



State of Wisconsin
Department of Employee Trust Funds
Robert J. Conlin
SECRETARY

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Correspondence Memorandum

Date: March 7, 2018
To: Employee Trust Funds Board
From: Cindy Klimke-Armatoski
Chief Trust Financial Officer
Subject: December 31, 2017 Actuarial Valuation of Retired Lives

ETF requests the Employee Trust Funds Board (Board) approve the report, 35th Annual Actuarial Valuation of Retired Lives as of December 31, 2017.

Gabriel Roeder Smith & Company (GRS) has completed the actuarial valuation of Wisconsin Retirement System retired lives as of December 31, 2017. This valuation determines the amounts to be transferred from member and employer accounts to fund 2017 new annuities, and the amount available to provide increases for existing Core and Variable annuities.

GRS is recommending Core annuities be increased by 2.4%. This is based on the 8.5% effective rate interest credited to the Core annuity reserve and mortality experienced during the last year. The increase will be applied to all Core annuities except those originating in 2017, which will receive a prorated increase.

Variable annuities will be increased by 17.0%. This is based on the 24% effective rate interest credited to the Variable annuity reserve and mortality experienced during the last year. The Variable annuity increase will be applied equally to all Variable annuities, regardless of the effective date.

Core and Variable increases will first be included on May 1, 2018, annuity payments.

Actuaries from GRS will be at the Board meeting to present the report and answer questions.

Attachment: 35th Annual Actuarial Valuation of Retired Lives

Reviewed and approved by Robert J. Conlin, Secretary

Electronically Signed 3/14/18

Board	Mtg Date	Item #
ETF	3.29.18	5A

Wisconsin Retirement System

35th Annual Actuarial Valuation of Retired Lives

December 31, 2017



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March 7, 2018

Employee Trust Funds Board
Madison, Wisconsin

Ladies and Gentlemen:

The results of the **35th annual actuarial valuation of core and variable annuities** being paid from the Wisconsin Retirement System are presented in this report. This report should not be relied on for any other purpose.

The date of this valuation was December 31, 2017. Actuarial assumptions used in the valuation are summarized in the Appendix.

The results of the valuation may be briefly summarized as follows (\$ millions):

	Core	Variable
Number of Annuitants	203,202	40,877
Annual Amount	\$ 4,747.0	\$ 369.9
Fund Balance	54,900.0	4,324.9
Actuarial Reserve	53,590.0	3,682.1
Ratio	1.024	1.175

Based upon these results, the increase in the core annuities is 2.4% and variable annuities will be increased by 17.0%.

This report was prepared at the request of the Wisconsin Retirement System and those designated or approved by the Wisconsin Retirement System. This report may be provided to parties other than the Wisconsin Retirement System only in its entirety and only with the permission of the Wisconsin Retirement System. GRS is not responsible for unauthorized use of this report. The valuation was based upon data furnished by the WRS staff, concerning Fund assets and individual annuitants and beneficiaries. Data was checked for internal consistency, but was not audited. We are not responsible for the accuracy or completeness of the information provided by the Wisconsin Retirement System.

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.

To the best of our knowledge this report is complete and accurate. All calculations have been made in conformity with generally accepted actuarial principles and practices and with the Actuarial Standards of Practice issued by the Actuarial Standards Board. Brian B. Murphy, Mark Buis and James D. Anderson are all 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 signing actuaries are independent of the plan sponsor.

The cooperation of the Secretary and his staff in gathering materials for this valuation is acknowledged with appreciation.

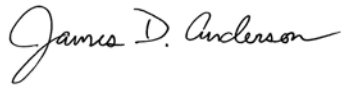
Respectfully submitted,



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



Mark Buis, FSA, EA, FCA, MAAA



James D. Anderson, FSA, EA, FCA, MAAA

BBM/MB/JDA:sac



SECTION A

EXECUTIVE SUMMARY

Executive Summary

1. Retiree Dividend in Core Annuities

The Net of fee investment return of 15.8% in the Core annuity fund was higher than the assumed investment return of 7.2% on a market value basis. However, under the asset valuation method, investment gains and losses are spread over a 5-year period. Partial recognition of this year's gain was combined with the continued phase-in of investment gains and losses from prior years resulting in a published effective earnings rate of 8.5%. The 8.5% published effective earnings rate exceeded the 5.0% assumed investment return threshold that triggers an annuity adjustment. This valuation determined the amount of available surplus. The available surplus in the core fund is \$1,310.0 million as of December 31, 2017. After adjusting for expected improvements in longevity and various other items (described in detail on page 6), **the result is a 2.4% increase in benefits.**

2. Change in Variable Annuities

The variable fund effective earnings rate was 24.0% resulting in a surplus of \$642.8 million. The surplus of \$642.8 million will **result in a 17.0% increase in all variable annuities in force.**

3. General Comments

Due to the asset smoothing method used in the core annuity fund, there are approximately \$3.2 billion in unrecognized asset gains as of December 31, 2017 which will be recognized over the next four years. Although only half of this applies to the annuitant reserve, this will put upward pressure on dividends being granted over the next few years.

The value of previously granted dividends is approximately \$6.1 billion. It is important that the value of dividend payments continue to build up in order to avoid the possibility of leveraged negative adjustments in the future. This will happen naturally as long as investments in the core fund attain the long term investment goal of 7.2%.

4. Conclusion

In accordance with the Administrative Code, ETF 20.25, Section 40.27(2) and Section 40.28(2) of the Wisconsin Statutes:

Core annuities will be increased by 2.4%, and
Variable annuities will be increased by 17.0%.

SECTION B

OPERATION OF THE SYSTEM

Operation of the Retirement System

Each year, as of December 31, an actuarial valuation of the liability for retired persons receiving benefits from the Wisconsin Retirement System is conducted. The purpose of the valuation is to determine the actuarial present value of future benefit payments on behalf of current retired lives. This present value is the “actuarial reserve.” Theoretically, if an amount of money equal to the actuarial present value were invested at a yield equal to the valuation interest rate, the initial amount plus the continuing investment income would provide exactly the right amount of money to pay the annuities of all current retired persons and their beneficiaries for the rest of their lives. The fund would decrease each year, and would become zero many decades in the future when the last annuitant dies.

The above is a “closed group” description of the operation of the annuity reserve fund. But the fund is really an “open group.” The size of the fund does not actually decrease because each year more benefits are added to the rolls than are removed and fresh money is transferred into the annuity reserve fund to finance the benefits of the new annuitants. (The actuary calculates the reserve transfers for new annuitants each year as a by-product of the actuarial valuation.)

According to theory, the fund will eventually reach a state when the number of people entering (retiring) each year is approximately equal to the number of people exiting (dying) each year. When this mature state is reached, the amount of money in the fund will remain approximately level in constant dollars from year to year. Each year, the reserve transfers for the new annuitants plus real investment earnings on the whole fund (total money in) will be approximately equal to the benefit payments (total money out). The only source of growth in assets would be the result of the effects of inflation. The dollars in the fund would increase, but the “real” value of the fund would not change.

There are at least two factors that cause the actual operation to be different from the theoretical operation described above. The first is that annuitants may have longer or shorter lifetimes than expected. In recognition of this, the actuary monitors mortality experience of the retirement system and recommends a new mortality table when appropriate. The second factor is that actual investment earnings are rarely equal to the assumed rate. When either mortality or investment earnings differ from expectations, the difference, positive or negative, is recorded in a supplemental reserve.

Operation of the Retirement System

The Wisconsin Retirement System (WRS) maintains separate reserves for core and variable annuities. Each year, the actuary determines the actuarial reserve for core and variable annuities separately. WRS' practice with respect to the use of supplemental reserves is described below.

Core Annuity Division: If the supplemental reserve is positive and is at least 0.5% of core annuity liabilities, core annuity increases (dividends) may be granted. If the supplemental reserve is negative and is equal to or greater than 0.5% of core annuity liabilities in absolute value, prior core annuity dividends are reduced by an aggregate amount equal to the shortfall. Increases or decreases become effective in April following the December 31 valuation.

Variable Annuity Division: If the supplemental reserve is at least 2% of variable annuity liabilities, substantially all of the reserve (dropping fractions of a percent) is used to increase or decrease variable annuities for the ensuing year. Increases or decreases become effective in April following the December 31 valuation.

In calculating both the dividend for the Core annuities and the adjustment for Variable annuities, a 5.0% assumed investment return is used to fund the original benefit. Only returns in excess of 5.0% can produce an increase in a member's annuity. Returns below 5% result in a decrease. Please see page 29 for a full description of these benefits.

SECTION C

CORE ANNUITIES

Core Annuity Division Development of Assets and Liabilities

	\$ Millions		Ratio
	Assets	Liabilities	
Ending Balance December 31, 2016	\$51,972.0	\$50,941.4	1.020
Closing Adjustments	(0.3)	0.0	
Variable Terminations	95.9	95.9	
2017 Core Annuity Average Adjustment: 2%	0.0	967.8	
Beginning Balance January 1, 2017	52,067.6	52,005.1	1.001
Increases			
Reserve Transfers	3,373.7	3,373.7	
Regular Interest	2,567.1	2,567.1	
Additional Earnings	1,602.4	0.0	
Addition for Experience Study/Mortality Reserve	0.0	301.1	
Other	0.0	53.8	
Total Increases	7,543.2	6,295.7	
Decreases			
Annuities & Lump Sums	4,710.8	4,710.8	
Credit Re-establishments	0.0	0.0	
Subtraction for Experience Study/Mortality Reserve	0.0	0.0	
Other	0.0	0.0	
Total Decreases	4,710.8	4,710.8	
Ending Balance December 31, 2017	\$54,900.0	\$53,590.0	1.024

The ending liability balance includes a data reserve of \$53.5 million and a liability for previously granted dividends of \$6,058 million (prior to any 2018 adjustments).

Reserve Transfer Recommendation

Amounts to be transferred from the Employer Reserve and the Employee Reserve to the Annuity Reserve to cover liabilities for new annuities are computed as the first step in the annual actuarial valuation. The actuarial present value at time of retirement of core annuities reported as new since the last actuarial valuation is \$3,355,842,004. Adjustments to prior transfers, related to estimated annuities for which final computations have now been made, totaled \$17,891,898. Reserve transfers are distributed as follows:

Group	Regular Transfer	Adjustment to Prior Transfer	Total Transfer
General	\$2,835,808,919	\$15,102,073	\$2,850,910,992
Protective with Social Security	379,585,902	1,337,969	380,923,871
Protective without Social Security	94,544,652	40,214	94,584,866
Executive & Elected	45,902,531	1,411,642	47,314,173
Totals	\$3,355,842,004	\$17,891,898	\$3,373,733,902

Accordingly, we recommend that \$3,373,733,902 be transferred to the Core Annuity Reserve. The results in this report assume that this transfer has been made.

Discussion of Dividend

The Core Annuity Fund balance, \$54,900.0 million, was greater than the actuarial present value of core annuities and reserves, \$53,590.0 million, by \$1,310.0 million, which resulted in an annuity adjustment of 2.4%. The primary sources of the 2.4% adjustment are:

	% of APV
1. SWIB net of fee investment return	15.82%
2. MRA adjustment	(7.32)%
3. Published effective earnings rate	8.50%
4. Adjustment to relate earnings to average core annuity fund balance	(0.39)%
5. Earnings rate based on average balance	8.11%
6. Expected dividend before adjustments: 1.0811/1.05-1	2.96%
7. Adjustment to relate average asset to ending liability	0.03%
8. Carryover from last year due to timing of dividend accounting adjustments and rounding	0.12%
9. Experience study/mortality reserve adjustment	(0.56)%
10. Experience and other effects	(0.11)%
11. Statutory adjustment to round to nearest one-tenth percent	(0.04)%
12. Computed average dividend rate: (6)+(7)+(8)+(9)+(10)+(11)	2.4%
13. Adjustment for members at or near the statutory floor	0.0%
14. Final maximum computed dividend rate: (12)+(13), if greater than 0.5% of core annuities, otherwise 0%	2.4%

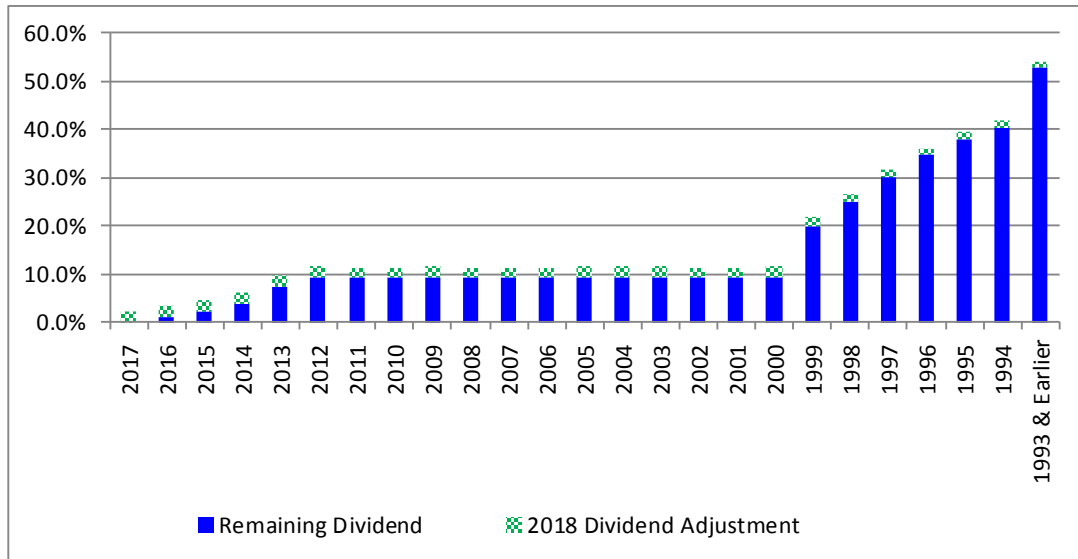
See pages 30 and 31 for a description of items on this page.

In accordance with the Administrative Code, ETF 20.25 and Section 40.27(2) Wisconsin Statutes (see page 29), the dividend adjustment is 2.4% effective April 1, 2018.

Discussion of Dividend

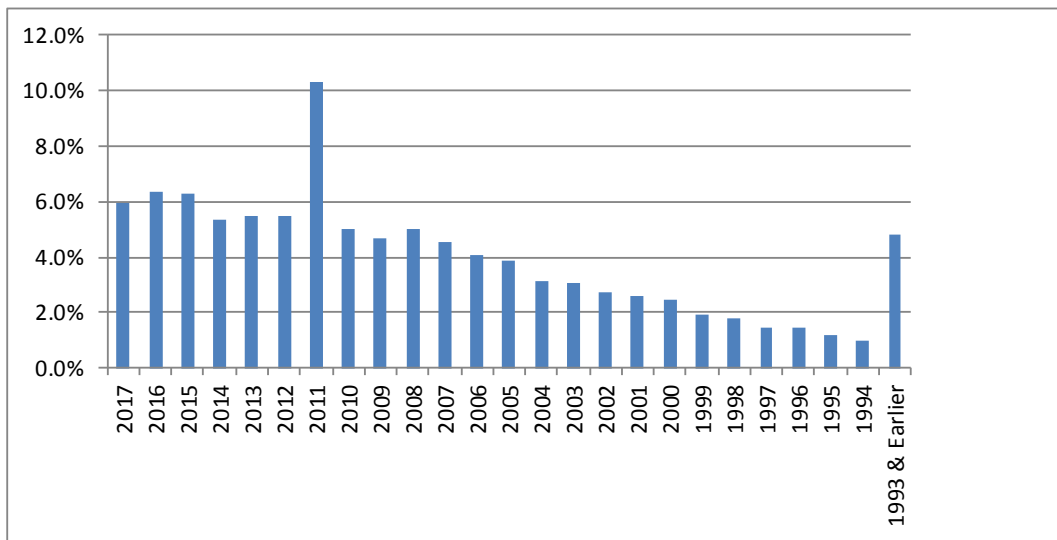
As shown on the prior page, the adjustment for all core fund members is 2.4%. This is the fifth positive dividend adjustment since 2008, and will be spread equally over all annuitants as shown in the chart below.

Dividend Remaining (as a Percentage of Total Benefit) by Year of Retirement



After the 2018 dividend adjustment, members retired prior to 2000 continue to have the highest dividend remaining as a percentage of total benefit and also represent a shrinking portion of the liabilities. The chart below shows liabilities by year of retirement.

Liabilities (as a Percentage of Total) by Year of Retirement



Looking ahead, a few years of spreading positive dividends over all annuitants is needed to decrease the probability of leveraged negative dividends that occurred between 2008 and 2012. Over this period, the liability for dividends decreased from about \$9.2 billion to \$3.0 billion. The value of previously granted dividends is approximately \$6.1 billion as of December 31, 2017 (prior to the 2018 dividend adjustment). However, there are currently about \$3.2 billion in unrecognized asset gains that will be recognized over the next four years, about half of which will be applied to the annuitant reserve.

Transfers to Annuity Reserve to Finance Core Annuities Approved in 2017 Tabulated by Type of Annuity and Option

Alpha Code	Type of Benefit	Number	Annual Amount	Present Value
REGULAR RETIREMENT				
SL	Straight Life	1,502	\$ 29,619,783	\$ 396,586,891
SL	Straight Life (accelerated)	0	3,653,702	13,180,364
A60	Life Annuity with 60 payments guaranteed	852	16,608,801	229,679,808
A60	Life Annuity with 60 payments guaranteed (accelerated)	0	2,781,672	9,789,668
A180	Life Annuity with 180 payments guaranteed	1,945	38,419,035	554,662,777
A180	Life Annuity with 180 payments guaranteed (accelerated)	0	6,771,892	26,707,380
A180F	Life Annuity with 180 payments guaranteed (forced)	21	272,610	3,362,699
JOINT	Joint and 75% Survivor	831	21,590,874	327,347,204
JOINT	Joint and 75% Survivor (accelerated)	0	3,194,258	11,937,447
R25	Reduced 25% on First Death	359	10,996,194	161,324,750
R25	Reduced 25% on First Death (accelerated)	0	1,300,598	4,540,920
C100	100% Continued to Named Survivor	1,030	20,896,004	322,614,282
C100	100% Continued to Named Survivor (accelerated)	0	2,857,428	11,320,460
C180	100% Continued to Named Survivor with 180 payments guaranteed	3,038	73,350,187	1,162,116,816
C180	100% Continued to Named Survivor with 180 payments guaranteed (accelerated)	0	13,973,106	56,285,164
AC24	Annuity Certain with 24 Payments	2	160,600	329,163
AC60	Annuity Certain with 60 Payments	1	65,845	303,203
AC120	Annuity Certain with 120 Payments	1	79,517	638,103
AC180	Annuity Certain between 24 and 180 Payments	2	113,451	704,467
SLNSD	Straight Life - Named Survivor Deceased	7	89,655	1,157,862
	Total Regular	9,591	\$ 246,795,212	\$ 3,294,589,428
	Average Age at Retirement	61.2 Years		
DISABILITY RETIREMENT				
SL	Straight Life	11	\$ 346,543	\$ 4,718,037
A60	Life Annuity with 60 payments guaranteed	13	439,882	5,899,260
A180	Life Annuity with 180 payments guaranteed	17	587,042	8,518,996
JOINT	Joint and 75% Survivor	6	226,309	3,584,808
R25	Reduced 25% on First Death	2	71,988	1,078,300
C100	100% Continued to Named Survivor	8	254,896	4,220,963
C180	100% Continued to Named Survivor with 180 payments guaranteed	41	1,373,573	22,310,120
	Total Disability	98	\$ 3,300,233	\$ 50,330,484
	Average Age at Retirement	55.4 Years		
DEATH-IN-SERVICE BENEFITS				
SL	Straight Life	6	\$ 76,461	\$ 1,050,641
SL	Straight Life (accelerated)	0	21,528	142,059
A60	Life Annuity with 60 payments guaranteed	2	168,306	2,265,144
A180	Life Annuity with 180 payments guaranteed	34	462,303	6,899,402
A180	Life Annuity with 180 payments guaranteed (accelerated)	0	110,082	564,846
	Total Death-in-Service	42	\$ 838,680	\$ 10,922,092
	Average Age at Retirement	55.4 Years		
GRAND TOTAL		9,731	\$ 250,934,125	\$ 3,355,842,004

In cases where an individual is receiving more than one annuity, the person only appears once in the above number counts, but the corresponding annual amounts can show up in several different places, depending on the option elected for the different annuities. This can result in, for example, a number count of zero (or a very low number count) combined with a significant annual dollar amount in the above table.

Core Annuities Being Paid Tabulated by Type of Annuity and Option

Alpha Code	Type of Benefit	Number	Annual Amount	Present Value
REGULAR RETIREMENT				
SL	Straight Life	26,905	\$ 547,032,792	\$ 5,915,753,168
SL	Straight Life (accelerated)	0	18,104,502	42,777,590
A60	Life Annuity with 60 payments guaranteed	20,627	420,641,500	4,330,422,385
A60	Life Annuity with 60 payments guaranteed (accelerated)	0	13,037,412	30,194,334
A120	Life Annuity with 120 payments guaranteed	52	627,910	1,701,597
A180	Life Annuity with 180 payments guaranteed	39,675	775,278,632	8,421,750,238
A180	Life Annuity with 180 payments guaranteed (accelerated)	0	35,990,412	91,957,094
A180F	Life Annuity with 180 payments guaranteed (forced)	319	2,617,763	22,995,111
JOINT	Joint and 75% Survivor	22,662	582,319,129	6,815,010,455
JOINT	Joint and 75% Survivor (accelerated)	0	17,149,092	41,273,756
R25	Reduced 25% on First Death	14,006	392,742,055	3,976,660,851
R25	Reduced 25% on First Death (accelerated)	0	7,180,000	16,494,091
C100	100% Continued to Named Survivor	18,846	411,114,436	5,057,089,545
C100	100% Continued to Named Survivor (accelerated)	0	15,274,509	37,489,649
C180	100% Continued to Named Survivor with 180 payments guaranteed	51,662	1,256,533,749	16,676,165,995
C180	100% Continued to Named Survivor with 180 payments guaranteed (accelerated)	0	69,551,366	180,175,382
LOL	Life with Optional Length Guaranteed	35	688,951	4,286,545
LOLF	Life with Optional Length Guaranteed (Forced)	2	37,309	120,979
AC24	Annuity Certain with 24 Payments	3	216,465	329,509
AC60	Annuity Certain with 60 Payments	6	550,300	1,210,979
AC120	Annuity Certain with 120 Payments	13	1,414,295	5,002,457
AC180	Annuity Certain between 24 and 180 Payments	11	2,065,522	8,272,979
C50	50% Continued to One Beneficiary	33	366,606	1,314,716
C50W180	50% Continued to One Beneficiary with 180 Months guaranteed	2	16,770	45,657
C75WSS	75% Continued to One Beneficiary and Social Security Integrated	49	1,088,006	4,803,765
R25W120	Reduced 25% on Death of Annuitant or Named Survivor with 120 Months guaranteed	1	4,199	12,413
A60WSS	Life with 60 Months Guaranteed and Social Security Integrated	43	202,725	634,658
A180WSS	Life with 180 Months Guaranteed and Social Security Integrated	43	970,569	2,917,477
PF6213	Police and Firemen s.62.13 *	46	1,564,234	5,558,078
SLNSD	Straight Life - Named Survivor Deceased	721	19,249,502	191,030,189
Total Regular		195,762	\$4,593,630,712	\$51,883,451,642

(concluded on next page)

In cases where an individual is receiving more than one annuity, the person only appears once in the above number counts, but the corresponding annual amounts can show up in several different places, depending on the option elected for the different annuities. This can result in, for example, a number count of zero (or a very low number count) combined with a significant annual dollar amount in the above table.

Core Annuities Being Paid Tabulated by Type of Annuity and Option

Alpha Code	Type of Benefit	Number	Annual Amount	Present Value
DISABILITY RETIREMENT				
SL	Straight Life	727	\$ 19,002,197	\$ 185,343,516
A60	Life Annuity with 60 payments guaranteed	392	10,043,801	94,499,046
A180	Life Annuity with 180 payments guaranteed	1,047	25,252,307	260,489,209
JOINT	Joint and 75% Survivor	495	11,004,419	120,758,062
R25	Reduced 25% on First Death	207	4,535,908	48,190,453
C100	100% Continued to Named Survivor	1,186	21,072,908	229,829,191
C180	100% Continued to Named Survivor with 180 payments guaranteed	2,011	42,192,519	542,619,643
DWSMC	Disability with Spouse or Minor/Dependent Child	8	186,433	1,389,374
DWOSMC	Disability without Spouse or Minor/Dependent Child	1	12,085	63,078
PF6213	Police and Firemen s.62.13 *	10	186,501	740,430
SLNSD	Straight Life - Named Survivor Deceased	7	219,384	2,348,543
Total Disability		6,091	\$ 133,708,462	\$ 1,486,270,545
DEATH-IN-SERVICE BENEFITS				
SL	Straight Life	247	\$ 3,413,438	\$ 36,509,746
SL	Straight Life (accelerated)	0	84,488	341,686
A60	Life Annuity with 60 payments guaranteed	130	2,274,807	25,045,581
A60	Life Annuity with 60 payments guaranteed (accelerated)	0	45,788	251,275
A180	Life Annuity with 180 payments guaranteed	939	12,898,351	154,296,132
A180	Life Annuity with 180 payments guaranteed (accelerated)	0	628,603	2,169,440
C180	100% Continued to Named Survivor with 180 payments guaranteed	2	10,787	158,027
LOL	Life with Optional Length Guaranteed	7	182,247	1,212,216
A60WSS	Life with 60 Months Guaranteed and Social Security Integrated	22	27,245	106,862
PF6213	Police and Firemen s.62.13 *	2	60,616	230,299
Total Death-in-Service		1,349	\$ 19,626,370	\$ 220,321,264
GRAND TOTAL		203,202	\$ 4,746,965,544	\$ 53,590,043,451

In cases where an individual is receiving more than one annuity, the person only appears once in the above number counts, but the corresponding annual amounts can show up in several different places, depending on the option elected for the different annuities. This can result in, for example, a number count of zero (or a very low number count) combined with a significant annual dollar amount in the above table.

*Additional Information for Police and Firemen 62.13 Annuities

	<u>Regular Retirement</u>			<u>Disability Retirement</u>			<u>Death-in-Service Retirement</u>		
	<u>Original</u>	<u>Dividends</u>	<u>Total</u>	<u>Original</u>	<u>Dividends</u>	<u>Total</u>	<u>Original</u>	<u>Dividends</u>	<u>Total</u>
Benefit Amount	\$ 436,976	\$ 1,127,258	\$ 1,564,234	\$ 42,195	\$ 144,306	\$ 186,501	\$ 14,477	\$ 46,139	\$ 60,616
Present Value	1,573,031	3,985,047	5,558,078	167,518	572,912	740,430	54,991	175,308	230,299

Core Annuities Being Paid Tabulated by Attained Ages

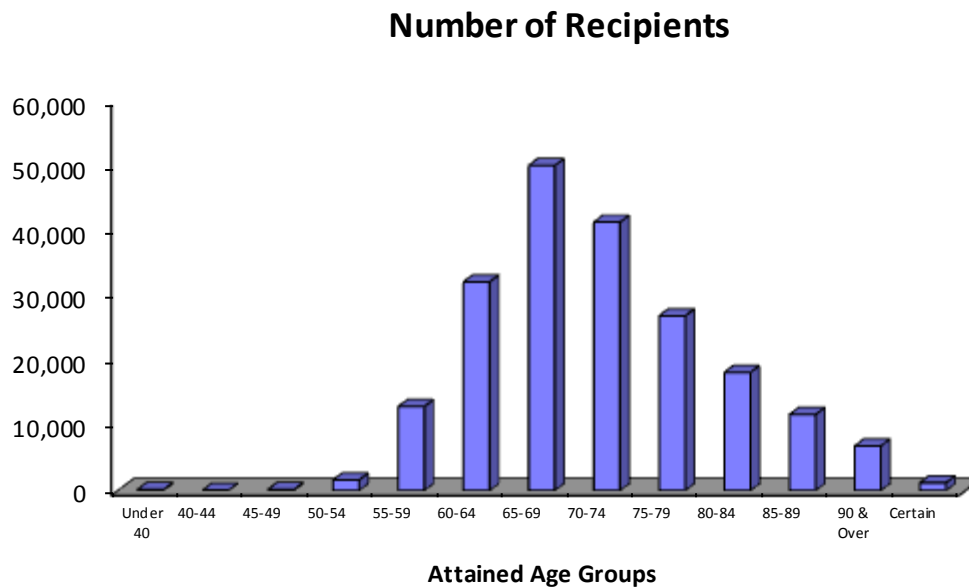
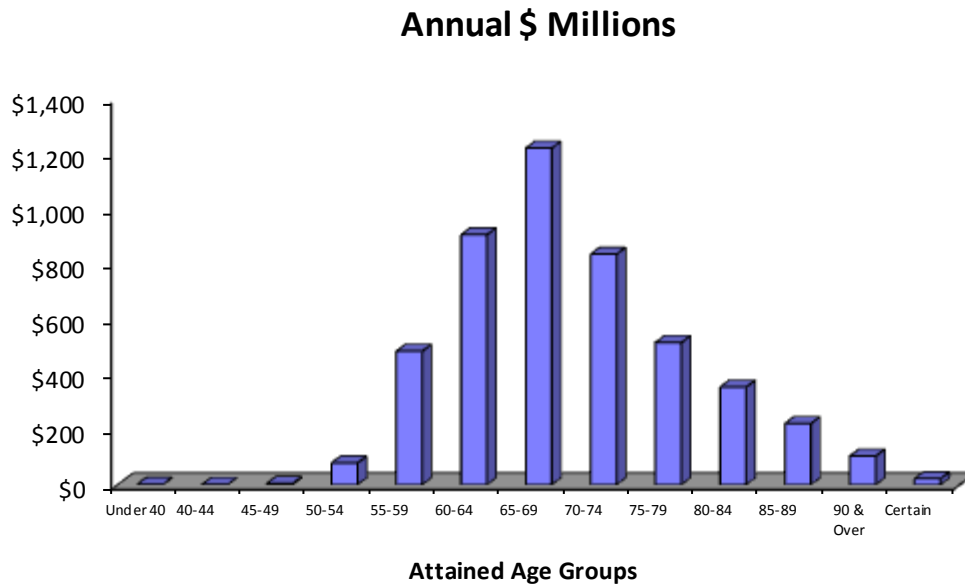
Attained Ages	Regular		Disability		Death-in-Service		Totals	
	No.	Annual Amount	No.	Annual Amount	No.	Annual Amount	No.	Annual Amount
Under 20	0	\$ 0	2	\$ 24,023	3	\$ 68,966	5	\$ 92,989
20-24	0	0	5	87,146	14	76,396	19	163,542
25-29	0	0	10	120,345	18	106,102	28	226,447
30-34	1	4,420	14	118,499	19	164,001	34	286,920
35-39	1	8,170	26	206,421	39	258,696	66	473,287
40-44	8	132,679	19	186,330	22	174,688	49	493,697
45-49	51	2,342,036	58	1,877,809	44	392,527	153	4,612,372
50-54	1,285	68,064,194	280	9,954,196	67	958,381	1,632	78,976,771
55-59	12,193	463,306,920	610	18,633,391	133	2,159,708	12,936	484,100,019
60-64	30,807	874,717,444	1,102	27,593,036	201	3,758,316	32,110	906,068,796
65-69	48,560	1,188,021,607	1,234	27,735,745	221	4,039,521	50,015	1,219,796,873
70-74	40,134	813,428,389	1,005	19,317,412	177	2,682,211	41,316	835,428,012
75-79	26,027	500,045,130	739	13,235,970	116	1,761,771	26,882	515,042,871
80-84	17,550	344,247,667	544	8,798,164	96	1,047,917	18,190	354,093,748
85-89	11,340	216,713,943	293	4,029,662	74	834,337	11,707	221,577,942
90-94	5,052	82,063,647	123	1,517,361	48	564,732	5,223	84,145,740
95& Up	1,589	19,182,601	27	272,952	19	90,713	1,635	19,546,266
Certain Only*	1,164	21,351,865	0	0	38	487,387	1,202	21,839,252
Totals	195,762	\$4,593,630,712	6,091	\$133,708,462	1,349	\$19,626,370	203,202	\$4,746,965,544

Averages in Years

Age at retirement	59.7	52.0	51.7	59.5
Attained age	70.6	68.3	67.7	70.6

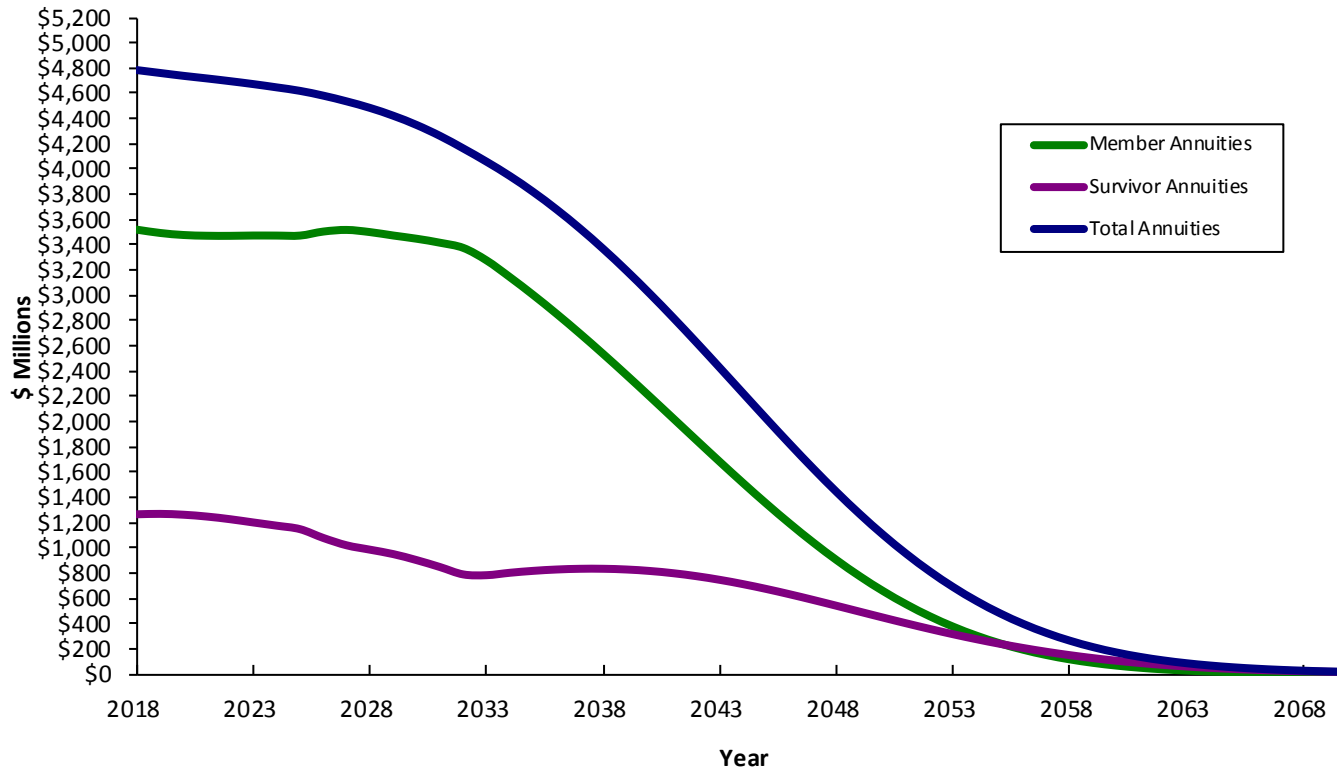
* Certain Only category consists of continuations of 5, 10 and 15-year certain and life annuities to beneficiaries of deceased annuitants.

Core Annuities Being Paid by Attained Age*



* Includes regular and disability retirees and survivor beneficiaries. The “certain” category includes annuities paid for a fixed period which is not dependent upon the age of the recipient.

Projected Future Core Annuity Payments on Behalf of Present Retired Lives Including Present Dividends



Total Future Payments	\$121.9 billion
From Present Assets	54.9
From Investment Return	67.0

SECTION D

VARIABLE ANNUITIES

Variable Annuity Division Development of Assets and Liabilities

	\$ Millions		Ratio
	Assets	Liabilities	
Ending Balance December 31, 2016	\$3,792.0	\$3,645.1	1.040
Closing Adjustments	(1.9)	0.0	
Variable Terminations	(95.9)	(95.9)	
2017 Adjustment: 4%	0.0	142.5	
Beginning Balance January 1, 2017	3,694.2	3,691.7	1.001
Increases			
Reserve Transfers	161.1	161.1	
Regular Interest	179.5	179.5	
Additional Earnings	657.6	0.0	
Addition for Experience Study/Mortality Reserve	0.0	18.4	
Other	0.0	0.0	
Total Increases	998.2	359.0	
Decreases			
Annuities & Lump Sums	367.5	367.5	
Credit Re-establishments	0.0	0.0	
Subtraction for Experience Study/Mortality Reserve	0.0	0.0	
Other	0.0	1.1	
Total Decreases	367.5	368.6	
Ending Balance December 31, 2017	\$4,324.9	\$3,682.1	1.175

Reserve Transfer Recommendation

Amounts to be transferred from the Employer Reserve and the Employee Reserve to the Annuity Reserve to cover liabilities for new annuities are computed as the first step in the annual actuarial valuation. The actuarial present value at time of retirement of variable annuities reported as new since the last actuarial valuation is \$154,477,629. Adjustments to prior transfers, relating to estimated annuities for which final computations have now been made, totaled \$6,620,976. Reserve transfers were distributed as follows:

Group	Regular Transfer	Adjustment to Prior Transfer	Total Transfer
General	\$135,939,285	\$6,012,542	\$141,951,827
Protective with Social Security	14,017,691	1,328,723	15,346,414
Protective without Social Security	1,638,754	158,062	1,796,816
Executive & Elected	2,881,899	(878,351)	2,003,548
Totals	\$154,477,629	\$6,620,976	\$161,098,605

Accordingly, we recommend that \$161,098,605 be transferred to the Variable Annuity Reserve. The results in this report assume that this transfer has been made.

Discussion of Variable Annuity Change

Variable Annuity Reserves, \$4,324.9 million, were more than the actuarial present value of variable annuities, \$3,682.1 million, by \$642.8 million as of December 31, 2017 or 17.5% of the Actuarial Present Value (APV) of variable annuity payments. In accordance with Section 40.28(2) of the Wisconsin statutes (see page 29), variable annuities will be increased by 17.0% effective April 1, 2018. The primary sources of the 17.0% are as follows:

	<u>% of APV</u>
1. SWIB net of fee investment return	23.2%
2. Adjustment to published effective rate	0.8%
3. Published effective earnings rate	24.0%
4. Adjustment to relate earnings to average variable annuity fund balance	(0.7)%
5. Earnings rate based on average balance	23.3%
6. Expected change before adjustments: 1.233/1.05-1	17.4%
7. Adjustment to relate average asset to ending liability	0.5%
8. Carryover from last year due to timing of distribution, accounting adjustments and truncation	0.1%
9. Experience study/mortality reserve adjustment	(0.5)%
10. Experience and other effects	0.0%
11. Statutory adjustment: (truncate to whole percent)	(0.5)%
12. Variable annuity change: (6)+(7)+(8)+(9)+(10)+(11)	17.0%

Please see pages 30 and 31 for a description of the items on this page.

Transfers to Annuity Reserve to Finance Variable Annuities Approved in 2017 Tabulated by Type of Annuity and Option

Alpha Code	Type of Benefit	Number	Annual Amount	Present Value
REGULAR RETIREMENT				
SL	Straight Life	262	\$ 1,535,480	\$ 20,511,804
SL	Straight Life (accelerated)	0	197,885	662,101
A60	Life Annuity with 60 payments guaranteed	144	722,434	10,074,204
A60	Life Annuity with 60 payments guaranteed (accelerated)	0	182,322	693,126
A180	Life Annuity with 180 payments guaranteed	355	1,817,340	26,180,118
A180	Life Annuity with 180 payments guaranteed (accelerated)	0	401,872	1,555,231
A180F	Life Annuity with 180 payments guaranteed (forced)	4	36,391	450,122
JOINT	Joint and 75% Survivor	168	1,125,424	16,834,464
JOINT	Joint and 75% Survivor (accelerated)	0	177,785	740,974
R25	Reduced 25% on First Death	69	429,672	6,363,757
R25	Reduced 25% on First Death (accelerated)	0	78,014	277,022
C100	100% Continued to Named Survivor	190	968,175	14,895,167
C100	100% Continued to Named Survivor (accelerated)	0	151,722	637,940
C180	100% Continued to Named Survivor with 180 payments guaranteed	561	3,039,095	47,834,196
C180	100% Continued to Named Survivor with 180 payments guaranteed (accelerated)	0	713,675	2,848,388
AC120	Annuity Certain with 120 Payments	0	1,986	16,769
AC180	Annuity Certain between 24 and 180 Payments	0	9,579	62,743
SLNSD	Straight Life - Named Survivor Deceased	5	35,640	445,985
	Total Regular	1,758	\$ 11,624,491	\$ 151,084,111
	Average Age at Retirement	60.3 Years		
DISABILITY RETIREMENT				
SL	Straight Life	4	\$ 23,990	\$ 341,942
A60	Life Annuity with 60 payments guaranteed	4	25,371	350,165
A180	Life Annuity with 180 payments guaranteed	9	52,057	728,557
JOINT	Joint and 75% Survivor	3	16,453	264,847
C100	100% Continued to Named Survivor	1	3,928	67,557
C180	100% Continued to Named Survivor with 180 payments guaranteed	11	56,849	917,517
	Total Disability	32	\$ 178,648	\$ 2,670,585
	Average Age at Retirement	53.9 Years		
DEATH-IN-SERVICE BENEFITS				
SL	Straight Life	0	\$ 0	\$ 0
A60	Life Annuity with 60 payments guaranteed	1	17,378	238,516
A180	Life Annuity with 180 payments guaranteed	8	27,498	404,020
A180	Life Annuity with 180 payments guaranteed (accelerated)	0	10,128	80,397
	Total Death-in-Service	9	\$ 55,004	\$ 722,933
	Average Age at Retirement	57.9 Years		
GRAND TOTAL		1,799	\$ 11,858,143	\$ 154,477,629

In cases where an individual is receiving more than one annuity, the person only appears once in the above number counts, but the corresponding annual amounts can show up in several different places, depending on the option elected for the different annuities. This can result in, for example, a number count of zero (or a very low number count) combined with a significant annual dollar amount in the above table.

Variable Annuities Being Paid Tabulated by Type of Annuity and Option

Alpha Code	Type of Benefit	Number	Annual Amount	Present Value
REGULAR RETIREMENT				
SL	Straight Life	4,963	\$ 40,487,807	\$ 378,188,915
SL	Straight Life (accelerated)	0	669,405	1,665,791
A60	Life Annuity with 60 payments guaranteed	3,677	30,316,724	273,041,479
A60	Life Annuity with 60 payments guaranteed (accelerated)	0	479,264	1,249,668
A120	Life Annuity with 120 payments guaranteed	14	87,026	253,228
A180	Life Annuity with 180 payments guaranteed	7,744	59,896,846	576,726,074
A180	Life Annuity with 180 payments guaranteed (accelerated)	0	1,489,321	3,923,924
A180F	Life Annuity with 180 payments guaranteed (forced)	34	221,459	1,765,913
JOINT	Joint and 75% Survivor	4,929	50,701,773	526,140,801
JOINT	Joint and 75% Survivor (accelerated)	0	683,936	1,721,081
R25	Reduced 25% on First Death	3,505	48,006,867	409,359,613
R25	Reduced 25% on First Death (accelerated)	0	329,468	775,729
C100	100% Continued to Named Survivor	3,736	34,169,284	356,636,020
C100	100% Continued to Named Survivor (accelerated)	0	542,265	1,318,711
C180	100% Continued to Named Survivor with 180 payments guaranteed	10,472	88,428,525	1,043,943,958
C180	100% Continued to Named Survivor with 180 payments guaranteed (accelerated)	0	2,419,062	6,437,163
LOL	Life with Optional Length Guaranteed	3	49,942	169,348
AC24	Annuity Certain with 24 Payments	0	0	0
AC60	Annuity Certain with 60 Payments	0	61,531	122,533
AC120	Annuity Certain with 120 Payments	1	85,219	336,434
AC180	Annuity Certain between 24 and 180 Payments	0	460,010	1,984,304
C50	50% Continued to One Beneficiary	19	176,148	563,882
C50W180	50% Continued to One Beneficiary with 180 Months guaranteed	2	19,379	56,027
C75WSS	75% Continued to One Beneficiary and Social Security Integrated	18	136,452	632,001
R25W120	Reduced 25% on Death of Annuitant or Named Survivor with 120 Months guaranteed	1	6,037	17,826
A60WSS	Life with 60 Months Guaranteed and Social Security Integrated	15	51,534	166,836
A180WSS	Life with 180 Months Guaranteed and Social Security Integrated	6	45,084	140,945
SLNSD	Straight Life - Named Survivor Deceased	144	1,602,713	13,849,891
Total Regular		39,283	\$361,623,081	\$3,601,188,095

(concluded on next page)

In cases where an individual is receiving more than one annuity, the person only appears once in the above number counts, but the corresponding annual amounts can show up in several different places, depending on the option elected for the different annuities. This can result in, for example, a number count of zero (or a very low number count) combined with a significant annual dollar amount in the above table.

Variable Annuities Being Paid Tabulated by Type of Annuity and Option

Numeric Code	Alpha Code	Type of Benefit	Number	Annual Amount	Present Value
DISABILITY RETIREMENT					
1	SL	Straight Life	123	\$ 544,596	\$ 4,711,090
3	A60	Life Annuity with 60 payments guaranteed	74	487,823	4,034,895
7	A180	Life Annuity with 180 payments guaranteed	245	1,035,670	9,893,122
10	JOINT	Joint and 75% Survivor	105	759,641	7,330,898
12	R25	Reduced 25% on First Death	43	247,290	2,164,996
14	C100	100% Continued to Named Survivor	229	1,202,163	11,082,740
16	C180	100% Continued to Named Survivor with 180 payments guaranteed	428	2,096,407	23,541,146
30	DWSMC	Disability with Spouse or Minor/Dependent Child	1	526	6,033
35	SLNSD	Straight Life - Named Survivor Deceased	0	0	0
Total Disability			1,248	\$ 6,374,116	\$ 62,764,920
DEATH-IN-SERVICE BENEFITS					
1	SL	Straight Life	68	\$ 434,490	\$ 4,254,628
2	SL	Straight Life (accelerated)	0	5,607	9,127
3	A60	Life Annuity with 60 payments guaranteed	28	212,371	1,682,319
4	A60	Life Annuity with 60 payments guaranteed (accelerated)	0	3,059	11,677
7	A180	Life Annuity with 180 payments guaranteed	241	1,201,423	11,860,045
8	A180	Life Annuity with 180 payments guaranteed (accelerated)	0	48,439	268,805
23	AC180	Annuity Certain between 24 and 180 Payments	0	0	0
28	A60WSS	Life with 60 Months Guaranteed and Social Security Integrated	9	7,423	29,655
Total Death-in-Service			346	\$ 1,912,812	\$ 18,116,256
GRAND TOTAL			40,877	\$ 369,910,009	\$ 3,682,069,271

In cases where an individual is receiving more than one annuity, the person only appears once in the above number counts, but the corresponding annual amounts can show up in several different places, depending on the option elected for the different annuities. This can result in, for example, a number count of zero (or a very low number count) combined with a significant annual dollar amount in the above table.

Variable Annuities Being Paid Tabulated by Attained Ages

Attained Ages	Regular		Disability		Death-in-Service		Totals	
	No.	Annual Amount	No.	Annual Amount	No.	Annual Amount	No.	Annual Amount
20-24	0	\$ 0	2	\$ 5,419	5	\$ 2,750	7	\$ 8,169
25-29	0	0	3	1,586	3	3,215	6	4,801
30-34	0	0	8	3,181	4	1,764	12	4,945
35-39	1	256	12	27,237	9	9,326	22	36,819
40-44	4	32,974	7	9,189	7	18,577	18	60,740
45-49	11	178,571	21	81,573	16	53,319	48	313,463
50-54	313	2,499,162	86	273,471	15	36,844	414	2,809,477
55-59	2,593	17,038,582	152	460,397	38	160,954	2,783	17,659,933
60-64	6,137	33,154,083	233	720,170	44	209,801	6,414	34,084,054
65-69	9,381	69,318,408	209	1,113,113	54	257,335	9,644	70,688,856
70-74	8,233	78,051,297	187	1,373,730	46	335,649	8,466	79,760,676
75-79	4,712	61,315,266	136	1,163,899	30	238,153	4,878	62,717,318
80-84	3,406	48,116,733	102	710,725	24	219,868	3,532	49,047,326
85-89	2,546	32,955,771	58	297,077	19	124,905	2,623	33,377,753
90-94	1,247	13,846,211	25	115,580	20	119,348	1,292	14,081,139
95 & Up	448	3,543,516	7	17,762	8	53,997	463	3,615,275
Certain Only*	251	1,572,251	0	7	4	67,007	255	1,639,265
Totals	39,283	\$361,623,081	1,248	\$6,374,116	346	\$1,912,812	40,877	\$369,910,009

Averages in Years

Age at retirement	59.2	52.6	51.3	59.0
Attained age	70.5	66.7	67.7	70.4

* Certain only category consists of continuations of 5, 10 and 15-year certain and life annuities to beneficiaries of deceased annuitants.

SECTION E

COMPARATIVE STATEMENTS

Core Annuities Comparative Statement 1983 Through 2017

Valuation Date	Number	\$ Millions				Change in		
		Annual Annuities	Fund Balance	Actuarial Reserve	Ratio	Annuities		CPI*
						Average	Maximum	
1983	57,770	\$ 177.7	\$ 1,830.3	\$ 1,738.3	1.053	5.0 %	3.8 %	
1984	60,302	214.3	2,255.5	2,121.3	1.064	6.0 %	4.0 %	
1985	62,953	257.6	2,758.2	2,561.0	1.077	7.2 %	3.8 %	
1986	65,425	303.5	3,256.9	3,021.2	1.078	7.6 %	1.1 %	
1987	67,688	366.9	3,833.7	3,594.6	1.067	6.7 %	4.4 %	
1988	70,017	420.6	4,319.6	4,150.9	1.041	4.1 %	4.4 %	
1989	73,232	488.7	5,487.4	4,928.1	1.113	11.3 %	4.6 %	
1990	77,666	611.3	6,443.8	6,219.1	1.036	3.6 %	6.2 %	
1991	79,465	660.4	7,137.8	6,711.3	1.063	6.3 %	3.0 %	
1992	81,508	732.3	7,782.4	7,456.6	1.044	4.4 %	3.0 %	
1993	83,836	801.7	8,608.2	8,205.3	1.049	4.9 %	2.7 %	
1994	86,214	882.2	9,286.2	9,029.6	1.028	2.8 %	2.7 %	
1995	88,998	955.8	10,351.7	9,804.1	1.056	5.6 %	2.6 %	
1996	92,198	1,065.8	11,699.8	10,977.1	1.066	6.6 %	3.3 %	
1997	95,128	1,188.4	13,185.1	12,240.4	1.077	7.7 %	1.7 %	
1998	99,112	1,349.5	14,951.8	13,943.0	1.072	7.2 %	1.6 %	
1999	102,817	1,513.8	16,857.8	15,687.2	1.075	17.1 % **	2.7 %	
2000	107,425	1,867.0	20,517.8	19,405.3	1.057	5.7 %	3.4 %	
2001	112,142	2,048.6	21,979.7	21,283.6	1.033	3.3 %	1.6 %	
2002	116,289	2,226.6	23,142.4	23,202.9	0.997	0.0 %	2.4 %	
2003	121,582	2,364.7	25,071.9	24,724.0	1.014	1.4 %	1.9 %	
2004	126,211	2,500.3	26,920.0	26,232.2	1.026	2.6 %	3.3 %	
2005	131,674	2,691.4	28,575.3	28,359.7	1.008	0.8 %	3.4 %	
2006	137,117	2,843.6	31,180.5	30,273.9	1.030	3.0 %	2.6 %	
2007	142,906	3,075.3	35,050.1	32,877.5	1.066	6.6 %	4.1 %	
2008	144,033	3,399.3	35,798.1	36,551.5	0.979	(2.1)%	(2.1)%	0.1 %
2009	150,671	3,449.3	36,655.8	37,072.7	0.989	(1.1)%	(1.3)%	2.7 %
2010	155,775	3,532.4	37,798.4	38,148.5	0.991	(0.9)%	(1.2)%	1.5 %
2011	167,453	3,842.0	40,411.5	42,078.3	0.960	(4.0)%	(7.0)%	3.0 %
2012	173,655	3,806.3	40,591.6	41,852.4	0.970	(3.0)%	(9.6)%	1.7 %
2013	180,056	3,800.7	44,273.2	42,300.5	1.047	4.7 %	4.7 %	1.5 %
2014	185,605	4,102.3	47,135.7	45,790.7	1.029	2.9 %	2.9 %	0.8 %
2015	191,795	4,364.9	49,147.0	48,897.5	1.005	0.5 %	0.5 %	0.7 %
2016	197,647	4,523.1	51,972.0	50,941.4	1.020	2.0 %	2.0 %	2.1 %
2017	203,202	4,747.0	54,900.0	53,590.0	1.024	2.4 %	2.4 %	2.1 %
35-Year Average						3.9 %	2.7 %	
20-Year Average						2.4 %	2.2 %	
10-Year Average						0.1 %	1.6 %	
5-Year Average						2.5 %	1.4 %	

* CPI percentage increase determined by ratio of current year CPI-U67 December index over prior year December index.

** Including 10.6% Act 11 transfer.

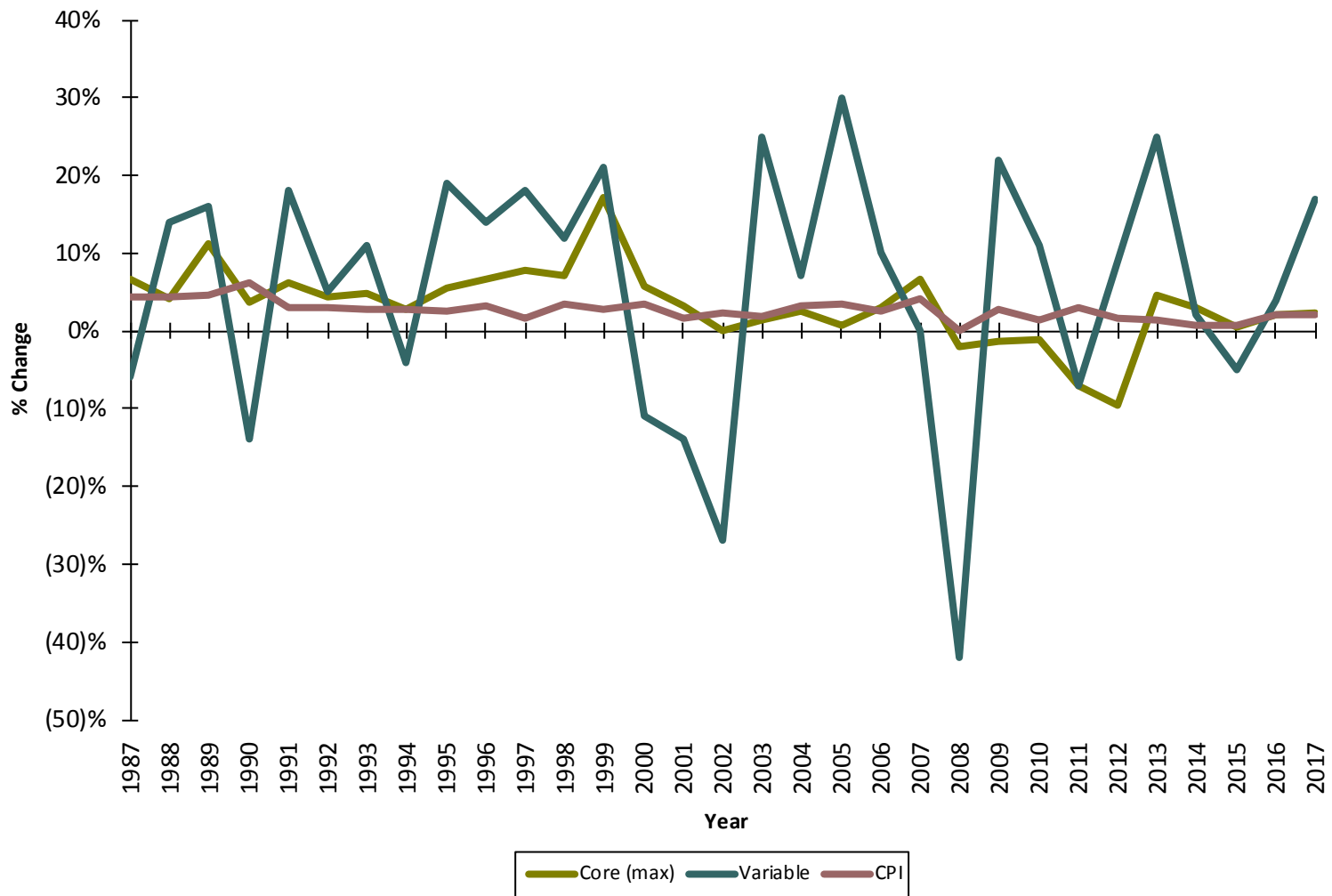
In cases where there is a negative dividend, a maximum decrease is calculated to account for annuitants that are already at the floor and whose dividend cannot be reduced.

Variable Annuities Comparative Statement 1983 Through 2017

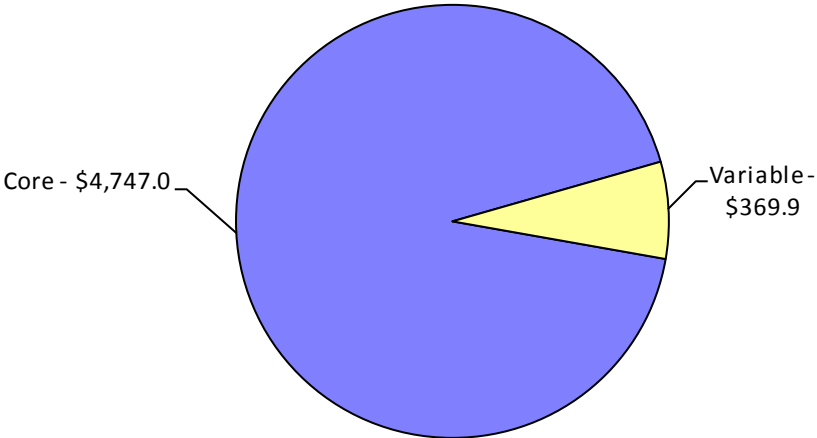
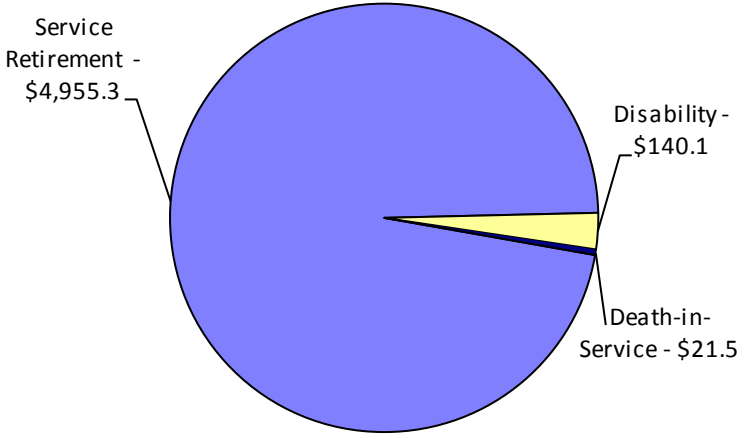
Valuation Date	Number	\$ Millions				Change in	
		Annual Annuities	Fund Balance	Actuarial Reserve	Ratio	Annuities	CPI*
1983	13,598	\$ 25.9	\$ 289.4	\$ 245.0	1.181	18.0 %	3.8 %
1984	14,520	34.2	329.2	327.5	1.005	0.0 %	4.0 %
1985	15,529	38.0	463.1	366.6	1.263	26.0 %	3.8 %
1986	16,276	51.8	538.7	498.6	1.080	8.0 %	1.1 %
1987	17,084	60.4	548.8	584.2	0.939	(6.0)%	4.4 %
1988	17,779	61.4	682.6	594.0	1.149	14.0 %	4.4 %
1989	18,502	75.9	878.1	756.5	1.161	16.0 %	4.6 %
1990	19,922	101.0	868.6	1,013.4	0.857	(14.0)%	6.2 %
1991	20,538	91.5	1,101.3	929.7	1.184	18.0 %	3.0 %
1992	20,968	112.6	1,208.6	1,147.4	1.053	5.0 %	3.0 %
1993	21,623	123.7	1,407.9	1,268.6	1.110	11.0 %	2.7 %
1994	22,248	144.6	1,418.0	1,487.0	0.954	(4.0)%	2.7 %
1995	22,978	150.2	1,854.2	1,556.0	1.192	19.0 %	2.6 %
1996	23,725	189.8	2,264.9	1,976.7	1.146	14.0 %	3.3 %
1997	24,462	228.2	2,800.0	2,371.5	1.181	18.0 %	1.7 %
1998	25,424	289.5	3,400.5	3,035.5	1.120	12.0 %	1.6 %
1999	26,257	345.8	4,432.9	3,659.1	1.212	21.0 %	2.7 %
2000	27,321	445.3	4,211.4	4,749.3	0.887	(11.0)%	3.4 %
2001	28,314	424.4	3,901.8	4,547.4	0.858	(14.0)%	1.6 %
2002	28,662	374.0	2,899.3	3,999.1	0.726	(27.0)%	2.4 %
2003	29,496	273.3	3,635.9	2,892.2	1.257	25.0 %	1.9 %
2004	30,270	346.0	3,909.9	3,654.5	1.070	7.0 %	3.3 %
2005	31,499	376.5	4,092.7	3,970.7	1.031	3.0 %	3.4 %
2006	32,683	391.8	4,594.2	4,145.2	1.108	10.0 %	2.6 %
2007	33,880	432.6	4,625.0	4,563.7	1.013	0.0 %	4.1 %
2008	34,927	427.0	2,574.5	4,491.0	0.573	(42.0)%	0.1 %
2009	34,836	240.3	3,078.4	2,512.7	1.225	22.0 %	2.7 %
2010	35,866	288.4	3,340.6	3,005.4	1.111	11.0 %	1.5 %
2011	38,949	330.3	3,197.9	3,462.9	0.924	(7.0)%	3.0 %
2012	39,873	304.6	3,463.9	3,169.6	1.093	9.0 %	1.7 %
2013	40,317	324.5	4,187.3	3,347.0	1.251	25.0 %	1.5 %
2014	39,420	386.5	3,995.4	3,917.1	1.020	2.0 %	0.8 %
2015	40,152	387.8	3,704.8	3,910.1	0.947	(5.0)%	0.7 %
2016	40,647	363.6	3,792.0	3,645.1	1.040	4.0 %	2.1 %
2017	40,877	369.9	4,324.9	3,682.1	1.175	17.0 %	2.1 %
35-Year Average						4.6 %	2.7 %
20-Year Average						1.5 %	2.2 %
10-Year Average						1.6 %	1.6 %
5-Year Average						8.1 %	1.4 %

* CPI percentage increase determined by ratio of current year CPI-U67 December index over prior year December index.

History of % Changes in Annuities and CPI



Annual Annuities Being Paid by Type \$ Millions



Annuities Being Paid Tabulated by Year of Retirement (\$1,000s annually)

Year Ret'd	Core Annuities				Variable Annuities				Avg. Total Annuity
	No.	Initial	Increases	Total	No.	Initial	Increases	Total	
2017	9,304	\$ 240,178	\$ 3	\$ 240,181	1,733	\$ 11,016	\$ 0	\$ 11,016	\$30,298
2016	9,988	255,600	2,800	258,400	1,599	9,746	390	10,136	29,867
2015	10,116	253,931	5,822	259,753	1,701	10,180	(122)	10,058	29,708
2014	9,143	213,417	8,791	222,208	1,710	9,726	77	9,803	28,146
2013	9,482	212,972	17,197	230,169	1,703	7,685	1,996	9,681	28,334
2012	9,430	209,807	21,797	231,604	1,742	6,548	2,442	8,990	28,690
2011	15,142	387,223	40,061	427,284	3,155	14,922	4,132	19,054	33,750
2010	8,287	189,120	19,603	208,723	1,635	5,937	2,478	8,415	29,778
2009	7,805	178,898	18,598	197,496	1,447	4,234	3,088	7,322	28,958
2008	8,457	196,538	20,352	216,890	1,750	10,813	39	10,852	27,548
2007	8,283	179,594	18,615	198,209	1,864	12,015	41	12,056	25,521
2006	8,020	164,144	17,009	181,153	1,723	11,663	1,205	12,868	24,259
2005	7,988	160,021	16,613	176,634	1,751	12,373	1,689	14,062	23,999
2004	7,174	135,336	14,058	149,394	1,628	11,675	2,521	14,196	22,886
2003	7,179	136,726	14,186	150,912	1,490	9,637	5,010	14,647	23,168
2002	6,586	121,624	12,604	134,228	1,295	12,812	1,411	14,223	22,612
2001	6,638	122,313	12,658	134,971	1,368	20,222	(920)	19,302	23,329
2000	6,562	118,927	12,421	131,348	1,160	23,151	(3,489)	19,662	23,140
1999	5,486	86,070	21,682	107,752	983	15,675	431	16,106	22,610
1998	5,313	78,414	26,204	104,618	990	13,972	2,108	16,080	22,825
1997	4,423	63,578	27,392	90,970	833	9,892	3,537	13,429	23,743
1996	4,272	60,040	31,884	91,924	865	8,990	4,911	13,901	24,947
1995	3,759	51,048	31,530	82,578	745	6,334	5,335	11,669	25,247
1994	3,366	43,440	29,464	72,904	758	6,205	4,771	10,976	25,159
1993	2,973	36,106	26,731	62,837	663	4,637	4,457	9,094	24,375
1992	2,460	28,307	23,407	51,714	554	3,633	3,856	7,489	24,244
1991	2,123	23,718	21,960	45,678	503	2,864	4,107	6,971	25,179
1990	3,386	39,413	39,580	78,993	842	5,145	5,619	10,764	26,881
1989	2,405	27,564	31,899	59,463	557	2,971	4,236	7,207	28,013
1988	1,634	14,504	19,262	33,766	404	1,618	2,857	4,475	23,650
1987	1,321	11,070	16,195	27,265	357	1,420	2,277	3,697	23,964
1986	1,127	9,160	15,293	24,453	323	1,172	2,118	3,290	25,017
1985	988	7,787	14,845	22,632	262	697	1,765	2,462	26,004
1984	679	4,809	9,961	14,770	215	579	1,469	2,048	25,253
1983	493	2,668	5,903	8,571	167	370	1,165	1,535	20,837
1982	345	1,412	3,484	4,896	97	159	608	767	16,509
1981	302	1,044	2,838	3,882	87	103	388	491	14,528
1980	192	710	1,927	2,637	59	76	364	440	15,946
1979	117	334	1,006	1,340	34	30	163	193	13,101
1978	99	245	747	992	24	15	90	105	11,085
Prior	355	639	2,135	2,774	101	54	324	378	5,632
Total	203,202	\$4,068,449	\$678,517	\$4,746,966	40,877	\$290,966	\$78,944	\$369,910	\$25,181

Liabilities as of December 31, 2017 Tabulated by Year of Retirement (\$1,000s annually)

Year Ret'd	Core Liabilities				Variable Liabilities				Total Liabilities
	No.	Initial	Increases	Total	No.	Initial	Increases	Total	
2017	9,304	\$ 3,190,279	\$ 46	\$ 3,190,325	1,733	\$ 145,207	\$ 0	\$ 145,207	\$3,335,532
2016	9,988	3,352,994	36,714	3,389,707	1,599	123,267	4,926	128,193	3,517,900
2015	10,116	3,301,873	75,706	3,377,579	1,701	129,926	(1,559)	128,367	3,505,946
2014	9,143	2,737,455	112,640	2,850,095	1,710	122,715	972	123,686	2,973,782
2013	9,482	2,705,796	218,480	2,924,276	1,703	96,970	25,188	122,158	3,046,433
2012	9,430	2,674,222	277,773	2,951,994	1,742	82,439	30,749	113,188	3,065,182
2011	15,142	5,011,842	518,401	5,530,243	3,155	188,898	52,309	241,207	5,771,450
2010	8,287	2,423,742	251,202	2,674,944	1,635	74,587	31,126	105,712	2,780,656
2009	7,805	2,266,961	235,705	2,502,666	1,447	51,632	37,659	89,291	2,591,957
2008	8,457	2,431,747	251,945	2,683,692	1,750	130,364	440	130,804	2,814,496
2007	8,283	2,201,475	228,106	2,429,580	1,864	143,625	485	144,109	2,573,690
2006	8,020	1,970,390	204,163	2,174,553	1,723	136,210	14,067	150,277	2,324,830
2005	7,988	1,868,574	193,920	2,062,494	1,751	141,124	19,267	160,391	2,222,885
2004	7,174	1,531,489	159,069	1,690,558	1,628	131,811	28,463	160,274	1,850,832
2003	7,179	1,504,742	156,053	1,660,795	1,490	105,806	55,007	160,813	1,821,608
2002	6,586	1,318,956	136,649	1,455,605	1,295	140,325	15,458	155,784	1,611,389
2001	6,638	1,272,538	131,691	1,404,230	1,368	207,863	(9,502)	198,361	1,602,590
2000	6,562	1,194,942	124,695	1,319,638	1,160	231,107	(34,833)	196,274	1,515,912
1999	5,486	828,578	207,709	1,036,287	983	147,039	4,043	151,082	1,187,369
1998	5,313	721,671	240,687	962,357	990	124,712	18,816	143,528	1,105,885
1997	4,423	553,890	238,050	791,940	833	84,347	30,159	114,506	906,446
1996	4,272	499,797	264,532	764,329	865	71,621	39,120	110,741	875,071
1995	3,759	402,941	248,085	651,026	745	47,842	40,300	88,142	739,168
1994	3,366	323,388	219,038	542,426	758	44,944	34,565	79,509	621,935
1993	2,973	256,501	189,808	446,309	663	31,319	30,084	61,403	507,712
1992	2,460	187,482	155,326	342,808	554	23,046	24,455	47,500	390,308
1991	2,123	148,748	137,775	286,523	503	16,891	24,209	41,100	327,623
1990	3,386	244,329	245,349	489,678	842	31,053	33,921	64,974	554,652
1989	2,405	155,554	179,825	335,379	557	16,125	22,990	39,114	374,494
1988	1,634	75,644	100,619	176,264	404	8,264	14,590	22,854	199,118
1987	1,321	53,158	77,354	130,512	357	6,414	10,282	16,696	147,208
1986	1,127	40,954	68,933	109,888	323	5,253	9,495	14,748	124,635
1985	988	33,807	64,383	98,190	262	2,950	7,466	10,416	108,606
1984	679	19,151	39,947	59,099	215	2,248	5,707	7,955	67,054
1983	493	10,038	22,251	32,289	167	1,343	4,213	5,557	37,845
1982	345	5,561	13,675	19,236	97	545	2,091	2,636	21,872
1981	302	3,998	10,916	14,913	87	383	1,437	1,820	16,733
1980	192	2,517	6,850	9,367	59	236	1,140	1,376	10,743
1979	117	1,143	3,447	4,590	34	94	513	608	5,198
1978	99	859	2,640	3,499	24	57	330	387	3,886
Prior	355	2,334	7,826	10,160	101	191	1,130	1,321	11,480
Total	203,202	\$47,532,062	\$6,057,981	\$53,590,043	40,877	\$3,050,794	\$631,275	\$3,682,068	\$57,272,112

Comparison of Actual to Expected Deaths Among Retired Lives (Normal Retirement Only) During 2017

Age	Male Deaths			Female Deaths			Total Deaths		
	Actual	Expected	Exposure	Actual	Expected	Exposure	Actual	Expected	Exposure
30-34						1			1
35-39						1			1
40-44			1			8			9
45-49			14			63			77
50-54	3	2	865	2		524	5	2	1,389
55-59	24	27	5,384	22	20	7,019	46	47	12,403
60-64	72	80	11,971	65	79	18,744	137	159	30,715
65-69	187	208	19,349	173	192	29,414	360	400	48,763
70-74	275	292	16,845	241	249	22,173	516	541	39,018
75-79	317	332	10,939	312	298	14,353	629	630	25,292
80-84	432	427	7,494	381	403	10,180	813	830	17,674
85-89	439	465	4,520	551	567	7,166	990	1,032	11,686
90-94	336	313	1,831	523	484	3,605	859	797	5,436
95-99	109	108	372	306	285	1,218	415	393	1,590
100 & Up	12	11	30	68	54	179	80	65	209
Totals	2,206	2,265	79,615	2,644	2,631	114,648	4,850	4,896	194,263
Average Ages	81.2	80.8	71.1	84.0	83.5	71.4	82.7	82.3	71.3

SECTION F

APPENDIX

Actuarial Assumptions Used in the Retired Life Actuarial Valuation

The interest rate used in the valuation was 5.0% a year, compounded yearly, as provided in Section 40.02 of the Wisconsin Statutes. To the extent that unfavorable investment performance reduces current dividends, liabilities would be lower than reported in this valuation. The mortality table used in the valuation was the Wisconsin 2015 Mortality Table, as adopted by the Board in connection with the 2012-2014 Experience Study. This table includes margin for future improvements in mortality by incorporating half of the MP-2015 fully generational scale. The impact of the new mortality tables is recognized equally over a three year period.

Single Life Retirement Values Wisconsin Projected Experience Table - 2015 with 5% Interest

Sample Attained Ages in 2017	Present Value of \$1 Monthly for Life		Future Life Expectancy (years)		Probability of Death Next Year	
	Males	Females	Males	Females	Males	Females
40	\$212.26	\$217.36	44.7	47.9	0.095%	0.059%
45	203.68	209.93	39.7	42.8	0.125%	0.091%
50	192.96	200.73	34.7	37.8	0.168%	0.136%
55	180.13	189.56	29.9	32.9	0.396%	0.243%
60	165.76	176.25	25.3	28.2	0.567%	0.349%
65	148.55	160.13	20.9	23.5	0.863%	0.530%
70	129.00	141.01	16.7	19.0	1.419%	0.896%
75	107.29	119.37	12.8	14.8	2.412%	1.627%
80	84.55	96.13	9.4	11.0	4.437%	3.050%
85	63.32	73.03	6.5	7.8	8.289%	6.107%

The values shown above are for non-disabled participants. Sample values for disabled participants are as follows:

Sample Attained Ages in 2017	Present Value of \$1 Monthly for Life		Future Life Expectancy (years)		Probability of Death Next Year	
	Males	Females	Males	Females	Males	Females
40	\$198.79	\$207.55	37.2	41.5	0.144%	0.102%
45	186.85	197.77	32.3	36.5	0.240%	0.153%
50	173.07	185.91	27.5	31.6	0.478%	0.268%
55	157.06	171.77	23.0	26.8	0.651%	0.400%
60	138.40	154.89	18.6	22.2	1.151%	0.624%
65	117.92	135.14	14.6	17.8	1.881%	1.074%
70	95.73	113.02	11.0	13.7	3.252%	1.943%
75	73.46	89.53	7.9	10.1	6.185%	3.669%
80	53.99	67.03	5.4	7.0	11.396%	7.493%
85	38.26	48.95	3.7	4.9	18.393%	12.937%

Statutory Provisions - Post-Retirement Adjustments

Core Annuities - 40.27(2)

“CORE ANNUITY RESERVE SURPLUS DISTRIBUTIONS. Surpluses in the core annuity reserve established under s. 40.04 (6) and (7) shall be distributed by the board if the distribution will result in at least a 0.5% increase in the amount of annuities in force, except as otherwise provided by the department by rule, on recommendation of the actuary, as follows:

(a) The distributions shall be expressed as percentage increases in the amount of the monthly annuity in force, including prior distributions of surpluses but not including any amount paid from funds other than the core annuity reserve fund, preceding the effective date of the distribution. For purposes of this subsection, annuities in force include any disability annuity suspended because the earnings limitation had been exceeded by that annuitant in that year.

(b) Prorated percentages based on the annuity effective date may be applied to annuities with effective dates during the calendar year preceding the effective date of the distribution, as provided by rule, but no other distinction may be made among the various types of annuities payable from the core annuity reserve.

(c) The distributions shall not be offset against any other benefit being received but shall be paid in full, nor shall any other benefit being received be reduced by the distributions. The annuity reserve surplus distributions authorized under this subsection may be revoked by the board in part or in total as to future payments upon recommendation of the actuary if a deficit occurs in the core annuity reserves and such deficit would result in a 0.5 percent or greater decrease in the amount of annuities in force, except as otherwise provided by the department by rule.

(d) Notwithstanding s 40.03 (2) (i), (7) (d), and (8) (d), the department may promulgate rules under this subsection without the approval of the teachers retirement board and the Wisconsin retirement board.”

Variable Annuities - 40.28(2)

“Whenever the balance in the variable annuity reserve, as of December 31 of any year, exceeds or is less than the then present value of all variable annuities in force, determined in accordance with the rate of interest and approved actuarial tables then in effect, by at least 2% of the present value of all variable annuities in force, the amount of each variable annuity payment shall be proportionately increased or decreased, disregarding fractional percentages, and effective on a date determined by rule, so as to reduce the variance between the balance of the variable annuity reserve and the present value of variable annuities to less than one percent.”

Narrative Regarding the Development of Dividend and Variable Annuity Changes Shown on Pages 6 and 16

- 1. SWIB Net of Fee Investment Return**
State of Wisconsin Investment Board net earnings rate on the Core/Variable Fund.
- 2. MRA Adjustment (Core)/Adjustment to Published Effective Rate (Variable)**
Item 3 below minus Item 1 above. For core annuities, this is the MRA adjustment which takes into account five-year smoothing of gains and losses.
- 3. Published Effective Earnings Rate**
The earnings rate published by DETF is funds' earnings credits expressed as a percentage of the beginning year balance adjusted for benefit payments and reserve transfers.
- 4. Adjustment to Relate Earnings to Average Core/Variable Annuity Balance**
Item 5 below minus Item 3 above.
- 5. Earnings Rate Based on Average Balance**
This is similar to the published earnings rate except that the rate is determined as a percentage of the average balance during the year instead of the adjusted beginning of year balance.
- 6. Expected Dividend (Variable Change) before Adjustments**
The relative difference in fund growth based on actual versus the 5% assumed earnings rates.
- 7. Adjustment to Relate Average Asset to Ending Liability**
The final dividend/variable change is calculated based on the end of year assets divided by the end of year liabilities. Since the calculations in Items 5 and 6 are based on average (approximately mid-year) balances, this adjustment is needed so that the final rate will be based on the end of year liabilities.
- 8. Carryover from Last Year Due to Timing of Distribution and Accounting Adjustments (and Truncation for Variable Annuity)**
The dividend or variable rate changes are made effective April 1 of each year. This adjustment takes into account the fact that the prior year dividend/variable increase was in effect for less than a full year as well as any accounting adjustments made to the asset value at the beginning of the year. This adjustment also carries over any truncated or rounded amounts from the prior year.

Narrative Regarding the Development of Dividend and Variable Annuity Changes Shown on Pages 6 and 16

9. Experience Study/Mortality Reserve Adjustment

A study is conducted for WRS every three years to analyze the assumptions that are made in the valuation versus the experience that actually occurred. If the results of the study show material changes in experience, WRS generally adopts a new set of assumptions. When assumptions are changed, this item displays the effect of the change on the dividend/variable rate. Although the mortality table now includes a projection for expected future improvements in mortality, each valuation phases into the full table incrementally over the three year experience study cycle. By increasing reserves gradually each year, instead of all at once every three years, the effect on dividends and variable increases will also be more gradual.

10. Experience and Other Effects

After making all other known adjustments, this is the remainder of all other experience. Changes here are primarily attributable to mortality experience and, generally to a lesser extent, on any data adjustments.

11. Statutory Adjustment to Round/Truncate

By statute, the dividend rate is calculated to the nearest one-tenth of a percent. For the variable annuity change, the rate is truncated to a whole percent. This is the adjustment made from the calculated dividend/variable annuity rate change without rounding/truncation to the statutory rate.

12. Computed Average Dividend Rate/Variable Annuity Change

This is the end of year asset value divided by the end of year liability. It is reconciled to the published earnings rate (Item 3) by making the adjustments in Items 6 through 11.

13. Adjustment for Members Not Eligible for Negative Dividend

This is an adjustment that is sometimes made for Core Fund recipients to reflect that some members may not have any remaining dividends and hence are not subject to a further negative dividend.

14. Final Maximum Computed Dividend Rate

When there is a negative dividend for the Core Fund, this will affect people differently based upon year of retirement. In years when there is a negative dividend, this will be the largest negative dividend that will occur in the Core Fund. If greater in absolute value than 0.5% of core annuities, Item 12 plus Item 13, otherwise 0%.