the various actuarial assumptions utilized in a pension plan actuarial valuation. Based on the study's results and expected future experience, we are recommending various changes in the current actuarial assumptions.

We are recommending changes in the assumptions for investment return, inflation, salary increases, retirement from active employment, reciprocity, pre-retirement mortality, post-retirement healthy and disabled life mortality, termination (refunds and deferred vested retirements), disability (non-duty and duty) and sick leave conversion.

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

Pg #	Actuarial Assumption Categories	Recommendation
7	**Inflation:** Future increases in the Consumer Price Index (CPI), which drives investment returns and active member salary increases, as well as cost-of-living adjustments (COLAs) for retirees.	Reduce the assumed rate of price inflation from 3.25% per annum to 3.00% per annum as discussed in Section (III)(A).

Pg #	Actuarial Assumption Categories	Recommendation
8	**Investment Return:** The estimated average future net rate of return on current and future assets of the System as of the valuation date. This rate is used to discount liabilities.	Reduce the current investment return assumption from 7.50% per annum to 7.00% per annum as discussed in Section (III)(B). A 7.00% assumption would provide a margin that is consistent with the practice followed in prior studies under the risk-adjusted model used by Segal to evaluate this assumption. As a decrease from 7.50% to 7.00% is a significant reduction in the long-term investment return assumption, we have also developed an alternative assumption of 7.25% that would provide a smaller margin than prior studies under the risk-adjusted model.
14	**Individual Salary Increases:** Increases in the salary of a member between the date of the valuation to the date of separation from active service. This assumption has three components: • Inflationary salary increases • Real "across the board" salary increases • Merit and promotional increases	Reduce the current inflationary salary increase assumption from 3.25% to 3.00% and maintain the current real "across the board" salary increase assumption at 0.25%. This means that the combined inflationary and real "across the board" salary increases will decrease from 3.50% to 3.25%. We recommend adjusting the merit and promotional rates of salary increase as developed in Section III (C) to reflect past experience. The recommended assumptions anticipate slightly higher salary increases overall.
20	**Retirement Rates:** The probability of retirement at each age at which participants are eligible to retire. **Other Retirement Related Assumptions including:** • Percent married and spousal age differences for members not yet retired • Retirement age for inactive vested members • Future reciprocal members and reciprocal salary increases	We recommend adjusting the retirement rates to those developed in Section IV (A) for Miscellaneous Tiers 1, 2 and 3 and Safety Tiers 1 and 2 members. We recommend no change in the retirement rates for Miscellaneous Tiers 4 and 5 and Safety Tiers 3 and 4 until actual experience becomes available. We also recommend decreasing the reciprocity assumption for both Miscellaneous and Safety members.
30 37	**Mortality Rates:** The probability of dying at each age. Mortality rates are used to project life expectancies.	For members who retire from service, we recommend adjusting the rates as developed in Section IV (B) for Miscellaneous and Safety members and all beneficiaries to reflect a slight mortality improvement and a generational approach to anticipating future mortality improvement. The disabled member mortality rates for Miscellaneous and Safety members have also been adjusted as developed in Section IV (C). The recommended pre-retirement mortality assumptions for Miscellaneous and Safety members have been adjusted as developed in Section IV (B). In addition, we recommend maintaining the assumption that all Miscellaneous pre-retirement deaths and 50% of Safety pre-retirement deaths are assumed to be non-duty deaths.

Pg #	Actuarial Assumption Categories	Recommendation
40	**Termination Rates:** The probability of leaving employment at each age and receiving either a refund of member contributions or a deferred vested retirement benefit.	We recommend adjusting the termination rates to those developed in Section IV (D) to reflect a slightly lower incidence of termination overall. In addition, a lower proportion of members is expected to elect a refund of member contributions with a higher proportion electing instead to receive a deferred vested benefit under the recommended assumptions.
45	**Disability Incidence Rates:** The probability of becoming disabled at each age.	We recommend adjusting the disability rates to those developed in Section IV (E) to reflect slightly lower incidence of disability for Miscellaneous and Safety members.
47	**Service from Unused Sick Leave Conversion:** Additional service that is expected to be received when the member retires due to conversion of unused sick leave.	We recommend introducing an assumption for new Miscellaneous disabled retirees to anticipate conversions of unused sick leave at retirement and maintaining the current assumptions to anticipate conversions of unused sick leave at retirement for all other groups of retirees.
48	**Average Entry Ages:** The entry age used to determine employee rates for members hired after January 1, 1975 and prior to January 1, 2013.	We recommend maintaining the current assumed average entry age of 35 for Miscellaneous and 29 for Safety.

We have estimated the impact of the proposed assumption changes as if they were applied to the June 30, 2016 actuarial valuation. Note that the cost impact shown is after reflecting the impact of some active members in the legacy tiers who have already agreed to pay a higher normal cost on a 50:50 cost-sharing basis, while the remaining active members continue to have agreed only to pay the full rate as defined by statute.[1]

Cost Impact (including a 7.00% investment return assumption)		
Change in Costs	**Contribution Rate**	**Estimated Annual Dollar Amount in Thousands**
Total Normal Cost	3.75%	$34,593
Member Normal Cost	1.79%	$16,532
Employer Normal Cost	1.96%	$18,061
Employer UAAL Payments	5.67%	$52,841
Total for Employer	7.63%	$70,902

*   *Based on June 30, 2016 projected annual payroll.*

If only the proposed economic assumptions changes were implemented (as recommended in Section III of this report), including a 7.00% investment return assumption, the total (employer and member) normal cost rate would have increased by 2.64% of payroll and the UAAL amortization rate would have increased by 3.39% of payroll. Of the various economic assumption changes, the most significant cost impact is from the investment return assumption change.

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[1]   Starting in 2017/2018, most Miscellaneous County members and all Safety County members in the legacy tiers would be paying 50% of the total normal cost rates in their tiers. In addition, Miscellaneous members in one District would also be paying 50% of the total normal cost rates in their tiers. All remaining members would pay the full rate.

Furthermore, if only the proposed demographic assumption changes were implemented (as recommended in Section IV of this report), the total (employer and member) normal cost rate would have increased by 1.11% of payroll and the UAAL amortization rate would have increased by 2.28% of payroll. Of the various demographic assumption changes, the most significant cost impact is from the mortality assumption change.

If a 7.25% investment return assumption were implemented instead of a 7.00% investment return assumption together with all the other recommended assumption changes in this report, the total (employer and member) normal cost rate would have increased by 2.25% of payroll and the UAAL amortization rate would have increased by 3.51% of payroll. The breakdown of the cost impact after reflecting the impact of some active members in the legacy tiers who have already agreed to pay a higher normal cost on a 50:50 cost-sharing basis is as follows:

Cost Impact (including a 7.25% investment return assumption)		
Change in Costs	**Contribution Rate**	**Estimated Annual Dollar Amount in Thousands**
Total Normal Cost	2.25%	$20,531
Member Normal Cost	1.07%	$9,791
Employer Normal Cost	1.18%	$10,740
Employer UAAL Payments	3.51%	$32,592
Total for Employer	4.69%	$43,332

*   *Based on June 30, 2016 projected annual payroll.*

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

II. Background and Methodology

In this report, we analyzed both economic and demographic ("non-economic") assumptions. The primary economic assumptions reviewed are inflation, investment return, and salary increases. Demographic assumptions include the probabilities of certain events occurring in the population of members, referred to as "decrements," e.g., termination from service, disability retirement, service retirement, and death after retirement. In addition to decrements, other demographic assumptions reviewed in this study include the percentage of members with an eligible spouse or domestic partner, spousal age difference, percent of members assumed to go on to work for a reciprocal system, reciprocal salary increases, service from unused sick leave conversion and average entry ages for members hired after January 1, 1975 and prior to January 1, 2013.

Economic Assumptions

Economic assumptions consist of:

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

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

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

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

Demographic Assumptions

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

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

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

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

III. Economic Assumptions

A. Inflation

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

The inflation assumption is long term in nature, so it is set using primarily historical information. Following is an analysis of 15 and 30 year moving averages of historical inflation rates:

HISTORICAL CONSUMER PRICE INDEX – 1930 TO 2016
(U.S. City Average - All Urban Consumers)

	25th Percentile	Median	75th Percentile
15-year moving averages	2.5%	3.4%	4.5%
30-year moving averages	3.1%	3.9%	4.8%

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

Based on information found in the Public Plans Data website, which is produced in partnership with the National Association of State Retirement Administrators (NASRA), the median inflation assumption used by 142 large public retirement funds in their 2015 fiscal year valuations was 3.00%. In California, CalPERS, CalSTRS, Contra Costa County, Los Angeles County, and two other 1937 Act CERL systems use an inflation assumption of 2.75% while OCERS and nine other 1937 Act CERL systems use an inflation assumption of 3.00%.

SCERS' investment consultant, Verus, anticipates an annual inflation rate of 2.10%, while the average inflation assumption provided by Verus and seven other investment advisory firms retained by Segal's California public sector clients was 2.30%. Note that, in general, investment consultants use a time horizon for this assumption that is shorter than the time horizon we use for the actuarial valuation.

To find a forecast of inflation based on a longer time horizon, we referred to the 2016 report on the financial status of the Social Security program. The projected average increase in the Consumer Price Index (CPI) over the next 75 years under the intermediate cost assumptions used in that report was 2.60%. We also compared the yields on the thirty-year inflation indexed U.S. Treasury bonds to comparable traditional U.S. Treasury bonds. As of February 2017, the difference in yields is about 2.10%, which provides a measure of market expectations of inflation.

Based on all of the above information, we recommend that the current 3.25% annual inflation assumption be reduced to 3.00% for the June 30, 2017 actuarial valuation.

Retiree Cost of Living Increases

In the last valuation, as of June 30, 2016, consistent with the 3.25% annual inflation assumption used by the Board for that valuation, the Board used a 3.25% cost-of-living adjustment (which is lower than the maximum COLA of 4.00% provided by the System) for all retirees in Tier 1 and a 2.00% cost-of-living adjustment for retirees in Miscellaneous Tiers 3, 4 and 5 and Safety Tiers 2, 3 and 4.

Consistent with our recommended inflation assumption, we also recommend that the current 3.25% assumption used to value the post-retirement cost-of-living adjustment for Tier 1 be reduced to 3.00%. We are recommending no change in the 2.00% assumption used to value the post-retirement cost-of-living adjustment for Miscellaneous Tiers 3, 4 and 5 and Safety Tiers 2, 3 and 4.

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

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

➤ Using a lower long-term COLA assumption based on a stochastic analysis would mean that an actuarial loss would occur even when the inflation assumption of 3.00% is met in a year. We question the reasonableness of this result.

We do not see the stochastic possibility of COLAs averaging less than those predicted by the assumed rate of inflation as a reliable source of cost savings that should be anticipated in our COLA assumptions. Therefore, we continue to recommend setting the COLA assumptions based on the long-term annual inflation assumption, as we have in prior years.

B. Investment Return

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

Real Rate of Investment Return

This component represents the portfolio's incremental investment market returns over inflation. Theory has it that as an investor takes a greater investment risk, the return on the investment is expected to also be greater, at least in the long run. This additional return is expected to vary by asset class and empirical data supports that expectation. For that reason, the real rate of return

assumptions are developed by asset class. Therefore, the real rate of return assumption for a retirement association's portfolio will vary with the Board's asset allocation among asset classes.

The following is the System's current target asset allocation and the assumed real rate of return assumptions by asset class. The first column of real rate of return assumptions are determined by netting Verus' total or "nominal" 2017 return assumptions by their assumed 2.10% inflation rate. The second column of returns (except for Growth Oriented Absolute Return, Private Equity, Private Credit/Private Debt, Diversifying Absolute Return and Private Real Assets) represents the average of a sample of real rate of return assumptions, where each firm's nominal returns have been reduced by that firm's assumed inflation rate. The sample includes the expected annual real rate of return provided to us by Verus and seven other investment advisory firms retained by Segal's public sector clients. We believe these averages are a reasonable forecast of long-term future market returns in excess of inflation.[2]

SCERS' TARGET ASSET ALLOCATION AND ASSUMED ARITHMETIC REAL RATE OF RETURN ASSUMPTIONS BY ASSET CLASS AND FOR THE PORTFOLIO

Asset Class	Percentage of Portfolio	Verus' Assumed Real Rate of Return[3]	Average Assumed Real Rate of Return from a Sample of Consultants to Segal's California Public Sector Clients[4]
U.S. Large Cap Equity	17%	3.80%	5.61%
U.S. Small Cap Equity	4%	4.90%	6.37%
International Developed Equity	16%	9.20%	6.96%
Emerging Markets Equity	4%	9.70%	9.28%
High Yield Bonds	1%	3.10%	3.65%
Bank Loans	1%	3.00%	2.96%
Growth Oriented Abs. Return	3%	4.97%	4.97%[5]
Private Equity	9%	8.70%	8.70%[5]
Private Credit/Private Debt	4%	5.10%	5.10%[5]
Core/Core Plus Bonds	10%	1.40%	1.06%
Global Bonds	3%	0.20%	0.07%
U.S. Treasury	5%	0.60%	0.16%
Diversifying Abs. Return	7%	3.04%	3.04%[5]
Private Real Estate	7%	3.00%	4.37%
Private Real Assets	7%	7.74%	7.74%[5]
Commodities	2%	3.40%	3.76%
Total	**100%**	**5.11%**	**5.15%**

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

[3] Derived by reducing Verus' nominal rate of return assumptions by their assumed 2.10% inflation rate.

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

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

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

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

The following are some observations about the returns provided above:

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

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

3. Therefore, we recommend that the 5.15% portfolio real rate of return be used to determine the System's investment return assumption. This is 0.52% lower than the return that was used three years ago in the review to prepare the recommended investment return assumption for the June 30, 2014 valuation. The difference is due to changes in the System's target asset allocation (-0.50%), changes in the real rate of return assumptions provided to us by the investment advisory firms (+0.06%) and the interaction effect between these changes (-0.08%).

System Expenses

For funding purposes, the real rate of return assumption for the portfolio needs to be adjusted for investment and administrative expenses expected to be paid from investment income. The following table provides the investment expenses in relation to the actuarial value of assets for the five years ending June 30, 2016.

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

Year Ending June 30	Actuarial Value of Assets[6]	Administrative Expenses	Investment Expenses[7]	Administrative %	Investment %	Total %
2012	$6,529,895	$6,288	$27,478[8]	0.10	0.42	0.52
2013	6,797,757	5,719	35,343[8]	0.08	0.52	0.60
2014	7,312,993	5,665	43,870[8]	0.08	0.60	0.68
2015	7,838,825	5,854	49,868[8]	0.07	0.64	0.71
2016	8,236,402	6,362	53,398[8]	0.08	0.65	0.73
			Average	0.08%	0.57%	0.65%

Based on this experience, we have increased the future expense component from 0.50% used in the last review in 2014 to 0.65%. This assumption will be re-examined in subsequent assumption reviews as new data becomes available.

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

We have not performed a detailed analysis to measure how much of the investment expenses paid to active managers might have been offset by additional returns ("alpha") earned by that active management. However, we observed based on information provided in the CAFR that the total fund return on a net of investment expense basis was lower than the policy benchmark by about 0.7% over the last five years. We will work with the System's staff to determine whether future studies might potentially exclude the level of investment expenses for active managers that are expected to be offset by investment returns. For now, we will continue to use the current approach that any "alpha" that may be identified would be treated as an increase in the risk adjustment and corresponding confidence level. For example, 0.25% of alpha would increase the confidence level by 3% (see discussions that follow on definitions of risk adjustment and confidence level).

Risk Adjustment

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

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[6]   As of end of plan year.

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

[8]   Excludes approximately $2 million, $2 million, $5 million, $12 million and $6 million in incentive based fees for 2012, 2013, 2014, 2015 and 2016, respectively.

correlation of returns among those asset classes. This portfolio risk is incorporated into the real rate of return assumption through a risk adjustment.

The purpose of the risk adjustment (as measured by the corresponding confidence level) is to increase the likelihood of achieving the actuarial investment return assumption in the long term.[9] The 5.15% expected real rate of return developed earlier in this report was based on expected mean or average arithmetic returns. This means there is a 50% chance of the actual return in each year being at least as great as the average (assuming a symmetrical distribution of future returns). The risk adjustment is intended to increase that probability somewhat above the 50% level. This is consistent with our experience that retirement plan fiduciaries would generally prefer that returns exceed the assumed rate more often than not. Note that, based on the investment return assumptions recently adopted by systems that have been analyzed under this model, we observe a confidence level generally in the range of 50% to 60%.

Three years ago, the Board adopted an investment return assumption of 7.50%. That return implied a risk adjustment of 0.92%, reflecting a confidence level of 60% that the actual average return over 15 years would not fall below the assumed return, assuming that the distribution of returns over that period follows the normal statistical distribution.[10]

In our model, the confidence level associated with a particular risk adjustment represents the likelihood that the actual average return would equal or exceed the assumed value over a 15-year period. For example, if we set our real rate of return assumption using a risk adjustment that produces a confidence level of 60%, then there would be a 60% chance (6 out of 10) that the average return over 15 years will be equal to or greater than the assumed value. The 15-year time horizon represents an approximation of the "duration" of the fund's liabilities, where the duration of a liability represents the sensitivity of that liability to interest rate variations.

If we use the same 60% confidence level from our last study to set this year's risk adjustment, based on the current long-term portfolio standard deviation of 10.50% provided by Verus, the corresponding risk adjustment would be 0.68%. Together with the other investment return components, this would result in an investment return assumption of 6.82%, which is substantially lower than the current assumption of 7.50%.

Based on the general practice of using one-quarter percentage point increments for economic assumptions, we evaluated the effect on the confidence level of alternative investment return assumptions. In particular, a net investment return assumption of 7.00%, together with the other investment return components, would produce a risk adjustment of 0.50%, which corresponds to a confidence level of 57%. As the Board has historically adopted investment return assumptions with confidence levels above 60% in the past several experience studies, we believe this analysis supports reducing the current assumption from 7.50% to 7.00%.

Because this would be a substantial change in this long-term assumption, we also examined the confidence level associated with an alternative assumption of 7.25%. A net investment return

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

[10] Based on an annual portfolio return standard deviation of 14.10% provided by SIS (before they became part of Verus) in 2014. Strictly speaking, future compounded long-term investment returns will tend to follow a log-normal distribution. However, we believe the Normal distribution assumption is reasonable for purposes of setting this type of risk adjustment.

assumption of 7.25%, together with the other investment return components, would produce a risk adjustment of 0.25%, which corresponds to a confidence level of 54%.

As we have discussed in prior experience studies, the risk adjustment model and associated confidence level is most useful as a means for comparing how the System has positioned itself relative to risk over periods of time.[11] The use of either a 57% or 54% confidence level should be considered in context with other factors, including:

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

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

➤ A confidence level of either 57% (associated with a 7.00% investment return assumption) or 54% (associated with a 7.25% investment return assumption) is within the range of about 50% to 60% that corresponds to the risk adjustments used by most of Segal's other California public retirement system clients. Most public retirement systems that have recently reviewed their investment return assumptions have seen decreases in their confidence level even though they adopted more conservative investment return assumptions for their valuations.

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

Recommended Investment Return Assumption

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

CALCULATION OF INVESTMENT RETURN ASSUMPTION

Assumption Component	June 30,2017 Recommended Value	June 30,2017 Alternative Assumption	June 30, 2014 Adopted Value	June 30, 2012 Adopted Value
Inflation	3.00%	3.00%	3.25%	3.25%
Plus Portfolio Real Rate of Return	5.15%	5.15%	5.67%	5.97%
Minus Expense Adjustment	(0.65%)	(0.65%)	(0.50%)	(0.45%)
Minus Risk Adjustment	(0.50%)	(0.25%)	(0.92%)	(1.27%)
Total	7.00%	7.25%	7.50%	7.50%
Confidence Level	57%	54%	60%	64%

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

Based on this analysis, we recommend that the investment return assumption be decreased from 7.50% to 7.00% per annum to maintain a confidence level associated with this assumption to a level more consistent with the practice followed in prior reviews of this assumption. However, an alternative assumption of 7.25% recommendation could be considered if the Board decides to decrease the confidence level associated with this assumption.

Comparing with Other Public Retirement Systems

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

We note that a 7.00% investment return assumption is becoming more common among California public sector retirement systems. In particular, four County employees retirement systems (Contra Costa, Fresno, Mendocino and Santa Barbara) use a 7.00% earnings assumption. Furthermore, the CalPERS Board has approved a reduction in the earnings assumption from 7.50% to 7.00% over the next three years. In addition, CalSTRS recently adopted a 7.25% earnings assumption for the 2016 valuation (down from 7.50%) and a 7.00% earnings assumption for the 2017 valuation.

The following table compares SCERS' recommended net investment return assumption against those of the nationwide public retirement systems that participated in the National Association of State Retirement Administrators (NASRA) 2016 Public Fund Survey for 142 large public retirement funds in their 2015 fiscal year valuations:

Assumption	SCERS	NASRA 2016 Public Fund Survey		
		Low	Median	High
Net Investment Return	7.00%	4.29%	7.50%	8.50%

The detailed survey results show that more than one-half of the systems have an investment return assumption in the range of 6.75% to 7.75%, and over half of those systems have used an assumption of 7.50%. The survey also notes that several plans have reduced their investment return assumption during the last year. State systems outside of California tend to change their economic assumptions less frequently and so may lag behind emerging practices in this area.

In summary, we believe that both the risk adjustment model and other considerations indicate a lower earnings assumption. While both the recommended assumption of 7.00% or the alternative assumption of 7.25% provides for a smaller margin for adverse deviation within the risk adjustment model as compared to three years ago, they are generally consistent with the System's current practice relative to other public systems.

C. Salary Increase

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

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

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

   As discussed earlier in this report, we are recommending that the assumed rate of inflation be reduced from 3.25% to 3.00% per annum. This inflation component is used as part of the salary increase assumption.

2. **Real "Across the Board" Pay Increases:** These increases are typically termed productivity increases since they are considered to be derived from the ability of an organization or an economy to produce goods and services in a more efficient manner. As that occurs, at least some portion of the value of these improvements can provide a source for pay increases. These increases are typically assumed to extend to all employees "across the board". The State and Local Government Workers Employment Cost Index produced by the Department of Labor provides evidence that real "across the board" pay increases have averaged about 0.6% - 0.9% annually during the last ten to twenty years.

   We also referred to the annual report on the financial status of the Social Security program published in June 2016. In that report, real "across the board" pay increases are forecast to be 1.2% per year under the intermediate assumptions.

   The real pay increase assumption is generally considered a more "macroeconomic" assumption that is not necessarily based on individual plan experience. However, recent salary experience with public systems in California as well as anecdotal discussions with plans and plan sponsors indicate lower future real wage growth expectations for public sector employees. We note that for SCERS' active members, the actual average inflation plus "across the board" increase (i.e., wage inflation) over three year period ending June 30, 2016 was 1.3%.

Valuation Date	Actual Average Increase[12]	Actual Change in CPI[13]
June 30, 2014	0.1%	2.2%
June 30, 2015	1.8%	2.8%
June 30, 2016	1.9%	2.6%
Three Year Average	**1.3%**	**2.5%**

   Considering these factors, we recommend maintaining the real "across the board" salary increase assumption at 0.25%. This means that the combined inflation and "across the board" salary increase assumption will decrease from 3.50% to 3.25%.

3. **Merit and Promotional Increases:** As the name implies, these increases come from an employee's career advances. This form of pay increase differs from the previous two, since

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

[13] Based on the change in the Annual CPI for the San Francisco-Oakland-San Jose area compared to the prior year.

it is specific to the individual. For SCERS, there are service-specific merit and promotional increases.

The annual merit and promotional increases are determined by measuring the actual increases received by members over the experience period, net of the inflationary and real "across the board" pay increases. Increases are measured separately for Miscellaneous and Safety members. This is accomplished by:

a. Measuring each member's actual salary increase over each year of the experience period;

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

c. Categorizing these increases according to member demographics;

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

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

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

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

The following table shows the average increases over the three-year experience period before removing the inflationary component:

Years of Service	Average Increase (%)	
	Miscellaneous Members	Safety Members
0 – 1	6.10	8.35
1 – 2	9.03	8.26
2 – 3	8.36	8.60
3 – 4	6.59	7.08
4 – 5	5.29	6.76
5 – 6	4.09	6.94
6 – 7	3.83	6.09
7 – 8	4.16	5.51
8 – 9	4.20	5.10
9 – 10	4.22	4.98
10 or more	3.35	4.69

The annual increase in average salary for this three-year period was about 1.17% for Miscellaneous members and 1.16% for Safety members. The following table shows the average merit and promotional increases for the current three-year period, after removing the increases in average salary in each service category:

Years of Service	Average Merit and Promotional Salary Increase (%)	
	Miscellaneous Members	Safety Members
0 – 1	4.74	6.84
1 – 2	7.59	6.84
2 – 3	6.88	7.09
3 – 4	5.27	5.37
4 – 5	4.42	5.89
5 – 6	3.35	6.13
6 – 7	2.76	4.86
7 – 8	2.93	4.40
8 – 9	2.82	4.14
9 – 10	2.77	3.84
10 or more	2.06	3.49

The following table shows the actual and the current and recommended merit and promotional assumptions based on this recent experience:

Years of Service	Current vs. Proposed Merit and Promotional Salary Increase (%)					
	Miscellaneous Members			Safety Members		
	Current	Actual	Proposed	Current	Actual	Proposed
0 – 1	5.00	4.74	5.00	8.00	6.84	7.50
1 – 2	4.50	7.59	4.75	7.00	6.84	7.25
2 – 3	3.75	6.88	4.50	6.00	7.09	6.50
3 – 4	3.50	5.27	4.00	5.00	5.37	5.50
4 – 5	3.00	4.42	3.50	4.00	5.89	5.00
5 – 6	2.50	3.35	2.75	3.50	6.13	4.25
6 – 7	2.25	2.76	2.25	3.25	4.86	3.75
7 – 8	2.00	2.93	2.00	3.00	4.40	3.25
8 – 9	1.75	2.82	1.75	2.75	4.14	3.00
9 – 10	1.00	2.77	1.50	2.00	3.84	2.50
10 or more	1.00	2.06	1.25	1.75	3.49	2.00

Charts 1 and 2 provide a graphical comparison of the current, actual experience and proposed merit and promotional increases.

All three of these forces are incorporated into a salary increase assumption that is applied in the actuarial valuation to project future benefits and future normal cost contribution collections.

Based on this experience, we are proposing overall increases in the merit and promotional salary increases for both Miscellaneous and Safety members. Overall, salary increases are assumed to be slightly lower for Miscellaneous members and slightly higher for Safety members due to the lower price inflation assumption.

Active Member Payroll

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

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

CHART 1: MERIT AND PROMOTIONAL SALARY INCREASE RATES
MISCELLANEOUS MEMBERS
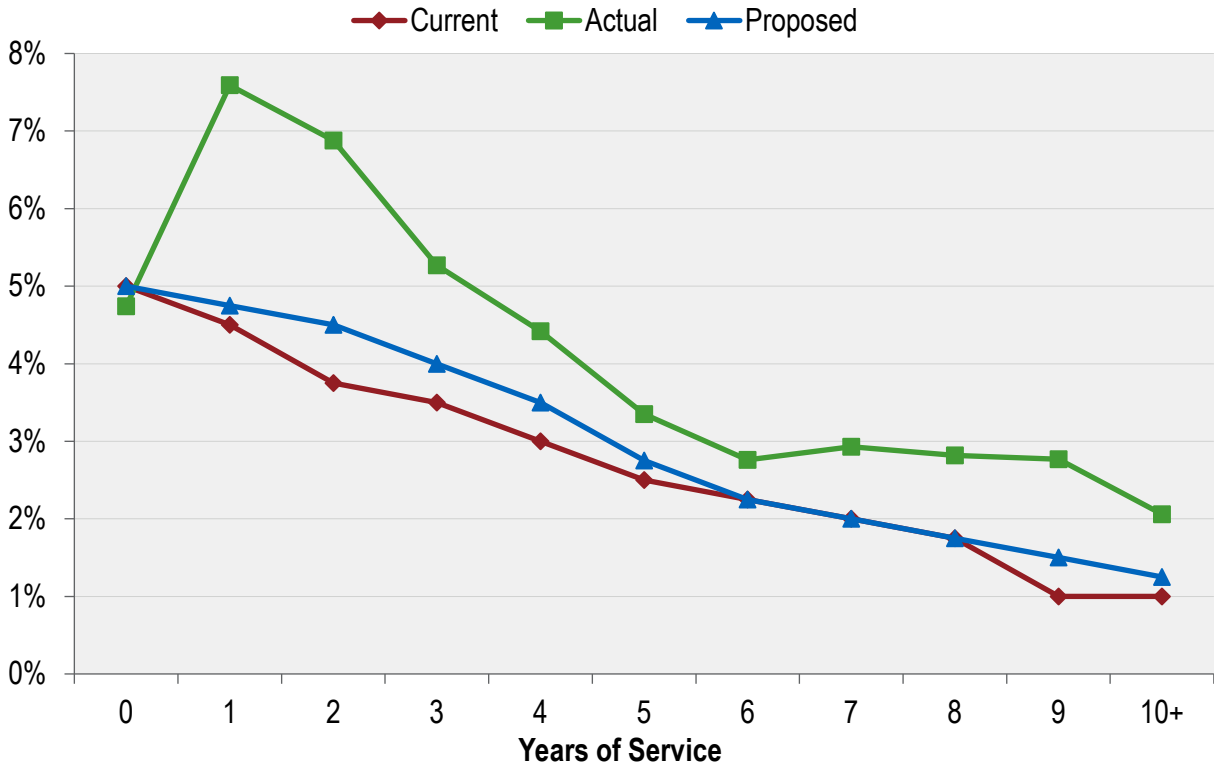
CHART 2: MERIT AND PROMOTIONAL SALARY INCREASE RATES
SAFETY MEMBERS
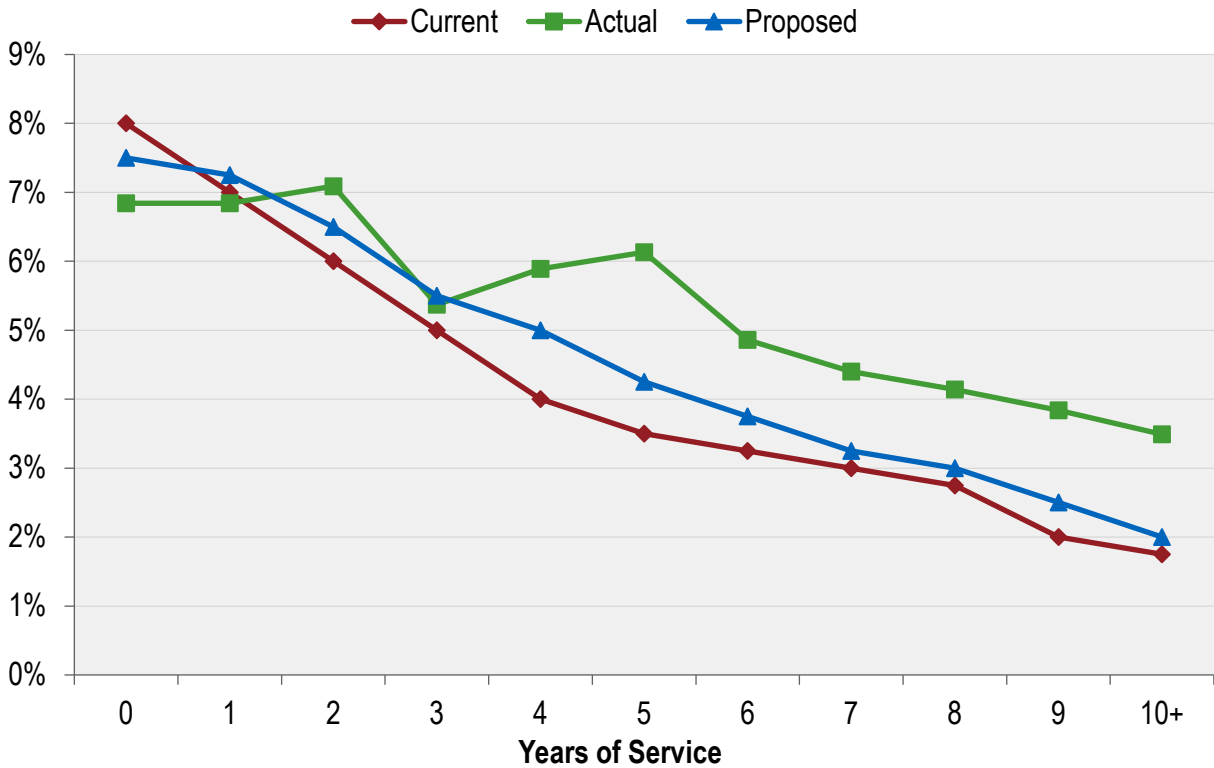
IV. Demographic Assumptions

A. Retirement Rates

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

The retirement experience during the current three-year period indicated that there were fewer actual retirements than expected from the Miscellaneous Tiers 1, 2 and 3 and Safety Tiers 1 and 2 member categories. For Miscellaneous Tiers 4 and 5, we are not recommending a change in the retirement assumptions because there is no data available to support a change (and these rates were developed specifically for those tiers).

During the three-year period, a retirement window was offered to DSA members who were eligible to retire. Salary increases were granted that would otherwise have been deferred if a member agreed to retire during the window. The System provided us with a listing of 172[14] members who signed up for the retirement window. For Safety, we studied the retirement experience both including and excluding these members. Excluding these members would have led to further reductions in the retirement rates. Since we are already proposing reductions in the retirement rates, we did not want to reduce them further by excluding these members and risk understating the proposed retirement rates. Therefore, the DSA members who retired during the retirement window are included in the analysis.

In this study, we have adjusted the retirement probabilities to reflect the most recent three-year experience. We have continued to balance this recent experience with the current assumptions so as to reflect the possibility that the most recent three-year experience was a statistical fluctuation related to recent economic conditions.

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[14]   Of the 172 DSA members, 120 were enrolled in the Safety Tiers and 52 were enrolled in the Miscellaneous Tiers.

Miscellaneous Tier 1

Age	Rate of Retirement (%)		
	Current Rate	Observed Rate	Proposed Rate
45 - 49	0.00	0.00	0.00
50	6.00	0.00	6.00
51	4.00	0.00	4.50
52	4.00	11.11	4.50
53	4.00	5.88	4.50
54	7.00	4.00	5.50
55	10.00	15.15	12.00
56	15.00	31.43	18.00
57	16.00	21.88	18.00
58	18.00	12.50	18.00
59	22.00	17.78	20.00
60	28.00	27.91	28.00
61	30.00	37.21	35.00
62	35.00	36.36	35.00
63	35.00	30.43	35.00
64	40.00	27.78	35.00
65	50.00	15.38	35.00
66	45.00	15.38	40.00
67	45.00	25.00	40.00
68	50.00	66.67	50.00
69	60.00	0.00	60.00
70	100.00	50.00	100.00

Miscellaneous Tiers 2 and 3

Age	Rate of Retirement (%)		
	Current Rate	Observed Rate	Proposed Rate
45 - 49	0.00	100.00*	0.00
50	2.00	0.97	2.00
51	2.00	1.65	2.00
52	2.00	2.68	2.00
53	3.00	3.17	3.00
54	4.00	2.85	4.00
55	6.00	6.49	6.00
56	6.00	5.77	6.00
57	8.00	7.42	8.00
58	12.00	6.30	10.00
59	14.00	10.58	12.00
60	14.00	10.33	12.00
61	14.00	15.34	14.00
62	25.00	26.98	25.00
63	30.00	17.49	25.00
64	35.00	16.00	30.00
65	40.00	31.70	35.00
66	45.00	32.20	40.00
67	45.00	25.23	40.00
68	50.00	21.33	50.00
69	60.00	32.14	60.00
70	100.00	24.38	100.00

* *Based on three members who retired between 45 - 49.*

Miscellaneous Tier 4

Age	Rate of Retirement (%)		
	Current Rate	Observed Rate	Proposed Rate
45 - 49	0.00	N/A	0.00
50	2.00	N/A	2.00
51	2.00	N/A	2.00
52	2.00	0.00*	2.00
53	2.00	50.00*	2.00
54	3.00	N/A	3.00
55	4.00	N/A	4.00
56	5.00	0.00*	5.00
57	6.00	0.00*	6.00
58	7.00	N/A	7.00
59	8.00	N/A	8.00
60	9.00	100.00*	9.00
61	10.00	N/A	10.00
62	18.00	N/A	18.00
63	16.00	N/A	16.00
64	20.00	N/A	20.00
65	25.00	N/A	25.00
66	20.00	N/A	20.00
67	20.00	N/A	20.00
68	30.00	N/A	30.00
69	40.00	N/A	40.00
70	100.00	0.00*	100.00

*   *There were members eligible to retire at these ages (although they did not elect to retire).
These members are generally eligible to retire due to reciprocal service or attaining age 70.*

Miscellaneous Tier 5

Age	Rate of Retirement (%)		
	Current Rate	Observed Rate	Proposed Rate
52	4.00	N/A	4.00
53	1.50	N/A	1.50
54	2.50	N/A	2.50
55	3.50	N/A	3.50
56	4.50	N/A	4.50
57	5.50	N/A	5.50
58	6.50	N/A	6.50
59	7.50	0.00*	7.50
60	8.50	N/A	8.50
61	9.50	0.00*	9.50
62	17.00	N/A	17.00
63	15.00	N/A	15.00
64	19.00	N/A	19.00
65	24.00	N/A	24.00
66	20.00	N/A	20.00
67	20.00	N/A	20.00
68	30.00	N/A	30.00
69	40.00	N/A	40.00
70	100.00	0.00*	100.00

* *There were members eligible to retire at these ages (although they did not elect to retire).*
  These members are generally eligible to retire due to reciprocal service or attaining age 70.

Safety Tiers 1 and 2

Age	Rate of Retirement (%)		
	Current Rate	**Observed Rate**	**Proposed Rate**
45	2.00	1.52	2.00
46	2.00	3.33	2.00
47	2.00	2.25	2.00
48	2.00	3.05	2.00
49	5.00	25.21	5.00
50	25.00	20.97	22.00
51	18.00	16.91	16.00
52	18.00	15.57	16.00
53	22.00	15.05	20.00
54	22.00	12.16	20.00
55	22.00	21.31	20.00
56	25.00	23.21	25.00
57	25.00	20.41	25.00
58	25.00	42.11	25.00
59	30.00	23.08	30.00
60	45.00	31.82	45.00
61	55.00	25.00	55.00
62	70.00	28.57	70.00
63	70.00	0.00	70.00
64	70.00	0.00	70.00
65	100.00	57.14	100.00
66	100.00	50.00	100.00
67	100.00	0.00	100.00
68	100.00	100.00	100.00
69	100.00	0.00	100.00
70	100.00	0.00	100.00

Safety Tier 3

	Rate of Retirement (%)		
Age	Current Rate	Observed Rate	Proposed Rate
45	1.50	N/A	1.50
46	1.50	N/A	1.50
47	1.50	N/A	1.50
48	1.50	N/A	1.50
49	4.00	0.00*	4.00
50	10.00	N/A	10.00
51	12.00	N/A	12.00
52	14.00	N/A	14.00
53	16.00	N/A	16.00
54	18.00	N/A	18.00
55	50.00	N/A	50.00
56	25.00	N/A	25.00
57	25.00	N/A	25.00
58	25.00	N/A	25.00
59	30.00	N/A	30.00
60	45.00	N/A	45.00
61	55.00	N/A	55.00
62	70.00	N/A	70.00
63	70.00	N/A	70.00
64	70.00	N/A	70.00
65	100.00	N/A	100.00
66	100.00	N/A	100.00
67	100.00	N/A	100.00
68	100.00	N/A	100.00
69	100.00	N/A	100.00
70	100.00	N/A	100.00

* *There were members eligible to retire at these ages (although they did not elect to retire). These members are generally eligible to retire due to reciprocal service.*

Safety Tier 4

Age	Rate of Retirement (%)		
	Current Rate	Observed Rate	Proposed Rate
50	15.00	N/A	15.00
51	10.50	N/A	10.50
52	12.00	N/A	12.00
53	14.00	N/A	14.00
54	15.50	N/A	15.50
55	40.00	N/A	40.00
56	25.00	N/A	25.00
57	25.00	N/A	25.00
58	25.00	N/A	25.00
59	25.00	N/A	25.00
60	45.00	N/A	45.00
61	55.00	N/A	55.00
62	70.00	N/A	70.00
63	70.00	N/A	70.00
64	70.00	N/A	70.00
65	100.00	N/A	100.00
66	100.00	N/A	100.00
67	100.00	N/A	100.00
68	100.00	N/A	100.00
69	100.00	N/A	100.00
70	100.00	N/A	100.00

Chart 3 compares actual experience with the current and proposed rates of retirement for Miscellaneous Tier 1 members. Chart 4 has the same data for Miscellaneous Tier 2 & 3 members and Chart 5 has the same data for Safety Tiers 1 & 2 members.

Deferred Vested Members

In prior valuations, deferred vested Miscellaneous and Safety members were assumed to retire at age 59 and 53, respectively. The average age at retirement over the prior three years was 59.7 for Miscellaneous and 53.5 for Safety. We recommend maintaining the assumed retirement age for deferred vested members for Miscellaneous and Safety members.

Reciprocity

It was also assumed that 40% of future inactive Miscellaneous and 50% of future inactive Safety deferred vested participants would be covered under a reciprocal retirement system and receive 4.50% and 5.25% salary increases from termination until their date of retirement for

Miscellaneous and Safety, respectively. Based on the actual experience that 33% of Miscellaneous and 42% Safety members went on to be covered by a reciprocal retirement system during the last three years, we recommend decreasing the current 40% reciprocal assumption for Miscellaneous to 35% and decreasing the current 50% reciprocal assumption for Safety to 45%. Based on our ultimate 1.25% and 2.00% recommended merit and promotional salary increase assumptions for members with ten or more years of service, we propose that a 4.50% and 5.25% salary increase assumption for Miscellaneous and Safety members, respectively, be used to anticipate salary increases from the date of termination from SCERS to the expected date of retirement for participants in a reciprocal retirement system.

Form of Payment and Survivor Continuance under the Unmodified Option

In prior valuations, it was assumed that all members would select the unmodified option at retirement. Actual experience for recent new retirees shows that around 85% select the unmodified option. Therefore, we recommend maintaining the assumption that all members will elect the unmodified option at retirement.

It was also assumed that 80% of all active male members and 55% of all active female members who selected the unmodified option would be married or have an eligible domestic partner when they retired. According to the experience of members who retired during the last three years, about 78% of all male members and 56% of all female members were married or had a domestic partner at retirement. We recommend no change to the current 80% married or domestic partner assumption for male members and 55% married or domestic partner assumption for female members.

Based on observed experience from members who retired during the last three years that when male active members retire, female spouses are about 2.4 years younger than their male spouses, we also recommend that we maintain the assumption that when male active members retire, female spouses are assumed to be three years younger than their male spouses. For when female active members retire, based on observed experience that when female active members retire, male spouses are about 1.6 years older than their female spouses, we recommend changing the assumption that male spouses are three years older to the assumption that male spouses are two year older than their female spouses. Spouses will be assumed to be of the opposite sex to the member as only 1.8% of members who retired during the last three years were reported with a spouse or domestic partner of the same sex.
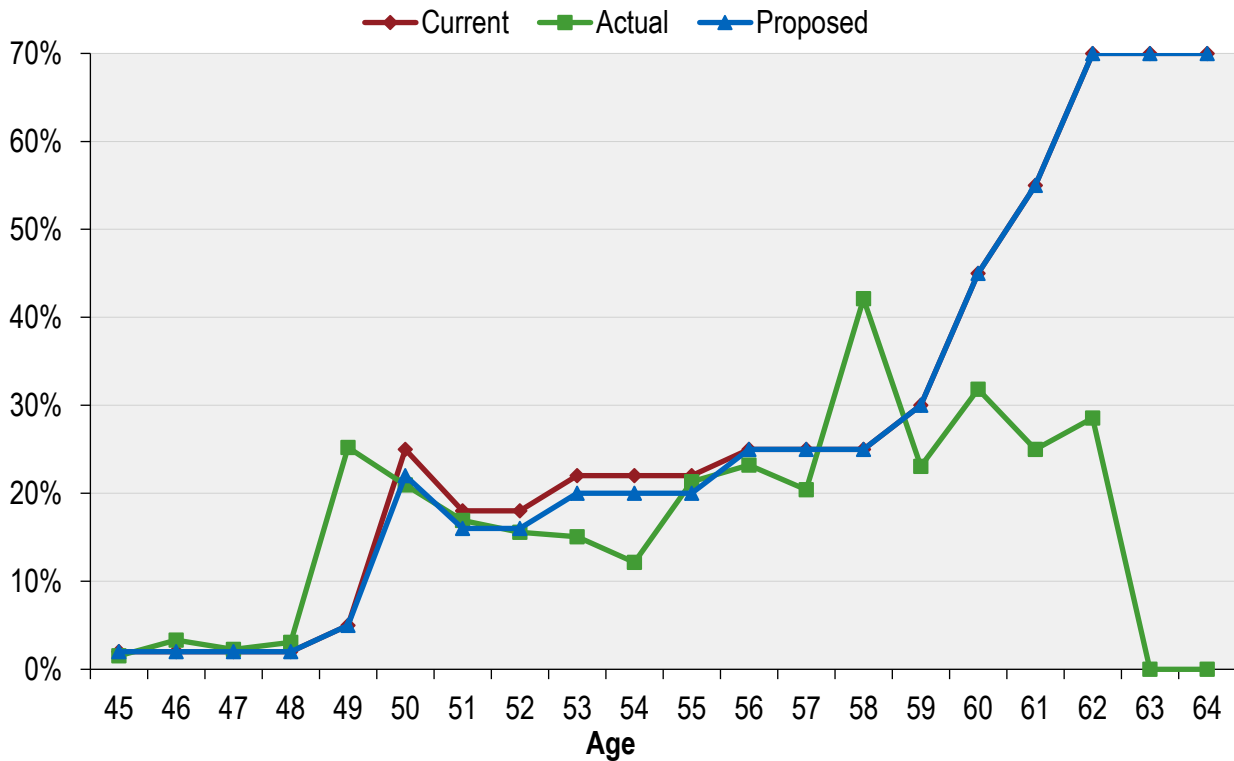
CHART 3: RETIREMENT RATES MISCELLANEOUS TIER 1 MEMBERS
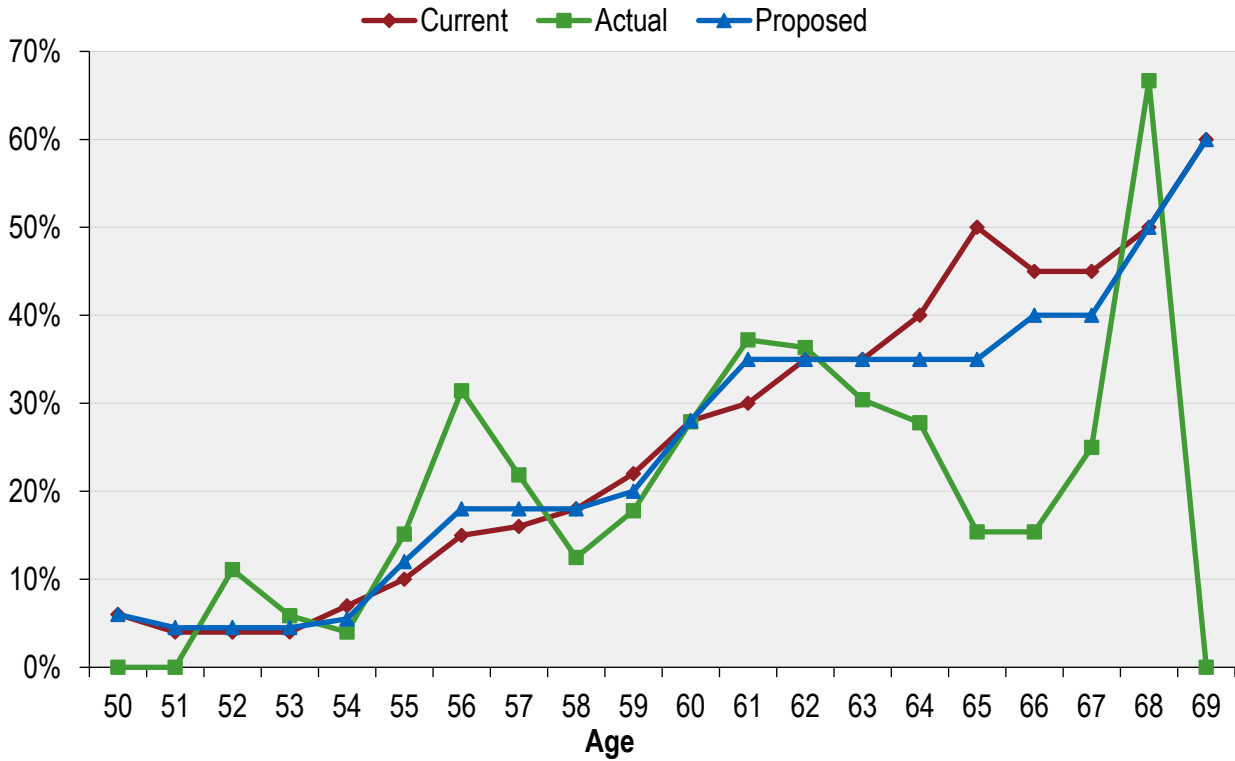
CHART 4: RETIREMENT RATES MISCELLANEOUS TIER 2 & 3 MEMBERS
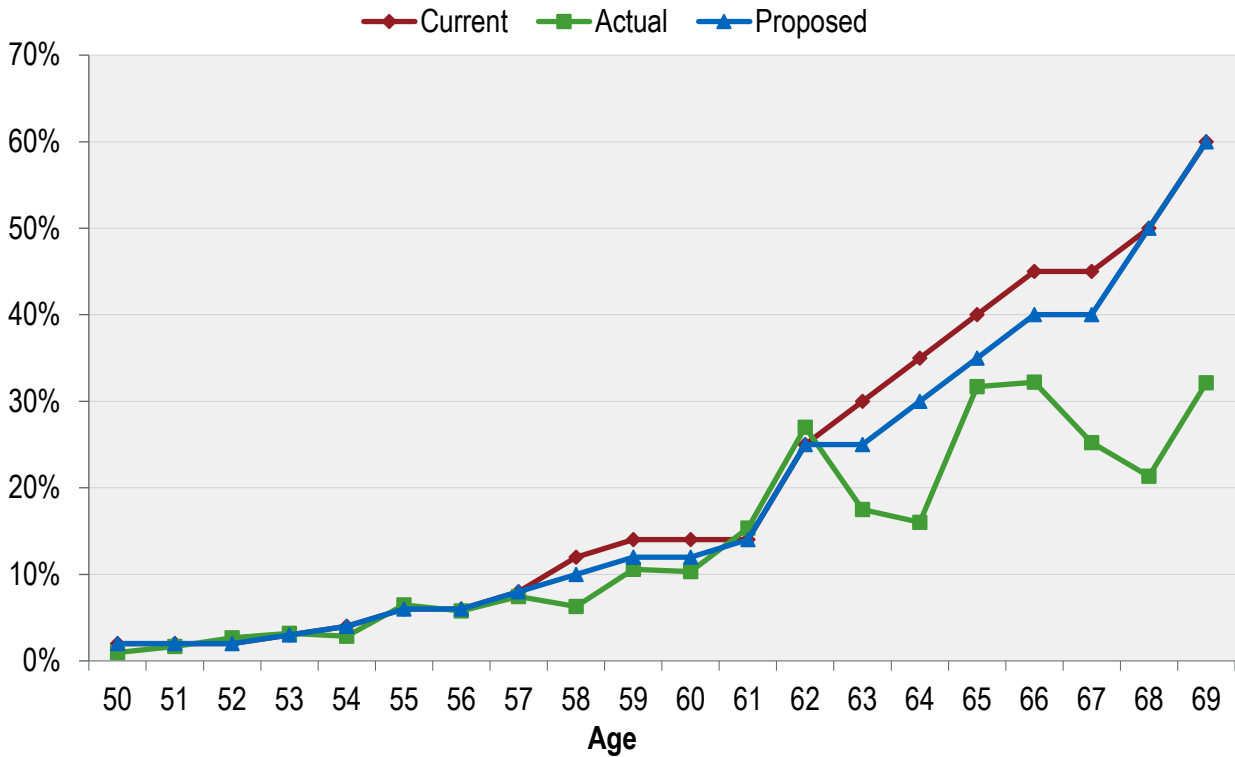
CHART 5: RETIREMENT RATES
SAFETY TIER 1 & 2 MEMBERS

B. Mortality Rates - Healthy

The "healthy" mortality rates project the life expectancy of a member who retires from service (i.e., who did not retire on a disability pension). For Miscellaneous members, the table currently being used for post-service retirement mortality rates is the RP-2000 Combined Healthy Mortality Table (separate tables for males and females) projected with scale BB to 2022 with no age adjustments. For Safety members, the table currently being used is the RP-2000 Combined Healthy Mortality Table (separate tables for males and females) projected with scale BB to 2022 set back one year for males and set forward two years for females. All beneficiaries are assumed to have the same mortality of a Miscellaneous member of the opposite sex who has taken a service (non-disabled) retirement.

Note that when we use a mortality table with a set forward in a valuation for a group of retirees, we anticipate that the group has a shorter life expectancy when compared to the unadjusted table. The opposite is true when we use a mortality table with a setback. For example, a 50-year old member under the age adjusted table, assuming a one year set forward, is anticipated to have the same life expectancy as a 51-year old under the unadjusted table.

The Society of Actuaries (SOA) has published the RP-2014 family of mortality tables and associated mortality improvement scales. Within that family of mortality tables, there are mortality rates developed for annuitants on a "headcount" weighted basis that weight all retirees at the same age the same way without regard to the level of benefits those annuitants are receiving from a retirement plan. Mortality rates are also developed for annuitants on a "benefit"

weighted basis, with higher credibility assigned to experience from annuitants receiving larger benefits. The headcount-weighted basis is the more common practice currently and is the approach used by Segal in the past for its California public system clients (including SCERS) and by other public sector actuaries in California.

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

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

The SOA is in the process of collecting data from public sector plans so that they can develop mortality tables based on public sector experience comparable to the RP-2014 mortality tables developed using data collected from private and multi-employer plans. Furthermore, after publishing the two-dimensional MP-2014 life expectancy improvement scale, the SOA replaced it with the two-dimensional MP-2015 life expectancy improvement scales to remove some of the conservatism built into the MP-2014 scale and to better reflect the most recent data of mortality improvement from the Social Security Administration. We understand that the Retirement Plans Experience Committee of the Society of Actuaries (RPEC) intends to publish annual updates to their mortality improvement scales. Improvement scale MP-2016 is the latest improvement scale available.

We recommend that given the trend in the retirement industry to move towards generational mortality, it would be reasonable for the Board to adopt the Headcount-Weighted RP-2014 mortality table (adjusted for SCERS experience), and project the mortality improvement generationally using the two-dimensional MP-2016 mortality improvement scale. Once the SOA has included data from public sector plans in developing the new tables, we will also include a discussion with the Board on whether to consider the benefit weighted mortality rates in a future experience study.

In the table below, we have provided the approximate increase in the total employer and member contribution rates based on the different approaches to build in margin for future mortality improvements.

	Employer and Member Contribution Rate Impact Combined
Headcount Weighted RP-2014 Family of Tables – Static Approach with Increased Margin*	2.8% of payroll
Benefit Weighted RP-2014 Family of Tables – Static Approach without Increased Margin	2.2% of payroll
Headcount Weighted RP-2014 Family of Tables – Generational Approach	**3.0% of payroll**

*   *Includes an increased margin of 20% to anticipate the move towards a "generational" approach.*

Pre-Retirement Mortality

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

From the RP-2014 family of tables, we recommend that pre-retirement mortality follow the Headcount-Weighted RP-2014 Employee Mortality Table (separate tables for males and females) times 50%, projected generationally with the two-dimensional scale MP-2016, all to account for the lower incidences of observed pre-retirement death on the combined Miscellaneous and Safety workforce. All Miscellaneous pre-retirement deaths are assumed to be non-duty while 50% of Safety pre-retirement deaths are assumed to be non-duty and the rest are assumed to be duty.

Post- Retirement Mortality (Service Retirements)

Our analysis starts with a table that shows, among all retired members, the actual deaths compared to the expected deaths under the current assumptions for the last six years.[15] We also show the deaths under proposed assumptions. In prior years we have generally set the mortality assumption using a static mortality projection so that actual deaths will be at least 10% greater than those assumed. As noted above, we are recommending the use of a generational mortality table rather than static mortality. A generational mortality table incorporates a more explicit assumption for future mortality improvement. Accordingly, the goal is to start with a mortality table that closely matches the current experience (without a margin for future mortality improvement), and then reflect mortality improvement by projecting lower mortality rates in future years. That is why the current actual to expected ratio shown in the table below for Miscellaneous and Safety is 102% and 95%, respectively. In future years these ratios would remain around 100%, as long as actual mortality improved at the same rates as anticipated in the

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[15]   Note that in order to use more actual SCERS experience in our analysis, we have used experience for a six-year period from both the current and the last experience study periods to study this assumption.

generational mortality tables. The actual deaths compared to the expected deaths under the current and proposed assumptions for the last six years are as follows:

Year Ending June 30	Miscellaneous – Healthy[*]			Safety - Healthy		
	Current Expected Deaths	Actual Deaths	Proposed Expected Deaths	Current Expected Deaths	Actual Deaths[**]	Proposed Expected Deaths
2011	161	171	183	13	7	13
2012	169	199	192	15	14	14
2013	178	195	202	16	16	15
2014	189	223	214	17	17	16
2015	198	234	224	18	16	18
2016	210	254	235	22	20	19
Total	1,105	1,276	1,250	101	90	95
Actual / Expected	115%		102%	89%		95%

*   *Includes beneficiaries of Miscellaneous and Safety members.*

** *There were 37 and 53 deaths during 2010-2013 and 2013-2016, respectively. For informational purposes, there were 51 deaths during 2007-2010.*

For Miscellaneous members, the ratio of actual to expected deaths was 115%. We recommend updating the current table to the RP-2014 Headcount-Weighted Healthy Annuitant Mortality Table (separate tables for males and females) set forward one year for males and no age adjustment for females. This table is then projected generationally with the two-dimensional mortality improvement scale MP-2016. This will bring the current actual to expected ratio to 102%.

For Safety members, the ratio of actual to expected deaths was 89%. We recommend updating the current table to the RP-2014 Headcount-Weighted Healthy Annuitant Mortality Table (separate tables for males and females) set back four years for males and females. This table is then projected generationally with the two-dimensional mortality improvement scale MP-2016. This will bring the current actual to expected ratio to 95%.

Of note is that the ratio of actual to expected deaths for Safety members under the proposed assumptions is lower than the 100% ratio we would normally propose to allow for some margin in future mortality improvements. This is the case because the number of actual deaths during the three-year period from 2011 to 2013 is much lower than during the three-year period from either 2007 to 2010 or 2014 to 2016.

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

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

Chart 7 has the same comparison for Safety members. Experience shows that there were fewer deaths than predicted by the current table over the last six years.

Chart 8 shows the life expectancies under the current and the proposed tables for Miscellaneous members and all beneficiaries.

Chart 9 has the same information for Safety members.

The expected deaths (Charts 6 and 7) and life expectancies (Charts 8 and 9) under the proposed generational mortality table are based on mortality rates from 2014, which is the base year of the table, with any applicable age adjustments. In practice, life expectancies will be increased after applying the mortality improvement scale.
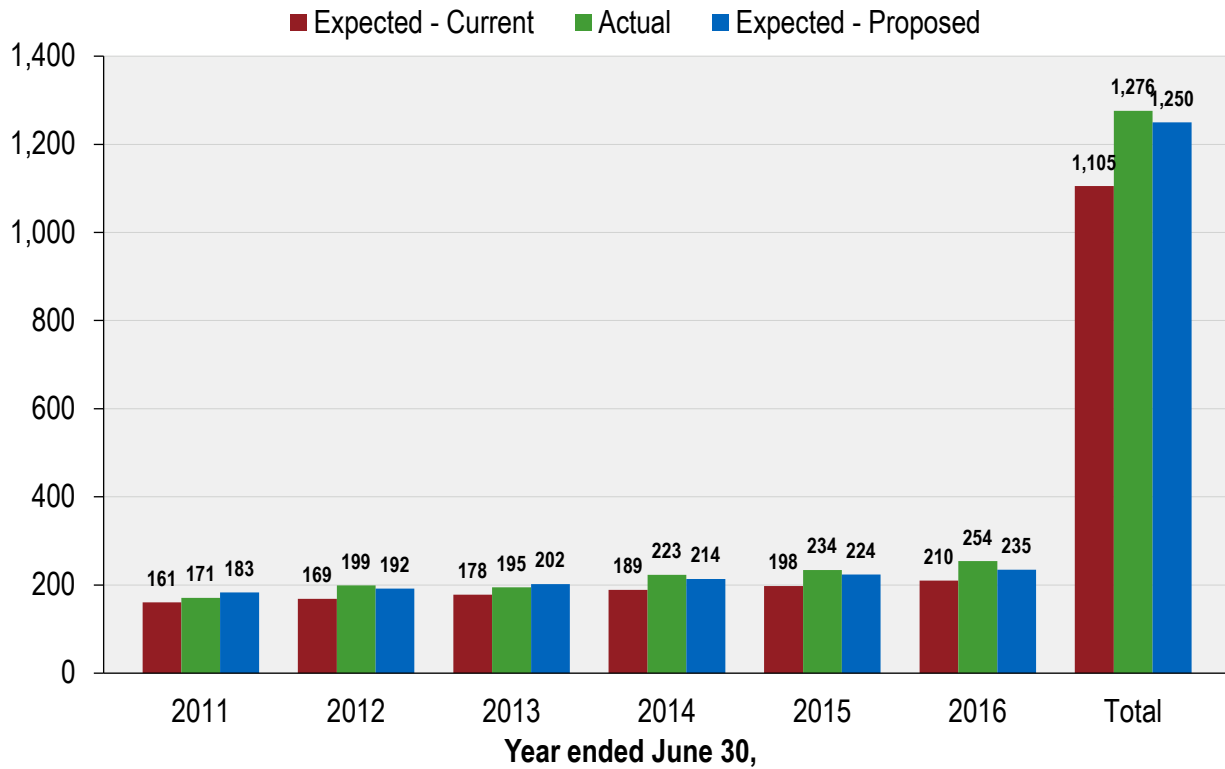
Mortality Table for Member Contributions, Optional Forms of Payment and Reserves

There are administrative reasons why a generational mortality table is more difficult to implement for determining member contributions for legacy tiers (i.e., Miscellaneous Tiers 1, 2, 3 and 4 and Safety Tiers 1, 2 and 3), optional forms of payment and reserves. One emerging practice is to approximate the use of a generational mortality table by the use of a static table with projection of the mortality improvement over a period that is close to the duration of the benefit payments for active members. We would recommend the use of this approximation.

We recommend that the mortality table used for determining contributions for Miscellaneous members be updated from the RP-2000 Combined Healthy Mortality Table projected with Scale BB to 2022 with no age adjustments weighted 40% male and 60% female to the RP-2014 Headcount-Weighted Healthy Annuitant Mortality Table projected 20 years with the two-dimensional mortality improvement scale MP-2016 set forward one year for males and no age adjustment for females weighted 40% male and 60% female. This is based on the proposed valuation mortality table for Miscellaneous members and the actual sex distribution of Miscellaneous members.

For Safety members, we recommend the mortality table be changed from the RP-2000 Combined Healthy Mortality Table projected with Scale BB to 2022 set back one year for males and set forward two years for females weighted 70% male and 30% female to the RP-2014 Headcount-Weighted Healthy Annuitant Mortality Table projected 20 years with the two-dimensional mortality improvement scale MP-2016 set back four years for males and females weighted 75% male and 25% female. This is based on the proposed valuation mortality table for Safety members and the actual sex distribution of Safety members.

CHART 6: POST-RETIREMENT DEATHS
MISCELLANEOUS – NON-DISABLED MEMBERS

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

Year ended June 30,	Expected - Current	Actual	Expected - Proposed
2011	161	171	183
2012	169	199	192
2013	178	195	202
2014	189	223	214
2015	198	234	224
2016	210	254	235
Total	1,105	1,276	1,250

CHART 7: POST-RETIREMENT DEATHS
SAFETY – NON-DISABLED MEMBERS

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

Year ended June 30,	Expected - Current	Actual	Expected - Proposed
2011	13	7	13
2012	15	14	14
2013	16	16	15
2014	17	17	16
2015	18	16	18
2016	22	20	19
Total	101	90	95
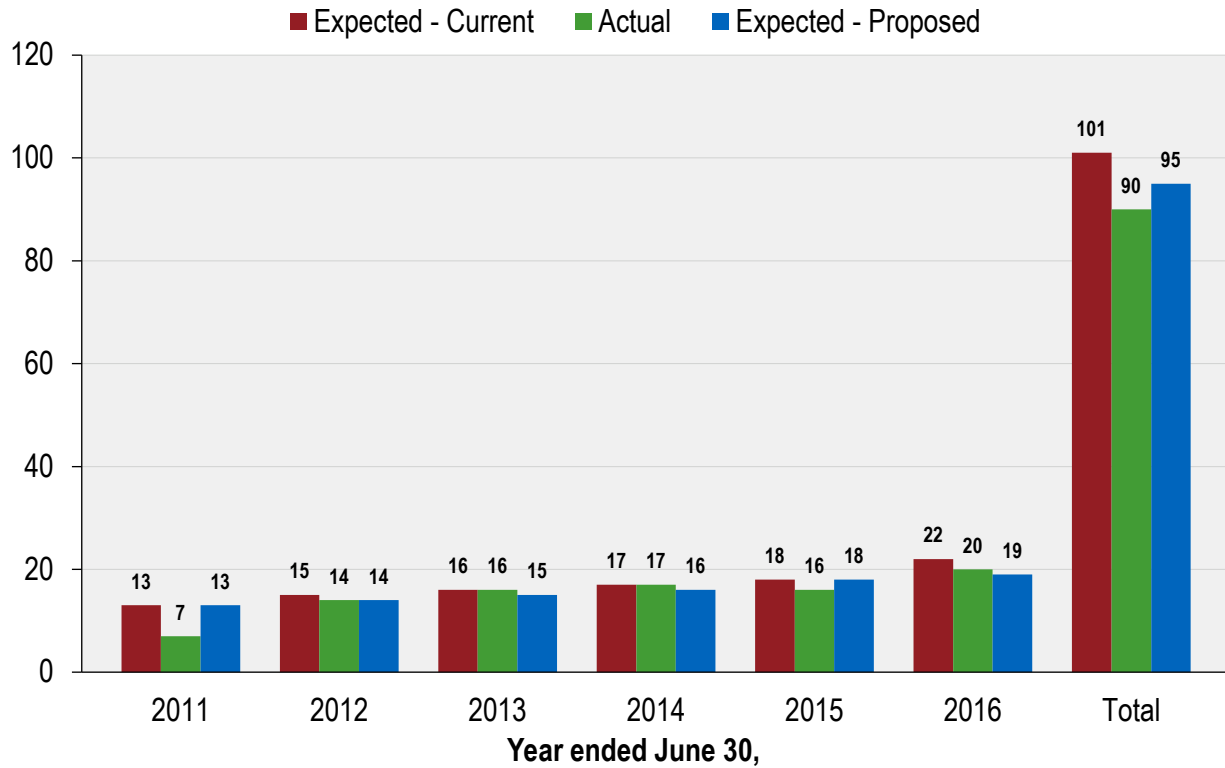
CHART 8: LIFE EXPECTANCIES
MISCELLANEOUS – NON-DISABLED MEMBERS
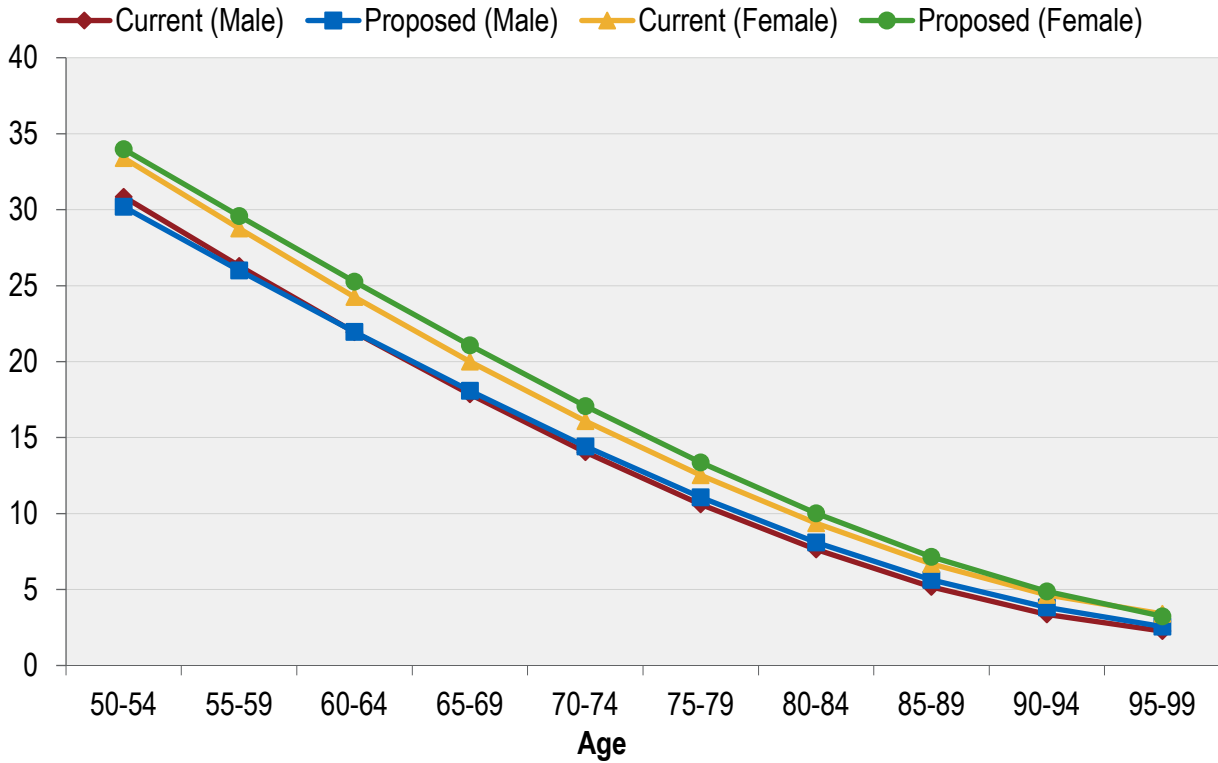
CHART 9: LIFE EXPECTANCIES
SAFETY – NON-DISABLED MEMBERS
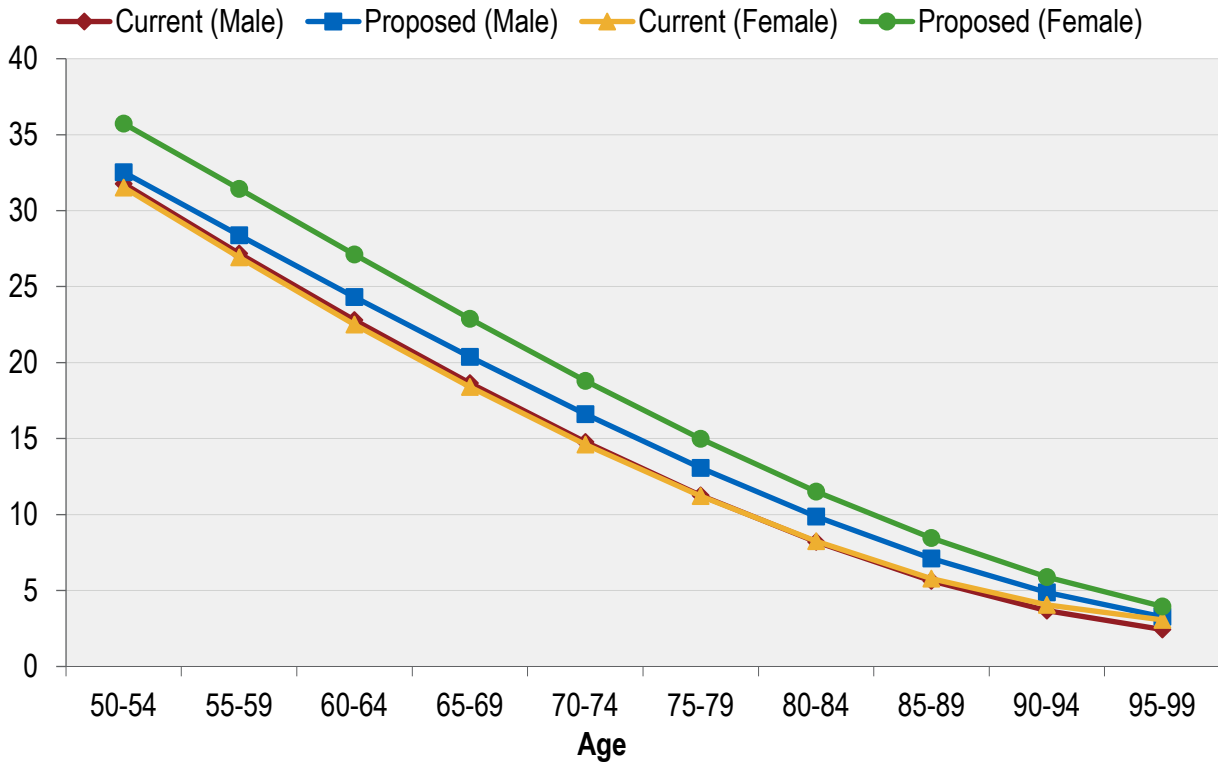
C. Mortality Rates - Disabled

Since mortality rates for disabled members can vary from those of healthy members, a different mortality assumption is often used. For Miscellaneous members, the table currently being used is the RP-2000 Disabled Retiree Mortality Table (separate tables for males and females) projected with Scale BB to 2022 with no age adjustment for males and set forward three years for females. For Safety members, the table currently being used is the RP-2000 Combined Healthy Mortality Table (separate tables for males and females) projected with Scale BB to 2022 set forward two years for males and females.

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

Year Ending June 30	Miscellaneous - Disabled			Safety - Disabled		
	Current Expected Deaths	Actual Deaths	Proposed Expected Deaths	Current Expected Deaths	Actual Deaths	Proposed Expected Deaths
2011	20	24	21	3	4	5
2012	21	23	21	3	3	5
2013	20	20	21	5	9	5
2014	20	11	21	4	6	6
2015	22	27	23	4	7	6
2016	22	29	22	5	5	6
Total	**125**	**134**	**129**	**24**	**34**	**33**
Actual / Expected	107%		104%	142%		103%

Based on the actual experience, we recommend changing the mortality table for Miscellaneous disabled members to the RP-2014 Headcount-Weighted Healthy Annuitant Mortality Table (separate tables for males and females) set forward seven years for males and set forward eight years for females. This table is then projected generationally with the two-dimensional mortality improvement scale MP-2016. This will bring the current actual to expected ratio to 104%.

Likewise, based on the actual experience, we recommend changing the mortality table for Safety disabled members to the RP-2014 Headcount-Weighted Healthy Annuitant Mortality Table (separate tables for males and females) set forward four years for males and females. This table is then projected generationally with the two-dimensional mortality improvement scale MP-2016. This will bring the current actual to expected ratio to 103%.

Chart 10 compares actual to expected deaths under both the current and proposed assumptions for disabled Miscellaneous members over the last six years. Experience shows that there were more deaths than predicted by the current table.

Chart 11 has the same comparison for Safety members. Experience shows that there were more deaths than predicted by the current table.

Chart 12 and 13 show the life expectancies under both the current and proposed tables for Miscellaneous and Safety, respectively.

CHART 10: POST-RETIREMENT DEATHS
MISCELLANEOUS - DISABLED MEMBERS

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

Year ended June 30,	Expected - Current	Actual	Expected - Proposed
2011	20	24	21
2012	21	23	21
2013	20	20	21
2014	20	11	21
2015	22	27	23
2016	22	29	22
Total	125	134	129
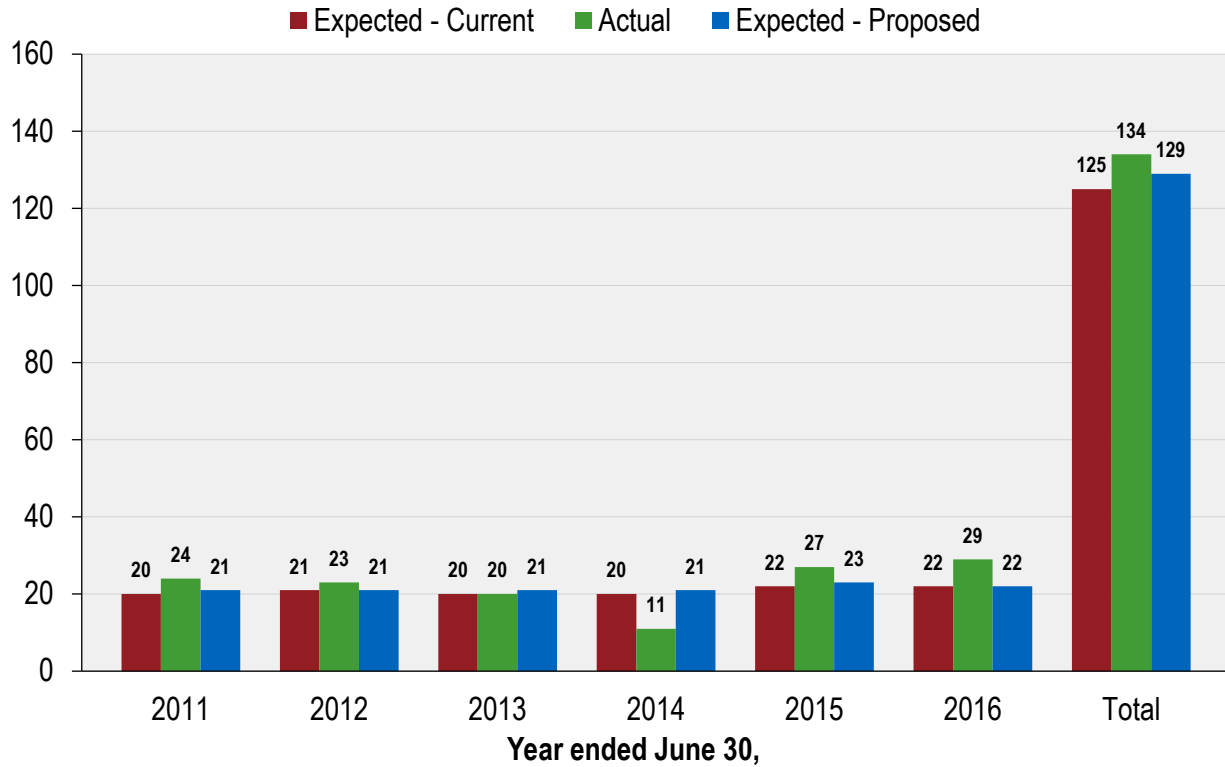
CHART 11: POST-RETIREMENT DEATHS
SAFETY - DISABLED MEMBERS

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

Year ended June 30,	Expected - Current	Actual	Expected - Proposed
2011	3	4	5
2012	3	3	5
2013	5	9	5
2014	4	6	6
2015	4	7	6
2016	5	5	6
Total	24	34	33
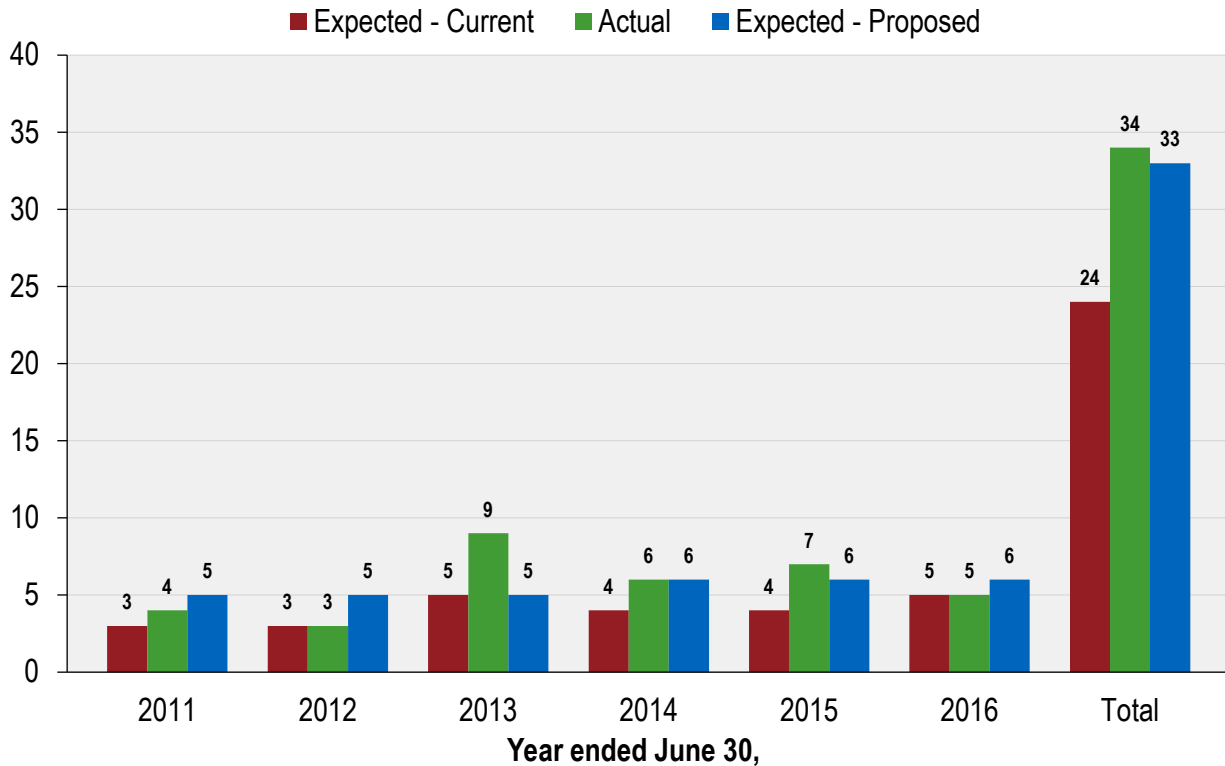
**CHART 12: LIFE EXPECTANCIES
MISCELLANEOUS - DISABLED MEMBERS**
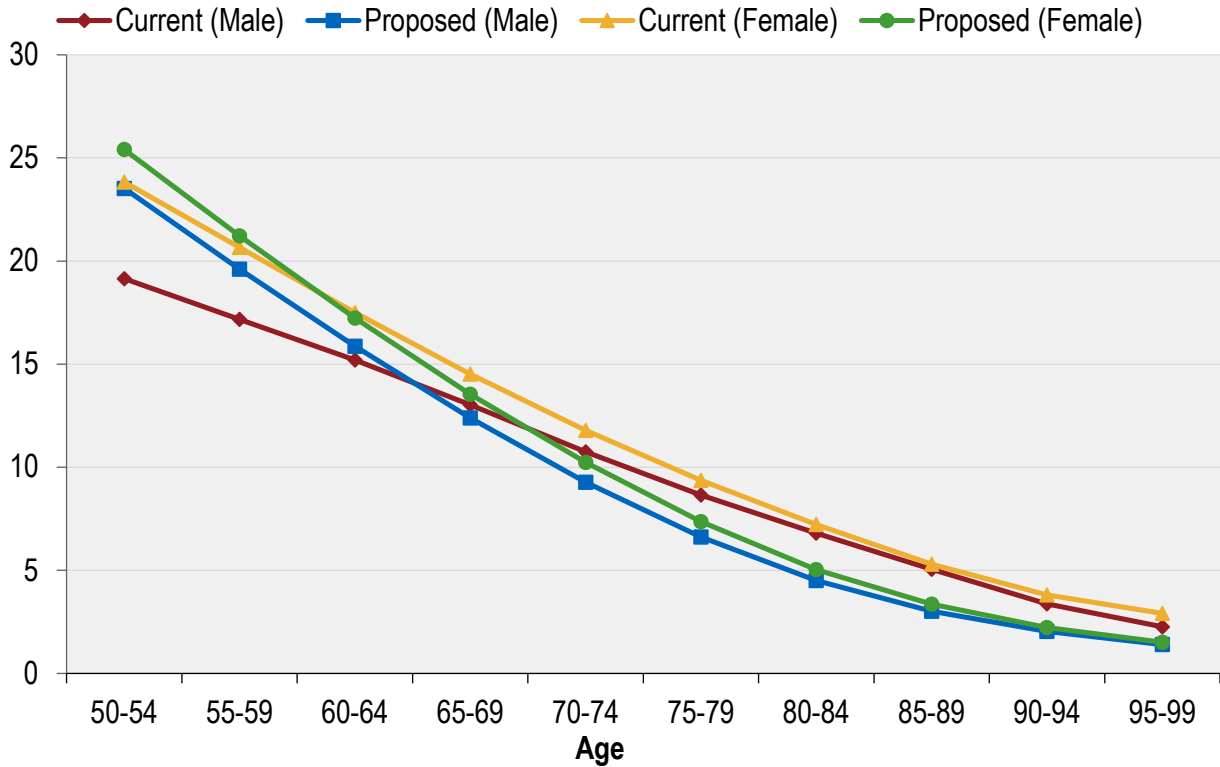
**CHART 13: LIFE EXPECTANCIES
SAFETY - DISABLED MEMBERS**
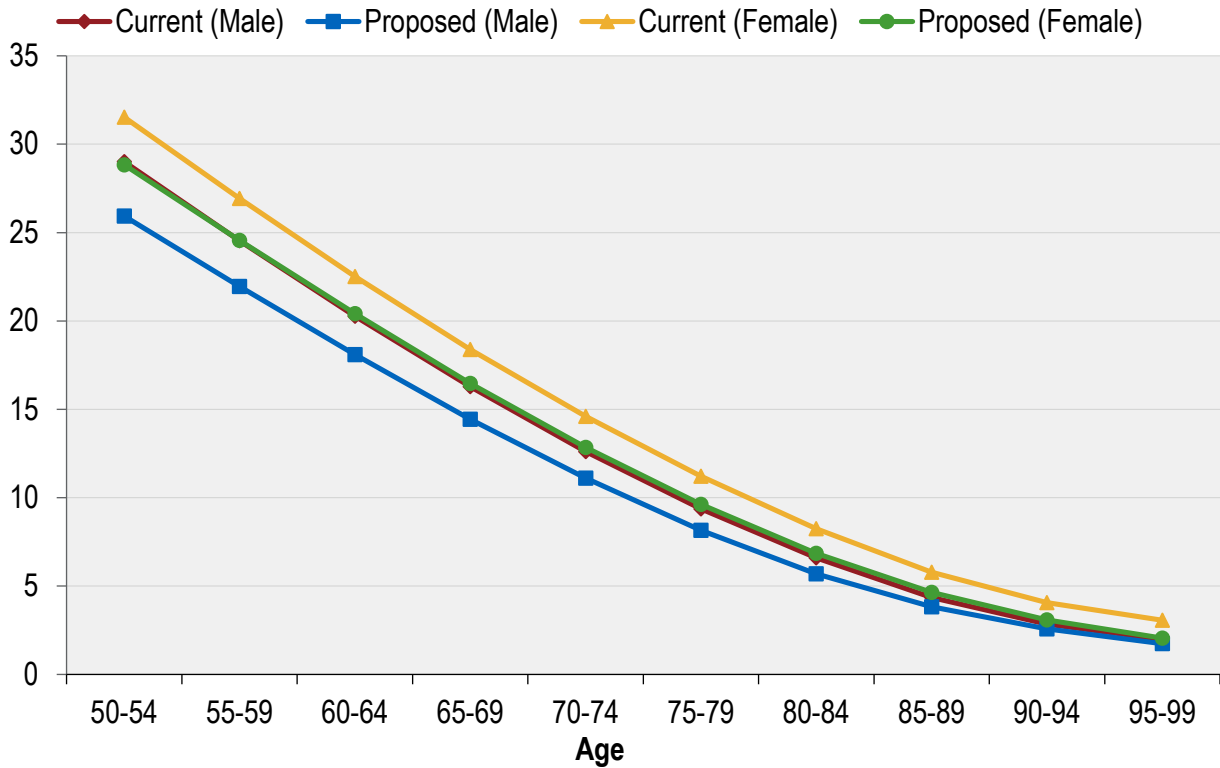
D. Termination Rates

Termination rates include all terminations for reasons other than death, disability, or retirement. Under the current assumptions there is an overall incidence of termination assumed, combined with assumptions, based on the plan membership, refund election and years of service, that an terminated vested member will choose a deferred vested benefit or will choose a refund of contributions. With this study, we continue to recommend that this same assumption structure be used.

For members who terminate employment with less than five years of service, it is anticipated under the current assumptions that 75% of Miscellaneous members and 50% of Safety members would elect a refund while the remaining 25% and 50% of Miscellaneous and Safety members, respectively, would elect a deferred retirement benefit. For members with over five years of service, it is anticipated under the current assumptions that 50% of Miscellaneous members and 20% of Safety members would elect a refund of contributions while the remaining 50% and 80% of Miscellaneous and Safety members, respectively, would elect a deferred retirement benefit.

The termination experience over the last three years for Miscellaneous and Safety members separated between those members with under five years of service and those with five or more years of service is as follows:

Rates of Termination – Fewer than Five Years of Service

	Termination Rate (%)					
	Miscellaneous			Safety		
Years of Service	Current Rate	Observed Rate	Proposed Rate	Current Rate	Observed Rate	Proposed Rate
0 – 1	13.00	13.91	13.00	8.00	4.55	6.00
1 – 2	8.00	7.40	8.00	6.00	3.43	5.00
2 – 3	7.00	5.91	7.00	5.00	2.99	4.00
3 – 4	6.00	6.72	6.00	4.00	2.17	3.00
4 – 5	5.50	5.93	5.50	3.00	3.53	3.00

Rates of Termination – Five or More Years of Service

| | Termination Rate (%) | | | | | |
| | Miscellaneous | | | Safety | | |
Age	Current Rate	Observed Rate	Proposed Rate	Current Rate	Observed Rate	Proposed Rate
20 – 24	5.00	0.00	5.50	2.50	0.00	2.50
25 – 29	5.00	5.26	5.50	2.50	2.50	2.50
30 – 34	4.50	5.38	5.00	2.50	1.91	2.00
35 – 39	4.00	4.05	4.00	2.00	0.87	1.50
40 – 44	3.00	2.68	3.00	1.75	0.59	1.25
45 – 49	2.50	2.00	2.50	1.50	0.76	1.00
50 – 54	2.00	3.69	2.40	1.50	0.00	1.00
55 – 59	1.75	3.28	2.30	1.50	3.33	1.00
60 – 64	1.00	3.94	2.20	1.50	0.00	1.00
65 – 69	1.00	11.28	1.00	0.00	0.00	0.00

Chart 14 compares actual to expected terminations of the past three years for both the current and proposed assumptions for Miscellaneous members and Safety members.

Chart 15 shows the current, along with the proposed withdrawal rates for Miscellaneous members with less than five years of service.

Chart 16 shows the same information as Chart 15, but for Safety members.

Chart 17 shows the current, along with the proposed termination rates for Miscellaneous members with five or more years of service.

Chart 18 shows the same information as Chart 17, but for Safety members.

Based upon the recent experience, we recommend slight adjustments to the withdrawal rates for Miscellaneous and Safety members.

Under the current withdrawal assumptions, for members with less than five years of service, it is anticipated under the current assumptions that 75% of Miscellaneous members and 50% of Safety members would elect a refund while the remaining 25% and 50% of Miscellaneous and Safety members, respectively, would elect a deferred retirement benefit. For members with over five years of service, it is anticipated under the current assumptions that 50% of Miscellaneous members and 20% of Safety members would elect a refund of contributions while the remaining 50% and 80% of Miscellaneous and Safety members, respectively, would elect a deferred retirement benefit.

Because there is often a lag between when a member terminates employment and when that member makes an election to receive either a refund of contributions or a deferred retirement benefit, we tracked the election made by all members who terminated during 2013/2014 from the date of termination through the end of the experience study period (June 30, 2016) to determine

the proportion of members that elect to leave their contributions on deposit. The table below shows the proportion of members assumed to elect a refund of contributions separately for members with less than five years of service and members with five or more years of service as well as Miscellaneous and Safety members.

Election for Refund of Contributions					
Members with Fewer than Five Years of Service			Members with Five or More Years of Service		
Current Assumption	Observed Rate	Proposed Assumption	Current Assumption	Observed Rate	Proposed Assumption
Miscellaneous 75%	58%	65%	50%	25%	40%
Safety 50%	47%	50%	20%	9%	15%

We will also continue to assume that all termination rates are zero at any age where members are assumed to retire. That means that, at these ages, the members will either retire (and commence receiving a benefit) or continue working.

CHART 14: ACTUAL NUMBER OF TERMINATIONS COMPARED TO EXPECTED

June 30, 2013 - 2016
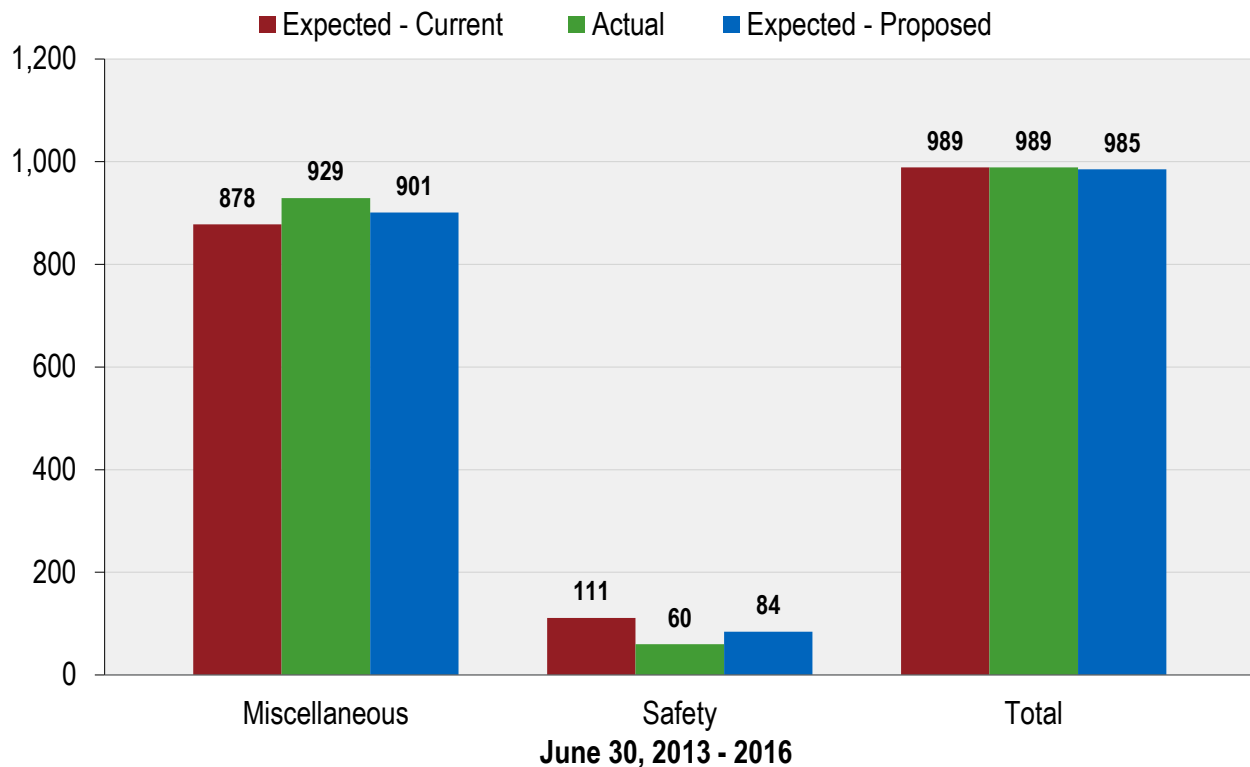
CHART 15: TERMINATION RATES – MISCELLANEOUS
LESS THAN FIVE YEARS OF SERVICE
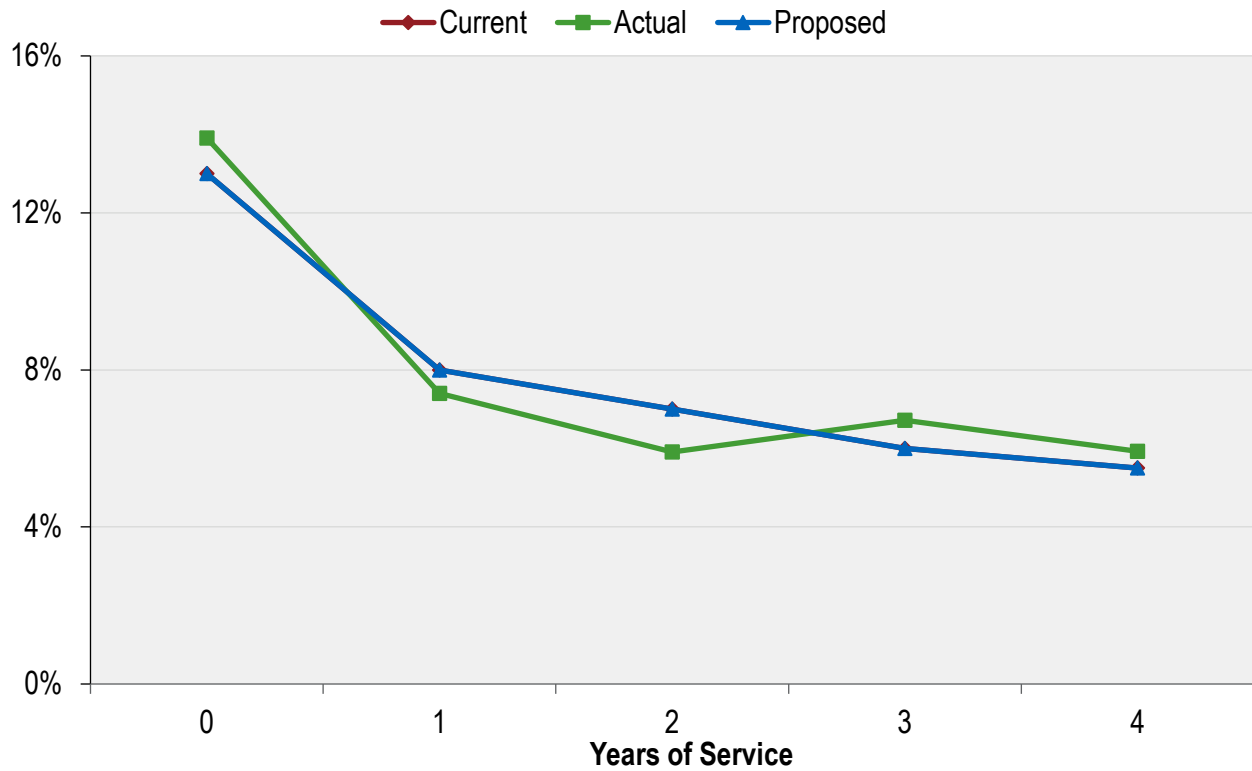
CHART 16: TERMINATION RATES – SAFETY
LESS THAN FIVE YEARS OF SERVICE
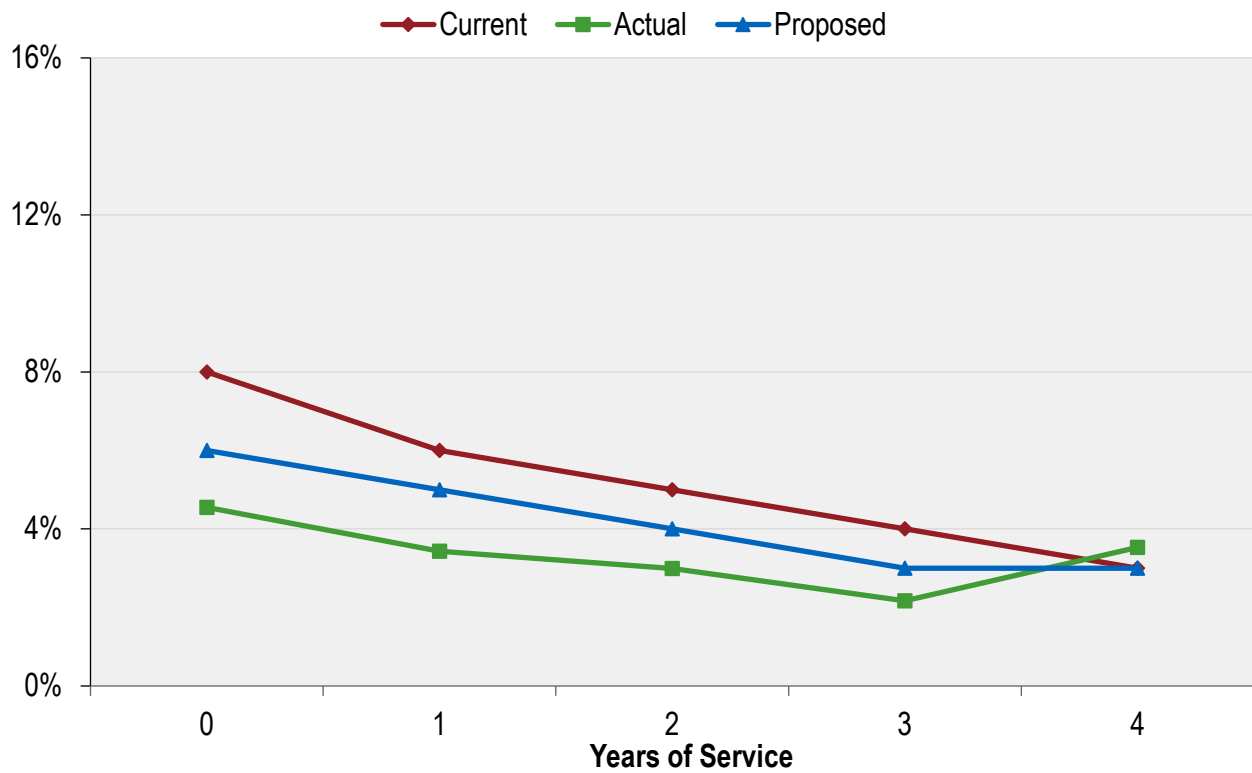
CHART 17: TERMINATION RATES – MISCELLANEOUS
MORE THAN FIVE YEARS OF SERVICE

CHART 18: TERMINATION RATES – SAFETY
MORE THAN FIVE YEARS OF SERVICE

E. Disability Incidence Rates

When a member becomes disabled, he or she may be entitled to at least a 50% of pay pension (duty disability), or a pension that depends upon the member's years of service (non-duty disability). The following summarizes the actual incidence of combined duty and non-duty disabilities over the past three years compared to the current and proposed assumptions for both duty and non-duty disability incidence:

Rates of Disability Incidence

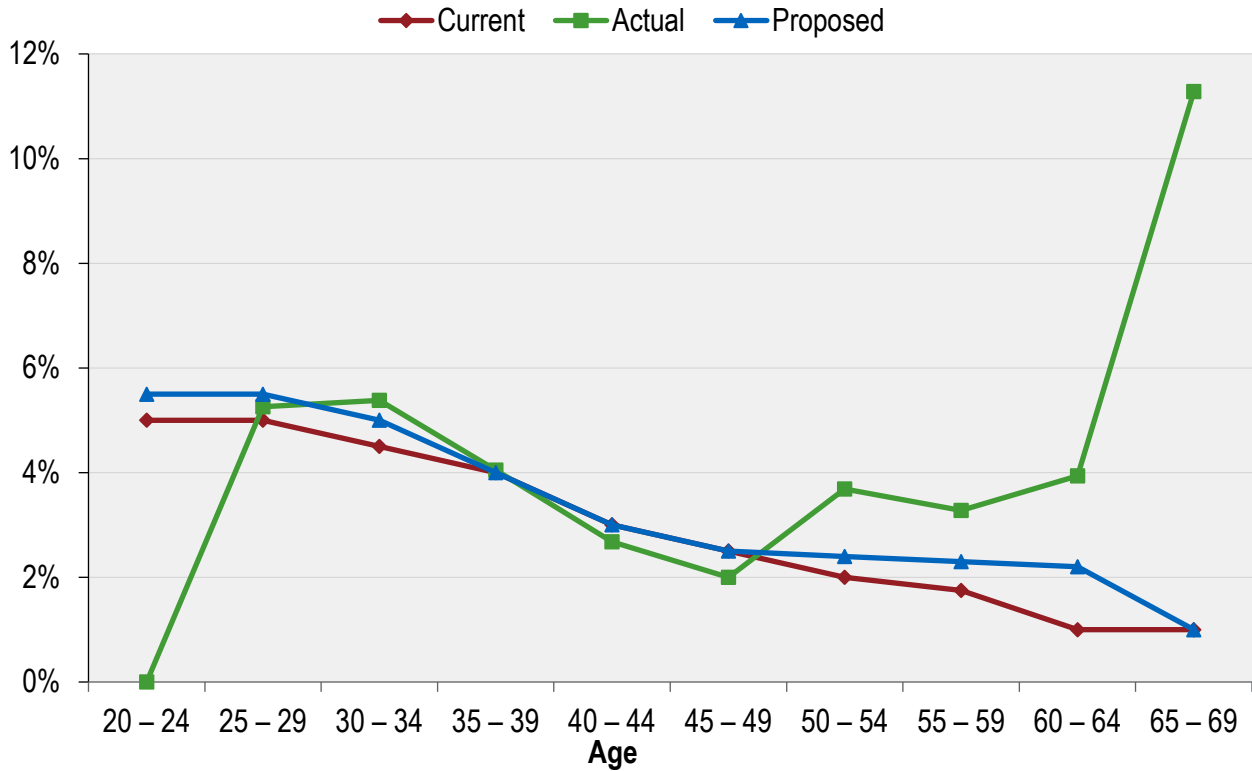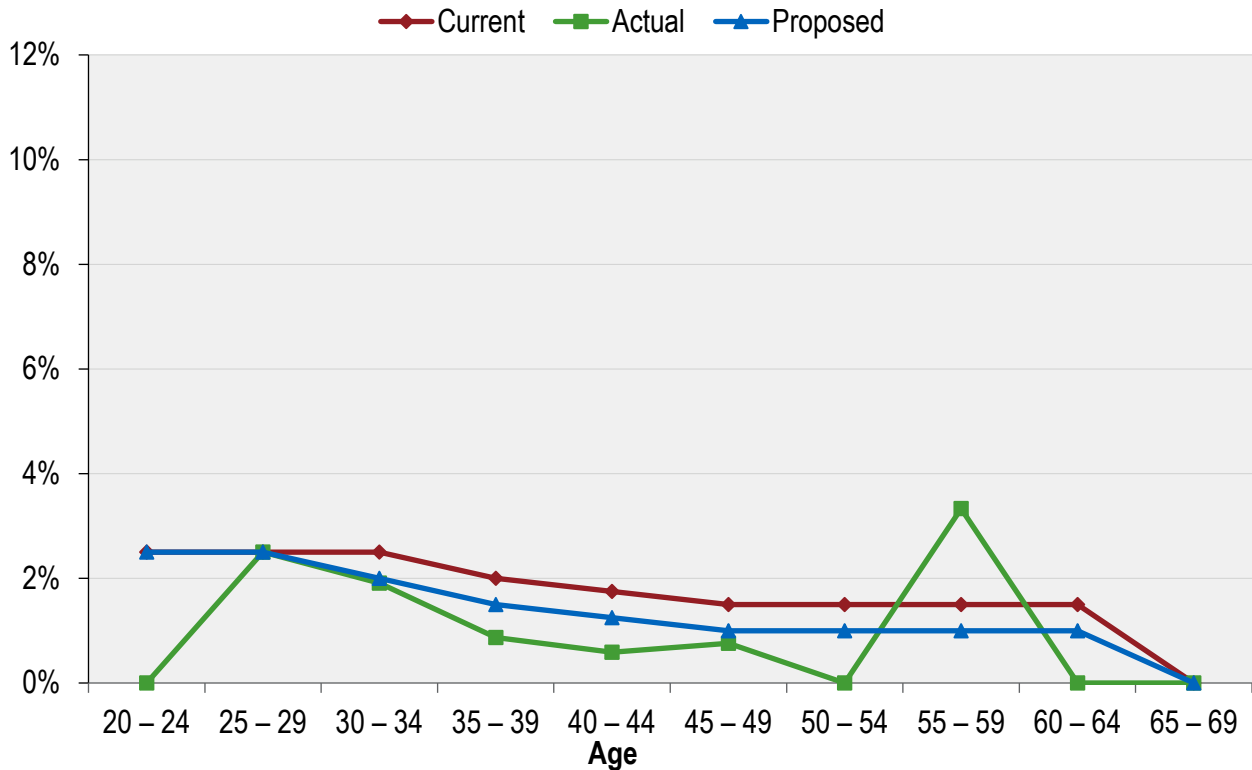|	Disability Incidence Rate (%)					
	Miscellaneous			Safety		
Age	Current Rate	Observed Rate	Proposed Rate	Current Rate	Observed Rate	Proposed Rate
20 – 24	0.00	0.00	0.00	0.10	0.00	0.10
25 – 29	0.02	0.00	0.02	0.10	0.00	0.10
30 – 34	0.04	0.00	0.04	0.20	0.14	0.20
35 – 39	0.06	0.00	0.06	0.30	0.53	0.40
40 – 44	0.10	0.10	0.10	0.55	0.22	0.45
45 – 49	0.20	0.13	0.15	0.65	0.49	0.55
50 – 54	0.30	0.24	0.25	0.90	0.88	0.90
55 – 59	0.40	0.41	0.40	1.50	0.35	1.00
60 – 64	0.60	0.41	0.50	2.50	1.10	1.50
65 – 69	1.10	0.41	1.00	0.00	0.00	0.00

Chart 19 compares the actual number of non-duty and duty disabilities over the past three years to that expected under both the current and proposed assumptions. The proposed disability rates were adjusted to reflect the past three years' experience.

Chart 20 shows actual disablement rates, compared to the assumed and proposed rates for Miscellaneous members.

Since 35% of disabled Miscellaneous members received a duty disability, we recommend that the current 25% assumption used to anticipate duty disability retirement be increased to 30%. The remaining 70% of Miscellaneous disabled members will be assumed to receive a non-duty disability.

Chart 21 graphs the same information as Chart 20, but for Safety members.

Since 92% of disabled Safety members received a duty disability, we are continuing to recommend that the current 90% assumption be used to anticipate duty disability retirement. The remaining 10% of Safety disabled members are assumed to receive a non-duty disability.

CHART 19: ACTUAL NUMBER OF DISABILITIES COMPARED TO EXPECTED

June 30, 2013 - 2016
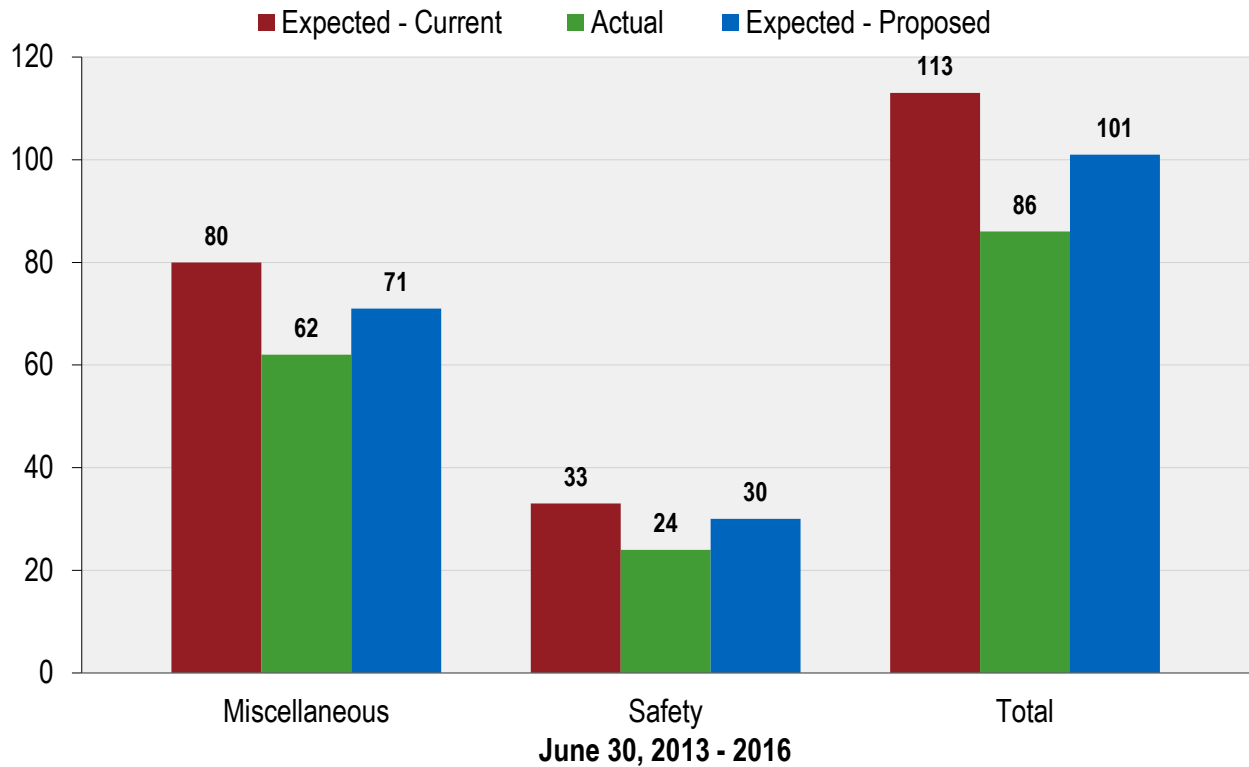
CHART 20: DISABILITY INCIDENCE RATES MISCELLANEOUS MEMBERS
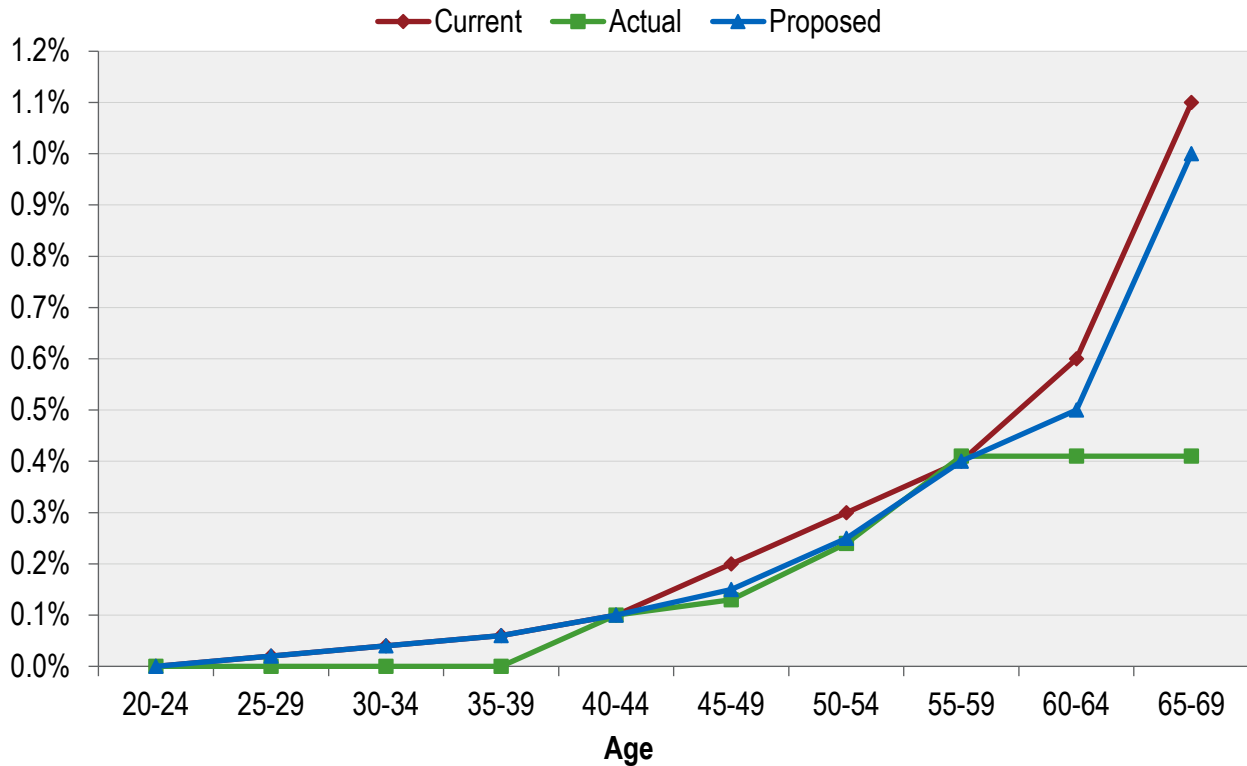
CHART 21: DISABILITY INCIDENCE RATES
SAFETY MEMBERS

Legend: Current (dark red diamond), Actual (green square), Proposed (blue triangle). X-axis: Age (20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69). Y-axis: 0.0% to 3.0%.
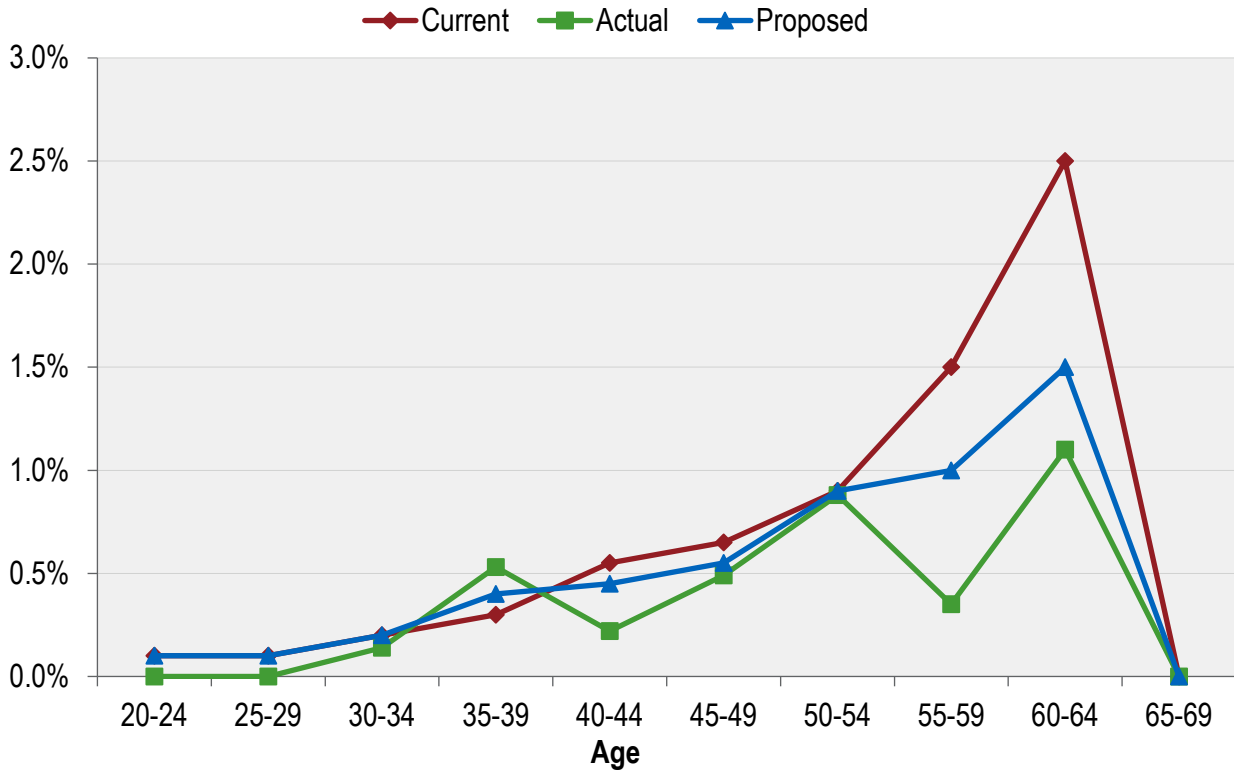
F. Service from Unused Sick Leave Conversion

At retirement, members can convert their unused sick leave to increase the service credit used in the calculation of their retirement benefit. The actuarial valuation anticipates this additional benefit using an assumption to estimate the proportional increase in service that will occur due to unused sick leave conversions.

We collected information on the actual amount of sick leave converted to service credit for retirees during the three-year period studied. Consistent with the format of the current assumption, the actual converted sick leave was expressed as a percentage of members' total service credit (before including the unused sick leave credit).

The tables below show the actual sick leave converted to service credit as a percentage of total service credit (before including the sick leave converted to service credit) at retirement separately for Miscellaneous and Safety members as well as for non-disabled and disabled members.

Miscellaneous New Retirees (Non-Disabled)			
Year of Retirement	Current Assumption	Actual Rate	Proposed Assumptions
2013 - 2016	1.50%	1.35%	1.50%

Safety New Retirees (Non-Disabled)			
Year of Retirement	Current Assumption	Actual Rate	Proposed Assumptions
2013 - 2016	2.25%	2.25%	2.25%

Miscellaneous New Retirees (Disabled)			
Year of Retirement	Current Assumption	Actual Rate*	Proposed Assumptions
2013 - 2016	0.00%	0.40%	0.25%

Safety New Retirees (Disabled)			
Year of Retirement	Current Assumption	Actual Rate	Proposed Assumptions
2013 - 2016	0.25%	0.14%	0.25%

* *Actual rate of conversion was 0.16% during 2010-2013 and 0.02% during 2007-2010.*

Based on this experience we recommend increasing the assumption for Miscellaneous new retirees (disabled) from 0.00% to 0.25% and maintaining the assumptions for all other groups of retirees.

G. Average Entry Ages

SCERS members who entered Miscellaneous Tiers 1, 2, 3 and 4 and Safety Tiers 1, 2 and 3 after January 1, 1975 and prior to January 1, 2013 pay member contribution rates based on an average entry age of all members in the Miscellaneous or the Safety plan.

Based on average age at entry of 34.8 and 28.7 for Miscellaneous and Safety, respectively, we recommend no change in the assumed average entry age of 35 for Miscellaneous and we recommend no change in the assumed average entry age of 29 for Safety.

V. Cost Impact

The tables below show the changes in the employer and member contribution rates due to the proposed assumption changes as if they were applied to the June 30, 2016 actuarial valuation. Note that the cost impact shown is after reflecting the impact of some active members in the legacy tiers who have already agreed to pay a higher normal cost on a 50:50 cost-sharing basis, while the remaining active members continue to have agreed only to pay the full rate as defined by statute.[16]

If all of the proposed assumption changes (both economic, including a 7.00% investment return assumption, and demographic) were implemented, the average employer rate would have increased by 7.63% of payroll. The average member rate would have increased by 1.79% of payroll. The UAAL would have increased by $767 million while the funded percentage would have decreased from 87.3% to 80.7%.

Impact on Aggregate Employer Rates taking into account Proportion of Members in Legacy Tiers Paying 50:50 and Full Rates

Employer Contribution Rate Impact (% of Payroll)					
Contributions	Miscellaneous County	Miscellaneous Court	Miscellaneous District	Safety County	Combined
Normal Cost	1.57%	2.27%	2.20%	3.01%	1.96%
UAAL	4.23%	4.23%	4.10%	10.50%	5.67%
Total	**5.80%**	**6.50%**	**6.30%**	**13.51%**	**7.63%**

Employer Contribution Rate Impact* (Estimated Annual Dollar Amounts in Thousands)					
Contributions	Miscellaneous County	Miscellaneous Court	Miscellaneous District	Safety County	Combined
Total	$37,185	$3,077	$1,842	$28,798	$70,902

*   *Based on June 30, 2016 projected annual payroll.*

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[16]   Starting in 2017/2018, most Miscellaneous County members and all Safety County members in the legacy tiers would be paying 50% of the total normal cost rates in their tiers. In addition, Miscellaneous members in one District would also be paying 50% of the total normal cost rates in their tiers. All remaining members would pay the full rate.

Impact on Member Rates for Members in Legacy Tiers Paying Full Rates

	Member Contribution Rate Impact at Sample Entry Ages (Annual Amounts in Dollars)							
	Miscellaneous Tier 1 Full Rates				Safety Tier 1 Full Rates			
Entry Age	Current*	Proposed*	Difference	Annual Amount**	Current*	Proposed*	Difference	Annual Amount**
25	4.19%	4.88%	0.69%	$526	15.26%	18.11%	2.85%	$3,646
30	4.55%	5.22%	0.67%	$514	16.30%	19.09%	2.79%	$3,571
35	4.95%	5.61%	0.66%	$503	17.48%	20.26%	2.78%	$3,548
40	5.40%	6.04%	0.64%	$492	18.96%	21.74%	2.78%	$3,541
45	5.95%	6.54%	0.59%	$153	19.80%	22.30%	2.50%	$3,169

Member Contribution Rate Impact (Annual Amounts in Dollars)				
	Full Rates			
	Current	Proposed	Difference	Annual Amount**
Miscellaneous Tier 1	4.95%*	5.72%*	0.77%	$587
Miscellaneous Tier 2	3.54%*	3.87%*	0.33%	$222
Miscellaneous Tier 3	4.78%*	5.52%*	0.74%	$539
Miscellaneous Tier 4	7.24%*	8.34%*	1.10%	$778
Safety Tier 1	16.09%*	19.06%*	2.97%	$3,803
Safety Tier 2	12.42%*	14.68%*	2.26%	$2,447
Safety Tier 3	12.10%*	14.22%*	2.12%	$1,967

*   Member rates shown are for annual salary in excess of $4,200 (or monthly salary of $350). For annual salary less than $4,200 (or monthly salary of $350), the rates are equal to 2/3 of the rates shown.

**   Based on average June 30, 2016 projected annual compensation for members in each respective tier.

Impact on Member Rates for Members in Legacy Tiers Paying 50:50 Rates and in CalPEPRA Tiers

Member Contribution Rate Impact (Annual Amounts in Dollars)				
	50:50 Rates			
	Current	**Proposed**	**Difference**	**Annual Amount****
Miscellaneous Tier 1	8.03%*	9.44%*	1.41%	$1,082
Miscellaneous Tier 2	7.27%*	8.43%*	1.16%	$788
Miscellaneous Tier 3	9.30%*	10.90%*	1.60%	$1,153
Miscellaneous Tier 4	8.67%*	10.24%*	1.57%	$1,107
Miscellaneous Tier 5	7.93%	9.38%	1.45%	$732
Safety Tier 1	18.42%*	21.84%*	3.42%	$4,375
Safety Tier 2	16.30%*	19.53%*	3.23%	$3,505
Safety Tier 3	15.45%*	18.35%*	2.90%	$2,694
Safety Tier 4	13.14%	15.04%	1.90%	$1,379

* *Member rates shown are for annual salary in excess of $4,200 (or monthly salary of $350). For annual salary less than $4,200 (or monthly salary of $350), the rates are equal to 2/3 of the rates shown.*

** *Based on average June 30, 2016 projected annual compensation for members in each respective tier.*

The total estimated annual dollar increase in member contributions is about $17 million (or 1.79% of payoll).

Considered separately, the changes in economic assumptions accounted for about two-thirds of the overall cost impact to the plan. Of the various economic assumption changes, the most significant cost impact is from the investment return assumption change. Of the various demographic assumption changes, the most significant cost impact is from the mortality assumption change.

In particular, if only the proposed economic assumptions changes were implemented (as recommended in Section III of this report), including a 7.00% investment return assumption, the total (employer and member) normal cost rate would have increased by 2.64% of payroll and the UAAL amortization rate would have increased by 3.39% of payroll. Of the various economic assumption changes, the most significant cost impact is from the investment return assumption change.

Furthermore, if only the proposed demographic assumption changes were implemented (as recommended in Section IV of this report), the total (employer and member) normal cost rate would have increased by 1.11% of payroll and the UAAL amortization rate would have increased by 2.28% of payroll. Of the various demographic assumption changes, the most significant cost impact is from the mortality assumption change.

If a 7.25% investment return assumption were implemented instead of a 7.00% investment return assumption together with all the other recommended assumption changes in this report, the total (employer and member) normal cost rate would have increased by 2.25% of payroll and the UAAL amortization rate would have increased by 3.51% of payroll.

Appendix A: Current Actuarial Assumptions

Economic Assumptions

Net Investment Return:	7.50%, net of administration and investment expenses
Employee Contribution Crediting Rate:	3.25% (assumed rate of inflation); compounded semi-annually.
Cost-of-Living Adjustment for Retirees:	Miscellaneous and Safety Tier 1 benefits are assumed to increase at 3.25% per year. Miscellaneous Tier 3, Tier 4 and Tier 5 and Safety Tier 2, Tier 3 and Tier 4 benefits are assumed to increase at 2.0% per year. Miscellaneous Tier 2 receive no COLA increases.
Payroll Growth:	Inflation of 3.25% per year plus real "across the board" salary increases of 0.25% per year.
Increase in Section 7522.10 Compensation Limit:	Increase of 3.25% per year from valuation date.

Salary Increases

Annual Rate of Compensation Increase (%)		
Inflation: 3.25%, plus "across the board" salary increases of 0.25% per year; plus the following merit and promotional increases.		
Years of Service	**Miscellaneous**	**Safety**
0 – 1	5.00	8.00
1 – 2	4.50	7.00
2 – 3	3.75	6.00
3 – 4	3.50	5.00
4 – 5	3.00	4.00
5 – 6	2.50	3.50
6 – 7	2.25	3.25
7 – 8	2.00	3.00
8 – 9	1.75	2.75
9 – 10	1.00	2.00
10 or More	1.00	1.75

Demographic Assumptions

Mortality Rates – Healthy

➤ **Miscellaneous Members and Beneficiaries:** RP-2000 Combined Healthy Mortality Table projected with scale BB to 2022

> **Safety Members:** RP-2000 Combined Healthy Mortality Table projected with scale BB to 2022 set back one year for males and set forward two years for females

Mortality Rates – Disabled

> **Miscellaneous Members:** RP-2000 Disabled Retiree Mortality Table projected with scale BB to 2022 with no age adjustment for males and set forward three years for females

> **Safety Members:** RP-2000 Combined Healthy Mortality Table projected with scale BB to 2022 set forward two years

Member Contribution Rates

> **Miscellaneous Members:** RP-2000 Combined Healthy Mortality Table projected with scale BB to 2022 weighted 40% male and 60% female

> **Safety Members:** RP-2000 Combined Healthy Mortality Table projected with scale BB to 2022 set back one year for males and set forward two years for females weighted 70% male and 30% female

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

Mortality Rates Before Retirement

	Rate (%)			
	Miscellaneous		**Safety**	
Age	**Male**	**Female**	**Male**	**Female**
25	0.04	0.02	0.04	0.02
30	0.04	0.02	0.04	0.03
35	0.07	0.04	0.07	0.05
40	0.10	0.07	0.10	0.08
45	0.14	0.11	0.13	0.12
50	0.20	0.16	0.19	0.19
55	0.34	0.24	0.30	0.30
60	0.58	0.41	0.52	0.51
65	0.98	0.74	0.88	0.93

All Miscellaneous pre-retirement deaths are assumed to be non-duty. For Safety, 50% pre-retirement deaths are assumed to be non-duty and the rest are assumed to be duty.

Disability Incidence Rates

Age	Rate (%)	
	Miscellaneous[1]	Safety[2]
20	0.00	0.10
25	0.01	0.10
30	0.03	0.16
35	0.05	0.26
40	0.08	0.45
45	0.16	0.61
50	0.26	0.80
55	0.36	1.26
60	0.52	2.10

[1]   *25% of Miscellaneous disabilities are assumed to be duty disabilities. The other 75% are assumed to be non-duty disabilities.*

[2]   *90% of Safety disabilities are assumed to be duty disabilities. The other 10% are assumed to be non-duty disabilities.*

Termination Rates – Less than Five Years of Service[1]

Years of Service	Rate (%)	
	Miscellaneous	Safety
0 - 1	13.00	8.00
1 - 2	8.00	6.00
2 – 3	7.00	5.00
3 – 4	6.00	4.00
4 – 5	5.50	3.00

[1]   *75% of the Miscellaneous members and 50% of the Safety members are assumed to elect a refund of contribution balance while the remaining 25% and 50% of Miscellaneous and Safety members, respectively, are assumed to elect a deferred retirement benefit. No withdrawal is assumed after a member is assumed to retire.*

Termination Rates –Five or More Years of Service[1]

Age	Rate (%)	
	Miscellaneous	**Safety**
20	5.00	2.50
25	5.00	2.50
30	4.70	2.50
35	4.20	2.20
40	3.40	1.85
45	2.70	1.60
50	2.20	1.50
55	1.85	1.50
60	1.30	1.50
65	1.00	0.00

[1] *50% of the Miscellaneous members and 20% of the Safety members are assumed to elect a refund of contribution balance while the remaining 50% and 80% of Miscellaneous and Safety members, respectively, are assumed to elect a deferred retirement benefit. No withdrawal is assumed after a member is assumed to retire.*

Retirement Rates

Age	Rate (%) Miscellaneous			
	Tier 1	Tiers 2 and 3	Tier 4	Tier 5
45	0.00	0.00	0.00	0.00
46	0.00	0.00	0.00	0.00
47	0.00	0.00	0.00	0.00
48	0.00	0.00	0.00	0.00
49	0.00	0.00	0.00	0.00
50	6.00	2.00	2.00	0.00
51	4.00	2.00	2.00	0.00
52	4.00	2.00	2.00	4.00
53	4.00	3.00	2.00	1.50
54	7.00	4.00	3.00	2.50
55	10.00	6.00	4.00	3.50
56	15.00	6.00	5.00	4.50
57	16.00	8.00	6.00	5.50
58	18.00	12.00	7.00	6.50
59	22.00	14.00	8.00	7.50
60	28.00	14.00	9.00	8.50
61	30.00	14.00	10.00	9.50
62	35.00	25.00	18.00	17.00
63	35.00	30.00	16.00	15.00
64	40.00	35.00	20.00	19.00
65	50.00	40.00	25.00	24.00
66	45.00	45.00	20.00	20.00
67	45.00	45.00	20.00	20.00
68	50.00	50.00	30.00	30.00
69	60.00	60.00	40.00	40.00
70	100.00	100.00	100.00	100.00

Retirement Rates (continued)

Age	Rate (%) Safety Tiers 1 and 2	Rate (%) Safety Tier 3	Rate (%) Safety Tier 4
45	2.00	1.50	0.00
46	2.00	1.50	0.00
47	2.00	1.50	0.00
48	2.00	1.50	0.00
49	5.00	4.00	0.00
50	25.00	10.00	15.00
51	18.00	12.00	10.50
52	18.00	14.00	12.00
53	22.00	16.00	14.00
54	22.00	18.00	15.50
55	22.00	50.00	40.00
56	25.00	25.00	25.00
57	25.00	25.00	25.00
58	25.00	25.00	25.00
59	30.00	30.00	25.00
60	45.00	45.00	45.00
61	55.00	55.00	55.00
62	70.00	70.00	70.00
63	70.00	70.00	70.00
64	70.00	70.00	70.00
65	100.00	100.00	100.00
66	100.00	100.00	100.00
67	100.00	100.00	100.00
68	100.00	100.00	100.00
69	100.00	100.00	100.00
70	100.00	100.00	100.00

Retirement Age and Benefit for Deferred Vested Members:	For deferred vested members, we make the following retirement assumption:
	
	    Miscellaneous Age: 59
	    Safety Age: 53
	
	We assume that 40% of future Miscellaneous and 50% of future Safety deferred vested members will continue to work for a reciprocal employer. For reciprocals, we assume 4.50% and 5.25% compensation increases per annum, respectively.

Future Benefit Accruals:	1.0 year of service per year for the full-time employees. Continuation of current partial service accrual for part-time employees.
Unknown Data for Members:	Same as those exhibited by members with similar known characteristics. If not specified, members are assumed to be male.
Definition of Active Members:	All active members of SCERS as of the valuation date.
Form of Payment:	All members are assumed to elect the unmodified option at retirement.
Percent Married:	80% of male members and 55% of female members are assumed to be married at pre-retirement death or retirement.
Age of Spouse:	Female (or male) spouses are 3 years younger (or older) than their spouses.

Service From Unused Sick Leave Conversion:	The following assumptions for service converted from unused sick leave as a percentage of service at retirement are used:
	
	    Service Retirements:
	        Miscellaneous: 1.50%
	        Safety: 2.25%
	    Disability Retirements:
	        Miscellaneous: 0.00%
	        Safety: 0.25%

Appendix B: Proposed Actuarial Assumptions

Economic Assumptions

Net Investment Return:	7.00%, net of administration and investment expenses
Employee Contribution Crediting Rate:	3.00% (assumed rate of inflation); compounded semi-annually.
Cost-of-Living Adjustment for Retirees:	Miscellaneous and Safety Tier 1 benefits are assumed to increase at 3.00% per year. Miscellaneous Tier 3, Tier 4 and Tier 5 and Safety Tier 2, Tier 3 and Tier 4 benefits are assumed to increase at 2.0% per year. Miscellaneous Tier 2 receive no COLA increases.
Payroll Growth:	Inflation of 3.00% per year plus real "across the board" salary increases of 0.25% per year.
Increase in Section 7522.10 Compensation Limit:	Increase of 3.00% per year from valuation date.

Salary Increases

Annual Rate of Compensation Increase (%)		
Inflation: 3.00%, plus "across the board" salary increases of 0.25% per year; plus the following merit and promotional increases.		
Years of Service	**Miscellaneous**	**Safety**
0 – 1	5.00	7.50
1 – 2	4.75	7.25
2 – 3	4.50	6.50
3 – 4	4.00	5.50
4 – 5	3.50	5.00
5 – 6	2.75	4.25
6 – 7	2.25	3.75
7 – 8	2.00	3.25
8 – 9	1.75	3.00
9 – 10	1.50	2.50
10 or More	1.25	2.00

Demographic Assumptions

Mortality Rates – Post-Retirement Healthy

➢ **Miscellaneous Members and Beneficiaries:** Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table projected generationally with the two-dimensional scale MP-2016 set forward one year for males and no age adjustment for females

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

Mortality Rates – Post-Retirement Disabled

> **Miscellaneous Members:** Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table projected generationally with the two-dimensional scale MP-2016 set forward seven years for males and set forward eight years for females

> **Safety Members:** Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table projected generationally with the two-dimensional scale MP-2016 set forward four years for males and females

Mortality Rates – Pre-Retirement

> **Miscellaneous and Safety Members:** Headcount-Weighted RP-2014 Employee Mortality Table times 50% projected generationally with the two-dimensional scale MP-2016

Member Contribution Rates

> **Miscellaneous Members:** Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table projected 20 years with the two-dimensional scale MP-2016 set forward one year for males and no age adjustment for females weighted 40% male and 60% female

> **Safety Members:** Headcount-Weighted RP-2014 Healthy Annuitant Mortality Table projected 20 years with the two-dimensional scale MP-2016 set back four years for males and females weighted 75% male and 25% female

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

Mortality Rates Before Retirement

	Rate (%)			
	Miscellaneous		Safety	
Age	Male	Female	Male	Female
25	0.03	0.01	0.03	0.01
30	0.03	0.01	0.03	0.01
35	0.03	0.02	0.03	0.02
40	0.04	0.02	0.04	0.02
45	0.06	0.04	0.06	0.04
50	0.10	0.06	0.10	0.06
55	0.17	0.10	0.17	0.10
60	0.28	0.15	0.28	0.15
65	0.49	0.22	0.49	0.22

Note that generational projections are not reflected in the above mortality rates.

All Miscellaneous pre-retirement deaths are assumed to be non-duty. For Safety, 50% pre-retirement deaths are assumed to be non-duty and the rest are assumed to be duty.

Disability Incidence Rates

Age	Rate (%)	
	Miscellaneous[1]	Safety[2]
20	0.00	0.10
25	0.01	0.10
30	0.03	0.16
35	0.05	0.32
40	0.08	0.43
45	0.13	0.51
50	0.21	0.76
55	0.34	0.96
60	0.46	1.30

[1] *30% of Miscellaneous disabilities are assumed to be duty disabilities. The other 70% are assumed to be non-duty disabilities.*

[2] *90% of Safety disabilities are assumed to be duty disabilities. The other 10% are assumed to be non-duty disabilities.*

Termination Rates – Less than Five Years of Service[1]

Years of Service	Rate (%)	
	Miscellaneous	Safety
0 - 1	13.00	6.00
1 - 2	8.00	5.00
2 – 3	7.00	4.00
3 – 4	6.00	3.00
4 – 5	5.50	3.00

[1] *65% of the Miscellaneous members and 50% of the Safety members are assumed to elect a refund of contribution balance while the remaining 35% and 50% of Miscellaneous and Safety members, respectively, are assumed to elect a deferred retirement benefit. No withdrawal is assumed after a member is assumed to retire.*

Termination Rates –Five or More Years of Service[1]

Age	Rate (%)	
	Miscellaneous	Safety
20	5.50	2.50
25	5.50	2.50
30	5.20	2.20
35	4.40	1.70
40	3.40	1.35
45	2.70	1.10
50	2.44	1.00
55	2.34	1.00
60	2.24	1.00
65	1.48	0.00

[1] *40% of the Miscellaneous members and 15% of the Safety members are assumed to elect a refund of contribution balance while the remaining 60% and 85% of Miscellaneous and Safety members, respectively, are assumed to elect a deferred retirement benefit. No withdrawal is assumed after a member is assumed to retire.*

Retirement Rates

Age	Rate (%) Miscellaneous			
	Tier 1	Tiers 2 and 3	Tier 4	Tier 5
45	0.00	0.00	0.00	0.00
46	0.00	0.00	0.00	0.00
47	0.00	0.00	0.00	0.00
48	0.00	0.00	0.00	0.00
49	0.00	0.00	0.00	0.00
50	6.00	2.00	2.00	0.00
51	4.50	2.00	2.00	0.00
52	4.50	2.00	2.00	4.00
53	4.50	3.00	2.00	1.50
54	5.50	4.00	3.00	2.50
55	12.00	6.00	4.00	3.50
56	18.00	6.00	5.00	4.50
57	18.00	8.00	6.00	5.50
58	18.00	10.00	7.00	6.50
59	20.00	12.00	8.00	7.50
60	28.00	12.00	9.00	8.50
61	35.00	14.00	10.00	9.50
62	35.00	25.00	18.00	17.00
63	35.00	25.00	16.00	15.00
64	35.00	30.00	20.00	19.00
65	35.00	35.00	25.00	24.00
66	40.00	40.00	20.00	20.00
67	40.00	40.00	20.00	20.00
68	50.00	50.00	30.00	30.00
69	60.00	60.00	40.00	40.00
70	100.00	100.00	100.00	100.00

Retirement Rates (continued)

Age	Rate (%)		
	Safety		
	Tiers 1 and 2	Tier 3	Tier 4
45	2.00	1.50	0.00
46	2.00	1.50	0.00
47	2.00	1.50	0.00
48	2.00	1.50	0.00
49	5.00	4.00	0.00
50	22.00	10.00	15.00
51	16.00	12.00	10.50
52	16.00	14.00	12.00
53	20.00	16.00	14.00
54	20.00	18.00	15.50
55	20.00	50.00	40.00
56	25.00	25.00	25.00
57	25.00	25.00	25.00
58	25.00	25.00	25.00
59	30.00	30.00	25.00
60	45.00	45.00	45.00
61	55.00	55.00	55.00
62	70.00	70.00	70.00
63	70.00	70.00	70.00
64	70.00	70.00	70.00
65	100.00	100.00	100.00
66	100.00	100.00	100.00
67	100.00	100.00	100.00
68	100.00	100.00	100.00
69	100.00	100.00	100.00
70	100.00	100.00	100.00

Retirement Age and Benefit for Deferred Vested Members:	For deferred vested members, we make the following retirement assumption:
	
	    Miscellaneous Age: 59
	    Safety Age: 53
	
	We assume that 35% of future Miscellaneous and 45% of future Safety deferred vested members will continue to work for a reciprocal employer. For reciprocals, we assume 4.50% and 5.25% compensation increases per annum, respectively.

Future Benefit Accruals:	1.0 year of service per year for the full-time employees. Continuation of current partial service accrual for part-time employees.
Unknown Data for Members:	Same as those exhibited by members with similar known characteristics. If not specified, members are assumed to be male.
Definition of Active Members:	All active members of SCERS as of the valuation date.
Form of Payment:	All members are assumed to elect the unmodified option at retirement.
Percent Married:	80% of male members and 55% of female members are assumed to be married at pre-retirement death or retirement.
Age of Spouse:	Female spouses are 3 years younger than their spouses. Male spouses are 2 years older than their spouses.

Service From Unused Sick Leave Conversion:	The following assumptions for service converted from unused sick leave as a percentage of service at retirement are used:
	
	  Service Retirements:
	    Miscellaneous: 1.50%
	    Safety: 2.25%
	  Disability Retirements:
	    Miscellaneous: 0.25%
	    Safety: 0.25%