

November • 2014

2007–2012 Experience Study

*Washington State Public
Retirement Systems*

PERS • TRS • SERS • LEOFF • WSPRS • PSERS



Office of the State Actuary

"Securing tomorrow's pensions today."

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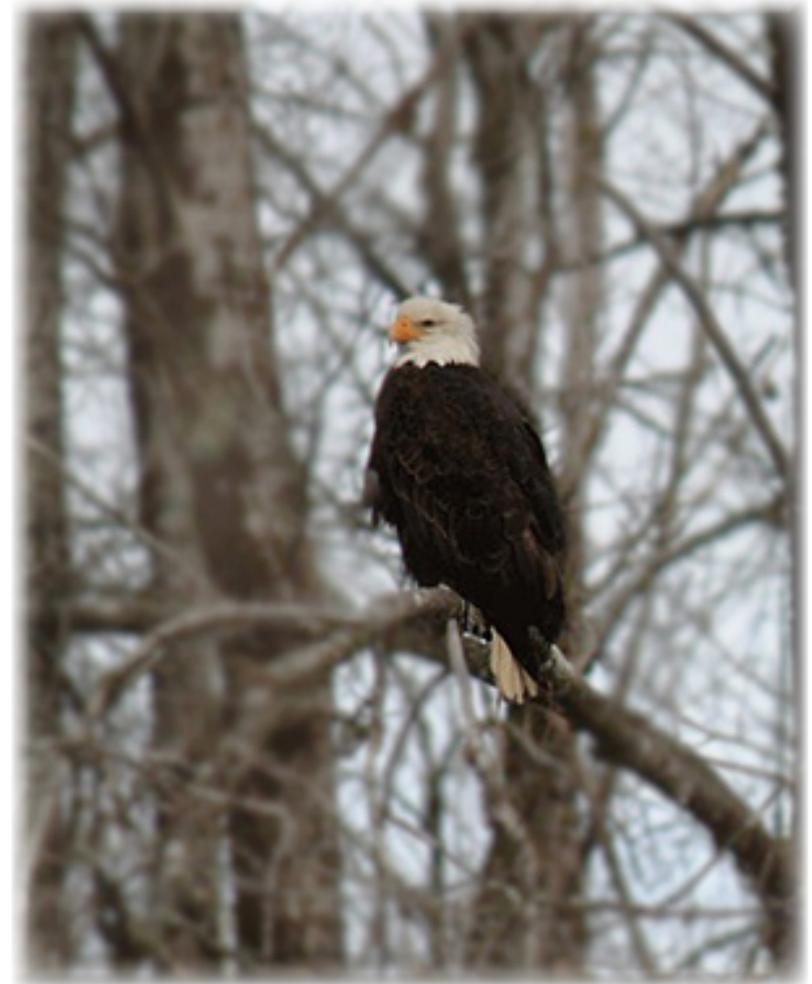


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Michael Harbour: Pages 1, 7,137, and back cover.
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Letter of Introduction Experience Study Report As of June 30, 2012

November 2014

As required under the Revised Code of Washington 41.45.090, this report documents the results of an experience study of the following Washington State retirement systems.

- ❖ Public Employees’ Retirement System.
- ❖ Teachers’ Retirement System.
- ❖ School Employees’ Retirement System.
- ❖ Public Safety Employees’ Retirement System.
- ❖ Law Enforcement Officers’ and Fire Fighters’ Retirement System.
- ❖ Washington State Patrol Retirement System.

The primary purpose of this experience study is to compare the current demographic assumptions to the actual experience of the plans to determine if any adjustments are required to ensure our assumptions remain reasonable. We organized this report in the following three sections.

- ❖ Executive Summary.
- ❖ Development of Demographic Assumptions.
- ❖ Appendices.
- ❖ Glossary.

The Executive Summary section provides a high-level summary of the study results for all systems. The Development of Demographic Assumptions and Appendices provide detailed information for each assumption by system and plan. The Glossary provides definitions of actuarial terms used throughout this report.

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We encourage you to submit any questions you might have concerning this report to our regular address or our e-mail address at state.actuary@leg.wa.gov. We also invite you to visit our website, at the address on the first page, for further information regarding the actuarial funding of the Washington State retirement systems.

Sincerely,

Matthew M. Smith, FCA, EA, MAAA
State Actuary

Aaron C. Gutierrez, MPA, JD
Senior Policy Analyst



Executive Summary

The Office of the State Actuary (OSA) prepared this actuarial experience study on the Washington State retirement plans as required under the Revised Code of Washington (RCW) 41.45.090. This experience study covers the period 2007 through 2012 and includes an analysis of all demographic assumptions used to develop contribution rates, administrative factors, and estimated fiscal costs (fiscal notes) associated with the retirement plans.

Intended Use

The primary purpose of this experience study is to compare the current demographic assumptions to the actual experience of the plans to determine if any adjustments are required to ensure our assumptions remain reasonable. Readers should not use this study for other purposes. We also advise readers of this study to seek professional guidance as to its content and interpretation and not to rely upon this communication without such guidance. Distribution of or reliance on only parts of this study could result in its misuse and may mislead others.

This analysis will become outdated with the release of our next experience study report. Please replace this report with our next report when available.

Our Approach

We gathered sufficient data, made assumptions where necessary, and established study methods for each assumption to evaluate how well our current demographic assumptions compare to past actual experience. We also reviewed whether different assumption formats (i.e., assumptions by gender, age, or years of service, etc.) would provide a better fit to past experience than the current formats. Lastly, we made expectations for the future and applied our professional judgment to update our current assumptions where necessary.

Please see the **Development of Demographic Assumptions** section for additional information.

Fiscal Impact

Actuaries use demographic and economic assumptions to estimate the cost of future plan benefits, which determines the timing and amount of plan contributions. Actual benefit payments plus expenses paid, less returns on invested contributions determine the actual cost of benefits.

Furthermore, we will review all demographic assumptions again within six years and likely make further updates at that time. Therefore, any assumption changes from this experience study impact short-term financing costs only.

Please see the [2013 Actuarial Valuation Report](#) for the impact on plan liabilities and contribution rates resulting from this experience study.

Economic Assumptions

We review the economic assumptions for the plans every two years as part of the contribution rate-setting process under RCW 41.45.030. The current economic assumptions, prescribed by the Legislature, follow:

◆ Inflation	3.00 percent.
◆ General salary growth	3.75 percent.
◆ Annual investment return	7.80 percent (7.50 percent in LEOFF 2).
◆ Growth in system membership	0.95 percent (0.80 percent in TRS, 1.25 percent in LEOFF 2).

We also reviewed the general salary growth assumption calculated in the [2013 Economic Experience Study](#) and found it was still reasonable for use here.

Demographic Assumptions

The following information summarizes the results for the major categories of demographic assumptions that comprise this report. Please see the **Development of Demographic Assumptions** section for additional information.

Mortality Rates

Our experience data continues to show improvements in mortality (i.e. members living longer) since the last study. Our experience indicates that the use of a different projection scale would be prudent; specifically 100 percent of Scale BB. Scale BB is a table

of annual mortality improvement rates published by the Society of Actuaries (SOA).

We also recommend the continued use of age offsets (shifts to the underlying RP-2000 table) to further refine our expected rates within our experience data.

Our latest experience supports the continued use of the RP-2000 Combined Healthy Mortality table for our healthy populations with appropriate age adjustments. We also recommend continued use of the RP-2000 “Disabled” table (also published by the SOA) for our disabled members in each plan except LEOFF 1.

Use of the new Scale BB increases the expected short-term cost of the plans, and increases the contribution rates required to fund those costs.

Retirement Rates

Our experience data shows that members are continuing to defer retirement. As a result, we lowered existing retirement rate assumptions (as developed in the prior study) toward the level of actual retirements.

Reducing the retirement rates decreases the expected short-term cost of the plans and decreases the contribution rates required to fund those costs.

Termination Rates

Our experience data shows that our current termination rates (as developed in the prior study) are still reasonable to use for early service years. The majority of terminations occur in early service years so the early service termination assumptions have the largest impact on plan costs.

We also observed higher-than-expected termination rates for Plans 2/3 members with 20 to 30 years of service. These higher-than-expected termination rates were most noticeable in Plan 3 for the Public Employees' Retirement System (PERS), the Teachers' Retirement System (TRS), and the School Employees' Retirement System (SERS).

We made only modest increases to the termination rates in the later service years. Generally, increasing the termination rates decreases the expected short-term cost of the plans and decreases the contribution rates required to fund these lower expected short-term costs.

Disability Rates

Our experience data shows that the current disability assumptions provide a good fit to the experience of the plans. The recommended changes to the disability assumptions create a minimal impact on contribution rates.

Service-Based Salary Increases

To estimate future salaries, we model two types of salary growth — general salary increases and service-based salary increases. General salary increases fall under the economic assumption category, and service-based salary increases fall under the demographic assumption category. The purpose of this experience study is to analyze the demographic assumptions. However, during our analysis of past salary growth, we reviewed the general salary growth assumption (as calculated in the [2013 Economic Experience Study](#)) and found it is still reasonable for use here.

Our experience data shows lower-than-expected service-based salary for a member at the beginning of that member's career. However, we observed higher-than-expected salary near the end of the scale for each system.

As a result, we made modest changes to the service-based salary rates. For most systems we lowered the assumption in the early years of membership service and increased it in later years. In some cases, the service based salary scale was extended to include later service years. Increasing the service based salary rates at the end of the member's career and extending the service based salary rates scale cost more in the short term than the short-term savings from lowering the member's early service based salary rates which increased the contribution rates.

Miscellaneous Assumptions

In addition to the major demographic assumptions described earlier, we use several other demographic assumptions in our actuarial valuation model to estimate the costs of the plans. We include each miscellaneous assumption, and its analysis, in this report. Overall, we recommend general updates, where appropriate, and each update has a very small impact on the expected short-term costs and contribution requirements of the plans. The total impact for all miscellaneous assumptions results in lower expected short-term costs and lower contribution rates for each plan.



Development of Demographic Assumptions



Office of the State Actuary

“Securing tomorrow’s pensions today.”

Actuarial Certification Letter Experience Study Report As of June 30, 2012

November 2014

This report documents the results of an experience study of the retirement plans defined under Chapters 41.26, 41.32, 41.35, 41.37, 41.40, and 43.43 of the Revised Code of Washington (RCW). The primary purpose of this study is to compare current demographic assumptions to the actual experience of the plans for the period 2007 through 2012, review data and trends that provide insight for future expectations, and apply this information to develop new demographic assumptions for the plans. This report should not be used for other purposes.

This analysis will become outdated with the release of our next experience study report. Please replace this report with our next report when available.

The experience study results summarized in this report involve methods for analyzing past demographic experience and setting new demographic assumptions for the plans. We believe that the methods used and the assumptions developed in this study are reasonable and are in conformity with generally accepted actuarial principles and standards of practice as of the date of this publication.

The Pension Funding Council hired an outside actuarial firm, Milliman, to audit the actuarial analysis we performed in this study including the new assumptions. They found our work to be reasonable. Milliman’s full audit report is available on our website.

The Department of Retirement Systems provided member and beneficiary data to us. We also received data from the following agencies.

- ❖ Law Enforcement Officers’ and Fire Fighters’ Plan 2 Retirement Board.

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Actuarial Certification Letter
Page 2 of 2

- ❖ Employment Security Department.
- ❖ Labor and Industries.
- ❖ Office of the Superintendent of Public Instruction.

We checked the data for reasonableness as appropriate based on the purpose of this study. An audit of the data was not performed. We relied on all the information provided as complete and accurate. In our opinions, this information is adequate and substantially complete for purposes of this study.

The undersigned, with actuarial credentials, meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. While this report is intended to be complete, we are available to offer extra advice and explanations as needed.

Sincerely,

Matthew M. Smith, FCA, EA, MAAA
State Actuary

Lisa A. Won, ASA, FCA, MAAA
Senior Actuary

Mortality Rates

Overall Summary

What is the Mortality Assumption and how is it Used?

Mortality assumptions are primarily used to estimate how long pension benefits will be paid after retirement. We also use these assumptions to determine the probability that a member will survive until retirement. These assumptions are typically gender and age-based.

In analyzing historical data, our goal is to establish assumptions that best estimate the probability of death in a given year for both the member and any eligible survivors. We also set assumptions for how we expect mortality rates to improve over time.

High-Level Takeaways

In general, we are observing improvements in mortality (i.e. members living longer). Our experience indicates that the use of a different projection scale would be prudent; specifically 100 percent of Scale BB. Unlike some other assumptions, we did not exclude data related to the Great Recession.

We believe we have sufficient data to develop our own mortality tables for most plans. Our latest experience supports the continued use of the RP-2000 Combined Healthy Mortality (RP-2000) table for our healthy populations with appropriate age adjustments.

To establish the age offsets, we extended the study period to 12 years of data for purposes of minimizing the volatility in our

analysis. Generally, our new offset assumptions did not change by more than one year since the last experience study.

Finally, we chose to simplify our approach to applying these assumptions by making age offsets directly to the RP-2000 table and using generational improvements to project mortality rates every year thereafter. This is a method change from our prior experience study.

Data

We began with 29 years of experience study records, from 1984 to 2012. No special data was added for this assumption, but some data was removed. We chose to remove valuation years 2001 and 2007 since they were, for the most part, only three-fourths of a year.¹

As noted above, we did not remove data related to the Great Recession, because we do not believe it materially impacted actual mortality rates.

Law Changes

No law changes impacted our selection of mortality assumptions.

¹For example, in 2007 the Legislature changed the valuation dates to match the fiscal year. Specifically, the valuation dates changed from September 30 to June 30 of each year.

Assumptions

All assumptions used in the development of mortality rates match those disclosed in the [2012 Actuarial Valuation Report](#) (AVR).

General Methodology

Actual mortality rates are calculated as follows. For each year and retirement plan we counted the number of deaths during the year and divided it by the number of members alive at the beginning of the year. This underlying data serves as the basis for setting our mortality assumptions.

We approached this analysis in three steps.

- ◆ First, we looked for a trend in the data to determine how mortality rates are improving over time. The results of this analysis were used in selecting a projection scale.
- ◆ Next, we reviewed our underlying base mortality table to determine if it remains appropriate or if other published tables may serve as a better fit for our retirement systems.
- ◆ Finally, we compared our actual mortality rates during the 2001-2012 period to the base table (projected to the mid-point of the period) for purposes of establishing age offset assumptions.

These steps are explained in more detail below.

Projection Scale

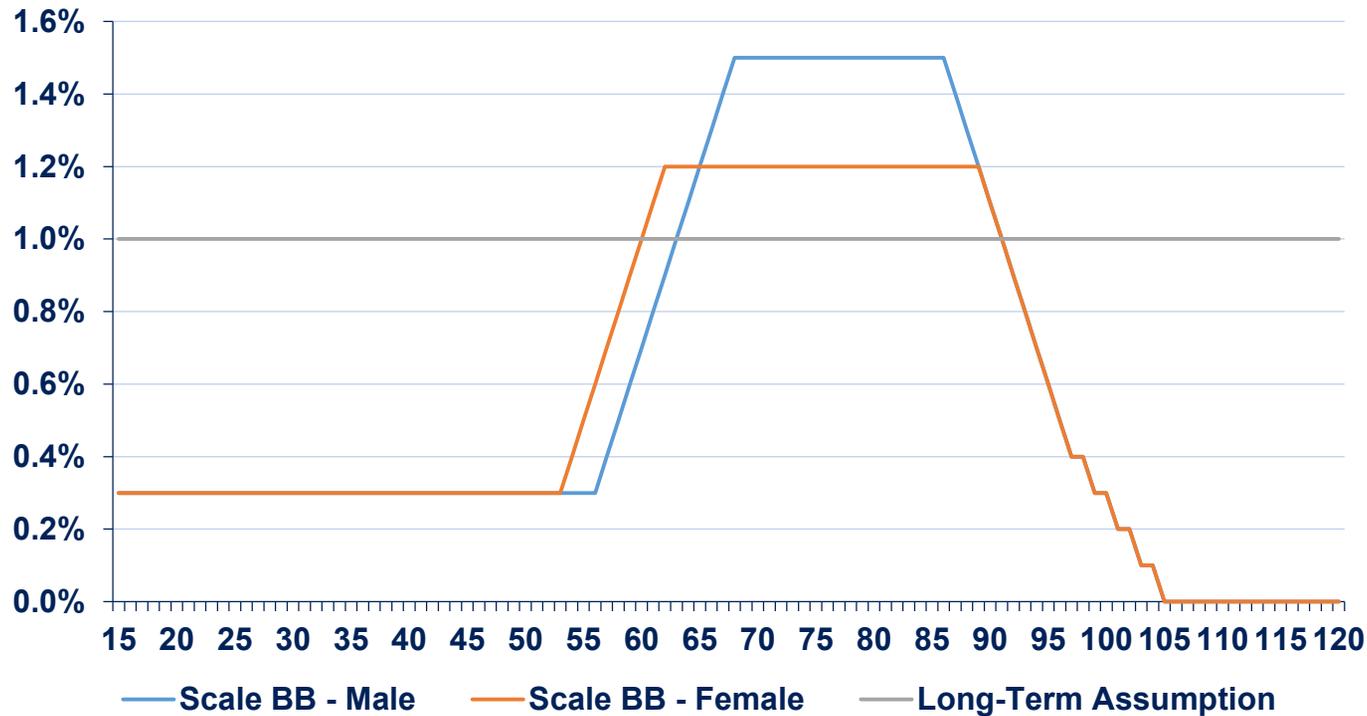
To select a projection scale, we began by reviewing our actual mortality experience from 1984-2012 and looking at the improvement in mortality at each age. We primarily focused our analysis on the Public Employees' Retirement System (PERS) and

the Teachers' Retirement System (TRS), since those two systems accounted for more than 90 percent of deaths across all time-frames studied. We then compared the results of our analysis to scales from the Society of Actuaries (SOA).

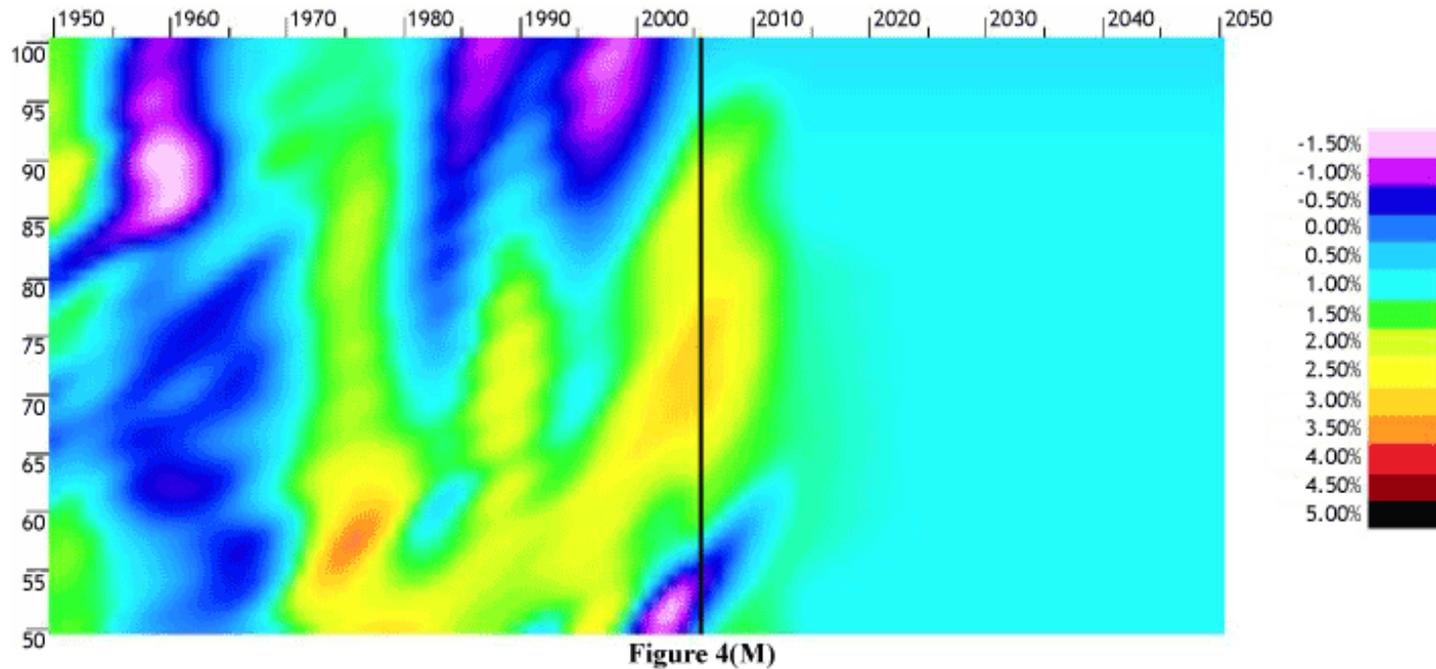
There are several scales currently available including: Scale AA, Scale BB, and MP-2014 (proposed). When preparing these scales, the SOA takes into account medical technology and innovation, new treatments and diseases, changes in amount/type of physical activity, changes in nutrition, prevalence of obesity and cigarette smoking, and other factors.

In selecting a mortality improvement scale for our systems, we took a death-weighted average of each system's experience over several time periods. We further eliminated experience that was several multiples higher or lower than the scale we are comparing it to by age (a concept we refer to as an "exclusion percentage").

In determining the exclusion percentage, we reviewed SOA's development of Scale BB. The following graph shows Scale BB by gender and compares it to a 1 percent annual mortality improvement assumption, consistent with the long-term expectations set forth by the SOA's Retirement Plans Experience Committee (RPEC).



We also reviewed a heat map from the Scale BB report that illustrates a range of experience from -1.5 percent to 5.0 percent annual mortality improvement.



We defined the exclusion percentage as the ratio of our mortality improvement experience by age compared to the scale of interest, where ratios larger in magnitude are excluded as outliers. Comparing the long-term RPEC assumption to the range provided in the heat maps, the use of an exclusion percentage around 350-650 percent seems reasonable.

Ultimately, we selected an exclusion percentage of 500 percent; or rather, have chosen to remove outlier experience that was larger in magnitude than five times the mortality improvement scale assumption at each age. The following tables summarize the healthy mortality improvement experience under our best-estimate exclusion percentage of 500 percent.

Observations as a % of Scale <i>(Using a 500% Exclusion)</i>			
Data Range	Scale AA	Scale BB	# of Deaths All System
1984-2012	109%	78%	84,949
1990-2012	152%	97%	72,307
1996-2012	204%	127%	56,118
2001-2012	143%	136%	40,101

We further include sensitivity of the results around the exclusion percentage assumption.

Observations as a % of Scale <i>(Using a 300% Exclusion)</i>		
Data Range	Scale AA	Scale BB
1984-2012	108%	70%
1990-2012	114%	81%
1996-2012	95%	102%
2001-2012	57%	110%
Observations as a % of Scale <i>(Using a 700% Exclusion)</i>		
Data Range	Scale AA	Scale BB
1984-2012	113%	86%
1990-2012	155%	107%
1996-2012	177%	147%
2001-2012	262%	158%

Note that our approach simply assigned 0 percent of the mortality improvement scale to the outliers. Alternatively, we could remove the weighting entirely from these observations. Below you'll find a table that illustrates that choice. We concluded that the difference between the two approaches would not change our conclusions.

PERS Observations as a % of Scale				
Data Range	<i>Original Results</i>		<i>Excluding Outliers</i>	
	AA	BB	AA	BB
1984-2012	133%	91%	137%	96%
1990-2012	179%	111%	185%	117%
1996-2012	266%	155%	281%	167%
2001-2012	170%	155%	238%	171%

At this point we do not plan to use the MP-2014 mortality projection scale since it is still preliminary. However, we will continue to review this in future studies.

Base Mortality Table

We reviewed the use of the RP-2000 Combined Healthy Mortality (RP-2000) table compared to separate Active/Employee and Retired tables. With PERS as an example, of the approximately 14,200 deaths during the experience study period, only about 1,200 were attributable to active and terminated vested members. Given that amount of data, we decided the use of separate mortality tables was not warranted.

Further, many of the early retirees in our plans do not leave the workforce. Rather, they just retire from public service or retire from their current occupation and continue to work in the private sector or in other occupations. As such, we believe active mortality is a better predictor of future mortality for these early retirees than an annuitant-based mortality table.

Please note that at this point, we do not plan to use the RP-2014 mortality tables for the same reason that we are not using the MP-2014 mortality projection scale. Further, the SOA has mentioned the possibility of a future study on public retirement system mortality. This suggests to us that RP-2014 may not be the best fit for our plans.

Age Offsets

Age offsets are the result of analyzing the difference between our actual mortality experience and the underlying base table (RP-2000). In other words, we use RP-2000 as a base reference point, then adjust the table to better model our experience.

To determine age offsets, we project the RP-2000 table to the midpoint of the 12-year study period (2006) using the chosen mortality improvement scale. We then summed the weighted differences in our actual mortality experience by age compared to the RP-2006 table. Finally, we tested a variety of age offsets with the goal of minimizing the magnitude of these weighted differences. The table below provides a high-level overview of the Actual to Expected (A/E) experience under a variety of age offsets.

Weighted Average A/E Experience							
PERS				SERS			
Offsets	Male	Offsets	Female	Offsets	Male	Offsets	Female
-2	1.111	-2	1.131	-3	1.000	-3	0.736
-1	1.001	-1	1.025	-2	0.902	-2	0.664
0	0.903	0	0.930	0	0.733	0	0.541
1	0.815	1	0.847	1	0.661	1	0.487
TRS				PSERS			
Offsets	Male	Offsets	Female	Offsets	Male	Offsets	Female
-4	1.110	-3	1.115	-2	N/A	-2	N/A
-3	0.999	-2	1.013	-1	N/A	-1	N/A
0	0.732	0	0.846	0	N/A	0	N/A
1	0.662	1	0.776	1	N/A	1	N/A
LEOFF				WSPRS			
Offsets	Male	Offsets	Female	Offsets	Male	Offsets	Female
-2	1.117	2	0.993	3	0.994	3	N/A
-1	1.005	1	1.093	2	1.096	2	N/A
0	0.906	0	1.207	0	1.339	0	N/A
1	0.816	-1	1.335	-1	1.484	-1	N/A

Milliman, the auditing actuarial consulting firm that reviewed our analysis, provided a suggested improvement for determining age offsets. Specifically, at their recommendation, we investigated the use of benefit-weighted analysis (as opposed to death-weighted). This approach could more accurately model plan liabilities by placing more weight on those receiving larger pension payments when setting mortality assumptions. However, our preliminary analysis did not indicate this would materially impact our assumptions at this time. We plan to use this new method and will continue to monitor this assumption in future experience studies.

Our old methodology projected the RP-2000 table to the mid-point of the experience study period, applied the age offsets, then further projected the table to a static year in the future for purposes of approximating the liability impact of using generational mortality improvements.

Results

All-Plan Summary

In general, we observed improvements in mortality (i.e. members living longer). Our experience indicates that the use of a different projection scale would be prudent, specifically 100 percent of Scale BB.

We believe we have sufficient data to develop our own mortality tables. Our latest experience supports the continued use of the RP-2000 table (with age adjustments where warranted) for our healthy populations.

Assumption Format

We simplified our approach from how we previously applied the mortality improvement and age offset assumptions. Specifically, we made age offsets directly to the RP-2000 table and use generational mortality improvements to project mortality rates every year thereafter.

Best Estimate Mortality Rates

Healthy Mortality

Projection Scale

We considered our expectations for the future and how those expectations may impact the observed trends. Then, we compared our conclusions with the available mortality scales and picked the scale we felt best reflects mortality trends for the Washington State retirement systems. For this study we selected 100 percent of Scale BB, whereas we previously used 50 percent of Scale AA.

100% of Scale BB														
Age	Male	Female	Age	Male	Female	Age	Male	Female	Age	Male	Female	Age	Male	Female
20	0.003	0.003	40	0.003	0.003	60	0.007	0.010	80	0.015	0.012	100	0.003	0.003
21	0.003	0.003	41	0.003	0.003	61	0.008	0.011	81	0.015	0.012	101	0.002	0.002
22	0.003	0.003	42	0.003	0.003	62	0.009	0.012	82	0.015	0.012	102	0.002	0.002
23	0.003	0.003	43	0.003	0.003	63	0.010	0.012	83	0.015	0.012	103	0.001	0.001
24	0.003	0.003	44	0.003	0.003	64	0.011	0.012	84	0.015	0.012	104	0.001	0.001
25	0.003	0.003	45	0.003	0.003	65	0.012	0.012	85	0.015	0.012	105	0.000	0.000
26	0.003	0.003	46	0.003	0.003	66	0.013	0.012	86	0.015	0.012	106	0.000	0.000
27	0.003	0.003	47	0.003	0.003	67	0.014	0.012	87	0.014	0.012	107	0.000	0.000
28	0.003	0.003	48	0.003	0.003	68	0.015	0.012	88	0.013	0.012	108	0.000	0.000
29	0.003	0.003	49	0.003	0.003	69	0.015	0.012	89	0.012	0.012	109	0.000	0.000
30	0.003	0.003	50	0.003	0.003	70	0.015	0.012	90	0.011	0.011	110	0.000	0.000
31	0.003	0.003	51	0.003	0.003	71	0.015	0.012	91	0.010	0.010	111	0.000	0.000
32	0.003	0.003	52	0.003	0.003	72	0.015	0.012	92	0.009	0.009	112	0.000	0.000
33	0.003	0.003	53	0.003	0.003	73	0.015	0.012	93	0.008	0.008	113	0.000	0.000
34	0.003	0.003	54	0.003	0.004	74	0.015	0.012	94	0.007	0.007	114	0.000	0.000
35	0.003	0.003	55	0.003	0.005	75	0.015	0.012	95	0.006	0.006	115	0.000	0.000
36	0.003	0.003	56	0.003	0.006	76	0.015	0.012	96	0.005	0.005	116	0.000	0.000
37	0.003	0.003	57	0.004	0.007	77	0.015	0.012	97	0.004	0.004	117	0.000	0.000
38	0.003	0.003	58	0.005	0.008	78	0.015	0.012	98	0.004	0.004	118	0.000	0.000
39	0.003	0.003	59	0.006	0.009	79	0.015	0.012	99	0.003	0.003	119	0.000	0.000
												120	0.000	0.000

Base Mortality Table

Based on our analysis, we think the continued use of the RP-2000 table is appropriate. Please see these mortality rates in the table below.

RP-2000 Combined Healthy Mortality Table														
Age	Male	Female	Age	Male	Female	Age	Male	Female	Age	Male	Female	Age	Male	Female
20	0.000345	0.000191	40	0.001079	0.000706	60	0.006747	0.005055	80	0.064368	0.045879	100	0.344556	0.237467
21	0.000357	0.000192	41	0.001142	0.000774	61	0.007676	0.005814	81	0.072041	0.050780	101	0.358628	0.244834
22	0.000366	0.000194	42	0.001215	0.000852	62	0.008757	0.006657	82	0.080486	0.056294	102	0.371685	0.254498
23	0.000373	0.000197	43	0.001299	0.000937	63	0.010012	0.007648	83	0.089718	0.062506	103	0.383040	0.266044
24	0.000376	0.000201	44	0.001397	0.001029	64	0.011280	0.008619	84	0.099779	0.069517	104	0.392003	0.279055
25	0.000376	0.000207	45	0.001508	0.001124	65	0.012737	0.009706	85	0.110757	0.077446	105	0.397886	0.293116
26	0.000378	0.000214	46	0.001616	0.001223	66	0.014409	0.010954	86	0.122797	0.086376	106	0.400000	0.307811
27	0.000382	0.000223	47	0.001734	0.001326	67	0.016075	0.012163	87	0.136043	0.096337	107	0.400000	0.322725
28	0.000393	0.000235	48	0.001860	0.001434	68	0.017871	0.013445	88	0.150590	0.107303	108	0.400000	0.337441
29	0.000412	0.000248	49	0.001995	0.001550	69	0.019802	0.014860	89	0.166420	0.119154	109	0.400000	0.351544
30	0.000444	0.000264	50	0.002138	0.001676	70	0.022206	0.016742	90	0.183408	0.131682	110	0.400000	0.364617
31	0.000499	0.000307	51	0.002449	0.001852	71	0.024570	0.018579	91	0.199769	0.144604	111	0.400000	0.376246
32	0.000562	0.000350	52	0.002667	0.002018	72	0.027281	0.020665	92	0.216605	0.157618	112	0.400000	0.386015
33	0.000631	0.000394	53	0.002916	0.002207	73	0.030387	0.022970	93	0.233662	0.170433	113	0.400000	0.393507
34	0.000702	0.000435	54	0.003196	0.002424	74	0.033900	0.025458	94	0.250693	0.182799	114	0.400000	0.398308
35	0.000773	0.000475	55	0.003624	0.002717	75	0.037834	0.028106	95	0.267491	0.194509	115	0.400000	0.400000
36	0.000841	0.000514	56	0.004200	0.003090	76	0.042169	0.030966	96	0.283905	0.205379	116	0.400000	0.400000
37	0.000904	0.000554	57	0.004693	0.003478	77	0.046906	0.034105	97	0.299852	0.215240	117	0.400000	0.400000
38	0.000964	0.000598	58	0.005273	0.003923	78	0.052123	0.037595	98	0.315296	0.223947	118	0.400000	0.400000
39	0.001021	0.000648	59	0.005945	0.004441	79	0.057927	0.041506	99	0.330207	0.231387	119	0.400000	0.400000
												120	1.000000	1.000000

Age Offsets

Generally, we observed that the retirement systems' experience matches those in the RP-2006 table who are about a year younger (a negative age offset). Some plans had relatively little experience in terms of total deaths over the period. As a result, we relied on their general relationship to the larger plans where appropriate when setting these assumptions for males and females.

The table below summarizes the new and old age offset assumptions.

Offset Assumptions						
Analysis of Mortality Table Offsets	PERS All Plans		TRS All Plans		SERS Plan 2/3	
	Male	Female	Male	Female	Male	Female
	Old	-1	-1	-2	-2	0
New	-1	-1	-3	-2	-1	-1
Analysis of Mortality Table Offsets	PSERS Plan 2		LEOFF All Plans		WSPRS Plan 1/2	
	Male	Female	Male	Female	Male	Female
	Old	-1	-1	-1	1	-1
New	-1	-1	-1	1	-1	1
Deaths	PERS	TRS	SERS	LEOFF	WSPRS	Total
2001-2012	27,195	10,406	979	1,365	156	40,101

We believe we have insufficient data to set system-specific mortality tables for the School Employees' Retirement System (SERS) and the Public School Employees' Retirement System (PSERS). As a result, we decided to rely on PERS experience for purposes of setting SERS and PSERS offsets. Given the nature of most SERS and PSERS jobs, we might see slightly higher actual rates of mortality for these plans than for PERS in the future. However, the use of PERS mortality provides a reasonable amount of conservatism given the uncertainty in this area. Similarly, we relied on the Law Enforcement Officers' and Fire Fighters' Plan 2 Retirement System (LEOFF) experience when setting this assumption for the Washington State Patrol Retirement System (WSPRS).

Although our data indicates a +2 age offset would be reasonable for LEOFF females, we decided to retain our current assumption of +1. A vast majority of deaths from this system for females are survivors (not female law enforcement officers or fire fighters), and data is limited. It's also reasonable to expect them to be similar to the general population (or PERS, perhaps).

Examples

The following examples will help illustrate how these assumption components are combined. For instance, we calculate the mortality rate as of the year 2001 for a male aged 25 and a female aged 70 given the age offsets for TRS. Note that this concept can be extrapolated for each year in the future.

An age 25 male with a -3 offset is assumed to have mortality experience consistent with a 22-year-old male; similarly, the age 70 female with that of a 68-year-old female for a -2 age offset. As of the year 2000, the age 22 (=25-3) male and age 68 (=70-2) female mortality rates are 0.000366 and 0.013445, respectively. This means that we expect there is a 0.0366 percent chance that a TRS male age 25 will die by the end of the year. As might be expected, the TRS female age 70 is assumed to have 1.3445 percent chance of dying before 2001.

The Scale BB improvements for these example members are 0.003 male and 0.012 female at those ages. In other words, the age 25 male mortality rate is expected to decrease by 0.3 percent each year and the age 70 female mortality rate by 1.2 percent. The following shows one year of this calculation. Projected to 2001, an age 25 male and an age 70 female in TRS will have corresponding mortality rates of 0.000365 [= 0.000366 * (1-0.003)] and 0.013284 [= 0.013445 * (1-0.012)].

Disabled Mortality

We reviewed the continued use of the RP-2000 Combined Disabled Mortality table. Based on our analysis of all plans combined (excluding LEOFF 1), we believe this remains reasonable. Please see these disabled mortality rates in the table below.

RP-2000 Combined Disabled Mortality Table														
Age	Male	Female	Age	Male	Female	Age	Male	Female	Age	Male	Female	Age	Male	Female
20	0.022571	0.007450	40	0.022571	0.007450	60	0.042042	0.021839	80	0.109372	0.072312	100	0.344556	0.237467
21	0.022571	0.007450	41	0.022571	0.007450	61	0.043474	0.022936	81	0.115544	0.077135	101	0.358628	0.244834
22	0.022571	0.007450	42	0.022571	0.007450	62	0.044981	0.024080	82	0.121877	0.082298	102	0.371685	0.254498
23	0.022571	0.007450	43	0.022571	0.007450	63	0.046584	0.025293	83	0.128343	0.087838	103	0.383040	0.266044
24	0.022571	0.007450	44	0.022571	0.007450	64	0.048307	0.026600	84	0.134923	0.093794	104	0.392003	0.279055
25	0.022571	0.007450	45	0.022571	0.007450	65	0.050174	0.028026	85	0.141603	0.100203	105	0.397886	0.293116
26	0.022571	0.007450	46	0.023847	0.008184	66	0.052213	0.029594	86	0.148374	0.107099	106	0.400000	0.307811
27	0.022571	0.007450	47	0.025124	0.008959	67	0.054450	0.031325	87	0.155235	0.114512	107	0.400000	0.322725
28	0.022571	0.007450	48	0.026404	0.009775	68	0.056909	0.033234	88	0.162186	0.122464	108	0.400000	0.337441
29	0.022571	0.007450	49	0.027687	0.010634	69	0.059613	0.035335	89	0.169233	0.130972	109	0.400000	0.351544
30	0.022571	0.007450	50	0.028975	0.011535	70	0.062583	0.037635	90	0.183408	0.140049	110	1.000000	1.000000
31	0.022571	0.007450	51	0.030268	0.012477	71	0.065841	0.040140	91	0.199769	0.149698	111	1.000000	1.000000
32	0.022571	0.007450	52	0.031563	0.013456	72	0.069405	0.042851	92	0.216605	0.159924	112	1.000000	1.000000
33	0.022571	0.007450	53	0.032859	0.014465	73	0.073292	0.045769	93	0.233662	0.170433	113	1.000000	1.000000
34	0.022571	0.007450	54	0.034152	0.015497	74	0.077512	0.048895	94	0.250693	0.182799	114	1.000000	1.000000
35	0.022571	0.007450	55	0.035442	0.016544	75	0.082067	0.052230	95	0.267491	0.194509	115	1.000000	1.000000
36	0.022571	0.007450	56	0.036732	0.017598	76	0.086951	0.055777	96	0.283905	0.205379	116	1.000000	1.000000
37	0.022571	0.007450	57	0.038026	0.018654	77	0.092149	0.059545	97	0.299852	0.215240	117	1.000000	1.000000
38	0.022571	0.007450	58	0.039334	0.019710	78	0.097640	0.063545	98	0.315296	0.223947	118	1.000000	1.000000
39	0.022571	0.007450	59	0.040668	0.020768	79	0.103392	0.067793	99	0.330207	0.231387	119	1.000000	1.000000
												120	1.000000	1.000000

Since we chose to use Scale BB with our Healthy mortality tables, and in light of our actual disabled mortality experience from our latest study, we decided to apply Scale BB for Disabled mortality improvements. Otherwise, we did not make any changes to the disabled mortality assumptions since the last experience study.

We analyzed how well PERS observations compared to the mortality improvement scales and reviewed the age offsets for PERS and LEOFF 1. Given the limited data as noted in the table below, we decided to analyze all disabled mortality data together (with and without LEOFF 1). The following table shows the counts of actual deaths of disabled members in the plans between 2001 and 2012.

Deaths (Disabled)		PERS	TRS	SERS	LEOFF 1	LEOFF 2	WSPRS	Total
2001-2012	Male	787	123	32	835	15	14	1,806
	Female	756	194	36	6	15	1	1,008
	Total	1,543	317	68	841	30	15	2,814

The next table summarizes the disabled mortality improvement experience under our best estimate exclusion percentage of 500 percent. We further include sensitivity of the results around that assumption. However, given the limited experience data (in terms of the number of disabled members who have died), we ultimately decided to rely on the mortality improvement assumption set for our healthy population, 100 percent of Scale BB.

Observations as a % of Scale						
Exclusion %	300%		500%		700%	
Data Range	AA	BB	AA	BB	AA	BB
1984-2012	58%	63%	78%	90%	101%	237%
1990-2012	69%	59%	87%	113%	100%	147%
1996-2012	50%	73%	94%	75%	79%	143%
2001-2012	20%	11%	11%	77%	85%	60%

We continue to observe that mortality experience in LEOFF 1 is closer to a healthier population than a disabled population. Their experience was compared to the RP-2000 Combined Healthy Mortality table for purposes of determining age offsets. Consistent with the prior assumption, we will continue to apply a +2 age offset for all disabled members in LEOFF 1.

All other plans will continue to use a zero age offset assumption with the RP-2000 Combined Disabled Mortality table. The table below provides a high-level overview of the A/E experience.

Weighted Average A/E Experience							
LEOFF 1 w/ Healthy Mortality				All Plans w/o LEOFF 1			
Offsets	Male	Offsets	Female*	Offsets	Male	Offsets	Female
3	0.964	3	3.930	3	0.862	3	1.154
2	1.067	2	4.333	1	0.947	1	1.287
0	1.313	0	5.322	0	0.991	0	1.358
-1	1.460	-1	5.895	-1	1.036	-1	1.434

* LEOFF 1 only had 6 female disabled deaths over the 12-year period.

Retirement Rates

Overall Summary

What is the Retirement Rate Assumption and how is it Used?

Retirement Rates represent the probability that a retirement-eligible individual will stop working and start collecting their pension benefits. In analyzing historical data, our goal is to establish assumptions that best represent when and how much money will be paid from the trust fund each year in the future.

This assumption is generally age-based. However, where appropriate, we set assumptions that vary by service-level and gender.

High-Level Takeaways

In general, we are continuing to observe members deferring retirement. When members work longer, we see fewer actual retirements per year. As a result, we lowered existing retirement rate assumptions (as developed in the prior study) toward the level of actual retirements.

We evaluated several potential changes to the structure of the retirement assumption (e.g. gender and service splits, simplifications, etc.), but ultimately did not make any changes from the structure in place for the prior experience study.

We saw that the data during the Great Recession reduced the ratio of actual to expected retirements in some systems by approximately half. Given the magnitude of the Great Recession's impact on

actual retirement rates, and the fact that it is likely a once-in-a-career event, we chose to remove those data years for the Public Employees' Retirement System (PERS) Plans 2/3, the Teachers' Retirement System (TRS) Plans 2/3, and the School Employees' Retirement System (SERS) Plans 2/3.

However, we chose not to exclude the Great Recession data for the Plans 1 (PERS 1 and TRS 1) or the Public Safety systems (the Law Enforcement Officers' and Fire Fighters' Retirement System [LEOFF], the Public Safety Employees' Retirement System [PSERS], and the Washington State Patrol Retirement System [WSPRS]). In the public safety plans, we observed that actual retirement rates appeared to return to pre-recession levels much faster. We suspect this is due to higher incomes and/or benefit adequacy.

Assumptions

Except as noted, all assumptions used in the development of retirement rates match those disclosed in the [2012 Actuarial Valuation Report](#).

Data

We began with 18 years of experience study records, from 1995-2012. No special data was added for this assumption, but some data was removed for some individual plans as noted below.

We chose to remove valuation years 2001 and 2007 since they were, for the most part, only three-fourths of a year.¹ Although retirements in some systems are seasonal, we wanted to ensure the number of expected retirements was consistent throughout the measurement period for actual retirements.

¹For example, in 2007 the Legislature changed the valuation dates to match the fiscal year. Specifically, the valuation dates changed from September 30 to June 30 of each year.

As noted above, we chose to remove data for the Great Recession years (2008-12) for the Plans 2/3 (PERS 2/3, TRS 2/3, and SERS 2/3). With the removal of that data, we have insufficient data to adjust retirement rates for members with more than 30 Years of Service (YOS) based on plan experience for the Plans 2/3. Therefore, any adjustments we made to the “at least 30 YOS” rates were based on the adjustments we made to the “less than 30 YOS” rates.

Counting Method

We adjusted our counting method to include members who would reach the minimum retirement age at some point in a given year. In other words, if a member is age 54 at the beginning of the year (at the time the data is compiled), but will reach age 55 later that year, our previous method would show this person as having retired at age 54. Our new method assumes these members are age 55 at the beginning of the year.

Law Changes

There were three law changes since the last study that impacted the retirement rates assumption:

- ◆ SHB 2688 (2006).
 - ▲ Applied to LEOFF 1.
 - ▲ This law removed the 30 YOS cap.
- ◆ ESHB 1981 (2011) – Repealed Plan 1 Return-To-Work Program Expansion.
 - ▲ Applied to members of PERS 1/TRS 1.
 - ▲ This law repealed a portion of the return-to-work rules (also known as post-retirement employment, or “retire-rehire”). This resulted in lower retirement rates, but no more than already being reduced due to other forces.

- ◆ 2ESB 6378 (2012) – Reduced Subsidized Early Retirement Factors (ERFs) for members hired on or after May 1, 2013.
 - ▲ Applied to PERS 2/3, TRS 2/3, and SERS 2/3.
 - ▲ In future studies we will provide a different set of retirement rates for the applicable groups using methods consistent with this legislation.

General Methodology

For each year and retirement plan we counted both the members who met the minimum eligibility requirements at the beginning of the year (exposures), and the members who retired during the year (retirements). We divided the number of retirements by the number of exposures to arrive at an observed, or actual, retirement rate.

We then analyzed the relation of actual to expected retirements in light of economic and demographic trends and applied our professional judgment to set retirement rates.

The main issue in setting the retirement rates during this experience study is to limit the large shifts in the rates over short periods of time and not overcompensate for short-term events (e.g. the Great Recession). As a result, we did not let the retirement rates decrease as much as the most recent information implies they should. If the data from the next experience study continue to show a trend of decreasing retirement rates we will reduce retirement rates further.

We determined which data to exclude and set new assumptions based upon that experience and expectations for the future. In most cases, we will limit the change in the assumed weighted average retirement age (due to an assumption change) to one year.

Results

All-Plan Summary

Generally, we made modest changes to the retirement rates; nudging the Actual-to-Expected (A/E) ratios closer to one. The notable exception is LEOFF Plan 2, where actual retirements have been consistently and significantly lower than expected.

The decade of investment returns from 2000-2010, also known as the “Lost Decade,” heavily influenced Plan 3 retirements (reducing Defined Contribution balances and leading to later retirements). We do not believe this decade of experience represents expected outcomes for future Plan 3 retirees. As a result, we decided to continue to apply one set of retirement rates for the Plans 2/3.

Please see the **Appendices** for results on all plans.

Summary of A/E Ratios		
	Under Old Assumptions	Under New Assumptions
PERS 1	0.954	0.995
PERS 2/3	0.958	0.992
TRS 1	0.933	0.991
TRS 2/3	0.714	0.789
SERS 2/3	0.893	0.970
PSERS	N/A	N/A
LEOFF 1	0.798	0.908
LEOFF 2	0.601	0.726
WSPRS	1.093	1.061

Disability Rates

Overall Summary

What is the Disability Rate Assumption and how is it Used?

Rates of disability represent the probability that members might collect a disability benefit. As used in this report, “disabled” and “disability” mean that an eligible member has experienced an incident of disability and selected a disability benefit (instead of a return of contributions benefit if available).

We estimate rates of disability based on the experience of a large population and adjust the rates as our data evolve and our confidence in the data increases.

This assumption is generally age-based. However, where appropriate we have set assumptions that vary by service level and gender.

High-Level Takeaways

Generally, we found that experience matched our assumptions well, and we made slight adjustments to disability assumptions for most plans. We did not change disability rates in the Law Enforcement Officers’ and Fire Fighters’ Retirement System (LEOFF) Plan 1 or the Teachers’ Retirement System (TRS) Plans 2/3.

We considered several changes to the format and structure of the disability rate assumption and, ultimately, made some plan-specific changes. Please see the individual system summary sections in the **Appendices** for more information.

We saw that the data during the Great Recession reduced the ratio of actual to expected disabilities in some systems. Given the magnitude of the Great Recession’s impact on actual disability rates, and the fact that it is likely a once-in-a-career event, we chose to remove those data years for the Public Employees’ Retirement System (PERS) Plans 2/3, TRS 2/3, and the School Employees’ Retirement System (SERS) Plans 2/3. However, we chose not to exclude the Great Recession data for the Plans 1 (PERS 1 and TRS 1) or the Public Safety systems (LEOFF, the Public Safety Employees’ Retirement System [PSERS], and the Washington State Patrol Retirement System [WSPRS]). In the Plans 1 and the public safety plans, we observed that actual disability rates did not appear as affected by the Great Recession as those in the Plans 2/3. We suspect this is due to higher incomes and/or benefit adequacy.

Assumptions

Except as otherwise noted, all assumptions used in the development of disability rates match those disclosed in the [2012 Actuarial Valuation Report](#).

Data

We began with 18 years of experience study records, from 1995-2012. The exception to this rule is LEOFF 2, where we started with experience study records from 2005-2012. To study the LEOFF 2 total (catastrophic) disability benefit only, we used preliminary 2013 valuation data to identify members who had this particular disability status within the study period. We studied this assumption using a different data format because the benefit is relatively new and studying the data at a single point in time is equivalent to studying rates by valuation year.

We chose to remove SERS data from the year 2000 and WSPRS data from 1995 due to quality concerns.¹

We chose to remove valuation years 2001 and 2007 for all plans since they were odd-length valuation periods.² We wanted to ensure the number of expected disabilities was consistent throughout the measurement period for actual disabilities.

As noted above, we chose to remove data for the Great Recession years (2008-2012) for the Plans 2/3 (PERS 2/3, TRS 2/3, and SERS 2/3).

Counting Method

In some cases, we changed the count and timing of disabilities to address delayed disability benefits. We did not take this approach in the *2001-2006 Experience Study*.

Specifically, there were some records where members would go from active status to terminated status. Then, after remaining in terminated status for several years (up to eight years in a row), the member would change to a disability status. In those cases, we changed the member's years of terminated status to years of disabled status. This is because we assume that the actual disability incident probably occurred immediately prior to the member terminating employment, but that some disabilities are not immediately approved by the approving entity.

¹For example, SERS officially opened just a few months before the end of the valuation cycle. As a result, the 2000 SERS valuation year was only four months long.

²For example, in 2007 the Legislature changed the valuation dates to match the fiscal year. Specifically, the valuation dates changed from September 30 to June 30 of each year.

Law Changes

Since the last study, no law changes have affected the disability assumption. However, several changes to LEOFF 2 disability benefits occurred just before the creation of that report. We discuss those changes in the LEOFF section in the Appendices.

General Methodology

For each year and retirement plan we counted both the members who started the year as active members (exposures), and the members who started receiving disability benefits during the year (disablements). We then divided the number of disablements by the number of exposures to arrive at an observed, or actual, disability rate.

For most plans, we counted only the active members who were not eligible to retire. This is because we assume that members of most plans, if offered the choice, would choose a service retirement. For LEOFF and WSPRS we counted all members, regardless of eligibility for service retirement. This is because their tax-free disability benefits are in some ways better than their after tax service retirement benefits, and we assume they may choose a disability benefit if presented the option.

Additional Considerations

As noted above, both an incidence of disability and selection of a disability benefit must occur before an eligible member can begin receiving a disability benefit.

For most plans, the Department of Retirement Systems (DRS) determines whether an individual who has experienced an incident of disability is eligible for a disability benefit. For LEOFF 1 members, this determination is made by local disability boards, and for WSPRS, it is made by the chief of the Washington State Patrol.

Plan definitions (e.g. “service” versus “total” disability) and eligibility requirements (e.g. medical check-ups) vary by plan. Please see the respective plan handbooks on the [DRS Publications](#) page for additional information.

Not all eligible members who experience an incident of disability will choose to receive a disability benefit. Some will choose to keep working, while others will choose a traditional service retirement or choose a new career (possibly withdrawing their contributions).

This selection aspect of the disability assumption is difficult to predict because that decision can be driven by many individual factors unrelated to the actual disability benefit provisions, such as health, job satisfaction, financial security, etc.

Results

All Plan Summary

Generally, we saw that the disability assumptions were a good fit to actual data. We made slight adjustments to the disability assumptions in most plans. We did not change disability rates in LEOFF 1 or TRS 2/3.

The table to the right shows Actual-to-Expected (A/E) counts before and after the assumption changes.

Please see the **Appendices** for results on all plans.

Summary of A/E Ratios		
	Under Old Rates	Under New Rates
PERS 1	0.90	0.93
PERS 2/3	0.98	1.00
TRS 1	0.89	0.89
TRS 2/3	1.05	1.05
SERS 2/3	0.77	0.87
PSERS*	0.45	0.45
LEOFF 1	0.79	0.79
LEOFF 2	0.46	0.70
WSPRS 1/2	0.58	0.82

**Ratios of rates for less than 10 years of PSERS service; very little experience.*

Termination Rates

Overall Summary

What is the Termination Rate Assumption and how is it Used?

Termination rates represent the likelihood an active member will leave (terminate) an eligible position without retiring. We use termination assumptions in combination with our percent vested assumption¹ to estimate who will collect a deferred retirement benefit. We assume that terminated members who do not take a deferred retirement benefit will receive a refund of accumulated contributions.

For reference, a member who terminates has two options:

- ◆ **Withdraw their employee contributions with interest.**
This option is available for any member who terminates. Members of Plans 1 and 2 who make a withdrawal will lose their membership service and forfeit their rights to future benefits. Plan 3 members do not lose their service upon withdrawal of their defined contribution accounts.
- ◆ **Defer retirement.**
This option is available only for members who are vested (or worked a designated number of years within their retirement plan). It allows the member to leave their contributions in the system and defer their annuity until the plan's retirement eligibility.

¹Members who are vested have a right to a future benefit even if they terminate their employment before retirement. This assumption is addressed in the Miscellaneous section of this report.

This assumption is generally distinguished by years of service and gender. However, where appropriate we have set unisex assumptions (Law Enforcement Officers' and Fire Fighters' Retirement System [LEOFF] and Washington State Patrol Retirement System [WSPRS]).

High-Level Takeaways

In general, we found the current termination rates were still reasonable to use for early service years.² The majority of terminations occur in early service years so the early service termination assumptions have the largest impact on plan costs.

We observed higher-than-expected termination rates for Plans 2/3 members with 20 to 30 years of service. These higher-than-expected termination rates were most noticeable in Plan 3 for the Public Employees' Retirement System (PERS), the Teachers' Retirement System (TRS), and the School Employees' Retirement System (SERS).

We did not exclude data related to the Great Recession for this assumption.

Assumptions

We assume a member who is eligible for service retirement will not terminate within their plan. We therefore set our termination rates to zero in our valuation model once a member has attained the age and service required for retirement.

We also assume a member will not return to active status if they remain terminated for more than two years.

²Over 50 percent of actual terminations occur in the first five service years for PERS, TRS, SERS, and LEOFF.

For all systems except WSPRS, termination rates above 30 years of service are equal to the termination rates at 30 years of service.

Except as noted, all other assumptions used in the development of termination rates match those disclosed in the [2012 Actuarial Valuation Report](#).

Data

We began with 16 years of experience study records, from 1995-2010. No special data was added for this assumption, but some data was removed. Specifically, we chose to remove valuation years 2001 and 2007 for all plans since they were (for the most part) only three-fourths of a year.³ We also removed data from the year 2000 for SERS due to a short valuation cycle.

Data Adjustments

We also adjusted the termination data for PERS in 2006 to remove an observed spike in terminations. In researching the spike, we realized that the PERS members who transferred to the Public Safety Employees' Retirement System (PSERS) were being counted as terminations when, in fact, they are dual members with portable benefits. We have fixed the PERS valuation year 2006 data by removing the members who transferred to PSERS from the termination counts.

Counting Method

We adjusted our counting method from the last study to consider members who terminate but return to work as active members

³For example, in 2007 the Legislature changed the valuation dates to match the fiscal year. The valuation dates changed from September 30 to June 30 of each year. The 2007 valuation had a nine-month valuation cycle for all systems.

within two years. If a member terminates and returns to work within two years then they will be considered active during their period of absence.

Under this counting approach, members who left employment in the last two years could still return to work, so we have not included the valuation data for 2011 and 2012 in our study.

Great Recession

As noted above, we did not remove data related to the Great Recession. We are not yet seeing the residual effects of the Great Recession in the termination rate experience like we saw in other assumptions. We expect this is due to normal budget cycles in government, which take time to react to market conditions. It is also possible that a depressed economy encourages members to continue working longer than they might otherwise, and this could be offsetting any downsizing one might expect during a recession.

Law Changes

Since the last study, no law changes have impacted the termination rate assumption.

General Methodology

For each system, we summarized data from the studied time period by service level. Additionally, we summarized the data by gender for all systems except for LEOFF and WSPRS.

The number of active members not eligible for retirement was the basis for determining the members we assume eligible to terminate.

The number of counted terminations at each service level equals the terminated members minus the members who were rehired back to active service.

The actual termination rate at each service level equals the number of counted terminations divided by the number of active members not eligible for retirement.

We relied on actual termination rates as the foundation for our new termination rates, but we also considered future expectations and applied our professional judgment.

Unlike several other decrements we studied, we did not remove any data related to the Great Recession. We did, however, remove some data as described in the Data section.

Results

All-Plan Summary

Generally, we made modest changes to the termination rates. The Actual-to-Expected (A/E) ratios for all systems moved closer to 100 percent. For all systems, except the TRS and WSPRS, we expect fewer terminations than expected under the Old assumptions.

Summary of A/E Ratios				
	Male		Female	
	Under Old Assumptions	Under New Assumptions	Under Old Assumptions	Under New Assumptions
PERS	97%	98%	97%	98%
TRS	105%	101%	106%	101%
SERS	96%	98%	103%	103%
LEOFF*	93%	98%	93%	98%
WSPRS*	111%	105%	111%	105%

*LEOFF and WSPRS have unisex termination rates.

We do not have enough data to create a termination rates assumption based purely on PSERS data. Our first year of PSERS data is 2007. We would only have four years of PSERS termination data based on our counting approach (2007-2010). Please see **PSERS** for more details.

Please see the **Appendices** for results on all plans.

Service-Based Salary

Overall Summary

What is the Service-Based Salary Assumption and how is it Used?

Assumptions about total salary growth help us project salaries to determine the size of the members' future benefits and calculate contribution rates, which are collected as a percentage of payroll.

Total salary growth consists of two parts.¹

◆ Service-Based Salary.

We assume active members in each system will receive Service-Based Salary (SBS) increases in the future, so long as they remain active in their plan. This assumption includes increases in salary due to step (or merit increases), promotion, overtime, or extra contracts.

◆ General Salary Increase.

The General Salary Increase (GSX) assumption is a combination of inflation and productivity. GSX is an economic assumption and reviewed as part of a different process and cycle. We did, however, review the GSX assumption calculated in the [2013 Economic Experience Study](#) and found it was still reasonable for use here.²

Only SBS increases are addressed in detail in this study, but the GSX helps inform that assumption.

¹See *Actuarial Standards of Practice (ASOP) 27* for more information.

²Under current law, the current GSX assumption is 3.75%. For more information, please see RCW 41.45.035.

Please note that the National Board Certification bonuses for teachers will be addressed separately in the Teachers' Retirement System (TRS) Salary Bonus section.

High-Level Takeaways

In general, we observed lower-than-expected SBS for a member at the beginning of that member's career. However, we observed higher-than-expected SBS near the end of the SBS scale for each system. For some systems, we extended the number of steps at the end of the SBS scale.

Given the nature of budgetary cycles, it typically takes a year or two for governments to react to sizeable events like the Great Recession. We began to observe significant decreases in salary during the 2010 valuation and continuing into the 2012 valuation. These decreases in salary are the result of laws³ that temporarily reduced active member salaries. Considering that the Great Recession is likely a once-in-a-lifetime event, we chose to remove the 2010-2012 data from our SBS study.

Assumptions

We assume the SBS increase for new entrants (service equal to zero) will match the SBS increase for members with one year of service.

Except as noted, all assumptions used in the development of SBS rates match those disclosed in the [2012 Actuarial Valuation Report](#).

³See the *Law Changes* section.

Data

We began with 29 years of experience study records, from 1984-2012. No special data was added for this assumption, but some data was removed as noted below.

Counting Method

For each valuation year, we studied the active members who worked full time for at least two consecutive years.

TRS/SERS

We adjusted the counting methods for some the TRS and the School Employees' Retirement System (SERS) members in valuation years 2008-2012. TRS and SERS members begin their first year at the beginning of the school year (late August or early September), but the valuation cut-off date is June 30. As a result, we found that the full time members in their first year of employment appeared to receive less than a full valuation year of service. We adjusted our counting method to compensate.

WSPRS

We adjusted our counting method to include the Washington State Patrol Retirement System (WSPRS) members during 1984-1991. Based on our data, all WSPRS members during that period received half-length valuation years of service, even though they should have been granted a full year of service. However, we found that their total amount of service credit and salary for those years was accurate.⁴

⁴This issue was not addressed in the 2001-2006 Experience Study.

Great Recession

We chose to remove the data from 2010-2012 for two reasons.

- ◆ The data from 2010-2012 was significantly impacted by the Great Recession. Specifically, the average salary increase for valuation years 2010 through 2012 was lower than other valuation years to a material degree.
- ◆ When we calculated the GSX component of Total Salary Growth in the *2013 Economic Experience Study*, we did so based on data from 1984-2009. For consistency, we chose to keep the two time periods of data consistent between the two studies.

Data Adjustments

We eliminated data records that showed zero years of service at the end of the member's first full-time year. Either the service was incorrect or, more likely, the field indicating the full time status was an error. As a result, we deleted one Public Employees' Retirement System (PERS) record, two TRS records, and 23 WSPRS records.

Law Changes

Reductions in Employee Compensation

There were two bills that reduced employee compensation costs in different ways during the 2009-2011 Biennium.

- ◆ **SB 6157 (2009 Session):** Modified the definition of Average Final Compensation (AFC).
 - ▲ Applied to members of PERS.
 - ▲ At retirement, AFC will include any salary foregone due to time off without pay during the 2009-11 Biennium.

- ◆ **ESSB 6503 (2010 Session):** Reduction in employee compensation.
 - ▲ Applied to members of TRS Public Safety Employees' Retirement System (PSERS), Law Enforcement Officers' and Fire Fighters' Retirement System (LEOFF) and WSPRS.
 - ▲ Required agencies to reduce employee compensation, and expanded AFC protection (see SB 6157) to TRS, PSERS, LEOFF, and WSPRS.

There was one bill that reduced employee compensation costs during the 2011-2013 Biennium.

- ◆ **ESSB 5860 (2011 Session):** Temporary salary reduction.
 - ▲ Applied to members of all state retirement systems.
 - ▲ Required a temporary base salary reduction for all state employees during the 2011-13 Biennium.

Salary Step M

The Legislature created a new salary step (Step M), effective July 1, 2013. Members eligible to receive the Step M increase are Washington general service employees (excluding registered nurses) in PERS.

General Methodology

We began by observing the Total Salary Growth at each service level.

We then determined SBS by dividing the total salary increase at each service level by the actual inflation and actual productivity.

As noted in the **What is the Service-Based Salary Assumption and how is it Used?** section, we assumed the GSX component of Total

Salary Growth from the 2013 Economic Experience Study was valid for most systems,⁵ so we relied on it as accurate.

We then applied our professional judgment to set the new SBS rates. Our new SBS rates reflect future expectations as well.

Results

All-Plan Summary

Generally, we made modest changes to the salary merit rates. For most systems, we lowered the SBS assumption in the early steps and increased the SBS assumption for steps later in the members' career.

Summary of Actual to Expected Ratios for Total Salary Growth						
	Old			New		
	Actual	Expected*	A/E	Actual	Expected**	A/E
PERS***	5.46%	5.47%	100%	5.46%	5.46%	100%
TRS	5.96%	6.03%	99%	5.96%	6.00%	99%
SERS	5.37%	5.40%	99%	5.37%	5.44%	99%
LEOFF	5.91%	5.84%	101%	5.91%	6.02%	98%
WSPRS	5.68%	5.78%	98%	5.68%	5.68%	100%

*Expected reflects (1+old service based salary scale) * (1+actual GSX) -1.

** Expected reflects (1+new service based salary scale) * (1+actual GSX) -1.

*** We assume PSERS will have the same SBS for PERS.

Please see the **Appendices** for results on all plans.

⁵During the 2013 Economic Experience Study, we noted that LEOFF displayed a lower productivity than other systems. For the Demographic Experience Study, we made an adjustment to the LEOFF observed general salary increase assumption by upward adjusting the productivity rate so that it is more consistent with other systems. Please see the **LEOFF** section in the Appendix for more details.



Appendices

Retirement Rates

PERS

Past Experience

PERS 1

The following table shows the year-by-year Actual and Expected retirements for the Public Employees' Retirement System (PERS) Plan 1 using the old retirement rate assumptions.

PERS 1 Retirement Experience by Year			
Age	Plan 1 (Males & Females)		
	Actual	Expected	Ratio
1995	1,576	1,390	1.134
1996	1,604	1,425	1.125
1997	1,749	1,490	1.174
1998	1,806	1,575	1.146
1999	2,018	1,693	1.192
2000	2,129	1,778	1.197
2001	1,707	1,740	0.981
2002	2,124	1,911	1.112
2003	1,905	1,927	0.988
2004	1,832	1,948	0.941
2005	1,811	2,023	0.895
2006	1,713	2,005	0.854
2007	1,200	1,957	0.613
2008	1,345	1,943	0.692
2009	1,241	1,834	0.677
2010	1,272	1,707	0.745
2011	1,201	1,543	0.778
2012	1,016	1,427	0.712
Total	29,249	31,316	0.934

The next table shows, by age, the Actual-to-Expected (A/E) ratios for PERS 1 after we removed the data as described in the Data section. As a result, note that the total Actual and Expected counts, along with the Ratio will not match the prior table.

PERS 1 Retirement Experience by Age			
Age	Plan 1 (Males & Females)		
	Actual	Expected	Ratio
47-49	502	467	1.075
50-54	4,403	4,719	0.933
55-59	7,456	7,618	0.979
60-64	10,039	10,789	0.930
65-69	3,244	3,240	1.001
70-75	510	466	1.094
75-79	145	132	1.102
80+	43	189	0.228
Total	26,342	27,620	0.954

PERS 2/3

The table below shows the year-by-year Actual and Expected retirements for PERS 2/3 using the old retirement rate assumptions.

PERS 2/3 Retirement Experience by Year			
Age	Plan 2/3 (Males & Females)		
	Actual	Expected	Ratio
1995	311	236	1.316
1996	329	270	1.220
1997	377	302	1.247
1998	441	360	1.226
1999	545	448	1.216
2000	568	507	1.120
2001	495	583	0.849
2002	670	741	0.904
2003	790	886	0.891
2004	901	1,005	0.896
2005	1,005	1,206	0.833
2006	1,113	1,396	0.797
2007	854	1,580	0.541
2008	1,266	1,979	0.640
2009	1,550	2,394	0.648
2010	1,869	2,778	0.673
2011	2,338	3,225	0.725
2012	2,330	3,670	0.635
Total	17,752	23,566	0.753

The table below shows, by age, the A/E ratios for PERS 2/3 after we removed the data as described in the Data section. As a result, note that the total Actual and Expected counts, along with the Ratio, will not match the prior table.

PERS 2/3 Retirement Experience by Age			
Age	Plan 2/3 (Males & Females)		
	Actual	Expected	Ratio
55-59	455	712	0.639
60-64	2,701	2,653	1.018
65-69	3,319	3,386	0.980
70-75	452	415	1.088
75-79	97	92	1.050
80+	26	99	0.263
Total	7,050	7,358	0.958

Methods and Format of Assumptions

As noted, we removed the Great Recession data for PERS 2/3 due to its disproportionate short-term impact on those plans. We did not remove that data for Plan 1.

We considered alternate formats for the assumptions and, ultimately, decided not to make any changes. For reference, we considered, but did not adopt:

- ◆ **Separate rates for PERS 3 members.**
Even though PERS 3 had lower actual retirement rates than PERS 2, we declined to make that change due to the relative lack of plan experience in PERS 3 and the Lost Decade of investment returns.
- ◆ **Modifications due to changes in return-to-work or “retire-rehire” rules.**
We feel the impact of those legislative changes was immaterial for this assumption as a whole.

Best Estimate PERS Retirement Rates

The table to the right shows the Old, Actual (1995-2012 experience, excluding the years we removed), and New Rates for PERS 1.

	PERS 1 Retirement Rates					
	Males			Females		
	Old Rates	Actual	New Rates	Old Rates	Actual	New Rates
47	0.483	0.514	0.460	0.580	0.692	0.540
48	0.580	0.643	0.550	0.435	0.500	0.460
49	0.532	0.556	0.500	0.387	0.404	0.380
50	0.532	0.527	0.450	0.338	0.322	0.300
51	0.436	0.432	0.400	0.339	0.317	0.300
52	0.436	0.423	0.400	0.339	0.302	0.300
53	0.436	0.409	0.400	0.300	0.271	0.300
54	0.437	0.409	0.400	0.466	0.405	0.400
55	0.213	0.220	0.170	0.223	0.222	0.280
56	0.175	0.177	0.170	0.175	0.182	0.160
57	0.175	0.166	0.170	0.175	0.162	0.160
58	0.176	0.173	0.170	0.166	0.165	0.160
59	0.216	0.211	0.200	0.324	0.292	0.300
60	0.147	0.148	0.160	0.167	0.159	0.160
61	0.226	0.205	0.230	0.206	0.189	0.210
62	0.325	0.294	0.300	0.285	0.265	0.260
63	0.230	0.220	0.220	0.210	0.208	0.200
64	0.300	0.262	0.280	0.260	0.232	0.280
65	0.400	0.344	0.340	0.390	0.350	0.360
66	0.260	0.312	0.300	0.220	0.263	0.220
67	0.260	0.272	0.260	0.230	0.267	0.220
68	0.200	0.213	0.220	0.220	0.244	0.220
69	0.230	0.226	0.220	0.250	0.252	0.220
70	0.240	0.247	0.220	0.200	0.223	0.220
71	0.200	0.269	0.220	0.200	0.212	0.220
72	0.200	0.232	0.220	0.200	0.217	0.220
73	0.200	0.223	0.220	0.200	0.201	0.220
74	0.200	0.168	0.220	0.200	0.219	0.220
75	0.200	0.266	0.220	0.200	0.189	0.220
76	0.200	0.224	0.220	0.200	0.192	0.220
77	0.200	0.234	0.220	0.200	0.205	0.220
78	0.200	0.290	0.220	0.200	0.215	0.220
79	0.200	0.167	0.220	0.200	0.283	0.220
80	1.000	1.000	1.000	1.000	1.000	1.000

The following table shows the Old, Actual (1995-2012 experience, excluding the years we removed), and New Rates for PERS 2/3.

PERS 2/3 Retirement Rates												
	Service < 30 Years						Service ≥ 30 Years					
	Males			Females			Males			Females		
	Old Rates	Actual	New Rates	Old Rates	Actual	New Rates	Old Rates	Actual	New Rates	Old Rates	Observed	New Rates
55	0.030	0.013	0.020	0.030	0.026	0.020	0.130	0.000	0.120	0.140	0.000	0.120
56	0.030	0.012	0.030	0.030	0.019	0.020	0.120	0.000	0.120	0.120	0.000	0.120
57	0.030	0.018	0.040	0.030	0.021	0.020	0.130	0.000	0.120	0.130	0.000	0.120
58	0.070	0.017	0.050	0.030	0.029	0.020	0.140	0.000	0.120	0.130	0.000	0.120
59	0.070	0.036	0.060	0.030	0.034	0.040	0.180	0.000	0.160	0.280	0.000	0.240
60	0.090	0.038	0.070	0.090	0.052	0.060	0.140	0.000	0.120	0.150	0.000	0.120
61	0.090	0.097	0.080	0.120	0.106	0.130	0.220	1.000	0.200	0.200	1.000	0.200
62	0.250	0.181	0.240	0.220	0.162	0.200	0.330	0.000	0.280	0.290	0.000	0.280
63	0.200	0.284	0.220	0.200	0.237	0.180	0.250	0.000	0.260	0.250	0.000	0.260
64	0.550	0.632	0.560	0.550	0.632	0.560	0.600	0.000	0.560	0.600	0.000	0.560
65	0.450	0.436	0.400	0.450	0.428	0.400	0.450	0.000	0.400	0.450	0.000	0.400
66	0.260	0.274	0.240	0.250	0.251	0.240	0.260	0.000	0.240	0.250	0.000	0.240
67	0.200	0.202	0.240	0.220	0.227	0.240	0.200	0.000	0.240	0.220	0.000	0.240
68	0.200	0.201	0.240	0.230	0.225	0.240	0.200	0.000	0.240	0.230	0.000	0.240
69	0.220	0.206	0.240	0.210	0.198	0.240	0.220	0.000	0.240	0.210	0.000	0.240
70	0.200	0.244	0.240	0.230	0.239	0.240	0.200	0.000	0.240	0.230	0.000	0.240
71	0.200	0.230	0.240	0.200	0.192	0.240	0.200	0.000	0.240	0.200	0.000	0.240
72	0.200	0.173	0.240	0.200	0.237	0.240	0.200	0.000	0.240	0.200	0.000	0.240
73	0.200	0.174	0.240	0.200	0.188	0.240	0.200	0.000	0.240	0.200	0.000	0.240
74	0.200	0.237	0.240	0.200	0.298	0.240	0.200	0.000	0.240	0.200	0.000	0.240
75	0.200	0.179	0.240	0.200	0.190	0.240	0.200	0.000	0.240	0.200	0.000	0.240
76	0.200	0.250	0.240	0.200	0.159	0.240	0.200	0.000	0.240	0.200	0.000	0.240
77	0.200	0.297	0.240	0.200	0.250	0.240	0.200	0.000	0.240	0.200	0.000	0.240
78	0.200	0.214	0.240	0.200	0.194	0.240	0.200	0.000	0.240	0.200	0.000	0.240
79	0.200	0.150	0.240	0.200	0.261	0.240	0.200	0.000	0.240	0.200	0.000	0.240
80	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

The table below shows the Actual and Expected retirements for PERS 1 by age using the new retirement rate assumptions for experience from 1995-2012, excluding the years we removed.

PERS 1 Under New Assumptions			
Age	Plan 1 (Males & Females)		
	Actual	Expected	Ratio
47-49	502	452	1.111
50-54	4,403	4,266	1.032
55-59	7,456	7,288	1.023
60-64	10,039	10,557	0.951
65-69	3,244	3,085	1.052
70-75	510	500	1.020
75-79	145	145	1.002
80+	43	189	0.228
Total	26,342	26,482	0.995

The table below shows the Actual and Expected retirements for PERS 2/3 by age using the new retirement rate assumptions for experience from 1995-2012, excluding the years we removed.

PERS 2/3 Under New Assumptions			
Age	Plan 2/3 (Males & Females)		
	Actual	Expected	Ratio
55-59	455	596	0.763
60-64	2,701	2,582	1.046
65-69	3,319	3,229	1.028
70-75	452	487	0.929
75-79	97	111	0.875
80+	26	99	0.263
Total	7,050	7,104	0.992

TRS

Past Experience

TRS₁

The next table shows the year-by-year Actual and Expected retirements for the Teachers' Retirement System (TRS) Plan 1 using the old retirement rate assumptions.

TRS 1 Retirement Experience by Year			
Age	Plan 1 (Males & Females)		
	Actual	Expected	Ratio
1995	980	1,063	0.922
1996	988	1,116	0.886
1997	1,043	1,197	0.871
1998	1,346	1,275	1.055
1999	1,376	1,323	1.040
2000	1,469	1,410	1.042
2001	3,118	1,516	2.057
2002	1,469	1,115	1.317
2003	1,233	1,144	1.078
2004	1,319	1,261	1.046
2005	1,247	1,282	0.973
2006	1,179	1,245	0.947
2007	1,004	1,261	0.796
2008	286	1,226	0.233
2009	861	1,282	0.672
2010	628	1,161	0.541
2011	854	1,088	0.785
2012	698	936	0.746
Total	21,098	21,899	0.963

The table below shows, by age, the A/E ratios for TRS 1 after we removed the data as described in the Data section. As a result, note that the total Actual and Expected counts, along with the Ratio, will not match the prior table.

TRS 1 Retirement Experience by Age			
Age	Plan 1 (Males & Females)		
	Actual	Expected	Ratio
47-49	0	0	N/A
50-54	3,340	2,249	1.485
55-59	6,460	7,608	0.849
60-64	5,326	6,246	0.853
65-69	1,404	1,627	0.863
70-75	139	130	1.072
75-79	16	20	0.784
80+	5	15	0.333
Total	16,690	17,896	0.933

TRS 2/3

This table shows the year-by-year Actual and Expected retirements for TRS 2/3 using the old retirement rate assumptions.

TRS 2/3 Retirement Experience by Year			
Age	Plan 2/3 (Males & Females)		
	Actual	Expected	Ratio
1995	20	21	0.937
1996	28	28	1.003
1997	42	36	1.161
1998	56	68	0.821
1999	98	98	1.002
2000	125	136	0.920
2001	251	178	1.408
2002	146	185	0.790
2003	143	232	0.617
2004	218	322	0.676
2005	256	402	0.637
2006	301	478	0.630
2007	244	574	0.425
2008	229	753	0.304
2009	405	1,049	0.386
2010	451	1,338	0.337
2011	734	1,682	0.436
2012	631	1,949	0.324
Total	4,378	9,530	0.459

The table below shows, by age, the A/E ratios for TRS 2/3 after we removed the data as described in the Data section. As a result, note that the total Actual and Expected counts, along with the Ratio, will not match the prior table.

TRS 2/3 Retirement Experience by Age			
Age	Plan 2/3 (Males & Females)		
	Actual	Expected	Ratio
55-59	280	640	0.437
60-64	657	823	0.798
65-69	455	499	0.912
70-75	31	37	0.836
75-79	10	7	1.429
80+	0	0	N/A
Total	1,433	2,006	0.714

Methods and Format of Assumptions

For the TRS plans, we considered the same alternatives and made the same relative changes as in PERS. Please see the **PERS — Methods and Format Assumptions** section above for more information.

Best Estimate TRS Retirement Rates

The table on the following page shows the Old, Actual (1995-2012 experience, excluding the years we removed), and New Rates for TRS 1.

TRS 1 Retirement Rates												
	Service <> 30 Years						Service = 30 Years					
	Males			Females			Males			Females		
	Old Rates	Actual	New Rates	Old Rates	Actual	New Rates	Old Rates	Actual	New Rates	Old Rates	Actual	New Rates
47	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
48	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
49	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
50	0.000	0.500	0.000	0.000	1.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000
51	0.000	0.988	0.000	0.000	0.990	0.000	0.000	1.000	0.000	0.290	0.250	0.300
52	0.000	0.981	0.000	0.000	0.886	0.200	0.381	0.399	0.360	0.328	0.287	0.300
53	0.240	0.522	0.220	0.240	0.382	0.200	0.381	0.374	0.360	0.328	0.327	0.300
54	0.240	0.397	0.220	0.240	0.393	0.200	0.381	0.372	0.360	0.328	0.321	0.300
55	0.240	0.191	0.220	0.240	0.188	0.200	0.381	0.378	0.360	0.328	0.373	0.300
56	0.238	0.199	0.220	0.238	0.171	0.200	0.331	0.345	0.360	0.328	0.306	0.300
57	0.238	0.172	0.220	0.238	0.157	0.200	0.331	0.338	0.360	0.339	0.289	0.300
58	0.238	0.177	0.220	0.238	0.180	0.200	0.381	0.413	0.390	0.339	0.327	0.300
59	0.238	0.202	0.220	0.238	0.249	0.260	0.431	0.427	0.420	0.339	0.342	0.300
60	0.238	0.185	0.220	0.238	0.180	0.200	0.431	0.414	0.420	0.339	0.277	0.300
61	0.238	0.210	0.220	0.238	0.192	0.230	0.484	0.369	0.420	0.438	0.436	0.400
62	0.383	0.324	0.350	0.383	0.237	0.260	0.581	0.534	0.560	0.579	0.523	0.500
63	0.290	0.296	0.300	0.290	0.226	0.220	0.500	0.325	0.480	0.500	0.440	0.460
64	0.270	0.227	0.250	0.270	0.227	0.290	0.500	0.292	0.400	0.500	0.466	0.460
65	0.400	0.326	0.360	0.400	0.315	0.360	0.700	0.692	0.700	0.600	0.444	0.550
66	0.400	0.349	0.360	0.400	0.366	0.360	0.700	0.385	0.700	0.600	0.548	0.550
67	0.330	0.323	0.320	0.330	0.271	0.280	0.700	0.667	0.700	0.600	0.556	0.550
68	0.280	0.264	0.280	0.280	0.269	0.280	0.700	0.667	0.700	0.600	0.294	0.550
69	0.280	0.325	0.280	0.280	0.268	0.280	0.700	0.750	0.700	0.600	0.500	0.550
70	0.230	0.209	0.220	0.230	0.298	0.280	1.000	0.000	1.000	0.450	0.400	0.550
71	0.200	0.303	0.220	0.200	0.368	0.280	1.000	0.000	1.000	0.450	0.500	0.550
72	0.200	0.222	0.220	0.200	0.167	0.210	1.000	0.000	1.000	1.000	0.000	1.000
73	0.200	0.238	0.220	0.200	0.262	0.210	1.000	0.000	1.000	1.000	1.000	1.000
74	0.200	0.333	0.220	0.200	0.130	0.210	1.000	0.000	1.000	1.000	0.000	1.000
75	0.200	0.111	0.220	0.200	0.238	0.210	1.000	0.000	1.000	1.000	0.000	1.000
76	0.200	0.000	0.220	0.200	0.214	0.210	1.000	0.000	1.000	1.000	0.000	1.000
77	0.200	0.667	0.220	0.200	0.222	0.210	1.000	0.000	1.000	1.000	0.000	1.000
78	0.200	0.000	0.220	0.200	0.091	0.210	1.000	0.000	1.000	1.000	0.000	1.000
79	0.200	0.000	0.220	0.200	0.286	0.210	1.000	0.000	1.000	1.000	0.000	1.000
80	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

The following two tables show the Old, Actual (1995-2012 experience, excluding the years we removed), and New Rates for TRS 2/3.

TRS 2/3 Retirement Rates									
	Service < 30 Years			Service = 30 Years			Service > 30 Years		
	Males			Males			Males		
	Old Rates	Actual	New Rates	Old Rates	Actual	New Rates	Old Rates	Actual	New Rates
55	0.030	0.008	0.020	0.240	0.000	0.220	0.150	0.000	0.130
56	0.030	0.010	0.020	0.230	0.000	0.220	0.170	0.000	0.150
57	0.030	0.009	0.020	0.250	0.000	0.220	0.180	0.000	0.170
58	0.030	0.020	0.020	0.310	0.000	0.280	0.200	0.000	0.190
59	0.030	0.037	0.040	0.380	0.000	0.340	0.210	0.000	0.210
60	0.110	0.044	0.060	0.410	0.000	0.410	0.230	0.000	0.230
61	0.110	0.097	0.140	0.480	0.000	0.480	0.240	0.000	0.250
62	0.250	0.152	0.220	0.600	0.000	0.550	0.400	0.000	0.360
63	0.200	0.211	0.200	0.500	0.000	0.500	0.300	0.000	0.330
64	0.500	0.543	0.550	0.550	0.000	0.550	0.550	0.000	0.550
65	0.500	0.448	0.480	0.500	0.000	0.480	0.500	0.000	0.480
66	0.400	0.455	0.410	0.400	0.000	0.410	0.400	0.000	0.410
67	0.350	0.350	0.340	0.350	0.000	0.340	0.350	0.000	0.340
68	0.300	0.231	0.270	0.300	0.000	0.270	0.300	0.000	0.270
69	0.300	0.200	0.270	0.300	0.000	0.270	0.300	0.000	0.270
70	0.300	0.167	0.270	0.300	0.000	0.270	0.300	0.000	0.270
71	0.500	0.417	0.410	0.500	0.000	0.410	0.500	0.000	0.410
72	0.500	0.000	0.550	0.500	0.000	0.550	0.500	0.000	0.550
73	0.500	0.667	0.550	0.500	0.000	0.550	0.500	0.000	0.550
74	0.500	0.000	0.550	0.500	0.000	0.550	0.500	0.000	0.550
75	0.500	0.000	0.550	0.500	0.000	0.550	0.500	0.000	0.550
76	0.500	0.000	0.550	0.500	0.000	0.550	0.500	0.000	0.550
77	0.500	0.667	0.550	0.500	0.000	0.550	0.500	0.000	0.550
78	0.500	0.500	0.550	0.500	0.000	0.550	0.500	0.000	0.550
79	0.500	1.000	0.550	0.500	0.000	0.550	0.500	0.000	0.550
80	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

TRS 2/3 Retirement Rates (Continued)									
	Service < 30 Years Females			Service = 30 Years Females			Service > 30 Years Females		
	Old Rates	Actual	New Rates	Old Rates	Actual	New Rates	Old Rates	Actual	Rates
55	0.020	0.009	0.020	0.210	0.000	0.190	0.130	0.000	0.120
56	0.030	0.013	0.030	0.230	0.000	0.210	0.150	0.000	0.140
57	0.070	0.021	0.040	0.250	0.000	0.230	0.160	0.000	0.160
58	0.070	0.025	0.050	0.270	0.000	0.250	0.180	0.000	0.180
59	0.070	0.031	0.060	0.290	0.000	0.270	0.240	0.000	0.220
60	0.090	0.061	0.070	0.320	0.000	0.290	0.210	0.000	0.200
61	0.120	0.102	0.150	0.430	0.000	0.410	0.240	0.000	0.220
62	0.250	0.138	0.230	0.600	0.000	0.530	0.350	0.000	0.320
63	0.250	0.177	0.210	0.500	0.000	0.490	0.300	0.000	0.300
64	0.450	0.496	0.480	0.500	0.000	0.530	0.500	0.000	0.490
65	0.450	0.400	0.400	0.450	0.000	0.400	0.450	0.000	0.400
66	0.300	0.293	0.320	0.300	0.000	0.320	0.300	0.000	0.320
67	0.250	0.179	0.240	0.250	0.000	0.240	0.250	0.000	0.240
68	0.250	0.245	0.240	0.250	0.000	0.240	0.250	0.000	0.240
69	0.400	0.394	0.420	0.400	0.000	0.420	0.400	0.000	0.420
70	0.250	0.282	0.300	0.250	0.000	0.300	0.250	0.000	0.300
71	0.250	0.250	0.300	0.250	0.000	0.300	0.250	0.000	0.300
72	0.250	0.154	0.300	0.250	0.000	0.300	0.250	0.000	0.300
73	0.250	0.100	0.300	0.250	0.000	0.300	0.250	0.000	0.300
74	0.250	0.167	0.300	0.250	0.000	0.300	0.250	0.000	0.300
75	0.250	0.333	0.300	0.250	0.000	0.300	0.250	0.000	0.300
76	0.250	1.000	0.300	0.250	0.000	0.300	0.250	0.000	0.300
77	0.250	0.000	0.300	0.250	0.000	0.300	0.250	0.000	0.300
78	0.250	0.000	0.300	0.250	0.000	0.300	0.250	0.000	0.300
79	0.250	0.000	0.300	0.250	0.000	0.300	0.250	0.000	0.300
80	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

The next table shows the Actual and Expected retirements for TRS 1 by age using the new retirement rate assumptions for experience from 1995-2012, excluding the years we removed.

TRS 1 Under New Assumptions			
Age	Plan 1 (Males & Females)		
	Actual	Expected	Ratio
47-49	0	0	N/A
50-54	3,340	2,134	1.565
55-59	6,460	7,153	0.903
60-64	5,326	5,895	0.904
65-69	1,404	1,495	0.939
70-75	139	131	1.062
75-79	16	21	0.747
80+	5	15	0.333
Total	16,690	16,844	0.991

The table below shows the Actual and Expected retirements for TRS 2/3 by age using the new retirement rate assumptions for experience from 1995-2012, excluding the years we removed.

TRS 2/3 Under New Assumptions			
Age	Plan 2/3 (Males & Females)		
	Actual	Expected	Ratio
55-59	280	493	0.568
60-64	657	800	0.821
65-69	455	476	0.957
70-75	31	41	0.760
75-79	10	8	1.258
80+	0	0	N/A
Total	1,433	1,817	0.789

SERS

Past Experience

SERS 2/3

The following table shows the year-by-year Actual and Expected retirements for the School Employees' Retirement System (SERS) Plans 2/3 using the old retirement rate assumptions.

SERS 2/3 Retirement Experience by Year			
Age	Plan 2/3 (Males & Females)		
	Actual	Expected	Ratio
1995	109	88	1.232
1996	153	118	1.293
1997	148	121	1.221
1998	198	144	1.376
1999	181	162	1.120
2000	30	239	0.126
2001	265	316	0.837
2002	308	384	0.801
2003	368	442	0.833
2004	462	523	0.883
2005	467	583	0.801
2006	492	664	0.741
2007	338	760	0.445
2008	461	930	0.496
2009	538	1,094	0.492
2010	550	1,270	0.433
2011	822	1,495	0.550
2012	831	1,698	0.490
Total	6,721	11,032	0.609

The following table shows, by age, the A/E ratios for SERS 2/3 after we removed the data as described in the Data section. As a result, note that the total Actual and Expected counts, along with the Ratio, will not match the prior table.

SERS 2/3 Retirement Experience by Age			
Age	Plan 2/3 (Males & Females)		
	Actual	Expected	Ratio
55-59	307	435	0.706
60-64	1,153	1,226	0.941
65-69	1,205	1,284	0.938
70-75	170	179	0.952
75-79	34	44	0.776
80+	17	63	0.270
Total	2,886	3,230	0.893

Methods and Format of Assumptions

For the SERS plans, we considered the same alternatives and made the same relative changes as in PERS. Please see the **PERS – Methods and Format Assumptions** section above for more information.

Best Estimate SERS Retirement Rates

The following table shows the Old, Actual (1995-2012 experience, excluding the years we removed), and New Rates for SERS 2/3.

SERS 2/3 Retirement Rates												
	Service < 30 Years						Service ≥ 30 Years					
	Males			Females			Males			Females		
	Old Rates	Actual	New Rates	Old Rates	Actual	New Rates	Old Rates	Actual	New Rates	Old Rates	Actual	New Rates
55	0.030	0.004	0.010	0.030	0.018	0.020	0.130	0.000	0.120	0.140	0.000	0.120
56	0.030	0.006	0.020	0.030	0.017	0.020	0.120	0.000	0.120	0.120	0.000	0.120
57	0.030	0.013	0.030	0.030	0.016	0.020	0.130	0.000	0.120	0.130	0.000	0.120
58	0.070	0.024	0.040	0.030	0.026	0.030	0.140	0.000	0.120	0.130	0.000	0.120
59	0.070	0.040	0.050	0.030	0.044	0.040	0.180	0.000	0.160	0.280	0.000	0.250
60	0.090	0.035	0.060	0.090	0.050	0.050	0.140	0.000	0.120	0.150	0.000	0.120
61	0.090	0.087	0.150	0.120	0.103	0.130	0.220	0.000	0.210	0.200	0.000	0.200
62	0.250	0.224	0.240	0.220	0.166	0.210	0.330	0.000	0.300	0.290	0.000	0.280
63	0.200	0.276	0.220	0.200	0.202	0.200	0.250	0.000	0.280	0.250	0.000	0.260
64	0.500	0.597	0.560	0.500	0.539	0.520	0.550	0.000	0.570	0.550	0.000	0.480
65	0.450	0.429	0.390	0.450	0.408	0.360	0.450	0.000	0.390	0.450	0.000	0.360
66	0.260	0.208	0.220	0.250	0.256	0.240	0.260	0.000	0.220	0.250	0.000	0.240
67	0.200	0.204	0.220	0.220	0.208	0.230	0.200	0.000	0.220	0.220	0.000	0.230
68	0.200	0.184	0.220	0.230	0.236	0.220	0.200	0.000	0.220	0.230	0.000	0.220
69	0.220	0.220	0.220	0.210	0.193	0.210	0.220	0.000	0.220	0.210	0.000	0.210
70	0.200	0.227	0.220	0.230	0.217	0.200	0.200	0.000	0.220	0.230	0.000	0.200
71	0.200	0.215	0.200	0.200	0.200	0.190	0.200	0.000	0.200	0.200	0.000	0.190
72	0.200	0.188	0.180	0.200	0.159	0.180	0.200	0.000	0.180	0.200	0.000	0.180
73	0.200	0.141	0.160	0.200	0.194	0.170	0.200	0.000	0.160	0.200	0.000	0.170
74	0.200	0.111	0.160	0.200	0.216	0.170	0.200	0.000	0.160	0.200	0.000	0.170
75	0.200	0.207	0.160	0.200	0.238	0.170	0.200	0.000	0.160	0.200	0.000	0.170
76	0.200	0.053	0.160	0.200	0.118	0.170	0.200	0.000	0.160	0.200	0.000	0.170
77	0.200	0.143	0.160	0.200	0.160	0.170	0.200	0.000	0.160	0.200	0.000	0.170
78	0.200	0.091	0.160	0.200	0.053	0.170	0.200	0.000	0.160	0.200	0.000	0.170
79	0.200	0.091	0.160	0.200	0.267	0.170	0.200	0.000	0.160	0.200	0.000	0.170
80	1.000	0.344	1.000	1.000	0.194	1.000	1.000	0.000	1.000	1.000	0.000	1.000

The next table shows the Actual and Expected retirements for SERS 2/3 by age using the new retirement rate assumptions for experience from 1995-2012, excluding the years we removed.

SERS 2/3 Under New Assumptions			
Age	Plan 2/3 (Males & Females)		
	Actual	Expected	Ratio
55-59	307	343	0.895
60-64	1,153	1,216	0.948
65-69	1,205	1,151	1.047
70-75	170	165	1.033
75-79	34	36	0.934
80+	17	63	0.270
Total	2,886	2,974	0.970

PSERS

The Public Safety Employees' Retirement System (PSERS) Plan 2 opened in 2006 and did not have enough experience data to develop plan-specific assumptions in the prior study. Thus, in the prior study we used the rates that were established when the plan was created.

According to the data, there were only 13 exposures during the experience study period. We observed members deferring retirement in most plans and, based on those observations, we lowered the prior PSERS retirement rates by a similar magnitude.

We will continue to monitor the appropriateness of these retirement rates for PSERS 2. The following table shows the Old, Actual, and New Rates for PSERS 2.

Age	PSERS Retirement Rates					
	Males			Females		
	Old Rates	Actual	New Rates	Old Rates	Actual	New Rates
53	0.030	0.000	0.020	0.030	0.000	0.020
54	0.030	0.000	0.020	0.030	0.000	0.020
55	0.030	0.000	0.020	0.030	0.000	0.020
56	0.080	0.000	0.050	0.080	1.000	0.040
57	0.080	0.000	0.080	0.080	0.000	0.060
58	0.150	0.000	0.110	0.110	0.000	0.080
59	0.160	1.000	0.140	0.120	1.000	0.100
60	0.300	1.000	0.300	0.360	0.000	0.340
61	0.260	0.000	0.260	0.260	1.000	0.260
62	0.360	0.000	0.300	0.360	0.000	0.340
63	0.500	0.000	0.500	0.500	1.000	0.520
64	0.890	1.000	0.700	0.890	1.000	0.700
65	0.460	0.000	0.500	0.310	0.000	0.350
66	0.300	0.000	0.300	0.300	0.000	0.350
67	0.220	0.000	0.300	0.260	0.000	0.350
68	0.220	0.000	0.300	0.260	0.000	0.350
69	0.260	0.000	0.300	0.220	0.000	0.350
70	1.000	1.000	1.000	1.000	1.000	1.000

LEOFF

Past Experience

LEOFF₁

The table below shows the year-by-year Actual and Expected retirements for the Law Enforcement Officers' and Fire Fighters' Retirement System (LEOFF) Plan 1 using the old retirement rate assumptions.

LEOFF 1 Retirement Experience by Year			
Age	Plan 1 (Males & Females)		
	Actual	Expected	Ratio
1995	96	94	1.021
1996	96	97	0.993
1997	107	102	1.049
1998	107	106	1.013
1999	99	108	0.915
2000	100	109	0.920
2001	83	111	0.746
2002	83	114	0.730
2003	82	116	0.710
2004	92	117	0.785
2005	81	116	0.701
2006	76	112	0.681
2007	71	125	0.570
2008	84	121	0.693
2009	63	106	0.597
2010	55	96	0.573
2011	52	87	0.598
2012	61	72	0.843
Total	1,488	1,907	0.780

The next table shows, by age, the A/E ratios for LEOFF 1 after we removed the data as described in the Data section. As a result, note that the total Actual and Expected counts, along with the Ratio, will not match the prior table.

LEOFF 1 Retirement Experience by Age			
Age	Plan 1 (Males & Females)		
	Actual	Expected	Ratio
49-54	559	589	0.949
55-59	495	671	0.738
60-64	234	334	0.700
65-69	35	43	0.819
70+	11	34	0.324
Total	1,334	1,671	0.798

LEOFF₂

The table to the right shows the year-by-year Actual and Expected retirements for LEOFF 2 using the old retirement rate assumptions.

LEOFF 2 Retirement Experience by Year			
Age	Plan 2 (Males & Females)		
	Actual	Expected	Ratio
1995	9	14	0.655
1996	5	17	0.287
1997	15	23	0.663
1998	11	28	0.399
1999	24	36	0.662
2000	25	49	0.513
2001	34	64	0.535
2002	42	82	0.510
2003	61	103	0.591
2004	84	129	0.652
2005	112	160	0.701
2006	134	192	0.697
2007	119	228	0.522
2008	141	271	0.521
2009	170	320	0.531
2010	202	367	0.550
2011	276	419	0.658
2012	289	452	0.640
Total	1,753	2,954	0.593

The table below shows, by age, the A/E ratios for LEOFF 2 after we removed the data as described in the Data section. As a result, note that the total Actual and Expected counts, along with the Ratio, will not match the prior table.

LEOFF 2 Retirement Experience by Age			
Age	Plan 2 (Males & Females)		
	Actual	Expected	Ratio
49-54	631	968	0.652
55-59	626	1,212	0.517
60-64	267	417	0.641
65-69	71	56	1.270
70+	5	10	0.500
Total	1,600	2,662	0.601

◆ **Separate service-based assumptions.**

We did not split rates between those with less than 20 Years of Service (YOS), and those with at least 20 YOS. Unlike some of the other systems, we did not observe significantly different behavior between the cohorts.

Methods and Format of Assumptions

We considered alternate formats for the assumptions and, ultimately, decided not to make any changes. For reference, we considered, but did not include:

- ◆ **Raising the retirement rate range higher than age 70.**
While retirements above the age of 70 do occur, the scarcity of such retirements did not justify this change.
- ◆ **Gender-based rates.**
We chose to keep rates gender-neutral since less than 1.5 percent of actual retirements in LEOFF 1 and less than 6.5 percent of actual retirements in LEOFF 2 were female.
- ◆ **Different rates for Police vs. Fire Fighter.**
We reviewed the retirement experience for these cohorts separately, but chose not to create distinct assumptions since their behavior has not been significantly different.

Best Estimate LEOFF Retirement Rates

The table to the right shows the Old, Actual (1995-2012 experience, excluding the years we removed), and New Rates for LEOFF 1.

LEOFF 1 Retirement Rates						
	Plan 1					
	Service < 30 Years			Service ≥ 30 Years		
	Old Rates	Actual	New Rates	Old Rates	Actual	New Rates
50	0.070	0.067	0.070	0.140	0.143	0.120
51	0.070	0.066	0.070	0.140	0.024	0.120
52	0.070	0.051	0.070	0.140	0.088	0.120
53	0.070	0.069	0.070	0.150	0.063	0.120
54	0.110	0.098	0.100	0.190	0.135	0.160
55	0.120	0.078	0.100	0.200	0.149	0.200
56	0.120	0.082	0.100	0.210	0.191	0.200
57	0.150	0.096	0.130	0.240	0.182	0.200
58	0.160	0.113	0.130	0.250	0.201	0.200
59	0.160	0.071	0.130	0.260	0.165	0.200
60	0.230	0.235	0.230	0.330	0.253	0.250
61	0.250	0.176	0.230	0.340	0.167	0.250
62	0.250	0.250	0.230	0.330	0.258	0.250
63	0.250	0.000	0.230	0.310	0.244	0.250
64	0.250	0.333	0.230	0.300	0.198	0.250
65	0.250	0.000	0.230	0.300	0.231	0.250
66	0.250	0.000	0.230	0.290	0.303	0.250
67	0.250	0.000	0.230	0.280	0.250	0.250
68	0.250	0.000	0.230	0.270	0.133	0.250
69	0.250	0.000	0.230	0.270	0.231	0.250
70	1.000	1.000	1.000	1.000	1.000	1.000

LEOFF 2 Retirement Rates			
	Plan 2		
	Old Rates	Actual	New Rates
50	0.045	0.015	0.030
51	0.045	0.020	0.040
52	0.044	0.046	0.050
53	0.094	0.066	0.100
54	0.114	0.070	0.100
55	0.143	0.074	0.100
56	0.143	0.069	0.100
57	0.143	0.073	0.100
58	0.192	0.101	0.150
59	0.192	0.107	0.150
60	0.192	0.107	0.150
61	0.241	0.131	0.190
62	0.241	0.206	0.230
63	0.241	0.179	0.200
64	0.241	0.142	0.200
65	0.240	0.269	0.250
66	0.240	0.317	0.250
67	0.240	0.385	0.250
68	0.239	0.250	0.250
69	0.239	0.429	0.250
70	1.000	1.000	1.000

The table to the left shows the Old, Actual (1995-2012 experience, excluding the years we removed), and New Rates for LEOFF 2.

The table on the right shows the Actual and Expected retirements for LEOFF 1 by age using the new retirement rate assumptions for experience from 1995-2012, excluding the years we removed.

LEOFF 1 Under New Assumptions			
Age	Plan 1 (Males & Females)		
	Actual	Expected	Ratio
49-54	559	560	0.998
55-59	495	577	0.858
60-64	234	261	0.898
65-69	35	37	0.947
70+	11	34	0.324
Total	1,334	1,469	0.908

The table below shows the Actual and Expected retirements for LEOFF 2 by age using the new retirement rate assumptions for experience from 1995-2012, excluding the years we removed.

LEOFF 2 Under New Assumptions			
Age	Plan 2 (Males & Females)		
	Actual	Expected	Ratio
49-54	631	912	0.692
55-59	626	880	0.711
60-64	267	345	0.773
65-69	71	58	1.219
70+	5	10	0.500
Total	1,600	2,205	0.726

WSPRS

Past Experience

The table below shows the year-by-year Actual and Expected retirements for the Washington State Patrol Retirement System (WSPRS) Plans 1/2 using the old retirement rate assumptions.

WSPRS Retirement Experience by Year			
Age	Males & Females		
	Actual	Expected	Ratio
1995	48	38	1.272
1996	43	31	1.387
1997	27	35	0.772
1998	33	35	0.936
1999	35	37	0.947
2000	34	35	0.978
2001	28	26	1.091
2002	23	23	1.018
2003	24	19	1.262
2004	29	22	1.302
2005	36	27	1.337
2006	20	22	0.923
2007	14	18	0.772
2008	16	16	1.003
2009	11	16	0.685
2010	21	18	1.146
2011	35	30	1.171
2012	43	33	1.290
Total	520	481	1.082

The table at the right shows, by age, the A/E ratios for WSPRS 1/2 after we removed the data as described in the Data section. As a result, note that the total Actual and Expected counts, along with the Ratio, will not match the prior table.

WSPRS Retirement Experience by Year			
Age	Males & Females		
	Actual	Expected	Ratio
44-49	180	154	1.172
50-54	194	176	1.105
55-59	91	95	0.958
60-64	13	13	0.999
65+	0	0	N/A
Total	478	437	1.093

Methods and Format of Assumptions

We considered alternate formats for the assumptions and, ultimately, made no changes. For reference, we considered, but did not:

- ◆ **Address Plan 1 and 2 separately.**
Plan 2 was created in 2003 and there were no Plan 2 retirements in the study period.
- ◆ **Adopt gender-based rates.**
We chose to keep rates gender-neutral since only 3.1 percent of actual retirements were female.
- ◆ **Separate service-based assumptions.**
We did not split rates between those with less than 25 YOS, and those with at least 25 YOS. Unlike some of the other systems, we did not observe significantly different behavior between the cohorts.

Best Estimate WSPRS Retirement Rates

WSPRS Retirement Rates			
Age	Males & Females		
	Old Rates	Actual	New Rates
45	0.450	0.600	0.500
46	0.310	0.357	0.330
47	0.310	0.344	0.330
48	0.310	0.326	0.330
49	0.280	0.357	0.300
50	0.280	0.280	0.270
51	0.230	0.219	0.240
52	0.230	0.270	0.240
53	0.230	0.246	0.240
54	0.230	0.328	0.240
55	0.230	0.206	0.200
56	0.230	0.182	0.200
57	0.230	0.218	0.200
58	0.200	0.182	0.200
59	0.230	0.390	0.330
60	0.230	0.423	0.330
61	0.250	0.167	0.330
62	0.250	0.000	0.330
63	0.270	0.000	0.330
64	0.330	0.000	0.330
65	1.000	1.000	1.000

The table to the left shows the Old, Actual (1995-2012 experience, excluding the years we removed), and New Rates for WSPRS 1/2.

The table on the right shows the Actual and Expected retirements for WSPRS 1/2 by age using the new retirement rate assumptions for experience from 1995-2012, excluding the years we removed.

WSPRS Under New Assumptions			
Age	Males & Females		
	Actual	Expected	Ratio
44-49	180	164	1.096
50-54	194	180	1.080
55-59	91	89	1.019
60-64	13	17	0.743
65+	0	0	N/A
Total	478	451	1.061

Disability Rates

PERS

Past Experience

We analyzed the data by looking at overall fit by year, as well as all data combined by plan, age, and gender to make slight adjustments to the Public Employees' Retirement System (PERS) disability rates.

PERS 1

PERS 1 Disability Counts by Year			
(Males and Females)			
Year	Actual	Expected	Ratio
1995	108	100	1.08
1996	86	98	0.88
1997	83	96	0.86
1998	101	93	1.09
1999	96	88	1.09
2000	72	83	0.87
2001	68	78	0.87
2002	63	71	0.89
2003	69	64	1.07
2004	60	59	1.01
2005	40	53	0.75
2006	34	48	0.71
2007	13	41	0.31
2008	17	35	0.48
2009	19	30	0.63
2010	15	24	0.63
2011	13	19	0.67
2012	2	15	0.14
Total	959	1,096	0.87

The table on the left shows the year-by-year Actual and Expected disabilities for PERS 1, as well as the Ratio of Actual-to-Expected (A/E) counts.

The table below shows the A/E ratios for PERS 1 after we removed the data as described in the Data section.

PERS 1 Disability Counts by Age						
Age	Male			Female		
	Actual	Expected	Ratio	Actual	Expected	Ratio
20-24	0	0	0.00	0	0	0.00
25-29	0	0	0.00	0	0	0.00
30-34	0	0	0.00	0	0	0.00
35-39	1	1	1.86	0	1	0.00
40-44	13	11	1.15	26	19	1.37
45-49	60	59	1.02	82	69	1.19
50-54	127	150	0.85	182	200	0.91
55-59	164	194	0.85	218	243	0.90
60-64	3	14	0.22	2	8	0.26
65+	0	6	0.00	0	3	0.00
Total	368	434	0.85	510	543	0.94

PERS 2/3

The table to the right shows the year-by-year Actual and Expected disabilities for PERS 2/3, as well as the Ratio of A/E counts.

PERS 2/3 Disability Counts by Year (Males and Females)			
Year	Actual	Expected	Ratio
1995	62	84	0.74
1996	85	91	0.94
1997	73	98	0.74
1998	109	105	1.04
1999	134	112	1.19
2000	121	120	1.01
2001	116	129	0.90
2002	153	137	1.11
2003	150	146	1.02
2004	159	155	1.02
2005	162	165	0.98
2006	159	174	0.92
2007	109	183	0.60
2008	116	195	0.60
2009	97	205	0.47
2010	108	209	0.52
2011	110	209	0.53
2012	72	207	0.35
Total	2,095	2,725	0.77

The following table displays the A/E ratios for PERS 2/3 after we removed the data as described in the Data section.

PERS 2/3 Disability Counts by Age						
Age	Male			Female		
	Actual	Expected	Ratio	Actual	Expected	Ratio
20-24	0	0	0.00	0	0	0.00
25-29	2	4	0.50	2	1	2.52
30-34	5	10	0.51	2	9	0.23
35-39	14	17	0.81	15	26	0.58
40-44	37	35	1.05	30	39	0.77
45-49	76	72	1.05	103	75	1.37
50-54	139	120	1.16	133	134	0.99
55-59	199	187	1.07	201	200	1.01
60-64	203	215	0.95	193	204	0.95
65+	11	23	0.48	2	19	0.10
Total	686	682	1.01	681	707	0.96

◆ **Unisex Rates.**

We considered creating unisex rates for all plans. However, we found that male and female rates are materially different and, ultimately, chose to continue to distinguish rates by gender.

Methods and Format of Assumptions

Whenever we consider changes to methods and formats of assumptions we must balance the desire for precision with the potential for increasing the complexity of the model. We considered alternate formats for the assumptions and, ultimately, decided not to make any changes. For reference, we considered, but did not adopt:

◆ **Separate rates for PERS 3 members.**

Even though PERS 3 had lower actual disability rates than PERS 2, we declined to make that change due to the relative lack of plan experience in PERS 3.

◆ **Separate duty-related disability rates for Plan 1 members.**

We found that our old assumption that 10 percent of all disabilities are duty-related continues to fit the experience very well.

Best Estimate PERS Disability Rates

The tables below show a sampling of the Old, Actual, and New Rates for PERS.

PERS 1 Disability Rates						
Age	Old Rates		Actual Rates		New Rates	
	Male	Female	Male	Female	Male	Female
20	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
25	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
30	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
35	0.000310	0.000319	0.000000	0.000000	0.000310	0.000319
40	0.000762	0.000710	0.002336	0.001239	0.000762	0.000710
45	0.001481	0.001431	0.002086	0.001389	0.001481	0.001431
50	0.002542	0.003023	0.002203	0.003607	0.002542	0.003023
55	0.008240	0.006411	0.007893	0.007860	0.008240	0.006411
60	0.011701	0.006502	0.003040	0.000000	0.007541	0.003458
65	0.011701	0.005495	0.000000	0.000000	0.002204	0.000386
70	0.011701	0.005495	0.000000	0.000000	0.000644	0.000043
75	0.011701	0.005495	0.000000	0.000000	0.000188	0.000005
80	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

PERS 2/3 Disability Rates						
Age	Old Rates		Actual Rates		New Rates	
	Male	Female	Male	Female	Male	Female
20	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
25	0.000052	0.000000	0.000000	0.000000	0.000052	0.000000
30	0.000115	0.000056	0.000081	0.000000	0.000115	0.000056
35	0.000156	0.000194	0.000170	0.000153	0.000156	0.000194
40	0.000235	0.000275	0.000232	0.000297	0.000235	0.000275
45	0.000476	0.000467	0.000420	0.000483	0.000476	0.000467
50	0.000922	0.001003	0.000874	0.001031	0.000922	0.001003
55	0.002630	0.002782	0.002906	0.003207	0.002630	0.002782
60	0.007603	0.007681	0.006717	0.007763	0.007863	0.007681
65	0.010244	0.010271	0.009153	0.000000	0.006146	0.005257
70	0.010244	0.010271	0.000000	0.000000	0.001358	0.001315
75	0.010244	0.010271	0.033898	0.000000	0.000300	0.000329
80	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

The tables on this page show the A/E disabilities for PERS by age under both the Old and New disability assumptions, as well as the Ratio of New Rates to Actual disabilities.

PERS 1 A/E Disability Counts								
Age	Male				Female			
	Actual	Expected		Ratio	Actual	Expected		Ratio
		Old Rates	New Rates			Old Rates	New Rates	
20-24	0	0	0	0.00	0	0	0	0.00
25-29	0	0	0	0.00	0	0	0	0.00
30-34	0	0	0	0.00	0	0	0	0.00
35-39	1	1	1	1.86	0	1	1	0.00
40-44	13	11	11	1.15	26	19	19	1.37
45-49	60	59	59	1.02	82	69	69	1.19
50-54	127	150	150	0.85	182	200	200	0.91
55-59	164	194	187	0.88	218	243	238	0.92
60-64	3	14	6	0.47	2	8	3	0.73
65+	0	6	1	0.00	0	3	0	0.00
Total	368	434	415	0.89	510	543	529	0.96

PERS 2/3 A/E Disability Counts								
Age	Male				Female			
	Actual	Expected		Ratio	Actual	Expected		Ratio
		Old Rates	New Rates			Old Rates	New Rates	
20-24	0	0	0	0.00	0	0	0	0.00
25-29	2	4	4	0.50	2	1	1	2.52
30-34	5	10	10	0.51	2	9	9	0.23
35-39	14	17	17	0.81	15	26	26	0.58
40-44	37	35	35	1.05	30	39	39	0.77
45-49	76	72	72	1.05	103	75	75	1.37
50-54	139	120	120	1.16	133	134	134	0.99
55-59	199	187	197	1.01	201	200	200	1.01
60-64	203	215	224	0.91	193	204	192	1.01
65+	11	23	7	1.63	2	19	5	0.42
Total	686	682	686	1.00	681	707	680	1.00

TRS

Past Experience

We analyzed the data by looking at overall fit by year, as well as all data combined by plan, age, and gender to make slight adjustments to the Teachers' Retirement System (TRS) Plan 1 disability rates. We did not change TRS 2/3 disability rates as part of this study.

TRS 1

TRS 1 Disability Counts by Year (Males and Females)			
Year	Actual	Expected	Ratio
1995	36	33	1.08
1996	31	33	0.93
1997	32	33	0.97
1998	36	32	1.11
1999	30	31	0.96
2000	19	29	0.65
2001	38	26	1.46
2002	20	23	0.87
2003	21	20	1.04
2004	11	17	0.65
2005	10	14	0.71
2006	8	11	0.71
2007	5	8	0.60
2008	3	6	0.50
2009	2	4	0.46
2010	2	3	0.63
2011	2	2	0.95
2012	0	1	0.00
Total	306	329	0.93

The table to the left shows the year-by-year Actual and Expected disabilities for TRS 1, as well as the Ratio of A/E counts.

The following table shows the A/E ratios for TRS 1 after we removed the data as described in the Data section.

Age	Male			Female		
	Actual	Expected	Ratio	Actual	Expected	Ratio
20-24	0	0	0.00	0	0	0.00
25-29	0	0	0.00	0	0	0.00
30-34	0	0	0.00	0	0	0.00
35-39	0	0	0.00	0	0	0.00
40-44	2	2	0.91	7	5	1.41
45-49	14	19	0.74	34	35	0.96
50-54	47	48	0.97	88	92	0.96
55-59	15	15	0.98	56	75	0.75
60-64	0	1	0.00	0	2	0.00
65+	0	0	0.00	0	0	0.00
Total	78	86	0.91	185	209	0.89

TRS 2/3

The table below shows the year-by-year Actual and Expected disabilities for TRS 2/3, as well as the Ratio of A/E counts.

TRS 2/3 Disability Counts by Year (Males and Females)			
Year	Actual	Expected	Ratio
1995	4	6	0.62
1996	7	7	0.95
1997	8	8	0.97
1998	11	9	1.25
1999	8	10	0.82
2000	11	10	1.05
2001	18	11	1.58
2002	18	13	1.43
2003	9	13	0.67
2004	26	14	1.83
2005	12	15	0.80
2006	14	16	0.88
2007	8	16	0.48
2008	7	17	0.42
2009	5	17	0.30
2010	9	17	0.53
2011	5	16	0.31
2012	2	15	0.13
Total	182	232	0.78

This table displays the A/E ratios for TRS 2/3 after we removed the data as described in the Data section.

TRS 2/3 Disability Counts by Age						
Age	Male			Female		
	Actual	Expected	Ratio	Actual	Expected	Ratio
20-24	0	0	0.00	0	0	0.00
25-29	0	1	0.00	0	1	0.00
30-34	0	1	0.00	0	3	0.00
35-39	2	2	0.82	4	4	1.02
40-44	1	4	0.24	3	8	0.40
45-49	4	8	0.52	12	16	0.76
50-54	9	10	0.91	23	22	1.03
55-59	13	8	1.66	29	16	1.84
60-64	8	6	1.25	20	12	1.67
65+	0	0	0.00	0	0	0.00
Total	37	41	0.91	91	82	1.12

Methods and Format of Assumptions

For the TRS plans, we considered the same alternatives and made the same relative changes as in PERS. Please see the **PERS – Methods and Format Assumptions** section for more information.

Best Estimate TRS Disability Rates

The following table shows a sampling of the Old, Actual, and New disability rates for TRS 1.

TRS 1 Disability Rates						
Age	Old Rates		Actual Rates		New Rates	
	Male	Female	Male	Female	Male	Female
20	0.000013	0.000014	0.000000	0.000000	0.000013	0.000014
25	0.000091	0.000092	0.000000	0.000000	0.000091	0.000092
30	0.000187	0.000190	0.000000	0.000000	0.000187	0.000190
35	0.000321	0.000326	0.000000	0.000000	0.000321	0.000326
40	0.000428	0.000434	0.000000	0.000000	0.000428	0.000434
45	0.000944	0.000957	0.002182	0.000814	0.000944	0.000957
50	0.001634	0.001656	0.001674	0.001677	0.001634	0.001656
55	0.003347	0.003393	0.003895	0.001541	0.003347	0.003393
60	0.004686	0.004750	0.000000	0.000000	0.004686	0.004750
65	0.007213	0.007311	0.000000	0.000000	0.005633	0.005681
70	0.007213	0.007311	0.000000	0.000000	0.001485	0.001486
75	0.007213	0.007311	0.000000	0.000000	0.000391	0.000389
80	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

The following table shows a sampling of the Unchanged and Actual disability rates for TRS 2/3.

TRS 2/3 Disability Rates			
Unchanged Rates		Actual Rates	
Male	Female	Male	Female
0.000003	0.000003	0.000000	0.000000
0.000024	0.000019	0.000000	0.000000
0.000048	0.000040	0.000000	0.000000
0.000083	0.000068	0.000000	0.000000
0.000111	0.000091	0.000000	0.000000
0.000244	0.000201	0.000000	0.000160
0.000422	0.000347	0.000459	0.000176
0.001118	0.000750	0.002224	0.002138
0.002500	0.001875	0.004839	0.003207
0.002362	0.001552	0.000000	0.000000
0.000334	0.000283	0.000000	0.000000
0.000047	0.000052	0.000000	0.000000
0.000000	0.000000	0.000000	0.000000

The tables on this page show the Actual and Expected disabilities for TRS by age under both the old and new disability assumptions, as well as the Ratio of New Rates to Actual disabilities. As a reminder, we did not change the TRS 2/3 disability rates.

TRS 1 A/E Disability Counts								
Age	Male				Female			
	Expected				Expected			
	Actual	Old Rates	New Rates	Ratio	Actual	Old Rates	New Rates	Ratio
20-24	0	0	0	0.00	0	0	0	0.00
25-29	0	0	0	0.00	0	0	0	0.00
30-34	0	0	0	0.00	0	0	0	0.00
35-39	0	0	0	0.00	0	0	0	0.00
40-44	2	2	2	0.91	7	5	5	1.41
45-49	14	19	19	0.74	34	35	35	0.96
50-54	47	48	48	0.97	88	92	92	0.96
55-59	15	15	15	0.98	56	75	75	0.75
60-64	0	1	1	0.00	0	2	2	0.00
65+	0	0	0	0.00	0	0	0	0.00
Total	78	86	86	0.91	185	209	209	0.89

TRS 2/3 A/E Disability Counts						
Age	Male			Female		
	Actual	Expected	Ratio	Actual	Expected	Ratio
20-24	0	0	0.00	0	0	0.00
25-29	0	1	0.00	0	1	0.00
30-34	0	1	0.00	0	3	0.00
35-39	2	2	0.82	4	4	1.02
40-44	1	4	0.24	3	8	0.40
45-49	4	8	0.52	12	16	0.76
50-54	9	10	0.91	23	22	1.03
55-59	13	8	1.66	29	16	1.84
60-64	8	6	1.25	20	12	1.67
65+	0	0	0.00	0	0	0.00
Total	37	41	0.91	91	82	1.12

SERS 2/3

Past Experience

We analyzed the data by looking at overall fit by year, as well as all data combined by plan, age, and gender to make slight adjustments to the School Employees' Retirement System (SERS) disability rates.

SERS Disability Counts by Year			
Males and Females			
Year	Actual	Expected	Ratio
1995	26	30	0.87
1996	36	32	1.13
1997	24	35	0.69
1998	32	38	0.84
1999	27	41	0.67
2000	13	39	0.33
2001	31	42	0.75
2002	34	44	0.78
2003	34	46	0.73
2004	42	48	0.88
2005	34	50	0.67
2006	30	53	0.56
2007	25	57	0.44
2008	18	59	0.30
2009	24	63	0.38
2010	27	66	0.41
2011	27	67	0.40
2012	16	66	0.24
Total	500	877	0.57

The table to the left shows the year-by-year Actual and Expected disabilities for SERS 2/3.

The table below shows the A/E ratios for SERS 2/3 after we removed the data as described in the Data section.

SERS 2/3 Disability Counts by Age						
Age	Male			Female		
	Actual	Expected	Ratio	Actual	Expected	Ratio
20-24	0	0	0.00	0	0	0.00
25-29	0	0	0.00	0	0	0.00
30-34	0	0	0.00	3	2	1.41
35-39	2	2	1.17	3	10	0.31
40-44	1	6	0.18	8	11	0.74
45-49	9	12	0.74	27	27	0.99
50-54	21	24	0.89	38	73	0.52
55-59	37	42	0.87	71	77	0.92
60-64	53	62	0.85	41	60	0.68
65+	4	6	0.62	1	2	0.47
Total	127	155	0.82	192	262	0.73

Methods and Format of Assumptions

For the SERS plans, we considered the same alternatives and made the same relative changes as in PERS. Please see the **PERS – Methods and Format Assumptions** section for more information.

Best Estimate SERS Disability Rates

The following table shows a sampling of the Old, Actual, and New disability rates for the SERS Plans 2/3.

SERS Plans 2/3 Disability Rates						
Age	Old Rates		Actual Rates		New Rates	
	Male	Female	Male	Female	Male	Female
20	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
25	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
30	0.000000	0.000048	0.000000	0.000000	0.000000	0.000048
35	0.000081	0.000176	0.000000	0.000000	0.000081	0.000176
40	0.000258	0.000164	0.000000	0.000154	0.000258	0.000164
45	0.000568	0.000201	0.001510	0.000366	0.000528	0.000214
50	0.001102	0.000797	0.000649	0.000206	0.001213	0.000611
55	0.003175	0.002166	0.002889	0.001833	0.002787	0.001742
60	0.007200	0.005888	0.010222	0.002772	0.006404	0.004971
65	0.012600	0.004069	0.007937	0.005682	0.005928	0.004121
70	0.001260	0.001538	0.000000	0.000000	0.001271	0.001816
75	0.000126	0.000581	0.000000	0.000000	0.000272	0.000800
80	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

The table below shows the Actual and Expected disabilities for SERS 2/3 by age under both the old and new disability assumptions, as well as the Ratio of New Rates to actual disabilities.

SERS 2/3 A/E Disability Counts								
Age	Male				Female			
	Actual	Expected		Ratio	Actual	Expected		Ratio
		Old Rates	New Rates			Old Rates	New Rates	
20-24	0	0	0	0.00	0	0	0	0.00
25-29	0	0	0	0.00	0	0	0	0.00
30-34	0	0	0	0.00	3	2	2	1.41
35-39	2	2	2	1.17	3	10	10	0.31
40-44	1	6	6	0.18	8	11	11	0.74
45-49	9	12	12	0.73	27	27	27	0.99
50-54	21	24	25	0.85	38	73	57	0.66
55-59	37	42	37	0.99	71	77	63	1.12
60-64	53	62	53	0.99	41	60	56	0.73
65+	4	6	4	1.09	1	2	2	0.44
Total	127	155	139	0.91	192	262	229	0.84

PSERS 2

Past Experience

The Public Safety Employees' Retirement System (PSERS) opened in 2006 and did not have enough experience data to develop plan-specific assumptions in the prior study. For this study, PSERS experience continues to be limited. We used updated PERS disability rates to model disabilities when PSERS service is less than ten years.

PSERS Disability Counts by Year			
Plan 2			
Year	Actual	Expected	Ratio
2007	1	1	1.15
2008	0	1	0.00
2009	2	2	1.04
2010	1	2	0.43
2011	0	3	0.00
2012	2	3	0.68
Total	6	12	0.47

The table on the left shows the year-by-year Actual and Expected disabilities for PSERS, as well as the Ratio of A/E counts.

The table below shows the A/E ratios for PSERS after we removed the data as described in the Data section.

PSERS Disability Counts by Age						
Age	Male			Female		
	Actual	Expected	Ratio	Actual	Expected	Ratio
20-24	0	0	0.00	0	0	0.00
25-29	0	0	0.00	0	0	0.00
30-34	0	0	0.00	0	0	0.00
35-39	0	0	0.00	0	0	0.00
40-44	0	1	0.00	0	0	0.00
45-49	1	1	0.81	0	1	0.00
50-54	0	2	0.00	1	1	1.20
55-59	2	2	1.04	0	1	0.00
60-64	1	1	0.81	0	0	0.00
65+	0	0	0.00	0	0	0.00
Total	4	8	0.50	1	3	0.33

Methods and Format of Assumptions

Whenever we consider changes to methods and formats of assumptions we must balance the desire for precision with the potential for increasing the complexity of the model. Based on the different plan provisions for PSERS, we made the following change.

- ◆ Increased disability rates for people with more than ten years of service because members with ten or more years of PSERS service receive benefits actuarially reduced from an earlier age. Without sufficient experience, we based the increased rates on future expectations only.

Best Estimate PSERS Disability Rates

The table on this page shows a sampling of the Old, Actual, and New Rates for PSERS.

PSERS Disability Assumptions								
Age	Old Rates		Actual Rates		New Rates			
	Male	Female	Male	Female	Service < 10 Years		Service ≥ 10 Years	
					Male	Female	Male	Female
20	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
25	0.000052	0.000000	0.000000	0.000000	0.000052	0.000000	0.000052	0.000000
30	0.000115	0.000056	0.000000	0.000000	0.000115	0.000056	0.000115	0.000056
35	0.000156	0.000194	0.000000	0.000000	0.000156	0.000194	0.000158	0.000197
40	0.000235	0.000275	0.000000	0.000000	0.000235	0.000275	0.000298	0.000348
45	0.000476	0.000467	0.000000	0.000000	0.000476	0.000467	0.000607	0.000596
50	0.000922	0.001003	0.000000	0.000000	0.000922	0.001003	0.001182	0.001285
55	0.002630	0.002782	0.005882	0.000000	0.002630	0.002782	0.003409	0.003606
60	0.007603	0.007681	0.000000	0.000000	0.007863	0.007681	0.000000	0.000000
65	0.010244	0.010271	0.000000	0.000000	0.006146	0.005257	0.000000	0.000000
70	0.010244	0.010271	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
75	0.010244	0.010271	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
80	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

This table shows the Actual and Expected disabilities for PSERS members, using rates for members with less than ten years of service, by age under both the old and new disability assumptions, as well as the Ratio of New Rates to Actual disabilities.

PSERS A/E Disability Counts								
Age	Male				Female			
	Expected				Expected			
	Actual	Old Rates	New Rates (Service < 10)	Ratio	Actual	Old Rates	New Rates (Service < 10)	Ratio
20-24	0	0	0	0.00	0	0	0	0.00
25-29	0	0	0	0.00	0	0	0	0.00
30-34	0	0	0	0.00	0	0	0	0.00
35-39	0	0	0	0.00	0	0	0	0.00
40-44	0	1	1	0.00	0	0	0	0.00
45-49	1	1	1	0.81	0	1	1	0.00
50-54	0	2	2	0.00	1	1	1	1.20
55-59	2	2	2	0.99	0	1	1	0.00
60-64	1	1	1	0.78	0	0	0	0.00
65+	0	0	0	0.00	0	0	0	0.00
Total	4	8	8	0.50	1	3	3	0.33

LEOFF

Past Experience

We analyzed the Law Enforcement Officers' and Fire Fighters' Retirement System (LEOFF) Plan 1 data by looking at overall fit by year, as well as all data combined by plan and age to see if we needed to make any adjustments to the disability rates. We did not change LEOFF 1 disability rates.

LEOFF 2 has a more complicated disability benefit structure than most public plans in Washington. Beginning in 2004, several disability benefit improvements were implemented for LEOFF 2. There are both duty-related and non-duty related benefits for this plan. Duty-related disabilities are further classified into occupational and total (or catastrophic) disabilities. Each of these disability classifications can result in a different benefit level. Therefore, we develop assumptions for all three types of disabilities. Please see the **LEOFF 2** section for more information about these assumptions.

We made adjustments to the assumption for all LEOFF 2 disabilities combined. We found that our duty-related disabilities assumption was a very close fit to the experience data and made only minor adjustments. We found that the assumed percent of duty-related disabilities that are also total (catastrophic) disabilities was a good fit and we did not change that assumption; it remains at 12 percent.

LEOFF 1

The table below shows the year-by-year Actual and Expected disabilities for LEOFF 1, as well as the Ratio of A/E counts.

LEOFF 1 Disability Counts by Year			
(Males and Females)			
Year	Actual	Expected	Ratio
1995	157	177	0.89
1996	213	172	1.24
1997	154	161	0.96
1998	181	151	1.20
1999	130	137	0.95
2000	123	125	0.98
2001	93	111	0.83
2002	68	102	0.67
2003	57	92	0.62
2004	42	82	0.51
2005	18	72	0.25
2006	25	63	0.40
2007	10	53	0.19
2008	10	46	0.22
2009	4	38	0.10
2010	0	33	0.00
2011	0	28	0.00
2012	1	23	0.04
Total	1,286	1,667	0.77

LEOFF 1 Disability Counts by Age			
Male and Female			
Age	Actual	Expected	Ratio
20-24	0	0	0.00
25-29	0	0	0.00
30-34	0	0	0.00
35-39	1	2	0.40
40-44	75	60	1.25
45-49	303	362	0.84
50-54	545	592	0.92
55-59	228	364	0.63
60-64	30	111	0.27
65+	1	11	0.09
Total	1,183	1,502	0.79

The table to the left shows the A/E ratios for LEOFF 1 after we removed the data as described in the Data section.

LEOFF 2 All Disability Counts by Age			
Male and Female			
Age	Actual	Expected	Ratio
20-24	0	0	0.00
25-29	1	5	0.22
30-34	2	16	0.12
35-39	11	39	0.28
40-44	16	57	0.28
45-49	22	74	0.30
50-54	56	95	0.59
55-59	41	58	0.71
60-64	16	17	0.94
65+	1	3	0.39
Total	166	364	0.46

The table to the left shows the A/E ratios for all disabilities combined in LEOFF 2, after we removed the data as described in the Data section.

LEOFF 2

LEOFF 2 Disability Counts by Year			
(Males and Females)			
Year	Actual	Expected	Ratio
2005	24	41	0.59
2006	31	44	0.71
2007	18	47	0.38
2008	26	50	0.52
2009	29	53	0.54
2010	23	56	0.41
2011	23	59	0.39
2012	10	61	0.16
Total	184	411	0.45

The table to the left shows the year-by-year Actual and Expected counts for all disabilities combined in LEOFF 2.

Methods and Format of Assumptions

We considered alternate formats for the assumptions and, ultimately, decided not to make any changes. For reference, we considered, but did not adopt:

- ◆ **Separate rates by gender.**
Since female members comprise a small minority of total LEOFF members we chose to keep rates gender-neutral.
- ◆ **Separate rates by occupation (police v. fire fighter).**
The benefits are basically the same for both groups, and we felt that splitting an already-small system into separate occupation classifications would reduce the credibility of those separate rates.

Best Estimate LEOFF Disability Rates

The table on the right shows a sampling of the Unchanged and Actual Rates for LEOFF 1.

LEOFF 1 Disability Rates		
Age	Unchanged Rates	Actual Rates
	Male & Female	Male & Female
20	0.001000	0.000000
25	0.001000	0.000000
30	0.007968	0.000000
35	0.014888	0.000000
40	0.023471	0.006579
45	0.040000	0.030928
50	0.070000	0.069284
55	0.090000	0.069973
60	0.100000	0.029730
65	0.100000	0.000000
70	0.000000	0.000000
75	0.000000	0.000000
80	0.000000	0.000000

The following table shows a sampling of the Old, Actual, and New Rates for all disabilities combined in LEOFF 2.

LEOFF 2 Disability Rates (All Disabilities Combined)			
Age	Old Rates	Actual Rates	New Rates
	Male & Female	Male & Female	Male & Female
20	0.000124	0.000000	0.000074
25	0.000319	0.000904	0.000191
30	0.000779	0.000361	0.000467
35	0.001345	0.000000	0.000807
40	0.002266	0.000210	0.001360
45	0.002994	0.000730	0.001796
50	0.005635	0.001461	0.003236
55	0.007955	0.002573	0.005534
60	0.010041	0.008696	0.009462
65	0.011769	0.000000	0.016180
70	0.000000	0.000000	0.000000
75	0.000000	0.000000	0.000000
80	0.000000	0.000000	0.000000

The table on the right shows the Actual and Expected combined disabilities for LEOFF 2 by age under both the old and new assumptions, as well as the Ratio of New Rates to Actual disabilities.

LEOFF 2 – Disability Experience (All Disabilities Combined) Male and Female				
Age	Actual	Expected		Ratio
		Old Rates	New Rates	
20-24	0	0	0	0.00
25-29	1	5	3	0.37
30-34	2	16	10	0.21
35-39	11	39	24	0.47
40-44	16	57	34	0.47
45-49	22	74	44	0.50
50-54	56	95	58	0.96
55-59	41	58	44	0.93
60-64	16	17	18	0.90
65+	1	3	2	0.62
Total	166	364	237	0.70

The table below shows the actual and expected duty disabilities for LEOFF 2 by age under both the old and new assumptions, as well as the Ratio of New Rates to Actual duty-related disabilities.

LEOFF 2 Duty Disability Experience 2005-2012				
Age	Actual	Expected		Ratio
		Old Rates	New Rates	
20-24	0	0	0	0.00
25-29	1	1	1	1.04
30-34	2	2	2	1.06
35-39	11	10	10	1.08
40-44	15	14	14	1.03
45-49	19	19	19	0.99
50-54	43	47	48	0.90
55-59	30	34	34	0.88
60-64	13	13	13	0.97
65+	1	1	1	1.20
Total	135	142	143	0.95

The table to the right shows a sampling of the Old, Actual, and New percent duty disabilities in LEOFF 2.

LEOFF 2 – Percent of Disabilities that are Duty Related			
Age	Old Rates	Actual	New Rates
20	97.15%	0.00%	97.25%
25	95.71%	100.00%	95.86%
30	94.30%	100.00%	94.50%
35	92.85%	0.00%	93.11%
40	91.45%	100.00%	91.75%
45	88.60%	100.00%	89.00%
50	85.75%	80.00%	86.25%
55	82.90%	40.00%	83.50%
60	82.90%	80.00%	83.50%
65	82.90%	0.00%	83.50%
70	82.90%	0.00%	83.50%

LEOFF 2 Total (Catastrophic) Disability			
Male and Female			
Age	Actual	Expected	Ratio
20-24	0	0	0.00
25-29	0	0	0.00
30-34	0	0	0.00
35-39	1	1	0.76
40-44	2	2	1.11
45-49	4	2	1.75
50-54	5	5	0.97
55-59	6	4	1.67
60-64	0	2	0.00
65+	0	0	0.00
Total	18	16	1.11

The table to the left shows the Actual and Expected total (catastrophic) disabilities over the period studied. The data proved to be a good fit to the assumption, so we left it unchanged at 12 percent. In other words, we expect 12 percent of all duty-related disabilities to be classified as total disabilities.

WSPRS

Past Experience

We analyzed the data by looking at overall fit by year, as well as all data combined by plan and age to make adjustments to the Washington State Patrol Retirement System (WSPRS) disability rates.

The table to the right shows the year-by-year Actual and Expected disabilities for WSPRS 1/2, as well as the Ratio of A/E counts.

WSPRS 1/2 Disability Counts by Year			
(Males and Females)			
Year	Actual	Expected	Ratio
1995	4	1	4.31
1996	3	1	3.42
1997	1	1	1.15
1998	1	1	1.13
1999	1	1	1.11
2000	0	1	0.00
2001	0	1	0.00
2002	1	1	1.02
2003	0	1	0.00
2004	1	1	0.96
2005	0	1	0.00
2006	0	1	0.00
2007	1	1	0.95
2008	0	1	0.00
2009	0	1	0.00
2010	1	1	0.84
2011	0	1	0.00
2012	0	1	0.00
Total	14	18	0.76

The table on the right shows the A/E ratios for WSPRS 1/2 by age after we removed the data as described in the Data section.

WSPRS Plan 1/2 Disability Counts by Age			
Males and Females			
Age	Actual	Expected	Ratio
20-24	0	0	0.00
25-29	1	1	1.41
30-34	1	2	0.59
35-39	0	3	0.00
40-44	2	3	0.63
45-49	4	4	1.13
50-54	1	2	0.41
55-59	0	1	0.00
60-64	0	0	0.00
65+	0	0	0.00
Total	9	15	0.58

Methods and Format of Assumptions

We considered alternate formats for the assumptions, and ultimately decided not to make any changes. For reference, we considered, but did not adopt:

◆ **Separate rates by gender.**

Because female members comprise a small minority of total members for those systems we chose to keep rates gender-neutral.

◆ **Separate rates by plan.**

At this time, Plan 2 does not have enough experience data with which to develop a credible rate.

Best Estimate WSPRS Disability Rates

The following table shows a sampling of the Old, Actual, and New Rates for WSPRS 1/2.

WSPRS 1/2 Disability Rates			
Age	Old Rates	Actual Rates	New Rates
	Male & Female	Male & Female	Male & Female
20	0.000256	0.000000	0.000052
25	0.000353	0.000000	0.000094
30	0.000488	0.000000	0.000169
35	0.000675	0.000000	0.000306
40	0.000933	0.000000	0.000551
45	0.001290	0.001869	0.000995
50	0.001783	0.000000	0.001794
55	0.002465	0.000000	0.003237
60	0.003408	0.000000	0.000560
65	0.000000	0.000000	0.000000
70	0.000000	0.000000	0.000000
75	0.000000	0.000000	0.000000
80	0.000000	0.000000	0.000000

The table below shows the actual and expected disabilities for WSPRS 1/2 by age under both the Old and New disability assumptions, as well as the Ratio of New Rates to actual disabilities.

WSPRS 1/2 A/E Disability Counts				
Males and Females				
Age	Actual	Expected		Ratio
		Old Rates	New Rates	
20-24	0	0	0	0.00
25-29	1	1	0	4.62
30-34	1	2	1	1.50
35-39	0	3	1	0.00
40-44	2	3	2	0.95
45-49	4	4	3	1.32
50-54	1	2	3	0.37
55-59	0	1	1	0.00
60-64	0	0	0	0.00
65+	0	0	0	0.00
Total	9	15	11	0.82

Termination Rates

By System

Please note that the following termination rates are set by system. In other words, there will only be one set of rates for all plans within a system, rather than separate rates for Plan 1 and Plans 2/3. However, we will continue to study and review each plan individually and may calculate plan-specific rates in a future study.

PERS

Past Experience

The table to the right shows the year-by-year Actual and Expected terminations using the old termination rate assumptions for the Public Employees' Retirement System (PERS).

PERS Termination Experience by Year			
Year	Actual	Expected	Ratio
1995	8,872	9,555	0.93
1996	8,348	9,233	0.90
1997	9,007	9,266	0.97
1998	9,103	9,379	0.97
1999	10,033	9,956	1.01
2000	11,423	10,201	1.12
2001	9,032	10,415	0.87
2002	8,972	10,330	0.87
2003	8,904	10,027	0.89
2004	8,833	9,752	0.91
2005	10,554	9,827	1.07
2006	11,823	9,627	1.23
2007	7,706	9,715	0.79
2008	10,523	10,167	1.04
2009	9,791	10,467	0.94
2010	8,763	9,359	0.94
Total	151,687	157,275	0.96

The following table shows, by service level, the Actual-to-Expected (A/E) ratios for PERS after we removed the data described in the Data section. As a result, the total Actual and Expected counts will not match the prior table.

PERS Termination Experience by Service Level						
Service	Males			Females		
	Actual	Expected	Ratio	Actual	Expected	Ratio
0	12,551	12,609	1.00	15,497	16,404	0.94
1	11,799	12,291	0.96	15,919	16,757	0.95
2	6,217	6,480	0.96	9,176	9,415	0.97
3	4,157	4,347	0.96	6,466	6,569	0.98
4	3,270	3,397	0.96	4,684	4,867	0.96
5	2,673	2,688	0.99	3,873	3,910	0.99
6-9	6,887	6,953	0.99	10,268	10,547	0.97
10-14	4,632	4,981	0.93	6,381	6,381	1.00
15-19	2,552	2,784	0.92	3,155	3,254	0.97
20-24	1,124	948	1.19	1,317	1,087	1.21
25-29	312	273	1.14	277	183	1.52
30+	14	12	1.17	22	6	3.62
Total	56,188	57,763	0.97	77,035	79,381	0.97

Totals and ratios may not agree due to rounding.

Methods and Format of Assumptions

We found that the early service years have the largest termination rates. We also found that terminations spike beginning at 20 years of service.

Service Levels	Males		Females	
	Old Ratio	New Ratio	Old Ratio	New Ratio
0-5	97%	97%	96%	97%
6-19	96%	98%	98%	99%
20-30	118%	107%	126%	110%

In light of this information, we reviewed the trends in the actual termination rates using three service-based cohorts:

- ◆ **0-5.**
The actual terminations fit expected terminations, so very little adjustment to the old termination rates were needed.
- ◆ **6-19.**
We fit the actual terminations to exponential trend lines and used our professional judgment to create new rates.
- ◆ **20-30.**
We fit the actual terminations to exponential trend lines and used our professional judgment to create new rates.

We considered alternate formats for the assumptions and, ultimately, decided not to make any changes. For reference, we considered, but did not adopt:

- ◆ **Separate rates for each plan.**
We will consider separate termination rates for Plan 2 and Plan 3 in the future if we have enough experience data for each plan and find that the experience for each plan is materially different. We did not consider separate termination rates for Plan 1 due to the

shrinking size of the population and the fact that the majority of the active Plan 1 population is retirement eligible.

- ◆ **Unisex rates for the system.**
We considered creating unisex rates for all plans. However, we found that male and female rates are materially different and ultimately chose to continue to distinguish rates by gender.
- ◆ **Rates by age.**
We believe termination rates are more strongly tied to service than to age, so we chose not to use age-based assumptions.

Best Estimate PERS Termination Rates

The table on the following page shows the Old, Actual (1995-2010 experience, excluding the years we removed), and New termination rates for PERS.

PERS Termination Rates*						
Service	Males			Females		
	Old Rates	Actual	New Rates	Old Rates	Actual	New Rates
0	0.262	0.261	0.262	0.268	0.253	0.262
1	0.155	0.148	0.155	0.168	0.159	0.168
2	0.101	0.097	0.101	0.117	0.114	0.117
3	0.075	0.072	0.075	0.093	0.091	0.093
4	0.063	0.061	0.063	0.076	0.073	0.076
5	0.054	0.054	0.054	0.067	0.066	0.067
6	0.046	0.046	0.045	0.061	0.058	0.058
7	0.043	0.043	0.042	0.055	0.054	0.053
8	0.038	0.037	0.039	0.050	0.048	0.049
9	0.036	0.036	0.036	0.045	0.044	0.045
10	0.034	0.033	0.034	0.041	0.040	0.042
11	0.031	0.029	0.031	0.037	0.037	0.038
12	0.030	0.028	0.029	0.034	0.035	0.035
13	0.029	0.026	0.027	0.032	0.031	0.033
14	0.028	0.026	0.025	0.031	0.032	0.030
15	0.027	0.023	0.024	0.030	0.029	0.028
16	0.024	0.023	0.022	0.027	0.027	0.025
17	0.022	0.020	0.020	0.024	0.025	0.023
18	0.020	0.018	0.019	0.022	0.021	0.022
19	0.017	0.016	0.018	0.020	0.017	0.020
20	0.014	0.017	0.015	0.017	0.021	0.018
21	0.012	0.013	0.013	0.014	0.017	0.016
22	0.010	0.010	0.011	0.012	0.014	0.014
23	0.008	0.011	0.010	0.011	0.012	0.012
24	0.008	0.009	0.009	0.008	0.012	0.011
25	0.007	0.009	0.007	0.007	0.013	0.009
26	0.006	0.009	0.006	0.006	0.010	0.008
27	0.007	0.006	0.006	0.006	0.006	0.007
28	0.006	0.005	0.005	0.005	0.006	0.006
29	0.005	0.004	0.004	0.004	0.003	0.006
30	0.005	0.006	0.004	0.004	0.012	0.005

*For display purposes, rates have been rounded.

The table below shows the Actual and Expected terminations for PERS by service, using the new termination rate assumptions for experience from 1995-2010, excluding the years we removed.

PERS Under New Assumptions						
Service	Males			Females		
	Actual	Expected	Ratio	Actual	Expected	Ratio
0	12,551	12,609	1.00	15,497	16,079	0.96
1	11,799	12,291	0.96	15,919	16,757	0.95
2	6,217	6,480	0.96	9,176	9,415	0.97
3	4,157	4,347	0.96	6,466	6,569	0.98
4	3,270	3,397	0.96	4,684	4,867	0.96
5	2,673	2,688	0.99	3,873	3,910	0.99
6-9	6,887	6,877	1.00	10,268	10,312	1.00
10-14	4,632	4,821	0.96	6,381	6,502	0.98
15-19	2,552	2,612	0.98	3,155	3,118	1.01
20-24	1,124	1,077	1.04	1,317	1,208	1.09
25-29	312	265	1.18	277	251	1.10
30+	14	10	1.47	22	8	2.85
Total	56,188	57,473	0.98	77,035	78,997	0.98

Totals and ratios may not agree due to rounding.

TRS

Past Experience

The next table shows the year-by-year Actual and Expected terminations using the old termination rate assumptions for the Teachers' Retirement System (TRS).

TRS Termination Experience by Year			
Year	Actual	Expected	Ratio
1995	1,600	1,857	0.86
1996	1,766	1,869	0.95
1997	1,635	1,812	0.90
1998	1,817	1,856	0.98
1999	2,027	1,882	1.08
2000	2,233	1,920	1.16
2001	3,591	1,987	1.81
2002	2,780	2,424	1.15
2003	2,289	2,392	0.96
2004	2,258	2,288	0.99
2005	2,609	2,274	1.15
2006	2,691	2,305	1.17
2007	1,448	2,318	0.62
2008	2,543	1,990	1.28
2009	2,158	1,989	1.09
2010	2,099	1,946	1.08
Total	35,544	33,108	1.07

The following table shows, by service level, the A/E ratios for TRS after we removed the data described in the Data section. As a result, the total Actual and Expected counts will not match the prior table.

TRS Termination Experience by Service Level						
Service	Males			Females		
	Actual	Expected	Ratio	Actual	Expected	Ratio
0	692	655	1.06	2,087	1,996	1.05
1	1,292	1,364	0.95	3,885	4,102	0.95
2	839	838	1.00	2,846	2,878	0.99
3	629	577	1.09	2,392	2,232	1.07
4	526	525	1.00	1,971	1,777	1.11
5	444	437	1.01	1,610	1,482	1.09
6-9	1,112	1,053	1.06	4,052	3,630	1.12
10-14	761	705	1.08	2,268	2,059	1.10
15-19	427	369	1.16	1,205	1,087	1.11
20-24	310	235	1.32	679	459	1.48
25-29	199	151	1.32	251	184	1.37
30+	17	3	4.89	11	3	3.33
Total	7,248	6,914	1.05	23,257	21,889	1.06

Totals and ratios may not agree due to rounding.

Methods and Format of Assumptions

We found that the early service years have the largest termination rates. We also found that terminations spike beginning at 20 years of service.

Service Levels	Males		Females	
	Old Ratio	New Ratio	Old Ratio	New Ratio
0-5	101%	100%	102%	101%
6-19	108%	101%	111%	101%
20-30	135%	109%	146%	101%

In light of this information, we chose to study the actual termination rates as three service-based cohorts similar to PERS.

For TRS, we considered the same alternatives and made the same relative changes as in PERS. Please see the **PERS – Methods and Format of Assumptions** section above for more information.

Best Estimate TRS Termination Rates

The table to the right shows the Old, Actual (1995-2010 experience, excluding the years we removed), and New termination rates for TRS.

Service	TRS Termination Rates*					
	Males			Females		
	Old Rates	Actual	New Rates	Old Rates	Actual	New Rates
0	0.108	0.114	0.111	0.109	0.114	0.111
1	0.093	0.088	0.090	0.097	0.092	0.095
2	0.060	0.060	0.060	0.072	0.071	0.072
3	0.043	0.047	0.045	0.059	0.063	0.061
4	0.041	0.041	0.041	0.050	0.056	0.053
5	0.037	0.037	0.037	0.045	0.049	0.047
6	0.032	0.031	0.030	0.040	0.044	0.041
7	0.025	0.028	0.027	0.034	0.039	0.037
8	0.022	0.022	0.025	0.030	0.032	0.033
9	0.021	0.025	0.023	0.024	0.028	0.030
10	0.020	0.019	0.021	0.023	0.027	0.027
11	0.019	0.021	0.020	0.022	0.023	0.024
12	0.019	0.019	0.018	0.020	0.023	0.021
13	0.014	0.016	0.017	0.017	0.018	0.019
14	0.013	0.018	0.015	0.017	0.018	0.017
15	0.012	0.015	0.014	0.016	0.015	0.016
16	0.012	0.014	0.013	0.015	0.019	0.016
17	0.011	0.012	0.012	0.013	0.016	0.015
18	0.010	0.010	0.012	0.012	0.012	0.015
19	0.009	0.012	0.011	0.011	0.014	0.014
20	0.009	0.014	0.010	0.011	0.015	0.013
21	0.007	0.010	0.010	0.008	0.014	0.013
22	0.007	0.009	0.009	0.008	0.011	0.012
23	0.007	0.008	0.009	0.007	0.010	0.011
24	0.007	0.008	0.009	0.007	0.009	0.010
25	0.007	0.011	0.008	0.007	0.010	0.010
26	0.007	0.010	0.008	0.007	0.010	0.009
27	0.006	0.009	0.007	0.006	0.009	0.009
28	0.005	0.006	0.007	0.005	0.005	0.008
29	0.005	0.003	0.006	0.005	0.005	0.008
30	0.004	0.024	0.006	0.004	0.014	0.007

*For display purposes, rates have been rounded.

The following table shows the Actual and Expected terminations for TRS by service, using the new termination rate assumptions for experience from 1995-2010, excluding the years we removed.

TRS Under New Assumptions						
Service	Males			Females		
	Actual	Expected	Ratio	Actual	Expected	Ratio
0	692	674	1.03	2,087	2,042	1.02
1	1,292	1,328	0.97	3,885	3,993	0.97
2	839	838	1.00	2,846	2,862	0.99
3	629	603	1.04	2,392	2,312	1.03
4	526	526	1.00	1,971	1,874	1.05
5	444	441	1.01	1,610	1,546	1.04
6-9	1,112	1,099	1.01	4,052	3,954	1.02
10-14	761	753	1.01	2,268	2,278	1.00
15-19	427	421	1.01	1,205	1,189	1.01
20-24	310	297	1.04	679	666	1.02
25-29	199	180	1.10	251	263	0.95
30+	17	5	3.34	11	6	1.78
Total	7,248	7,165	1.01	23,257	22,985	1.01

Totals and ratios may not agree due to rounding.

SERS

Past Experience

The table to the right shows the year-by-year Actual and Expected terminations using the old termination rate assumptions for the School Employees' Retirement System (SERS).

SERS Termination Experience by Year			
Year	Actual	Expected	Ratio
1995	3,329	3,535	0.94
1996	3,205	3,422	0.94
1997	3,578	3,509	1.02
1998	3,811	3,699	1.03
1999	4,107	3,726	1.10
2000	1,161	3,883	0.30
2001	3,565	3,998	0.89
2002	3,759	3,948	0.95
2003	4,055	3,921	1.03
2004	3,633	3,635	1.00
2005	3,998	3,612	1.11
2006	4,002	3,597	1.11
2007	2,716	3,596	0.76
2008	3,743	3,357	1.11
2009	3,078	3,397	0.91
2010	2,936	3,304	0.89
Total	54,676	58,139	0.94

The table below shows, by service level, the A/E ratios for SERS after we removed the data described in the Data section. As a result, the total Actual and Expected counts will not match the prior table.

SERS Termination Experience by Service Level						
Service	Males			Females		
	Actual	Expected	Ratio	Actual	Expected	Ratio
0	2,207	2,402	0.92	7,088	7,131	0.99
1	2,076	2,176	0.95	6,602	6,345	1.04
2	1,386	1,357	1.02	4,391	4,283	1.03
3	973	1,009	0.96	3,228	2,959	1.09
4	698	724	0.96	2,608	2,351	1.11
5-9	1,781	1,841	0.97	7,416	7,070	1.05
10-14	739	786	0.94	3,531	3,627	0.97
15-19	315	342	0.92	1,471	1,705	0.86
20-24	149	102	1.46	457	385	1.19
25-29	36	21	1.74	78	42	1.84
30+	2	2	1.28	2	2	1.04
Total	10,362	10,762	0.96	36,872	35,900	1.03

Totals and ratios may not agree due to rounding.

Methods and Format of Assumptions

We found that the early service years have the largest termination rates. We also found that terminations spike beginning at 20 years of service.

Service Levels	Males		Females	
	Old Ratio	New Ratio	Old Ratio	New Ratio
0-4	96%	97%	104%	104%
5-19	95%	99%	100%	100%
20-30	151%	113%	125%	108%

In light of this information, we chose to study the actual termination rates as three service-based cohorts similar to PERS.

For SERS, when applicable, we considered the same alternatives and made the same relative changes as in PERS. Please see the **PERS – Methods and Format of Assumptions** section above for more information.

Best Estimate SERS Termination Rates

The table on the following page shows the Old, Actual (1995-2010 experience, excluding the years we removed), and New termination rates for SERS.

SERS Termination Rates*						
Service	Males			Females		
	Old	Actual	New	Old	Actual	New
0	0.256	0.235	0.245	0.199	0.198	0.199
1	0.159	0.151	0.159	0.131	0.137	0.131
2	0.117	0.119	0.117	0.103	0.106	0.103
3	0.100	0.096	0.100	0.079	0.086	0.079
4	0.081	0.078	0.081	0.068	0.075	0.068
5	0.070	0.065	0.066	0.062	0.067	0.062
6	0.061	0.063	0.061	0.056	0.059	0.056
7	0.056	0.055	0.056	0.053	0.055	0.053
8	0.050	0.047	0.051	0.050	0.051	0.050
9	0.048	0.046	0.047	0.047	0.047	0.047
10	0.044	0.042	0.043	0.046	0.045	0.046
11	0.041	0.042	0.039	0.045	0.044	0.045
12	0.039	0.036	0.036	0.044	0.042	0.044
13	0.037	0.031	0.033	0.044	0.044	0.044
14	0.033	0.030	0.030	0.043	0.039	0.043
15	0.031	0.029	0.027	0.043	0.037	0.043
16	0.028	0.025	0.025	0.039	0.034	0.039
17	0.026	0.026	0.025	0.036	0.032	0.036
18	0.023	0.020	0.024	0.035	0.031	0.035
19	0.020	0.017	0.024	0.032	0.026	0.032
20	0.018	0.030	0.023	0.029	0.032	0.030
21	0.017	0.028	0.023	0.027	0.032	0.028
22	0.016	0.022	0.022	0.025	0.027	0.027
23	0.015	0.019	0.021	0.021	0.028	0.026
24	0.015	0.016	0.018	0.019	0.030	0.025
25	0.012	0.019	0.016	0.016	0.023	0.023
26	0.010	0.016	0.014	0.012	0.026	0.021
27	0.008	0.019	0.012	0.009	0.017	0.019
28	0.005	0.013	0.011	0.007	0.019	0.017
29	0.005	0.004	0.009	0.007	0.016	0.015
30	0.005	0.010	0.008	0.007	0.011	0.014

*For display purposes, rates have been rounded.

The table below shows the Actual and Expected terminations for SERS by service, using the new termination rate assumptions for experience from 1995-2010, excluding the years we removed.

SERS Under New Assumptions						
Service	Males			Females		
	Actual	Expected	Ratio	Actual	Expected	Ratio
0	2,207	2,296	0.96	7,088	7,131	0.99
1	2,076	2,176	0.95	6,602	6,345	1.04
2	1,386	1,357	1.02	4,391	4,283	1.03
3	973	1,009	0.96	3,228	2,959	1.09
4	698	724	0.96	2,608	2,351	1.11
5-9	1,781	1,806	0.99	7,416	7,070	1.05
10-14	739	733	1.01	3,531	3,627	0.97
15-19	315	328	0.96	1,471	1,705	0.86
20-24	149	133	1.12	457	421	1.09
25-29	36	30	1.18	78	72	1.08
30+	2	3	0.79	2	4	0.54
Total	10,362	10,596	0.98	36,872	35,968	1.03

Totals and ratios may not agree due to rounding.

PSERS

The Public Safety Employees' Retirement System (PSERS) Plan 2 opened in 2006 and did not have enough experience data to develop plan-specific assumptions in the prior study. Thus, in the prior study we used the rates that were established when the plan was created (PERS termination rates).

We will continue to assume PERS termination rates for PSERS active employees. However, we will continue to monitor the appropriateness of these termination rates for PSERS 2. Please see PERS for Old and New termination rates.

LEOFF

Past Experience

The table to the right shows the year-by-year Actual and Expected terminations using the old termination rate assumptions for the Law Enforcement Officers' and Fire Fighters' Retirement System (LEOFF).

LEOFF Termination Experience by Year			
Year	Actual	Expected	Ratio
1995	209	240	0.87
1996	223	247	0.90
1997	224	252	0.89
1998	251	255	0.98
1999	295	254	1.16
2000	302	275	1.10
2001	239	264	0.91
2002	241	276	0.87
2003	237	268	0.89
2004	265	276	0.96
2005	263	258	1.02
2006	262	268	0.98
2007	211	284	0.74
2008	266	293	0.91
2009	235	295	0.80
2010	200	277	0.72
Total	3,923	4,282	0.92

The table to the right shows, by service level, the A/E ratios for LEOFF after we removed the data described in the Data section. As a result, the total Actual and Expected counts will not match the prior table.

LEOFF Termination Experience by Service Level			
Service	Actual	Expected	Ratio
0	578	574	1.01
1	547	564	0.97
2	261	270	0.97
3	202	227	0.89
4	164	211	0.78
5-9	796	879	0.91
10-14	512	544	0.94
15-19	267	277	0.96
20-24	123	148	0.83
25-29	23	40	0.57
30+	0	0	0.00
Total	3,473	3,734	0.93

Totals and ratios may not agree due to rounding.

Methods and Format of Assumptions

We found that the early service years have the largest termination rates. We also found that termination rates decrease at an approximate linear trend after the second level of service.

Males and Females		
Service Levels	Old Ratio	New Ratio
	0-2	98%
3-30	90%	97%

In light of this information, we chose to study the actual termination rates as two service based cohorts:

- ◆ **0-2.**
We decided to keep the old termination rates.
- ◆ **3-30.**
We fit the actual terminations to a linear trend line and used our professional judgment to create new rates.

We considered alternate formats for this assumption and, ultimately, decided not to make any changes. For reference, we considered, but did not adopt:

◆ **Separate rates by gender.**

Since female members comprise a small minority of total LEOFF members we chose to keep rates gender-neutral.

◆ **Separate rates by occupation.**

We chose not to make this change since the higher terminations (law enforcement) for one group offset the lower terminations in the other (fire fighters). Additionally, the benefits are basically the same for both groups, and we felt that splitting an already small system into separate occupation classifications would reduce the credibility of those separate rates.

Best Estimate LEOFF Termination Rates

The table on the right shows the Old, Actual (1995-2010 experience, excluding the years we removed), and New termination rates for LEOFF.

LEOFF Termination Rates*			
Service	Old Rates	Actual	New Rates
0	0.107	0.108	0.107
1	0.048	0.047	0.048
2	0.024	0.024	0.024
3	0.022	0.019	0.019
4	0.020	0.016	0.019
5	0.020	0.018	0.018
6	0.019	0.018	0.017
7	0.019	0.017	0.017
8	0.018	0.015	0.016
9	0.017	0.016	0.015
10	0.017	0.017	0.015
11	0.015	0.015	0.014
12	0.015	0.013	0.014
13	0.014	0.012	0.013
14	0.011	0.011	0.012
15	0.011	0.012	0.012
16	0.010	0.010	0.011
17	0.008	0.007	0.010
18	0.009	0.008	0.010
19	0.009	0.008	0.009
20	0.009	0.009	0.008
21	0.008	0.007	0.008
22	0.008	0.006	0.007
23	0.007	0.006	0.006
24	0.007	0.004	0.006
25	0.007	0.005	0.005
26	0.008	0.005	0.004
27	0.007	0.000	0.004
28	0.006	0.003	0.003
29	0.002	0.003	0.002
30	0.002	0.000	0.002

**For display purposes, rates have been rounded.*

LEOFF Under New Assumptions			
Service	Actual	Expected	Ratio
0	578	574	1.01
1	547	564	0.97
2	261	270	0.97
3	202	203	1.00
4	164	193	0.85
5-9	796	788	1.01
10-14	512	501	1.02
15-19	267	304	0.88
20-24	123	131	0.94
25-29	23	26	0.88
30+	0	0	0.00
Total	3,473	3,556	0.98

Totals and ratios may not agree due to rounding.

The table to the left shows the Actual and Expected terminations for LEOFF by service, using the new termination rate assumptions for experience from 1995-2010, excluding the years we removed.

WSPRS

Past Experience

The table to the right shows the year-by-year Actual and Expected terminations using the old termination rate assumptions for the Washington State Patrol Retirement System (WSPRS).

WSPRS Termination Experience by Year			
Year	Actual	Expected	Ratio
1995	9	11	0.84
1996	9	9	1.00
1997	8	10	0.81
1998	10	10	1.00
1999	10	10	0.99
2000	13	11	1.18
2001	9	12	0.74
2002	16	13	1.26
2003	8	12	0.65
2004	17	13	1.32
2005	17	12	1.44
2006	17	11	1.56
2007	12	10	1.16
2008	18	10	1.74
2009	11	12	0.93
2010	8	11	0.71
Total	192	177	1.08

The table on the right shows, by service level, the A/E ratios for WSPRS after we removed the data described in the Data section. As a result, the total Actual and Expected counts will not match the prior table.

WSPRS Termination Experience by Service Level			
Service	Actual	Expected	Ratio
0	9	7	1.36
1	4	7	0.54
2	7	13	0.56
3	17	15	1.10
4	13	16	0.82
5	19	11	1.67
6	18	11	1.59
7	10	10	0.97
8	17	10	1.75
9	10	8	1.18
10-14	26	26	1.00
15-19	15	15	1.03
20-24	6	5	1.22
Total	171	155	1.11

Totals and ratios may not agree due to rounding.

Methods and Format of Assumptions

In the WSPRS Termination Experience by Service Level table we can see that WSPRS terminations are unique from other systems. WSPRS terminations do not steadily decline as the member's service level increases. WSPRS terminations seem to jump from higher-than-expected to lower-than-expected in the subsequent year.

Males and Females		
Service Levels	Old Ratio	New Ratio
0-4	86%	99%
5-24	125%	107%

In light of this information, we chose to study the actual termination rates as two service based cohorts:

- ◆ **0-4.**
We used our professional judgment to fit a trend line to the actual data.
- ◆ **5-24.**
We fit the actual terminations to a natural log trend line and used our professional judgment to create new rates.

We considered alternate formats for this assumption and, ultimately, decided not to make any changes. For reference, we considered, but did not adopt:

- ◆ **Separate rates by gender.**
Since female members comprise a small minority of total WSPRS members we chose to keep rates gender-neutral.
- ◆ **Separate rates by plan.**
At this time, Plan 2 does not have enough experience data with which to develop a credible rate.

Best Estimate WSPRS Retirement Rates

WSPRS Termination Rates*			
Service	Rates	Actual	Rates
0	0.033	0.045	0.042
1	0.029	0.016	0.020
2	0.026	0.014	0.020
3	0.024	0.026	0.020
4	0.023	0.019	0.020
5	0.016	0.026	0.020
6	0.015	0.024	0.019
7	0.014	0.014	0.017
8	0.014	0.024	0.016
9	0.013	0.016	0.015
10	0.010	0.008	0.013
11	0.010	0.009	0.012
12	0.009	0.012	0.011
13	0.009	0.002	0.010
14	0.009	0.017	0.009
15	0.007	0.009	0.008
16	0.007	0.002	0.007
17	0.006	0.006	0.006
18	0.006	0.011	0.006
19	0.006	0.005	0.005
20	0.003	0.000	0.004
21	0.003	0.003	0.004
22	0.003	0.006	0.003
23	0.003	0.005	0.003
24	0.002	0.003	0.002
25	0.000	0.000	0.000

*For display purposes, rates have been rounded.

The table on the left shows the Old, Actual (1995-2010 experience, excluding the years we removed), and New termination rates for WSPRS.

The table to the right shows the Actual and Expected terminations for WSPRS by service, using the new termination rate assumptions for experience from 1995-2010, excluding the years we removed

WSPRS Under New Assumptions			
Service	Actual	Expected	Ratio
0	9	8	1.07
1	4	5	0.78
2	7	10	0.72
3	17	13	1.31
4	13	14	0.93
5	19	14	1.32
6	18	14	1.26
7	10	12	0.82
8	17	11	1.51
9	10	10	1.04
10-14	26	31	0.84
15-19	15	14	1.05
20-24	6	6	1.06
Total	171	163	1.05

Totals and ratios may not agree due to rounding.

Service-Based Salary

PERS

Past Experience

Over the 26-year study period (excluding 2010-2012), we observed lower than expected salary increases at the beginning of a Public Employees' Retirement System (PERS) member's career, but higher than expected salary increases later in the PERS member's career.

The table below shows, by service, the Actual-to-Expected (A/E) ratios for PERS total salary increases.

PERS A/E Total Salary Increases			
Service	Actual	Expected*	Ratio
1	10.27%	10.37%	0.99
2	8.81%	9.01%	0.98
3	7.73%	7.97%	0.97
4	6.98%	7.04%	0.99
5	6.32%	6.31%	1.00
6-10	5.10%	5.03%	1.02
11-15	4.34%	4.30%	1.01
16-20	4.09%	4.07%	1.01
21+	3.99%	4.02%	0.99
Total	5.46%	5.47%	1.00

*Expected reflects (1+old service based salary scale) *(1+actual GSX) -1. Actual inflation=3.13% and actual productivity = 0.89%.

Methods and Format of Assumptions

As noted in the Data section above, we removed Great Recession data due to its short-term impact on salaries and consistency with the [2013 Economic Experience Study](#).

To get from total salary increases to service-based assumptions, we backed out an actual general salary increase developed during the [2013 Economic Experience Study](#). The actual PERS general salary increase was 4.02 percent.

We considered alternate formats for the assumptions and, ultimately, decided not to make any changes. For reference, we considered, but did not adopt:

- ◆ **Salary increase assumptions by valuation year.**
We studied the total salary increase, by valuation year, and did not observe a trend.
- ◆ **Salary increase assumptions by age.**
We think salary is more strongly tied to service than to age, so we chose not to use age-based salary increase assumptions.
- ◆ **Salary increase assumptions by plan.**
We studied the total salary increase, at each service level for Plans 2/3 and observed similar salary increase trends.

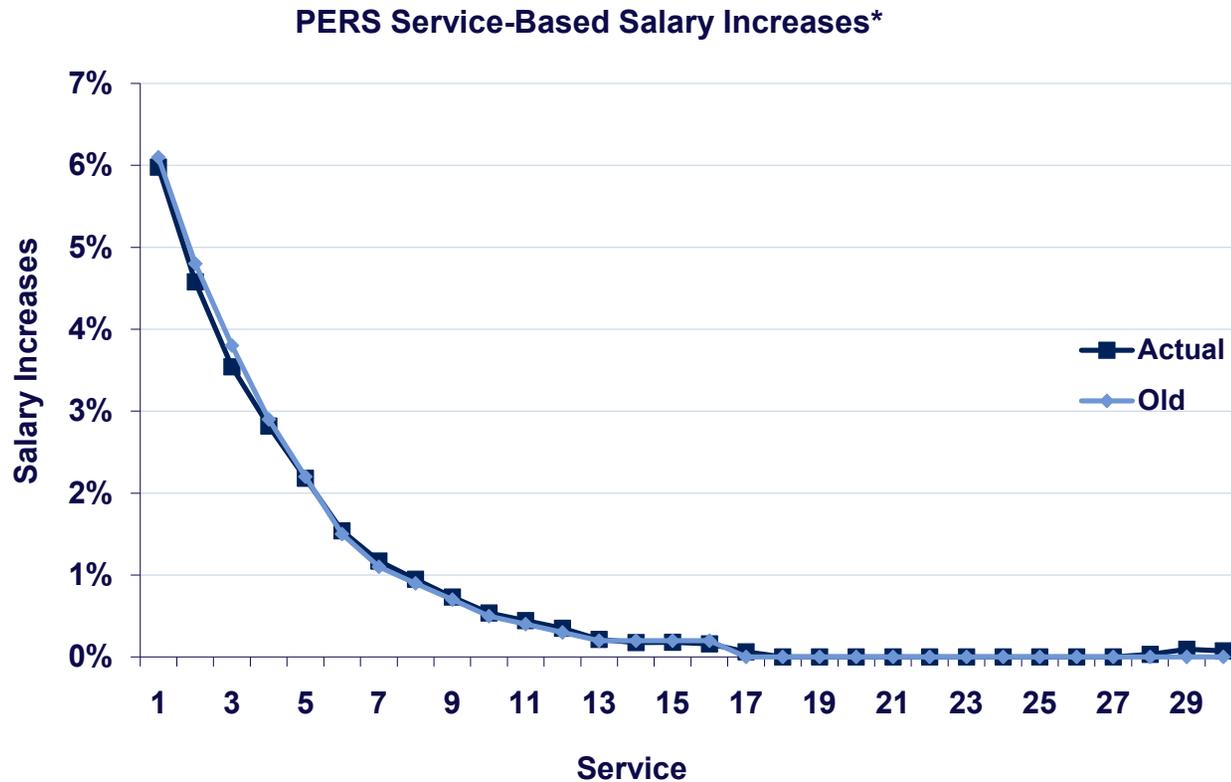
We chose not to apply separate salary increase assumptions for Plan 1, because experience in the closed plan is shrinking.
- ◆ **Salary increase assumptions by gender.**
We studied the total salary increase by valuation year, for males and females, and observed similar increases.

◆ **Lagged inflation.**

We considered implementing a lagged (or delayed) inflation, but did not find a consistently stronger correlation between lagged inflation and salary increase than non-lagged inflation and the salary increase. We studied this to observe whether inflation had a delayed effect on salary.

Best Estimate Service-Based Salary Rates

The chart below shows a comparison of actual Service-Based Salary (SBS) increases and expected SBS increases under old assumptions.



*For display purposes only, we assumed service-based salary increases would not fall below zero.

PERS actual increases match expected increases fairly closely. We made minor adjustments to the old SBS increases.

Our new SBS increase rates rely on historical experience. We expect future SBS increases to follow past experience. We then used our professional judgment to set the new SBS increases.

For PERS, we created a new step to reflect the creation of a new salary increase step for PERS employees (Step M).

The table to the right shows the Actual (1984-2009), Old, and New SBS increases for PERS. We also display the Rate Change from old assumptions.

PERS Service Based Salary Increase				
Service	Actual*	Old	New	Rate Change
1	5.98%	6.10%	6.00%	(0.10%)
2	4.58%	4.80%	4.70%	(0.10%)
3	3.54%	3.80%	3.60%	(0.20%)
4	2.82%	2.90%	2.90%	0.00%
5	2.18%	2.20%	2.20%	0.00%
6	1.54%	1.50%	1.50%	0.00%
7	1.17%	1.10%	1.20%	0.10%
8	0.95%	0.90%	0.90%	0.00%
9	0.73%	0.70%	0.70%	0.00%
10	0.54%	0.50%	0.50%	0.00%
11	0.45%	0.40%	0.40%	0.00%
12	0.35%	0.30%	0.30%	0.00%
13	0.22%	0.20%	0.30%	0.10%
14	0.17%	0.20%	0.20%	0.00%
15	0.18%	0.20%	0.20%	0.00%
16	0.16%	0.20%	0.20%	0.00%
17	0.06%	0.00%	0.10%	0.10%
18	(0.00%)	0.00%	0.00%	0.00%
19	(0.03%)	0.00%	0.00%	0.00%
20	(0.03%)	0.00%	0.00%	0.00%
21	(0.05%)	0.00%	0.00%	0.00%
22	(0.07%)	0.00%	0.00%	0.00%
23	(0.11%)	0.00%	0.00%	0.00%
24	(0.04%)	0.00%	0.00%	0.00%
25	(0.16%)	0.00%	0.00%	0.00%
26	(0.06%)	0.00%	0.00%	0.00%
27	(0.10%)	0.00%	0.00%	0.00%
28	0.03%	0.00%	0.00%	0.00%
29	0.09%	0.00%	0.00%	0.00%
30	0.08%	0.00%	0.00%	0.00%

*Actual reflects Total Salary Growth divided by actual inflation and actual productivity. Actual inflation = 3.13% and actual productivity=0.89%.

The next table shows the Actual and Expected total salary increases for PERS, by service, using the new assumptions for experience from 1984-2009.

PERS A/E Total Salary Increases			
Service	Actual	Expected*	Ratio
1	10.27%	10.26%	1.00
2	8.81%	8.91%	0.99
3	7.73%	7.77%	1.00
4	6.98%	7.04%	0.99
5	6.32%	6.31%	1.00
6-10	5.10%	5.05%	1.01
11-15	4.34%	4.32%	1.01
16-20	4.09%	4.09%	1.00
21+	3.99%	4.02%	0.99
Total	5.46%	5.46%	1.00

**Expected reflects (1+ new service based actual salary scale) *(1+actual GSX) -1. Actual inflation=3.13% and actual productivity=0.89%.*

TRS

Past Experience

Over the 26-year study period (excluding 2010-2012), we observed lower than expected salary increases at the beginning of a Teachers' Retirement System (TRS) member's career, but higher than expected salary increases later in the TRS member's career.

The table to the right shows, by service, the A/E ratios for TRS total salary increases.

TRS A/E Total Salary Increases			
Service	Actual	Expected*	Ratio
1	9.40%	10.14%	0.93
2	8.01%	8.58%	0.93
3	7.95%	8.37%	0.95
4	7.64%	7.75%	0.99
5	7.19%	7.33%	0.98
6-10	6.79%	6.62%	1.03
11-15	5.66%	5.55%	1.02
16-20	4.35%	4.27%	1.02
21+	4.12%	4.16%	0.99
Total	5.96%	6.03%	0.99

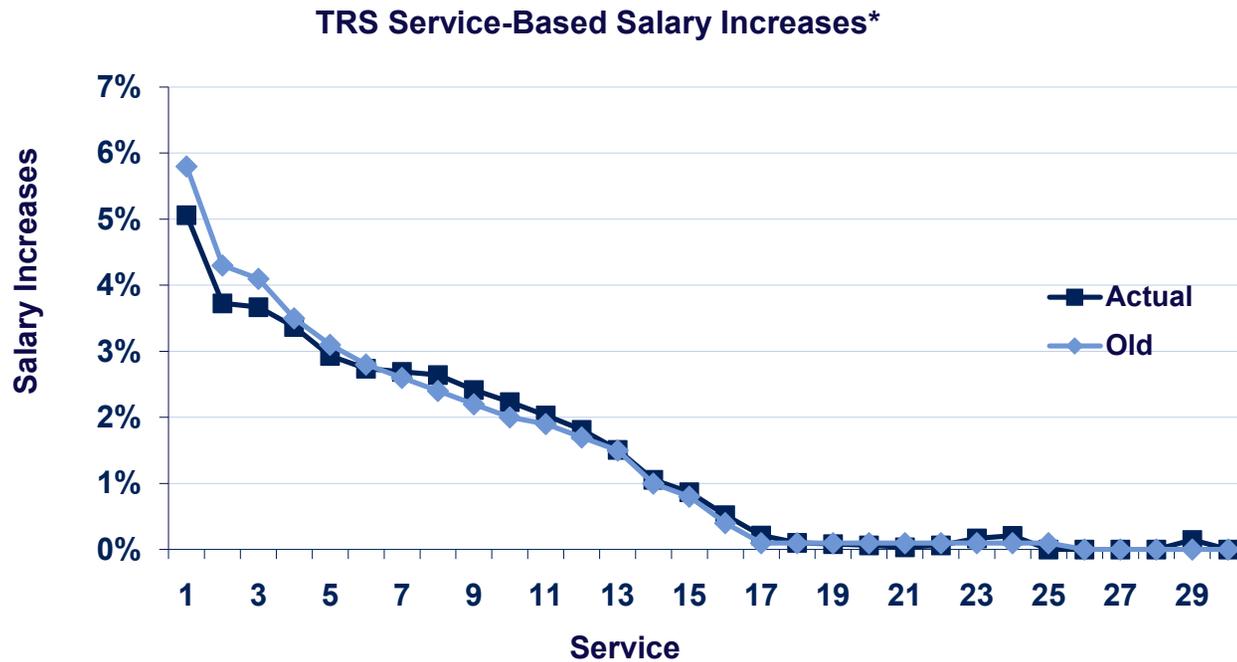
**Expected reflects (1+old service based salary scale) *(1+actual GSX) -1. Actual inflation=3.13% and actual productivity =0.97%.*

Methods and Format of Assumptions

The actual TRS general salary increase was 4.10 percent. Otherwise, for the TRS plans, we considered the same alternatives and made the same relative changes as in PERS. Please see the **PERS – Methods and Format of Assumptions** section above for more information.

Best Estimate Service-Based Salary Rates

The chart below shows a comparison of actual SBS increases and expected SBS increases under old assumptions.



*For display purposes only, we assumed service-based salary increases would not fall below zero.

TRS actual increases match expected increases fairly closely. We made minor adjustments to the old SBS increases. Service levels one and two were the only salary increase steps that changed by more than 20 basis points from the old assumptions.

Our new SBS increase rates rely on historical experience. We expect future SBS increases to follow past experience. We then used our professional judgment to set the new SBS increases.

The table to the right shows the Actual (1984-2009), Old, and New SBS increases for TRS. We also display the Rate Change from old assumptions.

TRS Service Based Salary Increase				
Service	Actual*	Old	New	Rate Change
1	5.06%	5.80%	5.10%	(0.70%)
2	3.73%	4.30%	3.90%	(0.40%)
3	3.67%	4.10%	3.90%	(0.20%)
4	3.37%	3.50%	3.50%	0.00%
5	2.93%	3.10%	3.00%	(0.10%)
6	2.74%	2.80%	2.70%	(0.10%)
7	2.69%	2.60%	2.70%	0.10%
8	2.64%	2.40%	2.60%	0.20%
9	2.41%	2.20%	2.40%	0.20%
10	2.23%	2.00%	2.20%	0.20%
11	2.03%	1.90%	2.00%	0.10%
12	1.81%	1.70%	1.80%	0.10%
13	1.51%	1.50%	1.50%	0.00%
14	1.06%	1.00%	1.20%	0.20%
15	0.87%	0.80%	0.90%	0.10%
16	0.52%	0.40%	0.50%	0.10%
17	0.21%	0.10%	0.20%	0.10%
18	0.10%	0.10%	0.10%	0.00%
19	0.08%	0.10%	0.10%	0.00%
20	0.06%	0.10%	0.10%	0.00%
21	0.04%	0.10%	0.10%	0.00%
22	0.07%	0.10%	0.10%	0.00%
23	0.17%	0.10%	0.10%	0.00%
24	0.21%	0.10%	0.10%	0.00%
25	(0.02%)	0.10%	0.10%	0.00%
26	(0.24%)	0.00%	0.00%	0.00%
27	(0.36%)	0.00%	0.00%	0.00%
28	(0.02%)	0.00%	0.00%	0.00%
29	0.14%	0.00%	0.00%	0.00%
30	(0.10%)	0.00%	0.00%	0.00%

*Actual reflects Total Salary Growth divided by actual inflation and actual productivity. Actual inflation= 3.13% and actual productivity=0.97%.

The table below shows the Actual and Expected total salary increases for TRS, by service, using the new assumptions for experience from 1984-2009.

TRS A/E Total Salary Increases			
Service	Actual	Expected*	Ratio
1	9.40%	9.41%	1.00
2	8.01%	8.16%	0.98
3	7.95%	8.16%	0.97
4	7.64%	7.75%	0.99
5	7.19%	7.23%	0.99
6-10	6.79%	6.74%	1.01
11-15	5.66%	5.65%	1.00
16-20	4.35%	4.32%	1.01
21+	4.12%	4.16%	0.99
Total	5.96%	6.00%	0.99

*Expected reflects (1+ new service based salary scale) \times (1+actual GSX) -1. Actual inflation =3.13% and actual productivity =0.97%.

SERS

Past Experience

Over the 26-year study period (excluding 2010-2012), we observed lower-than-expected salary increases at the beginning of a School Employees' Retirement System (SERS) member's career, but higher-than-expected salary increases later in the SERS member's career.

The table to the right shows, by service, the A/E ratios for SERS total salary increases.

SERS A/E Total Salary Increases			
Service	Actual	Expected*	Ratio
1	10.28%	10.86%	0.95
2	7.65%	7.75%	0.99
3	6.54%	6.71%	0.97
4	5.99%	6.09%	0.98
5	5.73%	5.99%	0.96
6-10	4.95%	4.94%	1.00
11-15	4.19%	4.12%	1.02
16-20	3.94%	3.79%	1.04
21+	3.92%	3.70%	1.06
Total	5.37%	5.40%	0.99

*Expected reflects (1+old service based salary scale) \times (1+actual GSX) -1. Actual inflation=3.13% and actual productivity =0.57%.

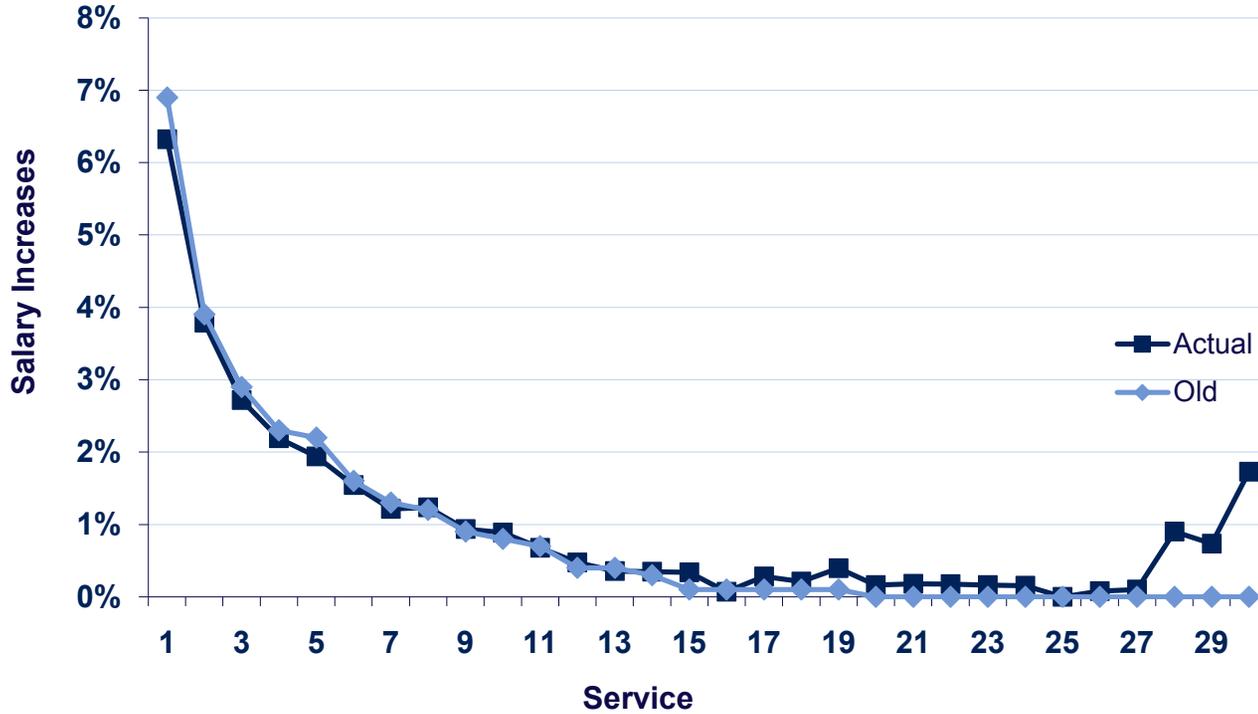
Methods and Format of Assumptions

The actual SERS general salary increase was 3.7 percent. Otherwise, for the SERS plans, where applicable, we considered the same alternatives and made the same relative changes as in PERS. Please see the **PERS – Methods and Format of Assumptions** section above for more information.

Best Estimate Service-Based Salary Rates

The following chart shows a comparison of Actual SBS increases and expected SBS increases under Old assumptions.

SERS Service-Based Salary Increases*



*For display purposes only, we assumed service-based salary increases would not fall below zero.

SERS actual increases match expected increases fairly closely. We made minor adjustments to the old SBS increases.

Our new SBS increase rates rely on historical experience. We expect future SBS increases to follow past experience. We then used our professional judgment to set the new SBS increases.

The table displayed to the right shows the Actual (1984-2009), Old, and New SBS increases for SERS. We also display the Rate Change from old assumptions.

SERS Service Based Salary Increase				
Service	Actual*	Old	New	Rate Change
1	6.32%	6.90%	6.60%	(0.30%)
2	3.79%	3.90%	3.90%	0.00%
3	2.72%	2.90%	2.80%	(0.10%)
4	2.19%	2.30%	2.30%	0.00%
5	1.94%	2.20%	2.10%	(0.10%)
6	1.54%	1.60%	1.60%	0.00%
7	1.21%	1.30%	1.20%	(0.10%)
8	1.24%	1.20%	1.20%	0.00%
9	0.94%	0.90%	0.90%	0.00%
10	0.89%	0.80%	0.90%	0.10%
11	0.68%	0.70%	0.70%	0.00%
12	0.48%	0.40%	0.50%	0.10%
13	0.36%	0.40%	0.40%	0.00%
14	0.34%	0.30%	0.30%	0.00%
15	0.34%	0.10%	0.20%	0.10%
16	0.07%	0.10%	0.20%	0.10%
17	0.28%	0.10%	0.20%	0.10%
18	0.21%	0.10%	0.20%	0.10%
19	0.40%	0.10%	0.10%	0.00%
20	0.16%	0.00%	0.10%	0.10%
21	0.18%	0.00%	0.00%	0.00%
22	0.17%	0.00%	0.00%	0.00%
23	0.16%	0.00%	0.00%	0.00%
24	0.15%	0.00%	0.00%	0.00%
25	(0.05%)	0.00%	0.00%	0.00%
26	0.08%	0.00%	0.00%	0.00%
27	0.10%	0.00%	0.00%	0.00%
28	0.90%	0.00%	0.00%	0.00%
29	0.73%	0.00%	0.00%	0.00%
30	1.73%	0.00%	0.00%	0.00%

*Actual reflects Total Salary Growth divided by actual inflation and actual productivity. Actual inflation=3.13% and actual productivity=0.57%.

The table to the right shows the Actual and Expected total salary increases for SERS, by service, using the new assumptions for experience from 1984-2009.

SERS A/E Total Salary Increases			
Service	Actual	Expected*	Ratio
1	10.28%	10.60%	0.97
2	7.65%	7.80%	0.98
3	6.54%	6.66%	0.98
4	5.99%	6.14%	0.98
5	5.73%	5.93%	0.97
6-10	4.95%	4.98%	0.99
11-15	4.19%	4.21%	1.00
16-20	3.94%	3.93%	1.00
21+	3.92%	3.75%	1.05
Total	5.37%	5.44%	0.99

**Expected reflects (1+ new service based salary scale) *(1+actual GSX) -1. Actual inflation=3.13% and actual productivity =0.57%.*

PSERS

The Public Safety Employees' Retirement System (PSERS) Plan 2 opened in 2006, and does not have enough experience data to develop plan-specific assumptions. We will continue to assume PERS SBS increases for PSERS and monitor the appropriateness of this assumption.

LEOFF

Past Experience

Over the 26-year study period (excluding 2010-2012), we observed the salary increases to be similar to the expected salary increases.

The table displayed on the right shows, by service, the A/E ratios for the Law Enforcement Officers' and Fire Fighters' Retirement System (LEOFF) total salary increases.

LEOFF A/E Total Salary Increases			
Service	Actual	Expected*	Ratio
1	14.90%	14.87%	1.00
2	11.47%	11.46%	1.00
3	9.56%	9.80%	0.98
4	7.54%	7.63%	0.99
5	6.38%	6.39%	1.00
6-10	5.13%	5.19%	0.99
11-15	4.83%	4.83%	1.00
16-20	4.74%	4.63%	1.02
21+	4.03%	3.49%	1.16
Total	5.91%	5.84%	1.01

**Expected reflects (1+old service based salary scale) *(1+actual GSX) -1. Actual inflation = 3.13% and actual productivity =0.36%.*

Methods and Format of Assumptions

“Ninety Percent Approach”

Productivity and inflation are economic assumptions and should be consistent among the systems. During the [2013 Economic Experience Study](#), we determined the currently assumed LEOFF 2 SBS was too high and resulted in a low actual productivity relative to other systems. In the table below, you can see the productivity rates between the Washington retirement systems.

2013 Economic Experience Study						
	Data Time					
	Period	PERS	TRS	SERS	LEOFF	WSPRS
Productivity	1984-2009	0.89%	0.97%	0.57%	0.36%	0.92%
Inflation	1984-2009	3.13%	3.13%	3.13%	3.13%	3.13%
Observed GSX		4.02%	4.10%	3.70%	3.49%	4.05%

For this study, we re-calculated a new productivity rate based on an approach we referred to as the “90 percent approach.” Under this approach, we multiplied the old LEOFF SBS assumptions by 90 percent and then calculated a new productivity based on our *2013 Economic Experience Study* approach. As a result, we calculated a new LEOFF actual productivity of 0.61 percent. We will refer to this as the “adjusted” actual productivity.

Alternative Methods

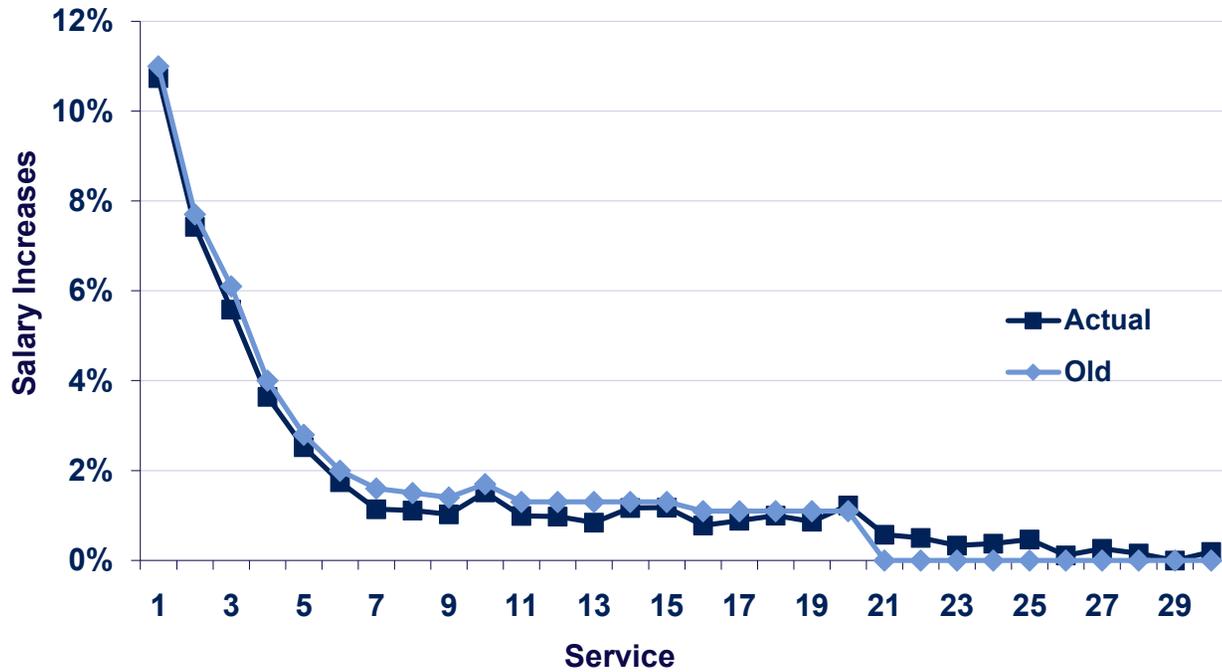
Since LEOFF is primarily male (approximately 90 percent), we did not consider studying this assumption by gender.

Otherwise, for the LEOFF plans, where applicable, we considered the same alternatives, and made the same relative changes as in PERS. Please see the **PERS – Methods and Format of Assumptions** section above for more information.

Best Estimate Service-Based Salary Rate

The following chart shows a comparison of actual SBS increase based on the 90 percent approach and expected SBS increases under old assumptions.

LEOFF Service-Based Salary Increases



**For display purposes only, we assumed service-based salary increases would not fall below zero*

The LEOFF actual increases are approximately 10 to 30 basis points lower than the old SBS increases.

Our new SBS increase rates rely on historical experience. We expect future SBS increases to follow past experience. We then used our professional judgment to set the new SBS increases.

The table on the right shows the Actual (1984-2009), Old, and New SBS increases for LEOFF. We also display the Rate Change from old assumptions.

LEOFF Service Based Salary				
Service	Actual*	Old	New	Change
1	10.74%	11.00%	10.70%	(0.30%)
2	7.42%	7.70%	7.50%	(0.20%)
3	5.58%	6.10%	5.90%	(0.20%)
4	3.64%	4.00%	3.70%	(0.30%)
5	2.52%	2.80%	2.60%	(0.20%)
6	1.74%	2.00%	1.80%	(0.20%)
7	1.14%	1.60%	1.40%	(0.20%)
8	1.11%	1.50%	1.30%	(0.20%)
9	1.03%	1.40%	1.20%	(0.20%)
10	1.51%	1.70%	1.70%	0.00%
11	0.99%	1.30%	1.20%	(0.10%)
12	0.98%	1.30%	1.20%	(0.10%)
13	0.85%	1.30%	1.20%	(0.10%)
14	1.17%	1.30%	1.20%	(0.10%)
15	1.18%	1.30%	1.20%	(0.10%)
16	0.78%	1.10%	1.00%	(0.10%)
17	0.89%	1.10%	1.00%	(0.10%)
18	1.00%	1.10%	1.00%	(0.10%)
19	0.87%	1.10%	1.00%	(0.10%)
20	1.22%	1.10%	1.00%	(0.10%)
21	0.57%	0.00%	0.50%	0.50%
22	0.50%	0.00%	0.50%	0.50%
23	0.34%	0.00%	0.50%	0.50%
24	0.38%	0.00%	0.50%	0.50%
25	0.47%	0.00%	0.50%	0.50%
26	0.11%	0.00%	0.00%	0.00%
27	0.26%	0.00%	0.00%	0.00%
28	0.15%	0.00%	0.00%	0.00%
29	(0.73%)	0.00%	0.00%	0.00%
30	0.19%	0.00%	0.00%	0.00%

*Actual reflects Total Salary Growth divided by actual inflation and adjusted actual productivity. Actual inflation=3.13% and adjusted actual productivity =0.61%.

The table to the right shows the Actual and Expected total salary increases for LEOFF, by service, using the new assumptions for experience from 1984-2009.

LEOFF A/E Total Salary Increases			
Service	Actual	Expected*	Ratio
1	14.90%	14.84%	1.00
2	11.47%	11.52%	0.99
3	9.56%	9.86%	0.97
4	7.54%	7.58%	0.99
5	6.38%	6.44%	0.99
6-10	5.13%	5.28%	0.97
11-15	4.83%	4.99%	0.97
16-20	4.74%	4.78%	0.99
21+	4.03%	4.07%	0.99
Total	5.91%	6.02%	0.98

**Expected reflects (1+ new service based salary scale) *(1+ adjusted actual GSX) -1. Actual inflation = 3.13% and adjusted actual productivity = 0.61%.*

WSPRS

Past Experience

Over the 26-year study period (excluding 2010-2012), we observed higher than expected salary increases in the first service year, but generally lower than expected salary increases later in the Washington State Patrol Retirement System (WSPRS) member's career.

The table displayed on the right shows, by service, the A/E ratios for WSPRS total salary increases.

WSPRS A/E Total Salary Increases			
Service	Actual	Expected	Ratio
1	13.57%	12.90%	1.05
2	10.72%	10.30%	1.04
3	9.54%	9.26%	1.03
4	9.01%	9.26%	0.97
5	8.91%	9.26%	0.96
6-10	5.22%	5.31%	0.98
11-15	4.22%	4.51%	0.94
16-20	4.54%	4.47%	1.02
21+	4.68%	4.41%	1.06
Total	5.68%	5.68%	1.00

**Expected reflects (1+new service based salary scale) *(1+actual GSX) -1. Actual inflation = 3.13% and actual productivity = 0.92%.*

Methods and Format of Assumptions

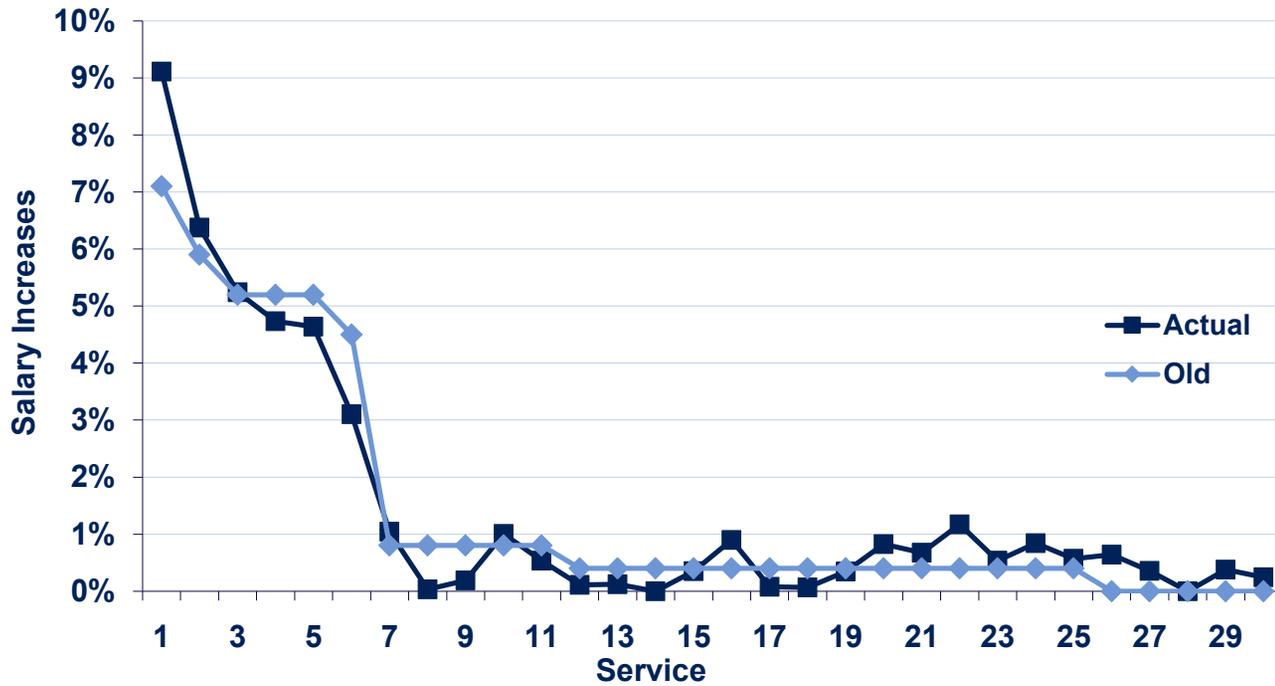
We considered studying Plans 1/2 individually, but chose not to due to the lack of Plan 2 data. As with the LEOFF plans, WSPRS is primarily male (90 percent), so we did not study this assumption by gender.

Otherwise, for the WSPRS plans, we considered the same alternatives and made the same relative changes as in PERS. Please see the **PERS – Methods and Format of Assumptions** section above for more information.

Best Estimate Service-Based Salary Rates

The following chart shows a comparison of actual SBS increases and expected SBS increases under old assumptions.

WSPRS Service-Based Salary Increases*



*For display purposes only, we assumed service-based salary increases would not fall below zero.

WSPRS actual increases are significantly higher in the first service year, but generally lower than the old assumptions in the service years following service year one.

Our new SBS increase rates rely on historical experience. We expect future SBS increases to follow past experience. We then used our professional judgment to set the new SBS increases.

The table to the right shows the Actual (1984-2009), Old, and New SBS increases for WSPRS. We also display the Rate Change from old assumptions.

WSPRS Service Based Salary Increase				
Service	Actual*	Old	New	Rate Change
1	9.11%	7.10%	8.50%	1.40%
2	6.38%	5.90%	6.00%	0.10%
3	5.24%	5.20%	5.00%	(0.20%)
4	4.74%	5.20%	5.00%	(0.20%)
5	4.64%	5.20%	5.00%	(0.20%)
6	3.11%	4.50%	3.50%	(1.00%)
7	1.04%	0.80%	0.60%	(0.20%)
8	0.03%	0.80%	0.60%	(0.20%)
9	0.19%	0.80%	0.60%	(0.20%)
10	1.00%	0.80%	0.60%	(0.20%)
11	0.53%	0.80%	0.60%	(0.20%)
12	0.11%	0.40%	0.40%	0.00%
13	0.12%	0.40%	0.40%	0.00%
14	(0.46%)	0.40%	0.40%	0.00%
15	0.35%	0.40%	0.40%	0.00%
16	0.90%	0.40%	0.40%	0.00%
17	0.07%	0.40%	0.40%	0.00%
18	0.07%	0.40%	0.40%	0.00%
19	0.35%	0.40%	0.40%	0.00%
20	0.83%	0.40%	0.40%	0.00%
21	0.67%	0.40%	0.40%	0.00%
22	1.17%	0.40%	0.40%	0.00%
23	0.54%	0.40%	0.40%	0.00%
24	0.84%	0.40%	0.40%	0.00%
25	0.57%	0.40%	0.40%	0.00%
26	0.64%	0.00%	0.40%	0.40%
27	0.36%	0.00%	0.40%	0.40%
28	(0.54%)	0.00%	0.00%	0.00%
29	0.38%	0.00%	0.00%	0.00%
30	0.24%	0.00%	0.00%	0.00%

*Actual reflects Total Salary Growth divided by actual inflation and actual productivity. Actual inflation = 3.13% and actual productivity = 0.92%.

The table displayed on this page shows the Actual and Expected total salary increases for WSPRS, by service, using the new assumptions for experience from 1984-2009.

WSPRS A/E Total Salary Increases			
Service	Actual	Expected	Ratio
1	13.57%	12.90%	1.05
2	10.72%	10.30%	1.04
3	9.54%	9.26%	1.03
4	9.01%	9.26%	0.97
5	8.91%	9.26%	0.96
6-10	5.22%	5.31%	0.98
11-15	4.22%	4.51%	0.94
16-20	4.54%	4.47%	1.02
21+	4.68%	4.41%	1.06
Total	5.68%	5.68%	1.00

**Expected reflects (1+new service based salary scale) *(1+actual GSX) -1. Actual inflation = 3.13% and actual productivity = 0.92%.*

Miscellaneous Assumptions

Percent Vested

Overall Summary

What is the Percent Vested Assumption and how is it Used?

The Percent Vested assumption represents the likelihood that members who leave employment (terminate) will be entitled to a future annual benefit. This can happen one of two ways:

- ◆ The member is vested at termination and defers retirement.
- ◆ The member is not vested at termination, but returns to work and becomes vested at some time in the future.

Members who terminate have the option to withdraw their contributions, with interest, or leave their contributions in the plan. In either of the two scenarios above, the member must leave his or her contributions in the plan in order to be eligible for a future benefit. We use the percent vested assumption in combination with our termination assumptions to estimate who will collect a deferred retirement benefit.

Percent Vested rates are generally service-based.

High-Level Takeaways

We generally found that our actual experience exceeded our assumptions and adjusted the assumptions upward based on past experience and future expectations.

We noted that interest rates outside the pension environment have been low and stable for about ten years, while the Department of Retirement Systems (DRS) interest rate credited to accounts is 5.5 percent. Terminating members may see leaving their contributions in their pension accounts as an attractive alternative to withdrawal. This fact alone could indicate that the percentage of people leaving their savings in place when they terminate could be higher than what we've observed in all of our past data. We think this could create a slight increase in actual observations for the future. We kept this in mind as we considered the amount of adjustment made in this study.

Assumptions

We assume that a member who is eligible for a service retirement will not terminate. Specifically, if that member chooses to leave employment then we assume the member will choose to retire immediately, if eligible, rather than withdraw their contributions or defer retirement to a later date.

We also assume a member will not return to active status if they remain terminated for more than two years, and that if a member has not withdrawn his or her contributions within those two years, he or she will not do so prior to retirement.

For purposes of studying this assumption only, we assume 100 percent of Plan 3 members are vested. These members might withdraw their defined contributions upon termination, but they will not lose their service upon withdrawal.

All other assumptions used in the development of Percent Vested match those disclosed in the [2012 Actuarial Valuation Report \(AVR\)](#).

Data

We began with 18 years of experience study records, from 1995-2012. No special data was added for this assumption, but some data was removed as noted below.

We only considered active members, new terminations, and withdrawals through 2010. Any members who terminated through 2010 and did not rehire or withdraw by 2012, were included in our count of actual terminations.

We chose to remove the School Employees' Retirement System (SERS) data from 2000 due to a much shorter-than-normal valuation cycle. SERS opened September 1, 2000, and that valuation period was only four months long. We eliminated that year's data to ensure that it did not overly influence the overall result.

We considered removing 2001 and 2007 data for all systems/plans due to odd-length valuation periods. However, these valuation periods were closer to a full year than the 2000 SERS period, and we do not expect the ratio of people deferring retirement to be affected by the length of valuation period in 2001 and 2007.

We also considered removing 2008-12 data due to the Great Recession, but we do not expect the ratio of people deferring retirement to be affected by it.

Law changes

Since the last study, no law changes have impacted this assumption.

General Methodology

We began by identifying newly terminated member counts. We then divided the count of terminated members who did not

withdraw by the number of terminations. This gives us an observed, or actual, percent vested.

We made this calculation for each system, by years of service and by plan. The exception to this is the Washington State Patrol Retirement System, which has one assumption for both plans combined.

Results

All-Plan Summary

We generally found that our actual experience exceeded our assumptions. We adjusted the assumptions upward based on past experience and future expectations. The table below shows Actual-to-Expected (A/E) counts before and after the assumption changes.

Summary of A/E Ratios*		
	Under Old Rates	Under New Rates
PERS 1	1.12	1.06
PERS 2	1.30	1.07
TRS 1	1.04	1.04
TRS 2	1.12	1.05
SERS 2	1.21	1.06
LEOFF 1	0.96	0.96
LEOFF 2	1.46	1.09
WSPRS	1.67	1.15

*Excludes PSERS due to lack of experience.

By System

PERS

Past Experience

The following table shows the Actual and Expected Public Employees' Retirement System (PERS) Plans 1/2 counts of members who did not withdraw their contributions after termination, along with the A/E Ratio.

PERS Members Maintaining Savings Funds After Termination						
Service	Plan 1			Plan 2		
	Actual	Expected	Ratio	Actual	Expected	Ratio
0-4	0	0	0.00	0	0	0.00
5-9	680	562	1.21	14,338	10,350	1.39
10-14	597	513	1.16	6,912	5,479	1.26
15-19	562	525	1.07	3,647	3,093	1.18
20-24	470	448	1.05	1,399	1,208	1.16
25-29	133	131	1.02	324	298	1.09
30+	0	0	0.00	22	25	0.89
Total	2,442	2,178	1.12	26,642	20,453	1.30

Methods and Format of Assumptions

We considered alternate formats for the assumption and, ultimately, decided not to make any changes. For reference, we considered, but did not adopt:

- ◆ Separate rates by gender.

We studied separate rates by gender, but felt that both genders' experience is reflected well in the data (a natural weighted average based on plan membership).

Best Estimate PERS Percent Vested Assumptions

We increased the PERS Percent Vested rates to bring the A/E ratio closer to 100 percent. The following table shows a summary of Actual, Old, and New percent vested rates by service and plan.

Service Years	PERS Percent Vested					
	Plan 1			Plan 2		
	Actual Rates	Old Rates	New Rates	Actual Rates	Old Rates	New Rates
0	0.641	0.000	0.000	0.769	0.000	0.000
5	0.608	0.450	0.500	0.591	0.400	0.550
10	0.609	0.525	0.600	0.623	0.500	0.575
15	0.677	0.625	0.650	0.678	0.575	0.650
20	0.723	0.650	0.675	0.796	0.675	0.750
25	0.817	0.725	0.700	0.856	0.775	0.800
30+	0.000	0.925	0.950	0.833	0.950	0.950

TRS

Past Experience

The table below shows the Actual and Expected Teachers' Retirement System (TRS) Plans 1/2 counts of members who did not withdraw their contributions after termination, along with the A/E Ratio.

TRS Members Maintaining Savings Funds After Termination						
Service Years	Plan 1			Plan 2		
	Actual	Expected	Ratio	Actual	Expected	Ratio
0-4	0	0	0.00	0	0	0.00
5-9	230	205	1.12	1,915	1,700	1.13
10-14	285	270	1.06	937	830	1.13
15-19	297	285	1.04	411	383	1.07
20-24	286	288	0.99	99	96	1.03
25-29	246	241	1.02	26	26	0.99
30+	0	0	0.00	2	2	1.00
Total	1,344	1,290	1.04	3,390	3,038	1.12

Methods and Format of Assumptions

For the TRS plans, we considered the same alternatives and made the same relative changes as in PERS. Please see the **PERS – Methods and Format Assumptions** section above for more information.

Best Estimate TRS Percent Vested Assumptions

We increased the TRS Percent Vested rates to bring the A/E ratio closer to 100 percent. The following table shows a summary of Actual, Old, and New percent vested rates by service and plan.

Service Years	TRS Percent Vested					
	Plan 1			Plan 2		
	Actual Rates	Old Rates	New Rates	Actual Rates	Old Rates	New Rates
0	0.778	0.000	0.000	0.833	0.000	0.000
5	0.904	0.725	0.725	0.744	0.650	0.700
10	0.885	0.800	0.800	0.831	0.700	0.750
15	0.967	0.875	0.875	0.871	0.775	0.850
20	0.918	0.900	0.900	0.969	0.925	0.950
25	0.979	0.925	0.925	1.000	0.950	0.950
30+	0.000	1.000	1.000	1.000	1.000	1.000

SERS

Past Experience

The table displayed to the right shows the Actual and Expected SERS Plan 2 counts of members who did not withdraw their contributions after termination, along with the A/E Ratio.

SERS Members Maintaining Savings Funds After Termination			
Service	Plan 2		
	Actual	Expected	Ratio
0-4	0	0	0
5-9	5,164	4,126	1.25
10-14	2,280	1,930	1.18
15-19	904	793	1.14
20-24	206	193	1.07
25-29	31	34	0.92
30+	1	1	1.05
Total	8,586	7,078	1.21

Methods and Format of Assumptions

For the SERS plans, we considered the same alternatives and made the same relative changes as in PERS. Please see the **PERS – Methods and Format Assumptions** section above for more information.

Best Estimate SERS Percent Vested Assumptions

SERS Percent Vested			
Plan 2			
Service Years	Actual Rates	Old Rates	New Rates
0	0.853	0.000	0.000
5	0.696	0.550	0.650
10	0.751	0.625	0.700
15	0.777	0.700	0.750
20	0.824	0.775	0.800
25	0.786	0.850	0.850
30+	1.000	0.950	0.950

We increased the SERS Percent Vested rates to bring the A/E Ratio closer to 100 percent. The following table shows a summary of Actual, Old, and New percent vested rates by service and plan.

We considered blending the PERS 2 rates with rates from another plan with similar retirement qualifications as PSERS, but the experience of those plans at those service levels didn't reflect our expectations for PSERS.

The table on the right shows a summary of Old and New percent vested rates by service.

PSERS Percent Vested		
Plan 2		
Service Years	Old Rates	New Rates
0	0.000	0.000
5	0.400	0.550
10	0.500	0.575
15	0.575	0.650
20	0.675	0.788
25	0.775	0.840
30+	0.950	0.950

LEOFF

Past Experience

The following table shows the Actual and Expected Law Enforcement Officers' and Fire Fighters' Retirement System (LEOFF) Plans 1/2 counts of members who did not withdraw their contributions after termination, along with the A/E Ratio.

PSERS

Past Experience

The Public Safety Employees' Retirement System (PSERS) Plan 2 opened in 2006 and we do not yet have enough experience data to develop plan-specific assumptions. As a result, we applied modified PERS 2 rates for this study.

Specifically, the PSERS rates use PERS 2 rates that were increased by 5 percent between 20 and 30 years of service and PERS 2 rates for all other service levels. We used increased rates between 20 and 30 years because PSERS members can retire early (at age 53) with subsidized Early Retirement Factors once they reach 20 years of service, while PERS 2/3 members cannot.

LEOFF Members Maintaining Savings Funds After Termination						
Service	Plan 1			Plan 2		
	Actual	Expected	Ratio	Actual	Expected	Ratio
0-4	0	0	0.00	0	0	0.00
5-9	0	0	0.00	354	216	1.64
10-14	0	0	0.00	241	145	1.67
15-19	2	2	1.00	139	95	1.46
20-24	14	15	0.93	98	107	0.92
25-29	6	6	1.00	18	18	0.99
30+	0	0	0.00	0	0	0.00
Total	22	23	0.96	850	581	1.46

Methods and Format of Assumptions

For the LEOFF plans, we considered the same alternatives and made the same relative changes as in PERS. Please see the **PERS – Methods and Format Assumptions** section above for more information.

Best Estimate LEOFF Percent Vested Assumptions

We did not revise the LEOFF 1 Percent Vested assumptions. There are very few active members left in this plan, and all are eligible for retirement. We generally increased the LEOFF 2 Percent Vested rates to bring the ratio of actual to expected closer to 100 percent. The table below shows a summary of Actual, Unchanged (Plan 1), Old, and New percent vested rates by service and plan.

LEOFF Percent Vested					
Service Years	Plan 1		Plan 2		
	Actual Rates	Unchanged Rates	Actual Rates	Old Rates	New Rates
0	1.000	0.000	0.650	0.000	0.000
5	0.000	1.000	0.376	0.240	0.325
10	0.000	1.000	0.377	0.240	0.375
15	0.000	1.000	0.402	0.270	0.400
20	1.000	1.000	0.696	0.690	0.600
25	1.000	1.000	0.778	0.910	0.900
30+	0.000	1.000	0.000	0.910	0.950

WSPRS

Past Experience

The table to the right shows the Actual and Expected Washington State Patrol Retirement System (WSPRS) Plans 1/2 counts of members who did not withdraw their contributions after termination, along with the A/E Ratio.

WSPRS Members Maintaining Savings Funds After Termination			
Service	Plan 1/2		
	Observed	Expected	Ratio
0-4	0	0	0.00
5-9	47	22	2.16
10-14	16	10	1.53
15-19	10	8	1.18
20-24	5	6	0.83
25-29	0	0	0.00
30+	0	0	0.00
Total	78	47	1.67

Methods and Format of Assumptions

For the WSPRS plans, we considered the same alternatives, and made the same relative changes as in PERS. Please see the **PERS – Methods and Format Assumptions** section above for more information.

Best Estimate WSPRS Percent Vested Assumptions

We generally increased the WSPRS Percent Vested rates to bring the A/E ratio closer to 100 percent. The table displayed on the right shows a summary of Actual, Old, and New percent vested rates by service.

WSPRS Percent Vested			
Service Years	Plan 1/2		
	Actual Rates	Old Rates	New Rates
0	0.500	0.000	0.000
5	0.667	0.275	0.475
10	0.429	0.275	0.475
15	0.400	0.400	0.500
20	0.000	0.775	0.750
25	0.000	1.000	1.000
30+	0.000	1.000	1.000

Survivors Selecting Annuities

Overall Summary

What is the Survivors Selecting Annuities Assumption and how is it Used?

The Survivors Selecting Annuities (Survivor Annuity) assumption estimates the rate at which survivors of active members select an annuity. When a member dies their survivor can select an annuity or take a refund of contributions and interest.

This assumption is set by age for each system, plan, and gender.

Survivors of members who are vested and leave employment are also eligible to select an annuity. We use this assumption to find a weighted average for those annuities.

High-Level Takeaways

We used a different rate calculation method than the last demographic experience study.

We calculated rates using a trend line approach, where a trend line is fit to the actual experience and the rate at each age is calculated. We then adjusted that trend line to account for the increase in eligible survivors due to recent law changes.

Since we have so little experience data for the Public Safety Employees' Retirement System (PSERS), the Washington State Patrol Retirement System (WSPRS), and for female members in the Law Enforcement Officers' and Fire Fighters' Retirement System (LEOFF), we took the following approaches for those systems.

- ◆ **PSERS.**
We applied blended PERS Plans 1/2 actual rates to PSERS.
- ◆ **WSPRS.**
We used the LEOFF results for each respective plan (LEOFF 1 rates for WSPRS 1 and LEOFF 2 rates for WSPRS 2).
- ◆ **LEOFF/WSPRS Females.**
We combined the male and female data to calculate the rates.

Assumptions

All assumptions used in the development of survivors selecting annuities rates match those disclosed in the [2012 Actuarial Valuation Report](#).

General Methodology

We calculated different assumptions for survivors of active and inactive members.

Calculation Method for Actives

For active members, we studied the counts of survivors selecting annuities at each age. Then, we determined a trend line that best matched the data. Finally, we adjusted the trend at each age to account for the increase in eligible survivors due to recent law changes (see the **Law Changes** section.)

Calculation Method for Inactives

For inactive members, we used the same method as in the prior study. Specifically, we calculated a single weighted average age of survivors selecting annuities for each system and plan.

Data

We began with 18 years of experience study records, from 1995-2012. No special data was added for this assumption and no data was excluded due to the Great Recession or any other event.

Law Changes

Since the last experience study, state law now allows domestic partners and same-sex spouses to qualify as survivors.

◆ E2SSB 5688 (2009).

- ▲ Applied to all citizens and members of all retirement plans.
- ▲ This bill provided that registered domestic partners would be treated exactly like married couples under state law.

◆ ESSB 6239 (2012).

- ▲ Applied to all citizens and members of all retirement plans.
- ▲ This bill established same-sex marriage, created full reciprocity with other states, and automatically converted most (but not all) same-sex domestic partnerships registered in Washington to marriages.

Results

By Plan

PERS

Past Experience:

For the Public Employees' Retirement System (PERS) Plan 1, actual rates were lower than expected for males and higher than expected for females. For PERS 2, actual rates were higher than expected for males and females (much higher for females). For PERS 3, actual rates were much lower than expected for males and females.

The two tables displayed on the right show the Actual-to-Expected (A/E) Ratios for PERS by plan, gender, and age.

PERS Male – Survivors of Active Deaths Selecting Annuities									
Age	Plan 1			Plan 2			Plan 3		
	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
20 - 24	0	0	0.00	0	0	0.00	0	0	0.00
25 - 29	0	0	0.00	0	0	0.00	0	1	0.00
30 - 34	0	0	0.00	1	0	0.00	1	3	0.34
35 - 39	0	0	0.00	2	0	0.00	1	3	0.34
40 - 44	4	4	0.98	6	4	1.68	7	8	0.87
45 - 49	28	28	0.99	17	13	1.27	8	11	0.71
50 - 54	71	69	1.03	78	67	1.17	11	16	0.68
55 - 59	90	90	1.00	137	121	1.13	21	22	0.97
60 - 64	59	71	0.83	153	154	1.00	20	21	0.95
65+	25	32	0.78	85	78	1.09	3	5	0.57
Total	277	294	0.94	479	436	1.10	72	91	0.80

PERS Female – Survivors of Active Deaths Selecting Annuities									
Age	Plan 1			Plan 2			Plan 3		
	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
20 - 24	0	0	0.00	0	0	0.00	0	0	0.00
25 - 29	0	0	0.00	0	0	0.00	0	0	0.00
30 - 34	0	0	0.00	0	0	0.00	2	1	1.75
35 - 39	0	0	0.00	0	0	0.00	3	2	1.50
40 - 44	2	1	1.39	1	2	0.48	1	2	0.42
45 - 49	7	10	0.72	4	4	1.11	6	5	1.09
50 - 54	40	38	1.06	25	19	1.32	5	10	0.51
55 - 59	65	52	1.25	45	39	1.16	4	9	0.44
60 - 64	42	47	0.90	59	31	1.91	0	3	0.00
65+	23	25	0.91	27	24	1.11	1	3	0.29
Total	179	173	1.03	161	119	1.36	22	37	0.60

Best Estimate Rates of Survivors of Active Deaths Selecting Annuities

The three tables on this page show a sample of our best estimate rates of survivors of active deaths selecting annuities.

PERS 1 Sample of Rates						
Ratio of Survivors of Active Deaths Selecting Annuities						
Age	Actual Rates	Old Rates	New Rates	Actual Rates	Old Rates	New Rates
	Male			Female		
40	0.0000	0.4622	0.2578	0.0000	0.1027	0.0000
45	0.5000	0.5634	0.4799	0.0000	0.3418	0.2631
50	0.3750	0.6140	0.5550	0.6154	0.4853	0.3728
55	0.8065	0.7151	0.6015	0.4706	0.4853	0.4406
60	0.6897	0.7151	0.6352	0.4545	0.4853	0.4899
65	0.7143	0.7481	0.6946	0.5455	0.5183	0.5615
70	0.5000	0.7481	0.7164	0.6667	0.5183	0.5934
75	0.0000	0.7481	0.7164	0.0000	0.5183	0.5934
80	0.5000	0.7481	0.7164	1.0000	0.5183	0.5934

PERS 2 Sample of Rates						
Ratio of Survivors of Active Deaths Selecting Annuities						
Age	Actual Rates	Old Rates	New Rates	Actual Rates	Old Rates	New Rates
	Male			Female		
40	0.0000	0.0553	0.0234	0.0000	0.0490	0.0000
45	0.0952	0.1036	0.1468	0.0625	0.0490	0.0638
50	0.2381	0.2968	0.2701	0.1176	0.1330	0.1343
55	0.4444	0.4417	0.3935	0.2558	0.2170	0.2049
60	0.5156	0.5866	0.5169	0.2955	0.2170	0.2754
65	0.5938	0.6196	0.6732	0.2059	0.2500	0.3790
70	0.7143	0.6196	0.7966	0.6000	0.2500	0.4495
75	0.6667	0.6196	0.7966	0.0000	0.2500	0.4495
80	0.6000	0.6196	0.7966	0.0000	0.2500	0.4495

PERS 3 Sample of Rates						
Ratio of Survivors of Active Deaths Selecting Annuities						
Age	Actual Rates	Old Rates	New Rates	Actual Rates	Old Rates	New Rates
	Male			Female		
25	0.0000	0.4365	0.0000	0.0000	0.1214	0.1411
30	0.0000	0.4902	0.0532	0.0000	0.2358	0.1592
35	0.5000	0.4902	0.1533	0.0000	0.2930	0.1774
40	0.0000	0.5439	0.2533	0.0000	0.3502	0.1955
45	0.3333	0.5439	0.3533	0.5000	0.4646	0.2136
50	0.3333	0.6298	0.4534	0.0000	0.5218	0.2317
55	0.4286	0.7049	0.5534	0.2500	0.5790	0.2499
60	1.0000	0.7586	0.6534	0.0000	0.5790	0.2680
65	0.6667	0.7916	0.7865	1.0000	0.6120	0.3191
70	0.0000	0.7916	0.7865	0.0000	0.6120	0.3191
75	0.0000	0.7916	0.7865	0.0000	0.6120	0.3191
80	0.0000	0.7916	0.7865	0.0000	0.6120	0.3191

TRS**Past Experience:**

For the Teachers' Retirement System (TRS) Plan 1, actual rates were lower than expected for males and higher than expected for females. For TRS 2, actual rates were higher than expected for males and for females. For TRS 3, actual rates were lower than expected for males and females.

The tables on the right show the A/E Ratios for TRS by plan, gender, and age.

TRS Male – Survivors of Active Deaths Selecting Annuities									
Age	Plan 1			Plan 2			Plan 3		
	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
20 - 24	0	0	0.00	0	0	0.00	0	0	0.00
25 - 29	0	0	0.00	0	0	0.00	0	1	0.00
30 - 34	0	0	0.00	0	0	0.00	3	3	0.99
35 - 39	0	0	0.00	0	0	0.00	1	4	0.28
40 - 44	5	4	1.41	0	0	0.00	7	9	0.78
45 - 49	6	8	0.72	0	0	0.00	8	13	0.63
50 - 54	38	37	1.04	3	2	1.77	16	16	1.02
55 - 59	37	38	0.98	10	10	1.02	30	23	1.31
60 - 64	19	20	0.95	10	9	1.09	12	11	1.06
65+	9	10	0.87	1	1	0.71	3	3	0.97
Total	114	117	0.98	24	22	1.09	80	82	0.97

TRS Female – Survivors of Active Deaths Selecting Annuities									
Age	Plan 1			Plan 2			Plan 3		
	Actual	Expected	Ratio	Actual	Expected	Ratio	Actual	Expected	Ratio
20 - 24	0	0	0.00	0	0	0.00	0	0	0.00
25 - 29	0	0	0.00	0	0	0.00	0	2	0.00
30 - 34	0	0	0.00	0	0	0.00	5	7	0.76
35 - 39	0	0	0.00	0	0	0.00	4	7	0.55
40 - 44	0	0	0.00	0	0	0.00	8	16	0.51
45 - 49	17	12	1.45	1	0	0.00	20	19	1.07
50 - 54	14	18	0.80	1	2	0.58	29	30	0.98
55 - 59	35	27	1.32	11	7	1.54	31	29	1.06
60 - 64	12	15	0.78	12	14	0.84	16	13	1.19
65+	4	4	1.02	5	7	0.77	5	4	1.24
Total	82	75	1.09	30	30	1.01	118	126	0.93

Best Estimate Rates of Survivors of Active Deaths Selecting Annuities

The tables on this page show a sample of our best estimate rates of survivors of active deaths selecting annuities.

TRS 1 Sample of Rates						
Ratio of Survivors of Active Deaths Selecting Annuities						
Age	Actual Rates	Old Rates	New Rates	Actual Rates	Old Rates	New Rates
	Male			Female		
40	0.0000	0.5977	0.2849	0.0000	0.4075	0.0306
45	0.0000	0.6469	0.5142	1.0000	0.4576	0.3205
50	0.6923	0.6961	0.5918	0.2500	0.4576	0.4186
55	0.5882	0.6961	0.6398	0.5556	0.4576	0.4792
60	0.7500	0.6961	0.6746	0.4286	0.4576	0.5232
65	0.5714	0.7291	0.7349	0.6667	0.4906	0.5908
70	1.0000	0.7291	0.7349	0.0000	0.4405	0.5908
75	0.0000	0.7291	0.7349	0.0000	0.4405	0.5908
80	0.0000	0.7291	0.7349	0.0000	0.4405	0.5908

TRS 2 Sample of Rates						
Ratio of Survivors of Active Deaths Selecting Annuities						
Age	Actual Rates	Old Rates	New Rates	Actual Rates	Old Rates	New Rates
	Male			Female		
50	0.0000	0.1951	0.1830	0.0000	0.1788	0.0992
55	0.6667	0.5243	0.3737	0.0000	0.2934	0.2518
60	0.5000	0.7124	0.5644	0.5556	0.4652	0.4045
65	0.0000	0.7454	0.7881	0.6667	0.5555	0.5901
70	0.0000	0.7454	0.7881	0.0000	0.8419	0.5901
75	0.0000	0.7454	0.7881	0.0000	0.8419	0.5901
80	0.0000	0.7454	0.7881	0.0000	0.8419	0.5901

TRS 3 Sample of Rates						
Ratio of Survivors of Active Deaths Selecting Annuities						
Age	Actual Rates	Old Rates	New Rates	Actual Rates	Old Rates	New Rates
	Male			Female		
25	0.0000	0.3454	0.0000	0.0000	0.4550	0.0000
30	0.0000	0.3454	0.1186	0.5000	0.5109	0.2032
35	0.0000	0.4018	0.2507	0.0000	0.5669	0.3067
40	0.0000	0.4582	0.3323	0.5000	0.5109	0.3707
45	0.1667	0.4808	0.3916	0.5000	0.5109	0.4172
50	0.1250	0.5146	0.4381	0.3333	0.4550	0.4537
55	0.4000	0.5146	0.4765	0.5833	0.4550	0.4837
60	0.5714	0.5710	0.5090	0.5556	0.4550	0.5093
65	0.5000	0.6604	0.5704	0.5000	0.4880	0.5645
70	0.0000	0.7168	0.5955	0.0000	0.4880	0.5842
75	0.0000	0.7168	0.5955	0.0000	0.4880	0.5842
80	0.0000	0.7168	0.5955	0.0000	0.4880	0.5842

SERS**Past Experience**

For the School Employees' Retirement System (SERS) Plan 2, actual rates were lower than expected for males and females (much higher for females). For SERS 3, actual rates were slightly higher for males and lower for females.

The next two tables show the A/E Ratios for SERS by plan, gender, and age.

SERS Male – Survivors of Active Deaths Selecting Annuities						
Age	Plan 2			Plan 3		
	Actual	Expected	Ratio	Actual	Expected	Ratio
20 - 24	0	0	0.00	0	0	0.00
25 - 29	0	0	0.00	0	0	0.00
30 - 34	0	0	0.00	0	0	0.00
35 - 39	0	0	0.00	0	0	0.00
40 - 44	0	0	0.00	1	1	0.86
45 - 49	2	1	1.70	1	3	0.36
50 - 54	1	5	0.20	15	15	1.00
55 - 59	19	15	1.24	12	10	1.17
60 - 64	17	20	0.85	19	20	0.96
65+	26	28	0.94	14	11	1.22
Total	65	69	0.94	62	61	1.02

SERS Female – Survivors of Active Deaths Selecting Annuities						
Age	Plan 2			Plan 3		
	Actual	Expected	Ratio	Actual	Expected	Ratio
20 - 24	0	0	0.00	0	0	0.00
25 - 29	0	0	0.00	0	0	0.00
30 - 34	0	0	0.00	0	0	0.00
35 - 39	0	0	0.00	2	1	1.96
40 - 44	0	0	0.00	3	5	0.59
45 - 49	3	1	5.74	12	13	0.92
50 - 54	13	5	2.49	23	26	0.89
55 - 59	21	9	2.44	27	36	0.75
60 - 64	20	14	1.42	15	21	0.72
65+	10	11	0.88	3	8	0.38
Total	67	40	1.68	85	110	0.77

Best Estimate Rates of Survivors of Active Deaths Selecting Annuities

The tables displayed below show a sample of our best estimate rates of survivors of active deaths selecting annuities.

SERS 2 Sample of Rates						
Ratio of Survivors of Active Deaths Selecting Annuities						
Age	Actual Rates	Old Rates	New Rates	Actual Rates	Old Rates	New Rates
	Male			Female		
40	0.0000	0.0559	0.0000	0.0000	0.0000	0.0000
45	0.0000	0.1538	0.1783	0.0000	0.0396	0.1592
50	0.0000	0.3007	0.3061	0.4444	0.1376	0.2533
55	0.5000	0.3986	0.3851	0.4286	0.2029	0.3115
60	0.4286	0.5944	0.4425	0.6667	0.3008	0.3537
65	0.5000	0.6763	0.5205	0.2857	0.3664	0.4199
70	0.0000	0.7742	0.5576	0.3333	0.3664	0.4472
75	0.0000	0.8721	0.5576	0.0000	0.3664	0.4472
80	1.0000	0.8721	0.5576	0.0000	0.3664	0.4472

SERS 3 Sample of Rates						
Ratio of Survivors of Active Deaths Selecting Annuities						
Age	Actual Rates	Old Rates	New Rates	Actual Rates	Old Rates	New Rates
	Male			Female		
35	0.0000	0.0000	0.0000	0.0000	0.3467	0.2464
40	0.0000	0.2392	0.0000	0.0000	0.3467	0.3169
45	0.0000	0.3553	0.2570	0.2000	0.4033	0.3408
50	0.0000	0.4134	0.3888	0.4706	0.4033	0.3555
55	1.0000	0.4715	0.4702	0.3333	0.5732	0.3662
60	0.5000	0.5295	0.5293	0.1667	0.5732	0.3746
65	1.0000	0.5625	0.6088	0.3333	0.6062	0.4146
70	1.0000	0.5625	0.6470	0.0000	0.6062	0.4205
75	0.0000	0.5625	0.6470	0.0000	0.6062	0.4205
80	0.0000	0.5625	0.6470	0.0000	0.6062	0.4205

PSERS

Past Experience:

PSERS Plan 2 opened in 2006 and does not yet have enough experience data to develop this assumption based on PSERS experience. In the prior study we applied PERS 2 rates to PSERS. For this study, we have applied a blended rate that is a combination of PERS 1 and PERS 2 because the unreduced or Normal Retirement Age (NRA) in PSERS falls between the NRA in PERS 1 and PERS 2. In general, the closer a member is to NRA at their death, the more likely the survivor will select an annuity. We believe this new method will provide a better estimate for PSERS than the previous method.

Specifically, we applied the PERS 2 rate for members under age 53. For members between age 53 and 65, we applied a 50/50 blend of PERS 1 and PERS 2 rates. For members age 66 and older, we applied the PERS 2 rates.

PSERS Male – Survivors of Active Deaths Selecting Annuities			
Plan 2			
Age	Actual	Expected	Ratio
20 - 24	0	0	0.00
25 - 29	0	0	0.00
30 - 34	0	0	0.00
35 - 39	0	0	0.00
40 - 44	1	0	20.71
45 - 49	0	0	0.00
50 - 54	1	0	3.45
55 - 59	0	0	0.00
60 - 64	0	0	0.00
65+	0	0	0.00
Total	2	0	5.92

The table on the left shows the A/E Ratios for PSERS males by age. We saw no active female deaths in PSERS.

Best Estimate Rates of Survivors of Active Deaths Selecting Annuities

The table below shows a sample of our best estimate rates of survivors of active deaths selecting annuities. Please note that columns labeled Actual Rates are the actual PERS 1 and PERS 2 rates, blended consistent with the method described in the **PSERS – Past Experience** section.

PSERS 2 Sample of Rates						
Ratio of Survivors of Active Deaths Selecting Annuities						
Age	Actual Rates (Blended PERS 1 & 2)	Old Rates (PERS 2)	New Rates (Blended PERS 1 & 2)	Actual Rates (Blended PERS 1 & 2)	Old Rates (PERS 2)	New Rates (Blended PERS 1 & 2)
	Male			Female		
40	0.0000	0.0553	0.1461	0.0000	0.0490	0.0745
45	0.0952	0.1036	0.3016	0.0625	0.0490	0.1736
50	0.2381	0.2968	0.3977	0.1176	0.1330	0.2349
55	0.6254	0.4417	0.4674	0.3632	0.2170	0.2794
60	0.6026	0.5866	0.5222	0.3750	0.2170	0.3144
65	0.5938	0.6196	0.6003	0.2059	0.2500	0.3762
70	0.7143	0.6196	0.6386	0.6000	0.2500	0.4006
75	0.6667	0.6196	0.6386	0.0000	0.2500	0.4006
80	0.6000	0.6196	0.6386	0.0000	0.2500	0.4006

LEOFF**Past Experience**

Data is limited due to very few female deaths in LEOFF plans. As such, we calculated combined rates for both genders. For LEOFF 1, actual rates were higher than expected. For LEOFF 2, actual rates were much higher than expected.

The following table shows the A/E Ratios for LEOFF by plan, gender, and age.

LEOFF Male & Female – Survivors of Active Deaths Selecting Annuities						
Age	Plan 1			Plan 2		
	Actual	Expected	Ratio	Actual	Expected	Ratio
20 - 24	0	0	0.00	0	0	0.00
25 - 29	0	0	0.00	1	0	0.00
30 - 34	0	0	0.00	0	0	0.00
35 - 39	0	0	0.00	8	1	7.15
40 - 44	2	1	1.79	8	6	1.35
45 - 49	8	6	1.30	14	7	2.05
50 - 54	19	12	1.54	29	12	2.51
55 - 59	23	16	1.42	8	4	2.03
60 - 64	55	38	1.47	9	6	1.55
65+	543	503	1.08	0	1	0.00
Total	650	577	1.13	77	36	2.16

Best Estimate Rates of Survivors of Active Deaths Selecting Annuities

The tables displayed to the right show a sample of our best estimate rates of survivors of active deaths selecting annuities.

LEOFF 1 Sample of Rates			
Ratio of Survivors Selecting Annuities			
Age	Actual Rates	Old Rates	New Rates
	Male & Female		
40	0.0000	0.5670	0.6370
45	1.0000	0.5670	0.6370
50	1.0000	0.5670	0.6370
55	0.8750	0.5670	0.6370
60	0.8462	0.5670	0.6370
65	0.7500	0.6000	0.6700
70	0.8125	0.6000	0.6700
75	0.6757	0.6000	0.6700
80	0.6333	0.6000	0.6700

LEOFF 2 Sample of Rates			
Ratio of Survivors of Active Deaths Selecting Annuities			
Age	Actual Rates	Old Rates	New Rates
	Male & Female		
35	0.5000	0.0728	0.2837
40	0.4000	0.1714	0.4310
45	0.5000	0.2701	0.5220
50	0.7143	0.3030	0.5881
55	1.0000	0.4017	0.6400
60	0.7500	0.5332	0.6827
65	0.0000	0.5662	0.7521
70	0.0000	0.5662	0.7521
75	0.0000	0.5662	0.7521
80	0.0000	0.5662	0.7521

WSPRS

Past Experience:

WSPRS is too small to develop reliable assumptions based on past plan experience. As with the prior demographic experience study, we applied LEOFF 1 rates to WSPRS 1 and LEOFF 2 rates to WSPRS 2.

The table below shows the A/E Ratios for WSPRS by plan, gender, and age.

WSPRS Male & Female – Survivors of Active Deaths Selecting Annuities						
Age	Plan 1			Plan 2		
	Actual	Expected	Ratio	Actual	Expected	Ratio
20 - 24	0	0	0.00	0	0	0.00
25 - 29	0	0	0.00	0	0	0.00
30 - 34	2	0	0.00	0	0	0.00
35 - 39	1	0	0.00	0	0	0.00
40 - 44	5	3	1.49	0	0	0.00
45 - 49	0	1	0.00	0	0	0.00
50 - 54	2	1	1.79	0	0	0.00
55 - 59	0	1	0.00	0	0	0.00
60 - 64	0	0	0.00	0	0	0.00
65+	0	0	0.00	0	0	0.00
All	10	6	1.79	0	0	0.00

Best Estimate Rates of Survivors of Active Deaths Selecting Annuities

The two tables on the right show a sample of our best estimate rates of survivors of active deaths selecting annuities.

Please note that columns labeled Actual Rates for WSPRS 1 and WSPRS 2 are the actual rates for LEOFF 1 and LEOFF 2, respectively.

WSPRS 1 Sample of Rates			
Ratio of Survivors Selecting Annuities			
Age	Actual Rates (LEOFF 1)	Old Rates (LEOFF 1)	New Rates (LEOFF 1)
	Male & Female		
40	0.0000	0.5670	0.6370
45	1.0000	0.5670	0.6370
50	1.0000	0.5670	0.6370
55	0.8750	0.5670	0.6370
60	0.8462	0.5670	0.6370
65	0.7500	0.6000	0.6700
70	0.8125	0.6000	0.6700
75	0.6757	0.6000	0.6700

WSPRS 2 Sample of Rates			
Ratio of Survivors of Active Deaths Selecting Annuities			
Age	Actual Rates (LEOFF 2)	Old Rates (LEOFF 2)	New Rates (LEOFF 2)
	Male & Female		
35	0.5000	0.0728	0.2837
40	0.4000	0.1714	0.4310
45	0.5000	0.2701	0.5220
50	0.7143	0.3030	0.5881
55	1.0000	0.4017	0.6400
60	0.7500	0.5332	0.6827
65	0.0000	0.5662	0.7521
70	0.0000	0.5662	0.7521
75	0.0000	0.5662	0.7521

AFC Load

Overall Summary

What is the AFC Load Assumption and how is it Used?

We apply a “load” to a given benefit provision to estimate the additional cost of another, related benefit provision. In application, a load is a percentage increase applied to an existing benefit in our valuation software where the increase represents the cost of another benefit provision.

The Average Final Compensation (AFC) Load assumption is used to estimate the expected cost of certain increases to member benefits near retirement.

Specifically, members of the Public Employees’ Retirement System (PERS) Plan 1, the Teachers’ Retirement System (TRS) Plan 1, the Law Enforcement Officers’ and Fire Fighters’ Retirement System (LEOFF) Plan 1, and the Washington State Patrol Retirement System (WSPRS) Plan 1 are eligible for payments that could increase their AFC. This in turn would increase the members' retirement benefit. Since these payments are unknown at the valuation date, we must make an assumption about the future cost.

Some of these payments are covered by the employer, while others are not. The AFC Load assumption only estimates the expected cost of increases not covered by the employer.

This is a new assumption for LEOFF 1 and did not appear in the prior study.

We set a single assumption for each of the affected plans.

High-Level Takeaways

In general, we are observing declining rates in PERS, TRS, and WSPRS Plans 1. Initial calculations for LEOFF 1 suggested a higher load; however, after outliers were removed and the study period was restricted to more recent experience, the calculated load decreased.

Assumptions

Except as noted, all assumptions used in the development of the AFC loads match those disclosed in the [2012 Actuarial Valuation Report](#).

General Methodology

Calculation Method

We used different calculation methods for LEOFF than for PERS, TRS, and WSPRS.

PERS, TRS, and WSPRS

For PERS 1, TRS 1, and WSPRS 1 we analyzed the AFC load under three methods.

1. **Aggregate average method.**

We calculate the overall average cost/load throughout the study period.

2. **Year-to-year average method.**

We calculate the load for each year in the study period and then set a trend line to the results.

3. Three-year rolling average method.

We calculate the three-year rolling average at each year in the study period and then set a trend line to the results.

LEOFF

Since this is the first time we set an AFC load assumption for LEOFF 1, we considered several possible methods and data sets. For example, we considered using different data, such as:

- ◆ Including all years of data.
- ◆ Including/excluding various groups of data.
- ◆ Including part-time members.

We also considered setting this assumption under different methods, such as:

- ◆ Studying the assumption based on year-to-year salary increases.
- ◆ Using a different base year to compare with the AFC.

To determine the load in LEOFF 1, we compare the AFC used for the member's actual retirement benefit to the AFC. This method is different than the method used to analyze and set the loads for PERS 1, TRS 1, and WSPRS 1 because the data used for LEOFF 1 does not contain the same type of information found for the other plans.

Specifically, we used the actual AFC and the expected AFC based on general AFC growth to calculate an aggregate average increase. We also calculated year-to-year average trends and then projected these trends to 2015. Finally, the load was selected based on the aggregate average and the percentage difference between the year-to-year average projected trends.

Data

PERS 1, TRS 1, WSPRS 1

We began with 17 years of experience study records, from 1996-2012 for all plans. No special data was added for this assumption, and no data was excluded.

LEOFF 1

For LEOFF 1, we began from 1989-2012. No special data was added, but we decided to limit the data to the last 15 years (1998-2012) to catch more recent trends in the data.

Law changes

No law changes impacted our study of AFC loads.

Results

All-Plan Summary

Best Estimate AFC Load Assumption

	AFC Load	
	Old Assumptions	New Assumptions
PERS 1	4.50%	4.00%
TRS 1	1.00%	0.75%
LEOFF 1	0.00%	4.50%
WSPRS 1	7.50%	7.00%

The table to the left shows both the new and old AFC Load assumptions for PERS 1, TRS 1, WSPRS 1, and LEOFF 1.

In general, we saw a downward trend for PERS and TRS, while we saw a fairly steady trend for WSPRS.

PERS 1, TRS 1, and WSPRS 1 Rates						
	PERS 1		TRS 1		WSPRS 1	
	Year-to- Year Average	3-Year Rolling Average	Year-to- Year Average	3-Year Rolling Average	Year-to- Year Average	3-Year Rolling Average
	1996	5.43%	0.00%	0.91%	0.00%	1.73%
1997	5.04%	0.00%	1.54%	0.00%	2.77%	0.00%
1998	5.11%	5.20%	0.98%	1.14%	4.73%	3.08%
1999	4.99%	5.05%	1.02%	1.18%	4.77%	4.09%
2000	5.43%	5.18%	1.14%	1.05%	7.19%	5.56%
2001	5.71%	5.38%	1.07%	1.08%	7.45%	6.47%
2002	4.79%	5.31%	0.99%	1.07%	6.16%	6.93%
2003	4.94%	5.15%	0.82%	0.96%	7.06%	6.89%
2004	4.31%	4.68%	0.91%	0.91%	7.06%	6.76%
2005	4.69%	4.65%	0.73%	0.82%	7.06%	7.06%
2006	4.61%	4.54%	0.75%	0.80%	7.60%	7.24%
2007	4.43%	4.58%	0.70%	0.73%	5.95%	6.87%
2008	4.36%	4.47%	0.98%	0.81%	7.18%	6.91%
2009	4.06%	4.28%	1.06%	0.92%	7.54%	6.89%
2010	4.31%	4.24%	0.84%	0.96%	6.77%	7.16%
2011	3.66%	4.01%	0.58%	0.83%	6.23%	6.84%
2012	3.10%	3.69%	0.54%	0.65%	6.30%	6.43%

For LEOFF 1, we observed salary growth during the AFC period above the assumed general salary growth.

LEOFF 1 Salary Averages					
	Adjusted		Adjusted		Year-to-Year Rate*
	Expected AFC	Actual AFC	Expected AFC Trend	Actual AFC Trend	
1998	\$62,417	\$63,353	\$59,355	\$60,581	2.07%
1999	\$62,387	\$64,381	\$62,609	\$64,150	2.46%
2000	\$67,665	\$69,536	\$65,864	\$67,718	2.81%
2001	\$68,419	\$70,548	\$69,118	\$71,287	3.14%
2002	\$72,116	\$75,530	\$72,373	\$74,855	3.43%
2003	\$76,314	\$78,360	\$75,628	\$78,424	3.70%
2004	\$75,825	\$78,066	\$78,882	\$81,992	3.94%
2005	\$81,263	\$83,067	\$82,137	\$85,561	4.17%
2006	\$84,680	\$88,121	\$85,391	\$89,129	4.38%
2007	\$86,200	\$88,712	\$88,646	\$92,698	4.57%
2008	\$86,755	\$94,092	\$91,900	\$96,267	4.75%
2009	\$94,177	\$101,595	\$95,155	\$99,835	4.92%
2010	\$102,977	\$110,083	\$98,410	\$103,404	5.07%
2011	\$105,607	\$110,203	\$101,664	\$106,972	5.22%
2012	\$105,248	\$107,766	\$104,919	\$110,541	5.36%
2013	-	-	\$108,173	\$114,109	5.49%
2014	-	-	\$111,428	\$117,678	5.61%
2015	-	-	\$114,682	\$121,246	5.72%

*Rates are the percentage difference between the Actual AFC Trend and the Adjusted Expected AFC

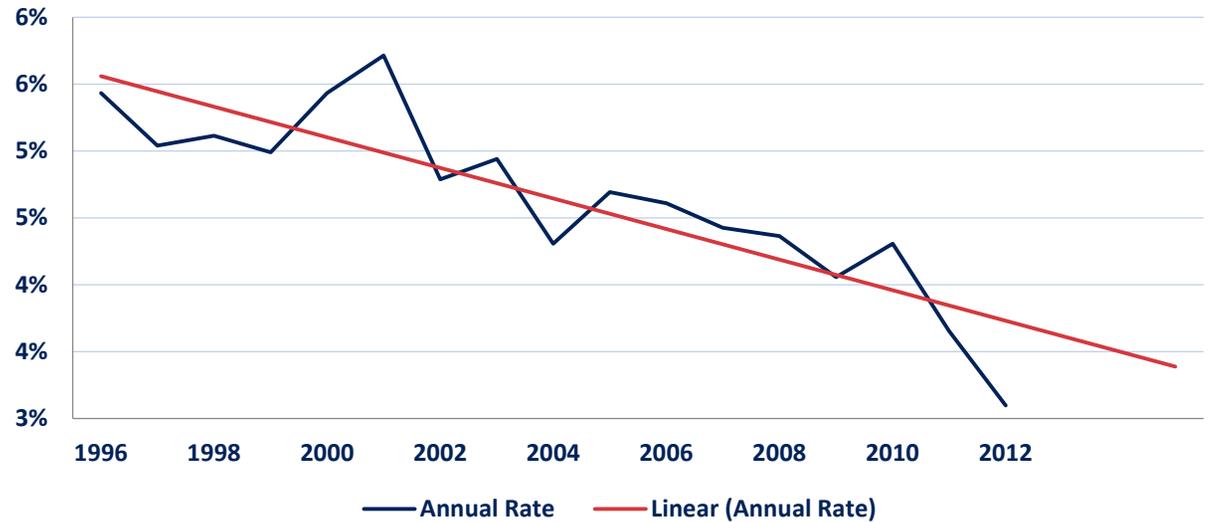
By Plan

PERS 1

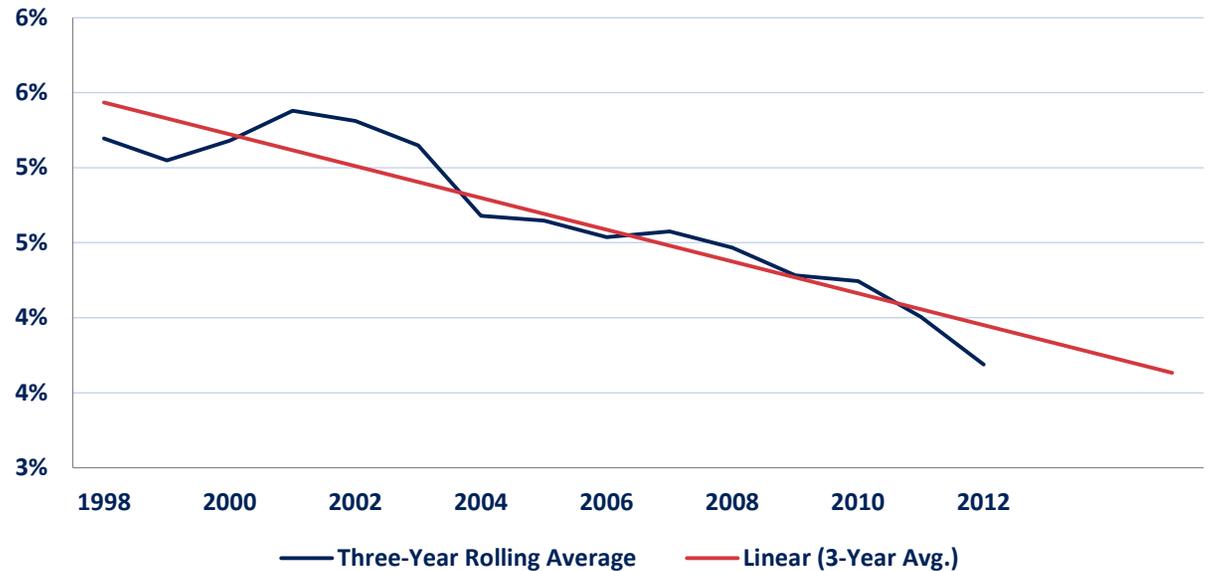
Past Experience

The following two charts show PERS 1 AFC load calculated under two of the three methods mentioned in the Calculation Method section.

PERS 1 – Year-to-Year Average Rate



PERS 1 – Three-Year Rolling Average Rate



General Methodology

We considered, but did not adopt an alternate study period from 2002-2012.

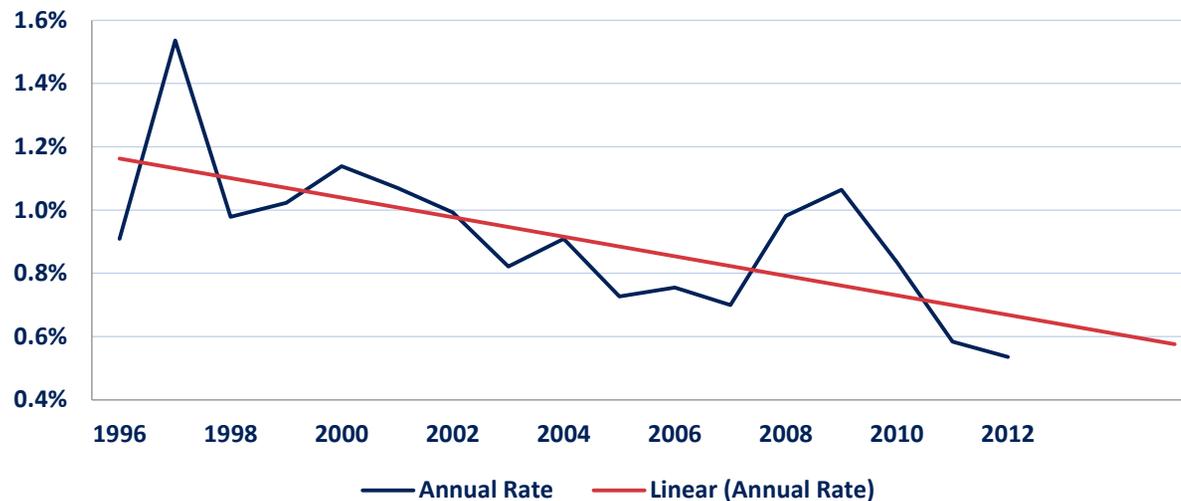
Since the previous study looked at the period from 1996-2006, we considered rolling this six-year data window forward. However, we found that the calculated loads are similar for both time periods, so we chose to use all the data available.

TRS 1

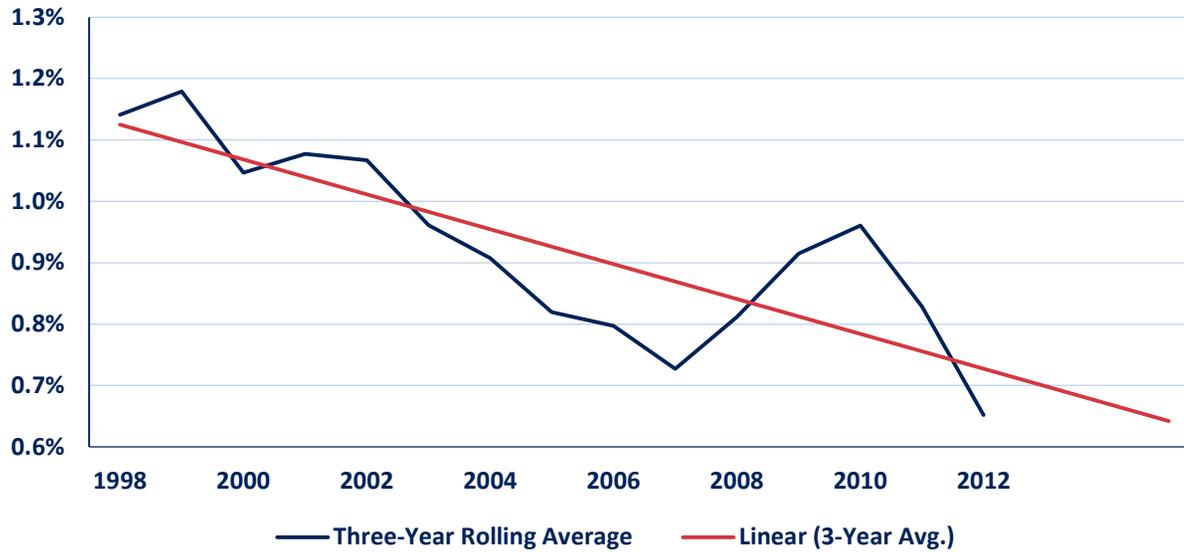
Past Experience

The next two charts show TRS 1 AFC load calculated under two of the three methods mentioned in the Calculation Method section.

TRS 1 – Year-to-Year Average Rate



TRS 1 – Three-Year Rolling Average Rate



General Methodology

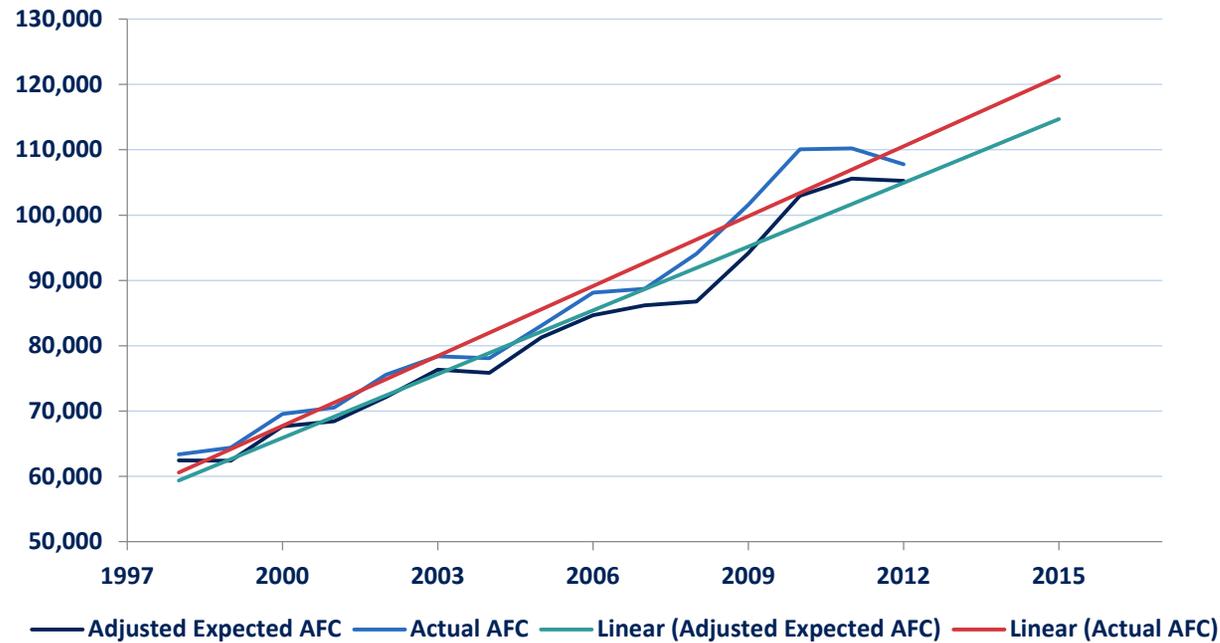
For TRS, we considered the same alternatives, and made the same relative changes as in PERS. Please see the **PERS – Methods and Format of Assumptions** section above for more information.

LEOFF 1

Past Experience

The following charts show LEOFF 1 Actual and Expected AFC calculated under one of the two methods mentioned in the Calculation Method section.

LEOFF 1 – Actual and Expected AFC



General Methodology

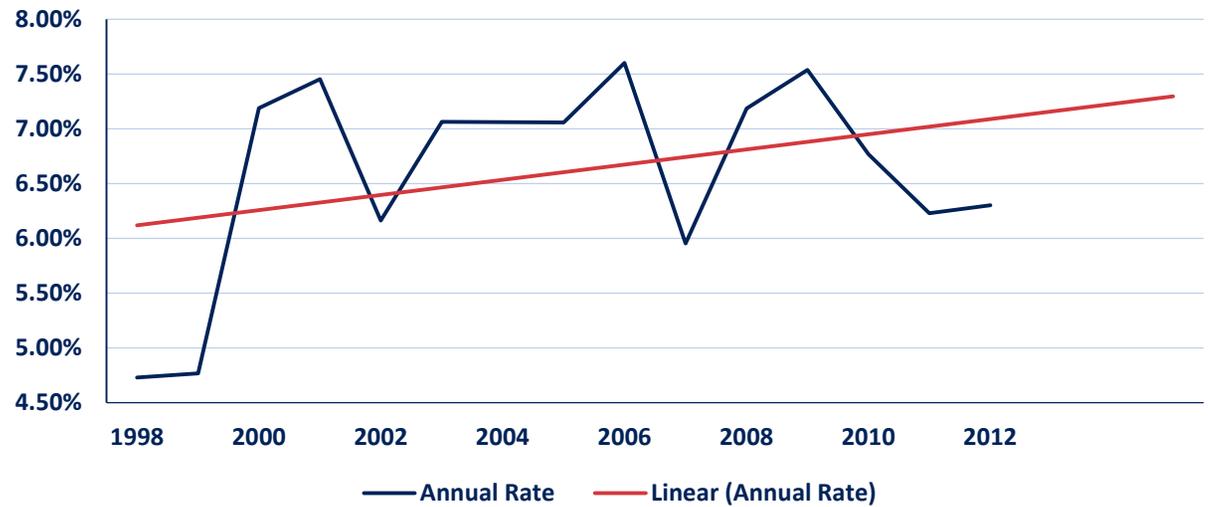
For more information, please see the **Calculation Method** section.

WSPRS 1

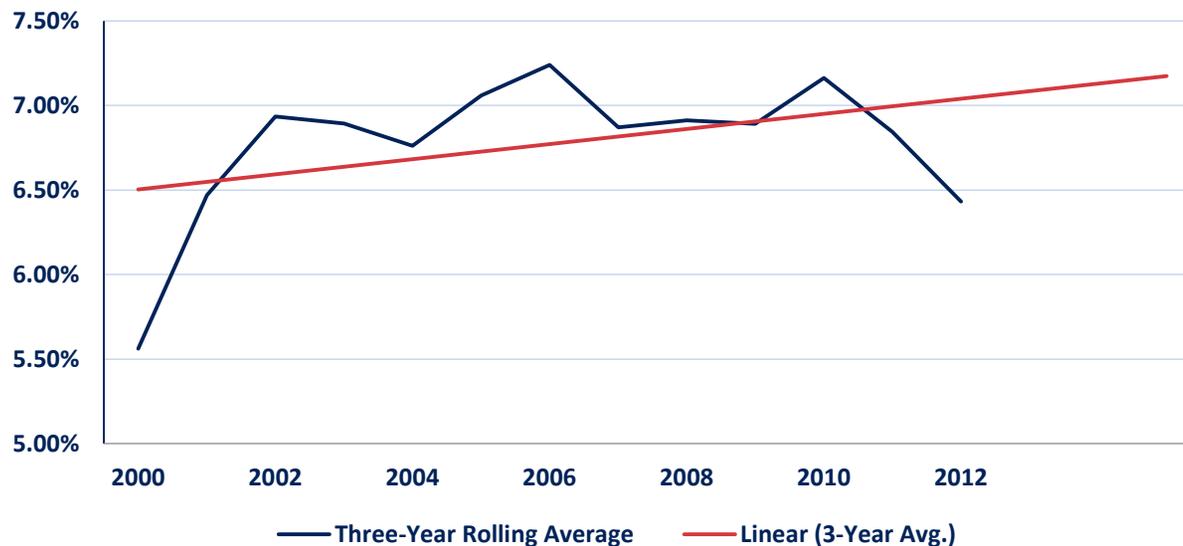
Past Experience

The following two charts show WSPRS 1 AFC load calculated under two of the three methods mentioned in the Calculation Method section.

WSPRS 1 – Year-to-Year Average Rate



WSPRS 1 – Three-Year Rolling Average Rate



General Methodology

For WSPRS, we considered the same alternatives, and made the same relative changes as in PERS. Please see the **PERS – Methods and Format of Assumptions** section above for more information.

Certain and Life Annuities

Overall Summary

What is the Certain and Life Annuity Assumption and how is it Used?

In many of the plans, the standard retirement option is a monthly benefit payable for the lifetime of the member. If a retired member dies before the total pension payments they've received exceed the value of their accumulated contributions, the difference is paid to their beneficiary or estate. We estimate the value of this benefit using a Certain and Life Annuity – a life annuity with a certain, or guaranteed, payment period.

High-Level Takeaways

We generally found that the current assumptions fit our experience and expectations well. We adjusted the assumptions for a few plans as necessary.

Assumptions

We developed the expected Plan 2 certain period assumptions by using new retirement rates, service-based salary increase scales, and Percent Male/Female assumptions detailed in this report. We also used early retirement factors adopted in 2012 and disclosed in the [2013 Actuarial Valuation Report](#) (AVR). All other assumptions used match those disclosed in the 2012 AVR.

General Methodology

To develop the certain and life annuity assumption, we determine the average ratio of accumulated contributions to annual retirement benefits.

For the closed Plans 1 that have very reliable retirement data and an average population that is close to retirement age, we use recent retiree data to calculate this ratio. It is simply the total savings funds divided by the total annual retirement benefits for all recent retirees.

For the open Plans 2 that have fewer retirements and a younger average population, our best estimate for a future certain and life annuity assumption is to model the future expectation of accumulated contributions and annual retirement benefits of a new entrant. For each plan, we project future accumulated contributions using the average entry age of a member, the Entry Age Normal Cost (EAN) contribution rate for that plan, the general salary increase assumption, the service-based salary scale, and the assumed savings fund interest rate of 5.5 percent. To calculate the future annual retirement benefit for each plan, we use the general salary increase assumption, the service-based salary scale, retirement rates, and early retirement factors. These calculations are developed for each eligible retirement age. The certain period is determined at each retirement age by dividing the accumulated contributions by the annual retirement benefit. Finally, we develop one average expected certain period for each plan by weighting each calculation by the probability of retirement at each age.

Data

We used records of new retirees in 2010–2013 to study the average ratio of accumulated contributions to annual retirement benefits for Plan 1 members. To study certain periods for Plan 2 members, we used active records from the 2012 valuation data.

No special data was added and we did not eliminate data from the Great Recession years since we did not see evidence that the results were impacted by the economy during that time.

Law changes

No law changes impacted our study of the Certain and Life Annuity assumption.

Results

All-Plan Summary

- ◆ Assumption staying the same for most plans.
- ◆ Increases in Public Employees' Retirement System (PERS) Plan 1 and the Washington State Patrol Retirement System (WSPRS) Plans 1/2.
- ◆ Decrease in the Teachers' Retirement system (TRS) Plan 1.

The table on the right shows the old and new assumptions by plan.

Plan	Old Assumption	New Assumption
PERS 1	3	4
PERS 2	4	4
TRS 1*	11	9
TRS 2	5	5
SERS 2	4	4
PSERS 2	4	4
LEOFF 1	3	3
LEOFF 2	5	5
WSPRS 1	3	4
WSPRS 2	4	5

**Applies to "annuity" portion of the TRS 1 disability benefit only. In the prior study, we assumed the annuity portion comprised 30% of the benefit. Based on new data, we've increased that assumption to 40% for this study.*

By System

Past Experience

PERS

PERS 1 analysis of recent retiree records results in a certain period of four years. This is higher than our current assumption of three years.

PERS 2, with an average entry age of 36, has an average future expected certain period of four years. This is consistent with our current assumption.

TRS

TRS 1 is different from other plans. The standard option for most benefits in this plan is a single life benefit with no guarantee of excess savings refund. The exception is the TRS 1 disability benefit,

and that guarantee only applies to the portion of the benefit attributable to the member's savings. TRS 1 analysis of recent disability retiree records results in a certain period of nine years, applied to 40 percent of the disability benefit. This is different from our current assumption of eleven years, applied to 30 percent of the disability benefit.

TRS 2, with an average entry age of 34, has an average future expected certain period of five years. This is consistent with our current assumption.

SERS

The School Employees' Retirement System Plan 2, with an average entry age of 40, has an average future expected certain period of four years. This is consistent with our current assumption.

PSERS

The Public Safety Employees' Retirement System Plan 2, with an average entry age of 32, has an average future expected certain period of four years. This is consistent with our current assumption.

LEOFF

The Law Enforcement Officers' and Fire Fighters' Retirement System (LEOFF) Plan 1 analysis of recent retiree records results in a certain period of three years. This is consistent with our current assumption.

LEOFF 2, with an average entry age of 28, has an average future expected certain period of five years. This is consistent with our current assumption.

WSPRS

WSPRS 1 analysis of recent retiree records results in a certain period of four years. This is higher than our current assumption of three years.

WSPRS 2, with an average entry age of 27, has an average future expected certain period of five years. This is higher than our current assumption of four years.

Military Service Credit Load

Overall Summary

What is the Military Service Credit Load Assumption and how is it Used?

We apply a “load” to a given benefit provision to estimate the additional cost of another, related benefit provision. In application, a load is a percentage increase applied to an existing benefit in our valuation software where the increase represents the cost of another benefit provision.

The Military Service Load assumption is used to compensate for the cost of additional service credit applied in recognition of military service earned before joining a state retirement plan. This type of service is known as non-interruptive military service.

Members of the Public Employees’ Retirement System (PERS) Plan 1 and the Washington State Patrol Retirement System (WSPRS) Plan 1 are eligible to add up to five years of military service to their membership service total once the member reaches at least 25 years of Washington retirement plan service (membership service). This service is provided at no cost to the member. The load estimates the cost to the system.

These loads are gender and plan-based.

High-Level Takeaways

Generally, we are seeing a downward trend in the percentage of members with non-interruptive military service for PERS 1 and WSPRS 1. Since WSPRS 1 closed recently, we also considered the possibility of steady or even upward trends for WSPRS 1.

These downward trends are likely driven by the limited time periods during which members could have served in the military. Specifically, the cost that we estimate is only for military service that occurs before entry into the plan. PERS 1 closed to new members in 1977 and WSPRS 1 closed to new members in 2002.

Assumptions

Except as noted, all assumptions used in the development of this assumption match those disclosed in the [2012 Actuarial Valuation Report](#).

General Methodology

Calculation Method

We used three different methods to calculate the non-interruptive military service cost/load for PERS 1 and WSPRS 1. Based on these three methods, we selected a load reflecting past experience and future expectation.

For each method, we used the same basic calculation. We identified the percentage of members with at least 25 years of membership service and calculated the average length of their military service. We then divided the average length of military service by the average membership service among all active members. We performed this calculation for each year in the study period. This results in an increase factor that we use to estimate the cost/load of non-interruptive military service.

We used the following methods to analyze the load.

- ◆ **Aggregate average method.**

We calculate the overall average cost/load throughout the entire study period.

◆ **Year-to-year average method.**

We calculate the load for each year in the study period and then set a trend line to the results.

◆ **Three-year rolling average method.**

We calculate the three-year rolling average at each year in the study period and then set a trend line to the results.

Data Adjustments

We corrected an error from the prior demographic experience study associated with the data used. Specifically, we study trends in military service for members who retire in a given year with 25 years of service. The prior study incorrectly counted all retirees in a given year.

Data

We began with 17 years of experience study records, from 1996-2012. No special data was added for this assumption and no data was excluded.

Law changes

No laws changes impacted our selection of this assumption.

Results

All-Plan Summary

For males, we see an overall downward trend in the rates. For females, we held the rate steady for PERS 1 and increased the rate for WSPRS 1.

PERS 1 — Months of Military Service for Members with at least 25 Years of Service				
	Year-to-Year Average		3-Year Rolling Average	
	Male	Female	Male	Female
1996	37.67	34.33	0.00	0.00
1997	37.03	38.00	0.00	0.00
1998	36.72	31.88	37.14	34.74
1999	36.87	38.00	36.87	35.96
2000	35.94	27.43	36.51	32.43
2001	34.73	33.77	35.85	33.07
2002	34.89	25.00	35.19	28.73
2003	35.01	29.00	34.88	29.26
2004	32.21	36.00	34.04	30.00
2005	30.86	18.00	32.70	27.67
2006	31.29	18.20	31.46	24.07
2007	33.54	38.25	31.90	24.82
2008	34.59	33.00	33.14	29.82
2009	35.69	23.00	34.61	31.42
2010	33.55	21.33	34.61	25.78
2011	34.75	34.00	34.66	26.11
2012	35.53	0.00	34.61	18.44

WSPRS 1 — Months of Military Service for Members with at least 25 Years of Service				
	Year-to-Year Average		3-Year Rolling Average	
	Male	Female	Male	Female
1996	32.10	0.00	0.00	0.00
1997	36.64	0.00	0.00	0.00
1998	28.27	0.00	32.34	0.00
1999	31.33	0.00	32.08	0.00
2000	23.91	0.00	27.84	0.00
2001	31.00	0.00	28.75	0.00
2002	37.50	0.00	30.80	0.00
2003	36.57	0.00	35.02	0.00
2004	45.11	0.00	39.73	0.00
2005	40.50	0.00	40.73	0.00
2006	21.25	0.00	35.62	0.00
2007	41.20	0.00	34.32	0.00
2008	35.00	0.00	32.48	0.00
2009	48.50	0.00	41.57	0.00
2010	48.43	0.00	43.98	0.00
2011	40.82	48.50	45.92	16.17
2012	33.88	60.00	41.04	36.17

PERS 1 — Percentage of Members with Military Service and at least 25 Years of Service				
	Year-to-Year Average		3-Year Rolling Average	
	Male	Female	Male	Female
1996	53.00%	1.48%	0.00%	0.00%
1997	50.70%	1.27%	0.00%	0.00%
1998	48.99%	1.89%	50.90%	1.54%
1999	49.80%	0.58%	49.83%	1.25%
2000	45.30%	1.15%	48.03%	1.21%
2001	47.00%	1.92%	47.37%	1.22%
2002	42.84%	0.54%	45.05%	1.20%
2003	36.29%	0.95%	42.05%	1.14%
2004	37.06%	0.62%	38.73%	0.70%
2005	29.48%	0.15%	34.28%	0.57%
2006	25.50%	0.74%	30.68%	0.51%
2007	21.07%	0.63%	25.35%	0.51%
2008	21.90%	0.60%	22.83%	0.66%
2009	24.13%	0.87%	22.37%	0.70%
2010	25.27%	0.68%	23.77%	0.71%
2011	22.95%	1.09%	24.12%	0.88%
2012	25.59%	0.00%	24.60%	0.59%

WSPRS 1 — Percentage of Members with Military Service and at least 25 Years of Service				
	Year-to-Year Average		3-Year Rolling Average	
	Male	Female	Male	Female
1996	35.71%	0.00%	0.00%	0.00%
1997	53.85%	0.00%	0.00%	0.00%
1998	34.38%	0.00%	41.31%	0.00%
1999	44.12%	0.00%	44.11%	0.00%
2000	33.33%	0.00%	37.28%	0.00%
2001	53.33%	0.00%	43.59%	0.00%
2002	38.10%	0.00%	41.59%	0.00%
2003	33.33%	0.00%	41.59%	0.00%
2004	34.62%	0.00%	35.35%	0.00%
2005	33.33%	0.00%	33.76%	0.00%
2006	23.53%	0.00%	30.49%	0.00%
2007	31.25%	0.00%	29.37%	0.00%
2008	33.33%	0.00%	29.37%	0.00%
2009	18.18%	0.00%	27.59%	0.00%
2010	26.92%	0.00%	26.15%	0.00%
2011	30.56%	100.00%	25.22%	33.33%
2012	22.86%	33.33%	26.78%	44.44%

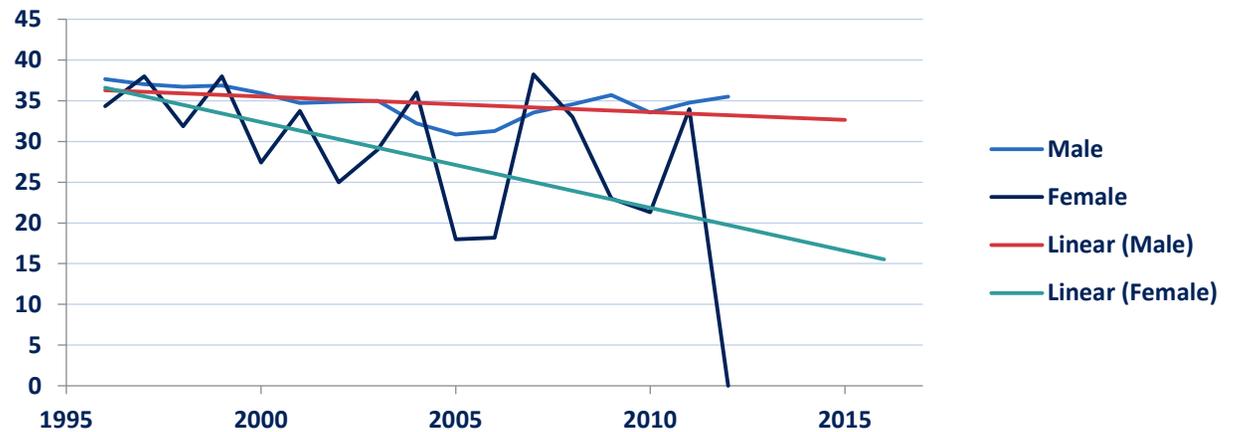
By Plan

PERS 1

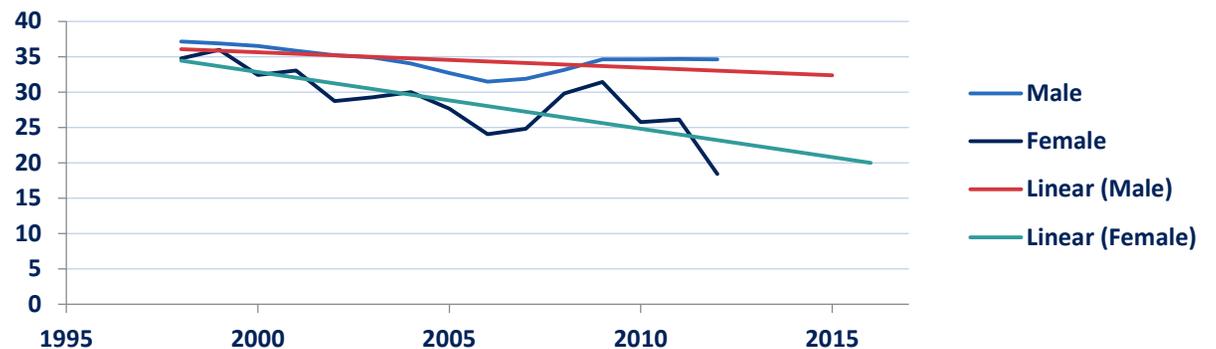
Past Experience

The following charts show the average length of military service for PERS members with at least 25 years of membership service.

PERS 1 – Year-to-Year Average Number of Months of Military Service for Members with at least 25 Years of Service

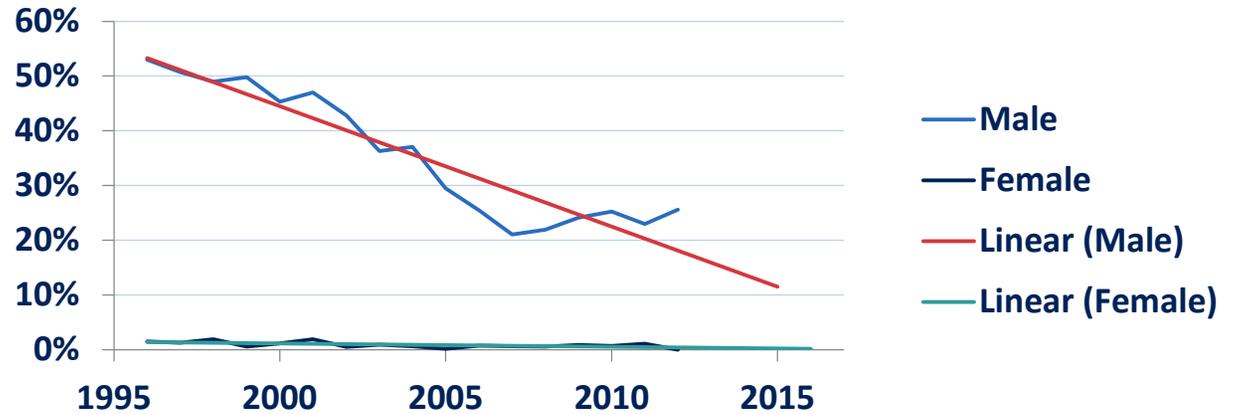


PERS 1 – Three-Year Rolling Average Number of Months of Military Service for Members with at least 25 Years of Service

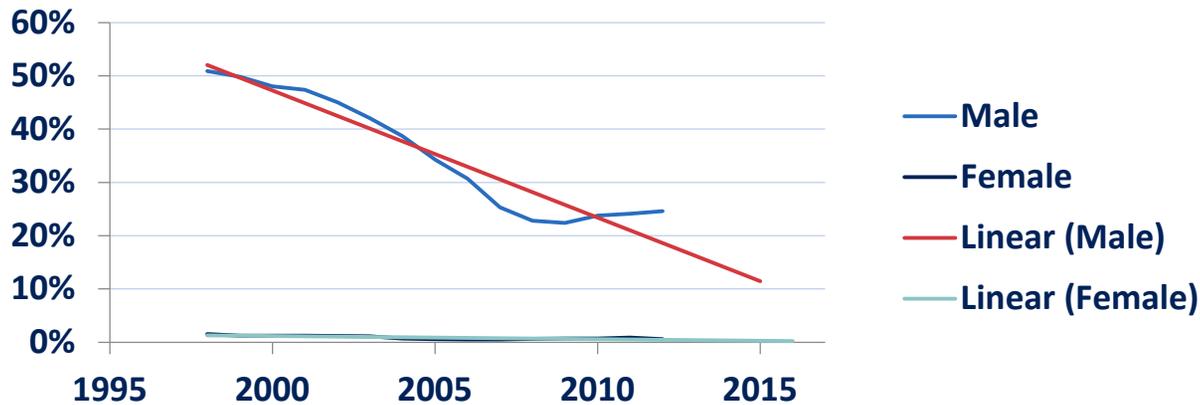


The next two charts show the proportionate percent of PERS 1 members who have military service and at least 25 years of membership service.

PERS 1 – Year-to-Year Average Percentage of Members with Military Service and at least 25 Years of Service



PERS 1 - Three-Year Rolling Average Percentage of Members with Military Service and at least 25 Years of Service



General Methodology

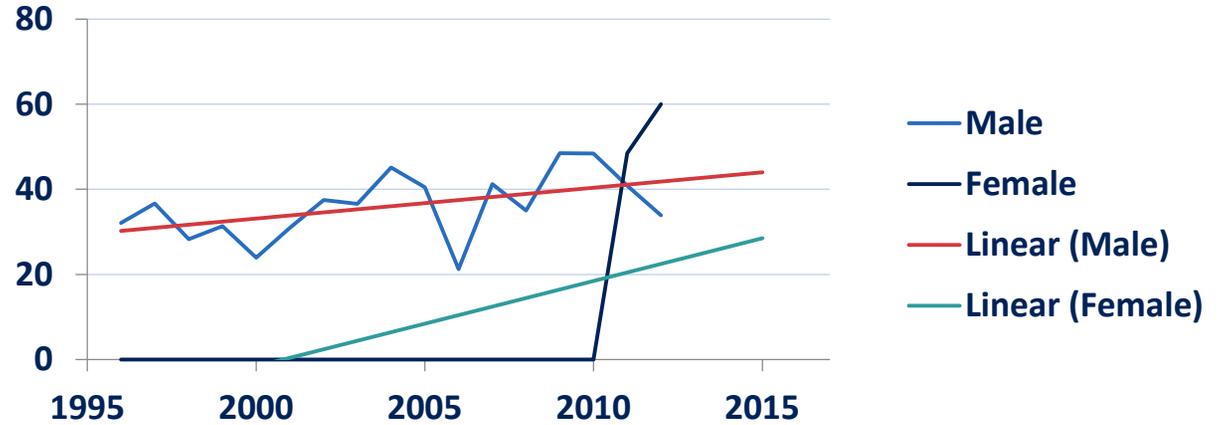
We considered, but ultimately chose not to compare members with military service to all retirees in the plan (i.e., instead of just those who retired with at least 25 years of membership service.) We chose not to use this alternative because we believe the existing method is a better model of the benefit.

WSPRS 1

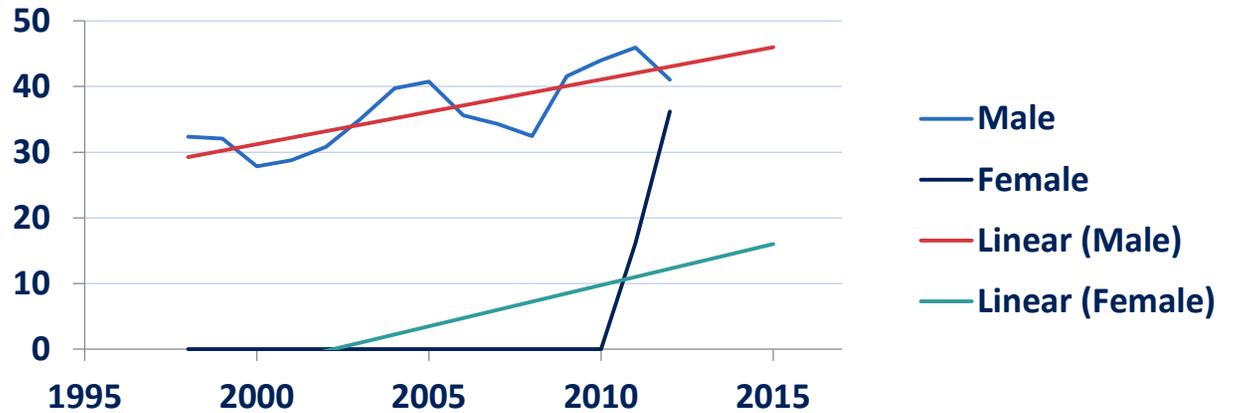
Past Experience

The following charts show the average length of military service for WSPRS members with at least 25 years of membership service.

WSPRS 1 - Year-to-Year Average Number Months of Military Service for Members with at least 25 Years of Service

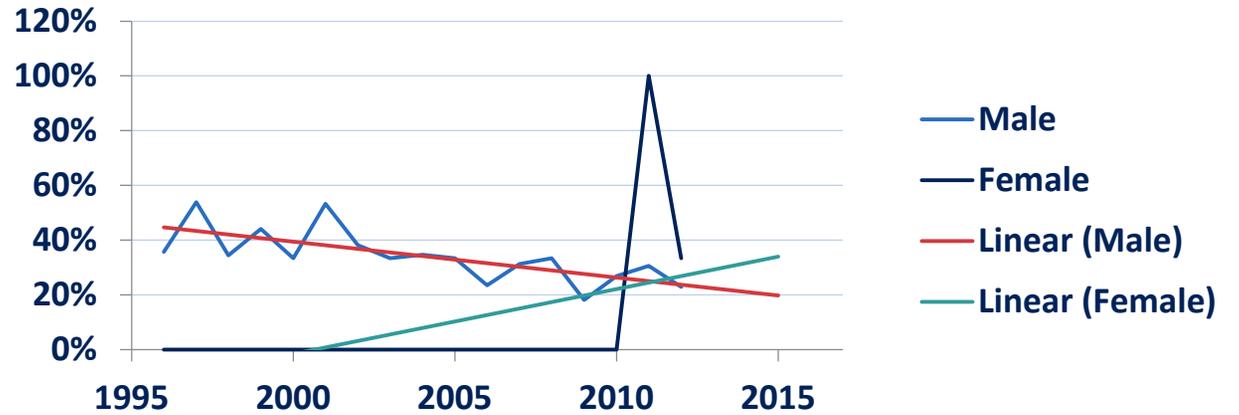


WSPRS 1 - Three-Year Rolling Average Number of Months of Military Service for Members with at least 25 Years of Service

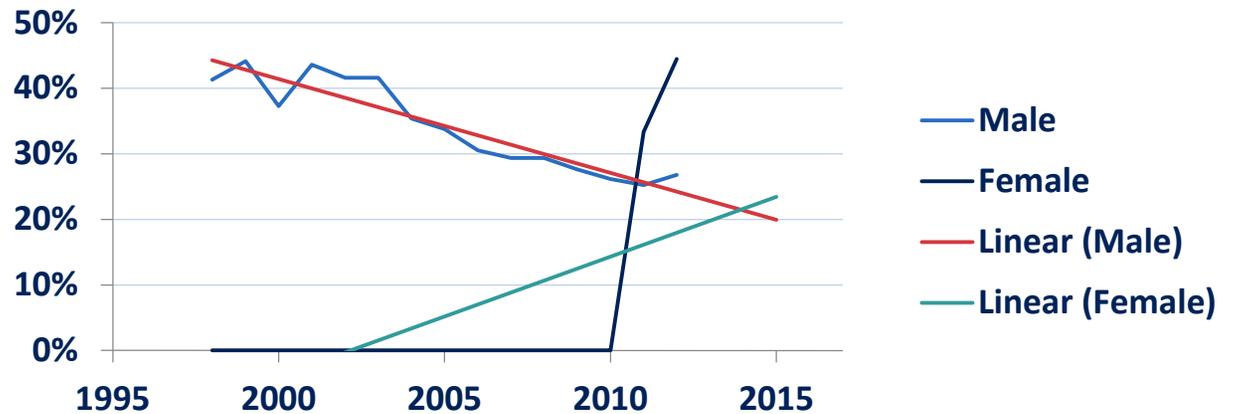


The next charts show the proportionate percent of WSPRS 1 members who have military service and at least 25 years of membership service.

WSPRS 1 - Year-to-Year Average Percentage of Members with Military Service and at least 25 Years of Service



WSPRS 1 - Three-Year Rolling Average Percentage of Members with Military Service and at least 25 Years of Service



General Methodology

We considered and did not adopt the same alternatives as we considered for PERS 1. Please see the **PERS 1 – Methods and Format of Assumptions** section above for more information

Best Estimate Military Service Factors

The following table shows both the new and old non-interruptive military service credit assumptions for PERS 1 and WSPRS 1.

Military Service Credit Load				
	Old Assumptions		New Assumptions	
	Male	Female	Male	Female
PERS 1	2.50%	0.10%	1.50%	0.10%
WSPRS 1	3.70%	0.10%	3.00%	1.00%

Age Difference

Overall Summary

What is the Age Difference Assumption and how is it Used?

The Age Difference assumption represents the difference in age between a member and his or her qualifying survivor. This helps us estimate the cost of survivor benefits.

If an active or terminated vested member dies, their qualifying survivor is eligible for a survivor annuity. Of these deceased members, we assume a percentage of their qualifying survivors will select an annuity.¹ Our valuation model then uses the age of the member's spouse to calculate the survivor benefits that may be payable throughout the spouse's life.

If the member is not currently married, or if their qualifying survivor data is missing from our valuation data file, then we use the Age Difference assumption to estimate how much older (or younger) the member is than his/her beneficiary.

This assumption is gender-based, but we have assumed this same gender-based age difference for all plans.

High-Level Takeaways

We modified the age difference for females to -1. We held the age difference for males at +3.

We found no evidence that any particular plan will have experience that is significantly different from the general plan population. Therefore, we developed one age difference assumption per gender for all plans.

Assumptions

We have assumed that all eligible survivors are of the opposite gender. Recent law² changes have increased the potential pool of eligible survivors by including same-sex spouses and domestic partners. However, considering the relative newness of these laws and the current inability of our data to distinguish certain survivor types, we chose not to make an adjustment to our method to reflect these changes for this study. We will review this assumption in the next demographic experience study.

General Methodology

For each year and retirement plan, we took the weighted average of all the age differences within that plan.

Except as noted, all assumptions used in the development of this assumption match those disclosed in the [2012 Actuarial Valuation Report](#).

Data

We began with nine years of experience study records, from 2005-2012. The data are limited to members retiring within 12 years prior to each year within the study period and limited to a 25-year maximum age difference between the member and the member's spouse. The data set includes all beneficiaries; not just those who would be eligible had the member died pre-retirement.

¹See the *Miscellaneous Assumptions: Survivors Selecting Annuities* section for more information about this assumption.

²See the *Law Changes* section for more information.

The data are presented from the member's perspective; how much older (or younger) the member is to his/her beneficiary, as opposed to showing how much older (or younger) the member's beneficiary is to the member.

No data was excluded due to the Great Recession or any other event.

Law changes

Since the last experience study, state law now allows domestic partners and same-sex spouses to qualify as survivors.

◆ E2SSB 5688 (2009).

- ▲ Applied to all citizens and members of all retirement plans.
- ▲ This bill provided that registered domestic partners would be treated exactly like married couples under state law.

◆ ESSB 6239 (2012).

- ▲ Applied to all citizens, and members of all retirement plans.
- ▲ This bill established same-sex marriage, created full reciprocity with other states, and automatically converted most (but not all) same-sex domestic partnerships registered in Washington to marriages.

Results

All-Plan Summary

In general, we saw a shift in females to a rounded age difference of -1. The age difference for males moved slightly for each plans but overall remained near +3.

		Age Difference				
		By System				
		Old	New	Count	Weight*	Product**
PERS	Male	3	3.18	10,827	0.589	1.869
	Female	(2)	(0.94)	4,490	0.465	(0.436)
TRS	Male	3	2.81	3,873	0.211	0.591
	Female	(2)	(1.07)	4,143	0.429	(0.461)
SERS	Male	3	3.37	912	0.050	0.167
	Female	(2)	(1.41)	957	0.099	(0.140)
PSERS	Male	3	4.75	4	0.000	0.001
	Female	(2)	(1.00)	1	0.000	0.000
LEOFF	Male	4	2.96	2,491	0.135	0.400
	Female	(1)	(0.87)	45	0.005	(0.004)
WSPRS	Male	4	2.80	289	0.016	0.044
	Female	(6)	(1.42)	12	0.001	(0.002)

*The ratio of the count for each system and gender combination to the total count of each gender.

**The product of the New and Weight columns. The final Age Difference assumption is based on the sum of each gender's products.

General Methodology

We considered alternate formats for the assumptions, but ultimately did not make any formatting changes.

◆ Different age maximum and minimum.

Using a 25-year minimum and maximum age difference resulted in larger-than-expected groupings at the endpoints. In response, we studied two options: Increasing the minimum/maximum to +/-35 years, and +/-60 years. Ultimately, we found that the new ranges did not significantly affect results and chose to retain the +/-25-year range.

◆ Different database.

We considered using a larger database that ranged from 1982-2012. Using the larger database showed only a minor impact on the resulting age differences; in some cases by a few tenths of a year. We felt this impact was not large enough to change the final rounded age difference.

◆ Different “Years Retired” limits.

We limited the data to members remaining retired for no more than 12 years. For this report, we started by studying 100-year limits, but then considered both five and 12-year limits. Ultimately, we felt the 12-year limit best reflected the current population while maintaining sufficient levels of data to set the assumption.

Best Estimate Age Difference Assumptions

The following table shows both the new and old age difference assumption for all systems and plans.

All Systems - Age Difference		
	Old Assumptions	New Assumptions
Male	3	3
Female	(2)	(1)

Replacement Salaries

Overall Summary

What are the Replacement Salaries Assumptions and how are they Used?

Each year we review the salaries reported in the valuation data for reasonableness and make a number of salary adjustments when we determine it is necessary. We must also estimate default salaries for certain members for whom salaries are not provided in the data.

Minimum/Maximum Salary

If we find that a reported salary for an active member is too low, we reset that salary to a minimum level. Unreasonably low salaries might result from a number of sources. For example, employers occasionally report incorrect or incomplete salaries for certain members, and those errors are not always corrected before the valuation data is prepared.

If a member's salary is higher than is reasonably expected, we currently reset the salary to a predetermined maximum salary. However, we have changed the method we use to set maximum salaries. Please see the **Maximum Salaries** section for more information.

Low Service

Our valuation software projects service and salaries based on full-time employment, so the salaries of any active members with less than a full year of service must be adjusted. Generally speaking, if the member has at least two months of service, we simply annualize their salary. If the member's service is less than two months, we set default salaries for these members.

Terminated Vested Salary

Terminated vested members can receive deferred retirement benefits, but historical salaries for these members are not always accessible through the valuation data. As a result, we develop basic salary levels where needed for these members during each experience study.

TRS 1 Temporary Disability

Like terminated vested members, Teachers' Retirement System (TRS) Plan 1 temporarily disabled members are inactive members who will eventually be entitled to pensions; their historical salaries are not provided in the valuation data. As a result, we estimate default salaries for these members.

WSPRS Disability Average Final Salary

Like the previous two categories, members in the Washington State Patrol Retirement System (WSPRS) with disabilities are also inactive members. While the disability benefits are paid from a fund outside the pension system, the spouses of disabled members may also receive a survivor pension paid out of the pension fund after that member's death. According to [RCW 43.43.270](#), the Average Final Salary (AFS) of a disabled member who dies and leaves a survivor will be the same as for currently active members who hold the same rank the disabled member held when the disability occurred. Our valuation model requires that we supply this salary for currently disabled members.

High-Level Takeaways

Our current replacement salary assumptions (and the resulting rates) are reasonable. With the exception of the maximum salary, we have not changed any of these assumptions.

Assumptions

All assumptions used in the development of replacement salaries match those disclosed in the [2012 Actuarial Valuation Report](#). In particular, we assume that active members will become full-time in the future, even if they are not reported as full time in any given valuation period.

General Methodology

We used different methods for each assumption. Please see the individual sections below for the methods used.

Data

We used the final 2012 valuation data to study minimum and maximum salaries. For the terminated vested salary, TRS 1 temporary disability salary, and WSPRS disability AFS assumptions we used preliminary 2013 valuation data.

Law Changes

Since the last study, no law changes have impacted these assumptions.

Results

Minimum Salaries

PERS

Job classifications in the Public Employees' Retirement System (PERS) are quite varied. For this reason, salaries range from very low to very high. We believe the minimum salary in PERS can reasonably be represented by the minimum wage in Washington. Each valuation year, we set the minimum PERS salary to the minimum hourly wage in effect on January 1 of the valuation year multiplied by 2,080 hours (40 hours per week times 52 weeks in a year). We round the resulting annual salary to the nearest thousand dollars.

For example, in 2012, the result was:

$$\$9.04 \times 2,080 = \$18,803 \text{ (rounds to } \$19,000\text{)}.$$

TRS

Membership in TRS mainly consists of certificated teachers and administrators employed by school districts. Washington State's teachers' pay schedule is an appropriate measure to set minimum salaries.

Salaries in this scale vary by education level and years of teaching experience. For the minimum salary, we select the salary level for a teacher with a Bachelor of Arts degree and zero years of experience, rounded down to the nearest thousand dollars.

For example, in 2012, the TRS minimum salary was \$30,000.

SERS

The School Employees' Retirement System (SERS) membership consists of non-certificated employees of school districts and educational service districts. In SERS, as in PERS, salaries are widely varied. However, SERS is different than PERS in that a lot of members work less than full time, or work fewer than 2000 hours and receive full-time service, so it is not feasible to use the same minimum wage rule.

Instead, we multiply the state's minimum hourly wage in effect as of January 1 of the valuation year by the full-time number of hours in a school year. We estimate the number of hours in a school year as eight hours a day times 180 days. We round this value to the nearest thousand dollars.

For example, in 2012, the result was:

$$\$9.04 \times 8 \times 180 = \$13,018 \text{ (rounds to } \$13,000\text{).}$$

LEOFF, WSPRS, PSERS

The Law Enforcement Officers' and Fire Fighters' Retirement System (LEOFF), WSPRS, and the Public Safety Employees' Retirement System (PSERS) represent public safety employees. While their salaries may be varied, their job classifications are fairly similar in nature. Minimum salaries for these systems are set once at the beginning of the experience study period and left unchanged until the next experience study. We select values such that the minimum only impacts about 1 percent of all actives.

LEOFF	All Plans	
	\$47,000	
WSP	Plan 1	Plan 2
	\$65,000	\$43,000
PSERS	Plan 2	
	\$30,000	

Maximum Salaries

For all systems, we currently set the maximum Salary at \$500,000. However, our valuation software has the ability to limit pensionable salary for us, so we will use that method beginning with the 2014 valuation. We will limit salaries in our valuations to the projected Internal Revenue Code 401(a)(17) maximum compensation level. This limit was \$255,000 in the 2013 calendar year.

Low-Service Salaries

We use the following methods when setting low-service salaries. Low-service actives fall into two categories: those with less than two months' service during the valuation year and those with at least two months' service, but less than a full year of service for the year.

Non-SERS Members

For active non-SERS members with less than two months' service credit, we assign a default salary according to the following. First, a default entry salary is found by examining the prior year's valuation data. The entry salary for a given system is the average salary for actives with one year of service, rounded to the nearest thousand dollars. We adjust the salary with one year of the general salary increase assumption to bring last year's salary forward to the current valuation year. Then, to reflect that not all members with low service are new members, we adjust this entry salary by our service-based salary increase scale. Members with more work experience, who receive this adjustment, are assigned a higher salary. Finally, the resulting adjusted salary is rounded to the nearest thousand dollars.

Non-SERS members with more than two months' service, but less than a full year of service also have their salaries adjusted to an annual level. We do this by dividing their actual pay by the portion of full service credit they received. For example, a member with

0.25 years of service during the year who earned \$10,000 during that time receives an annualized salary of \$40,000.

SERS Members

Due to the differences in service credit rules, we used a different method for annualizing SERS salaries than we did for Non-SERS salaries.

SERS members with less than two months service are assigned salaries equal to the median hourly SERS wage from the prior valuation period, times the average number of SERS hours worked in the prior valuation period. The resulting annual salary is rounded down to the nearest \$1,000. For example, in 2012, the replacement salary was

$$\$16.99 \text{ (median hourly wage)} \times 1,557 \text{ (average hours)} = \$26,000.$$

Members with at least two months of service have their service adjusted as follows. If the member worked the full school year, but received less than a full year of credit, salaries are adjusted as described above for non-SERS members with at least two months of service credit above.

If the member entered service after November 15, they are assigned the greater of their actual salary and the salary assigned for SERS members with less than two months service.

Terminated Vested Salaries

To assign salaries for terminated vested members (who may be entitled to a deferred pension benefit) we first look to see if we kept a historical salary for such a member in the prior year's data. If so, we copy the salary to the current year's data. If a member was

active in the prior year and terminated in the current year, we copy the prior year's salary to the current year's salary and keep it as historical.

To determine default salaries for terminated vested members whose salary history is not known, we estimate average pay for each system in various service groups as of a particular base year. We assign members a salary consistent with their service level (service is rounded down to the nearest full year). We then adjust the salaries by the general salary increase for as many years as have passed between the base year and the year the member terminated. We round the resulting salary to the nearest thousand dollars.

The following table lists the new base salaries by system and service.

Terminated Vested Base Salaries as of 2013						
Years of Service	LEOFF	PERS	TRS	SERS	PSERS	WSP
Less Than 5	\$75,000	\$45,000	\$52,000	\$22,000	\$46,000	\$58,000
At least 5, Less Than 10	87,000	55,000	57,000	27,000	56,000	69,000
At least 10, Less Than 15	94,000	60,000	67,000	30,000	61,000	77,000
At least 15, Less Than 20	99,000	63,000	75,000	32,000	65,000	79,000
At least 20, Less Than 25	105,000	66,000	77,000	35,000	68,000	82,000
At Least 25	\$113,000	\$69,000	\$79,000	\$42,000	\$71,000	\$85,000

TRS 1 Temporary Disability Salary

To set the default salary for these members, we use the salary from the default terminated vested table above for TRS members with between 20 and 25 years of service, or \$77,000, with a base year of 2013. This amount will be increased with our General Salary Increase assumption for each year in the study period.

WSPRS Disability AFS

The default disability AFS assumption for WSPRS members is \$81,000, with a base year of 2013. This amount will be increased with our assumption for each year in the study period.

Percent Male/Female

Overall Summary

What is the Percent Male/Female Assumption and how is it Used?

The Percent Male/Female assumption is used to provide a default gender whenever we receive data with missing gender information.

Many assumptions vary by gender and our valuation data requires a gender code for each plan member in order to calculate and project benefits accurately. We use several gender-based assumptions in the actuarial valuation, such as mortality and disability.

High-Level Takeaways

The data fit the assumptions well, so we did not change our current Percent Male/Female assumption.

Assumptions

All assumptions used in the development of the Percent Male/Female match those disclosed in the [2012 Actuarial Valuation Report](#).

General Methodology

To develop Percent Male/Female assumptions, we simply calculate the percent of active members that are male and the percent of active members that are female and set the assumption to a multiple of 10 percent.

Data

We used active records from the 1983–2012 valuation data. No special data was added for this assumption and no data was excluded.

Law changes

No law changes impacted our study of the Percent Male/Female assumption.

Results

All-Plan Summary

We did not change the Percent Male/Female assumptions for any system. The table to the right summarizes these assumptions.

Percent Male/Female Assumptions		
System	Percent Male	Percent Female
PERS	50%	50%
TRS	30%	70%
SERS	20%	80%
PSERS	70%	30%
LEOFF	90%	10%
WSPRS	90%	10%

By System

PERS

The Public Employees' Retirement System (PERS) as a whole shows slight variations in Percent Male/Female over the study period, but stays relatively stable, with slightly more females than males each year.

Studied independently of the other PERS plans, PERS 1 shows slightly lower Percent Male rates than the analysis of the PERS system as a whole. However, since Plan 1 is a closed plan and much smaller than the other PERS plans, we feel it would not be prudent to change the assumption format.

PERS 3 was introduced as a new plan during the previous experience study period, and we do not have historical data for the entire period. However, the data for PERS 3 models the same trends as the PERS 2 data.

TRS

The Teachers' Retirement System (TRS) as a whole shows slight variations in Percent Male/Female over the study period, but stays relatively stable in the last ten years, with about 70 percent of the population consisting of female membership.

Studied independently of the other TRS plans, TRS 1 shows slightly lower Percent Female rates than the analysis of the TRS system as a whole. However, since Plan 1 is a closed plan and much smaller than the other TRS plans, we feel it would not be prudent to change the assumption format.

TRS 3 was introduced as a new plan in 1996 and we do not have historical data for the entire period. The data for TRS 3 models the same trends as the TRS 2 data.

SERS

The School Employees' Retirement System (SERS) as a whole shows slight variations in Percent Male/Female over the study period, but stays relatively stable in the last 20 years, with about 80 percent of the population consisting of female membership.

While SERS 2 opened in 2000, its membership consists of employees in school and educational service districts who would have been in PERS 2 prior to 2000. This allowed us to track data by identifying the members in the PERS 2 data for the entire study period.

SERS 3 was introduced in 2000 and, therefore, we do not have historical data in that plan for the entire study period. The data we do have for SERS 3 tracks closely with the SERS 2 data over that time period.

PSERS

The Public Safety Employees' Retirement System opened in 2006, and we do not have data for the entire study period.

Male membership as a percentage of the total has remained relatively steady at slightly over 70 percent. We believe there is a chance that female membership could increase in the future, so we have rounded the percent male assumption in this system down to 70 percent.

LEOFF

The Law Enforcement Officers' and Fire Fighters' Retirement System (LEOFF) as a whole shows very slow increases in female membership over the study period, but stays relatively stable, with just over 90 percent of the population consisting of male membership.

We believe that female membership will continue to show slight increases in the future, so we have rounded the percent male assumption in this system down to 90 percent.

Studied independently, LEOFF 1 shows slightly higher male rates than the analysis of the LEOFF Plans 1 and 2 together. However, since LEOFF 1 is a closed plan and much smaller than LEOFF 2, we feel it would not be prudent to change the assumption format.

WSPRS

The Washington State Patrol Retirement System (WSPRS) as a whole shows very slow increases in female membership over the study period, but stays relatively stable, with just over 90 percent of the population consisting of male membership.

WSPRS 2 was introduced in 2003 and we do not have historical data for the entire period. The data we have for WSPRS 2 models the same trends as the WSPRS 1 data.

We believe that female membership will continue to show slight increases in the future, so we have rounded the percent male assumption in this system down to 90 percent.

WSPRS Disabled Life Expectancy

Overall Summary

What is the WSPRS Disabled Life Expectancy Assumption and how is it Used?

When a disabled Washington State Patrol Retirement System (WSPRS) member dies, the member's spouse may receive a survivor benefit that is based on the salary for current active members who hold the same rank as the member did at the time the disability occurred. This assumption is used in our valuation system to represent the number of years a member's salary at disablement is likely to grow in order to determine their spouse's survivor benefit.

For active members, we adjust the member's current salary from the time of disablement to the expected time of death with the general salary growth assumption. In order to make this adjustment, we need to determine the life expectancy, by gender, for a disabled WSPRS member.

High level Takeaways

Based on the new mortality assumption, life expectancy has decreased slightly for a male disabled member and increased slightly for a female disabled member. (See the **Mortality** section for more information about life expectancies.)

Assumptions

We assume that future disablements will occur, on average, at the same average age of current disablements.

The disabled mortality assumption is described in the Mortality section.

All other assumptions used in the development of this assumption match those disclosed in the [2012 Actuarial Valuation Report \(AVR\)](#).

General Methodology

The benefit begins at the date of the member's death, but uses salary from the member's date of disablement, increased with the general salary growth assumption. Thus, we begin by calculating the life expectancies of members at each age by projecting the RP-2000 disabled mortality base table to the year 2015 using 100 percent of scale BB (the new mortality projection assumption developed in this experience study). We chose the year 2015 for projection purposes because it approximates the mid-point of the next experience study period.

The table to the right shows the life expectancies for the average age of disablement in the 2012 valuation data, based on the previously described mortality assumption.

Once an active member is assumed to exit due to disability, we assume, on average, the member's survivor benefits will begin after the specified years above have elapsed.

For currently disabled members, we use an identical method, but base the life expectancy on the member's actual age at disablement.

Age	Male	Female
42	23	32

Data

We gathered the most recent valuation data and reviewed the dates of disability. Given the active members in both plans are over 90 percent male, we did not review data by gender.

Results

The member's final average salary at disablement is projected to their expected year of death as follows.

Age at Disability	Number
<30	5
30-34	5
35-39	8
40-44	9
45-49	10
50-54	12
55-59	0
Total	49

Male (Increase Factor) ^ (Life Expectancy) = $(1.0375/1.03)^{23} = 1.18$

Female (Increase Factor) ^ (Life Expectancy) = $(1.0375/1.03)^{32} = 1.26$

Because our valuation system assumes a benefit commences at disablement, it grows that benefit with the valuation COLA of 3 percent. We therefore have to back out the 3 percent growth in the benefit when applying the salary adjustment factor.

LEOFF 1 Dependent Children

Overall Summary

What is the LEOFF 1 Dependent Children Assumption and how is it Used?

Based on our analysis, we decided to remove this assumption. In prior years, the Law Enforcement Officers' and Fire Fighters' Retirement System (LEOFF) Plan 1 Dependent Children assumption was used to estimate the expected cost of additional benefits paid to certain disabled retirees and surviving spouses of members who die in service who have qualifying dependent children.

Specifically, disabled retirees and surviving spouses of members who die in service are eligible to receive an additional 5 percent of the member's Final Average Salary (FAS) per dependent child, up to a maximum of 10 percent. Members do not make contributions toward this benefit and, therefore, it is a cost to the system.

Only children under age 18 may receive these benefits. Benefits may be extended to age 20 years and 11 months when the child is a full-time student.

These rates are generally age based.

High-Level Takeaways

Our decision to remove this assumption was based on the following factors.

- ◆ LEOFF 1 is a closed plan and there are fewer than 150 Active members, the youngest of which is 54 years old.

- ◆ There are currently only 34 children in Pay Status, a decrease of 147 since the last experience study.
- ◆ The probabilities of disabled retirees or survivors having dependent children have significantly decreased at nearly all ages.
- ◆ The estimated cost of applying the assumption from the prior demographic experience study is immaterial (in this case less than \$5,000 per year).
- ◆ The LEOFF 1 Present Value of Future Benefits is \$4,420 billion as of June 30, 2013; removal of this benefit from our model is estimated to have an approximately 0.0001 percent impact.

General Methodology

There are two main calculations for this assumption.

- ◆ Probability of an eligible member having a dependent child.
- ◆ Duration of payments for those dependent children.

We assume all members who have qualifying children have two of them, resulting in the maximum increase of 10 percent of FAS.

We assume all qualifying children remain full-time students until age 21.

Data

We used annuitant records from the 2013 valuation data to study this LEOFF Plan 1 benefit.

Law changes

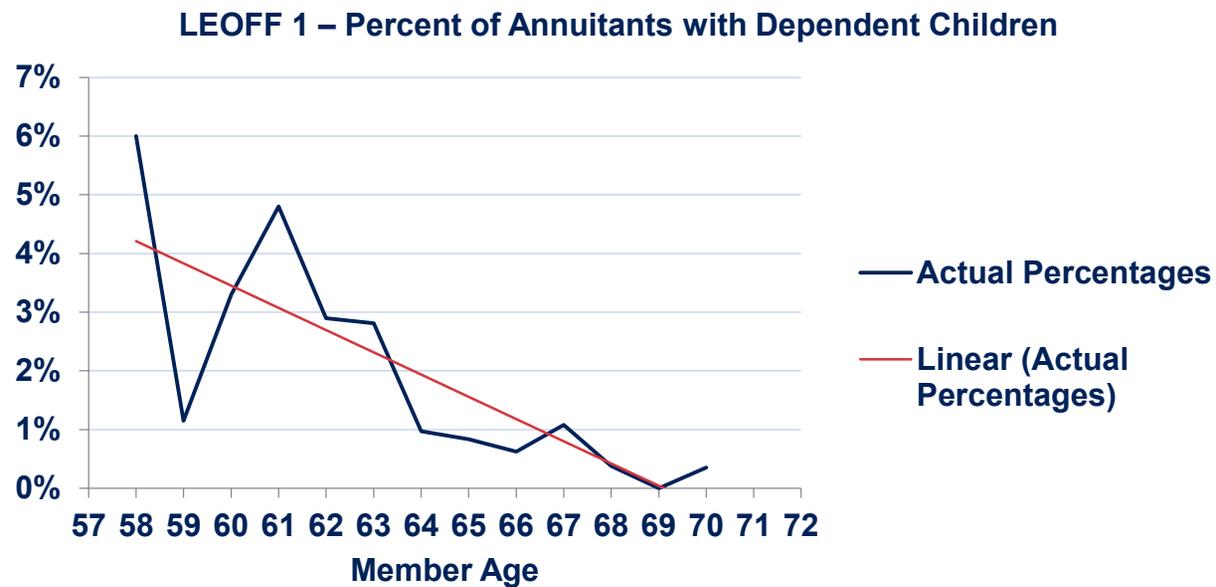
No law changes impacted our study of LEOFF 1 Dependent Children.

Results

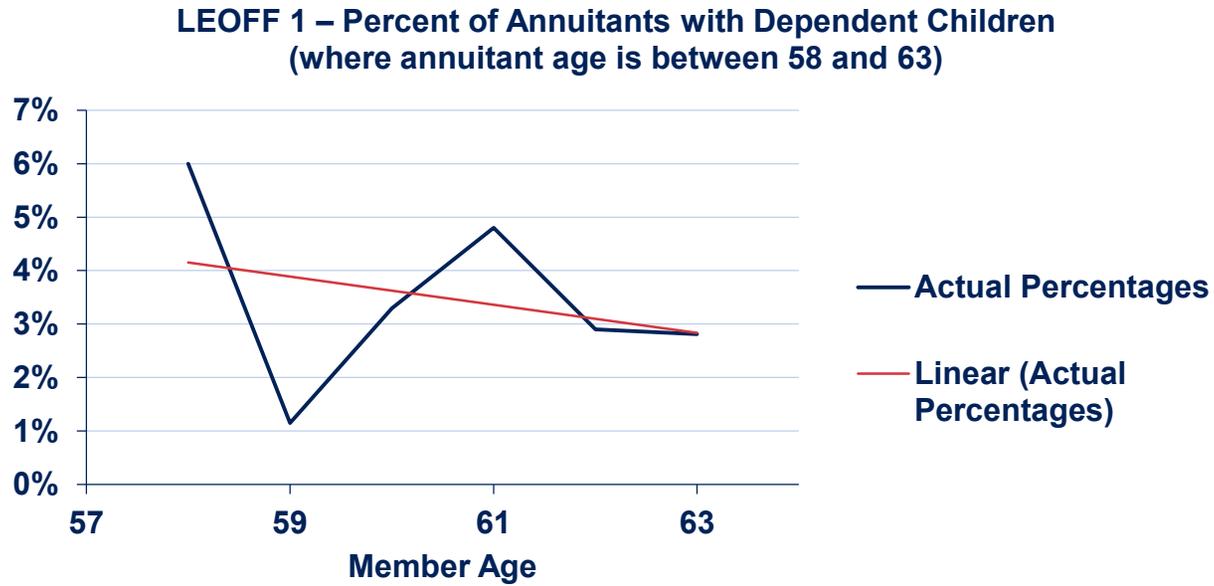
All-Plan Summary

We chose to remove this assumption for the reasons outlined in High-Level Takeaways. We present the following analysis of current annuitant experience for illustration purposes only.

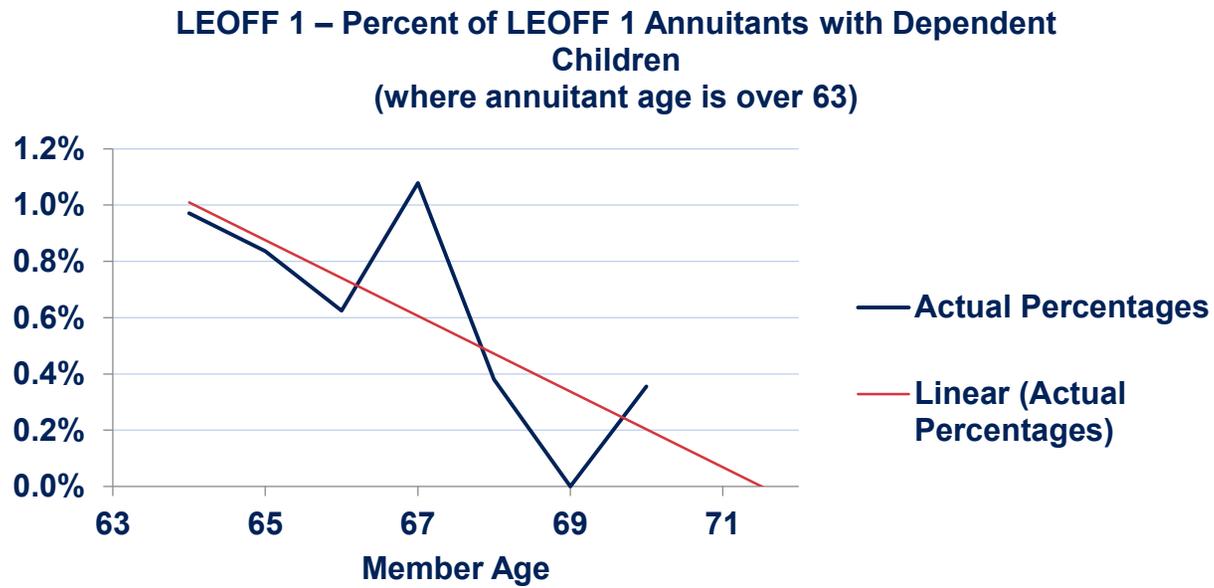
The chart displayed to the right shows the percent of LEOFF 1 retirees over age 58 with dependent children.



The following chart shows the percent of LEOFF 1 retirees between age 58 and 63 with dependent children.



The following chart shows the percent of LEOFF 1 retirees over age 63 with dependent children.



Percent Fire Fighter and Catastrophic Disability Benefit in LEOFF 2

Overall Summary

What are the Percent Fire Fighter and Catastrophic Disability Assumptions and how are they Used?

The catastrophic, or total disability, assumption reflects the potential impact of benefits for the Law Enforcement Officers' and Fire Fighters' Retirement System (LEOFF) Plan 2 members whose injuries received in the line of duty result in the member being totally disabled. For more information about disabilities and disability classifications, please see the **Disability** section.

If a member is totally disabled, the LEOFF 2 Plan pays 70 percent of Final Average Salary (FAS). However, the maximum amount of combined disability benefits cannot exceed 100 percent of pay. Members may also be eligible for disability benefits from sources like Social Security (SS) and Labor and Industries (L&I) wage-replacement benefits under Title 51.

The percent fire fighter assumption helps us reflect the difference in SS eligibility between the two job categories in LEOFF 2: fire fighters and police officers.

High Level Takeaways

After reviewing our methodology and reflecting current data, we expect the average plan benefit (as a proportion of total disability benefits) to increase from 34 percent to 44 percent of FAS. The main reason for this change is the addition of a new assumption for members not eligible for L&I benefits.

General Methodology

Since a member's combined disability benefit from all sources cannot exceed 100 percent of FAS, we estimate what members would receive from SS and L&I and reduce the LEOFF 2 benefit (from the default of 70 percent of FAS) if necessary.

For instance, for LEOFF 2 members eligible for L&I, federal statutes limit the allowable SS disability benefit (plus state time-loss compensation) to 80 percent of average current earnings. Therefore, assuming a member receives both the full SS and L&I benefits, the retirement plan benefit is limited to paying 20 percent of final average earnings so that the total does not exceed 100 percent of a member's final average earnings.

Data

For the percent fire fighter assumption, we reviewed member data from 1995-2012. We also gathered data on the following.

- ◆ LEOFF members eligible for Social Security, as provided by the LEOFF 2 Retirement Board.
- ◆ Washington State Average Wage (SAW) – \$51,595 in 2012, as provided by the state Employment Security Department. L&I benefits are subject to a maximum of 120 percent of the SAW.
- ◆ Current catastrophic disability retirements not receiving, and not expected to receive, L&I benefits, as provided by the Department of Retirement Systems.

Law changes

Since the last study, no law changes have affected these assumptions.

Results

All Plan Summary

	Prior Assumption	New Assumption
A. Percent Not Eligible for L&I Benefits	0%	25%
B. Percent Fire Fighter	42%	45%
C. Percent Eligible for SS		
i. Fire Fighters	5%	5%
ii. Law Enforcement	55%	55%
D. Expected Percent of FAS Plan Benefit		
i. SS Eligible	20%	20%
ii. Not SS Eligible	41%	43%
Valuation Factor	0.34	0.44

For the catastrophic disability benefit, the average percent of FAS that is expected to be paid from the plan is calculated as follows.

$$0.44 = (A) * 0.70 + (1-A) * (0.20 * [B * C(i) + (1-B) * C(ii)] + 0.43 * [B * (1-C(i)) + (1-B) * (1-C(ii))])$$

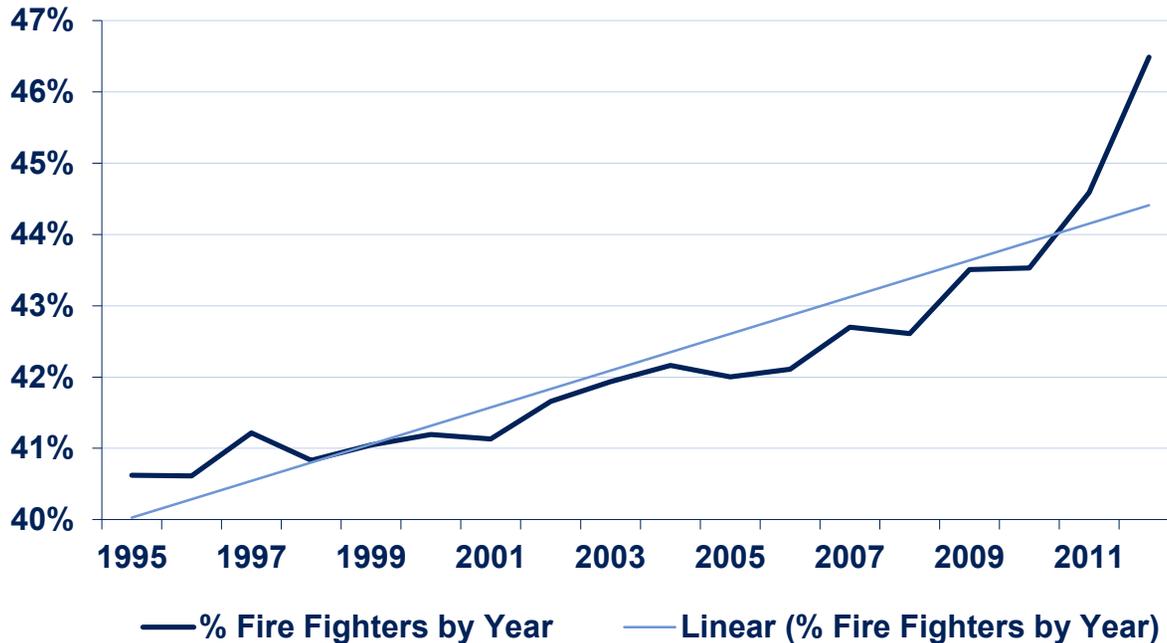
L&I will pay 60 percent to 75 percent of total pay depending on marital status and number of minor dependents. This is also subject to a maximum of 120 percent of SAW. For members not eligible for SS, we estimated the average amount expected to be paid from L&I to be 57 percent. This is equal to taking the average of the minimum of 60 percent of pay and 120 percent of the SAW for each active member and dividing it by the average salary for the active members. We therefore assume the plan will pay $1 - 0.57$, or 43 percent of FAS.

Percent Fire Fighter

The chart on this page shows the projected percentage of fire fighters compared to all active members of LEOFF 2 by year. We fit a linear trend line to the data, which can be used to predict the expected percentage of fire fighters in LEOFF. Generally, we see that the percentage of fire fighters is increasing.

disabilities would not receive any benefits from L&I. We assumed that members who are ineligible for L&I will receive the full 70 percent of FAS plan benefit. We will continue to monitor this assumption and adjust as necessary.

Percent Fire Fighters to All LEOFF Plan 2 Actives by Year



Based on the trend line, we project the percent fire fighter to be 45 percent in 2015, the middle of the next experience study. This is an increase from 42 percent in the prior study.

While reviewing calculations for current members on catastrophic disability, we learned that not all members are receiving income from L&I. Seven of the 29 members were not receiving L&I; therefore, we assumed 25 percent of all future catastrophic

Deferred Annuity Assumption

Overall Summary

What is the Deferred Annuity Assumption and how is it Used?

This assumption is used to anticipate the behavior of members who leave employment with greater than 20 Years Of Service (YOS) and defer retirement.

Specifically, terminated members of the Public Employees' Retirement System (PERS) Plan 3, the Teachers' Retirement System (TRS) Plan 3, the School Employees' Retirement System (SERS) Plan 3, and the Law Enforcement Officers' and Fire Fighters' Retirement System (LEOFF) Plan 2 with at least 20 YOS may qualify for additional benefits if they defer their retirement benefit. For each year after termination that the member defers retirement, the member's benefit is increased by 3 percent.

This increase creates a cost to the system so we use an assumption to estimate the cost.

High Level Takeaways

Using the most recent data, the behavior of members is very similar to the current assumption and we have made no changes.

Assumptions

We assume that for members of all Plans 3, the younger the member is at termination the more likely he or she is assumed to defer retirement and take advantage of the 3 percent COLA increase.

For LEOFF 2, we assume no members defer retirement when they leave after attaining age 50 with 20 YOS.¹ Since LEOFF 2 members receive unreduced benefits at age 53 with 20 YOS, and the early retirement reduction of 3 percent per year is the same as the Cost Of Living Adjustment (COLA) increase, there is less incentive to delay retirement than in the Plans 3.

Except as noted, all assumptions used in the development of the Deferred Annuity Assumption match those disclosed in the [2012 Actuarial Valuation Report](#).

General Methodology

We looked at the current inactive population of those already retired or were eligible to retire (i.e., were at least age 55 and 20 YOS). We determined the ratio of those who retired at each age versus those who deferred their benefit. We then created a series of age-based assumptions that approximated the curve created by the ratios.

Data

We utilized the most recent valuation data for all Plan 3 terminated vested and retired members with greater than 20 YOS but less than 30 YOS. No special data was added for this assumption, and no data was removed.

¹This is the earliest date that LEOFF 2 members can qualify for early retirement.

Law changes

Since the last study, no law changes have affected this assumption.

Results

The behavior of members using the most recent data is very similar to the current assumption, and we have made no changes.

The table to the right shows the prior valuation assumption, which is the probability the member will defer retirement to age 65, and the rates of deferral for each age we studied. The results were very close to the prior valuation assumption so we did not feel a change was needed.

Probability of Deferring Retirement to 65	
Age	Rate
55	0.85
56	0.85
57	0.75
58	0.75
59	0.75
60	0.6
61	0.4
62	0.4
63	0.2
64	0.15

Minimum and Maximum Ages

Overall Summary

What are the Minimum and Maximum Age and Member Service Assumptions and how are they Used?

The minimum and maximum age and member service assumptions help us determine if reported ages and service levels are reasonable.

Specifically, we use substitute ages for our valuation data records when a member's age is missing or invalid. An age is considered invalid if it falls outside our minimum and maximum age limits or is unreasonable given the plan's closure date.

For example, if the data showed a 30-year-old PERS 1 member, the data would be considered invalid. This is because PERS 1 closed to new members over 30 years ago and thus it is impossible to have a member of that plan who is a 30-year-old.

We also consider whether a member's reported service level is reasonable and make changes if necessary.

High-Level Takeaways

We found that our current minimum and maximum ages and service boundaries are reasonable and made no changes.

Assumptions

All assumptions used in the development of minimum and maximum ages match those disclosed in the [2012 Actuarial Valuation Report](#).

General Methodology

We review the data as reported for ages and service levels that are below/above the currently set minimum/maximum range. If too many are outside this range, then we consider adjusting the range.

For age level, if a plan is closed, we adjust the minimum age level by the number of years the plan has been closed for members of that plan.

For service level, we only adjust the service if it is too low. The minimum service level is zero years; we reset negative reported service levels to zero. Service levels above 50 years (our current maximum) are considered unusual, but no adjustment to the service level is made. Instead, we note the occurrence as an unusual observation as part of our internal quality control process and leave it as reported.

Data

We used 2012 valuation data in its originally reported form to determine if anybody falls outside the current age/service bounds.

Law changes

No law changes impacted our study of this assumption.

Results

Almost no members had ages outside our currently set minimum/maximum age levels. We found that the current ranges for age are reasonable, and remain unchanged, as follows.

	Non-Annuitants	Annuitants
Minimum Age	16	20
Maximum Age	80	110

We observed no members in the data with service over 50 years. We concluded that the current maximum level is reasonable

Duty Death Assumption

Overall Summary

What is the Duty Death Assumption and how is it Used?

The Duty Death Assumption represents the likelihood that a member who dies, either during the course of employment or after, will receive certain duty-related death benefits.

Specifically, survivors of active members who suffer a duty-related death receive a one-time lump sum as well as a subsidized survivor annuity.

Survivors of inactive members receive only the one-time lump sum benefit, provided the member died due to an occupational disease or infection that arose out of employment.

The survivor annuity is considered subsidized because it does not require any early retirement reductions. The survivor annuity is further subsidized in the Law Enforcement Officers' and Fire Fighters' Retirement System (LEOFF) and the Washington State Patrol Retirement System (WSPRS) plans because no Joint and Survivor reduction is applied.

The lump sum payment is as follows:

- ◆ \$150,000 for the Public Employees' Retirement System (PERS), the Teachers' Retirement System (TRS), the School Employee's Retirement System (SERS), and the Public Safety Employees' Retirement System (PSERS).
- ◆ \$214,000 for LEOFF and WSPRS, indexed for inflation each year beginning in 2008.

High Level Takeaways

Data is limited given the infrequent observations. This limits our ability to review all plan assumptions for accuracy. However, observations were less than expected across all plans based on the current assumptions.

We compared total active member duty-deaths versus exposures and found that the data suggested duty-death rates are fairly constant by age. This means the observed duty-death rate for a 50-year-old member was similar to that of a 30-year-old member.

We also compared total active member duty deaths versus all active member deaths and found the data suggested that at younger ages, a higher percentage of deaths are duty related.

We looked at these relationships both with and without public safety to see if public safety members showed a different relationship. While public safety showed higher rates of duty-death, we did not observe anything that made us feel the same relationships did not apply. We plan to continue to review these relationships as more data is gathered.

Assumptions

All assumptions are consistent with the [2012 Actuarial Valuation Report](#), except the new mortality assumption was used in setting the updated duty death rates. The new mortality assumption is described in the Mortality section of this report.

General Methodology

We began by reviewing the assumption set in the prior demographic experience study. Given the limited number of observations, our goal was to see if the prior assumption was still reasonable. We then decided that unless we had data to suggest the prior assumption

was not reasonable we would leave the prior assumption in place until more data was gathered.

For information about the prior assumption, please see the Office of the State Actuary's (OSA) [2001-2006 Demographic Experience Study](#), and turn to page 15.

The duty-death assumption was studied in conjunction with the mortality rates documented in this report. For more information on the mortality assumptions and rates please see the **Mortality** section.

The current actuarial valuation assumes a portion of the deaths for LEOFF members on disability will be due to occupational disease. However, the duty-death data provided by the Department of Retirement Systems (DRS) did not list who was disabled at the time of death, nor does it track those who died due to occupational disease. As a result, we are unable to review this portion of the duty-death assumption at this time.

Data

We began with duty related death data dating back to 1981. Because the lump sum duty-death provisions began in March 1996 for LEOFF plans and July 2003 for the other plans, we excluded data prior to those dates, since it would only capture those duty-deaths that resulted in an annuity payment and not the true incidence of the event.

System	Observations Since 2004
PERS	20
TRS	2
SERS	2
LEOFF*	32 (52)
WSPRS	1

*LEOFF observations since 2006 and (1996).

Law changes

- ◆ **SHB 2933 (2006 session).**
 - ▲ Applied to members of LEOFF.
 - ▲ This law expanded the lump sum duty death benefit to cover occupational disease.
- ◆ **SHB 1266 (2007 session).**
 - ▲ Applied to all plans.
 - ▲ Provided coverage of the lump sum benefit to non-active members if their death is due to occupational disease from their course of employment.

Results

Past Experience

The tables on the following page show the ratio of Actual-to-Expected (A/E) observations for the systems with the most events, PERS and LEOFF.

PERS A/E Duty-Deaths			
Year	Lives	Expected	Actual
2004	156,117	4.06	3
2005	157,691	4.1	4
2006	157,109	4.08	0
2007	156,473	4.07	4
2008	159,370	4.14	1
2009	162,771	4.23	2
2010	160,646	4.18	3
2011	157,723	4.1	2
2012	153,686	4	1
Total	1,421,586	36.96	20
	Actual/Expected		0.54

LEOFF A/E Duty-Deaths			
Year	Lives	Expected	Actual
1996	13,141	4.94	0
1997	13,445	5.06	2
1998	13,750	5.17	2
1999	13,961	5.25	3
2000	14,494	5.45	1
2001	14,670	5.52	2
2002	14,944	5.62	1
2003	15,255	5.74	4
2004	15,647	5.88	2
2005	15,712	5.91	3
2006	15,975	6.01	5
2007	16,379	6.16	3
2008	16,695	6.28	5
2009	17,122	6.44	11
2010	17,388	6.54	4
2011	17,303	6.51	4
2012	17,104	6.43	0
Total	262,985	98.88	52
	Actual/Expected		0.53

Methods and Format of Assumptions

We considered alternate formats for the assumptions and, ultimately, decided not to make any changes. For reference, we considered, but did not adopt:

- ◆ **Separate assumptions for police and fire members of LEOFF.**
Given the similar make-up of the average police and fire members and the same benefit provisions for active duty death benefits, we did not feel a separate assumption was necessary.
- ◆ **Separate assumption for inactive members of non-LEOFF plans.**
We have only observed four duty-deaths in PERS inactive members since 2004. We will continue to monitor this assumption and review next experience study.

Best Estimate Duty-Related Death Rates

The following table shows our best estimate duty-related death rates for active members in each system.

System	Previous Rate	New Rate
PERS	0.0026%	0.0018%
TRS	0.0008%	0.0008%
SERS	0.0026%	0.0018%
PSERS	0.0026%	0.0018%
LEOFF	0.0376%	0.0350%
WSPRS	0.0200%	0.0200%

The data from DRS represents recipients of the lump sum duty-death benefit. In addition to that payment, beneficiaries have the option to collect a survivor annuity or elect a return on contributions. We are unable to determine which duty deaths

resulted in an annuity election or a return on contribution election. Therefore the updated assumption removes the 10 percent increase applied to the lump sum take rate since the rates above reflect duty death lump sums paid.

The rate change for PERS yields an actual-to-expected ratio of 0.78 over the time period studied, up from 0.54. We did not feel comfortable relying too heavily on historical experience given the limited data. We will continue to adjust the rate in future studies if experience follows the trend of the previous nine years.

Since LEOFF benefits were expanded in 2006 to include death due to occupational disease, there has been an increase in the incidence of payment for police as well as fire fighters. The new rate for LEOFF relies more on the experience of the most recent six years as an indicator of future experience. Similar to PERS, we end up with an A/E of 0.78 when compared to the experience from 2006-2012, and we will continue to monitor this in future studies.

Due to lack of data, we did not adjust the WSPRS or TRS rates, and continued to set the SERS and PSERS rate to match that of PERS.

We also did not make any changes to the LEOFF plan retiree death rate due to occupational disease due to the limited data.

TRS Salary Bonus Reviews

Overall Summary

What is the TRS Salary Bonus Assumption and how is it Used?

The Teachers' Retirement System (TRS) Salary Bonus rates reflect the increasing membership of teachers obtaining a National Board (NB) certification. NB certified teachers receive an annual bonus that is included in pensionable compensation. We reflect the expected impact of those bonuses on average salary by adding an additional rate to our General Salary Growth (GSX) assumption for TRS. Please see the Service-Based Salary Assumption section for more information about salary growth.

Teachers who obtain or maintain an NB certification receive an annual bonus (regular bonus). Newly certified teachers receive 60 percent of the annual bonus in the first year.

NB certified teachers who work at any one of the specified "challenging schools" receive an additional annual bonus (CS bonus). Both bonuses are included in pensionable compensation.

High Level Take-Aways

According to the Office of Superintendent of Public Instruction (OSPI), the National Board for Professional Teaching Standards (NBPTS) is revising their assessment process over the next three years to make the NB certification more accessible. That means the application process will be put on hold until 2017 at the earliest. Because of this hold, OSPI observed an influx of candidates registering for the NB process before the hold took place, causing their new head count projections to look markedly different compared to prior forecasts.

OSPI expects an ultimate rate of 15 to 17 percent of TRS members to be certified. Given the desire of the NBPTS to make the certification more accessible, and OSPI's acknowledgment that the ultimate rate could be even higher, we project the ultimate rate to be 20 percent and expect it to be reached in year 2030.

OSPI has received a grant to specifically recruit teachers in challenging schools to pursue certification. Based on the OSPI provided data, we expect 40 percent of all NB certified teachers will be working in a Challenging School (CS).

Assumptions

We assume the ultimate percentage of all teachers obtaining an NB certification is 20 percent and we estimate that rate to be reached in year 2030. In 2013, approximately 9 percent of all teachers received the annual bonus. Based on feedback from OSPI, we believe 20 percent to be a reasonable expectation.

We also assume the ultimate percentage of certified teachers working in challenged schools will be 40 percent. In 2013, 31 percent of certified teachers received the CS bonus. OSPI projections estimated close to 37 percent of certified teachers would earn the CS bonus in 2018. We expect this percentage to increase given the work that is expected to be done on recruitment.

We will continue to monitor these assumptions in future studies and adjust as needed.

Except as noted, all assumptions match those disclosed in the [2012 Actuarial Valuation Report](#).

General Methodology

We projected TRS head counts and salary, but excluded the aforementioned bonus assumption. Baseline salaries were projected using the general salary growth assumption of 3.75 percent. From there, we calculated the average salary for each member.

To reflect the growing membership in this program, we determined the average expected annual bonus for an NB certified member and, therefore, the average pensionable salary for an NB certified teacher. The average bonus takes into account that new members only receive 60 percent of the NB bonus in the first year as well as any eligible CS bonuses. Based on the projected percent of teachers expected to be NB certified, we then calculated a weighted average of the two average salaries. This yielded the new expected average salary for the entire group. Taking the ratio of the new average with the old average estimates how salaries will outgrow the general salary growth assumption of 3.75 percent. The resulting ratio is the amount that is added to the baseline salary inflation assumption for that year.

Data

Bonus Amount

NB certification bonuses are set in statute¹ as follows.

¹RCW 28A.405.415.

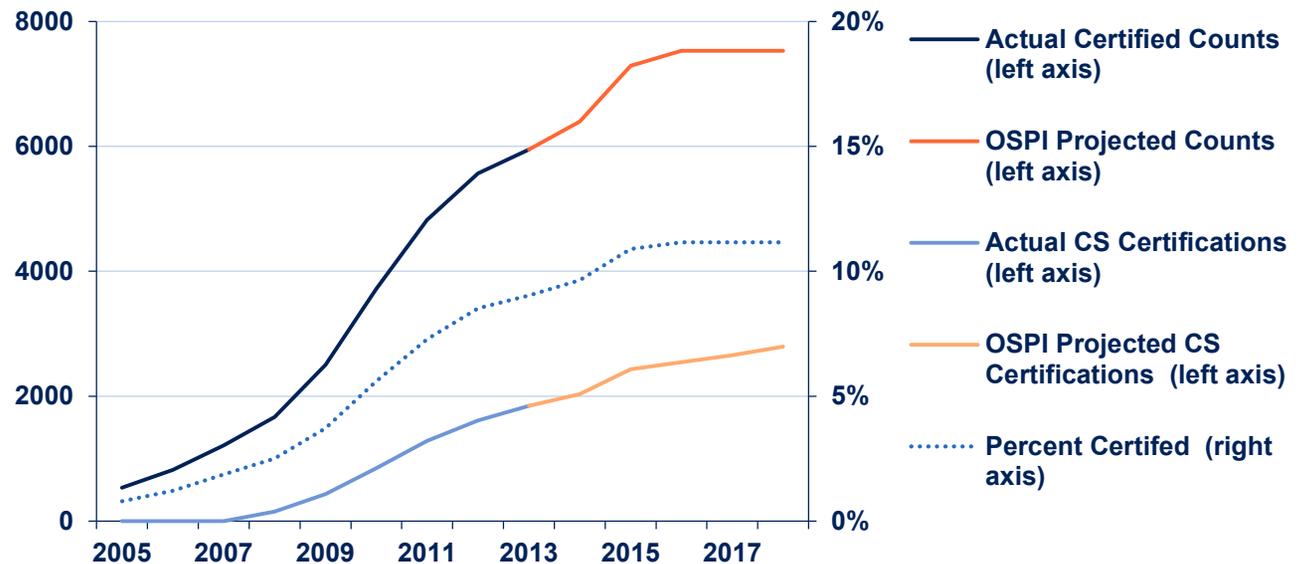
The regular bonus was \$5,000 in the 2007-2008 school year and has increased by inflation after that. However, there were no increases to the regular bonus during the 2013-2015 school years. For the 2013-2014 school year, the regular bonus is \$5,090. Please see the **Law Changes** section for more information.

The CS bonus is a flat \$5,000, with no inflation adjustment.

Head Counts

We studied data provided by OSPI, which included historical head counts from 2005-2013 of NB certified teachers and how many of those teachers worked in a CS. OSPI also projected the head counts through 2018.

TRS Certified Counts by Year



Law changes

There were two law changes since the last study that impacted the salary bonus assumption:

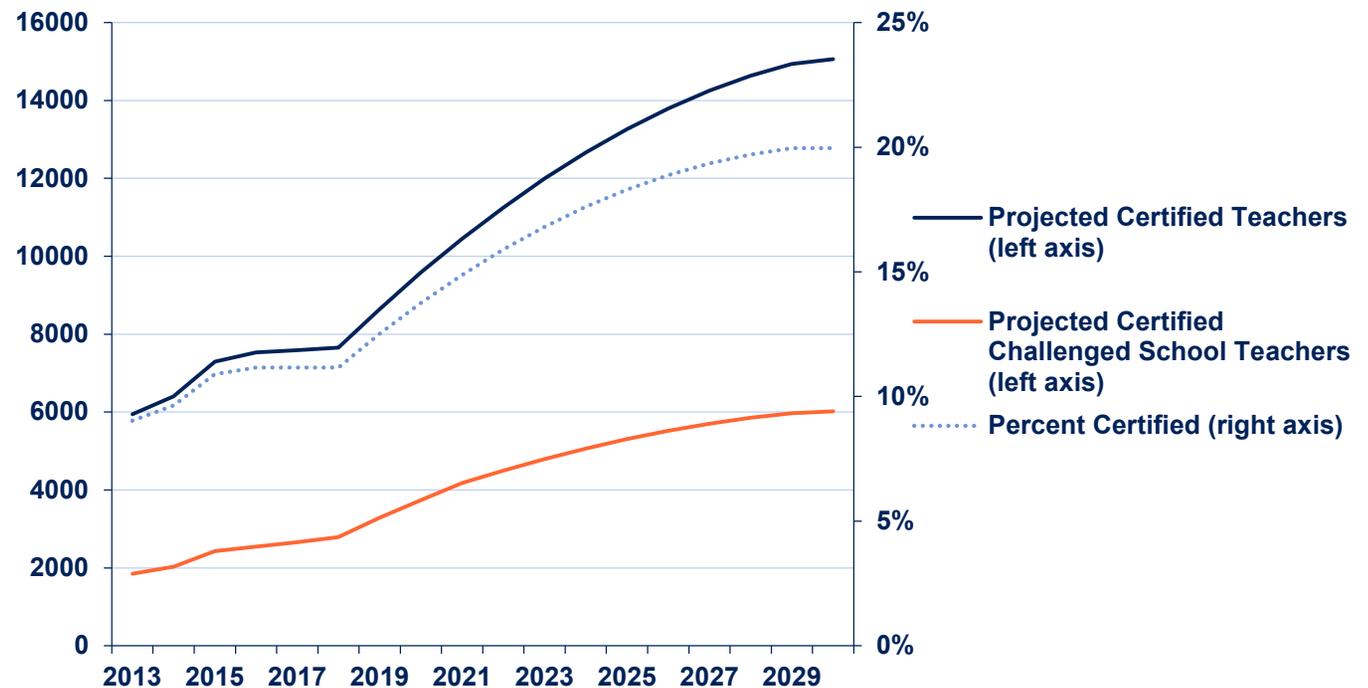
- ◆ **2SHB 1132 (2011, 1st Sp. Session).**
 - ▲ This bill suspended the increase in the NB bonus for the 2011-13 school years.
- ◆ **HB 2043 (2013, 2nd Sp. Session).**
 - ▲ This bill extended the suspension of increases to the 2013-15 school years.

Results

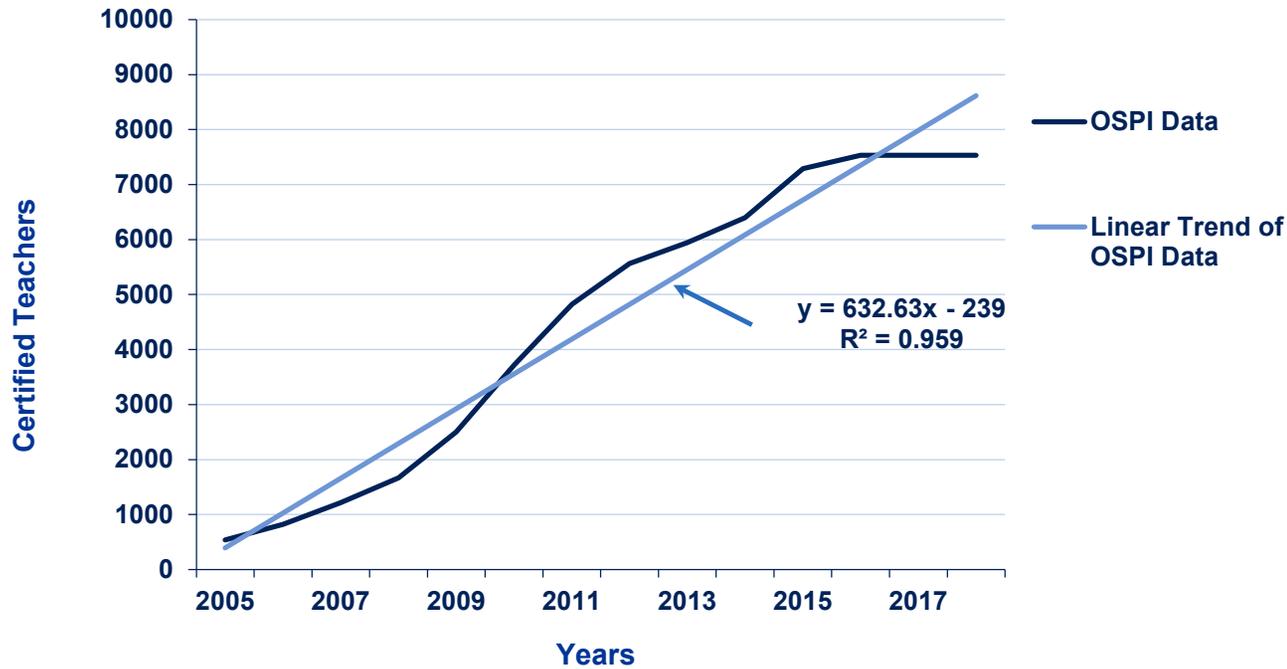
All-Plan Summary

The ultimate rate of certified teachers is assumed to be 20 percent and is estimated to be reached in year 2030. The ultimate rate of certified teachers in challenged schools is assumed to be 40 percent. Combining those percentages with our TRS active head counts, we projected the NB certified and CS teachers until the ultimate rates were reached.

TRS Projected Certified Counts by Year



We also compared the projected certified head counts from the model, for years 2019 and beyond, to a trend line that fits the OSPI provided head counts (2005-2018).



The projected head counts follow the trend line relatively closely until 2030 when the ultimate participation of 20 percent is expected to be achieved and new membership has leveled off.

Projected NB Certified TRS Members Beyond 2018		
	OSPI Trendline	OSA Projection
2019	9,250	8,646
2020	9,883	9,579
2021	10,516	10,449
2022	11,148	11,254
2023	11,781	11,993
2024	12,414	12,665
2025	13,046	13,266
2026	13,679	13,796
2027	14,311	14,253
2028	14,944	14,634
2029	15,577	14,938
2030	16,209	15,058

Best Estimate TRS Salary Bonus Assumption

The following new rates will be added to the general salary growth assumption of 3.75 percent.

TRS Salary Bonus Assumption				
Year	Prior TRS Plan 1	Prior TRS Plan 2/3	New TRS Plan 1	New TRS Plan 2/3
2013	0.11%	0.12%	0.04%	0.04%
2014	0.10%	0.10%	0.05%	0.05%
2015	0.09%	0.09%	0.10%	0.10%
2016	0.08%	0.08%	0.02%	0.02%
2017	0.07%	0.08%	0.00%	0.00%
2018	0.06%	0.07%	0.00%	0.00%
2019	0.05%	0.06%	0.10%	0.10%
2020	0.05%	0.05%	0.09%	0.09%
2021	0.04%	0.04%	0.08%	0.08%
2022	0.03%	0.03%	0.08%	0.07%
2023	0.02%	0.02%	0.07%	0.07%
2024	0.02%	0.02%	0.06%	0.06%
2025	0.01%	0.01%	0.05%	0.05%
2026	0.00%	0.00%	0.04%	0.04%
2027	0.00%	0.00%	0.03%	0.03%
2028	0.00%	0.00%	0.02%	0.02%
2029	0.00%	0.00%	0.02%	0.02%
2030	0.00%	0.00%	0.00%	0.00%

When comparing the new rates to the old rates, rates are lower in the early years (2013-2018) and larger in the later years (2019-2028). This is due to actual membership being less than the previous projections because of the upcoming freeze on new applicants. OSPI anticipates the program changes will make certification more attractive so the ultimate participation rate is expected to be the same as under the prior assumption. It just takes a few more years to reach those levels under the new projection.



Glossary

Glossary

See our [online glossary](#) also.

Active Member

A person currently employed in an eligible position with a public employer. Active members accrue membership service in a public retirement system and generally make contributions toward their retirement benefits.

Actuarial Assumptions

Factors actuaries use to estimate the cost of funding a defined benefit pension plan. Examples include: the rate of return on plan investments; mortality rates; and the rates at which plan participants are expected to leave the system because of retirement, disability, termination, etc.

Prescribed Assumption

A specific assumption mandated or selected from a specific range that is deemed to be acceptable by law, regulation, or other binding authority.

Assumption Format

The form in which a particular assumption will be used or expressed. The format can be as simple as a single point estimate, where one number is applied, regardless of a member's age or gender. An assumption can also be developed by age, gender, credited service, plan or other group, or any combination of those categories.

Actuarial Gain or Loss

Experience of the plan, from one year to the next, which differs from that assumed, results in an actuarial gain or loss. For example, an

actuarial gain would occur if assets earned 10 percent for a given year since the assumed interest rate in the valuation is 8 percent.

Actuarial Reduction

A reduction in a benefit received at an early date so that the expected total cost to the retirement system is equivalent to the cost if the benefit did not begin until later.

Annuitant

A person receiving periodic payments from a retirement system. This term includes service and disability retirees, and their survivors.

Annuity

A series of periodic payments, usually for life, payable monthly or at other specified intervals.

Deferred Annuity

An annuity for which payments do not commence until a designated time in the future.

Joint and Survivor Annuity

A provision that enables a plan participant to take annuity payments with continuing payments of all or part of the benefits after his or her death going to a designated beneficiary. The survivor annuity will automatically be provided to a married participant if he or she does not choose against it. The annual pension benefits of the participant electing to have such a survivor annuity are generally reduced to provide for the survivor.

Life Annuity

A monthly benefit payable as long as the annuitant is alive. There are no residual payments to survivors.

Beneficiary

The person designated to receive benefits under an employee benefit plan in the event of the death of the person covered by the plan.

Data Outliers

Observations that lie well outside the normal range experienced by others. An example of an outlier could be a recorded service retirement at age 110, when most other members retire by age 80.

Death Benefit

A benefit payable to a survivor or estate by reason of a member's death. The benefit can be in the form of a lump sum, an annuity, or a refund of the member's contributions.

Life Expectancy

The average number of future years a person of a given age might be expected to live.

Portability

The ability of an employee who changes jobs and joins a different retirement system to become a dual member, maintaining membership in both systems. Dual members may combine service for benefit eligibility. They may also use their highest salary from either system for benefit calculation.

Ratio of Actual to Expected (A/E)

A helpful statistic in determining how closely existing assumptions match actual experience. Ratios near 1.0 indicate a very close match. Ratios below 1.0 demonstrate that current assumptions are higher than actual rates. Ratios above 1.0 show that current assumptions are lower than actual rates.

Retirement**Disability Retirement**

A termination of employment that provides, as a result of an accident or sickness, the payment of a retirement allowance before a participant is eligible for normal retirement.

Service Retirement

Retirement dependent upon attainment of a specified age and/or completion of a given length of service. In some cases, the term has the same meaning as "normal retirement".

Early Retirement

A termination of employment that provides the payment of a retirement allowance before a participant is eligible for normal retirement. The retirement allowance payable in the event of early retirement is often lower than the normal retirement allowance.

Vesting

The right of an employee to the benefits he or she has accrued, or some portion of them, even if employment under the plan is terminated. An employee who has met the vesting requirements of a pension plan is said to have a vested right. Voluntary and mandatory employee contributions are always fully vested.

Withdrawal

The termination of employment prior to becoming eligible for any benefits. The term sometimes refers to subsequent termination of membership in a system by withdrawal of the employee's accumulated contributions from the system.

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