2013-18 Demographic Experience Study

Presentation to: LEOFF Plan 2 Retirement Board

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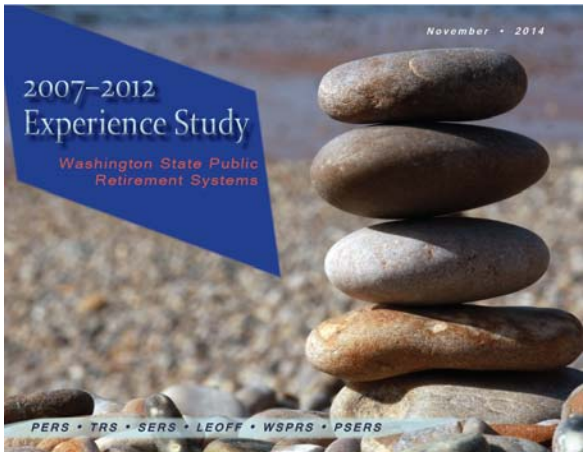
Office of the State Actuary

"Supporting financial security for generations."

May 27, 2020

Today's Presentation

- Background on Demographic Experience Study (DES)
- Summary of assumptions studied
- Estimated impact of new assumptions
- No Board action required today
  - Potential June adoption of assumptions



What is the DES?

- Thorough study of member behaviors and demographics
- Important component of systematic actuarial funding
  - Pre-funding benefits from future projections
  - Future projections are modeled using assumptions
- Opportunity to update assumptions and learn more about member behavior

When is the DES Performed?

- At least once every six years, as directed by statute
  - Ensures assumptions remain current and reasonable
  - Balances the large time-investment that this project requires
- Assumptions will be incorporated into the *June 30, 2019, Actuarial Valuation Report*
  - Forms the foundation for the 2021-23 contribution rates that the Board will consider in July

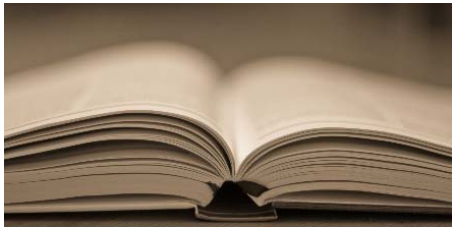
How is the DES Performed?

For each assumption studied…

1. Examine actual plan experience
   - 20+ years of historical data for many assumptions
   - Consider events and outliers (e.g., recessions)
2. Compare actual plan experience to prior assumptions
   - How close were we?
3. Considerations for the future
   - Will future plan experience look similar to the past?
4. Select assumption
   - Actuarial Standards of Practice (ASOPs)
   - Professional Judgement
5. Assumption Audit
   - Check for reasonable assumptions

Assumptions Studied

- Five major assumptions…
  - Mortality
  - Retirement
  - Termination
  - Disability
  - Service-Based Salary Increases
- Approximately 15 other assumptions…
  - Probability of Duty-Related Death/Disability
  - Probability of Catastrophic Disability
  - Percent Law Enforcement Officers/Firefighters



Mortality–Overview

How is this Assumption Used?

- To determine if a member will survive until retirement or will receive death benefits
- To determine how long benefits will be paid after retirement

What did we Look at?

- 30+ years of LEOFF data by age and gender
- National public safety mortality tables

What did we See?

- LEOFF members typically live longer than average estimated by new public safety mortality table
- Slower rate of mortality improvements than we previously expected
- Working status matters (i.e., Active vs. Disabled vs. Retired vs. Beneficiary)

Mortality–Results & Impacts

Life Expectancy	
55-Year Old Retiree	
Old Assumption	86.6
New Assumption	86.0

- Lowering the life expectancy means pension benefits won't be paid for quite as long
- Expected to decrease contribution rates

Retirement–Overview

How is this Assumption Used?

- To determine when a member will stop working and start collecting their pension benefit

What did we Look at?

- 20+ years of plan data by age
- Impact of the Great Recession and subsequent recovery

What did we See?

- Members are generally delaying retirement later than previously expected

Retirement–Results & Impacts

Retirement Rates			
Age	Old	New	Difference
50	3%	3%	0%
51	4%	3%	(1%)
52	5%	5%	0%
53-56	10%	9%	(1%)
57	10%	10%	0%
58	15%	14%	(1%)
59	15%	15%	0%
60	15%	15%	0%
61	19%	19%	0%
62	23%	23%	0%
63	20%	20%	0%
64	20%	20%	0%
65-69	25%	30%	5%
70	100%	100%	0%

- By delaying retirement, members contribute longer and will collect larger pensions for a shorter amount of time
- Expected to decrease contribution rates

Termination–Overview

How is this Assumption Used?

- To determine if/when a member will leave employment without becoming disabled or retiring
- Terminated members are eligible for a deferred retirement benefit or a refund of their contributions

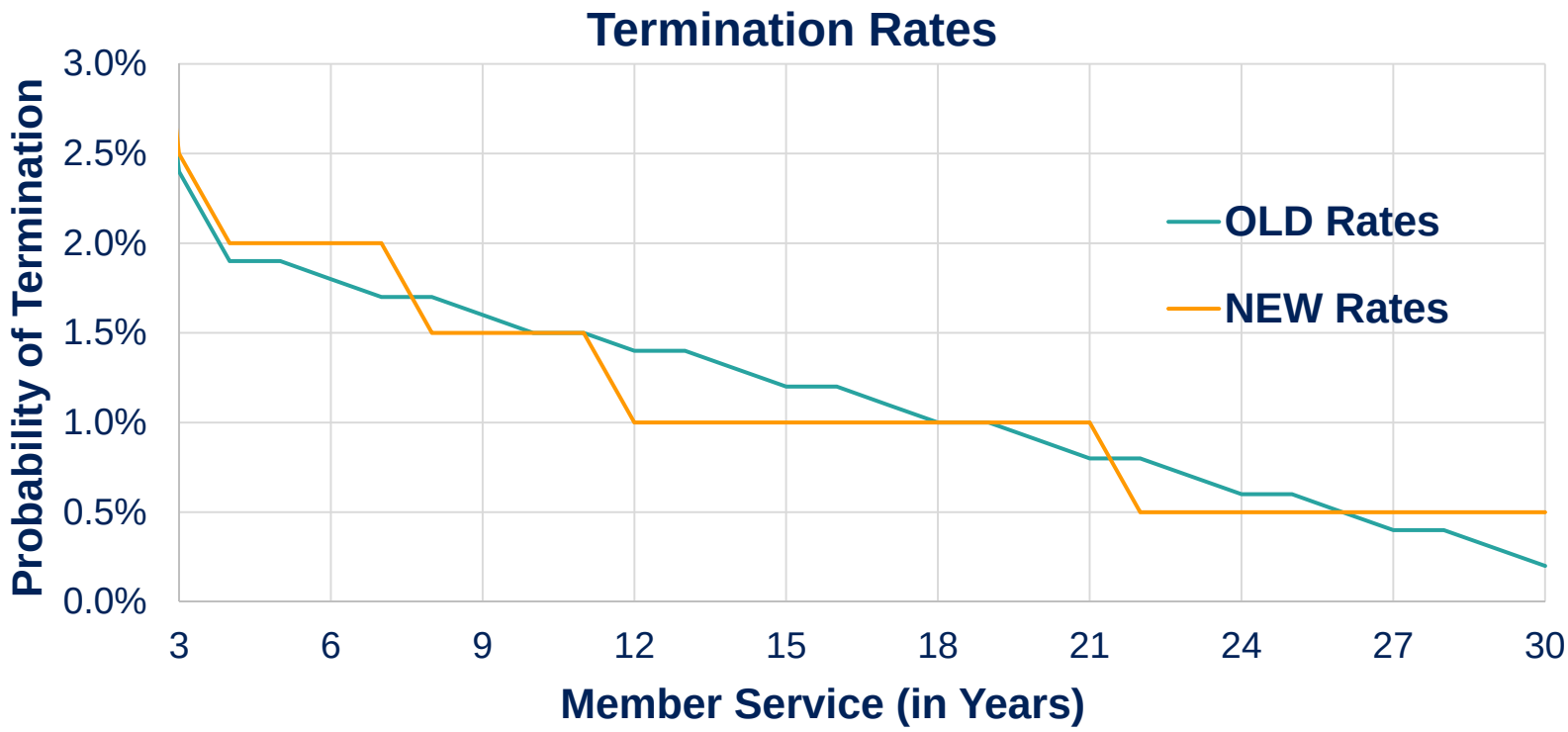
What did we Look at?

- 20+ years of plan data by service
- Excluded members who return to work within two years

What did we See?

- Fewer members are terminating than we expected

Termination–Results & Impacts



Termination rates are appx 10% and 5% in the first and second year respectively under both old and new rates (not shown in the graph above).

- Decreasing termination rates means more members are expected to make it to retirement
- Expected to increase contribution rates

Disability–Overview

How is this Assumption Used?

- To determine if/when an active member will experience a disabling incident and elect a disability pension benefit

What did we Look at?

- 10+ years of plan data by age
- Recent legislation expanding list of occupational diseases

What did we See?

- Fewer members are disabling than we expected

Disability–Results & Impacts

Disability Rates			
Age	**Old**	**New**	**Difference**
20-24	0.01%	0.00%	**(0.01%)**
25-29	0.03%	0.01%	**(0.02%)**
30-34	0.06%	0.02%	**(0.04%)**
35-39	0.11%	0.10%	**(0.01%)**
40-44	0.15%	0.10%	**(0.05%)**
45-49	0.23%	0.20%	**(0.03%)**
50-54	0.41%	0.40%	**(0.01%)**
55-59	0.69%	0.60%	**(0.09%)**
60-64	1.19%	0.70%	**(0.49%)**
65-69	0.39%	0.36%	**(0.03%)**
70-79	0.00%	0.36%	**0.36%**
80	0.00%	0.00%	0.00%

- Only minor adjustments made to disability rates
- Not expected to round to a contribution rate impact

Service-Based Salary Increases–Overview

How is this Assumption Used?

- Salary growth due to merit increases, promotions, and overtime
- To project member salaries, which is used to estimate future benefits and calculate future contribution rates

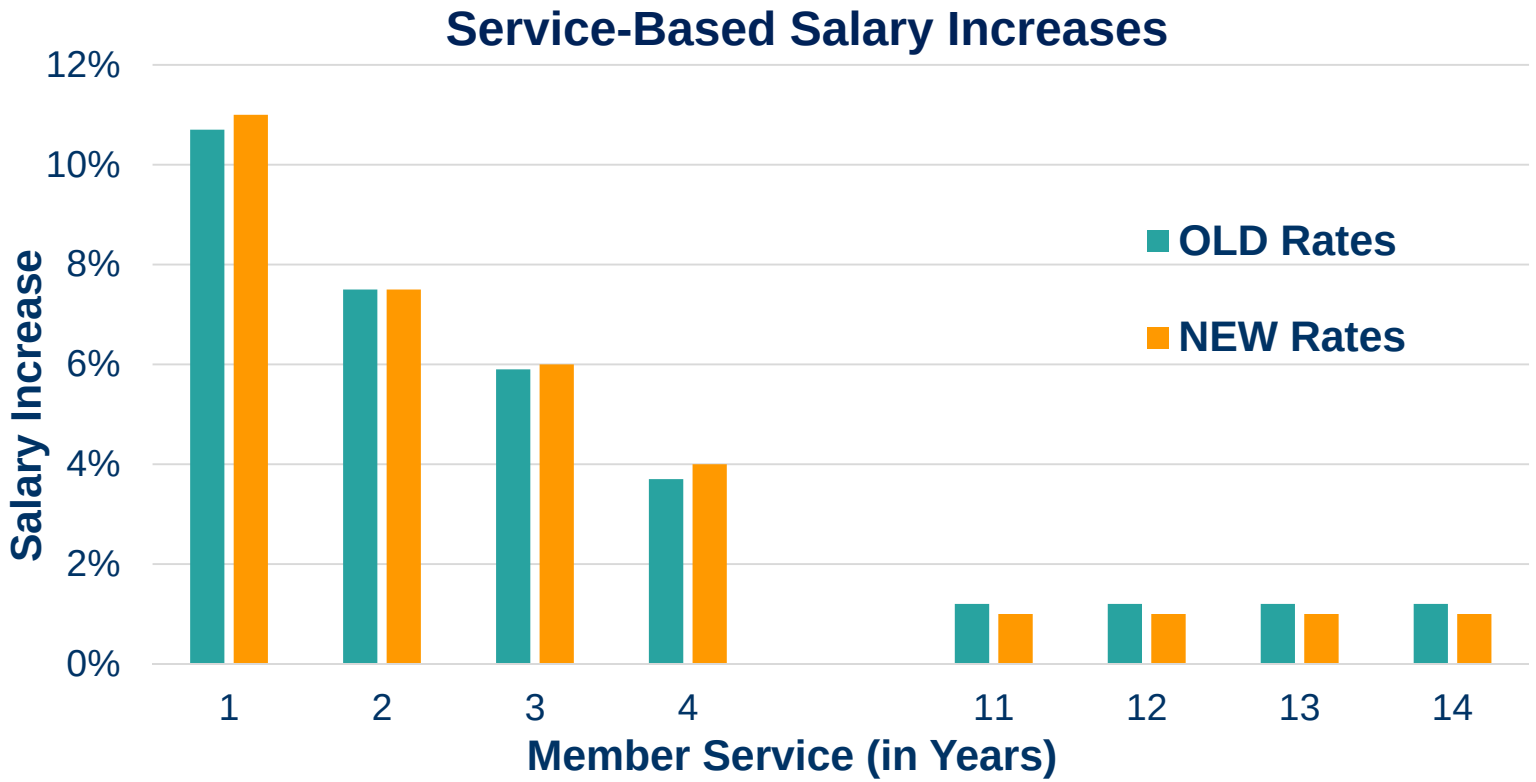
What did we Look at?

- 20+ years of plan data by service
- Impact of the Great Recession and subsequent recovery

What did we See?

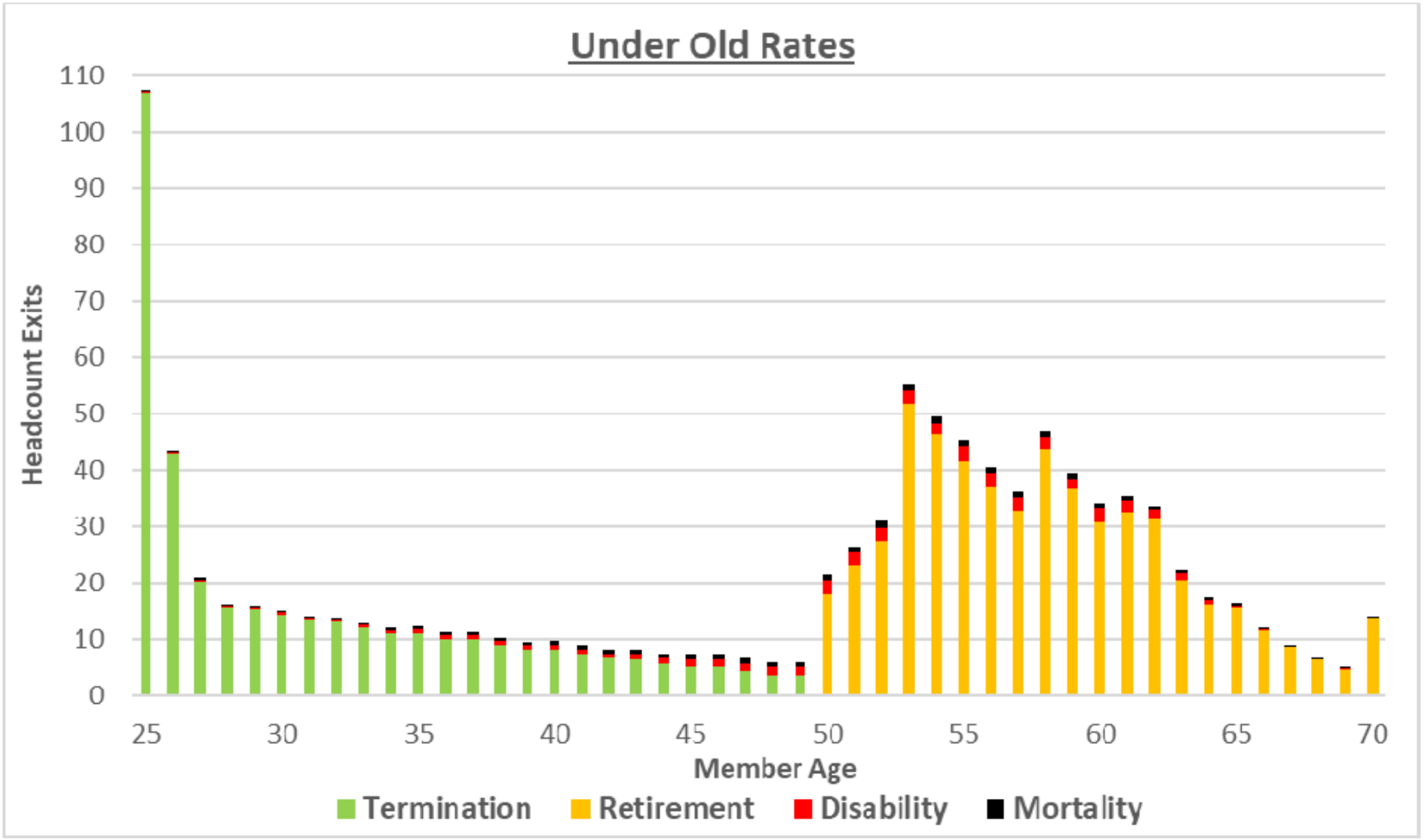
- Service-based salary increases are higher earlier in career
- Experience matched our expectations quite well

Service-Based Salary–Results & Impacts



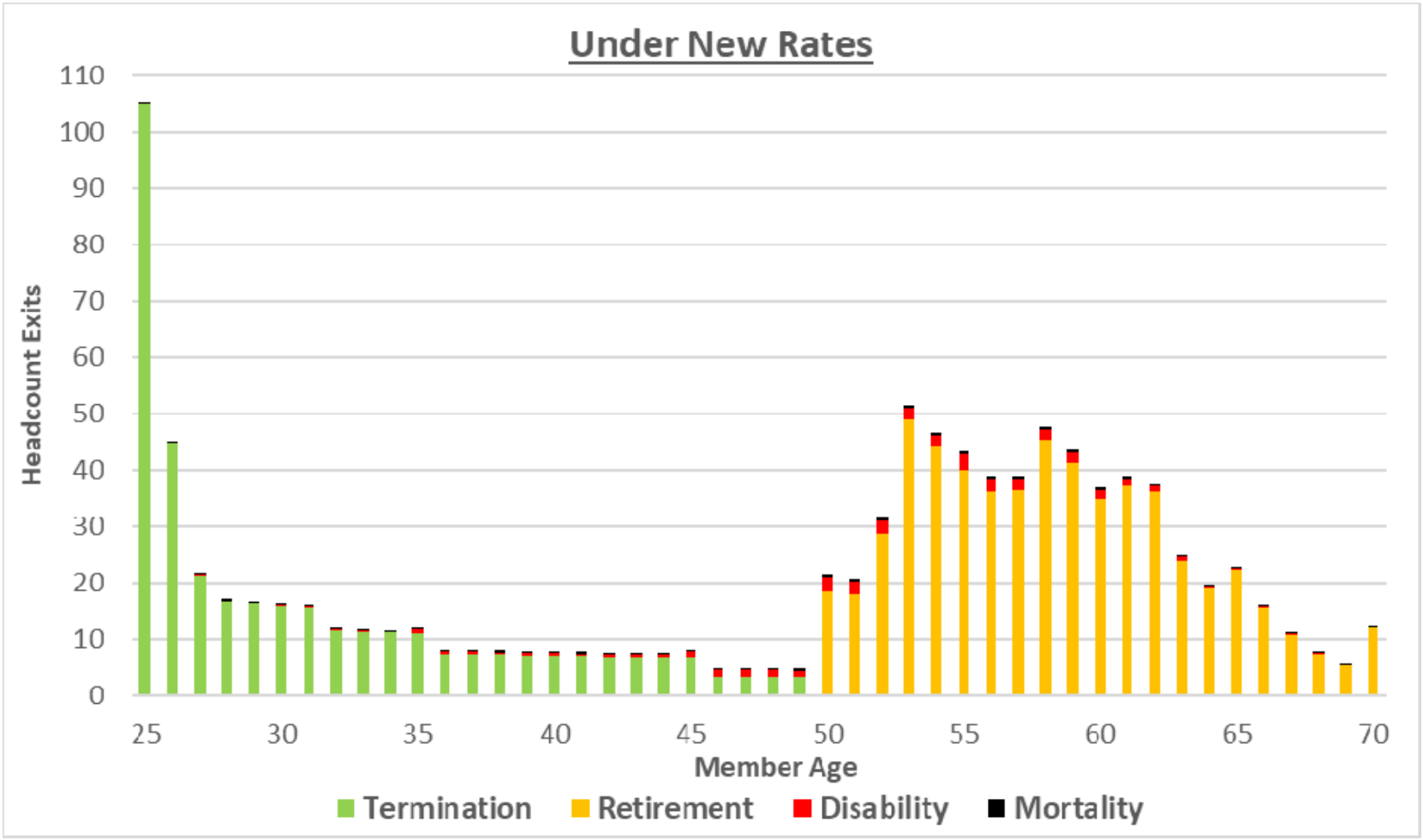
- Slightly increased assumption in early years, and slightly decreased assumption in later years
- Net impact is expected to decrease contribution rates

Modeling 1,000 Age 25 New Hires



Exits	Terminations	Retirements	Disablements	Deaths
Old Rates	370	550	50	30
New Rates	360	580	40	20

Modeling 1,000 Age 25 New Hires



Exits	Terminations	Retirements	Disablements	Deaths
Old Rates	370	550	50	30
New Rates	360	580	40	20

Other Assumptions

- Approximately 15 other assumptions…
  - Probability of death being duty-related
    - No change in assumption
  - Probability of disability being duty-related
    - Simplified assumption, so now constant at all ages
  - Probability of disability being catastrophic
    - Slight increase in assumption
  - Percent Law Enforcement Officers/Fire Fighters
    - No change in assumption

Estimated Employee Rate & Funded Status Impacts

	Plan Cost Method Rate Change*	Minimum Rate Change**	Funded Status Change
Retirement Rates	(0.12%)	(0.06%)	0.4%
Termination Rates	0.02%	0.02%	0.0%
Disability Rates	0.00%	(0.01%)	0.0%
Salary Merit	(0.03%)	(0.03%)	0.0%
Mortality Rates	(0.03%)	0.01%	0.2%
Miscellaneous	(0.06%)	0.02%	0.4%
Total Impact	**(0.22%)**	**(0.06%)**	**0.8%**
Before DES	**6.48%**	**8.57%**	**108%**
After DES	**6.26%**	**8.51%**	**109%**

NOTE: All numbers displayed based on the June 30, 2018, AVR. Figures may not add due to rounding.

**Plan Cost Method Rate Change is based on Aggregate method.*

***Minimum Rate Change is based on 100% of normal cost under the Entry Age Cost method.*

Recap and Next Steps

- Reasonable assumptions contribute to reasonable funding
- Board may adopt assumptions at the June meeting
  - If adopted, demographic assumptions will be implemented in the *2019 Actuarial Valuation Report*
  - Final results and contribution rates available at the July meeting
- Questions?

Questions? Please Contact:

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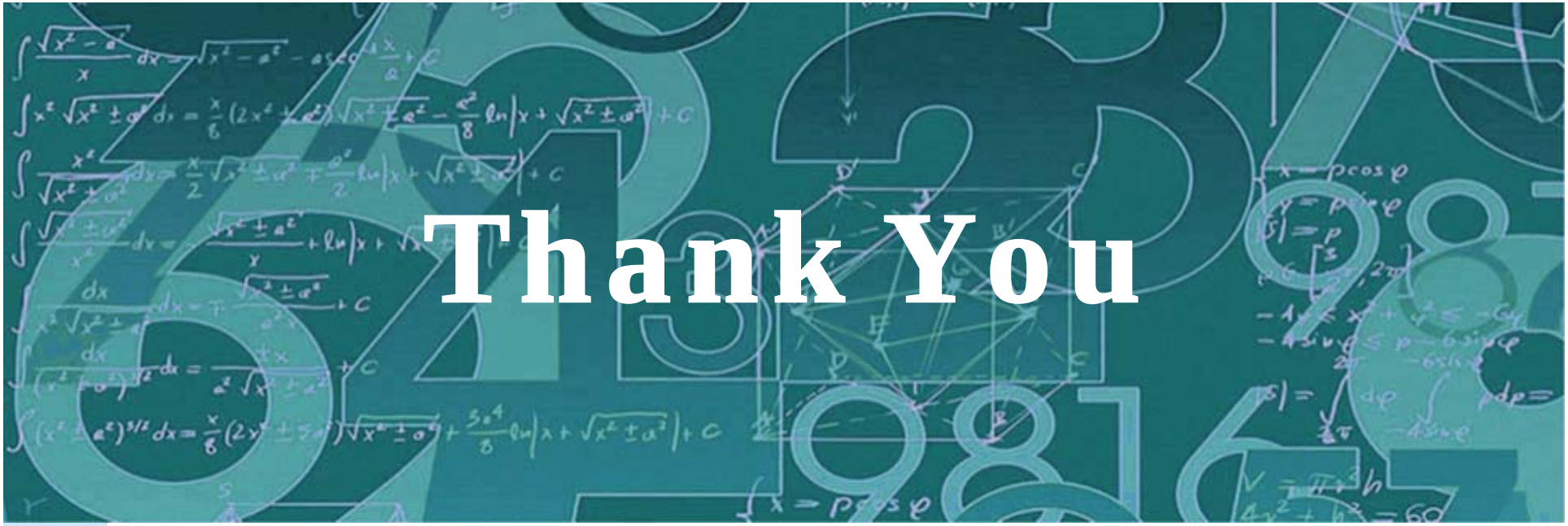

Office of the State Actuary

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May 27, 2020

State of Washington Pension Funding Council LEOFF 2 Board

Actuarial Audit of Demographic Experience Study

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May 1, 2020

Mr. Shawn Merchant
Legislative & Stakeholder Relations Director
Department of Retirement Services

Mr. Steve Nelsen
Executive Director
LEOFF Plan 2 Retirement Board

Re: **Actuarial Audit Report for Demographic Experience Study**

Dear Shawn and Steve:

The enclosed report presents the findings and comments resulting from a detailed review of the demographic experience study performed by the Office of the State Actuary (OSA) for the Pension Funding Council (PFC) and the LEOFF 2 Board. An overview of our findings is included in the Executive Summary section of the report. More detailed commentary on our review process is included in what follows.

The actuarial assumptions proposed by the OSA are based on its 2013-2018 experience study for use in the June 30, 2019 actuarial valuation. Note that economic assumptions for inflation, wage growth, and investment rate of return were updated for the June 30, 2017 actuarial valuation.

As discussed in this report, we believe the package of actuarial assumptions and methods is reasonable (taking into account the experience of Washington State Public Retirement Systems and reasonable expectations). Nevertheless, the emerging costs will vary from those presented in this report to the extent that actual experience differs from that projected by the actuarial assumptions. Future actuarial measurements may differ significantly from the current measurements presented in this report due to factors such as the following:

- Plan experience differing from the actuarial assumptions,
- Future changes in the actuarial assumptions,
- Increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as potential additional contribution requirements due to changes in the plan's funded status), and
- Changes in the plan provisions or accounting standards.

Due to the scope of this assignment, we did not perform an analysis of the potential range of such measurements.

In preparing this report, we relied, without audit, on information (some oral and some in writing) supplied by the OSA's staff. This information includes information supplied to the OSA by the Department of Retirement Systems (DRS). This information includes, but is not limited to, statutory provisions and employee data. In our examination of these data, we have found them to be reasonably consistent and comparable with data used for other purposes. Since the audit results are dependent on the integrity of the data supplied, the results can be expected to differ if the underlying data is incomplete or missing. It should be noted that if any data or other information is inaccurate or incomplete, our calculations may need to be revised.

On the basis of the foregoing, we hereby certify that, to the best of our knowledge and belief, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices which are consistent with the Actuarial Standards of Practice promulgated by the

Actuarial Standards Board and the applicable Guides to Professional Conduct, amplifying Opinions, and supporting Recommendations of the American Academy of Actuaries.

Milliman's work product was prepared exclusively for the Pension Funding Council and the LEOFF 2 Board for a specific and limited purpose. It is a complex, technical analysis that assumes a high level of knowledge concerning the operations of the Washington State Public Retirement Systems, and uses DRS's census data, which Milliman has not audited. It is not for the use or benefit of any third party for any purpose. Any third party recipient of Milliman's work product who desires professional guidance should not rely upon Milliman's work product, but should engage qualified professionals for advice appropriate to its own specific needs.

The consultants who worked on this assignment are retirement actuaries. Milliman's advice is not intended to be a substitute for qualified legal or accounting counsel.

The signing actuaries are independent of the plan sponsor. We are not aware of any relationship that would impair the objectivity of our work.

We would like to express our appreciation to the OSA's staff for their assistance in supplying the data and information on which this report is based.

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

We respectfully submit the following report, and we look forward to discussing it with you.

Sincerely,

Mark C. Olleman, FSA, EA, MAAA
Consulting Actuary

Nick J. Collier, ASA, EA, MAAA
Consulting Actuary

Daniel R. Wade, FSA, EA, MAAA
Consulting Actuary

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1. Summary of the Findings

Purpose and Scope of the Actuarial Audit

This actuarial audit reviews the 2013-2018 demographic experience study performed by the Office of the State Actuary (OSA). The purpose of this audit is to verify the assumptions recommended to be used for the June 30, 2019 valuation are reasonable. The following tasks were performed in this audit:

- Evaluation of the calculations that form the basis of the recommended assumptions
- Based on those calculations, we assessed the reasonableness of the assumptions recommended to be used in the valuation
- Analysis of the written summaries provided by the OSA

Audit Conclusion

The results of this audit are very positive. Specifically, we want to highlight the following:

- Reasonable Demographic Assumptions: We believe that all the recommended assumptions to be used to value liabilities are reasonable for use in the valuation.
- We find the recommended update of the mortality tables to the PUB-2010 mortality tables issued by the Retirement Plans Experience Committee (RPEC) of the Society of Actuaries (SoA) in 2019 to be prudent. The “2010” in the title refers to the central year of the data used by the SoA. The “Pub” indicates that the mortality experience was specific to public retirement plans in the United States. Separate tables were created for public safety, teacher, and general employees.
- We also believe that the use of the long-term MP-2017 mortality improvement scale for projecting future mortality improvement is a good recommendation that is aligned with historical data and the actuarial standards of practice. Using these long-term improvement scales is consistent with the approach we usually recommend.
- We have a comment for consideration regarding the differences between benefits-weighted and headcount-weighted mortality tables; however, as previously noted, we believe the recommended mortality assumptions are reasonable.

Based upon our review of the recommendations of the 2013-2018 demographic experience study, we found the actuarial work performed by OSA was reasonable, appropriate, and accurate.

2. Detailed Review of Demographic Experience Study

Introduction

Studies of demographic experience involve a detailed comparison of actual and expected experience. If the actual experience differs significantly from the overall expected results, or if the actual pattern does not follow the expected pattern of decrements by age, sex, or duration of employment, new assumptions are considered. Recommended revisions normally are not an exact representation of the experience during the observation period. Judgment is required to predict future experience from past trends and current evidence, including a determination of the amount of weight to assign to the most recent experience.

The observation period used in this study was 2013-2018, although data prior to those years was used for some of the assumptions. If adopted, the assumptions recommended would serve as the basis for the June 30, 2019 actuarial valuation. The demographic assumptions used in the June 30, 2017 actuarial valuation were based on the demographic assumptions from the 2007-2012 demographic experience study.

Actuarial Standard of Practice (ASOP) No.35

Actuarial Standard of Practice (ASOP) No. 35, Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations, provides guidance on selecting demographic assumptions used in measuring obligations under defined benefit pension plans. The general process for recommending demographic assumptions as defined in ASOP No. 35 is as follows:

- Identify the types of assumptions;
- Consider the relevant assumption universe;
- Consider the assumption format;
- Select the specific assumptions; and
- Evaluate the reasonableness of the selected assumption.

The actuary should select reasonable demographic assumptions in light of the characteristics of the defined benefit plan that is the subject of the measurement. A reasonable assumption is one that is expected to appropriately model the contingency being measured and is not anticipated to produce significant cumulative actuarial gains or losses over the measurement period.

Actual-to-Expected Ratio

In performing an Experience Study, an actuary will compare the actual results of the study with those the assumptions would have predicted. This comparison is called the “Actual-to-Expected” (A/E) ratio. If, for example, the A/E ratio for service retirement is 120%, this would indicate that the actual number of service retirements exceeded the number expected by the assumptions by 20%. Generally when the A/E ratio is significantly different from 100%, consideration should be given to adjusting the assumption so that the A/E is closer to 100%.

Mortality

Perhaps the most important demographic assumption is the mortality assumption. Mortality rates are used to project the length of time benefits will be paid to current and future retirees and beneficiaries. The selection of a mortality assumption affects plan liabilities because the estimated value of retiree benefits depends on how long the benefit payments are expected to continue. Typically, there are differences in the mortality rates by gender, retirement system, non-annuitant versus annuitant, and non-disabled versus disabled retired members. As a result, each group is reviewed separately.

The Retirement Plans Experience Committee (RPEC) of the Society of Actuaries (SOA) issued the "Pub-2010" family of static base mortality tables earlier in 2019. The 2010 in the title refers to the central year of collected study data. These are the first tables published by the RPEC based solely on public sector experience. The RPEC created separate tables for public safety, teachers, and general employees.

The OSA's recommendations for this assumption can be split into two fundamental pieces. The first piece is the "base table," measuring the probability of people alive at the valuation date living another year. The other piece is the improvement scale.

Mortality rates have declined over time and are expected to continue to decrease in the future. The resulting increased longevity should be anticipated in the actuarial valuation. For Washington state, this continues to be done through the use of generational mortality improvement projection. Mortality improvement projection anticipates future improvements in mortality by adjusting the static base mortality table using a mortality improvement projection scale. Generational mortality improvement projection results in a different mortality rate assumption for each year of birth, with the rates for later years of birth assuming lower mortality than the rates for earlier years of birth. The June 30, 2017 valuation used (mortality improvement projection) Scale BB, while the recommendation for the June 30, 2019 valuation is the long-term Scale MP-2017, which was published by the SOA in October 2017. Note that the long-term Scale MP-2017 table is the same as the long-term Scale MP-2019 table published by the SoA in October 2019.

Base Table Development

The approach used for developing the base table was to use the Pub-2010 table that best matched the population (public safety for PSERS, LEOFF, and WSPRS; teachers for TRS, and general employees for PERS and SERS). The experience considered was from 2006 and 2017. The headcount-weighted tables were used and projected to 2011, the middle of the period used to develop the base table assumptions. Age adjustments were used to match the experience in the study period. For example, if an age adjustment of -1 is used, then someone who is 60 years old is assigned the probability of living to the next year that matches someone age 59 in the standard table. An alternative way to approach the adjustments is to apply a percentage to the standard table. This maintains the shape of the curve and can allow for better flexibility in matching to actual experience.

We believe that the recommended base mortality tables are reasonable; however, consideration should be given in future studies to adding an adjustment to the base tables, as discussed below.

Benefits-weighted versus Headcount-weighted Mortality Tables

Our analysis of public retirement systems, which is supported by the analysis of the OSA and the Society of Actuaries, has typically shown that retirees with above-average benefit amounts tend to live longer than those with below-average benefit amounts. Note that benefits levels are a good proxy for the associated lability. This means that if the assumptions are accurately predicting the number of deaths, the decrease in liability due to the expected deaths may be less the projected by the valuation assumptions. The new public sector mortality tables include both a benefit amount-weighted version, which accounts for the correlation between higher benefits and lower mortality, and a headcount-weighted version, which is designed to estimate the number of deaths.

The OSA performed analysis on its largest group of retirees (PERS) using both the headcount-weighted and the amount-weighted mortality tables. The OSA found that based on the PERS-specific experience during the study period, the correlation between benefit amounts and mortality was less than projected by the amount-weighted mortality tables. Further, the OSA found that headcount-weighted mortality fit the PERS-specific experience better than the comparable amount-weighted table and therefore have recommended the use of headcount-weighted mortality tables in the upcoming valuation. Given the observed mortality patterns, we believe this is reasonable.

Our recommendation for future valuations is that if headcount-weighted mortality tables are used consideration be given to applying an adjustment to reduce the assumed mortality rates to account for the impact of benefit levels on mortality experience. For example, a factor less than 100% could be applied to the headcount-weighted mortality rates if the headcount-weighted mortality rates match experience. When a factor of 100% is used and the experience suggests longer life expectancies for those with larger benefits, there could be actuarial losses even if assumptions are met on a headcount-weighted basis. We believe the recommended assumptions provide a good predictor of future mortality patterns; applying an adjustment could result in the mortality tables better predicting future liability experience.

Beneficiary Mortality

Assumptions are made with respect to mortality for the beneficiaries of members who retired from one of the Washington state systems. For married retired members with joint-and-survivor forms of benefits, assumptions must be used for beneficiary mortality both before and after the death of the retiree. When the PUB-2010 tables were created, the RPEC decided only to use data after the retiree was deceased due to having incomplete data for beneficiary mortality prior to the retiree death. The resulting contingent survivor mortality table generally has rates higher than the general annuitant table, particularly for those in their 50s and 60s, where they can be up to 165% of the general annuitant table.

It is possible that young contingent survivors have higher mortality than the general population due to tendencies in lifestyle among those who have had spouses die young, grieving widow(er) effects, or other reasons. If there are unique characteristics for contingent survivors, it is not clear that those same higher rates should be applied for beneficiaries prior to the death of the member.

The RPEC report suggests three possible approaches: (https://www.soa.org/globalassets/assets/files/resources/research-report/2019/pub-2010-mort-report.pdf)

1. Assume the same mortality basis as the retiree, adjusted for the gender of the beneficiary
2. Use the retiree basis while the retiree is alive, but the contingent survivor mortality table after the retiree dies.
3. Assume contingent survivor mortality rates for the beneficiary both before and after the death of the original retired member

It is our understanding that approach #2 cannot be implemented easily with current software, but that it will likely be an option in the future.

Milliman and the OSA discussed these issues. The OSA recognizes that mortality rates for certain ages can be quite different between the contingent survivor table and the general annuitant tables. In an effort to reflect contingent survivor mortality rates for beneficiaries only after the death of the member, the OSA is recommending a modified mortality table for beneficiaries.

The general approach is meant to approximate Approach 2 above and is as follows:

1. For beneficiary ages less than 70 (60 for public safety plans): Use the plan/system specific annuitant table.
2. For beneficiary ages 70-79 (60-69 for public safety plans): Use a blend of the plan/system specific table and the public plan contingent survivor table. The earlier ages in the period would apply greater weight to the table described in 1 and transition to applying greater weight to the table described in 3 as the age approaches the upper end of the range.
3. For beneficiary ages greater than or equal to age 80 (70 for public safety plans): Use the public plan contingent table for all plan/systems.

The OSA believes that prior to the retiree's death, the general annuitant tables for each system are a reasonable approximation for the mortality of the beneficiaries in that system.

The crossover windows were chosen because of when most of the OSA's historical mortality experience studied for survivors occurred.

We believe that the OSA's recommended assumption for beneficiary mortality is reasonable for valuation purposes.

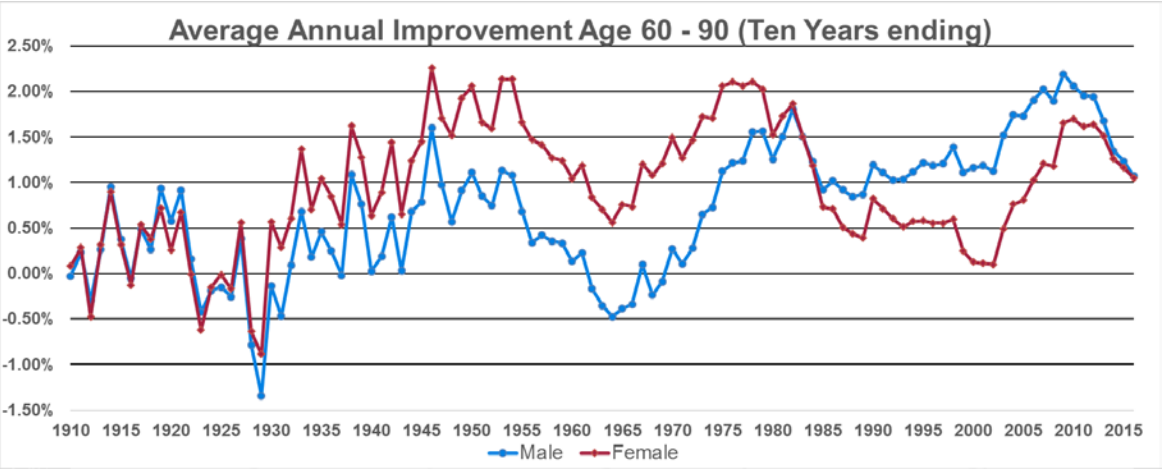
Mortality Improvement Scale

It is difficult to predict how much future mortality will improve compared to mortality today. The Society of Actuaries (SoA) has created very precise projections of mortality improvement in "MP" tables that are updated each year. The OSA is recommending the use of the "long-term" MP table, a variation of the tables created by the SoA. While the annual updates made by the SoA may be reasonable, the precision can cause volatility in the annual calculations of contribution rates and actuarial liabilities if updated tables are used each year. The SoA's calculations feature a two-dimensional assumption to allow for varying improvements by age and calendar year. We do not believe that the additional complexity of those tables leads to a materially better prediction of life expectancies in the context of pension funding.

In our opinion, the long-term variation chosen by the OSA will serve to reduce volatility from changes in the mortality improvement assumption, and therefore lead to more stable long-term pension contribution rate and liability calculations, while providing a reasonable estimate of the long-term pension liability in accordance with the Actuarial Standards of Practice (ASOPs).

The SoA's tables have short-term and long-term components to them, sometimes called a select and ultimate period. The short-term numbers have changed each year that the tables have been produced and also vary by male and female. The long-term projection scales have been unchanged from MP-2014 through MP-2019 and use unisex (combined male and female) rates. The OSA is recommending the use of the long-term rates that have not changed each year, which leads us to believe the recommended rates will have more stability in the future than the short-term rates published by the SoA.

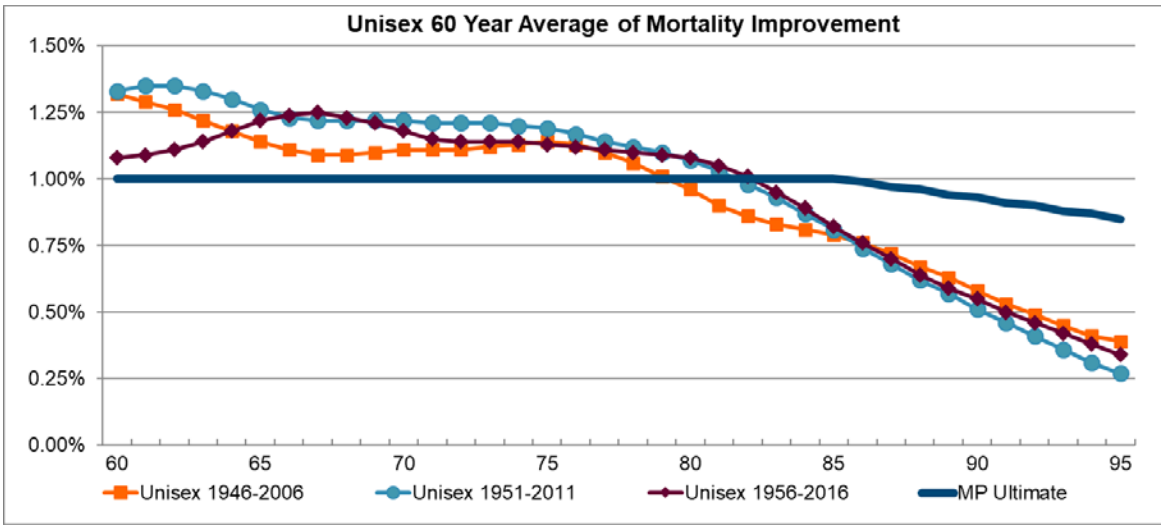
Milliman has studied data from the Social Security Administration (SSA) website. The SSA provides historical rates of death from 1900 to 2016. From that data, Milliman calculated historical mortality improvement. The SSA database was used because of its size, credibility, and public availability. On the following page is a chart that summarizes what we found:



From our analysis of the SSA data, we made these observations:

1. People continue to live longer. Both males and females show mortality improvement in most of the 10-year periods.
2. Mortality improvement is often very different from one decade to the next. The mortality improvement in one decade has not necessarily been a reliable indicator of the mortality improvement in the next decade.
3. Males and females have alternated in having the more rapid rate of improvement. This leads us to believe that a long-term assumption based on unisex improvement, as is recommended by the OSA in its use of the long-term MP table, is reasonable.
4. Mortality improvement tends to decline at older ages. The long-term MP table reflects this.

The chart below shows the unisex average rates of mortality improvement by age for three different 60-year periods spaced five years apart compared to the MP ultimate rates. In the Society of Actuaries studies the long-term MP rates apply to improvement that occurs more than 15 years in the future. MP tables have been produced annually from 2014 through 2019. Although the "select period" portion of the MP tables that apply to the near future has been updated each year, there has been no change to the long-term MP rates. The long-term MP rates are identical for males and females, with values that are a level 1.00% relative improvement per year until age 85 and then decline slowly to 0.85% at age 95, and then more rapidly to 0% at age 115.



Merit and Longevity Salary Increases

The OSA gathered pay data from 1995-2017, which should include years of various stages of the economic cycles. The OSA studied all pay for people actively employed at the beginning and end of each valuation period. The OSA summed all pay amounts for the entire time period studied to get total pay growth by years of service.

After determining the total salary increases at each level of service, the OSA isolated general salary growth. That was done by dividing the total salary increase as each service level by the estimates for inflation and real wage growth.

Milliman's typical approach is to look at total increases by individual member on a year-by-year basis. The productivity component of the pay increases is estimated based on the increase in the average salary for the membership class over the year. Backing out the CPI and productivity provides an estimate of the merit increases for each individual and these can be used to determine historical merit increases. Although not exactly the same,

the OSA approach is similar to Milliman's typical approach, we believe it would yield similar results. We also agree that using a longer study period is appropriate for this type of study.

The OSA used service levels instead of age in its analysis and our studies typically have supported the idea that service is a better predictor of salary increases than age.

The OSA studied Plan 2 versus Plan 3 salary increases and saw very little difference and therefore recommended identical assumptions for Plans 2 and 3. Note, however, that there were differences by retirement system and OSA reflected those. The OSA also found higher increases than previously assumed for non-LEOFF employees, with a good match for LOEFF employees. For this reason, adjustments were only made for non-LEOFF employees.

We believe that the shape of the merit salary increase curve is supported by the historical data and that the resulting recommendations are reasonable.

Rates of Service Retirement

Separate tables for retirement assumptions by age are used for each retirement system. Previously, the OSA used sex-distinct tables. Previous studies had indicated males retiring later than females, but that difference has largely diminished or even reversed in some cases. Therefore, we agree the move to gender-neutral rates is appropriate. While there are no longer distinctions based on gender, the OSA has now developed separate Plan 2 and Plan 3 rates, as Plan 3 has lower retirements for most ages (i.e., later retirements).

No assumptions were studied with this experience study for those hired after May 1, 2013 with the new early retirement factors, because the study period did not have any experience under the new factors.

We reviewed the recommended service retirement rates and found them all to be reasonable. We had a handful of minor suggestions and shared those with the OSA, and the OSA has addressed our suggestions.

Rates of Disability

We reviewed all the calculations and recommendations made by OSA for rates of disability and found them to be reasonable. For LEOFF 2, the benefit structure changed in 2005, so only data after that date was used. For most plans, data back to 1995 was considered. The disability rates were generally lowered due to lower disability experience over the past decade. The OSA introduced lower rates for Plan 3 than for Plan 2.

In addition to the disability rates, assumptions are made for what proportion of the disabilities are duty related. For LEOFF 2, there is also an assumption for the percentage of duty disabilities that are catastrophic. Each of these types of disabilities has a different benefit. We believe that the rates for total disabilities and the proportions for different types of disabilities are reasonable.

The OSA changed to have gender-neutral rates as the data did not support the idea that there was a significant difference in disability rates by gender within a retirement system. This is aligned with what we have seen in other systems and we support this change.

Rates of Termination (Withdrawal of Contributions and Vested Termination)

We reviewed all the calculations and recommendations made by OSA for rates of termination of employment and found them to be reasonable. We agree with the methodology of using tables based on length of service. We find this to be the strongest predictor of the likelihood of terminating employment. An exception was made to switch to aged-based tables for those who are eligible for service retirement, but choose to defer retirement. This is done to better align with the assumptions for service retirement and we believe this approach is reasonable. In aggregate, the actual-to-expected ratios were close to prior assumptions for terminations.

Data from 1995-2015 was used. The reason for ending in 2015 is so people who are rehired soon after terminating employment are excluded from the calculations. We believe this is a reasonable approach.

The OSA is now reflecting the fact that PERS Plan 3 tends to have higher rates of termination than Plan 2. This makes intuitive sense, as those members more likely to stay with their employer would be more inclined to choose the plan with the greater defined benefit component, which is Plan 2. This trend was much more limited for TRS (teachers). Plan 3 members are also more likely to defer retirement when retirement eligible, which may be the result of having less need for immediate income when able to draw on their defined contribution plan account balances.

Other Assumptions

We reviewed the calculations and recommendations for the following assumptions and found them to be reasonable. We provide additional commentary for some of the items.

Average Final Compensation Load: Members in PERS 1, TRS 1, and WSPRS 1 are eligible for payments that can increase Average Final Compensation. OSA reviewed data regarding those payments for retirements from 1996-2018 and developed plan-specific loads based on that information.

Legislation was passed in 2017 (SB 5274) which allows voluntary overtime, up to 70 hours per year, to be included in salaries for purposes of calculating retirement benefits in WSPRS. OSA has reflected this change as an increase in the underlying salary growth assumption. OSA will monitor any additional impact as experience emerges in the future. We believe this is a reasonable approach.

Age Difference with Spouse at Retirement Date: This assumption is used to assign ages for future retirees. It was studied by system, but the OSA found little difference by system. The OSA is recommending no changes to the assumption that female spouses are three years younger than male retirees and that male spouses are one year older than female retirees. The OSA also found that over 98.5% of recent retirees with spouses had spouses of the opposite sex and will continue with the assumption of opposite sex for spouses.

Military Service Credit Load: This assumption only impacts Plans 1 of PERS and WSPRS. It is for “non-interruptive” military service earned before entering the retirement system. Other employees can receive service credit for interruptive service under some circumstances and require a return to service. Interruptive service credit is included in the data files used for the valuation calculations.

Portion Withdrawal of Contributions upon Termination versus Taking Annuities: This assumption only applies to Plans 2. These members can take a withdrawal of their own contributions or can receive annuity benefits, waiting until meeting the age eligibility requirements if necessary. The probability of withdrawing contributions decreases with years of service. The assumption varies by membership class and plan. The OSA only considered terminations through 2015 due to the possibility of rehires.

Certain and Life Annuities: If a Plan 1 or Plan 2 retired member dies before the total pension payments received exceed the value of the accumulated contributions, the difference is paid to the beneficiary or estate. The OSA approximates the value of this by estimating a “certain period,” where the member is effectively assumed to be guaranteed to receive payments for a certain number of years. The OSA studied the ratio of the savings fund to the annual benefits for those retired 2014-2017. The calculations are forward looking, but are contemplative of recent history. OSA recommended small changes to a few of the plans.

Percent Male / Female: This assumption is used to estimate proportion of each sex when data not available. There is a gender "X" on the data for some individuals. OSA has assigned these members to either male or female based on the respective plan due to limitations in the valuation software. Our understanding is that gender X currently is a very small percentage of the total data, so this assumption will not materially impact the valuation. OSA will monitor the emerging experience in future studies.

Percent Duty Death: Since benefits vary by the type of death, an assumption is needed for which deaths are duty related. The assumptions were lowered for those not in WSPRS or LEOFF, left alone for WSPRS, and increased for LEOFF. The increase for LEOFF is largely based on changes to the law to include certain occupational diseases and the presumption for post-traumatic stress disorder.

Catastrophic Disability Rates for LEOFF 2: LEOFF 2 duty disability benefits are classified as either catastrophic or non-catastrophic. This did not become a designation until 2005, so the data is becoming more robust. The assumption moved from 12% to 14% based on historical data.

Maximum/Minimum/Default Salaries and Ages: The assumptions are applied for outliers and those with little service. Because benefits are limited by IRC 401(a)(17), the maximum salary does not impact benefit levels. Default salaries are necessary for vested terminated members when the information is missing. Note that the information is only missing for approximately 0.5% of vested terminated members. Default salaries are also used in certain situations when an active member has less than a year of service.

Different approaches are taken for different membership classes, but all calculations and recommendations appear reasonable.

TRS Salary Bonus: There are programs that enable teachers to get bonuses that are included in pensionable pay upon obtaining certification. This is expected to have an influence on the general salary growth in the short term. Once this program has existed for more years, a stable portion of the population will be assumed to have the certification and the assumption will no longer have an effect on percentage increases in general salary growth. Individual salary increases are modeled separately. OSA has recommended a reduction in the long-term assumption for TRS members eligible for the bonus. Note that this assumption does not impact other systems.

Portability with First Class Cities: Chapter 41.54 of the RCW allows for "portability" of benefits with the city employee retiree systems for Seattle, Tacoma, and Spokane. The law only had a material impact on PERS 2 members. A load of 0.9% for vested terminated members and future vested terminated members is based on salary increases seen as a result of portability for this group. This is a new assumption with this study.

Percentage Firefighter: This assumption is used to blend the retirement and termination assumptions for LEOFF members based on differences seen between the rates for firefighters and other LEOFF members. The assumption is 45% based on historical information.

Survivors Selecting Annuities: This assumption is used to determine how many receive a return of contributions instead of an annuity upon death. The assumption varies by age and plan. For Plan 3, there is no refund of contributions, so this assumption simply approximates the number who will have covered spouses. This is set equal to 35% for those under 35 and 65% for those ages 35 and older, informed by Washington state marriage percentages.

Review of Preliminary Report

Because the final 2017 demographic experience reports have not been completed at this time, we base the comments on the preliminary report. Overall, we found OSA's report to be very thorough.

Recommendations from Prior Audits

We have also reviewed the comments from our prior actuarial audits of the actuarial valuations and the OSA has addressed them. We had several recommendations in our 2014 report pertaining to the demographic experience study. Based on our review, it appears that each of the recommendations was incorporated in OSA's work.

Recommendations and Other Considerations

We recommend consideration be given to putting additional emphasis on the impact of benefit levels on mortality rates in the next demographic experience study, such as applying a small reduction to the headcount-weighted mortality tables so there is a larger margin in the A/E ratio for the recommended rates.