Pennsylvania Public School Employees' Retirement System

Five-Year Demographic Experience Review

Prepared as of June 30, 2020

March 4, 2021

Disclosures

The information contained herein is developed for the Board of Trustees and Staff of PSERS by Buck Global, LLC using generally accepted actuarial principles and techniques in accordance with all applicable Actuarial Standards of Practice (ASOPs). The purpose of this presentation is to provide key results of the June 30, 2020 five-year experience study. All recommendations contained in this report are consistent with each other, as appropriate.

Use of this presentation for any other purpose, or by anyone other than the Board of Trustees or the staff of PSERS, may not be appropriate and may result in mistaken conclusions because of failure to understand applicable assumptions, methods, or inapplicability of the presentation for that purpose. Buck should be asked to review any statement to be made on the basis of the results contained herein. Buck will accept no liability for any such statement made without prior review by Buck. No third party recipient of Buck's work product should rely upon Buck's work product absent involvement of Buck or without our approval.

The material contained herein is based on member and financial data, actuarial assumptions and methods, and System provisions applicable for the June 30, 2020 experience investigation of the Pennsylvania Public School Employees' Retirement System.

Where presented, references to "funded ratio" and "unfunded accrued liability" are measured on an actuarial value of assets basis. It should be noted that the same measurements using market value of assets would result in reduced funded ratios and increased unfunded accrued liabilities. Moreover, the funded ratios presented are appropriate for evaluating the need for and level of future contributions but provide no indication of the funded status of the System if the System were to settle (i.e., purchase annuities to cover) a portion or all of its liabilities.

See the appendix for a discussion of models used in calculating the results shown in this presentation.

Future actuarial measurements may differ significantly from current measurements due to System experience differing from that anticipated by the economic and demographic assumptions, increases or decreases expected as part of the natural operation of the methodology used for these measurements, and changes in System provisions or applicable law. An analysis of the potential range of future results is beyond the scope of this study.

David L. Driscoll is a Fellow of the Society of Actuaries and a Member of the American Academy of Actuaries. Edward Quinn and Salvador Nakar are Members of the American Academy of Actuaries. We meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. We are available to answer any questions on the material contained herein, or to provide explanations or further details as may be appropriate.

Experience Review

- Section 8502(j) of the Retirement Code provides that in every five-year period, the actuary of the System is to make an actuarial investigation and evaluation of the mortality, service and compensation experience of the members and beneficiaries covered under the System during the preceding five years.
  - This report presents the results of the System's non-mortality related demographic experience review for the five-year period July 1, 2015 through June 30, 2020, which include:
    - Withdrawal
    - Retirement
    - Disability
    - Withdrawal Annuity Benefit Commencement
    - Optional Forms of Payment Elections
  - This report discusses the current practice and application of the Society of Actuaries' Pub-2010 Public Retirement Plans Mortality Tables
  - The results of the System's mortality experience, economic experience and funding methods review for the five-year period July 1, 2015 through June 30, 2020 will be presented in June 2021 and will include:
    - Mortality
    - Investment Return
    - Inflation
    - Individual Salary Increases
    - Payroll Growth

Experience Review

- Act 5-2017 created two new classes of PSERS active members, Class T-G and Class T-H:
  - Employees who become members of PSERS on or after July 1, 2019 have 90 days to elect membership as Class T-G, Class T-H or participation in the DC plan only
  - Actuarial valuations currently apply the same demographic assumptions used for legacy Classes T-E and T-F to Classes T-G and T-H
  - Class T-G and Class T-H members were first reported during the June 30, 2020 actuarial valuation
    - As of the June 30, 2020 actuarial valuation, there were 15,122 Class T-G members with average service of 0.4 years and 91 Class T-H members with average service of 0.5 years
    - As of June 30, 2020, there is no Class T-G and Class T-H data accumulated to develop demographic assumptions solely for Class T-G and Class T-H active members
    - The Class T-G and Class T-H experience will be reviewed when the next scheduled study is prepared as of June 30, 2025 and changes, if warranted, will be recommended at that time

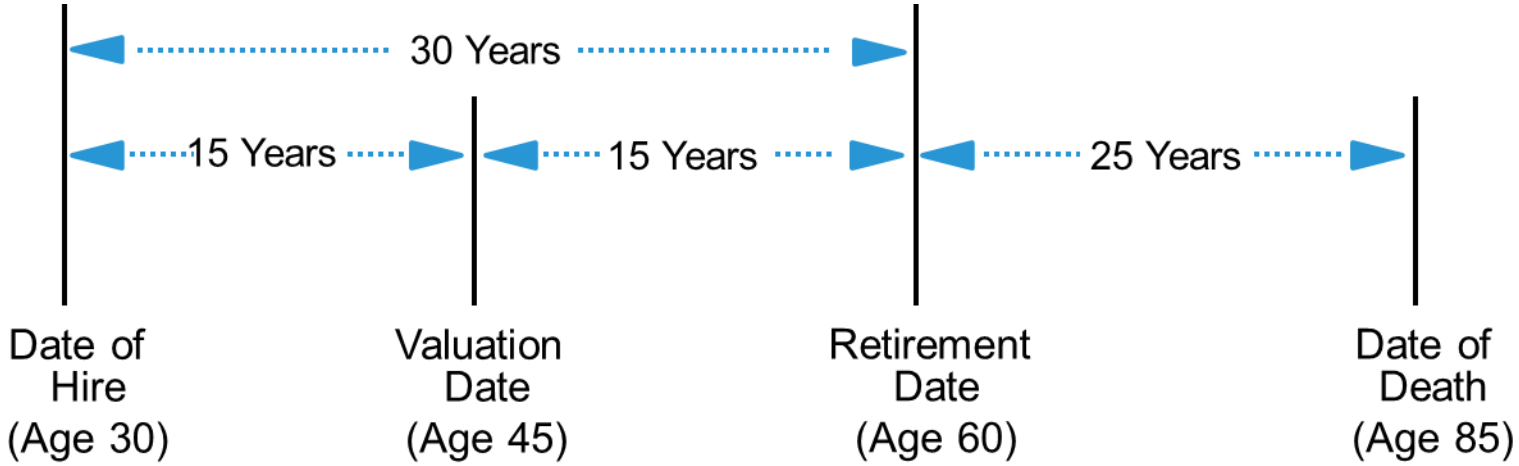
Experience Review

- Act 120-2010 created two new classes of PSERS active members, Class T-E and Class T-F:
  - Employees who became members of PSERS between June 30, 2011 and July 1, 2019 were automatically enrolled as Class T-E members but had the option to elect membership into Class T-F within 45 days of enrollment
  - Actuarial valuations currently apply the same demographic assumptions used for legacy Classes T-C and T-D to Classes T-E and T-F
  - Class T-E and Class T-F members were first reported during the June 30, 2012 actuarial valuation
    - As of the June 30, 2020 actuarial valuation, there were 64,658 Class T-E members with average service of 3.6 years and 14,559 Class T-F members with average service of 4.1 years.
    - As of June 30, 2020, the Class T-E and Class T-F data accumulated:
      - Shows credible experience information for non-vested withdrawal prior to 10 years of Service and for Superannuation (age 65 with 3 years of service)
      - Does not provide credible information to examine experience for vested withdrawal after 10 years of Service and vested withdrawal after age 55 with 25 years of Service. The Class T-E and Class T-F experience will be reviewed when the next scheduled study is prepared as of June 30, 2025 and changes, if warranted, will be recommended at that time.

Things That Happen to Members (Demographic Assumptions)

- KNOWN at valuation date:
  - Age
  - Gender
  - Service to date
  - Membership class

- ASSUMED at valuation date:
  - Withdrawal
  - Retirement rates
  - Disability rates
  - Death rates before and after withdrawal or retirement



Selection of Assumptions

What Assumption	Who Recommends to the Board
• Demographic:	• Demographic:
— Withdrawal	— Actuary
— Retirement	
— Disability	
— Withdrawal Annuity Benefit Commencement	
— Optional forms of payment elections	
— Mortality	
— Option 4 Lump Sum Elections	— PSERS staff and Actuary

Actuarial Assumptions - Demographic

- Death After Retirement
- Death in Active Service
- Disability with at least 5 years
- Withdrawal
  - Members enrolled prior to enactment of Act 120 (Classes T-C and T-D)
    - Non-Vested with less than 5 years
    - Vested with at least 5 years but less than 10 years
    - Vested with at least 10 years
  - Members enrolled after enactment of Act 120 (Classes T-E and T-F) and Act 5 (Classes T-G and T-H)
    - Non-Vested with less than 10 years
    - Vested with at least 10 years
- Early Retirement
  - Age 55 with 25 Years
  - Age 57 with 25 Years for Class T-G only

Actuarial Assumptions - Demographic

- Superannuation Retirement
  - Classes T-C and T-D
    - Age 62
    - Age 60 with 30 years
    - 35 years
  - Classes T-E and T-F
    - Age 65 with 3 years
    - Any combination of age and service that totals 92 with at least 35 years of service
  - Classes T-G and T-H
    - Age 67 with 3 years
    - For Class T-G only, any combination of age and service that totals 97 with at least 35 years of service
- Age 74 Ultimate Retirement
- Withdrawing member benefit commencement – Immediate or deferred
- Optional forms of payment elections – Refund of accumulated deductions at retirement and/or form of payment elected by member

Setting Demographic Assumptions

- Based on five-year Experience Review
- Full review covers July 1, 2015 - June 30, 2020
- Compare past experience (“actual”) with assumptions (“expected”)
- Determine trends
- Make judgments about future

Setting Demographic Assumptions

- Non-Mortality Related
  - The expected number of separations from service on account of withdrawal, disability and service retirement is calculated by multiplying the rates of separation used as a basis for the active service tables by the number of those exposed to risk
  - For each decrement, the actual number of those who separated from service is then compared with the expected number
  - If the ratio of actual to expected is 100%, the table has exactly predicted what actually occurred. If the ratio of actual to expected is greater than 100%, then the table has underestimated actual experience. If the ratio is less than 100%, then the table has overstated actual experience
  - The ideal adjustment to the current non-mortality related rates is to produce an expected number that falls between the current expected number caused by the assumption and the actual number of separations

Setting Demographic Assumptions

- Mortality Related
  - Mortality trends among the plan population groups are examined through the relationship of “amounts” that determine liability that was expected to be released due to deaths versus the actual amount released due to actual deaths
    - The expected “amount” that should have been released based on the mortality table being examined (expected)
    - The actual “amount” released based on the mortality table being examined (actual)
    - If the ratio of actual to expected is 100%, the table has exactly predicted what actually occurred. If the ratio of actual to expected is greater than 100%, then the table has underestimated actual experience. If the ratio is less than 100%, then the table has overestimated actual experience
    - The ideal adjustment to the current mortality related rates is to find a mortality table basis that produces an expected amount released that is close to the amount actually released
  - Mortality has continually been improving over the last decade
  - Mortality expected to improve in the future
  - ASOP No. 35 states that the actuary should “include an assumption as to expected mortality improvement after the measurement date.”

Mortality Assumptions

- In January 2015 the Society of Actuaries (SOA) and the Retirement Plans Experience Committee (RPEC or “the Committee”) initiated a mortality study of public pension plans
  - The primary focus of this study was a comprehensive review of recent mortality experience of public retirement plans in the United States
- In January 2019 the SOA published the Pub-2010 Public Retirement Plans Mortality Tables Report with the results of the study
  - The analysis included several versions of the table based on job types (Public Safety, Teachers and General Employees) and income levels (above and below median)
- Since the Pub-2010 publication, numerous teacher retirement systems have adopted it
- The System population
  - Annual valuation data provided to Buck does not contain information on members’ job description
  - PSERS staff communicated that current in-house data estimates 48% to 58% of System active members are teachers and or certified staff
- We are considering a mortality table basis of a blended table based on 50% PubT-2010 (Total Teacher dataset) and 50% PubG-2010 (Total General Employees dataset)

Mortality Assumptions

- Mortality Improvement Scale
  - In general, the rates of mortality observed in America decline over time; each generation lives longer than preceding generations
  - Actuarial professional standards of practice recommend projecting these mortality improvements into the future
  - Theoretically will not have to update mortality (as much) in future experience reviews
  - We are considering the Buck Modified MP-2020 Improvement Scale

Mortality Assumptions

- Experience Credibility
  - The decision on what table to use and whether to adjust for actual System experience is based on the “exposures” and expected number of deaths
  - Credibility factor is a measurement of the reliability of the System experience as compared to the broader experience reflected in standard tables
  - In general, PSERS is large enough to generate statistically credible mortality experience
    - This enables Buck to adjust the probabilities found in a standard table to reflect the experience of the System, where necessary
    - Active and service retiree groups will have a higher degree of credibility because of sufficient System experience
    - Disabled retiree, beneficiaries & survivor annuitants and vestee mortality will, generally, have a lesser degree of credibility due to the limited System experience

Mortality Assumptions

- Buck is currently analyzing various applications of the Pub-2010 tables for best fit to PSERS
  - Considering specific mortality tables for actives and various retiree classes
  - The published Pub-2010 mortality tables include several versions:
    - Based on headcount or amount weighted methods
    - Based on job types (Public Safety, Teachers and General Employees) and income levels (above and below median)
  - Under the amount weighted method, “amount” can be based on:
    - Liability
    - Benefit amount (for retirees), Pay (for actives)
- Buck will provide a five-year examination of mortality experience and final recommendations for updated mortality assumptions at the upcoming June Board meeting

Disability Retirement - Male

With at Least 5 Years of Service						
Central Age	Actual Separations	Expected Separations		Exposed	Actual / Expected	
		Current	Proposed		Current	Proposed
Under 33	0	5	2	18,955	0%	0%
35	6	20	13	33,613	30	46
40	13	43	23	39,019	30	57
45	31	70	45	41,256	44	69
50	75	110	88	38,176	68	82
55	107	152	128	34,491	70	85
60	88	134	104	28,055	66	85
65	13	17	14	12,853	76	93
70	2	6	4	4,772	33	50
Total	335	557	421	251,190	60%	80%

Recommendation: Decrease rates since the incidence of actual disability retirements is lower than expected.

Disability Retirement - Female

With at Least 5 Years of Service						
Central Age	Actual Separations	Expected Separations		Exposed	Actual / Expected	
		Current	Proposed		Current	Proposed
Under 33	8	12	11	53,901	67%	73%
35	12	47	26	85,225	26	46
40	29	85	53	88,458	34	55
45	90	134	110	99,661	67	82
50	155	247	194	107,979	63	80
55	291	367	323	111,325	79	90
60	199	303	231	96,398	66	86
65	23	31	26	37,204	74	88
70	8	10	8	8,501	80	100
Total	815	1,236	982	688,652	66%	83%

Recommendation: Decrease rates since the incidence of actual disability retirements is lower than expected.

Classes T-C and T-D Experience

- Withdrawal
  - Non-Vested with less than 5 years
  - Vested with at least 5 years but less than 10 years
  - Vested with at least 10 years
- Early Retirement
  - Age 55 with 25 Years
- Superannuation Retirement
  - Age 62
  - Age 60 with 30 years
  - 35 years

Classes T-C and T-D Experience
Non-Vested Withdrawals - Male

With Less Than 5 Years of Service						
Central Age	Actual Separations	Expected Separations		Exposed	Actual / Expected	
		Current	Proposed		Current	Proposed
20	2	1	1	5	200%	200%
25	112	63	93	426	178	120
30	326	239	281	1,879	136	116
35	314	248	280	1,849	127	112
40	265	218	241	1,505	122	110
45	262	238	250	1,652	110	105
50	302	250	276	1,745	121	109
55	312	220	266	1,709	142	117
60	186	144	165	1,189	129	113
Total	2,081	1,621	1,853	11,959	128%	112%

Recommendation: Increase the rates since the total incidence of actual non-vested withdrawals is higher than expected.

Classes T-C and T-D Experience
Non-Vested Withdrawals - Female

With Less Than 5 Years of Service						
Central Age	Actual Separations	Expected Separations		Exposed	Actual / Expected	
		Current	Proposed		Current	Proposed
20	2	0	0	2	0%	0%
25	110	82	111	608	134	99
30	656	549	602	3,974	119	109
35	551	515	532	3,631	107	104
40	538	485	512	3,980	111	105
45	701	572	635	4,953	123	110
50	695	547	611	4,690	127	114
55	576	449	513	3,822	128	112
60	366	293	330	2,392	125	111
Total	4,195	3,492	3,846	28,052	120%	109%

Recommendation: Increase the rates since the total incidence of actual non-vested withdrawals is higher than expected.

Classes T-C and T-D Experience
Vested Withdrawals - Male

With at Least 5 Years of Service but Less Than 10 Years of Service Can Elect Immediate Retirement or Deferred Retirement						
Central Age	Actual Separations	Expected Separations		Exposed	Actual / Expected	
		Current	Proposed		Current	Proposed
Under 28	63	35	56	609	180%	113%
30	428	373	425	11,060	115	101
35	405	307	360	9,561	132	113
40	237	193	216	4,856	123	110
45	217	169	193	3,728	128	112
50	189	153	171	3,448	124	111
55	205	166	185	3,739	123	111
60	217	169	193	3,036	128	112
Total	1,961	1,565	1,799	40,037	125%	109%

Recommendation: Actual withdrawals were higher than expected for all ages and we recommend increasing the rates.

Classes T-C and T-D Experience
Vested Withdrawals - Female

With at Least 5 Years of Service but Less Than 10 Years of Service Can Elect Immediate Retirement or Deferred Retirement						
Central Age	Actual Separations	Expected Separations		Exposed	Actual / Expected	
		Current	Proposed		Current	Proposed
Under 28	86	70	70	943	123%	123%
30	1,840	2,001	1,958	33,082	92	94
35	1,444	1,368	1,406	24,746	106	103
40	748	667	707	13,695	112	106
45	994	751	875	16,661	132	114
50	1,139	835	986	18,846	136	116
55	1,002	704	853	16,073	142	117
60	779	526	663	8,811	148	117
Total	8,032	6,922	7,518	132,857	116%	107%

Recommendation: Actual withdrawals were higher than expected for all ages after age 30 and we recommend increasing the rates at these ages. Actual withdrawals at age 30 were lower than expected and we recommend decreasing the rates. There is a very small number of members younger than age 30 and we expect no one to remain in this age group; no change is recommended.

Classes T-C and T-D Experience
Vested Withdrawals - Male

With at Least 10 Years of Service Can Elect Immediate Retirement or Deferred Retirement						
Central Age	Actual Separations	Expected Separations		Exposed	Actual / Expected	
		Current	Proposed		Current	Proposed
Under 33	46	41	42	1,594	112%	110%
35	350	324	348	21,610	108	101
40	475	439	465	32,772	108	102
45	535	500	514	36,466	107	104
50	578	644	634	33,546	90	91
55	794	569	674	21,496	140	118
60	941	802	863	11,939	117	109
Total	3,719	3,319	3,540	159,423	112%	105%

Recommendation: Actual withdrawals were higher than expected for all ages, except age 50, and we recommend increasing the rate at these ages. Actual withdrawals at age 50 were lower than expected and we recommend decreasing the rates.

Classes T-C and T-D Experience
Vested Withdrawals - Female

With at Least 10 Years of Service Can Elect Immediate Retirement or Deferred Retirement						
Central Age	Actual Separations	Expected Separations		Exposed	Actual / Expected	
		Current	Proposed		Current	Proposed
Under 33	130	139	135	3,449	94%	96%
35	1,502	1,565	1,554	54,924	96	97
40	1,248	1,136	1,185	70,979	110	105
45	1,230	1,300	1,261	78,791	95	98
50	1,794	1,747	1,764	84,797	103	102
55	2,896	2,344	2,565	77,716	124	113
60	4,158	3,710	3,933	53,078	112	106
Total	12,958	11,941	12,397	423,734	109%	105%

Recommendation: Actual total withdrawals were higher than expected at age 40 and for all ages after age 45. We recommend an increase to the rates at these ages. Actual experience at age 45 and under age 40 were lower than expected and we recommend decreasing the rate.

Classes T-C and T-D Experience
Early Retirement - Male

Age 55 with at Least 25 Years Service, but Not Eligible for Superannuation Immediate Retirement with 3% per annum Early Retirement Reduction from Superannuation						
Age	Actual Separations	Expected Separations		Exposed	Actual / Expected	
		Current	Proposed		Current	Proposed
55	270	492	384	2,648	55%	70%
56	330	432	363	2,504	76	91
57	277	359	306	2,107	77	91
58	248	312	261	1,803	79	95
59	343	346	344	1,594	99	100
60	109	111	112	771	98	97
61	198	191	193	666	104	103
Total	1,775	2,243	1,963	12,093	79%	90%

Recommendation: Actual retirements were lower than expected for all ages lower than age 61 and we recommend decreasing the rates. Actual retirements were higher than expected at 61 and we recommend increasing the rate.

Classes T-C and T-D Experience
Early Retirement - Female

Age 55 with at Least 25 Years Service, but Not Eligible for Superannuation Immediate Retirement with 3% per annum Early Retirement Reduction from Superannuation						
Age	Actual Separations	Expected Separations		Exposed	Actual / Expected	
		Current	Proposed		Current	Proposed
55	572	909	709	4,892	63%	81%
56	539	776	669	4,613	69	81
57	571	735	647	4,315	78	88
58	549	699	603	4,021	79	91
59	762	800	775	3,744	95	98
60	318	387	341	2,270	82	93
61	671	710	687	2,369	95	98
Total	3,982	5,016	4,431	26,224	79%	90%

Recommendation: Actual retirements were lower than expected for all ages and we recommend decreasing the rates.

Classes T-C and T-D Experience
Normal Retirement (Superannuation) - Male

Age 62, Age 60 with 30 Years, or 35 Years						
Age	Actual Separations	Expected Separations		Exposed	Actual / Expected	
		Current	Proposed		Current	Proposed
Under 53	2	1	1	4	200%	200%
55	184	227	198	763	81	93
60	1,685	3,137	2,395	7,203	54	70
65	2,946	2,887	2,811	12,885	102	105
68	254	236	246	1,228	108	103
69	248	203	210	1,051	122	118
Subtotal under 70	5,319	6,691	5,861	23,134	79%	91%
70+	532	502	519	2,596	106	103
Total All Ages	5,851	7,193	6,380	25,730	81%	92%

Recommendation: There is insufficient experience at ages under 53 to justify a change in the assumed rates at those ages. Actual retirements at ages 55 and 60 were lower than expected and we recommend a decrease to the rates for these ages. Actual retirements after age 60 were higher than expected and we recommend an increase to these rates.

Classes T-C and T-D Experience
Normal Retirement (Superannuation) - Female

Age 62, Age 60 with 30 Years, or 35 Years						
Age	Actual Separations	Expected Separations		Exposed	Actual / Expected	
		Current	Proposed		Current	Proposed
Under 53	0	1	1	5	0%	0%
55	157	176	163	689	89	96
60	4,841	11,215	6,367	20,585	43	76
65	9,161	9,063	9,073	37,761	101	101
68	583	584	578	2,629	100	101
69	498	467	472	2,050	107	106
Subtotal under 70	15,240	21,506	16,654	63,719	71%	92%
70+	917	943	911	4,329	97	101
Total All Ages	16,157	22,449	17,565	68,048	72%	92%

Recommendation: There is insufficient experience at ages under 53 to justify a change in the assumed rates at those ages. Actual retirements at ages 55, 60 and after age 69 were lower than expected and we recommend a decrease to the rates for these ages. Actual retirements after age 60 but prior to age 70 were higher than expected and we recommend an increase to these rates.

Classes T-E and T-F Experience

- Withdrawal
  - Non-Vested with less than 10 years
  - Vested with at least 10 years
- Early Retirement
  - Age 55 with 25 Years
- Superannuation Retirement
  - Age 65 with 3 years
  - Age + Service is at least 92 with 35 Years

Classes T-E and T-F Experience

- Currently, we apply the same set of assumed probabilities used for Classes T-C and T-D members to Classes T-E and T-F members
- Significant differences in benefit provisions from non-Act 120 member benefits warrant separate demographic assumption sets
- As of June 30, 2020, the Class T-E and Class T-F data accumulated:
  - Shows experience for non-vested withdrawal prior to 10 years of Service and for Superannuation (age 65 with 3 years of service)
  - Is insufficient to establish vested withdrawal after 10 years of Service, early retirement after age 55 with 25 years of Service and the Superannuation (Rule of 92)
    - Continue to apply the same probability used for Classes T-C and T-D to Classes T-E and T-F withdrawal after 10 years of Service, early retirement after age 55 with 25 years of Service until enough experience data is accumulated to develop separate decrements for these classes
    - Adopt the same decrements developed for Classes T-E and T-F Superannuation (age 65 with 3 years of service) to anticipate Superannuation retirements under the Rule of 92
    - The Class T-E and Class T-F experience will be reviewed when the next scheduled study is prepared as of June 30, 2025 and changes, if warranted, will be recommended at that time

Classes T-E and T-F Experience
Non-Vested Withdrawals - Male

With Less Than 10 Years of Service						
Central Age	Actual Separations	Expected Separations		Exposed	Actual / Expected	
		Current	Proposed		Current	Proposed
20	1,144	810	968	3,734	141%	118%
25	3,531	2,731	3,220	18,920	129	110
30	2,281	1,898	2,075	18,447	120	110
35	1,357	1,139	1,252	10,357	119	108
40	1,033	948	992	7,547	109	104
45	1,113	984	1,047	7,549	113	106
50	1,146	1,014	1,080	7,900	113	106
55	932	867	898	7,537	107	104
60	790	759	775	6,928	104	102
Total	13,327	11,150	12,307	88,919	120%	108%

Recommendation: Increase the rates since the total incidence of actual non-vested withdrawals is higher than expected.

Classes T-E and T-F Experience
Non-Vested Withdrawals - Female

With Less Than 10 Years of Service						
Central Age	Actual Separations	Expected Separations		Exposed	Actual / Expected	
		Current	Proposed		Current	Proposed
20	1,169	790	971	3,537	148%	120%
25	7,310	6,501	7,159	49,237	112	102
30	5,768	5,587	5,691	48,721	103	101
35	3,289	3,277	3,283	26,501	100	100
40	3,042	2,827	2,935	25,457	108	104
45	3,137	2,849	2,994	27,246	110	105
50	2,610	2,424	2,516	23,471	108	104
55	1,809	1,693	1,752	16,300	107	103
60	1,305	1,205	1,262	10,860	108	103
Total	29,439	27,153	28,563	231,330	108%	103%

Recommendation: Increase the rates since the total incidence of actual non-vested withdrawals is higher than expected.

Classes T-E and T-F Experience
Normal Retirement (Superannuation) - Male

Age 65 with 3 Years						
Age	Actual Separations	Expected Separations		Exposed	Actual / Expected	
		Current	Proposed		Current	Proposed
65	71	93	71	433	76%	100%
66	48	78	59	363	62	81
67	30	61	52	316	49	58
68	33	54	46	282	61	72
69	34	48	36	248	71	94
Subtotal under 70	216	334	264	1,642	65%	82%
70+	78	131	111	681	60	70
Total All Ages	294	465	375	2,323	63%	78%

Recommendation: Total actual retirements were lower than expected and we recommend decreasing the rates.

Classes T-E and T-F Experience
Normal Retirement (Superannuation) - Female

Age 65 with 3 Years						
Age	Actual Separations	Expected Separations		Exposed	Actual / Expected	
		Current	Proposed		Current	Proposed
65	82	106	93	476	77%	88%
66	60	97	68	350	62	88
67	35	58	51	262	60	69
68	35	53	47	240	66	74
69	32	44	37	192	73	86
Subtotal under 70	244	358	296	1,520	68%	82%
70+	85	114	102	522	75	83
Total All Ages	329	472	398	2,042	70%	83%

Recommendation: Total actual retirements were lower than expected and we recommend decreasing the rates.

Classes T-G and T-H Experience

- Withdrawal
  - Non-Vested with less than 10 years
  - Vested with at least 10 years
- Early Retirement
  - Class T-G: Age 57 with 25 Years
  - Class T-H: Age 55 with 25 Years
- Superannuation Retirement
  - Age 67 with 3 years
  - For Class T-G only, Age + Service is at least 97 with at least 35 years of service

Classes T-G and T-H Experience

- Currently, we apply the same set of assumed probabilities used for Classes T-E and T-F members to Classes T-G and T-H members
- Significant differences in benefit provisions from non-Act 5 member benefits warrant separate demographic assumption sets
- As of June 30, 2020, the Class T-G and Class T-H data accumulated is insufficient to develop separate decrements for these classes
- The Class T-G and Class T-H experience will be reviewed when the next scheduled study is prepared as of June 30, 2025 and changes, if warranted, will be recommended at that time

Ultimate Retirement Age

- The valuation currently assumes that all active members will retire no later than age 74

- Retirement information during the examination period shows that the active population who continue to remain active past age 74 decreases annually by approximately 25%

- Recommendation: Assume that all active members will retire no later than age 80

Withdrawing Member Benefit Commencement

- Members may elect to commence benefit immediately upon vested withdrawal from the System and receive a reduced annuity based on:
  - For Class T-C, Class T-D, Class T-E and Class T-F members, early retirement factors are based on the statutory interest rate of 4%
  - For Class T-G and T-H members, early retirement factors from age 62 to superannuation are based on the statutory interest rate of 4%. From commencement age to age 62, early retirement factors are based on the assumed long-term return on System assets as adopted by the Board
- Current valuation assumption: 90% of members are assumed to commence payment immediately and 10% are assumed to defer payment to superannuation age
- Withdrawal after vesting information during the examination period was compared to the retired member data used for the annual valuations and shows approximately 37% of the withdrawals commenced benefits immediately
- Recommendation: Assume 50% of members are assumed to commence payment immediately and 50% are assumed to defer payment to superannuation age

Optional Forms of Benefit Payment at Retirement: Annuity Payments

- Members, upon retirement, may elect to receive the Maximum Single Life Annuity (MSLA), or one of the following annuity payment options that is actuarially equivalent to the MSLA:
  - Option 1 - Guarantee of total payments equal to maximum single life annuity reserve
  - Option 2 - 100% Joint and Survivor annuity
  - Option 3 - 50% Joint and Survivor annuity
  - Option 4 - Some other form of annuity payment that is actuarially equivalent to the MSLA (subject to the System's Code restrictions)

- The System's optional forms of payment factors are based on a 4% interest rate.
  - Presents a reduction in liability to the System's annual valuation which, currently, uses a 7.25% rate of investment return

Optional Forms of Benefit Payment at Retirement: Annuity Payments

- During the examination period, the distribution of optional forms of annuity payment elected by retiring members were:
  - 47.0% elected MSLA
  - 23.1% elected Option 1
  - 19.7% elected Option 2
  - 8.9% elected Option 3
  - 1.3% elected Option 4

- Proposed valuation assumption:
  - 45% will elect MSLA
  - 25% will elect Option 1
  - 20% will elect Option 2 (assuming males are 3 years older than females)
  - 10% will elect Option 3 (assuming males are 3 years older than females)
  - 0% will elect Option 4

- Recommendation: Adjust the optional form of benefit payment election assumption to reflect recent experience

Optional Forms of Benefit Payment at Retirement:
Option 4 – Withdrawal of Accumulated Deductions at Retirement

- Members may elect to receive a lump sum that is less than or equal to the member's Accumulated Deductions at retirement. In addition, the member receives a reduced annuity.

- The System's factors for calculating the offset due to a withdrawal are based on:
  - For Classes T-C and T-D: 4% interest rate
    - Presents an additional liability to the System's annual valuation which, currently, uses a 7.25% rate of investment return.
  - For Classes T-E, T-F, T-G and T-H: the current rate of investment return assumption used for the annual valuation

Optional Forms of Benefit Payment at Retirement: Option 4 – Withdrawal of Accumulated Deductions at Retirement

- Current valuation assumption: Assume 80% of all eligible retirements will elect an Option 4 form of payment - withdrawing all accumulated deductions
  - Annual valuation data provided to Buck:
    - Does not contain information on withdrawal of accumulated deductions upon retirement
    - Retired data provides information on the balance of a member's accumulated deductions: 72% of retired member records during the examination period report no remaining balance for the accumulated deductions
  - PSERS staff communicated that in-house data shows:
    - 72% of recent Class T-C and Class T-D retirements elect to receive a partial or full withdrawal of the member's accumulated deductions
    - 48% of recent Class T-E and Class T-F retirements elect to receive a partial or full withdrawal of the member's accumulated deductions
    - No information is available for Class T-G and Class T-H retirements

- Recommendation:
  - Assume 75% of all eligible Class T-C and Class T-D retirements will elect an Option 4 form of payment - withdrawing all accumulated deductions
  - Assume 50% of all eligible Class T-E, Class T-F, Class T-G and Class T-H retirements will elect an Option 4 form of payment - withdrawing all accumulated deductions

Cost Impact of Non-Mortality Related Demographic Assumption Changes

Item	June 30, 2020 Actuarial Valuation				
	Unfunded Accrued Liability[1]	Funded Ratio[1]	Normal Cost Rate	Employer Pension Rate[2]	Employer Pension Contribution[2 3]
BEFORE CHANGES	**$44,034 Mil**	**59.2%**	**7.20%**	**33.99%**	**$4,857 Mil**
Non-Mortality Related Demographic Assumptions[4]					
(1) Disability retirement	(20)	0.0	(0.04)	(0.05)	(7)
(2) Withdrawal prior to Retirement	193	(0.1)	(0.38)	(0.28)	(40)
(3) Retirement (Early, Superannuation and Late)	(841)	0.5	(0.19)	(0.60)	(86)
(4) Optional forms of benefit payment	(258)	0.1	(0.31)	(0.44)	(63)
TOTAL DEMOGRAPHIC CHANGES	$(926) Mil	0.5%	(0.92%)	(1.37)%	$(196) Mil
AFTER REFLECTING CHANGES	$43,108 Mil	59.7%	6.28%	32.62%	$4,661 Mil

1. Actuarial value of assets basis.
2. Without regard to the Act 5 DC contribution and Premium Assistance.
3. Based on the fiscal year 2022 appropriation pay of $14,289,000,000.
4. The cost effect of each proposed assumption is subject to change depending on the sequence of recognized assumptions.

Consideration of Risk

- ASOP 51 risk - actual future measurements deviating from expected future measurements due to actual experience deviating from actuarial assumptions

- Experience studies attempt to mitigate this risk by re-evaluating the actuarial assumptions compared to past experience on a regular basis
  - Use combination of past experience and professional judgement

- Demographic experience study addresses the risk that actual demographic experience will be different than assumed
  - Longevity risk – Members living longer than assumed increases costs
    - Mortality assumption addresses this risk
  - Risk due to option 4 withdrawal of accumulated deductions at retirement - more retirees are electing a lump sum than assumed
    - possible liquidity issues increasing investment risk
    - For Class T-C and T-D difference in interest versus investment return rate presents an additional liability
  - Retirement risk - more retirees commence their benefits earlier than assumed generally increases costs
    - May pay out subsidized early and superannuation benefits for a longer period of time than assumed
    - May be offset some by lower accrued benefits at retirement due to lower salary and service at retirement than assumed
  - Withdrawal prior to retirement risk – less members withdraw than assumed generally increases the costs

- Contribution risk – actuarial assumption out of line with actual experience may create losses that make contributions more volatile and expensive at times when the System sponsor is less able to afford the costs. This increases the risk of not contributing an actuarially determined contribution.

Experience Study – Next Steps

- This presentation analyzed the current non-mortality related demographic assumptions used to determine liabilities for funding purposes, GASB disclosure purposes and other related uses against the System's actual experience during the five-year period ending June 30, 2020
- At the upcoming June Board meeting, Aon and Buck will provide the five-year experience examination of the current mortality and economic assumptions used to determine liabilities for funding purposes, which will include:
  - Aon
    - Expected Long Term Rate of Return on Assets / Discount rate
    - Inflation Rate / CPI
  - Buck
    - Mortality
    - Individual Salary Increase
    - Payroll Growth
    - Update of Administrative Option Factors

Appendix

Use of Models

Actuarial Standard of Practice No. 56 (“ASOP 56”) provides guidance to actuaries when performing actuarial services with respect to designing, developing, selecting, modifying, using, reviewing, or evaluating models. For this presentation Buck used the following:

- internally developed and third party model to compare actual versus assumed experience and determine proposed assumptions to use for valuing the liabilities in the third-party software
- third-party software to calculate the liabilities associated with the System based on current and proposed assumptions
- an internally developed model that applies applicable funding methods and policies to the liabilities derived from the output of the third-party software and other inputs, such as plan assets and contributions, to determine the contribution rates and funded ratios

Buck has an extensive review process for annual valuations whereby the results of the liability calculations are checked using detailed sample output, changes from year to year are summarized by source, and significant deviations from expectations are investigated. Other outputs and the internal model are similarly reviewed in detail and at a high level for accuracy, reasonability and consistency with prior results. The models used for annual valuations are used for this presentation and any adaptations for this presentation are checked and reviewed by experts within the company who are familiar with applicable funding methods as well as the manner in which the model generates its output. If significant changes are made to the internal model, extra checking and review are completed.