

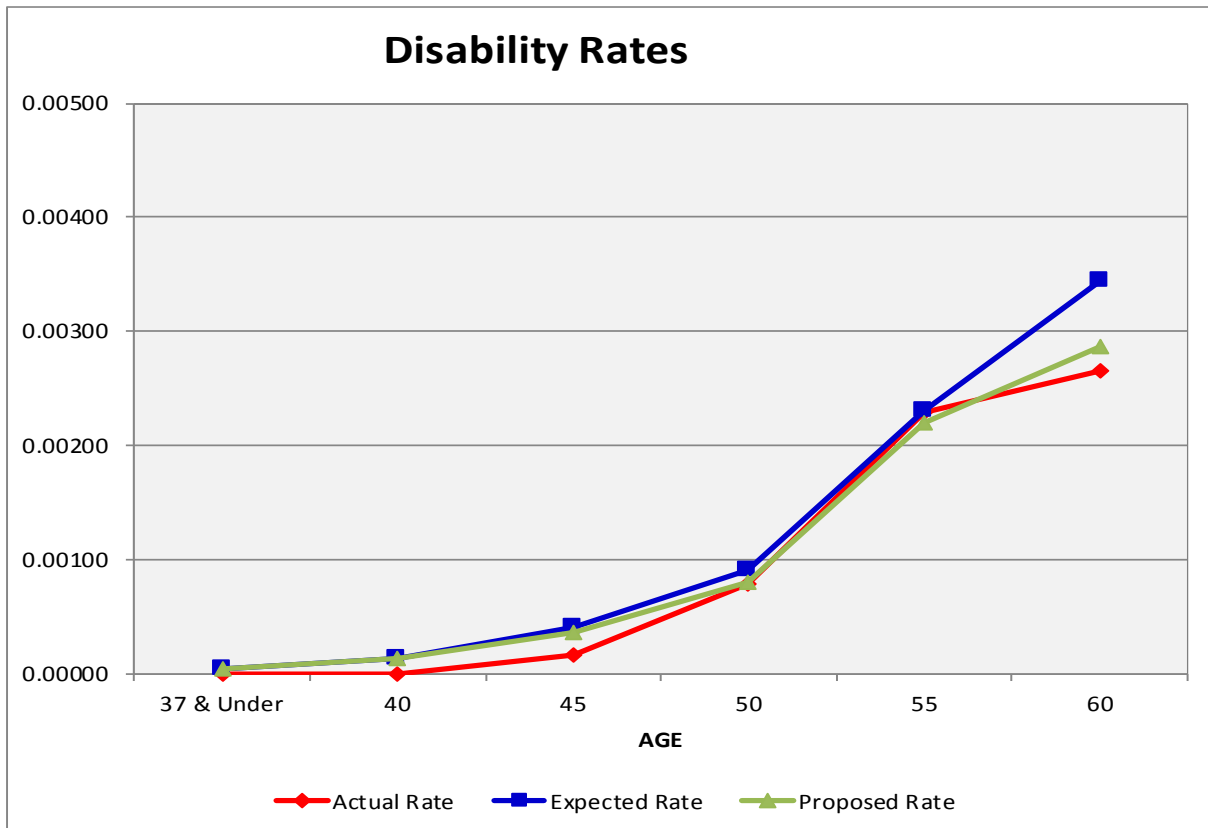
Section V – Demographic Assumptions

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

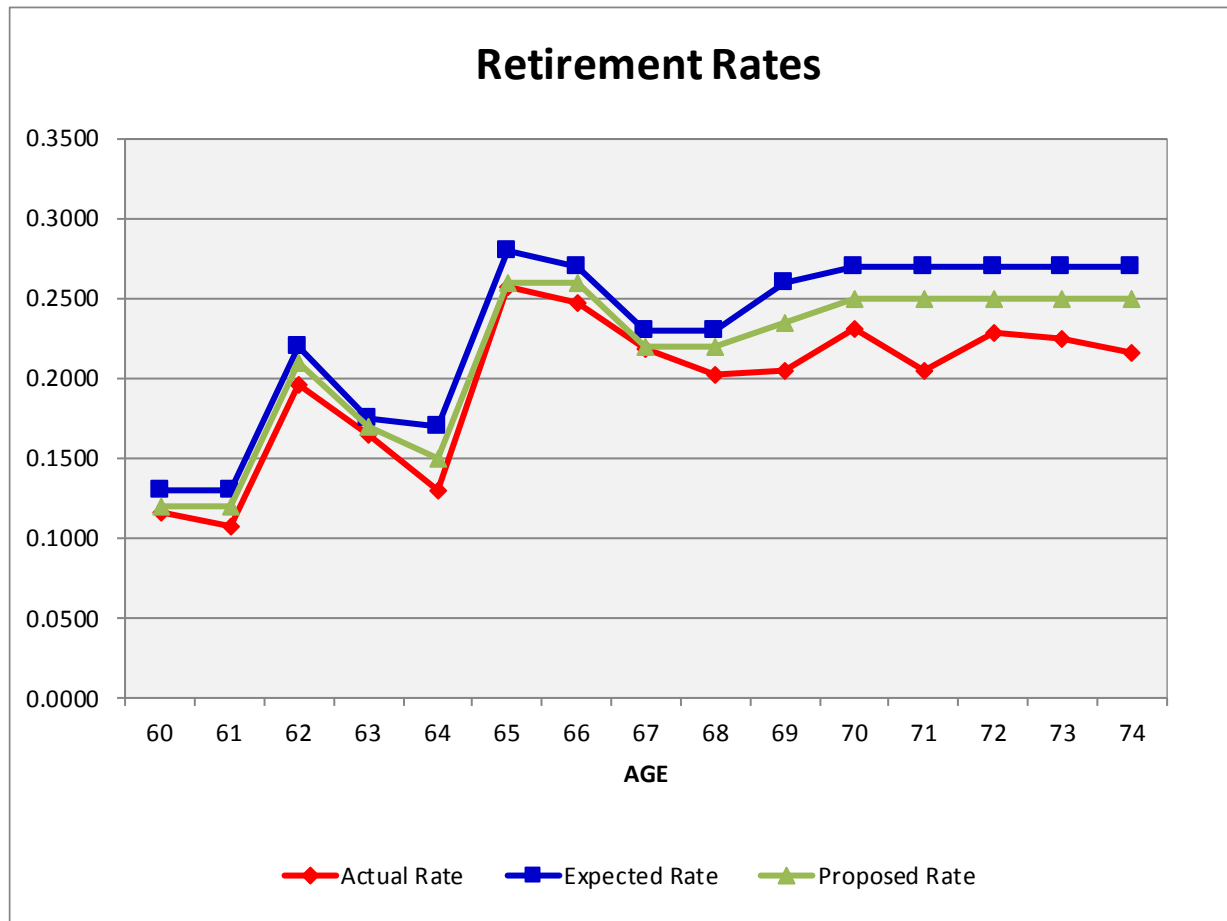
COMPARISON OF ACTUAL AND EXPECTED RETIREMENTS

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%

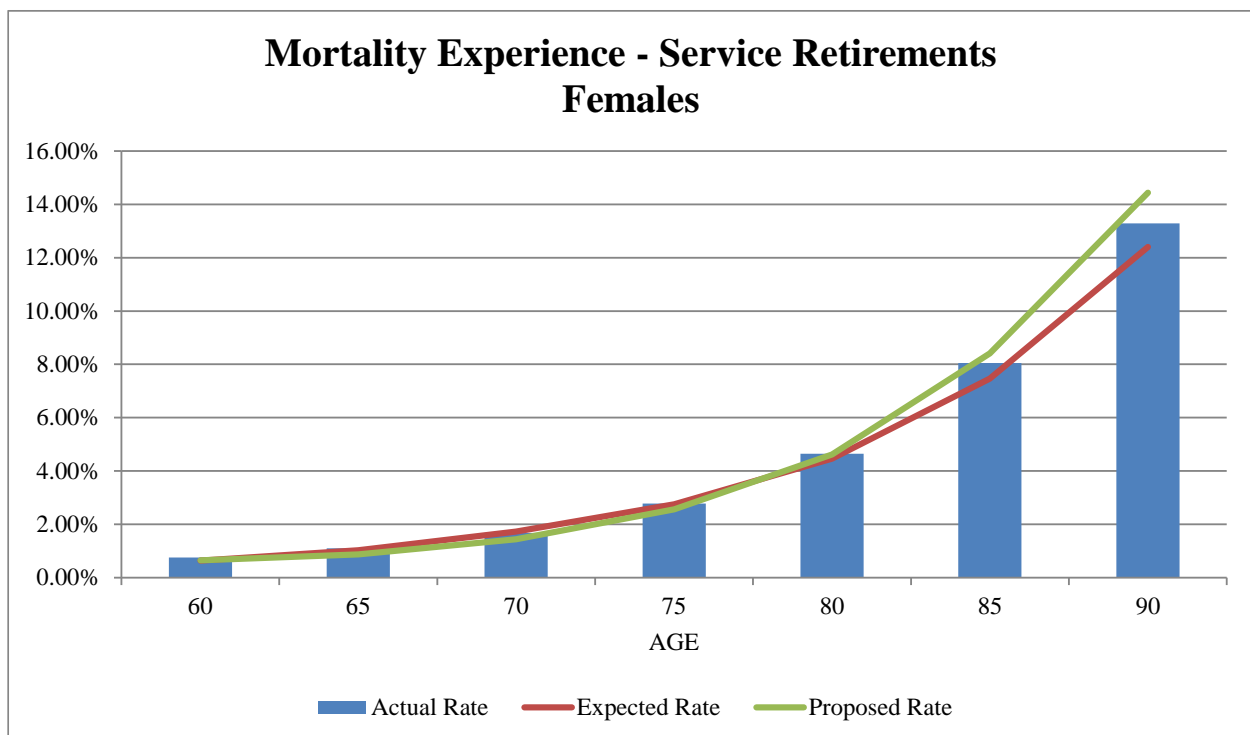
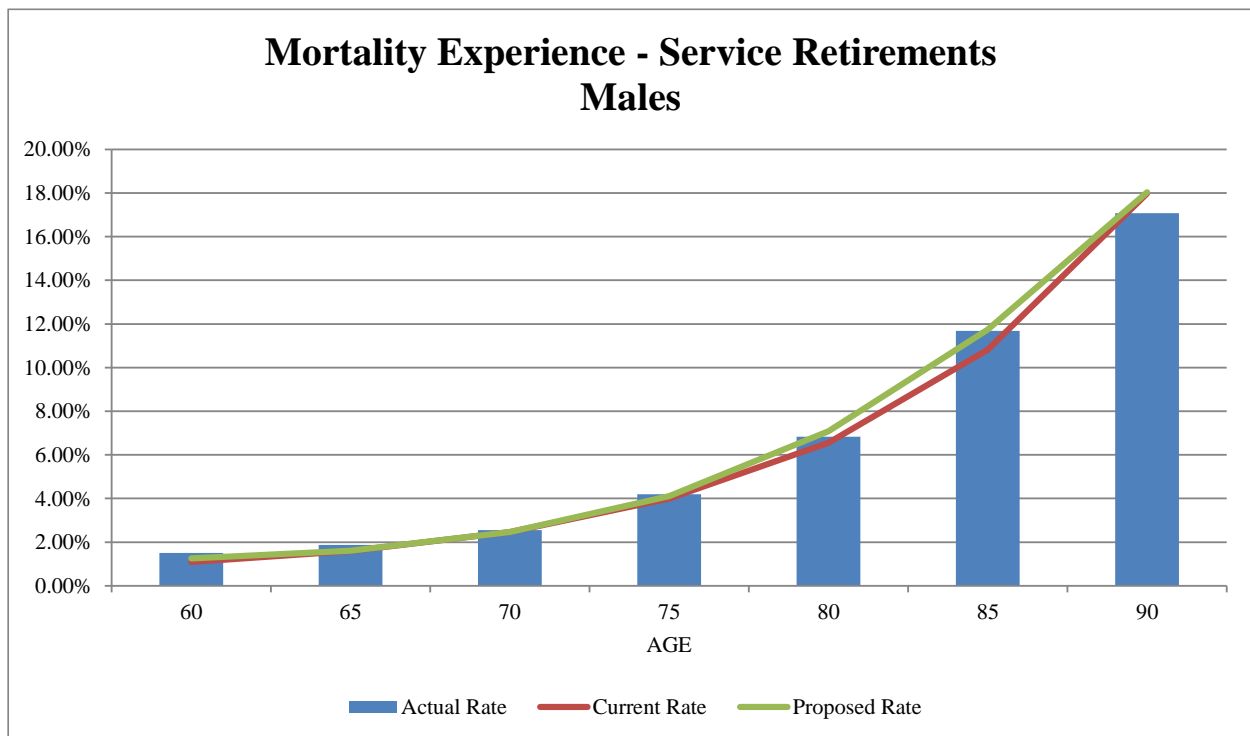
The resulting Actual to Expected Ratios, based on the proposed assumption for ages 60 to 90, are shown in the following table.

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			0.000380		
20	0.34000			0.000370		
21	0.34000			0.000360		
22	0.34000			0.000330		
23	0.33000	0.19000		0.000310		
24	0.32000	0.19000		0.000290		
25	0.31000	0.19000		0.000280		
26	0.30300	0.18700		0.000300		
27	0.29600	0.18500		0.000310		
28	0.28900	0.17900	0.14000	0.000330		
29	0.28200	0.17300	0.13500	0.000340		
30	0.27500	0.17000	0.12500	0.000360		
31	0.26900	0.16700	0.12200	0.000380	0.000005	
32	0.26300	0.16400	0.11900	0.000400	0.000005	
33	0.25700	0.16100	0.10000	0.000420	0.000009	
34	0.25100	0.15800	0.09500	0.000440	0.000014	
35	0.24500	0.15500	0.09000	0.000470	0.000018	
36	0.24000	0.15100	0.08850	0.000500	0.000036	
37	0.23500	0.14700	0.08700	0.000530	0.000054	
38	0.23000	0.14300	0.08550	0.000570	0.000072	
39	0.22500	0.13900	0.08400	0.000610	0.000090	
40	0.22000	0.13500	0.08250	0.000660	0.000110	
41	0.21800	0.13300	0.08000	0.000710	0.000154	
42	0.21600	0.13100	0.07750	0.000770	0.000198	
43	0.21400	0.12900	0.07500	0.000830	0.000242	
44	0.21200	0.12700	0.07250	0.000900	0.000286	
45	0.21000	0.12500	0.07000	0.000980	0.000330	
46	0.20200	0.12100	0.07000	0.001070	0.000420	
47	0.19900	0.11700	0.07000	0.001160	0.000510	
48	0.19400	0.11500	0.07000	0.001270	0.000600	
49	0.18900	0.11200	0.07000	0.001380	0.000690	
50	0.18500	0.11000	0.07000	0.001490	0.000770	
51	0.18100	0.10300	0.07000	0.001620	0.000870	
52	0.17700	0.09700	0.07000	0.001750	0.000990	
53	0.15250	0.09000	0.06500	0.001890	0.001490	
54	0.15250	0.09000	0.06000	0.002030	0.001700	
55	0.15250	0.09000	0.06000	0.002190	0.002250	
56	0.15250	0.09000	0.06000	0.002360	0.002500	
57	0.15250	0.09000	0.05500	0.002550	0.003000	
58	0.13500	0.09000	0.05000	0.002750	0.003250	
59	0.13500	0.09000	0.05000	0.002960	0.003500	
60	0.13500	0.09000		0.003190	0.002500	0.12000
61	0.13500	0.09000		0.003440	0.002500	0.12000
62	0.13500	0.09500		0.003710	0.002500	0.21000
63	0.13500	0.09500		0.004010	0.002500	0.17000
64	0.13500	0.09500		0.004330	0.002500	0.15000
65	0.13500	0.09500		0.004680		0.26000
66	0.13500	0.09500		0.005060		0.26000
67	0.13500	0.09500		0.005480		0.22000
68	0.13500	0.09500		0.005940		0.22000
69	0.13500	0.09500		0.006460		0.23500
70	0.13500	0.09500		0.007030		0.25000
71	0.13500	0.09500		0.007670		0.25000
72	0.13500	0.09500		0.008370		0.25000
73	0.13500	0.09500		0.009150		0.25000
74	0.13500	0.09500		0.010010		0.25000
75	0.13500	0.09500		0.010960		0.25000
76	0.13500	0.09500		0.012000		0.25000
77	0.13500	0.09500		0.013150		0.25000
78	0.13500	0.09500		0.014400		0.25000
79	0.13500	0.09500		0.015780		0.25000
80	0.00000	0.00000		0.017300		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 Service			Death	Disability	Retirement
	0 - 4	5 - 9	10+			
	19	0.35000				
20	0.35000			0.000130		
21	0.35000			0.000120		
22	0.35000			0.000110		
23	0.33500	0.20000		0.000100		
24	0.32000	0.20000		0.000090		
25	0.31000	0.20000		0.000090		
26	0.29800	0.19300		0.000100		
27	0.28600	0.18600		0.000110		
28	0.27400	0.17900	0.10000	0.000120		
29	0.26200	0.17200	0.10000	0.000130		
30	0.25000	0.16500	0.10000	0.000150		
31	0.24400	0.16200	0.10000	0.000160	0.000005	
32	0.23800	0.15900	0.10000	0.000180	0.000005	
33	0.23200	0.15600	0.10000	0.000190	0.000009	
34	0.22600	0.15300	0.10000	0.000210	0.000014	
35	0.22000	0.15000	0.10000	0.000230	0.000018	
36	0.21600	0.14800	0.10000	0.000250	0.000036	
37	0.21200	0.14600	0.09700	0.000280	0.000054	
38	0.20800	0.14400	0.09500	0.000300	0.000072	
39	0.20400	0.14200	0.09300	0.000330	0.000090	
40	0.20000	0.14000	0.09000	0.000360	0.000110	
41	0.19600	0.13600	0.08800	0.000400	0.000154	
42	0.19200	0.13200	0.08600	0.000430	0.000198	
43	0.18800	0.12800	0.08400	0.000470	0.000242	
44	0.18400	0.12400	0.08200	0.000510	0.000286	
45	0.18000	0.12000	0.08000	0.000560	0.000330	
46	0.17500	0.11600	0.07800	0.000610	0.000420	
47	0.17000	0.11200	0.07600	0.000660	0.000510	
48	0.16750	0.10800	0.07400	0.000710	0.000600	
49	0.16500	0.10400	0.07200	0.000770	0.000690	
50	0.16250	0.10000	0.07000	0.000830	0.000770	
51	0.15500	0.09500	0.06750	0.000900	0.000870	
52	0.15500	0.09000	0.06500	0.000970	0.000990	
53	0.14900	0.09000	0.06250	0.001050	0.001490	
54	0.13500	0.09000	0.06000	0.001130	0.001700	
55	0.13500	0.09000	0.06000	0.001230	0.002250	
56	0.13500	0.09000	0.05750	0.001330	0.002500	
57	0.13500	0.09000	0.05500	0.001440	0.003000	
58	0.13000	0.09000	0.05000	0.001560	0.003250	
59	0.13000	0.09000	0.05000	0.001700	0.003500	
60	0.13000	0.09000		0.001860	0.002500	0.12000
61	0.13000	0.09000		0.002030	0.002500	0.12000
62	0.13000	0.09000		0.002220	0.002500	0.21000
63	0.13000	0.09000		0.002440	0.002500	0.17000
64	0.13000	0.09000		0.002690	0.002500	0.15000
65	0.13000	0.09000		0.002960		0.26000
66	0.13000	0.09000		0.003270		0.26000
67	0.13000	0.09000		0.003620		0.22000
68	0.13000	0.09000		0.004000		0.22000
69	0.13000	0.09000		0.004420		0.23500
70	0.13000	0.09000		0.004890		0.25000
71	0.13000	0.09000		0.005410		0.25000
72	0.13000	0.09000		0.005980		0.25000
73	0.13000	0.09000		0.006610		0.25000
74	0.13000	0.09000		0.007310		0.25000
75	0.13000	0.09000		0.008080		0.25000
76	0.13000	0.09000		0.008930		0.25000
77	0.13000	0.09000		0.009860		0.25000
78	0.13000	0.09000		0.010900		0.25000
79	0.13000	0.09000		0.012040		0.25000
80	0.00000	0.00000		0.013300		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	0.000389	0.000140	71	0.019992	0.014418
20	0.000378	0.000130	72	0.022355	0.016168
21	0.000347	0.000119	73	0.025032	0.018133
22	0.000326	0.000108	74	0.028046	0.020336
23	0.000305	0.000097	75	0.031448	0.022799
24	0.000294	0.000097	76	0.035291	0.025574
25	0.000315	0.000108	77	0.039638	0.028706
26	0.000326	0.000119	78	0.044552	0.032249
27	0.000347	0.000130	79	0.050127	0.036288
28	0.000357	0.000140	80	0.056427	0.040900
29	0.000378	0.000162	81	0.063546	0.046181
30	0.000399	0.000173	82	0.071516	0.052207
31	0.000420	0.000194	83	0.080388	0.059119
32	0.000441	0.000205	84	0.090206	0.067014
33	0.000462	0.000227	85	0.100958	0.076043
34	0.000494	0.000248	86	0.112697	0.086260
35	0.000525	0.000270	87	0.125444	0.097697
36	0.000557	0.000302	88	0.139230	0.110333
37	0.000599	0.000324	89	0.154056	0.124060
38	0.000641	0.000356	90	0.169785	0.138596
39	0.000693	0.000389	91	0.186323	0.153781
40	0.000746	0.000432	92	0.203616	0.169582
41	0.000809	0.000464	93	0.221624	0.186062
42	0.000872	0.000508	94	0.240324	0.203310
43	0.000945	0.000551	95	0.259676	0.221454
44	0.001029	0.000605	96	0.279657	0.240602
45	0.001124	0.000659	97	0.300184	0.260788
46	0.001218	0.000713	98	0.321153	0.282020
47	0.001334	0.000767	99	0.342395	0.304128
48	0.001449	0.000832	100	0.363678	0.326862
49	0.003129	0.002398	101	0.384720	0.349726
50	0.003371	0.002516	102	0.405342	0.372535
51	0.003633	0.002657	103	0.425376	0.395075
52	0.003906	0.002797	104	0.444696	0.417150
53	0.004211	0.002938	105	0.463187	0.438577
54	0.004526	0.003089	106	0.480753	0.459205
55	0.004861	0.003251	107	0.497322	0.478883
56	0.005219	0.003434	108	0.512852	0.497524
57	0.005597	0.003629	109	0.525000	0.515052
58	0.006017	0.003866	110	0.525000	0.531414
59	0.006458	0.004147	111	0.525000	0.540000
60	0.006941	0.004493	112	0.525000	0.540000
61	0.007487	0.004903	113	0.525000	0.540000
62	0.008085	0.005400	114	0.525000	0.540000
63	0.008778	0.005962	115	0.525000	0.540000
64	0.009587	0.006620	116	0.525000	0.540000
65	0.010532	0.007366	117	0.525000	0.540000
66	0.011634	0.008208	118	0.525000	0.540000
67	0.012905	0.009169	119	1.000000	1.000000
68	0.014364	0.010260	120	1.000000	1.000000
69	0.016023	0.011480			
70	0.017882	0.012863			

*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	0.000382	0.000126	71	0.029797	0.018659
20	0.000350	0.000116	72	0.032690	0.020507
21	0.000329	0.000105	73	0.035849	0.022586
22	0.000307	0.000095	74	0.039284	0.024896
23	0.000297	0.000095	75	0.043036	0.027500
24	0.000318	0.000105	76	0.047170	0.030429
25	0.000329	0.000116	77	0.051728	0.033747
26	0.000350	0.000126	78	0.056816	0.037517
27	0.000360	0.000136	79	0.062508	0.041843
28	0.000382	0.000157	80	0.068879	0.046778
29	0.000403	0.000168	81	0.075991	0.052437
30	0.000424	0.000189	82	0.083899	0.058916
31	0.000445	0.000200	83	0.092676	0.066318
32	0.000466	0.000221	84	0.102375	0.074781
33	0.000498	0.000242	85	0.113049	0.084315
34	0.000530	0.000263	86	0.124741	0.094931
35	0.000562	0.000294	87	0.137567	0.106533
36	0.000604	0.000315	88	0.152831	0.118955
37	0.000647	0.000347	89	0.169038	0.132258
38	0.000700	0.000378	90	0.186083	0.146496
39	0.000753	0.000420	91	0.203902	0.161711
40	0.000816	0.000452	92	0.222452	0.177933
41	0.000880	0.000494	93	0.241680	0.195195
42	0.000954	0.000536	94	0.261544	0.213486
43	0.005819	0.002751	95	0.281971	0.232775
44	0.006063	0.002866	96	0.302884	0.252987
45	0.006318	0.002982	97	0.324159	0.274019
46	0.006583	0.003108	98	0.345655	0.295680
47	0.006848	0.003234	99	0.367142	0.317782
48	0.007431	0.003360	100	0.388384	0.340011
49	0.007674	0.003591	101	0.409202	0.362187
50	0.007918	0.003843	102	0.429427	0.384101
51	0.008173	0.004106	103	0.448931	0.405563
52	0.008448	0.004379	104	0.467598	0.426395
53	0.008734	0.004683	105	0.485332	0.446450
54	0.009052	0.004998	106	0.502058	0.465581
55	0.009402	0.005334	107	0.517736	0.483704
56	0.009794	0.005702	108	0.530000	0.500745
57	0.010229	0.006101	109	0.530000	0.516652
58	0.010727	0.006531	110	0.530000	0.525000
59	0.011310	0.007004	111	0.530000	0.525000
60	0.011978	0.007529	112	0.530000	0.525000
61	0.012741	0.008106	113	0.530000	0.525000
62	0.013632	0.008747	114	0.530000	0.525000
63	0.014670	0.009440	115	0.530000	0.525000
64	0.015868	0.010217	116	0.530000	0.525000
65	0.017257	0.011057	117	0.530000	0.525000
66	0.018826	0.012002	118	1.000000	1.000000
67	0.020596	0.013041	119	1.000000	1.000000
68	0.022567	0.014207	120	1.000000	1.000000
69	0.024751	0.015519			
70	0.027157	0.017000			

*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	0.00247	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