



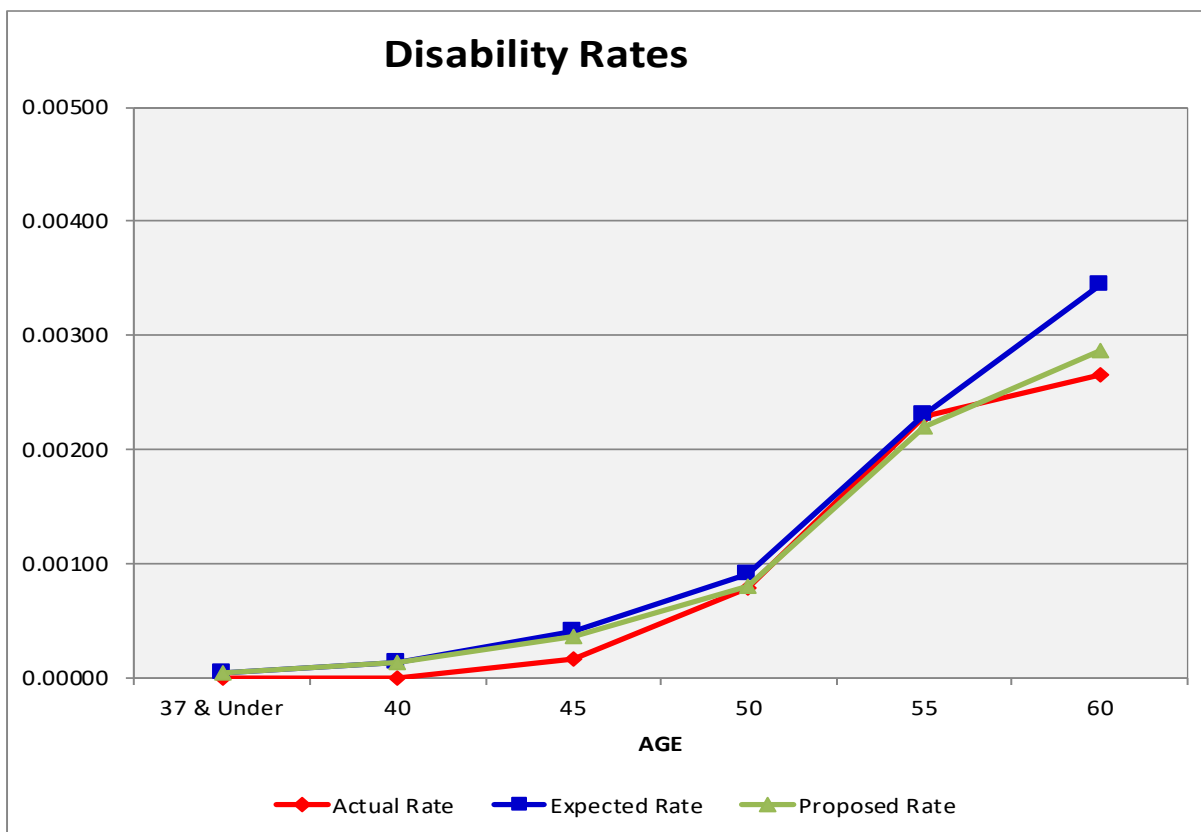
Section V – Demographic Assumptions

RATES OF DISABILITY RETIREMENT

COMPARISON OF ACTUAL AND EXPECTED DISABILITY RETIREMENTS

CENTRAL AGE OF GROUP	NUMBER OF DISABILITY RETIREMENTS		
	Actual	Expected	Ratio of Actual to Expected
37 & Under	0	0.4	0.000
40	0	1.8	0.000
45	3	7.8	0.385
50	20	23.4	0.855
55	73	73.5	0.993
60	82	106.4	0.771
TOTAL	178	213.3	0.835

The following graph shows a comparison of the current expected, actual, and proposed rates of disability retirement.





Section V – Demographic Assumptions

During the period under investigation, the actual rates of disability retirement were somewhat less than expected over all age groups. We recommend that the rates of disability be revised at this time to more closely reflect the experience of the System and maintain a degree of conservatism.

COMPARATIVE RATES OF DISABILITY RETIREMENT

AGE	RATES OF DISABILITY RETIREMENT	
	Present	Proposed
35	0.0025%	0.0018%
40	0.0110%	0.0110%
45	0.0370%	0.0330%
50	0.0865%	0.0770%
53	0.1750%	0.1490%
54	0.2000%	0.1700%
55	0.2250%	0.2250%
56	0.2500%	0.2500%
57	0.3000%	0.3000%
58	0.3250%	0.3250%
59	0.3500%	0.3500%
60	0.3500%	0.2500%
61	0.3500%	0.2500%
62	0.3500%	0.2500%
63	0.3500%	0.2500%
64	0.3500%	0.2500%

**COMPARISON OF ACTUAL AND EXPECTED DISABILITY RETIREMENTS
BASED ON PROPOSED RATES**

CENTRAL AGE OF GROUP	NUMBER OF DISABILITY RETIREMENTS		
	Actual	Expected	Ratio of Actual to Expected
37 & Under	0	0.4	0.000
40	0	1.7	0.000
45	3	7.0	0.429
50	20	20.4	0.980
55	73	70.0	1.043
60	82	88.4	0.928
TOTAL	178	187.9	0.947



Section V – Demographic Assumptions

RATES OF RETIREMENT

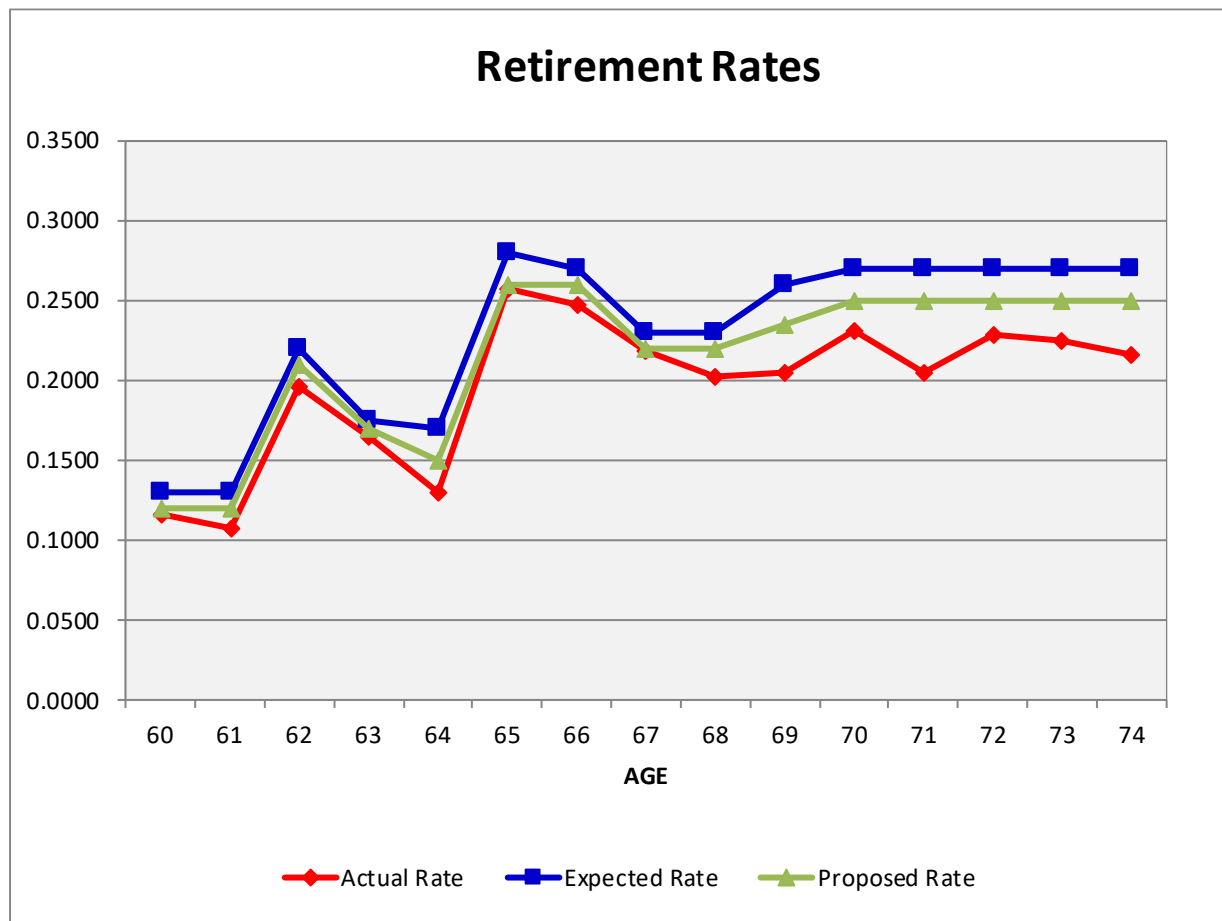
COMPARISON OF ACTUAL AND EXPECTED RETIREMENTS

AGE	NUMBER OF SERVICE RETIREMENTS		
	Actual	Expected	Ratio of Actual to Expected
60 & Under	384	428.0	0.897
61	334	406.8	0.821
62	577	648.1	0.890
63	402	427.2	0.941
64	287	376.9	0.761
65	535	584.1	0.916
66	424	462.5	0.917
67	312	328.2	0.951
68	262	298.8	0.877
69	237	301.9	0.785
70	242	283.8	0.853
71	185	244.1	0.758
72	173	204.4	0.846
73	144	172.8	0.833
74	118	147.7	0.799
SUBTOTAL	4,616	5,315.3	0.868
75 & Over	587	2,221.0	0.264
TOTAL	5,203	7,536.3	0.690



Section V – Demographic Assumptions

The following graph shows a comparison of the present, actual, and proposed rates of service retirements.



The analysis of the experience reflects that the current assumed rates of retirement were lower than expected at all ages. We recommend decreasing the rates to reflect the experience as well as extending the fixed retirement age from age 75 to age 80. These changes will continue to maintain a reasonable degree of margin.



Section V – Demographic Assumptions

The following table shows a comparison of the present and proposed rates of service retirement.

COMPARATIVE RATES OF RETIREMENT

AGE	RATES OF SERVICE RETIREMENT	
	Present	Proposed
60	13.0%	12.0%
61	13.0%	12.0%
62	22.0%	21.0%
63	17.5%	17.0%
64	17.0%	15.0%
65	28.0%	26.0%
66	27.0%	26.0%
67	23.0%	22.0%
68	23.0%	22.0%
69	26.0%	23.5%
70	27.0%	25.0%
71	27.0%	25.0%
72	27.0%	25.0%
73	27.0%	25.0%
74	27.0%	25.0%
75	100.0%	25.0%
76	100.0%	25.0%
77	100.0%	25.0%
78	100.0%	25.0%
79	100.0%	25.0%
80	100.0%	100.0%



Section V – Demographic Assumptions

**COMPARISON OF ACTUAL AND EXPECTED RETIREMENTS
BASED ON PROPOSED RATES OF RETIREMENT**

AGE	NUMBER OF SERVICE RETIREMENTS		
	Actual	Expected	Ratio of Actual to Expected
60 & Under	384	395.0	0.972
61	334	375.5	0.889
62	577	618.7	0.933
63	402	415.0	0.969
64	287	332.6	0.863
65	535	542.4	0.986
66	424	445.4	0.952
67	312	313.9	0.994
68	262	285.8	0.917
69	237	272.9	0.868
70	242	262.8	0.921
71	185	226.0	0.819
72	173	189.3	0.914
73	144	160.0	0.900
74	118	136.8	0.863
75	117	120.3	0.973
76	97	100.5	0.965
77	68	82.8	0.821
78	62	70.0	0.886
79	68	58.5	1.162
SUBTOTAL	5,028	5,404.2	0.930
80 & Over	175	493.0	0.355
TOTAL	5,203	5,897.2	0.882



Section V – Demographic Assumptions

RATES OF MORTALITY

One of the most important demographic assumptions in the valuation is mortality because it projects how long benefit payments will be made. The longer members live, the greater the true cost of future benefit obligations will be.

For many years, rates of mortality have been declining, meaning people, in general, are living longer. Consequently, we anticipate that mortality tables will need to be updated periodically. Because of potential differences in mortality, we break down our study by gender (males and females) and by status (healthy retirees, beneficiaries, disabled retirees, and active members).

Because of the substantial amount of data required to construct a mortality table, actuaries usually rely on standard tables published by the Society of Actuaries. Actuaries then use various adjustments such as age or scaling adjustments to the standard, published mortality tables in order to better match the observed mortality rates of a specific group.

The first of these adjustments is an age adjustment that can be either a “setback” or a “set forward”. A one-year age setback treats all members as if they were one year younger than they truly are when applying the rates in the mortality table. For example, a one year set back would treat a 61-year old retiree as if he will exhibit the mortality of a 60-year old in the standard mortality table.

The second adjustment that can be used to adjust the mortality rates in a standard table to better fit actual experience is to “scale” a mortality table by multiplying the probabilities of death by factors less than one (to reflect better mortality) or factors greater than one (to reflect poorer mortality). Scaling factors can be applied to an entire table or a portion of the table. Of course, if needed, actuaries may use both of these methods to develop an appropriate table to model the mortality of the specific plan population.

In 2019, the Society of Actuaries released a family of mortality tables named the Pub-2010 tables. While prior pension mortality tables have been based solely on private corporate and union retirement plans, these new tables are based entirely on public sector plan data. These tables are split by three membership types: Safety, Teachers, and General to reflect the observed differences in mortality patterns related to the three groups. Tables are further split for healthy retirees, disabled retirees, contingent beneficiaries, and employees. There are still other breakdowns in these tables for at, above or below median annuity values. We anticipate that this family of tables will be a good starting point in developing a recommended mortality assumption.

The issue of future mortality improvement is one that the actuarial profession has become increasingly focused on studying and monitoring. This has resulted in changes to the relevant Actuarial Standard of Practice, ASOP 35, *Selection of Demographic and Other Noneconomic*



Section V – Demographic Assumptions

Assumptions for Measuring Pension Obligations. This ASOP requires the pension actuary to make and disclose a specific recommendation with respect to future improvements in mortality after the valuation date, although it does not require that an actuary assume there will be future improvements. There have been significant improvements in longevity in the past, although there are different opinions about future expectations, and thus there is a subjective component in the estimation of future mortality improvement. We believe it is prudent to anticipate that the trend will continue to some degree in the future and that it is appropriate to reflect some future mortality improvement as part of the mortality assumption.

There are two, widely-used ways to reflect future improvements in mortality:

- (1) Static table with “margin”
- (2) Generational mortality

The first approach to reflecting mortality improvements is through the use of a static mortality table with “margin.” Under this approach, the Actual to Expected Ratio is intentionally targeted to be over 100% so that mortality can improve without creating actuarial losses. This has been the approach used historically by many other systems because of its computational simplicity.

Another approach, referred to as generational mortality, directly anticipates future improvements in mortality by using a different set of mortality rates based on each year of birth, with the rates for later years of birth assuming lower mortality than the rates for earlier years of birth. The varying mortality rates by year of birth create a series of tables that contain “built-in” mortality improvements, e.g., a member who turns age 65 in 2035 has a longer life expectancy than a member who turns age 65 in 2020. When using generational mortality, the Actual to Expected Ratios for the observed experience are set near 100% as future mortality improvements will be taken into account directly in the actuarial valuation process. The generational approach is our preferred method for recognizing future mortality improvements in the valuation process because it is more direct and results in longer life expectancy for members who are younger, consistent with what we believe is more likely to occur. Over the last 10-15 years, this method has become quite common as computing power has increased.



Section V – Demographic Assumptions

MORTALITY – Healthy Retirees

The valuation currently uses the same mortality assumption for all healthy members, including service retirees and beneficiaries. This table is divided for male and female members. The current underlying mortality table is from the Society of Actuaries RP-2000 table projected statically to 2025. For this study, we have reviewed service retirees separately from beneficiaries.

We also analyzed recent experience on a benefit-weighted basis where the exposures and deaths are multiplied by the monthly retirement benefit amount. This helps to reflect any differences that arise from better mortality experience among those with larger benefits. Because a valuation is designed to measure the amount and timing of future benefit payments (liability) rather than simply the number of retirees leaving pay status, this benefit-weighted approach is an important factor in valuing plan obligations. The Actual to Expected Ratios on the benefit-weighted basis were different from the Actual to Expected Ratios on a count basis, confirming that members with higher benefits also tend to have better mortality. Please note that we are not saying that larger benefits definitely lead to better mortality, but simply that there is a correlation between the two.

The Actual to Expected Ratios on a benefit-weighted basis are summarized and compared to those on a count basis in the following table. The fact that the ratios are lower on a weighted basis than on a count basis is an indication that individuals with larger benefits do indeed have slightly better mortality on average, as was anticipated. (Note that most mortality tables used by actuaries are developed on a weighted basis.)

The results of the experience study for healthy retirees ages 60 to 90, on a count and liability-weighted basis, are summarized in the following chart.

Healthy Retiree Deaths A/E Ratio		
	Count Basis	Liability-Weighted Basis
Male	103%	105%
Female	102%	104%



Section V – Demographic Assumptions

In order to more closely anticipate future liability experience, we believe that assigning more credibility to the benefit-weighted analysis is the better approach. Based on the observations summarized in the table above, we believe that mortality assumption changes are appropriate for PSERS. We believe the new Pub-2010 tables would be a good choice and we recommend changing the mortality basis for all the Systems so that all ERS can share a common family of tables. We also recommend the mortality improvement scale, MP-2019, be used to anticipate future mortality improvements in the valuation process through at least the next experience study.

Therefore, our recommended mortality assumption for service retirees is based on the Pub-2010 Healthy Below-Median Annuitant Tables, with adjustments as outlined below to better fit actual experience, projected generationally with the MP-2019 scale.

<u>Group</u>	<u>Membership Table</u>	<u>Set Forward (+)/ Setback (-)</u>	<u>Adjustment to Rates</u>
Service Retirees	General	Male: +2, Female: +2	Male: 101%, Female: 103%

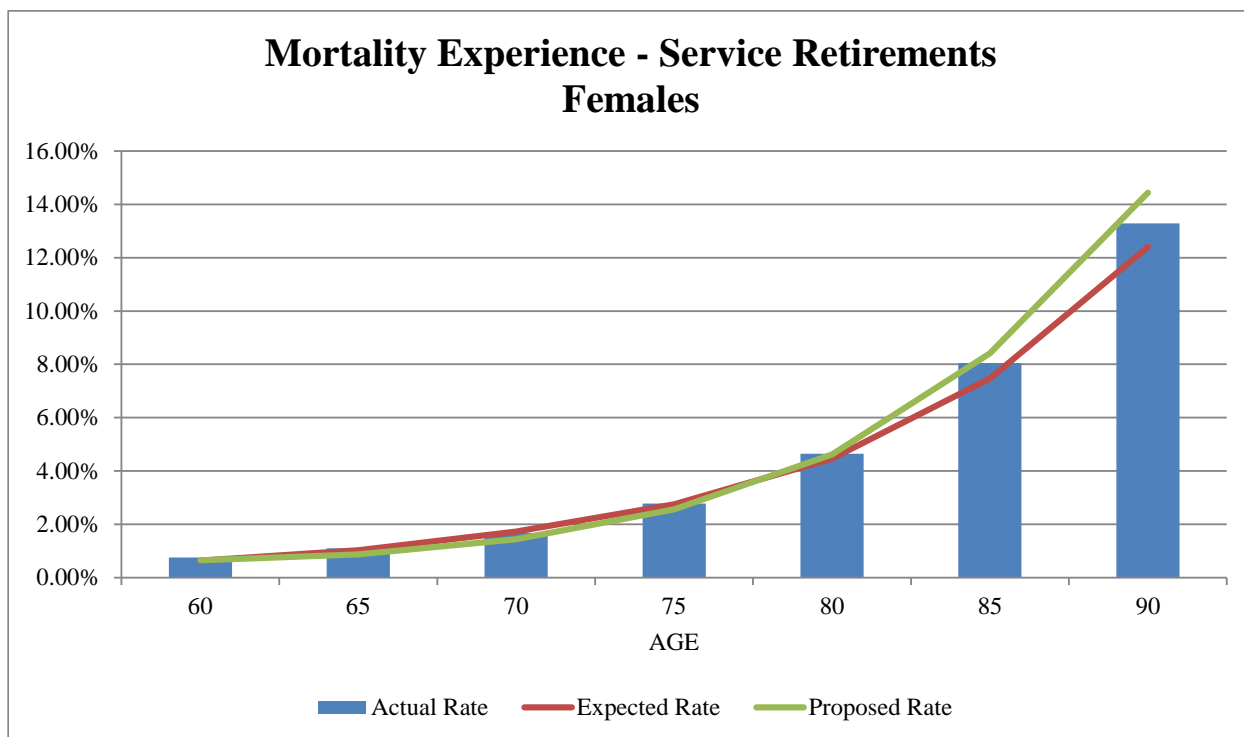
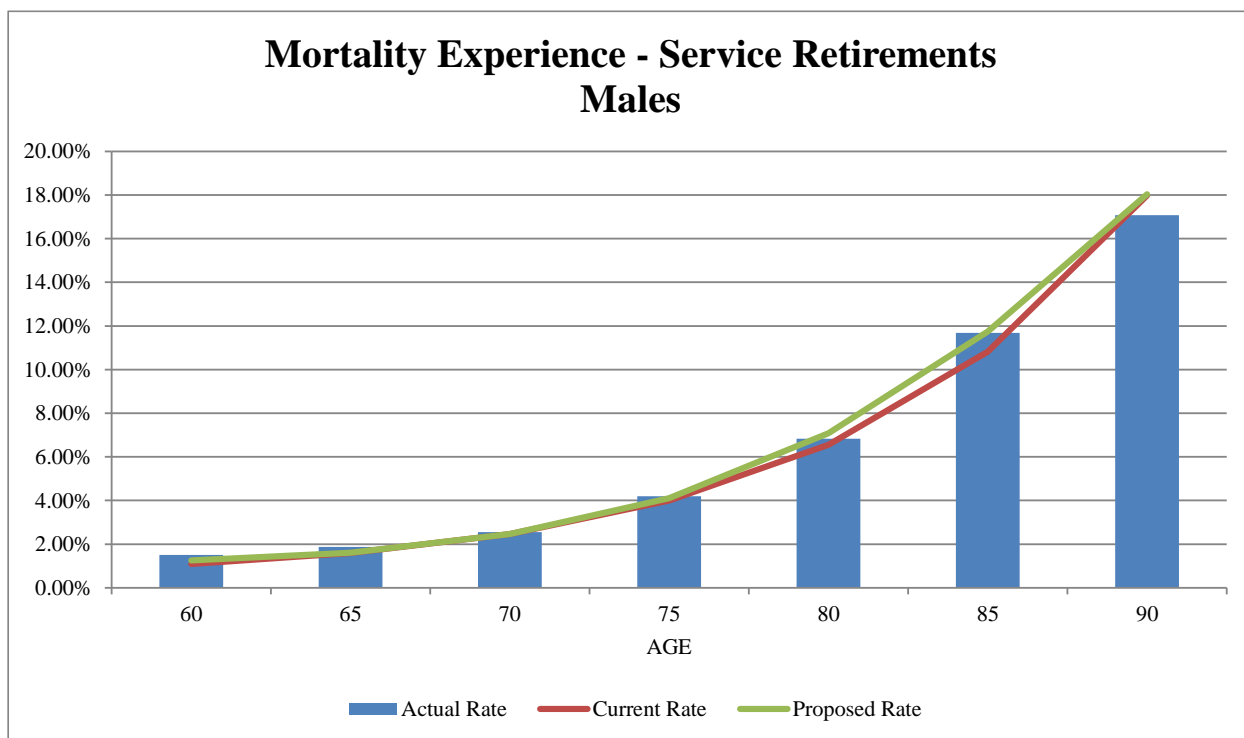
The resulting Actual to Expected Ratios, based on the proposed assumption for ages 60 to 90, are shown in the following table.

Healthy Mortality A/E Ratios (Liability Weighted)		
	<u>Current</u>	<u>Proposed</u>
Male	105%	100%
Female	104	100



Section V – Demographic Assumptions

The resulting comparisons of rates of mortality are shown in the following graphs





Section V – Demographic Assumptions

MORTALITY – Beneficiaries

The mortality of beneficiaries applies to the survivors of members who retired with a joint and survivor option. There are fewer members receiving survivor benefits under the joint and survivor options, but we do believe that the data is still somewhat credible. The results are summarized in the following table:

Beneficiary Mortality A/E Ratios (Weighted)		
	<u>Current</u>	<u>Proposed</u>
Male	108%	101%
Female	109	100

We recommend the Pub-2010 Healthy Below-Median Contingent Survivors Tables be used with adjustments as outlined below to better fit actual experience, projected generationally with the MP-2019 scale.

<u>Group</u>	<u>Membership Table</u>	<u>Set Forward (+)/ Setback (-)</u>	<u>Adjustment to Rates</u>
Beneficiaries	General	Male: +2, Female: +2	Male: 104%, Female: 99%



Section V – Demographic Assumptions

MORTALITY – Disabled Retirees

The valuation assumes that disabled members, in general, will not live as long as retired members who met the regular service retirement eligibility. There tends to be more fluctuation in disabled mortality than healthy mortality because of differences in the types of disabilities. In addition, the smaller number of exposures makes the results more volatile. Unfortunately, the mortality for disabled members was not credible enough to warrant setting a mortality table to fit the PSERS experience. Therefore, we recommend using the same disabled mortality table for PSERS as recommended for ERS.

We recommend the Pub-2010 General Disabled Table be used with adjustments as outlined below to better fit actual experience, projected generationally with the MP-2019 scale.

<u>Group</u>	<u>Membership Table</u>	<u>Set Forward (+)/ Setback (-)</u>	<u>Adjustment to Rates</u>
Disabled Retirees	General	Male: -3, Female: 0	Male: 103%, Female: 106%

MORTALITY – Actives

The active member mortality assumption models eligibility for death benefits prior to retirement. Therefore, it has a much smaller impact on the valuation results than the post-retirement mortality assumption.

It is difficult to isolate the mortality for active members as it may be impacted by active members first terminating or moving to disabled status before death. The data collection methods used in this study do not fully capture known deaths, and so can be misleading. Finally, the probability of active death is very small so volatility is not uncommon. Consequently, we prefer to set this assumption by utilizing the more reliable analysis performed on the retiree data.

Our recommended mortality assumption is based on the Pub-2010 Below-Median General Employee table, with no adjustments, projected generationally with the MP-2019 scale.



Section VI – Other Assumptions and Methods

ADMINISTRATIVE EXPENSES: Currently, the method used for administrative expenses is to add the budgeted expenses for the fiscal year to the normal cost. **We recommend an expense assumption of \$1,400,000 each year.**

COST OF LIVING: Currently, we assume cost of living increases of 1.5% semi-annually. **We recommend maintaining this assumption.**

OPTION FACTORS: The option factors currently used by the Retirement System are based on the mortality tables and investment rate of return (discount rate) used in the valuation. **We recommend that the factors be revised to the mortality table recommended in this experience study.**

ASSUMPTION FOR ACTIVE VESTED MEMBERS TERMINATION BENEFITS: Currently, we assume that 50% of active members who terminate with ten or more years of service before retirement will receive a benefit beginning at age 65 and 50% will receive a refund of member contributions. **We recommend changing this to assume that 75% will receive a benefit beginning at age 65 and 25% will receive a refund of member contributions**



Appendix A – Historical June CPI(U) Index

Year	CPI (U)	Year	CPI (U)
1961	29.8	1991	136.0
1962	30.2	1992	140.2
1963	30.6	1993	144.4
1964	31.0	1994	148.0
1965	31.6	1995	152.5
1966	32.4	1996	156.7
1967	33.3	1997	160.3
1968	35.7	1998	163.0
1969	34.7	1999	166.2
1970	38.8	2000	172.4
1971	40.6	2001	178.0
1972	41.7	2002	179.9
1973	44.2	2003	183.7
1974	49.0	2004	189.7
1975	53.6	2005	194.5
1976	56.8	2006	202.9
1977	60.7	2007	208.352
1978	65.2	2008	218.815
1979	72.3	2009	215.693
1980	82.7	2010	217.965
1981	90.6	2011	225.722
1982	97.0	2012	229.478
1983	99.5	2013	233.504
1984	103.7	2014	238.343
1985	107.6	2015	238.638
1986	109.5	2016	241.018
1987	113.5	2017	244.955
1988	118.0	2018	251.989
1989	124.1	2019	256.143
1990	129.9	2020	257.797



Appendix B – Capital Market Assumptions

As Provided by the System

Arithmetic Rates of Return and Standard Deviations by Asset Class

Asset Class	Expected Rate of Return*	Standard Deviation
Fixed Income	1.4%	2.3%
US Large Stocks	12.1%	19.8%
US Small Stocks	16.3%	31.5%
Int'l Developed Mkt Stocks	12.1%	21.8%
Int'l Emerging Mkt Stocks	13.3%	31.7%
Alternatives	13.5%	27.9%

*Includes 2.90% assumed inflation

Asset Class Correlation Coefficients

Asset Class	Fixed Income	US Large Stocks	US Small Stocks	Int'l Dev Mkt Stocks	Int'l EM Mkt Stocks	Alts
Fixed Income	1.00					
US Large Stocks	0.01	1.00				
US Small Stocks	(0.09)	0.79	1.00			
Int'l Developed Mkt Stocks	(0.11)	0.67	0.51	1.00		
Int'l Emerging Mkt Stocks	(0.11)	0.67	0.51	0.72	1.00	
Alternatives	0.31	0.74	0.74	0.64	0.62	1.00

Asset Allocation Targets

Asset Class	Asset Allocation
Fixed Income	30.0%
US Large Stocks	46.4%
US Small Stocks	1.1%
Int'l Developed Mkt Stocks	11.7%
Int'l Emerging Mkt Stocks	5.8%
Alternatives	5.0%



Appendix B – Capital Market Assumptions

As Determined by the 2020 Horizon Actuarial Services, LLC. Survey of Capital Market Assumptions (20-year Horizon)

Arithmetic Rates of Return and Standard Deviations by Asset Class

Asset Class	Expected Rate of Return*	Standard Deviation
Fixed Income	2.28%	1.78%
US Large Stocks	8.36%	16.22%
US Small Stocks	9.54%	20.22%
Int'l Developed Mkt Stocks	9.09%	18.05%
Int'l Emerging Mkt Stocks	11.33%	24.23%
Alternatives (Private Equity)	12.54%	21.99%

*Includes 2.17% assumed inflation

Asset Class Correlation Coefficients

Asset Class	Fixed Income	US Large Stocks	US Small Stocks	Int'l Dev Mkt Stocks	Int'l EM Mkt Stocks	Alts
Fixed Income	1.00					
US Large Stocks	(0.08)	1.00				
US Small Stocks	(0.08)	0.89	1.00			
Int'l Developed Mkt Stocks	(0.07)	0.84	0.76	1.00		
Int'l Emerging Mkt Stocks	(0.06)	0.73	0.69	0.80	1.00	
Alternatives (Private Equity)	(0.06)	0.73	0.71	0.67	0.59	1.00



Appendix C – Recommended Tables

**TABLE 1
RATES OF SEPARATION FROM ACTIVE SERVICE – MALES**

AGE	Rates of Withdrawal Service			Death	Disability	Retirement
	0 - 4	5 - 9	10+			
19	0.34000			0.000400		
20	0.34000			0.000410		
21	0.34000			0.000420		
22	0.34000			0.000410		
23	0.33000	0.19000		0.000410		
24	0.32000	0.19000		0.000400		
25	0.31000	0.19000		0.000410		
26	0.30300	0.18700		0.000430		
27	0.29600	0.18500		0.000450		
28	0.28900	0.17900	0.14000	0.000470		
29	0.28200	0.17300	0.13500	0.000500		
30	0.27500	0.17000	0.12500	0.000520		
31	0.26900	0.16700	0.12200	0.000550	0.000005	
32	0.26300	0.16400	0.11900	0.000580	0.000005	
33	0.25700	0.16100	0.10000	0.000610	0.000009	
34	0.25100	0.15800	0.09500	0.000650	0.000014	
35	0.24500	0.15500	0.09000	0.000680	0.000018	
36	0.24000	0.15100	0.08850	0.000730	0.000036	
37	0.23500	0.14700	0.08700	0.000770	0.000054	
38	0.23000	0.14300	0.08550	0.000830	0.000072	
39	0.22500	0.13900	0.08400	0.000890	0.000090	
40	0.22000	0.13500	0.08250	0.000960	0.000110	
41	0.21800	0.13300	0.08000	0.001030	0.000154	
42	0.21600	0.13100	0.07750	0.001120	0.000198	
43	0.21400	0.12900	0.07500	0.001210	0.000242	
44	0.21200	0.12700	0.07250	0.001320	0.000286	
45	0.21000	0.12500	0.07000	0.001430	0.000330	
46	0.20200	0.12100	0.07000	0.001560	0.000420	
47	0.19900	0.11700	0.07000	0.001700	0.000510	
48	0.19400	0.11500	0.07000	0.001850	0.000600	
49	0.18900	0.11200	0.07000	0.002010	0.000690	
50	0.18500	0.11000	0.07000	0.002180	0.000770	
51	0.18100	0.10300	0.07000	0.002360	0.000870	
52	0.17700	0.09700	0.07000	0.002550	0.000990	
53	0.15250	0.09000	0.06500	0.002750	0.001490	
54	0.15250	0.09000	0.06000	0.002970	0.001700	
55	0.15250	0.09000	0.06000	0.003200	0.002250	
56	0.15250	0.09000	0.06000	0.003450	0.002500	
57	0.15250	0.09000	0.05500	0.003710	0.003000	
58	0.13500	0.09000	0.05000	0.004000	0.003250	
59	0.13500	0.09000	0.05000	0.004320	0.003500	
60	0.13500	0.09000		0.004660	0.002500	0.12000
61	0.13500	0.09000		0.005020	0.002500	0.12000
62	0.13500	0.09500		0.005420	0.002500	0.21000
63	0.13500	0.09500		0.005850	0.002500	0.17000
64	0.13500	0.09500		0.006310	0.002500	0.15000
65	0.13500	0.09500		0.006820		0.26000
66	0.13500	0.09500		0.007370		0.26000
67	0.13500	0.09500		0.007990		0.22000
68	0.13500	0.09500		0.008660		0.22000
69	0.13500	0.09500		0.009420		0.23500
70	0.13500	0.09500		0.010250		0.25000
71	0.13500	0.09500		0.011180		0.25000
72	0.13500	0.09500		0.012210		0.25000
73	0.13500	0.09500		0.013350		0.25000
74	0.13500	0.09500		0.014610		0.25000
75	0.13500	0.09500		0.015990		0.25000
76	0.13500	0.09500		0.017510		0.25000
77	0.13500	0.09500		0.019180		0.25000
78	0.13500	0.09500		0.021010		0.25000
79	0.13500	0.09500		0.023020		0.25000
80	0.00000	0.00000		0.025230		1.00000

*Base mortality rates as of 2010 before application of the improvement scale



Appendix C – Recommended Tables

**TABLE 2
RATES OF SEPARATION FROM ACTIVE SERVICE – FEMALES**

AGE	Rates of Withdrawal			Death	Disability	Retirement
	Service					
	0 - 4	5 - 9	10+			
19	0.35000			0.000140		
20	0.35000			0.000130		
21	0.35000			0.000130		
22	0.35000			0.000120		
23	0.33500	0.20000		0.000120		
24	0.32000	0.20000		0.000110		
25	0.31000	0.20000		0.000120		
26	0.29800	0.19300		0.000130		
27	0.28600	0.18600		0.000140		
28	0.27400	0.17900	0.10000	0.000160		
29	0.26200	0.17200	0.10000	0.000170		
30	0.25000	0.16500	0.10000	0.000190		
31	0.24400	0.16200	0.10000	0.000210	0.000005	
32	0.23800	0.15900	0.10000	0.000220	0.000005	
33	0.23200	0.15600	0.10000	0.000250	0.000009	
34	0.22600	0.15300	0.10000	0.000270	0.000014	
35	0.22000	0.15000	0.10000	0.000300	0.000018	
36	0.21600	0.14800	0.10000	0.000320	0.000036	
37	0.21200	0.14600	0.09700	0.000360	0.000054	
38	0.20800	0.14400	0.09500	0.000390	0.000072	
39	0.20400	0.14200	0.09300	0.000430	0.000090	
40	0.20000	0.14000	0.09000	0.000470	0.000110	
41	0.19600	0.13600	0.08800	0.000510	0.000154	
42	0.19200	0.13200	0.08600	0.000550	0.000198	
43	0.18800	0.12800	0.08400	0.000600	0.000242	
44	0.18400	0.12400	0.08200	0.000660	0.000286	
45	0.18000	0.12000	0.08000	0.000720	0.000330	
46	0.17500	0.11600	0.07800	0.000780	0.000420	
47	0.17000	0.11200	0.07600	0.000840	0.000510	
48	0.16750	0.10800	0.07400	0.000910	0.000600	
49	0.16500	0.10400	0.07200	0.000990	0.000690	
50	0.16250	0.10000	0.07000	0.001070	0.000770	
51	0.15500	0.09500	0.06750	0.001150	0.000870	
52	0.15500	0.09000	0.06500	0.001240	0.000990	
53	0.14900	0.09000	0.06250	0.001340	0.001490	
54	0.13500	0.09000	0.06000	0.001450	0.001700	
55	0.13500	0.09000	0.06000	0.001570	0.002250	
56	0.13500	0.09000	0.05750	0.001700	0.002500	
57	0.13500	0.09000	0.05500	0.001850	0.003000	
58	0.13000	0.09000	0.05000	0.002000	0.003250	
59	0.13000	0.09000	0.05000	0.002180	0.003500	
60	0.13000	0.09000		0.002380	0.002500	0.12000
61	0.13000	0.09000		0.002600	0.002500	0.12000
62	0.13000	0.09000		0.002850	0.002500	0.21000
63	0.13000	0.09000		0.003130	0.002500	0.17000
64	0.13000	0.09000		0.003440	0.002500	0.15000
65	0.13000	0.09000		0.003800		0.26000
66	0.13000	0.09000		0.004190		0.26000
67	0.13000	0.09000		0.004630		0.22000
68	0.13000	0.09000		0.005120		0.22000
69	0.13000	0.09000		0.005670		0.23500
70	0.13000	0.09000		0.006270		0.25000
71	0.13000	0.09000		0.006930		0.25000
72	0.13000	0.09000		0.007670		0.25000
73	0.13000	0.09000		0.008480		0.25000
74	0.13000	0.09000		0.009370		0.25000
75	0.13000	0.09000		0.010360		0.25000
76	0.13000	0.09000		0.011450		0.25000
77	0.13000	0.09000		0.012650		0.25000
78	0.13000	0.09000		0.013970		0.25000
79	0.13000	0.09000		0.015430		0.25000
80	0.00000	0.00000		0.017050		1.00000

*Base mortality rates as of 2010 before application of the improvement scale



Appendix C – Recommended Tables

**TABLE 3
RATES OF MORTALITY FOR MEMBERS RETIRED ON ACCOUNT OF SERVICE***

AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.000424	0.000134	71	0.028563	0.017108
20	0.000414	0.000124	72	0.031664	0.019137
21	0.000414	0.000124	73	0.035128	0.021403
22	0.000404	0.000113	74	0.039006	0.023937
23	0.000414	0.000124	75	0.043329	0.026770
24	0.000434	0.000134	76	0.048167	0.029973
25	0.000455	0.000144	77	0.053591	0.033578
26	0.000475	0.000165	78	0.059661	0.037677
27	0.000505	0.000175	79	0.066468	0.042354
28	0.000525	0.000196	80	0.074043	0.047679
29	0.000556	0.000216	81	0.082446	0.053766
30	0.000586	0.000227	82	0.091678	0.060708
31	0.000616	0.000258	83	0.101737	0.068629
32	0.000657	0.000278	84	0.112615	0.077662
33	0.000687	0.000309	85	0.124301	0.087849
34	0.000737	0.000330	86	0.136794	0.099220
35	0.000778	0.000371	87	0.150096	0.111734
36	0.000838	0.000402	88	0.164155	0.125289
37	0.000899	0.000443	89	0.178578	0.139328
38	0.000970	0.000484	90	0.193173	0.153594
39	0.001040	0.000525	91	0.207939	0.168034
40	0.001131	0.000567	92	0.222988	0.182763
41	0.001222	0.000618	93	0.238532	0.198018
42	0.001333	0.000680	94	0.254783	0.214065
43	0.001444	0.000742	95	0.271932	0.231173
44	0.001576	0.000803	96	0.290102	0.249528
45	0.001717	0.000865	97	0.309302	0.269191
46	0.001869	0.000937	98	0.329351	0.290048
47	0.002030	0.001020	99	0.349824	0.311730
48	0.002282	0.004326	100	0.370064	0.333535
49	0.007626	0.004429	101	0.389900	0.355288
50	0.007989	0.004532	102	0.409171	0.376784
51	0.008363	0.004635	103	0.427755	0.397838
52	0.008726	0.004738	104	0.445541	0.418273
53	0.009100	0.004841	105	0.462439	0.437946
54	0.009474	0.004934	106	0.478376	0.456712
55	0.009837	0.005037	107	0.493314	0.474490
56	0.010201	0.005150	108	0.505000	0.491207
57	0.010565	0.005305	109	0.505000	0.506811
58	0.010938	0.005490	110	0.505000	0.515000
59	0.011322	0.005727	111	0.505000	0.515000
60	0.011726	0.006015	112	0.505000	0.515000
61	0.012171	0.006355	113	0.505000	0.515000
62	0.012655	0.006736	114	0.505000	0.515000
63	0.013211	0.007159	115	0.505000	0.515000
64	0.014372	0.007941	116	0.505000	0.515000
65	0.015736	0.008827	117	0.505000	0.515000
66	0.017291	0.009837	118	1.000000	1.000000
67	0.019069	0.010970	119	1.000000	1.000000
68	0.021069	0.012247	120	1.000000	1.000000
69	0.023301	0.013689			
70	0.025785	0.015296			

*Base mortality rates as of 2010 before application of the improvement scale



Appendix C – Recommended Tables

**TABLE 4
RATES OF MORTALITY FOR BENEFICIARIES OF DECEASED MEMBERS***

AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.000437	0.000129	71	0.033498	0.022523
20	0.000426	0.000119	72	0.036566	0.024512
21	0.000426	0.000119	73	0.039894	0.026720
22	0.000416	0.000109	74	0.043503	0.029165
23	0.000426	0.000119	75	0.047414	0.031878
24	0.000447	0.000129	76	0.051698	0.034917
25	0.000468	0.000139	77	0.056410	0.038313
26	0.000489	0.000158	78	0.061630	0.042154
27	0.000520	0.000168	79	0.067454	0.046510
28	0.000541	0.000188	80	0.073944	0.051450
29	0.000572	0.000208	81	0.081141	0.057044
30	0.000603	0.000218	82	0.089118	0.063380
31	0.000634	0.000248	83	0.097906	0.070557
32	0.000676	0.000267	84	0.107578	0.078656
33	0.000707	0.000297	85	0.118154	0.087684
34	0.000759	0.000317	86	0.129667	0.097584
35	0.000801	0.000356	87	0.142230	0.108237
36	0.000863	0.000386	88	0.157154	0.119434
37	0.000926	0.000426	89	0.173399	0.131254
38	0.000998	0.000465	90	0.190320	0.143778
39	0.001071	0.000505	91	0.207542	0.157113
40	0.001165	0.000545	92	0.224942	0.171369
41	0.001258	0.000594	93	0.242559	0.186635
42	0.001373	0.000653	94	0.260551	0.202980
43	0.007623	0.004594	95	0.279105	0.220433
44	0.007904	0.004742	96	0.298366	0.238966
45	0.008195	0.004881	97	0.318406	0.258479
46	0.008486	0.005029	98	0.339134	0.278784
47	0.008788	0.005178	99	0.360214	0.299624
48	0.009474	0.005316	100	0.381056	0.320582
49	0.009724	0.005613	101	0.401482	0.341491
50	0.009984	0.005930	102	0.421325	0.362152
51	0.010244	0.006257	103	0.440461	0.382388
52	0.010525	0.006603	104	0.458775	0.402029
53	0.010837	0.006970	105	0.476174	0.420938
54	0.011159	0.007346	106	0.492586	0.438976
55	0.011523	0.007742	107	0.507967	0.456063
56	0.011929	0.008168	108	0.520000	0.472131
57	0.012397	0.008623	109	0.520000	0.487130
58	0.012927	0.009118	110	0.520000	0.495000
59	0.013541	0.009653	111	0.520000	0.495000
60	0.014258	0.010237	112	0.520000	0.495000
61	0.015080	0.010870	113	0.520000	0.495000
62	0.016047	0.011563	114	0.520000	0.495000
63	0.017160	0.012306	115	0.520000	0.495000
64	0.018470	0.013187	116	0.520000	0.495000
65	0.019978	0.014147	117	0.520000	0.495000
66	0.021694	0.015197	118	1.000000	1.000000
67	0.023618	0.016365	119	1.000000	1.000000
68	0.025750	0.017662	120	1.000000	1.000000
69	0.028111	0.019117			
70	0.030680	0.020731			

*Base mortality rates as of 2010 before application of the improvement scale



Appendix C – Recommended Tables

**TABLE 5
RATES OF MORTALITY FOR MEMBERS RETIRED ON ACCOUNT OF DISABILITY***

AGE	MALES	FEMALES	AGE	MALES	FEMALES
19	0.000237	0.002597	71	0.036297	0.032213
20	0.000319	0.002470	72	0.038172	0.034333
21	0.004151	0.002279	73	0.040180	0.036718
22	0.004336	0.002056	74	0.042364	0.039411
23	0.004244	0.001866	75	0.044743	0.042432
24	0.003976	0.001738	76	0.047370	0.045813
25	0.003626	0.001738	77	0.050264	0.049587
26	0.003255	0.001897	78	0.053478	0.053795
27	0.002977	0.002078	79	0.057031	0.058480
28	0.002863	0.002279	80	0.060986	0.063674
29	0.003008	0.002491	81	0.065374	0.069430
30	0.003152	0.002724	82	0.070267	0.075790
31	0.003306	0.002979	83	0.075684	0.082797
32	0.003471	0.003254	84	0.081669	0.090482
33	0.003646	0.003562	85	0.088220	0.098909
34	0.003832	0.003890	86	0.095368	0.107728
35	0.004027	0.004251	87	0.103103	0.116748
36	0.004233	0.004643	88	0.111395	0.125907
37	0.004470	0.005077	89	0.120283	0.135224
38	0.004717	0.005554	90	0.129831	0.144849
39	0.005006	0.006084	91	0.140111	0.154940
40	0.005335	0.006667	92	0.153068	0.165731
41	0.005717	0.007303	93	0.167406	0.177444
42	0.006149	0.007992	94	0.182114	0.190323
43	0.006644	0.008745	95	0.196998	0.204559
44	0.007210	0.009561	96	0.212056	0.220310
45	0.007859	0.010441	97	0.227403	0.237906
46	0.008590	0.011374	98	0.243255	0.256796
47	0.009435	0.012370	99	0.259828	0.277031
48	0.010372	0.013430	100	0.277317	0.298496
49	0.011423	0.014554	101	0.295847	0.320809
50	0.012576	0.015720	102	0.315427	0.343249
51	0.013823	0.016271	103	0.335873	0.365636
52	0.015141	0.016822	104	0.356751	0.387759
53	0.016531	0.017384	105	0.377392	0.409425
54	0.017634	0.017935	106	0.397621	0.430455
55	0.018725	0.018465	107	0.417274	0.450701
56	0.019786	0.018963	108	0.436226	0.470015
57	0.020806	0.019430	109	0.454364	0.488310
58	0.021774	0.019864	110	0.471596	0.505514
59	0.022670	0.020288	111	0.487849	0.521573
60	0.023484	0.020734	112	0.503083	0.530000
61	0.024257	0.021200	113	0.515000	0.530000
62	0.025008	0.021741	114	0.515000	0.530000
63	0.025781	0.022366	115	0.515000	0.530000
64	0.026615	0.023087	116	0.515000	0.530000
65	0.027573	0.023914	117	0.515000	0.530000
66	0.028686	0.024868	118	0.515000	0.530000
67	0.029952	0.025970	119	0.515000	0.530000
68	0.031353	0.027231	120	1.000000	1.000000
69	0.032888	0.028684			
70	0.034536	0.030337			

*Base mortality rates as of 2010 before application of the improvement scale