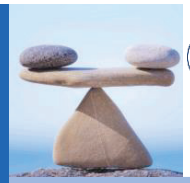
Development of Demographic Assumptions



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This analysis will become outdated with the release of our next experience study report.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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- 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.

[1] *For 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.

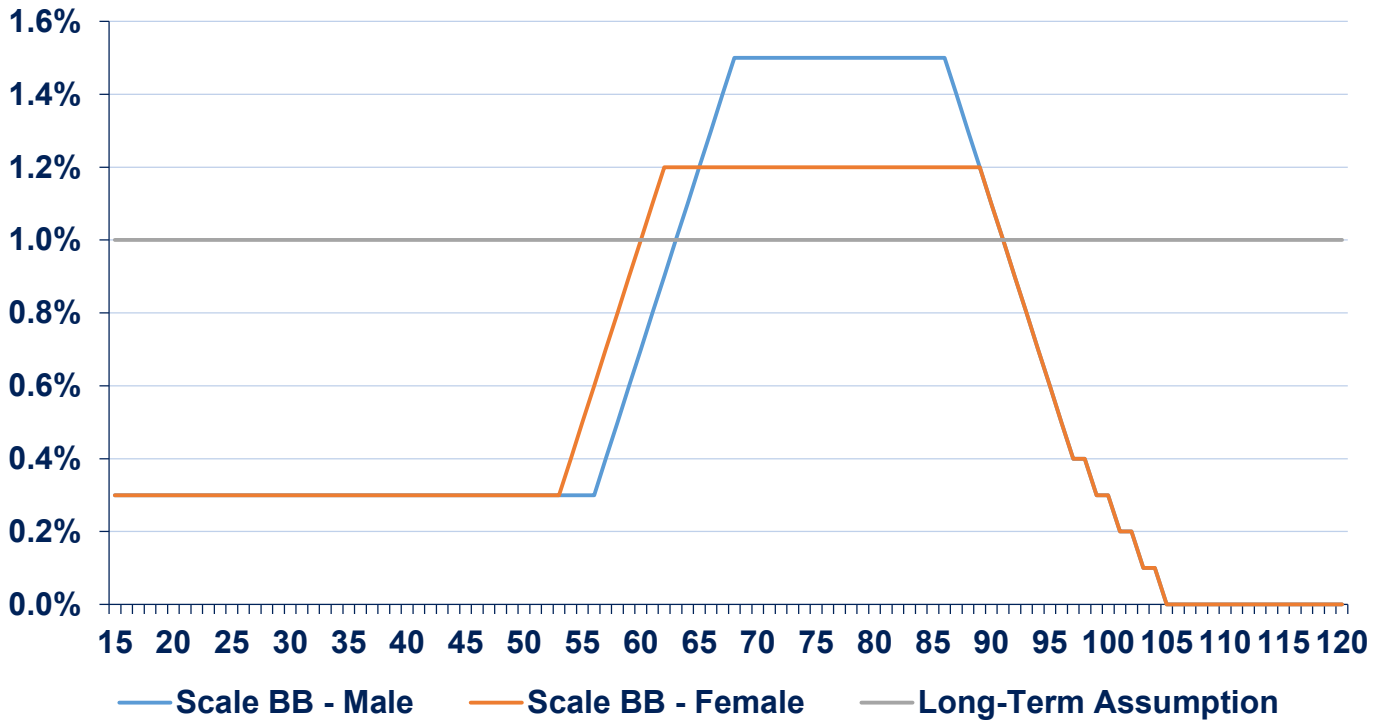
Projection Scale

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.

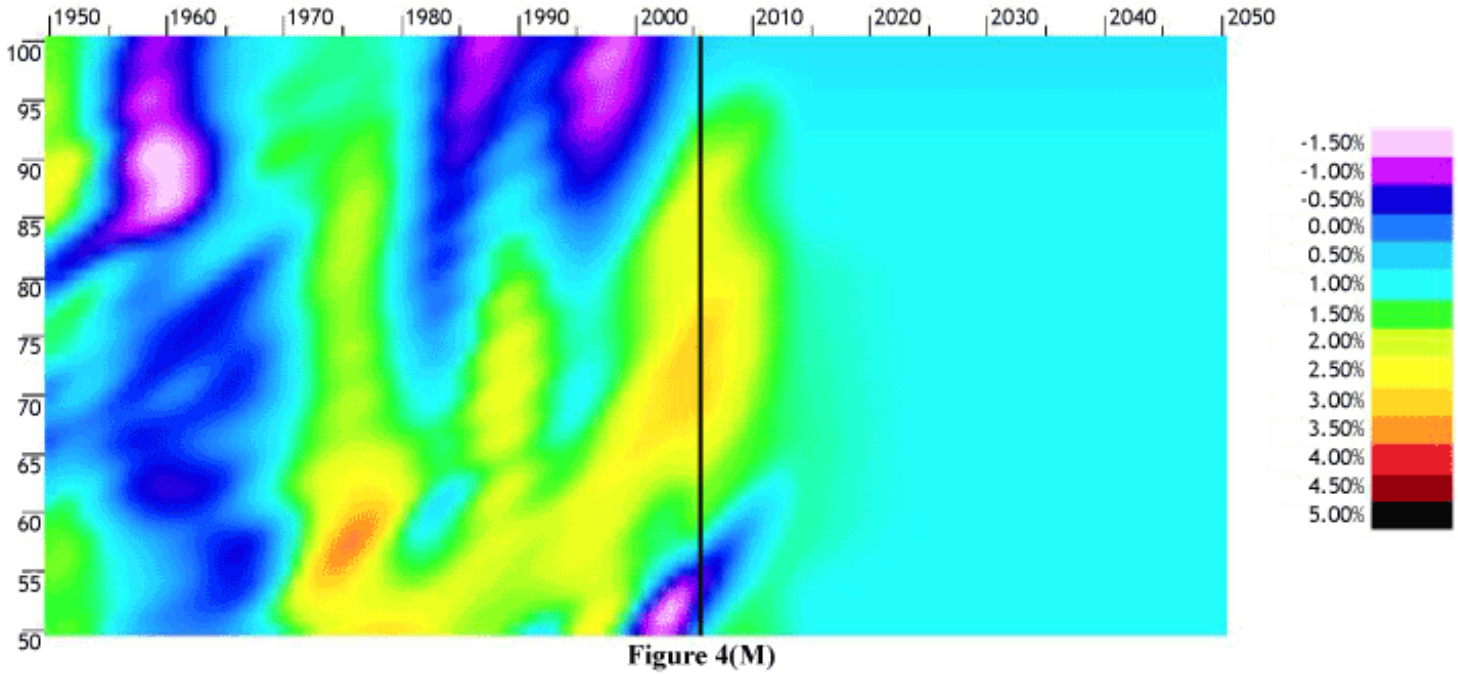


Figure 4(M)

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			
(Using a 500% Exclusion)			# of Deaths
Data Range	Scale AA	Scale BB	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		
(Using a 300% Exclusion)		
Data Range	Scale AA	Scale BB
1984-2012	108%	70%
1990-2012	114%	81%
1996-2012	95%	102%
2001-2012	57%	110%
(Using a 700% Exclusion)		
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				
	Original Results		*Excluding Outliers*	
Data Range	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.

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.

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.

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	-2
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	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.

[1] *For 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.

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

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

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.

[1] *For 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.*

[2] *For 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 assumption[1] 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.

[1]Members 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.

[2]Over 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 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.

[3] *For 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.*

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.

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.

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.*

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.

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 laws[3] 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*.

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

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

[3] *See 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]

[4] *This 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.

[5] *During 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.*