

Arkansas Teacher Retirement System

Annual Actuarial Valuation of Annuities Being Paid to
Retirees and Beneficiaries

June 30, 2018



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November 27, 2018

Board of Trustees
Arkansas Teacher Retirement System
Little Rock, Arkansas

Dear Board Members:

Presented in this report are the results of the ***Annual Actuarial Valuation of annuities being paid to retirees and beneficiaries*** of the Arkansas Teacher Retirement System.

The date of the valuation was June 30, 2018 (using amounts payable as of July 1, 2018).

This report was prepared at the request of the Board and is intended for use by the Retirement System and those designated or approved by the Board. This report may be provided to parties other than the Retirement System only in its entirety and only with the permission of the Board. GRS is not responsible for unauthorized use of this report.

The valuation was based upon census data and financial information provided by the System's administrative staff. Preparation of this data requires considerable staff time. The helpful cooperation of the Arkansas Teacher Retirement System staff in furnishing the data is acknowledged with appreciation. We checked for internal and year-to-year consistency, but did not audit the data. We are not responsible for the accuracy or completeness of the data provided by ATRS.

This report was prepared using certain assumptions approved by the Board. The actuarial assumptions used for valuation purposes are summarized in the Appendix. These assumptions reflect experience during the period July 1, 2010 to June 30, 2015 and expectations for the future.

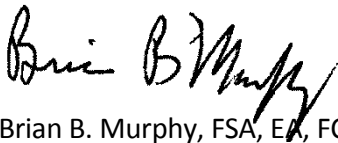
Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements; and changes in plan provisions or applicable law. The scope of an actuarial valuation does not contain an analysis of the potential range of such future measurements.

This is one of multiple documents comprising the actuarial results. The other document is the active and inactive valuation dated November 19, 2018.

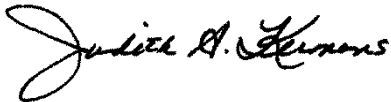
To the best of our knowledge, this report is complete and accurate and was made in accordance with standards of practice promulgated by the Actuarial Standards Board. The actuarial assumptions used for the valuation produce results which, individually and in the aggregate, are reasonable.

This report has been prepared by actuaries who have substantial experience valuing public employee retirement systems. Brian B. Murphy, Judith A. Kermans and Heidi G. Barry are Members of the American Academy of Actuaries (MAAA) and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. The actuaries submitting this report are independent of the plan sponsor.

Respectfully submitted,



Brian B. Murphy, FSA, EA, FCA, MAAA, PhD



Judith A. Kermans, EA, FCA, MAAA



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BBM/JAK/HGB:sc



Comments

As expected, during the year ended June 30, 2018 the number of retired lives increased, as did the total amount being paid monthly to retired lives.

The financing diagram on page 7 shows the general pattern in which cash benefits increase (the gold line). The schedule below shows how ATRS history illustrates the general pattern.

June 30	Retired Lives Receiving Benefits		
	No.	Annual Rates (millions)	% of Active Payroll#
1967	3,846	\$ 6.27	
1972	5,453	11.08	
1977	7,524	23.96	
1982	8,828	36.64	
1987	10,526	66.45	10.0%
1992	12,033	115.50	10.7%
1997	14,233	194.90	15.0%
1998	14,802	220.38	16.1%
1999	15,887	248.75	17.4%
2000	16,657	280.14	18.9%
2001	17,778	309.03	19.8%
2002	19,199	334.15	20.5%
2003	20,271	359.98	21.4%
2004	21,428	386.23	22.1%
2005	22,680	415.04	21.2%
2006	24,153	449.77	21.6%
2007	25,611	484.55	21.1%
2008	26,801	515.56	21.5%
2009	28,818	564.59	22.8%
2010	30,587	612.77	23.1%
2011	32,099	657.08	24.1%
2012	34,160	709.17	26.1%
2013	36,254	763.76	28.0%
2014	38,478	822.19	29.8%
2015	40,748	916.62	33.0%
2016	43,095	983.87	35.3%
2017	45,092	1,044.74	37.1%
2018	46,824	1,099.35	38.3%

Doesn't include payroll for retirees who have returned to work.

A significant financial goal for the Teacher Retirement System was to reach a point in time where System assets fully covered the liabilities for future benefit payments to retirees and beneficiaries then on rolls. This goal was achieved in 1980 and retired life liabilities continue to be 100% funded.

Other Observations

General Implications of Contribution Allocation Procedure or Funding Policy on Future Expected Plan Contributions and Funded Status

Given the plan's contribution allocation procedure, if all actuarial assumptions are met (including the assumption of the plan earning 7.50% on the actuarial value of assets), it is expected that:

- 1) The unfunded actuarial accrued liabilities will be fully amortized after 28 years;
- 2) The funded status of the plan will increase gradually towards a 100% funded ratio; and
- 3) The unfunded accrued liability will increase for an extended period before beginning to decline.

Limitations of Funded Status Measurements

Unless otherwise indicated, a funded status measurement presented in this report is based upon the actuarial accrued liability and the actuarial value of assets. Unless otherwise indicated, with regard to any funded status measurements presented in this report:

- 1) The measurement is inappropriate for assessing the sufficiency of plan assets to cover the estimated cost of settling the plan's benefit obligations, in other words of transferring the obligations to an unrelated third party in an arm's length market value type transaction.
- 2) The measurement is dependent upon the actuarial cost method which, in combination with the plan's amortization policy, affects the timing and amounts of future contributions. A funded status measurement in this report of 100% is not synonymous with no required future contributions. If the funded status were 100%, the plan would still require future normal cost contributions (i.e., contributions to cover the cost of the active membership accruing an additional year of service credit).
- 3) The measurement would produce a different result if the market value of assets were used instead of the actuarial value of assets, unless the market value of assets is used in the measurement.

Limitations of Project Scope

Actuarial standards do not require the actuary to evaluate the ability of the plan sponsor or other contributing entity to make required contributions to the plan when due. Such an evaluation was not within the scope of this project and is not within the actuary's domain of expertise. Consequently, the actuary performed no such evaluation.

FINANCIAL PRINCIPLES

Annual Reserve Transfers

The annual accounting transfers listed below are recommended so that retired life accounts will be fully funded as of the valuation date.

Reserve Account	June 30, 2018 Balance Reported	Transfer Amount	June 30, 2018 Balance After Transfer
Retiree Accounts			
RRA	\$ 11,366,265,784	\$ 136,292,238	\$ 11,502,558,022
808 RRA	12,599,124	499,746	13,098,870
SBA	102,835,207	4,207,860	107,043,067
Total Retiree Accounts	11,481,700,115	140,999,844	11,622,699,959
EAA	(5,509,753,553)	(140,999,844)	(5,650,753,397)
Total	\$ 5,971,946,562	\$ -	\$ 5,971,946,562

Lump sum death benefits for retirees are paid from the Employer Accumulation Account and are not included in the figures shown in this report. The liabilities for lump sum death benefits for retirees are currently \$119.6 million.

Financial Principles and Operational Techniques

Promises Made and To Be Paid For. As each year is completed, the System in effect hands an “IOU” to each member then acquiring a year of service credit. The “IOU” says: “The Arkansas Teacher Retirement System owes you one year’s worth of retirement benefits, payments in cash commencing when you qualify for retirement.”

The related *key financial questions* are:

Which generation of taxpayers contributes the money to cover the IOU?

The present taxpayers, who receive the benefit of the member’s present year of service?

Or the future taxpayers, who happen to be in Arkansas at the time the IOU becomes a cash demand?

The financial objective of the ATRS is that this year’s taxpayers contribute the money to cover the IOUs being handed out this year so that **the employer contribution rate will remain approximately level from generation to generation** -- our children and our grandchildren will not have to contribute greater percents of pay than we contribute now. This objective was set forth in Act 793 of 1977.

(There are systems which have **a design for deferring contributions to future taxpayers**, lured by a lower contribution rate now and putting aside the fact that the contribution rate must then relentlessly grow much greater over decades of time -- consume now, and let your children face higher contribution rates after you retire.)

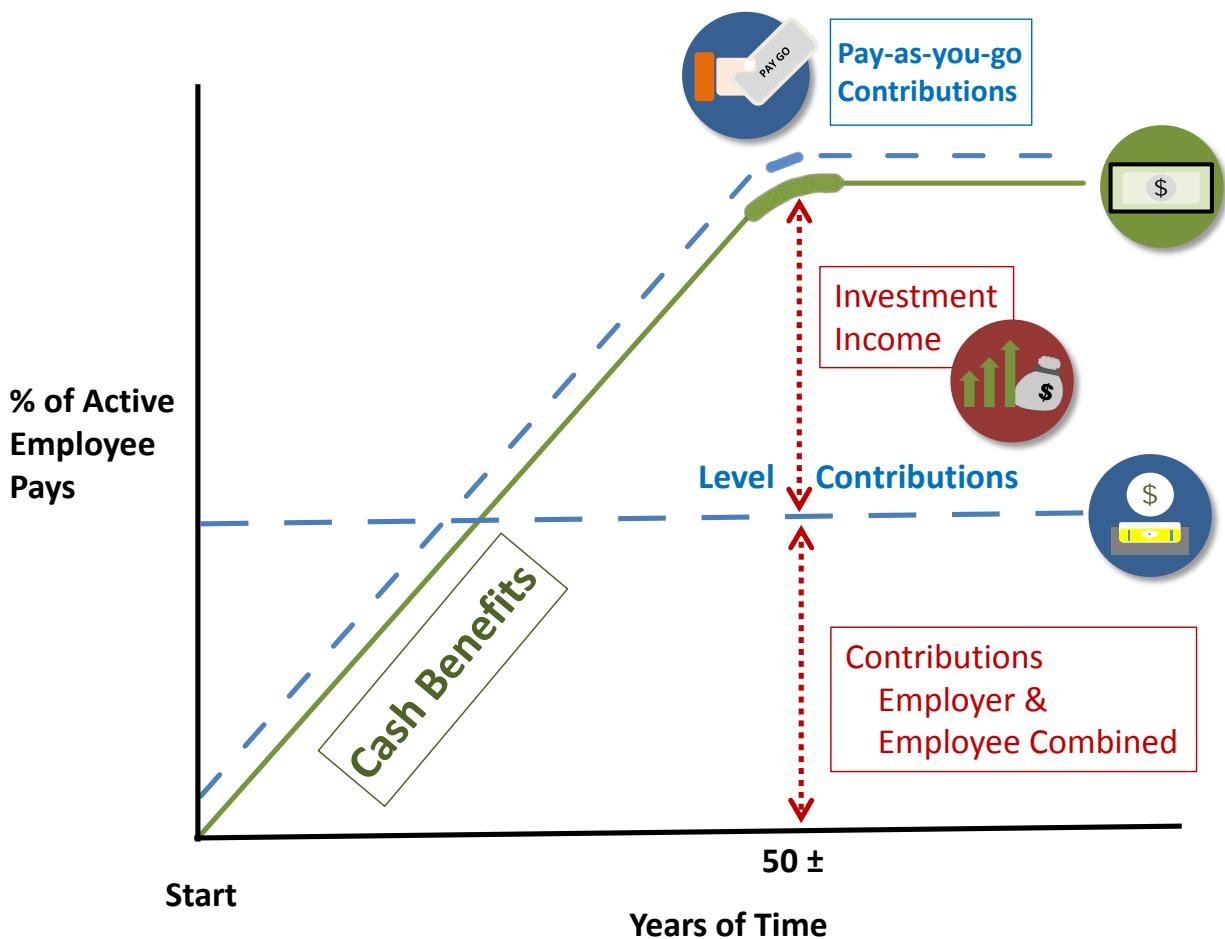
An inevitable byproduct of the level-cost design is the accumulation of reserve assets for decades and the income produced when the assets are invested. **Investment income** becomes the **third and largest contributor** for benefits to employees, and is interlocked with the contribution amounts required from employees and employers.

Translated to actuarial terminology, this level-cost objective means that the contribution rates must total at least the following:

- Normal Cost (the cost of members’ service being rendered this year)
- ... plus ...
- Interest on Unfunded Actuarial Accrued Liabilities (unfunded accrued liabilities are the difference between (i) liabilities for service already rendered and (ii) the accrued assets of the plan).

Computing Contributions to Support System Benefits. From a given schedule of benefits and from the employee data and asset data furnished, the actuary determines the contribution rates to support the benefits, by means of **an actuarial valuation**. An actuarial valuation has a number of ingredients such as: the rate of investment income which plan assets will earn; the rates of withdrawal of active members who leave covered employment before qualifying for any monthly benefit; the rates of mortality; the rates of disability; the rates of pay increases; and the assumed age or ages at actual retirement. In an actuarial valuation, assumptions must be made as to what the above rates will be, for the next year and for decades in the future. Only the subsequent actual experience of the System can indicate the degree of accuracy of the assumptions.

Reconciling Differences Between Assumed Experience and Actual Experience. Once actual experience has occurred and been observed, it will not coincide exactly with assumed experience, regardless of the accuracy of the assumptions or the skill of the actuary and the precision of the calculations made. The future can be predicted with considerable but not complete precision. ATRS copes with these continually changing differences by having annual actuarial valuations. Each actuarial valuation is a complete recalculation of assumed future experience, taking into account all past differences between assumed and actual experience. The result is continual adjustments in financial position.



CASH BENEFITS LINE. This relentlessly increasing line is the fundamental reality of retirement plan financing. It happens each time a new benefit is added for future retirements (and happens regardless of the design for contributing for benefits).

LEVEL CONTRIBUTION LINE. Determining the level contribution line requires detailed assumptions concerning a variety of experiences in future decades, including:

- **Economic Risk Areas**
 - Rates of investment return
 - Rates of pay increase
 - Changes in active member group size
- **Non-Economic Risk Areas**
 - Ages at actual retirement
 - Rates of mortality
 - Rates of withdrawal of active members (turnover)
 - Rates of disability

The Actuarial Valuation Process

The financing diagram on the preceding page shows the relationship between the two fundamentally different philosophies of paying for retirement benefits: the method where contributions match cash benefit payments (or barely exceed cash benefit payments, as in the Federal Social Security program), and is thus an **increasing contribution method**; and the **level contribution method** which equalizes contributions between the generations.

The actuarial valuation is the mathematical process by which the level contribution rate is determined, and the flow of activity constituting the valuation may be summarized as follows:

- A. **Census data**, furnished by plan administrator
 - Retired lives now receiving benefits
 - Former employees with vested benefits not yet payable
 - Active employees
- B. + **Asset data** (cash & investments), furnished by plan administrator
- C. + **Benefit provisions** that establish eligibility and amounts of payments to members
- D. + **Assumptions concerning future financial experience in various risk areas**, which assumptions are established by the Board of Trustees after consulting with the actuary
- E. + **The funding method** for employer contributions (the long-term planned pattern for employer contributions)
- F. + **Mathematically combining the assumptions, the funding method, and the data**
- G. = Determination of:
 - Plan financial position**, and/or
 - New Employer Contribution Rate**

BENEFIT PROVISIONS

Summary of Benefit Provisions

June 30, 2018

- 1. Post-Retirement Increases – A.C.A. §§ 24-7-713, 24-7-727 (compound COLA).** Each July 1, annuities are adjusted to be equal to the base annuity times 100% plus 3% for each full year in the period from the effective date of the base annuity to the current July 1. The base annuity is the amount of the member's annuity on the later of July 1, 2001 or the effective date of retirement, as re-determined by Acts 396 of 1999 and 992 of 1997. The July 1, 2009 cost of living adjustment for retirees was compounded. The annuity was set to 103% of the June 30, 2009 retirement benefit amount. After it was calculated on July 1, 2009, the base amount was reset to be the July 1, 2009 benefit amount. Future cost of living raises will be established by the new updated base amount. Future cost of living adjustments will be evaluated on an annual basis to determine if a simple or compound cost of living increase will be given, depending on the financial condition of the System. Act 967 of 2013 gives the ATRS Board authority to reverse the compounding of a benefit and reset the base amount to the pre-compounding amount. If this reversal were to occur, it would include participants in the T-DROP plan. The future benefits of a member would not be reduced to recover any benefits paid to a member as a result of the compounding. In addition, the member's benefit on the date of the reversal would not be impacted, but future COLA's would be based upon the reset base amount. *This act is dependent upon the actuary's certification that the amortization period is in excess of 30 years to pay unfunded liabilities prior to any reversal of the compounding of the COLA.* Act 780 of 2017 allows the right to reverse the 2009 compound COLA when unfunded liabilities exceed an 18 year amortization. The act also allows a phase in of the change during months in which a COLA raise is given to prevent any retiree or option beneficiary from having an actual reduction in monthly benefit payments.
- 2. Lump Sum Death Benefit – A.C.A. § 24-7-720.** Beneficiaries of deceased active members or retirees with 10 or more years of ATRS credited service are eligible to receive a lump sum death benefit of up to \$10,000 (\$6,667 for noncontributory service-benefit). The amount will be prorated for members who have both contributory service and noncontributory service. Members with 15 or more years of contributory service will receive the full \$10,000 (Act 977 of 2011).
- 3. Act 808 Retirement – A.C.A. § 24-4-732.** Any employee of a state agency who was an active member of the Arkansas Teacher Retirement System on April 8, 1987, and who qualified for retirement before January 1, 1988, could become a member of the Arkansas Public Employees Retirement System and retire from that system. All credited service was transferred to that system but the member's contributions were retained by the Arkansas Teacher Retirement System and the benefit amount is transferred monthly to the Arkansas Public Employees Retirement System. Each July 1, annuities are adjusted by 3% (compound escalator).
- 4. Act 793 Retirement – A.C.A. § 24-4-522.** Any employee who was a member of the rehabilitation services in 1977 was permitted to become a member of the Arkansas Public Employees Retirement System. Liabilities associated with prior service earned through June 30, 1978 remain in the Arkansas Teacher Retirement System. Future service is allocated to the Arkansas Public Employees Retirement System. Each July 1, annuities are adjusted by 3% (compound escalator).

Summary of Benefit Provisions

June 30, 2018

5. **Retiree Benefit Stipend – A.C.A. § 24-7-713.** Each retired member as of June 30, 2008, with 5 or more years of ATRS credited service receives a \$75 per month stipend. Members in T-DROP do not receive the \$75 per month stipend until actual retirement. For all members retiring on or after July 1, 2008, a minimum of 10 years of ATRS credited service is required to receive the \$75 per month stipend. Act 603 of 2013 allows the ATRS Board to increase or decrease the stipend to a minimum of \$1 per month and a maximum of \$75 per month. This act is dependent upon the actuary's certification that the amortization period is in excess of 18 years to pay unfunded liabilities prior to any reduction in the current stipend. The stipend for fiscal year 2018 remains at \$75 per month. **By Board Resolution 2017-34 on November 13, 2017 the benefit stipend is removed from the base amount for all retirees and beneficiaries beginning fiscal year 2019 and the benefit stipend will be reduced to \$50.00 for fiscal year 2020 and beyond. The Resolution contains a “hold harmless” provision that prevents the lowering of the stipend if it would actually reducing the total monthly benefit. This would only affect retirees when the COLA is less than \$25 per month.**
6. **T-DROP Cash Balance Account.** Effective July 1, 2012, a T-DROP cash balance account was established that allows members exiting (retiring) from T-DROP to place all or a portion of their T-DROP proceeds into a Cash Balance Account (CBA) at ATRS. The interest rate credited will be between 2.5% and 4.0%, increasing 25 basis points for each year on deposit through the 5th year, and then 4% for the 6th and subsequent years.
7. **Optional Forms of Benefits – A.C.A. § 24-7-706:**
 - Option 1 (Straight Life Annuity)**

A member will receive the maximum monthly benefit for which he/she qualifies, throughout his/her lifetime. No monthly benefits will be paid to his/her beneficiary after the member's death. Should a member die before he/she has drawn in benefits an amount equal to his/her contributions plus earned interest, the balance will be paid to a designated beneficiary. The designated beneficiary may be anyone chosen by the member.
 - Option A (100% Survivor Annuity)**

Under this option a member will receive a reduced annuity throughout his/her lifetime. Upon the member's death, the designated beneficiary will receive the same annuity for the balance of his/her lifetime.
 - Option B (50% Survivor Annuity)**

Under this option a member will receive a reduced annuity throughout his/her lifetime. Upon the member's death, the designated beneficiary will receive one-half (1/2) of this annuity for the balance of his/her lifetime.

Summary of Benefit Provisions

June 30, 2018

Option C (Annuity for Ten Years Certain and Life Thereafter)

A reduced monthly benefit payable for 120 months. After that time, or if the beneficiary dies prior to 120 months, a member's monthly allowance will revert to the amount he/she would have received under the regular plan and continue for life. If the member dies before receiving 120 payments, the designated beneficiary will receive a monthly benefit in the same amount until monthly benefits to both the member and the beneficiary equal 120 monthly payments. No further benefits are then payable to the beneficiary.

Option Factors are based upon a 5.0% interest rate and the RP-2014/MP-2017 mortality tables (static) adjusted with a 50% unisex mix.

Sample Benefit Computations for a Member Retiring July 1, 2018 with a Simple 3% COLA

Data for an example member is shown below.

Annual retirement benefit as of July 1, 2018 (excluding stipend): \$30,000

Projected benefits, taking into account increases after retirement would be:

Year Ended June 30	Annual Amount		\$ Increase
	Base	Current	
2019	\$30,000	\$30,000	\$ 0
2020	30,000	30,900	900
2021	30,000	31,800	900
2022	30,000	32,700	900
2023	30,000	33,600	900

Thereafter, the amount would increase by \$900 annually for life. Act 793 members and Act 808 members receive compound COLAs.

CHANGES IN PURCHASING POWER

Benefit Changes During Recent Years of Retirement & Related Changes in Purchasing Power (1980 \$)

Year Ended June 30	Increase Beginning of Year	Benefit Dollars in Year*	Inflation (Loss) in Year#	Purchasing Power at Year End	
				1980 \$	% of 1980
1980	\$ ----	\$ 5,000	----	\$5,000	100%
1981	75	5,075	(9.6)%	4,632	93%
1982	152	5,227	(7.1)%	4,456	89%
1983	152	5,379	(2.6)%	4,471	89%
1984	431	5,810	(4.2)%	4,633	93%
1985	438	6,248	(3.7)%	4,802	96%
1986	509	6,757	(1.7)%	5,103	102%
1987	197	6,954	(3.7)%	5,067	101%
1988	400	7,354	(3.9)%	5,154	103%
1989	503	7,857	(5.1)%	5,236	105%
1990	497	8,354	(4.7)%	5,319	106%
1991	230	8,584	(4.7)%	5,220	104%
1992	762	9,346	(3.1)%	5,513	110%
1993	792	10,138	(3.0)%	5,806	116%
1994	820	10,958	(2.5)%	6,123	122%
1995	303	11,261	(3.0)%	6,107	122%
1996	303	11,564	(2.8)%	6,103	122%
1997	1,657	13,221	(2.3)%	6,821	136%
1998	1,214	14,435	(1.7)%	7,324	146%
1999	323	14,758	(2.0)%	7,344	147%
2000	1,039	15,797	(3.7)%	7,583	152%
2001	1,220	17,017	(3.2)%	7,907	158%
2002	672	17,689	(1.1)%	8,132	163%
2003	468	18,157	(2.1)%	8,174	163%
2004	468	18,625	(3.3)%	8,120	162%
2005	468	19,093	(2.5)%	8,118	162%
2006	468	19,561	(4.3)%	7,973	159%
2007	468	20,029	(2.7)%	7,950	159%
2008	468	20,497	(5.0)%	7,747	155%
2009	468	20,965	1.4 %	8,038	161%
2010	629	21,594	(1.1)%	8,193	164%
2011	648	22,242	(3.6)%	8,149	163%
2012	648	22,890	(1.7)%	8,249	165%
2013	648	23,538	(1.8)%	8,336	167%
2014	648	24,186	(2.1)%	8,392	168%
2015	648	24,834	(0.1)%	8,606	172%
2016	648	25,482	(1.0)%	8,744	175%
2017	648	26,130	(1.6)%	8,822	176%
2018	648	26,778	(2.9)%	8,788	176%

* The \$5,000 benefit used to begin this schedule is an arbitrary amount. A different beginning amount could show a different purchasing power amount, but the same in percent loss.

Based on Consumer Price Index, All Urban Consumers, United States City Average (June values).

Benefit Changes During Recent Years of Retirement & Related Changes in Purchasing Power (1990 \$)

Year Ended June 30	Increase Beginning of Year	Benefit Dollars in Year*	Inflation (Loss) in Year#	Purchasing Power at Year End	
				1990 \$	% of 1990
1990	\$ - - - -	\$ 5,000	- - - -	\$5,000	100%
1991	150	5,150	(4.7)%	4,919	98%
1992	457	5,607	(3.1)%	5,195	104%
1993	475	6,082	(3.0)%	5,471	109%
1994	492	6,574	(2.5)%	5,770	115%
1995	182	6,756	(3.0)%	5,755	115%
1996	182	6,938	(2.8)%	5,751	115%
1997	330	7,268	(2.3)%	5,889	118%
1998	667	7,935	(1.7)%	6,324	126%
1999	177	8,112	(2.0)%	6,340	127%
2000	849	8,961	(3.7)%	6,756	135%
2001	826	9,787	(3.2)%	7,143	143%
2002	387	10,174	(1.1)%	7,346	147%
2003	270	10,444	(2.1)%	7,385	148%
2004	270	10,714	(3.3)%	7,337	147%
2005	270	10,984	(2.5)%	7,336	147%
2006	270	11,254	(4.3)%	7,205	144%
2007	270	11,524	(2.7)%	7,185	144%
2008	270	11,794	(5.0)%	7,002	140%
2009	270	12,064	1.4 %	7,265	145%
2010	362	12,426	(1.1)%	7,405	148%
2011	373	12,799	(3.6)%	7,366	147%
2012	373	13,171	(1.7)%	7,456	149%
2013	373	13,544	(1.8)%	7,535	151%
2014	373	13,917	(2.1)%	7,585	152%
2015	373	14,290	(0.1)%	7,779	156%
2016	373	14,663	(1.0)%	7,903	158%
2017	373	15,036	(1.6)%	7,974	159%
2018	373	15,409	(2.9)%	7,943	159%

* The \$5,000 benefit used to begin this schedule is an arbitrary amount. A different beginning amount could show a different purchasing power amount, but the same in percent loss.

Based on Consumer Price Index, All Urban Consumers, United States City Average (June values).

Benefit Changes During Recent Years of Retirement & Related Changes in Purchasing Power (2000 \$)

Year Ended June 30	Increase Beginning of Year	Benefit Dollars in Year*	Inflation (Loss) in Year#	Purchasing Power at Year End	
				2000 \$	% of 2000
2000	\$ - - - -	\$ 5,900	- - - -	\$5,900	100%
2001	177	6,077	(3.2)%	5,886	100%
2002	252	6,329	(1.1)%	6,065	103%
2003	179	6,508	(2.1)%	6,108	104%
2004	179	6,687	(3.3)%	6,078	103%
2005	179	6,867	(2.5)%	6,086	103%
2006	179	7,046	(4.3)%	5,987	101%
2007	179	7,225	(2.7)%	5,978	101%
2008	179	7,404	(5.0)%	5,834	99%
2009	179	7,583	1.4 %	6,061	103%
2010	228	7,811	(1.1)%	6,178	105%
2011	234	8,045	(3.6)%	6,145	104%
2012	234	8,280	(1.7)%	6,221	105%
2013	234	8,515	(1.8)%	6,287	107%
2014	234	8,749	(2.1)%	6,328	107%
2015	234	8,983	(0.1)%	6,490	110%
2016	234	9,217	(1.0)%	6,593	112%
2017	234	9,451	(1.6)%	6,652	113%
2018	234	9,685	(2.9)%	6,626	112%

* The \$5,900 benefit used to begin this schedule is an arbitrary amount. A different beginning amount could show a different purchasing power amount, but the same in percent loss.

Based on Consumer Price Index, All Urban Consumers, United States City Average (June values).

Benefit Changes During Recent Years of Retirement & Related Changes in Purchasing Power (2010 \$)

Year Ended June 30	Increase Beginning of Year	Benefit Dollars in Year*	Inflation (Loss) in Year#	Purchasing Power at Year End	
				2010 \$	% of 2010
2010	\$ - - - -	\$ 5,900	- - - -	\$5,900	100%
2011	177	6,077	(3.6)%	5,868	99%
2012	177	6,254	(1.7)%	5,940	101%
2013	177	6,431	(1.8)%	6,003	102%
2014	177	6,608	(2.1)%	6,043	102%
2015	177	6,785	(0.1)%	6,197	105%
2016	177	6,962	(1.0)%	6,296	107%
2017	177	7,139	(1.6)%	6,352	108%
2018	177	7,316	(2.9)%	6,328	107%

* The \$5,900 benefit used to begin this schedule is an arbitrary amount. A different beginning amount could show a different purchasing power amount, but the same in percent loss.

Based on Consumer Price Index, All Urban Consumers, United States City Average (June values).

VALUATION DATA

Summary of Annuities Being Paid Retirees and Beneficiaries July 1, 2018 by Disbursing Account and Gender

Disbursing Account	Men		Women		Totals	
	No.	Annual Annuities	No.	Annual Annuities	No.	Annual Annuities
Retirement Reserve Account						
Age & Service Annuities						
Retirees	9,613	\$ 256,294,377	32,075	\$757,206,010	41,688	\$ 1,013,500,387
Beneficiaries	343	6,861,261	774	17,863,123	1,117	24,724,384
Totals	9,956	263,155,638	32,849	775,069,133	42,805	1,038,224,771
Disability						
Retirees	567	8,282,017	2,224	32,760,554	2,791	41,042,571
Beneficiaries	144	2,155,464	143	2,436,501	287	4,591,965
Totals	711	10,437,481	2,367	35,197,055	3,078	45,634,536
Act 793	89	1,209,210	86	623,875	175	1,833,085
Total retirees and beneficiaries being paid from Retirement Reserve Account	10,756	274,802,329	35,302	810,890,063	46,058	1,085,692,392
Survivor's Benefit Account	352	5,102,427	364	5,939,647	716	11,042,074
Act 808	28	1,843,033	22	770,519	50	2,613,552
Totals	11,136	281,747,789	35,688	817,600,229	46,824	1,099,348,018
Prior Year Totals	10,796	\$ 269,996,895	34,296	\$774,747,827	45,092	\$ 1,044,744,722

Summary of Annuities Being Paid Retirees and Beneficiaries July 1, 2018 by Disbursing Account and Source of Financing

Disbursing Account	Annual Annuities		Total	
	Employee Financed	Employer Financed	No.	Annual Annuities
Retirement Reserve Account				
Age & Service Annuities				
Retirees	\$ 74,674,133	\$ 938,826,254	41,688	\$ 1,013,500,387
Beneficiaries	486,725	24,237,659	1,117	24,724,384
Totals	75,160,858	963,063,913	42,805	1,038,224,771
Disability				
Retirees	2,104,642	38,937,929	2,791	41,042,571
Beneficiaries	177,377	4,414,588	287	4,591,965
Totals	2,282,019	43,352,517	3,078	45,634,536
Act 793	140,626	1,692,459	175	1,833,085
Total retirees and beneficiaries being paid from Retirement Reserve Account	77,583,503	1,008,108,889	46,058	1,085,692,392
Survivor's Benefit Account	482,424	10,559,650	716	11,042,074
Act 808	113,198	2,500,354	50	2,613,552
Totals	78,179,125	1,021,168,893	46,824	1,099,348,018
Prior Year Totals	\$ 80,679,531	\$ 964,065,191	45,092	\$ 1,044,744,722

Annuities Being Paid Retirees and Beneficiaries July 1, 2018 by Type of Annuity Being Paid

Type of Annuity	No.	Annual Amounts		
		Original Annuities	Base Annuities	Current Annuities
RETIREMENT RESERVE ACCOUNT				
Age & Service				
Option 1 (Basic single life)	33,248	\$ 507,035,219	\$ 609,891,379	\$ 779,411,534
Option A (Joint & 100% Survivor)	5,209	87,829,685	102,597,702	130,749,149
Option B (Joint & 50% Survivor)	2,572	57,703,522	70,554,424	89,770,275
Option C (10 year certain)	659	10,422,882	10,938,995	13,569,429
Beneficiaries	1,117	19,257,602	18,802,728	24,724,384
Totals	42,805	682,248,910	812,785,228	1,038,224,771
Disability				
Option 1	2,310	23,267,757	26,107,177	33,897,320
Option A	371	4,030,545	4,132,034	5,280,156
Option B	81	1,110,180	1,215,283	1,557,452
Option C	29	248,561	232,361	307,643
Beneficiaries	287	3,143,953	3,406,530	4,591,965
Totals	3,078	31,800,996	35,093,385	45,634,536
Act 793	175	\$ 961,981	\$ 1,833,085	1,833,085
Totals	46,058	715,011,887	849,711,698	1,085,692,392
SURVIVOR'S BENEFIT ACCOUNT				
Beneficiaries of Deceased Members	716	\$ 7,571,527	\$ 8,687,570	\$ 11,042,074
OTHER ANNUITIES				
Act 808	50	924,310	2,613,552	2,613,552
RETIREMENT SYSTEM TOTALS				
Total Annuities Being Paid	46,824	\$ 723,507,724	\$ 861,012,820	\$ 1,099,348,018

The Original Annuity is the annuity at the date of retirement (includes stipend).

The Base Annuity is the amount from which the 3.0% COLA is calculated. Effective July 1, 2018, the stipend is no longer included.

The Current Annuity is the annuity payable at July 1, 2018 including the COLA granted on July 1.

Annuities Being Paid July 1, 2018
from the Retirement Reserve Account to
AGE AND SERVICE Retirees and Beneficiaries
by Attained Ages

Attained Age	Annual Amounts			
	No.	Original Annuities	Base Annuities	Current Annuities
Under 40	6	\$ 133,435	\$ 117,963	\$ 149,746
40-44	4	36,431	39,833	49,891
45-49	37	580,171	553,985	623,270
50-54	377	9,247,745	8,992,280	10,098,438
55-59	1,391	36,963,962	37,568,971	44,753,886
60-64	6,716	125,181,687	132,988,429	162,394,795
65-69	12,146	208,351,065	231,301,311	290,569,821
70-74	9,928	153,311,930	183,112,072	239,649,175
75-79	6,167	82,926,195	109,188,246	145,087,288
80-84	3,346	39,701,007	59,311,268	78,904,389
85-89	1,801	18,683,540	33,049,124	43,941,170
90-94	678	5,874,642	12,976,018	17,218,466
95 & Up	208	1,257,100	3,585,728	4,784,436
Totals	42,805	\$682,248,910	\$812,785,228	\$1,038,224,771

Annuities Being Paid July 1, 2018
from the Retirement Reserve Account to
DISABILITY Retirees and Beneficiaries by Attained Ages

Attained Age	Annual Amounts			
	No.	Original Annuities	Base Annuities	Current Annuities
Under 40	21	\$ 190,175	\$ 172,160	\$ 216,925
40-44	62	535,322	495,260	608,939
45-49	112	1,161,536	1,087,910	1,279,678
50-54	242	3,005,027	2,845,798	3,394,266
55-59	539	5,769,861	5,497,854	6,812,408
60-64	666	6,918,711	6,820,401	8,804,448
65-69	599	6,119,872	6,581,682	8,892,724
70-74	444	4,681,162	5,792,287	7,824,090
75-79	220	2,149,173	3,152,108	4,247,567
80-84	93	825,992	1,463,466	1,961,170
85-89	49	303,977	737,750	991,519
90-94	24	110,183	332,736	448,245
95 & Up	7	30,005	113,973	152,557
Totals	3,078	\$31,800,996	\$35,093,385	\$45,634,536

**Annuities Being Paid July 1, 2018
from the Retirement Reserve Account to
ACT 793 Retirees and Beneficiaries by Attained Ages**

Attained Age	Annual Amounts		
	No.	Original Annuities	Current Annuities
Under 40	-	\$ -	\$ -
40-44	-	-	-
45-49	-	-	-
50-54	-	-	-
55-59	-	-	-
60-64	6	14,702	22,890
65-69	27	89,783	143,358
70-74	50	254,498	443,878
75-79	43	282,533	519,909
80-84	25	189,302	377,731
85-89	17	115,374	277,918
90-94	6	11,086	32,995
95 & Up	1	4,703	14,406
Totals	175	\$961,981	\$1,833,085

Base annuities are equal to current annuities since the COLA is compound.

**Annuities Being Paid July 1, 2018
from the Retirement Reserve Account to
SURVIVOR BENEFICIARIES by Attained Ages**

Attained Age	Annual Amounts			
	No.	Original Annuities	Base Annuities	Current Annuities
Under 40	164	\$1,247,530	\$1,228,026	\$ 1,414,768
40-44	3	24,120	25,999	32,562
45-49	14	115,148	112,938	151,013
50-54	18	148,835	149,817	178,356
55-59	49	785,995	769,783	939,022
60-64	101	1,511,411	1,538,984	1,895,306
65-69	123	1,403,925	1,522,520	1,966,821
70-74	105	1,233,089	1,409,113	1,867,588
75-79	65	594,694	852,714	1,149,546
80-84	40	338,075	611,929	817,647
85-89	24	141,685	370,131	496,853
90-94	7	20,570	65,191	90,604
95 & Up	3	6,450	30,425	41,988
Totals	716	\$7,571,527	\$8,687,570	\$11,042,074

Annuities Being Paid July 1, 2018
from the Act 808 Retirement Reserve Account to
ACT 808 Retirees and Beneficiaries by Attained Ages

Attained Age	Annual Amounts		
	No.	Original Annuities	Current Annuities
Under 40	-	\$ -	\$ -
40-44	-	-	-
45-49	-	-	-
50-54	-	-	-
55-59	-	-	-
60-64	-	-	-
65-69	-	-	-
70-74	-	-	-
75-79	2	24,523	74,150
80-84	11	224,295	657,482
85-89	19	345,551	952,711
90-94	15	308,690	863,585
95 & Up	3	21,251	65,624
Totals	50	\$924,310	\$2,613,552

Base annuities are the same as current annuities since the COLA is compound.

Retiree and Beneficiary Data as of June 30

Year	Estimated Number		Total Retirees*	Annual Allowances (Millions)	% Increase in Annual Allowances@	Average Annual Allowances
	Added	Removed				
1990	588	337	11,654	\$ 92.69	7.0%	\$ 7,954
1991	489	253	11,890	104.60	12.8%	8,797
1992	455	312	12,033	115.50	10.4%	9,599
1993	589	316	12,306	129.71	12.3%	10,540
1994	846	512	12,640	141.87	9.4%	11,224
1995	908	342	13,206	156.59	10.4%	11,857
1996	1,107	654	13,659	170.59	8.9%	12,489
1997	1,049	475	14,233	194.90	14.3%	13,694
1998	809	240	14,802	220.38	13.1%	14,888
1999	1,582	497	15,887	248.75	12.9%	15,658
2000	1,249	479	16,657	280.14	12.6%	16,818
2001	1,571	450	17,778	309.03	10.3%	17,383
2002	1,989	568	19,199	334.15	8.1%	17,404
2003	1,621	549	20,271	359.98	7.7%	17,758
2004	1,685	528	21,428	386.23	7.3%	18,025
2005	1,822	570	22,680	415.04	7.5%	18,300
2006	1,958	485	24,153	449.77	8.4%	18,622
2007	2,017	559	25,611	484.55	7.7%	18,920
2008	1,703	513	26,801	515.56	6.4%	19,237
2009	2,721	704	28,818	564.59	9.5%	19,591
2010	2,588	819	30,587	612.77	8.5%	20,034
2011	2,394	882	32,099	657.08	7.2%	20,470
2012	2,932	871	34,160	709.17	7.9%	20,760
2013	3,039	945	36,254	763.76	7.7%	21,067
2014	3,156	932	38,478	822.19	7.7%	21,368
2015	3,326	1,056	40,748	916.62	11.5%	22,495
2016	3,272	925	43,095	983.87	7.3%	22,830
2017	2,996	999	45,092	1,044.74	6.2%	23,169
2018	2,927	1,195	46,824	1,099.35	5.2%	23,478

* T-DROP participants are classified as active members for purposes of the valuation and are not included in this schedule.

@ T-DROP annuities for retired members included 2015 and later.

REPORTED ASSETS

The assets of the Retirement System, as of June 30, 2018, were reported to your actuary to be \$17,492,627,740. This amount, together with a funding value adjustment of \$736,564,812, is used to finance the Retirement System liability.

Accounts	Assets at June 30	
	2018	2017
Regular Accounts		
Members' Deposit Accounts		
Contributions	\$ 1,287,855,312	\$ 1,229,715,817
Interest	9,645,971,617	8,648,950,788
Total	10,933,826,929	9,878,666,605
T-DROP Member Deposit Accounts		
Contributions	23,942,761	24,594,867
Interest	27,387,222	31,995,573
Total	51,329,983	56,590,440
Cash Balance Account	109,036,167	91,084,101
Employer's Accumulation Account	(5,509,753,553)	(4,840,656,333)
Retirement Reserve Account	11,366,265,784	10,545,265,390
Act 808 Retirement Reserve Account	12,599,124	13,986,693
T-Lump Payable	417,126,689	430,583,531
Survivors Benefit Account	102,835,207	99,931,749
Total Regular Accounts	17,483,266,330	16,275,452,176
Other Accounts		
Income Expense Account	9,361,410	9,356,069
Other Special Reserves	-	-
Miscellaneous	-	-
Total Other Accounts	9,361,410	9,356,069
Total Market Value of Assets	17,492,627,740	16,284,808,245
Funding Value Adjustment	(736,564,812)	(153,341,318)
Funding Value of Assets	\$16,756,062,928	\$16,131,466,927

VALUATION RESULTS

Liabilities for Annuities Being Paid July 1, 2018

Tabulated by Type of Annuity Being Paid

Type of Annuity	Liabilities July 1, 2018		
	Men	Women	Totals
RETIREMENT RESERVE ACCOUNT			
Age & Service Annuities			
Option 1 (Straight Life)	\$ 1,391,673,065	\$ 6,579,108,117	\$ 7,970,781,182
Option A (100% Joint & Survivor)	814,470,928	847,691,740	1,662,162,668
Option B (50% Joint & Survivor)	403,257,838	618,700,170	1,021,958,008
Option C (10 Years Certain & Life)	30,515,264	136,624,999	167,140,263
Beneficiaries	54,226,359	155,621,655	209,848,014
Total Age & Service	2,694,143,454	8,337,746,681	11,031,890,135
Disability Annuities			
Option 1	49,395,134	272,263,010	321,658,144
Option A	27,644,696	42,783,985	70,428,681
Option B	5,575,565	11,422,110	16,997,675
Option C	306,272	3,179,579	3,485,851
Beneficiaries	19,617,347	22,971,468	42,588,815
Total Disability	102,539,014	352,620,152	455,159,166
Act 793	9,763,657	5,745,064	15,508,721
Total Retirement Reserve Account	2,806,446,125	8,696,111,897	11,502,558,022
SURVIVORS' BENEFIT ACCOUNT			
Beneficiaries of Deceased Members	\$ 48,056,111	\$ 58,986,956	\$ 107,043,067
OTHER LIABILITIES			
Act 808	9,465,972	3,632,898	13,098,870
RETIREMENT SYSTEM TOTALS			
Total Annuity Liabilities	2,863,968,208	8,758,731,751	11,622,699,959
Cash Benefit Account Liabilities			109,036,167
Liabilities for Lump Sum Death Benefits			119,597,118
Total	\$ 2,863,968,208	\$ 8,758,731,751	\$ 11,851,333,244

Retirement Reserve Account

Comparative Statement of Annuities, Accrued Liabilities and Assets

(\$ Millions)

Valuation Date June 30	Annual Annuities Being Paid			Average	Computed Liabilities	Applicable Assets	Unfunded Retired Life Liabilities	Ratio of Assets to Liabilities
	No.	Amount	% Incr.					
1980*#	8,001	\$ 30.10	3.5%	\$ 3,761	\$ 280.70	\$ 280.7	none	100.0%
1985*+	9,331	51.49	13.6%	5,518	479.9	479.9	none	100.0%
1990	11,054	87.84	7.2%	7,946	847.7	847.7	none	100.0%
1995	12,622	150.45	10.8%	11,920	1,428.6	1,428.6	none	100.0%
2000* ##	16,172	275.65	14.6%	17,045	2,828.8	2,828.8	none	100.0%
2005	22,147	409.42	7.5%	18,486	4,148.1	4,148.1	none	100.0%
2006	23,606	443.98	8.4%	18,808	4,483.4	4,483.4	none	100.0%
2007	25,038	478.30	7.7%	19,103	4,816.4	4,816.4	none	100.0%
2008	26,258	509.29	6.5%	19,396	5,391.3	5,391.3	none	100.0%
2009	28,228	557.83	9.5%	19,762	5,891.9	5,891.9	none	100.0%
2010	29,969	605.55	8.6%	20,206	6,358.0	6,358.0	none	100.0%
2011^	31,498	649.47	7.3%	20,619	6,972.6	6,972.6	none	100.0%
2012	33,533	701.09	7.9%	20,907	7,481.0	7,481.0	none	100.0%
2013	35,622	755.26	7.7%	21,202	8,004.8	8,004.8	none	100.0%
2014	37,824	813.33	7.7%	21,503	8,561.9	8,561.9	none	100.0%
2015	40,070	907.09	11.5%@	22,638	9,515.7	9,515.7	none	100.0%
2016	42,395	973.78	7.4%	22,969	10,157.2	10,157.2	none	100.0%
2017* ^	44,394	1,034.17	6.2%	23,295	11,026.4	11,026.4	none	100.0%
2018	46,108	1,088.30	5.2%	23,603	11,515.7	11,515.7	none	100.0%

* After plan amendments.

After change in interest assumption from 6.0% to 7.0%, change in post-retirement adjustments from 1.5% to 3.0% and recommended reserve transfer.

+ After redetermination of base, retroactive application of new minimum benefit formula and reserve transfers.

Includes Act 808 and Act 793 retirees beginning in 2000.

^ After changes in assumptions.

@ T-DROP annuities for retired members included 2015 and later.

Survivors' Benefit Account Accrued Liabilities and Assets Comparative Statement

Valuation Date June 30	Annual Annuities Being Paid		Computed Liabilities	Applicable Assets	Unfunded Accrued Liabilities	Ratio of Assets to Liabilities
	No.	Amount				
1980*#	393	\$ 772,631	\$ 7,042,644	\$ 7,042,644	none	100.0%
1985*+	421	1,240,399	12,411,800	12,411,800	none	100.0%
1990	424	1,830,743	18,117,244	18,117,244	none	100.0%
1995	416	2,723,940	26,220,218	26,220,218	none	100.0%
2000*	485	4,487,519	43,701,138	43,701,138	none	100.0%
2005	533	5,619,675	56,257,745	56,257,745	none	100.0%
2006	547	5,791,974	57,605,939	57,605,939	none	100.0%
2007	573	6,250,603	63,481,565	63,481,565	none	100.0%
2008	543	6,269,551	66,496,539	66,496,539	none	100.0%
2009	590	6,761,034	70,857,161	70,857,161	none	100.0%
2010	618	7,224,585	75,108,334	75,108,334	none	100.0%
2011^	601	7,605,212	81,150,385	81,150,385	none	100.0%
2012	627	8,081,913	84,930,745	84,930,745	none	100.0%
2013	632	8,491,667	88,139,802	88,139,802	none	100.0%
2014	654	8,861,734	89,793,996	89,793,996	none	100.0%
2015	678	9,530,889	95,272,795	95,272,795	none	100.0%
2016	700	10,084,359	98,960,258	98,960,258	none	100.0%
2017* ^	698	10,574,602	104,668,995	104,668,995	none	100.0%
2018	716	11,042,074	107,043,067	107,043,067	none	100.0%

* Includes plan amendments.

After change in interest assumption from 6.0% to 7.0%, change in post-retirement adjustments from 1.5% to 3.0% and recommended reserve transfer.

+ After redetermination of base annuity, retroactive application of new minimum benefit formula and recommended reserve transfer.

^ After changes in assumptions.

Annual Allowances of Retired Lives by Year of Retirement as of June 30, 2018

Calendar Year of Retirement	No.	Annual Amount Being Paid			Average
		Original	Total Increase	Current	
2018*	652	\$ 7,217,460	\$ 478,264	\$ 7,695,724	\$11,803
2017	2,827	46,159,938	8,131,293	54,291,231	19,205
2016	2,904	46,980,557	9,869,056	56,849,613	19,576
2015	3,106	50,379,483	12,412,410	62,791,893	20,216
2014	3,081	51,120,957	14,167,615	65,288,572	21,191
2013	2,808	46,803,725	15,085,562	61,889,287	22,040
2012	2,772	44,335,833	15,947,337	60,283,170	21,747
2011	2,488	40,264,541	15,595,189	55,859,730	22,452
2010	2,139	34,373,233	15,408,069	49,781,302	23,273
2009	2,236	36,458,816	17,615,965	54,074,781	24,184
2008	2,131	33,240,127	16,202,618	49,442,745	23,202
2007	1,987	30,631,139	15,182,978	45,814,117	23,057
2006	1,769	27,771,993	15,371,206	43,143,199	24,388
2005	1,751	27,702,139	17,288,919	44,991,058	25,694
2004	1,549	23,193,512	14,463,554	37,657,066	24,311
2003	1,402	20,810,627	13,534,993	34,345,620	24,498
2002	1,328	20,380,435	13,609,993	33,990,428	25,595
2001	1,374	18,816,512	12,809,874	31,626,386	23,018
2000	1,163	18,132,666	13,582,699	31,715,365	27,270
1999	1,005	14,361,151	12,060,441	26,421,592	26,290
1998	987	13,198,059	11,732,341	24,930,400	25,259
1997	734	11,260,820	11,110,697	22,371,517	30,479
1996	595	9,510,694	9,572,713	19,083,407	32,073
1995	633	10,088,716	10,621,016	20,709,732	32,717
1994	651	10,357,604	11,904,388	22,261,992	34,197
1993	474	7,570,049	9,110,936	16,680,985	35,192
1992	330	4,114,884	5,779,636	9,894,520	29,983
1991	237	2,662,099	4,138,614	6,800,713	28,695
1990	277	2,887,698	5,095,626	7,983,324	28,821
1989	255	2,686,056	4,939,195	7,625,251	29,903
1988	254	2,692,008	5,221,346	7,913,354	31,155
1987	242	2,489,524	5,358,647	7,848,171	32,430
1986	155	1,510,291	3,291,776	4,802,067	30,981
1985	125	1,028,536	2,445,664	3,474,200	27,794
1984	82	622,961	1,645,180	2,268,141	27,660
Before 1983	321	1,692,881	5,054,484	6,747,365	21,020
TOTAL	46,824	\$723,507,724	\$375,840,294	\$1,099,348,018	\$23,478

* Reporting for calendar year 2018 is not yet complete. The July 1st retirees are not included in the schedule.

APPENDIX

APPENDIX

Single Life Retirement Values Based on RP-2014 Mortality Headcount Weighted Tables Adjusted Using MP-2017 Projection Scale & 7.5% Interest

Sample Attained Ages in 2018*	Present Value of \$1.00 Monthly for Life		Present Value of \$1 Monthly for Life Increasing 3.0% Annually		Future Life Expectancy (Years)		Percent Dying within Next Year	
	Men	Women	Men	Women	Men	Women	Men	Women
40	\$150.70	\$154.16	\$198.53	\$205.02	42.55	46.81	0.33 %	0.28 %
45	146.72	151.37	191.06	199.33	37.75	42.00	0.41 %	0.32 %
50	141.50	147.46	181.73	191.81	33.05	37.19	0.54 %	0.36 %
55	134.83	142.03	170.34	182.02	28.47	32.40	0.72 %	0.45 %
60	126.51	134.97	156.83	169.92	24.07	27.73	0.98 %	0.60 %
65	116.42	125.90	141.21	155.25	19.93	23.22	1.37 %	0.82 %
70	104.16	114.26	123.29	137.59	16.02	18.87	1.98 %	1.25 %
75	89.58	100.14	103.25	117.45	12.39	14.82	3.10 %	2.07 %
80	73.44	84.12	82.32	95.94	9.18	11.19	5.15 %	3.51 %
85	57.20	67.26	62.43	74.61	6.53	8.11	8.83 %	6.16 %
Base	2635 x 1.01	2636 x 0.91	2635 x 1.01	2636 x 0.91				
Projection	939	940 x 0.91	939	940				

* Applicable to calendar year 2018. Rates and life expectancies in future years are determined by the MP-2017 projection scale.

Sample Attained Ages	Benefit Increasing 3.0% Yearly	Portion of Age 60 Lives Still Alive	
		Men	Women
60	\$100.00	100%	100%
65	115.00	95%	97%
70	130.00	88%	92%
75	145.00	78%	86%
80	160.00	66%	77%
Ref		2635 x 1.01	2636 x 0.91