City of Battle Creek Police and Fire Retirement System

Fifty-Seventh Actuarial Valuation Report

June 30, 2019

June 30, 2019 Actuarial Valuation
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December 13, 2019

Retirement Board
City of Battle Creek
Police and Fire Retirement System
Battle Creek, Michigan

Dear Board Members:

The results of the June 30, 2019 Annual Actuarial Valuation of the City of Battle Creek Police and Fire Retirement System are presented in this report.

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 System only in its entirety and only with the permission of the Board. GRS is not responsible for unauthorized use of this report.

The purposes of the valuation are to measure the System's funding progress and to determine the employer contribution rate for the fiscal year ending June 30, 2021. Information required by Statement Nos. 67 and 68 of the Governmental Accounting Standards Board (GASB) are provided in separate reports. This report should not be relied on for any purpose other than the purposes described herein. Determinations of financial results, associated with the benefits described in this report, for purposes other than those identified above may be significantly different.

The contribution amount in this report is determined using the actuarial assumptions and methods disclosed in Section C of this report. This report includes risk metrics on page A-16 but does not include a more robust assessment of the risks of future experience not meeting the actuarial assumptions. Additional assessment of risks was outside the scope of this assignment. We encourage a review and assessment of investment and other significant risks that may have a material effect on the System's financial condition.

This valuation assumed the continuing ability of the plan sponsor to make the contributions necessary to fund this plan. A determination regarding whether or not the plan sponsor is actually able to do so is outside our scope of expertise and was not performed.

The findings in this report are based on data and other information through June 30, 2019. The valuation was based upon information furnished by the City, concerning Retirement System benefits, financial transactions, plan provisions and active members, terminated members, retirees and beneficiaries. We checked for internal reasonability and year-to-year consistency, but did not audit the data. We are not responsible for the accuracy or completeness of the information provided by the City.

This report was prepared using assumptions adopted by the Board. All actuarial assumptions used in this report are reasonable for the purposes of this valuation.

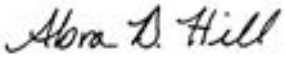
This report has been prepared by actuaries who have substantial experience valuing public employee retirement systems. To the best of our knowledge the information contained in this report is accurate and fairly presents the actuarial position of the City of Battle Creek Police and Fire Retirement System as of the valuation date. 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.

Abra D. Hill is a Member of the American Academy of Actuaries (MAAA) and meets the Academy's Qualification Standards to render the actuarial opinions contained herein.

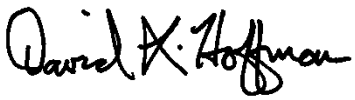
The signing individuals are independent of the plan sponsor.

Gabriel, Roeder, Smith & Company will be pleased to review this valuation and report with the Board of Trustees and to answer any questions pertaining to the valuation.

Respectfully submitted,



Abra D. Hill, ASA, EA, MAAA



David L. Hoffman

ADH/DLH:bd

SECTION A

VALUATION RESULTS, COMMENTS, RECOMMENDATIONS, AND CONCLUSIONS

Financial Objective

The financial objective of the Retirement System is to establish and receive contributions, expressed as percents of active member payroll, which will remain approximately level from year to year and will not have to be increased for future generations of citizens. This objective meets the requirements of Act No. 345 of the Public Acts of 1937, as amended, and the Michigan constitution.

Contribution Rates

The Retirement System is supported by member contributions, City contributions and investment income from Retirement System assets.

Contributions which are intended to satisfy the financial objective are determined by an annual actuarial valuation and are sufficient to:

(1) cover the actuarial present value of benefits assigned to the current year by the actuarial cost methods described in Section C (the normal cost); and

(2) amortize over a period of future years the actuarial present value of benefits not covered by valuation assets and anticipated future normal costs (unfunded actuarial accrued liability).

Computed contributions for the fiscal year beginning July 1, 2020 are shown on page A-2.

Contributions Computed to Meet the Financial Objective of the Retirement System

Contributions for	Contributions Expressed as Percents-of-Payroll		
Fiscal Year Beginning July 1	**2020**	**2020**	**2019**
Mortality Assumptions	**Proposed Mortality Rates**	**Current Mortality Rates**	**Current Mortality Rates**
Normal Cost			
Age and service benefits	23.64 %	23.41 %	23.34 %
Death and disability benefits	1.55 %	1.51 %	1.55 %
Termination benefits			
Deferred age & service benefits	2.11 %	2.09 %	2.09 %
Refunds of member contributions	0.53 %	0.52 %	0.51 %
Total Normal Cost	27.83 %	27.53 %	27.49 %
Amortization Payment/(Credit)	17.29 %	17.40 %	17.02 %
Total Contribution Requirement	45.12 %	44.93 %	44.51 %
Less average member portion	9.95 %	9.95 %	9.90 %
City portion	35.17 %	34.98 %	34.61 %

Please refer to page C-6 for information on the determination of the amortization payment.

A procedure for determining dollar contribution amounts is described on page A-3.

Comparative contribution amounts for prior fiscal years are shown on page A-6.

This report provides the liabilities and contribution requirements using an updated set of mortality tables. The results of the valuation using these proposed tables are included along with the current results on pages A-2 and A-4 of this report. All other exhibits in this report use results based only on the current set of mortality tables. The current mortality rates use the RP-2014 mortality tables with a static projection to the year 2019 using the MP-2014 mortality improvement scale. The proposed mortality rates use the RP-2014 mortality tables with fully generational mortality using the MP-2019 mortality improvement scale. Please see Section C for more information regarding the assumptions used in this valuation.

Determining Dollar Contributions

For any period of time, the percent-of-payroll contribution rate needs to be converted to dollar amounts. We recommend the following procedure.

Contribute dollar amounts at the end of each payroll period which are equal to the City's percent-of-payroll contribution requirement 34.98% multiplied by the covered active member payroll for the period. Adjustments should be made as necessary to exclude items of pay that are not covered compensation for Retirement System benefits and to include special payments that are covered compensation (overtime, longevity pay, etc.).

The above amounts are assumed to be contributed, on average, halfway through the fiscal year. If contributions are made on a later schedule, interest should be added at the rate of 0.53% for each month of delay.

Valuation Results
Comparative Statement
($ amounts in thousands)

Valuation Date June 30	(1) Valuation Assets	(2) Member Payroll	(3) AAL ^	(4) UAAL ^	Funded Ratio (1) / (3)
1990#	$ 35,694	$ 7,727	$ 42,480	$ 6,786	84.0 %
1991	40,110	7,770	43,785	3,675	91.6 %
1992*	43,929	8,359	46,891	2,962	93.7 %
1993	49,549	8,563	48,691	(858)	101.8 %
1994@	54,518	8,357	53,344	(1,174)	102.2 %
1995#	59,906	9,104	60,373	467	99.2 %
1996	65,885	9,834	65,549	(336)	100.5 %
1997	72,134	10,039	70,033	(2,101)	103.0 %
1998	79,796	9,813	73,270	(6,526)	108.9 %
1999	87,618	9,750	76,230	(11,388)	114.9 %
2000	95,548	11,235	81,667	(13,881)	117.0 %
2001	101,191	11,615	85,536	(15,655)	118.3 %
2002*	103,951	11,908	92,955	(10,996)	111.8 %
2003#	103,656	11,885	97,858	(5,798)	105.9 %
2004	103,746	12,114	101,773	(1,973)	101.9 %
2005	102,756	12,085	107,850	5,094	95.3 %
2006	103,283	12,284	114,501	11,218	90.2 %
2007#	108,245	12,358	121,823	13,578	88.9 %
2008#	113,286	12,497	126,752	13,466	89.4 %
2009*	112,094	11,954	133,053	20,959	84.2 %
2010	112,804	12,383	137,557	24,753	82.0 %
2011	115,775	12,610	140,864	25,089	82.2 %
2012	115,083	12,270	145,541	30,458	79.1 %
2013	117,879	11,701	149,005	31,126	79.1 %
2014#	125,527	12,656	154,038	28,511	81.5 %
2015*	131,758	13,496	166,935	35,177	78.9 %
2016#	135,408	13,471	171,939	36,531	78.8 %
2017*#	140,243	14,216	184,652	44,409	76.0 %
2018#	145,749	14,324	192,915	47,166	75.6 %
2019#	149,653	14,199	195,991	46,338	76.4 %
2019#(a)	149,653	14,199	195,637	45,984	76.5 %

* *After changes in actuarial assumptions or methods.*
\# *After changes in benefit provisions.*
^ *Prior to the 6/30/2006 valuation, actuarial present value of credited projected benefits was used.*
@ *Assets shown are net of health assets beginning in 1994.*
(a) *Using proposed mortality tables.*

Short Condition Test - Comparative Statement

The Short Condition Test is another way of looking at a system's progress under its funding program based on the entry-age accrued liability. In a short condition test, the plan's valuation assets are compared with: 1) Active member contributions on deposit; 2) The liabilities for future benefits to present retired lives; and 3) The liabilities allocated to service already rendered by active members. In a system that has been following the discipline of level percent-of-payroll financing, the liabilities for active member contributions on deposit (liability 1) and the liabilities for future benefits to present retired lives (liability 2) will be fully covered by valuation assets (except in rare circumstances). In addition, the liabilities assigned to service already rendered by active members (liability 3) will be partially covered by the remainder of the valuation assets. The larger the funded portion of liability 3, the stronger the condition of the system. Liability 3 being fully funded is uncommon.

The following schedule illustrates the history of liabilities 1, 2 and 3.

Val. Date June 30	Actuarial Accrued Liability ^ (1) Active Member Contributions	(2) Retirees and Beneficiaries	(3) Active & Inactive Members (Employer Financed)	Valuation Assets	Portion of Present Values Covered by Assets (1)	(2)	(3)
2000	$ 7,100,050	$46,324,310	$24,242,251	$ 95,548,441	100%	100%	149%
2001	7,271,115	49,610,467	28,654,887	101,190,705	100%	100%	155%
2002*	8,349,181	51,343,164	33,262,624	103,950,731	100%	100%	133%
2003#	8,560,912	54,767,310	34,529,455	103,655,770	100%	100%	117%
2004	9,281,501	56,062,967	36,428,766	103,745,735	100%	100%	105%
2005	9,474,647	62,017,507	36,357,438	102,755,663	100%	100%	86%
2006	10,309,119	62,976,517	38,560,107	103,283,413	100%	100%	78%
2007#	10,990,190	67,946,355	42,886,868	108,245,308	100%	100%	68%
2008#	11,173,085	71,090,277	44,488,843	113,285,618	100%	100%	70%
2009*	10,939,230	79,883,240	42,230,347	112,094,168	100%	100%	50%
2010	11,664,234	80,725,431	45,167,594	112,804,385	100%	100%	45%
2011	11,687,246	85,197,066	43,979,382	115,774,764	100%	100%	43%
2012	11,676,628	91,012,108	42,852,215	115,083,128	100%	100%	29%
2013	11,058,220	96,565,549	41,381,230	117,879,023	100%	100%	25%
2014#	11,386,585	98,326,146	44,325,246	125,526,809	100%	100%	36%
2015*	11,991,306	107,510,592	47,433,443	131,757,916	100%	100%	26%
2016#	12,869,644	106,715,647	52,353,595	135,407,676	100%	100%	30%
2017*#	13,607,875	110,428,262	60,616,061	140,243,417	100%	100%	27%
2018#	12,883,095	118,343,985	61,687,848	145,748,585	100%	100%	24%
2019#	13,204,916	121,636,098	61,149,590	149,652,941	100%	100%	24%

* *After changes in actuarial assumptions or methods.*

\# *After changes in benefit provisions.*

^ *Prior to the 6/30/2006 valuation, present value of credited projected benefits was used.*

Total Computed and Actual City Contributions
Comparative Statement

Fiscal Year	Valuation Date June 30	Actual Dollar Contribution @	Valuation Payroll	City's Computed % of Payroll Contributions
1991/92	1990 #	$ 1,990,000	$ 7,727,204	24.35%
1992/93	1991	1,875,000	7,770,366	21.76%
1993/94	1992 *#	2,278,039	8,359,429	25.85%
1994/95	1993	2,141,014	8,562,961	23.30%
1995/96	1994	2,209,630	8,357,447	23.14%
1996/97	1995	2,447,857	9,103,643	25.09%
1997/98	1996	2,862,874	9,834,167	23.81%
1998/99	1997	2,188,572	10,039,322	21.80%
1999/00	1998	2,005,241	9,813,441	13.65%
2000/01	1999	1,590,027	9,749,682	12.68%
2001/02	2000	1,748,678	11,235,312	13.37%
2002/03	2001	1,571,015	11,615,098	12.12%
2003/04	2002 *	2,720,559	11,907,553	21.54%
2004/05	2003 #	2,922,144	11,885,130	23.70%
2005/06	2004	3,108,229	12,114,360	23.91%
2006/07	2005	3,540,775	12,085,192	26.28%
2007/08	2006 *	3,617,333	12,283,787	23.33%
2008/09	2007#	3,908,721	12,358,265	23.77%
2009/10	2008#	3,622,270	12,497,433	23.93%
2010/11	2009*	4,346,195	11,953,735	26.67%
2011/12	2010	4,159,617	12,383,339	27.85%
2012/13	2011	4,105,429	12,609,794	27.80%
2013/14	2012	4,316,203	12,269,834	30.12%
2014/15	2013	4,612,446	11,700,630	31.10%
2015/16	2014#	4,664,957	12,656,141	29.21%
2016/17	2015*	4,728,234	13,495,955	29.89%
2017/18	2016#	5,180,487	13,470,636	31.01%
2018/19	2017*#	5,544,586	14,216,474	33.36%
2019/20	2018#	NA	14,324,168	34.61%
2020/21	2019#	NA	14,198,563	34.98%

* *After changes in actuarial assumptions or methods.*
\# *After plan amendment.*
@ *Includes post-retirement health care in 1993/1994 through 2016/2017.*

Schedule of Employer Contributions

Year Ended June 30	Annual Required Contribution / Actuarially Determined Contribution
2000	$1,059,168
2001	732,366
2002	622,529
2003	468,005
2004	1,268,053
2005	1,824,879
2006	2,458,298
2007	2,990,893
2008	3,617,333
2009	3,408,721
2010	3,116,270
2011	3,846,195
2012	3,659,617
2013	3,592,634
2014	3,803,408
2015	3,594,446
2016	4,164,957
2017	4,228,234
2018	4,680,487
2019	5,060,534

Development of Funding Value of Assets

Year Ended June 30	2016	2017	2018	2019	2020	2021	2022	2023
A. Funding Value Beginning of Year	$131,757,916	$135,407,676	$140,243,417	$ 145,748,585				
B. Market Value End of Year	132,048,993	138,509,336	144,588,460	150,109,694				
C. Market Value Beginning of Year	133,850,434	132,048,993	138,509,336	144,588,460				
D. Non-Investment Net Cash Flow	(4,201,988)	(4,914,524)	(3,859,299)	(4,067,616)				
E. Investment Income								
E1. Market Total: B - C - D	2,400,547	11,374,867	9,938,423	9,588,850				
E2. Assumed Rate of Investment Return	6.75%	6.75%	6.50%	6.50%	6.50%			
E3. Amount for Immediate Recognition	8,751,842	8,974,153	8,990,395	9,341,461				
E4. Amount for Phased-In Recognition: E1-E3	(6,351,295)	2,400,714	948,028	247,389				
F. Phased-In Recognition of Investment Income								
F1. Current Year: 0.20 x E4	(1,270,259)	480,143	189,606	49,478				
F2. First Prior Year	(818,455)	(1,270,259)	480,143	189,606	$ 49,478			
F3. Second Prior Year	1,793,038	(818,455)	(1,270,259)	480,143	189,606	$ 49,478		
F4. Third Prior Year	591,643	1,793,038	(818,455)	(1,270,259)	480,143	189,606	$ 49,478	
F5. Fourth Prior Year	(1,196,061)	591,645	1,793,037	(818,457)	(1,270,259)	480,142	189,604	$ 49,477
F6. Total Recognized Investment Gain	$ (900,094)	$ 776,112	$ 374,072	$ (1,369,489)	$ (551,032)	$ 719,226	$ 239,082	$ 49,477
G. Funding Value End of Year:								
G1. Preliminary Funding Value End of Year: A+D+E3+F6	135,407,676	140,243,417	145,748,585	149,652,941				
G2. Upper Corridor Limit: 120% x B	158,458,792	166,211,203	173,506,152	180,131,633				
G3. Lower Corridor Limit: 80% x B	105,639,194	110,807,469	115,670,768	120,087,755				
G4. Funding Value End of Year	**$135,407,676**	**$140,243,417**	**$145,748,585**	**$ 149,652,941**				
H. Difference between Market & Funding Value: B-G4	(3,358,683)	(1,734,081)	(1,160,125)	456,753				
I. Recognized Rate of Return	6.06%	7.33%	6.77%	5.55%				
J. Market Rate of Return	1.82%	8.78%	7.28%	6.73%				

The Funding Value of Assets recognizes assumed investment income (line E3) fully each year. Differences between actual and assumed investment income (line E4) are phased-in over a closed five-year period. During periods when investment performance exceeds the assumed rate, Funding Value of Assets will tend to be less than Market Value. During periods when investment performance is less than the assumed rate, Funding Value of Assets will tend to be greater than Market Value. The Funding Value of Assets is **unbiased** with respect to Market Value. At any time it may be either greater or less than Market Value. If actual and assumed rates of investment income are exactly equal for four consecutive years, the Funding Value will become equal to Market Value.

Actuarial Balance Sheet - June 30

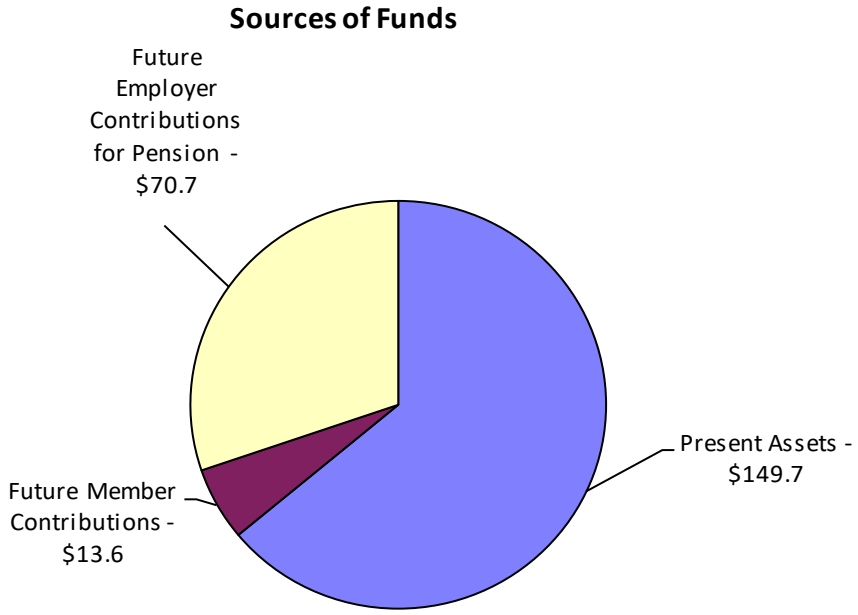
Present Resources and Expected Future Resources

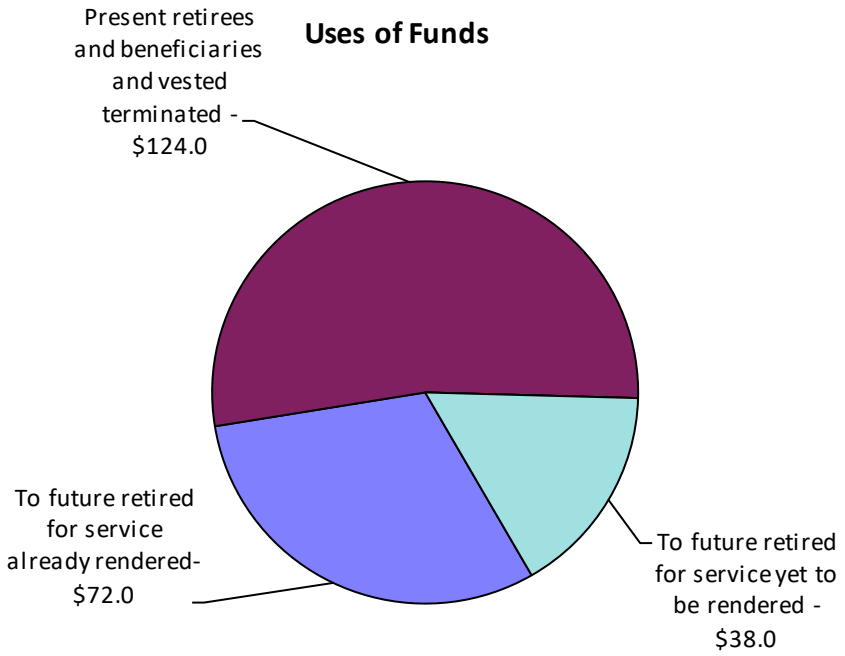
	2019	2018
A. Valuation assets		
1. Net assets from System financial statements (market value)	$150,109,694	$144,588,460
2. Valuation adjustment	(456,753)	1,160,125
3. Valuation assets	149,652,941	145,748,585
B. Actuarial present value of expected future employer contributions		
1. For normal costs	24,475,061	25,058,301
2. For unfunded actuarial accrued liabilities	46,337,663	47,166,343
3. Total	70,812,724	72,224,644
C. Actuarial present value of expected future member contributions	13,552,100	13,861,941
D. Reserves	0	0
E. Total Actuarial Present Value of Present and Expected Future Resources	$234,017,765	$231,835,170

Actuarial Present Value of Expected Future Benefit Payments and Reserves

A. To retirees and beneficiaries	$121,636,098	$118,343,985
B. To terminated members	2,331,198	2,146,289
C. To present active members		
1. Allocated to service rendered prior to valuation date	72,023,308	72,424,654
2. Allocated to service likely to be rendered after valuation date	38,027,161	38,920,242
3. Total	110,050,469	111,344,896
D. Total Actuarial Present Value of Expected Future Pension Payments	234,017,765	231,835,170
E. Reserves		
1. Allocated to retirees and beneficiaries	0	0
2. Post-Retirement Health Care	0	0
3. Total	0	0
F. Total Actuarial Present Value of Expected Future Benefit Payments and Reserves	$234,017,765	$231,835,170

Financing $234 Million of Benefit Promises
June 30, 2019





Derivation of Actuarial Gain (Loss)
Year Ended June 30

The actuarial gains or losses realized in the operation of the Retirement System provide an experience test. Gains and losses are expected to cancel each other over a period of years (in the absence of double-digit inflation) and sizable year-to-year fluctuations are common. Details of the derivation of the actuarial gain (loss) are shown below, along with a year-by-year comparative schedule.

	2019	2018
(1) UAAL* at start of year	$ 47,166,343	$ 44,408,781
(2) Employer normal cost	2,519,621	2,512,051
(3) Actual employer contributions	5,060,534	4,680,487
(4) Interest accrual	2,983,233	2,816,097
(5) Expected UAAL before changes: (1) + (2) - (3) + (4)	47,608,663	45,056,442
(6) Changes due to plan amendments	(11,845)	(111,600)
(7) Changes due to revised assumptions or methods	0	0
(8) Expected UAAL after changes	47,596,818	44,944,842
(9) Actual UAAL at end of year	46,337,663	47,166,343
(10) Gain (loss): (8) - (9)	1,259,155	(2,221,501)
(11) Gain (loss) as a percent of actuarial accrued liabilities at start of year ($192,914,928)	0.7%	(1.2%)

* *Unfunded actuarial accrued liability.*

Valuation Date June 30	Actuarial Gain (Loss) as % of Beginning Accrued Liabilities
2010	(2.4)%
2011	(0.1)%
2012	(3.5)%
2013	0.1 %
2014	2.0 %
2015	0.6 %
2016	0.0 %
2017	(0.8)%
2018	(1.2)%
2019	0.7 %

Comments, Recommendations and Conclusions

Experience: Investment experience on a market value basis for the year ended June 30, 2019 was favorable with a market rate of return of 6.73% (versus the expected return of 6.5%). On a funding value basis, investment losses as of June 30, 2019 totaled about $1.3 million. Overall experience from 2018-2019 was more favorable than expected. This is primarily due to lower pay increases than expected which was partially offset by more retirements than expected (7 actual vs. 2.2 expected).

Expected Computed Contribution Rates in Future Years: The method used to derive valuation assets will, over the long-term, produce rates of return equal to those measured on a pure market value basis. This means that over the long term, total employer contributions are not expected to be impacted by the method used to derive valuation assets. This relationship does not hold over the short term; valuation assets may drop to 80% of market value or go up to 120% of market value. Valuation assets are now approximately $0.5 million lower than the market value, with approximately $0.5 million of investment loss still to be recognized during the next year. Recognition of this loss is expected to put upward pressure on employer contribution rates (in the absence of significant investment gains).

Post-Retirement Health Care Benefit: Contributions made to the retiree health portion of the fund must meet certain requirements specified in IRC 401(h). Page A-14 of this report provides information regarding the required subordination test.

Please note the following:

- Even if contributions equal to the limit are made, they would not be expected to be sufficient to meet the ongoing post-retirement health care costs.
- As long as post-retirement health care payments made from the Retirement System do not exceed the Reserve for Health Care balance, the decision to either levy any money or make any contributions to cover post-retirement health care through the Retirement System remains a policy decision.

Amortization Method: The current method for amortizing Unfunded Actuarial Accrued Liability (UAAL) is a level percent of pay approach over a closed period of 30 years beginning July 1, 2015 and ending June 30, 2045 (25 years remaining as of the June 30, 2019 valuation, which determines the fiscal year 2021 contribution). Benefit changes and assumption changes are separately amortized over 30 years as they occur. Absent actuarial gains or losses, a closed amortization period is expected to result in UAAL amortization payments that remain level as a percentage of payroll.

Proposed Mortality Tables: This report provides the liabilities and contribution requirements using an updated set of mortality tables. The results of the valuation using these proposed tables are included along with the current results on pages A-2 and A-4 of this report. All other exhibits in this report use results based only on the current set of mortality tables. The current mortality rates use the RP-2014 mortality tables with a static projection to the year 2019 using the MP-2014 mortality improvement scale. The proposed mortality rates use the RP-2014 mortality tables with fully generational mortality using the MP-2019 mortality improvement scale. This change would increase the City contribution by 0.19% of payroll for the fiscal year beginning July 1, 2020. This change would also decrease the Accrued Liabilities by about $350 thousand. We recommend that the Board adopt the tables as proposed.

Comments, Recommendations and Conclusions

Benefit Changes: The following new benefit provisions were reported for this valuation:

OSP Chiefs:

- Deferred Retirement Option Plan (DROP) adopted and effective 4/2/2015;
- Removed benefit multiplier after 25 years of service and reduced maximum benefit to be 75% of FAC;
- No longer including longevity pay in FAC; and
- Employee contribution rate increased to 11.65%.

These provisions are reflected for the first time in the June 30, 2019 valuation.

Public Act 202: Public Act 202 (PA 202) was signed into law December 20, 2017 and requires local units of government to electronically submit Form 5572 to the Michigan Department of Treasury (DOT) on an annual basis to evaluate the funded status of the retirement pension system. The local unit of government is considered underfunded if the actuarial accrued liability of a retirement pension system is less than 60% funded, and if the annual required contribution for all of the retirement systems of the local unit of government is greater than 10% of annual general fund operating revenues. An underfunded local unit of government is required to develop and submit for approval a corrective action plan for the local unit of government.

The Michigan State Treasurer has established uniform actuarial assumptions as required by PA 202 for use with the annual Form 5572 (Retirement System Annual Report). The use of the uniform assumptions for reporting will be required for the 2019 fiscal year (note that the Department of Treasury is encouraging early adoption).

We would be happy to discuss with the Board options for fulfilling the reporting requirements. Fees associated with these reporting requirements would be based on the complexity of the assignment.

Conclusion: The Retirement System's financial objective is to meet long-term benefit obligations through contributions that remain approximately level from year to year as a percent of active member payroll. Continued receipt of these contributions is the best guarantee that the Plan will be able to pay all promised benefits when due.

IRC 401(h) Compliance Test

Valuation Year	Fiscal Year	(1) Estimated Payroll	(2) PUCNC Pension	(3) Actual $ Pension	(4) Total Actual PUCNC	(5) Health Contribution	(6) Sum of (4)+(5)	(7) Sum of All Years in (5)	(8) Sum of All Years in (6)	(9) Percentage Health/Total (7)/(8)
6/13	12/13	11,985,232	28.00%	4,637,167	3,356,361	512,795	3,869,156	16,714,182	80,323,826	20.8%
6/14	13/14	12,178,386	28.41%	4,787,871	3,460,149	512,795	3,972,944	17,226,977	84,296,770	20.4%
6/15	14/15	13,076,048	28.43%	4,760,687	3,718,152	1,018,000	4,736,152	18,244,977	89,032,922	20.5%
6/16	15/16	13,483,296	27.60%	5,242,590	3,720,972	500,000	4,220,972	18,744,977	93,253,894	20.1%
6/17	16/17	13,843,555	29.17%	5,461,382	4,038,054	500,000	4,538,054	19,244,977	97,791,948	19.7%
6/18	17/18	14,270,321	30.37%	6,156,346	4,334,088	500,000	4,834,088	19,744,977	102,626,036	19.2%
6/19	18/19	14,261,366	29.85%	6,534,126	4,257,187	484,052	4,741,239	20,229,029	107,367,275	18.8%

Other Observations

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

Given the System's contribution allocation procedure, if all actuarial assumptions are met (including the assumption of the Retirement System earning 6.50% on the Market Value of Assets), it is expected that:

1. The employer normal cost is sufficient to cover the cost of benefits accruing each year;
2. The Unfunded Actuarial Accrued Liabilities (UAAL) will continue to be amortized; and
3. The funded status of the Retirement System will continue to increase gradually towards a 100% funded ratio.

Limitations of Funded Status Measurements

Unless otherwise indicated, a funded status measurement presented in this report is based upon the Actuarial Accrued Liability (AAL) and the Funding Value of Assets (FVA). Unless otherwise indicated, with regard to any funded status measurements presented in this report:

1. The measurement is inappropriate for assessing the sufficiency of Retirement System assets to cover the estimated cost of settling the Retirement System's benefit obligations, for example: transferring the liability to an unrelated third party in a market value type transaction.
2. The measurement is dependent upon the Actuarial Cost Method which, in combination with the Retirement System's amortization policy, affects the timing and amounts of future contributions. The amounts of future contributions will most certainly differ from those assumed in this report due to future actual experience differing from assumed experience based upon the actuarial assumptions. Even if the funded status measurement in this report was 100%, it would not be synonymous with no required future contributions. The Retirement System would still require future normal cost contributions (i.e., contributions to cover the cost of active membership accruing an additional year of service credit).
3. The measurement would produce a different result if the Market Value of Assets (MVA) were used instead of the FVA, unless the MVA 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 entities 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.

Risks to Future Employer Contribution Requirements

There are ongoing risks to future employer contribution requirements to which the Retirement System is exposed, such as:

Actual and Assumed Investment Rate of Return
Actual and Assumed Mortality Rates
Amortization Policy

Risk Measures - Risks Associated with Measuring the Accrued Liability and Actuarially Determined Contribution

The determination of the accrued liability and the actuarially determined contribution requires the use of assumptions regarding future economic and demographic experience. Risk measures, as illustrated in this report, are intended to aid in the understanding of the effects of future experience differing from the assumptions used in the course of the actuarial valuation. Risk measures may also help with illustrating the potential volatility in the accrued liability and the actuarially determined contribution that result from the differences between actual experience and the actuarial assumptions.

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 due to changing conditions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period, or additional cost or contribution requirements based on the System's funded status); and changes in plan provisions or applicable law. The scope of an actuarial valuation does not include an analysis of the potential range of such future measurements.

Examples of risk that may reasonably be anticipated to significantly affect the plan's future financial condition include:

1. Investment risk – actual investment returns may differ from the expected returns;
2. Asset/Liability mismatch – changes in asset values may not match changes in liabilities, thereby altering the gap between the accrued liability and assets and consequently altering the funded status and contribution requirements;
3. Contribution risk – actual contributions may differ from expected future contributions. For example, actual contributions may not be made in accordance with the plan's funding policy or material changes may occur in the anticipated number of covered employees, covered payroll, or other relevant contribution base;
4. Salary and Payroll risk – actual salaries and total payroll may differ from expected, resulting in actual future accrued liability and contributions differing from expected;
5. Longevity risk – members may live longer or shorter than expected and receive pensions for a period of time other than assumed; and
6. Other demographic risks – members may terminate, retire or become disabled at times or with benefits other than assumed resulting in actual future accrued liability and contributions differing from expected.

The effects of certain trends in experience can generally be anticipated. For example, if the investment return since the most recent actuarial valuation is less (or more) than the assumed rate, the cost of the plan can be expected to increase (or decrease). Likewise, if longevity is improving (or worsening), increases (or decreases) in cost can be anticipated.

The computed contribution shown on page A-2 may be considered as a minimum contribution rate that complies with the Board's funding policy. The timely receipt of the actuarially determined contributions is critical to support the financial health of the plan. Users of this report should be aware that contributions made at the actuarially determined rate do not necessarily guarantee benefit security.

Risk Measures

($ in Thousands)

Actuarial Valuation Date (6/30)	(1) Actuarial Value of Assets	(2) Actuarial Accrued Liability (AAL)	(3) Unfunded AAL (UAAL) (2) - (1)	(4) Payroll	(5) Funded Ratio (1) / (2)	(6) Retiree Liabilities (RetLiab)	(7) RetLiab / AAL (6)/(2)	(8) AAL / Payroll (2) / (4)	(9) Assets / Payroll (1) / (4)	(10) UAAL / Payroll (3) / (4)	(11) Non-Invest. Cash Flow (NICF)	(12) NICF / Assets (11)/(1)	(13) Market Rate of Return	(14) 5-year Trailing Average
2015	$ 131,758	$ 166,935	$ 35,177	$ 13,496	78.9%	$ 107,511	64.4%	1,236.9%	976.3%	260.6%	$ (4,621)	(3.5)%	3.4%	N/A
2016 *	135,408	171,939	36,531	13,471	78.8%	106,716	62.1%	1,276.4%	1,005.2%	271.2%	(4,202)	(3.1)%	1.8%	N/A
2017 *	140,243	184,652	44,409	14,216	75.9%	110,428	59.8%	1,298.9%	986.5%	312.4%	(4,915)	(3.5)%	8.8%	N/A
2018 *	145,749	192,915	47,166	14,324	75.6%	118,344	61.3%	1,346.8%	1,017.5%	329.3%	(3,859)	(2.6)%	7.3%	7.0%
2019 *	149,653	195,991	46,338	14,199	76.4%	121,636	62.1%	1,380.3%	1,054.0%	326.3%	(4,068)	(2.7)%	6.7%	5.6%

** Revised actuarial assumptions or changes in benefit provisions.*

(5). The funded ratio is the most widely known measure of a plan's financial strength, but the trend in the funded ratio is much more important than the absolute ratio. The funded ratio should trend to 100%. As it approaches 100%, it is important to re-evaluate the level of investment risk in the portfolio and potentially to re-evaluate the assumed rate of return.

(6) and (7). The ratio of retiree liabilities to total accrued liabilities gives an indication of the maturity of the system. As the ratio increases, cash flow needs increase, and the liquidity needs of the portfolio change. A ratio on the order of 50% indicates a maturing system.

(8) and (9). The ratio of liabilities and assets to payroll gives an indication of both maturity and volatility. Many systems have ratios between 500% and 700%. Ratios significantly above that range may indicate difficulty in supporting the benefit level as a level % of payroll.

(10). The ratio of unfunded liability to payroll gives an indication of the plan sponsor's ability to actually pay off the unfunded liability. A ratio above approximately 300% or 400% may indicate difficulty in discharging the unfunded liability within a reasonable time frame.

(11) and (12). The ratio of Non-Investment Cash Flow to assets is an important measure of sustainability. Negative ratios are common and expected for a maturing system. In the longer term, this ratio should be on the order of -2% to -3% based upon current plan assumptions. A ratio that is significantly more negative than that for an extended period could be a leading indicator of potential exhaustion of assets.

(13) and (14). Investment return is probably the largest single risk that most systems face. The year-by-year return and the five-year geometric average both give an indication of the reasonableness of the system's assumed return. Of course, past performance is not a guarantee of future results. Market rate shown is based on actuarial estimation method and will differ modestly from figures reported by the investment consultant.

SECTION B

SUMMARY OF BENEFIT PROVISIONS AND VALUATION DATA

Brief Summary of Act 345 Benefit Conditions Evaluated (Updated to JUNE 30, 2019)

ELIGIBILITY	AMOUNT

SERVICE RETIREMENT

The benefit amounts attributable to regular retirements and the conditions under which such benefits may be paid are described in tabular form on page B-2.

DEFERRED RETIREMENT

Termination of employment after 10 or more years of service.	Computed as service retirement but based upon service, Average Final Compensation (AFC) and benefit in effect at termination. Benefit begins at date retirement would have occurred had member remained in employment.

DEATH AFTER RETIREMENT SURVIVOR'S PENSION

Payable to a surviving spouse, if any, upon the death of a retired member who was receiving a straight life pension which was effective July 1, 1975 or later.	Spouse's pension equals 60% of the straight life pension the deceased retiree was receiving.

NON-DUTY DEATH-IN-SERVICE SURVIVOR'S PENSION

Payable to a surviving spouse, if any, upon the death of a member with 20 or more years of service, or a Police member with 10 or more years of service.	Accrued straight life pension actuarially reduced in accordance with an Option I election.

DUTY DEATH-IN-SERVICE SURVIVOR'S PENSION

Payable upon the expiration of Worker's Compensation to the survivors of a member who died in the line of duty.	Same amount that was paid by Worker's Compensation.

NON-DUTY DISABILITY

Payable upon the total and permanent disability of a member with 5 or more years-of-service.	To age 55: 1.5% of AFC times years of service. At age 55: Same as Service Retirement Pension.

DUTY DISABILITY

Payable upon the total and permanent disability of a member in the line of duty.	To age 55: 50% of AFC. At age 55: Same as Service Retirement Pension with service credit from date of disability to age 55.

MEMBER CONTRIBUTIONS

Amounts are described on page B-23.

Summary of Benefit Provisions
as of JUNE 30, 2019

Group	No. People	GRS Code	Eligibility	Benefit Multiplier*	Maximum Benefit	Years In FAC	Member Contribution Rate
Police:							
Sergeants - POLC	16	91	25 yrs. of service or age 60	3.0%/1.0%	80% of FAC	3	11.72%
Lieutenants	4	90	25 yrs. of service or age 60	3.0%/1.0%	80% of FAC	3	10.00%
POLC	79	92	25 yrs. of service or age 60	3.0%/1.0%	80% of FAC	5	8.25%
Non-Represented	5	95,97	25 yrs. of service or age 60	3.0%/1.0%	80% of FAC	3	10.00%
Fire:							
OSP	4	94	25 yrs. of service or age 60	3.0%/0.0%	75% of FAC	3	11.65%
IAFF	73	93	25 yrs. of service or age 60	3.0%/1.0%	80% of FAC	3	11.04%
Non-Represented	1	98	25 yrs. of service or age 60	3.0%/1.0%	80% of FAC	3	10.00%
Total	**182**						

* *First multiplier applies to the first 25 years of service. Second multiplier applies to service greater than 25 years.*

Note: None of the above groups are covered by Social Security.
Employee contributions are made on a pre-tax basis.

Summary of Benefit Provisions
as of JUNE 30, 2019

DEFERRED RETIREMENT OPTION PLAN (DROP)

Effective April 2, 2015 for Firefighter OSP Chiefs and July 1, 2016 for Police Lieutenants, Firefighter IAFF, and members with credited service between 25 and 30 years may participate in the Deferred Retirement Option Plan for a maximum participation period of five years. The benefit amount is the participant's accrued benefit at the date of DROP election. DROP benefits are credited monthly and DROP interest is credited quarterly to a DROP account at the rate of 2% annually. Employer and employee contributions will continue while the member participates in the DROP. Employer and employee contributions are not deposited in the DROP account. Upon actual retirement, the participant may elect a lump sum distribution of the DROP Account or direct rollover to a qualified plan.

Sample Benefit Computation

Assumed data in connection with this sample retirement is shown below:

	Data	Description
A.	$40,000	Final Average Compensation
B.	27	Years of Credited Service
C.	50	Age of Retiree
D.	60%	Percentage to continue to spouse after retiree's death (this is automatic)

	Sample Computation Steps		Annual Amount
E.	Benefit Formula:	0.03 x 25 x $40,000 =	$30,000
		+0.01 x 2 x $40,000 =	800
			30,800
F.	Maximum Benefit:	0.80 x $40,000 =	$32,000
	Benefit payable to:		
G.	Retiree while spouse is alive (lesser of E and F)		$30,800
H.	Spouse after retiree's death (D x G)		18,480
I.	Retiree after spouse's death		$30,800

Statement of System Assets
as of June 30, 2019 and 2018

	2019	2018
Assets		
Cash and Short-Term Investments	$ 4,808,357	$ 5,366,006
Depository Receipts	0	0
Money Markets	0	0
Receivables		
Accrued Interest and Dividends	402,879	392,265
Investments		
U.S. Government Bonds	7,282,590	3,566,477
Corporate Bonds	17,434,512	17,497,728
Common Stocks	81,580,941	79,301,822
Real Estate	842,045	716,615
Other	38,040,808	38,060,419
	145,180,896	139,143,061
Accounts Receivable	(282,438)	(312,872)
Net assets held in trust for pension and health benefits	$150,109,694	$144,588,460

Statement of Changes in System Assets
for the Fiscal Years Ended June 30, 2019 and June 30, 2018

	June 30, 2019 @	June 30, 2018 @
Additions		
Contributions		
Employer	$ 5,060,534	$ 4,680,487
Plan members	1,473,592	1,475,859
Total contributions	6,534,126	6,156,346
Investment Income	9,588,850	9,938,423
Total additions	16,122,976	16,094,769
Deductions		
Benefits	10,436,876	9,946,758
Refunds of contributions	164,866	68,887
Health insurance premiums	0	0
Total deductions	10,601,742	10,015,645
Net Increase	5,521,234	6,079,124
Net assets held in trust for pension benefits		
Beginning of year	144,588,460	138,509,336
End of year	$150,109,694	$144,588,460

@ Net of health reserve.

The calculation of realized gains and losses is independent of the calculation of appreciation (depreciation) in the fair value of plan investments. Unrealized gains and losses in investments sold in the current year that had been held for more than one year were included in the net appreciation (depreciation) reported in the prior years and the current year.

Allocation of Employer Assets between Pension and Health

	Pension	Health	Total
1) Market Value of Assets June 30, 2018	**$144,588,460**	**$ 0**	**$144,588,460**
2) Employer Contrib. ($) FY 18/19	5,060,534	484,052	5,544,586
3) Employee Contrib. ($) FY 18/19	1,473,592	0	1,473,592
4) Benefits Paid and Refunds FY 18/19	10,601,742	484,052	11,085,794
5) Net Cash Flow FY 18/19: (2)+(3)-(4)	(4,067,616)	0	(4,067,616)
6) Investment Income FY 18/19 (Market Value)	9,588,850	0	9,588,850
7) Market Value of Assets June 30, 2019 (1)+(2)+(3)-(4)+(6)	**$150,109,694**	**$ 0**	**$150,109,694**

Reported Fund Balance

Reserves for	Reported Market Values June 30	
	2019	2018
Employees' Contributions	$ 35,590,499	$ 32,725,480
Employer Contributions	(53,706,249)	(30,762,112)
Retired Benefit Payments	168,225,444	142,625,092
Post-Retirement Health Care	0	0
Total Fund Balance	$150,109,694	$144,588,460

Valuation assets are equal to the funding value of assets derived on page A-9.

In financing actuarial accrued liabilities, valuation assets of $149,652,941 were distributed as follows:

Reserves for	Valuation Assets Applied to Actuarial Accrued Liabilities for			Totals
	Active Members	Retirees & Beneficiaries	Health Care Reserve	
Employees' Contributions	$35,590,499			$ 35,590,499
Employer Contributions	(7,116,903)	$ (46,589,346)		(53,706,249)
Retired Benefit Payments		168,225,444		168,225,444
Health Care			$0	0
Market Value Adjustment	(456,753)			(456,753)
Total Funding Value	$28,016,843	$121,636,098	$0	$149,652,941

Summary of Current Asset Information Reported for Valuation

Assets (Market Value)

	June 30	
	2019	2018
Cash & equivalents	$ 5,211,236	$ 5,758,271
Other short-term investments	0	0
Fixed income	62,757,910	59,124,624
Stocks	81,580,941	79,301,822
Real estate investments	842,045	716,615
Accounts receivable	(282,438)	(312,872)
Total Assets	$150,109,694	$144,588,460

Revenues and Expenses

	2018-19	2017-18
Balance - July 1	$144,588,463	$138,509,337
Revenues		
Employees' contributions	1,473,592	1,475,859
Employer contributions	5,544,586	5,180,487
Net Investment income	9,768,969	10,142,548
Expenses		
Benefit payments	10,436,876	9,946,758
Refunds of member contributions	164,866	68,887
Administrative expenses	180,119	204,123
Health insurance premiums	484,052	500,000
Rounding Adjustment	0	0
Balance - June 30	$150,109,697	$144,588,463

Asset Information Reported for Valuation
Comparative Statement

Year Ended June 30	Assets Beginning of Year	Revenues				Expenses			Assets Year-End
		Employee Contrib.	Employer Contrib.	Investment Income	Misc. Income	Retirement Benefits	Contribs. Refunds	Misc.(*) Expenses	
1995	$ 58,102,520	$ 664,170	$2,141,014	$ 5,142,121	$0	$ 2,321,947	$ 1,404	$ 1,152,671	$ 62,573,803
1996	62,573,803	758,715	2,209,630	5,867,205	0	2,679,317	22,840	541,958	68,165,238
1997	68,165,238	815,487	2,447,587	8,245,891	0	3,193,357	37,540	985,759	75,457,547
1998	78,893,397	782,573	2,862,874	16,532,678	0	3,569,152	96,598	1,516,407	93,889,365
1999	93,889,365	857,090	2,188,572	7,562,429	0	4,245,423	153,751	1,193,442	98,904,840
2000	98,904,840	860,852	2,005,241	10,074,744	0	4,206,891	112,149	1,327,756	106,198,881
2001	106,198,881	946,812	1,590,027	(508,876)	0	4,411,998	168,781	1,691,962	101,954,103
2002	101,954,103	924,388	1,748,678	(5,364,998)	0	4,556,200	34,664	1,734,654	92,936,653
2003	92,936,653	964,525	1,571,015	3,196,673	0	4,785,350	46,812	1,991,658	91,845,046
2004	91,845,046	999,306	2,720,559	8,470,556	0	4,990,364	141,260	2,320,746	96,583,097
2005	96,583,097	1,001,337	2,922,144	4,944,462	0	5,473,699	41,859	2,129,549	97,805,933
2006	97,805,933	960,556	3,108,229	8,955,746	0	6,166,401	105,665	2,375,321	102,183,077
2007	102,183,077	943,869	3,540,775	13,563,262	0	5,976,094	111,456	1,733,295	112,410,138
2008	112,410,138	1,057,662	3,617,333	(1,099,790)	0	6,035,431	130,761	792,349	109,026,802
2009	109,026,802	1,076,661	3,908,721	(12,529,495)	0	6,849,499	74,325	1,147,058	93,411,807
2010	93,411,807	1,010,170	3,622,270	11,782,723	0	7,290,810	107,078	1,277,732	101,151,350
2011	101,151,350	1,030,979	4,346,195	17,754,126	0	7,581,972	13,464	1,168,496	115,518,718
2012	115,518,718	922,117	4,159,617	2,600,092	0	8,669,455	110,630	1,123,098	113,297,361
2013	113,297,361	1,044,533	4,105,429	11,514,896	0	7,735,131	75,382	1,124,722	121,026,984
2014	121,026,984	984,463	4,316,203	17,738,393	0	8,899,974	47,356	1,180,048	133,938,665
2015	133,938,665	1,166,241	4,612,446	5,204,344	0	9,358,827	22,952	1,689,483	133,850,434
2016	133,850,434	1,077,633	4,664,957	2,617,276	0	9,441,511	3,067	716,729	132,048,993
2017	132,048,993	1,233,148	4,728,234	11,564,650	0	10,355,887	20,019	689,782	138,509,337
2018	138,509,337	1,475,859	5,180,487	10,142,548	0	9,946,758	68,887	704,123	144,588,463
2019	144,588,463	1,473,592	5,544,586	9,768,969	0	10,436,876	164,866	664,171	150,109,697

(*) Misc. expenses include investment expenses and health insurance premiums for retired lives paid after 8/1/1980.

Retirees and Beneficiaries Added to and Removed from Rolls
Comparative Statement

Year Ended June 30	Added to Rolls (Includes Benefit Adjustments)		Removed from Rolls		Rolls End of Year		% Incr. Annual Benefits	Average Annual Benefit	Present Value of Benefits	Expected Removals
	No.	Annual Benefits	No.	Annual Benefits	No.	Annual Benefits				
1990#	4	$ 132,412	2	$ 6,821	109	$ 1,536,502	8.9 %	$ 14,096	$ 17,080,913	3.1
1991	3	17,165	3	28,608	109	1,525,059	(0.7)%	13,991	16,615,266	3.4
1992	3	35,744	4	40,257	108	1,520,546	(0.3)%	14,163	15,355,839	3.6
1993	4	102,957	1	7,200	111	1,616,303	6.3 %	14,561	16,316,103	3.5
1994	20	592,886	5	41,062	126	2,168,127	34.1 %	17,207	23,000,034	3.8
1995#	11	313,427	2	15,728	135	2,465,826	13.7 %	18,265	26,363,115	3.9
1996@	9	452,213			144	2,918,042	18.3 %	20,264	31,375,781	4.3
1997	15	564,090	5	42,709	154	3,439,423	17.9 %	22,334	37,399,338	4.6
1998	11	370,753	1	11,172	164	3,799,004	10.5 %	23,165	41,008,304	5.1
1999	15	459,424	8	114,372	171	4,144,056	9.1 %	24,234	45,233,238	5.2
2000	12	274,422	7	129,923	176	4,288,555	3.5 %	24,367	46,324,310	5.6
2001	16	424,378	8	134,929	184	4,578,004	6.7 %	24,880	49,610,467	5.6
2002	6	123,085	3	41,718	187	4,659,371	1.8 %	24,916	51,343,164	5.1
2003	9	352,598	3	41,567	193	4,970,403	6.7 %	25,753	54,767,310	5.3
2004	5	197,292	5	55,272	193	5,112,423	2.9 %	26,489	56,062,967	5.3
2005	12	558,890	3	39,781	202	5,631,532	10.2 %	27,879	62,017,507	5.3
2006	4	168,387	2	15,692	204	5,784,227	2.7 %	28,354	62,976,517	5.7
2007#@	8	641,673	4	70,472	208	6,355,428	9.9 %	30,555	67,946,355	6.0
2008#	9	395,393	6	96,022	211	6,654,800	4.7 %	31,539	71,090,277	6.5
2009#	17	747,839	5	95,118	223	7,307,521	9.8 %	32,769	79,883,240	6.5
2010	11	283,961	8	145,046	226	7,446,436	1.9 %	32,949	80,725,431	5.9
2011	12	508,150	5	75,940	233	7,878,646	5.8 %	33,814	85,197,066	6.1
2012	13	647,101	7	148,315	239	8,377,432	6.3 %	35,052	91,012,108	6.4
2013	14	651,987	5	99,636	248	8,929,783	6.6 %	36,007	96,565,549	6.2
2014	6	319,868	3	79,524	251	9,170,127	2.7 %	36,534	98,326,146	6.7
2015#	9	418,887	8	148,950	252	9,440,064	2.9 %	37,461	107,510,592	7.0
2016#	9	241,162	11	235,038	250	9,446,188	0.1 %	37,785	106,715,647	5.5
2017#	8	355,784	10	270,124	248	9,531,848	0.9 %	38,435	110,428,262	5.4
2018#	18	909,453	10	225,743	256	10,215,558	7.2 %	39,905	118,343,985	5.5
2019#	12	487,882	5	138,202	263	10,565,238	3.4 %	40,172	121,636,098	5.6

 # After plan amendment and/or changes to actuarial assumptions.

@ Includes correction to data in between valuations (removal of two retirees who had died).

Retirees and Beneficiaries by Type of Benefits Being Paid

Type of Benefit Being Paid	No.#	Annual Benefits Being Paid	Average Annual Benefit
Age and Service Benefits			
Straight life benefit - benefit terminating at death of retiree	40	$ 1,361,115	$34,028
Automatic 60% survivor benefit to spouse	173	8,187,603	47,327
Option 1 benefit - 100% joint and survivor	1	14,285	14,285
Option 2 benefit - 50% joint and survivor	1	14,400	14,400
Benefit being paid survivor beneficiary of deceased retiree	34	611,902	17,997
Total age and service benefits	249	10,189,305	40,921
Casualty Benefits			
Duty disability benefits	6	181,778	30,296
Non-duty disability benefits	4	104,914	26,229
Duty death benefits	1	34,546	34,546
Non-duty death benefits	3	54,685	18,228
Total casualty benefits	14	375,923	26,852
Total Benefits Being Paid	**263**	**$10,565,228**	**$40,172**

 # In addition, there are 6 Alternate Payees that are receiving benefits over the lifetime of the member (benefits are included in the total above).

Retirees and Beneficiaries as of June 30, 2019
Tabulated by Attained Ages

Attained Ages	Age & Service Retirees		Disability Retirees		Survivor Beneficiaries	
	No.#	Annual Benefits	No.	Annual Benefits	No.	Annual Benefits
35-39			1	$ 28,773		
40-44	1	$ 14,285	3	82,843		
45-49	9	602,088				
50-54	18	1,037,983	1	23,651	1	$ 30,109
55-59	30	1,733,619	2	68,915	2	48,408
60-64	34	1,656,555			2	62,299
65-69	49	1,989,242	2	73,870	2	40,573
70-74	41	1,580,600			8	165,262
75-79	23	757,746			6	131,457
80-84	3	70,199			7	98,568
85-89	3	65,733	1	8,640	7	98,005
90-94	3	54,961			3	26,444
95-99	1	14,400				
Totals	**215**	**$9,577,411**	**10**	**$286,692**	**38**	**$701,125**

 # In addition, there are 6 Alternate Payees that are receiving benefits over the lifetime of the member (benefits are included in the total above).

Active Members in the DROP as of June 30, 2019

Valuation Divisions	No.	Annual Retirement Benefits	DROP Account Balances	Average Age	
				At DROP	Current
IAFF	5	$ 345,876	$ 511,994	53.5 yrs.	54.9 yrs.

Active Members as of June 30, 2019
Tabulated by Valuation Divisions

Valuation Division	No.	Annual Payroll	Average in Years		Average Pay
			Age	Service	
Police:					
Lieutenants	4	$ 454,178	46.7	22.2	$113,545
Sergeants (POLC)	16	1,600,757	44.5	18.4	100,047
Other POLC	79	5,640,816	37.0	9.9	71,403
Non-Represented	5	504,738	49.6	22.1	100,948
Fire:					
OSP	4	457,796	49.1	21.1	114,449
IAFF*	73	5,425,278	42.8	13.1	74,319
Non-Represented	1	115,000	61.5	0.8	115,000
Totals	**182**	**$14,198,563**	**40.9**	**12.7**	**$78,014**

* *Includes 5 DROP members with payroll of $433,827.*

Additions to and Removals from Active Membership
Actual and Expected Numbers
Ten-Year Historical Schedule

Year Ended June 30	Number Added		Normal Retirement		Disability Retirement		Died-In-Service		Terminations		Members End of Year
	A	E	A	E	A	E	A	E	A	E	
2010	9	7	5	7.0	0	0.4	0	0.1	2	3.4	190
2011	13	10	7	7.0	0	0.5	0	0.1	3	3.2	193
2012	5	14	10	5.8	0	0.5	0	0.1	4	3.4	184
2013	13	20	10	7.5	0	0.5	1	0.1	9	3.1	177
2014	13	7	4	4.3	0	0.5	0	0.1	3	3.1	183
2015	13	8	4	2.7	1	0.5	0	0.1	3	3.3	188
2016	5	5	2	2.8	1	0.4	0	0.1	2	3.3	188
2017	9	8	4	4.0	0	0.4	0	0.1	4	3.2	189
2018	13	17	11	5.3	3	0.4	0	0.1	3	3.1	185
2019	10	13	6	2.2	1	0.4	0	0.1	6	3.3	182
10-Year Totals	103	109	63	48.6	6	4.5	1	1.0	39	32.4	

A represents actual number.
E represents expected number based on assumptions outlined in Section C.

Final Average Compensation for New Retirees With and Without Lump Sums (Comparative Schedule)

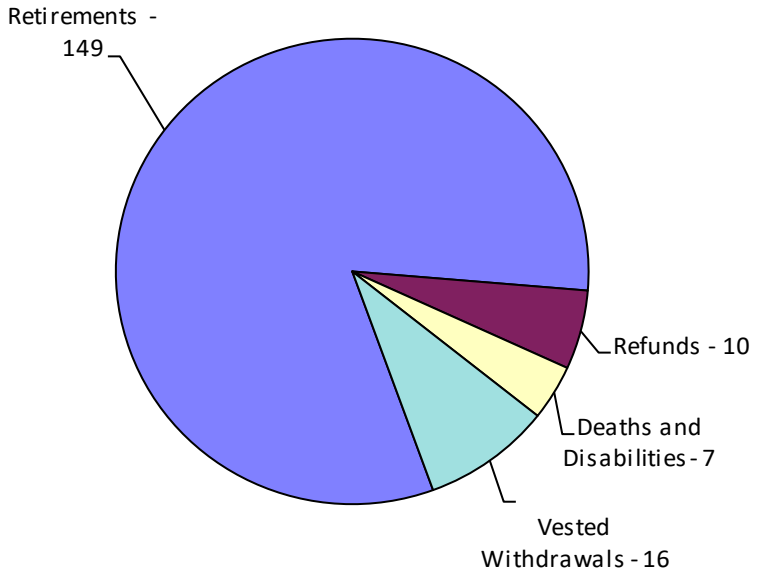
Year Ending June 30	Final Average Compensation		
	With	Without	Ratio
2010	$409,874	$369,887	1.11
2011	651,000	618,403	1.05
2012	812,029	648,518	1.25
2013	839,306	779,471	1.08
2014	382,165	323,231	1.18
2015	498,461	466,597	1.07
2016	224,046	206,720	1.08
2017	434,145	414,065	1.05
2018	971,268	930,353	1.04
2019	643,352	621,496	1.04
10-Year Average	$586,565	$537,874	1.09

Active Members Included in Valuation
Comparative Statement

Valuation Date June 30	Active Members	Vested Term. Members	Reported Payroll*	Average			% Increase
				Age	Service	Pay	
1985	214	2	$ 5,534,747	38.1	12.2	$25,863	1.8 %
1986	218	4	5,902,284	38.5	12.6	27,075	4.7 %
1987	218	4	6,713,148	38.6	12.7	30,794	13.7 %
1988	205	6	6,590,380	37.5	11.4	32,148	4.4 %
1989	208	5	7,298,136	38.1	11.8	35,087	9.1 %
1990	208	5	7,727,204	38.7	12.4	37,150	5.9 %
1991	212	6	7,770,366	39.2	13.0	36,653	(1.3)%
1992	217	6	8,359,429	39.7	13.4	38,523	5.1 %
1993	221	6	8,562,961	40.0	13.8	38,746	0.6 %
1994	206	6	8,357,447	39.8	13.5	40,570	4.7 %
1995	213	6	9,103,643	39.3	12.8	42,740	5.3 %
1996	229	6	9,834,167	38.6	11.6	42,944	0.5 %
1997	225	7	10,039,322	38.2	11.0	44,619	3.9 %
1998	216	6	9,813,441	38.3	11.2	45,433	1.8 %
1999	218	7	9,749,682	38.0	10.7	44,723	(1.6)%
2000	220	6	11,235,312	38.3	10.8	51,070	14.2 %
2001	215	7	11,615,098	38.2	10.8	54,024	5.8 %
2002	218	5	11,907,553	38.7	11.3	54,622	1.1 %
2003	207	5	11,885,130	39.3	12.0	57,416	5.1 %
2004	209	5	12,114,360	39.6	12.3	57,963	1.0 %
2005	199	5	12,085,192	39.9	12.5	60,730	4.8 %
2006	201	5	12,283,787	40.3	13.0	61,113	0.6 %
2007	201	5	12,358,265	40.7	13.3	61,484	0.6 %
2008	197	4	12,497,433	40.8	13.5	63,439	3.2 %
2009	188	5	11,953,735	40.3	13.0	63,584	0.2 %
2010	190	5	12,383,339	40.6	13.2	65,175	2.5 %
2011	193	5	12,609,794	40.7	13.0	65,336	0.2 %
2012	184	6	12,269,834	41.0	13.0	66,684	2.1 %
2013	177	9	11,700,630	40.2	12.6	66,105	(0.9)%
2014	183	11	12,656,141	40.2	12.3	69,159	4.6 %
2015	188	9	13,495,955	40.3	12.3	71,787	3.8 %
2016	188	9	13,470,636	41.0	12.9	71,652	(0.2)%
2017	189	9	14,216,474	41.4	13.2	75,219	5.0 %
2018	185	8	14,324,168	40.7	12.7	77,428	2.9 %
2019	182	9	14,198,563	40.9	12.7	78,014	0.8 %

* *Reported payroll. Beginning in 1980, payroll was projected by a factor of 1.07 to approximate the relationship between gross payroll and the reported base payroll. Beginning in 1987, gross payroll was reported and no projection was necessary.*

Active Members as of June 30, 2019
Expected Terminations by Type in Future Years



This chart shows the expected future development of the present population in simplified terms. The Retirement System presently covers 182 active members. 91% of the present population is expected to receive monthly retirement benefits either by retiring directly from active service, or by retiring from vested deferred status. 4% of the present population is expected to die or become disabled and receive a benefit. 5% of the present population is expected to terminate employment and forfeit eligibility for an employer provided benefit.

Active Members as of June 30, 2019
by Attained Age and Years of Service

Attained Age	Years of Service to Valuation Date							Totals	
	0-4	5-9	10-14	15-19	20-24	25-29	30 Plus	No.	Valuation Payroll
20-24	7							7	$ 347,827
25-29	9	5						14	852,073
30-34	17	12	3					32	2,144,479
35-39	6	7	13	4				30	2,238,966
40-44	2	4	6	11	6			29	2,546,224
45-49	1	5	2	6	19	1		34	2,963,146
50-54	2		2	1	13	2		20	1,654,084
55-59		2			9	2		13	1,171,922
60									
61					1			1	81,508
62	1					1		2	198,334
Totals	**45**	**35**	**26**	**22**	**48**	**6**		**182**	**$14,198,563**

While not used in the financial computations, the following group averages are computed and shown because of their general interest.

Age:	40.9 years
Service:	12.7 years
Annual Pay:	$78,014

SECTION C

FINANCIAL PRINCIPLES, ACTUARIAL VALUATION PROCESS, ACTUARIAL COST METHODS, ACTUARIAL ASSUMPTIONS AND DEFINITIONS OF TECHNICAL TERMS

Basic Financial Principles and Operation of the Retirement System

Benefit Promises Made Which Must Be Paid For. A retirement program is an orderly means of handing out, keeping track of, and financing pension promises to a group of employees. As each member of the retirement program acquires a unit of service credit the member is, in effect, handed an "IOU" which reads: "The Retirement System promises to pay you one unit of retirement benefits, payments in cash commencing when you retire."

The principal related financial question is: When shall the money required to cover the "IOU" be contributed? This year, when the benefit of the member's service is received? Or, some future year when the "IOU" becomes a cash demand?

The Constitution of the State of Michigan is directed to the question:

> "Financial benefits arising on account of service rendered in each fiscal year shall be funded during that year and such funding shall not be used for financing unfunded accrued liabilities."

This Retirement System meets this requirement by having as its financial objective the establishment and receipt of contributions, expressed as percents of active member payroll, which will remain approximately level from year-to-year and will not have to be increased for future generations of taxpayers.

Translated into actuarial terminology, a level percent-of-payroll contribution objective means that the contribution rate must be at least:

> Normal Cost (the present value of future benefits assigned to members' service being rendered in the current year)
>
> . . . plus . . .
>
> Interest on the Unfunded Actuarial Accrued Liability (the difference between the actuarial accrued liability and current System assets).

The accumulation of invested assets is a by-product of level percent-of-payroll contributions, not the objective. Investment income becomes the third major contributor to the retirement program, and the amount is directly reacted to the amount of contributions and investment performance.

If contributions to the retirement program are less than the preceding amount, the difference, plus investment earnings not realized thereon, will have to be contributed at some later time, or, benefits will have to be reduced, to satisfy the fundamental fiscal equation under which all retirement programs must operate:

B = C + I - E

The aggregate amount of Benefit payments to any group of members and their beneficiaries cannot exceed the sum of:

The aggregate amount of Contributions received on behalf of the group

. . . plus . . .

Investment earnings on contributions received and not required for immediate cash payments of benefits

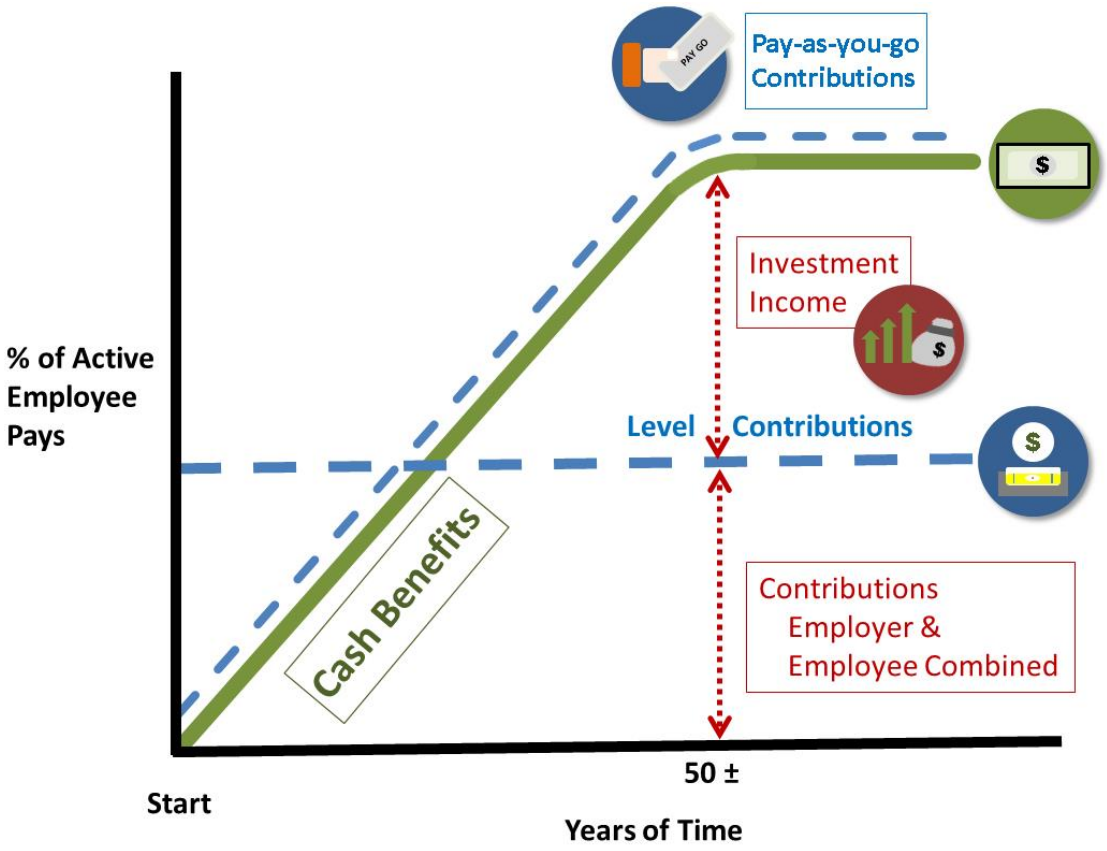
. . . minus . . .

The Expenses of operating the program.

There are retirement programs designed to defer the bulk of contributions far into the future. The present contribution rate for such systems is ***artificially low***. The fact that the contribution rate is destined to increase relentlessly to a much higher level, is often ignored.

This method of financing is prohibited in Michigan by the state constitution.

Computed Contribution Rate Needed To Finance Benefits. From a given schedule of benefits and from the data furnished, the actuary calculates the contribution rate ***by means of an actuarial valuation*** - the technique of assigning monetary values to the risks assumed in operating a retirement program.



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 previous 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) which is 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. ***Covered Person 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. \+ ***Assumptions concerning future financial experience in various risk areas,*** which assumptions are established by the Retirement System after consulting with the actuary

D. \+ ***The funding method*** the employer contributions (the long-term, planned pattern for employer contributions)

E. \+ ***Mathematically combining the assumptions, the funding method, and the data***

F. = Determination of:
   Plan financial position
   and/or New Employer Contribution Rate

Actuarial Cost Methods Used for the Valuation

Age and Service Benefits. Normal cost and the allocation of actuarial present values between service rendered before and after the valuation date were determined using an individual entry-age actuarial cost method having the following characteristics:

(i) the annual normal costs for each individual active member (usually expressed as a percent-of-payroll), payable from the member's date of hire to the member's projected date of retirement, are sufficient to accumulate the actuarial present value of the member's projected benefit at the time of retirement; and

(ii) the actuarial accrued liability under this method is equal to the assets which would have been accumulated had the normal cost contribution been made from the date of entry to the date of the valuation and had all actuarial assumptions been realized.

Casualty Benefits. Normal cost contributions were determined using a one-year term cost method. This method produces contributions sufficient to fund the value of (i) disability benefits likely to be incurred during the year (net of the member's accrued age and service benefits), and (ii) survivor benefits likely to be incurred during the year because of a member's death while employed.

Funding Value of Assets. The funding value of assets is derived as follows: prior year valuation assets are increased by contributions and expected investment income and reduced by refunds and benefit payments. To this amount is added 20% of the difference between expected and actual investment income for each of the previous five years. Funding value of assets may not be less than 80% nor more than 120% of market value.

Amortization of Unfunded Actuarial Accrued Liabilities. Unfunded actuarial accrued liabilities were amortized by level percent-of-payroll contributions (principal and interest combined) over periods described on page C-6.

Active member payroll was assumed to increase 4.00% per year for the purpose of determining the level percent contributions. Characteristics of this method of amortization are illustrated on page C-6.

Schedule of Amortizations for Development of Employer Contribution Rates Attributable to Actuarial Gains and Losses and Changes

Year Established	Initial Years	Years Remaining	Initial Amount	Previous Amount	Current Amount	Amortization Factor	Payment	Previous Payment	Percent of Payroll
	Initial Unfunded								
2019		25			$24,714,879	18.4882	$1,336,792		9.05%
	Benefit Changes								
2007	30	18	$4,422,379	$5,105,134	5,109,790	14.3434	356,247	$340,906	2.40%
2008	30	19	390,603	449,264	450,902	14.9752	30,110	28,813	0.20%
2009	30	20	121,354	138,731	139,580	15.5922	8,952	8,566	0.06%
2014	30	25	(135,876)	(146,253)	(148,528)	18.4678	(8,043)	(7,696)	(0.05)%
2016	30	27	954,398	988,646	1,004,415	19.5360	51,413	49,318	0.35%
2017	30	28	1,322,624	1,343,715	1,366,860	20.0466	68,184	65,373	0.46%
2018	30	29	(111,600)	(111,600)	(113,379)	20.5547	(5,516)	(5,304)	(0.04)%
2019	30	30	(11,845)	0	(11,845)	21.0413	(563)	0	0.00%
	Actuarial Cost Methods/Assumptions								
2009	30	20	1,503,821	1,719,139	1,729,651	15.5922	110,930	106,154	0.75%
2015	30	26	6,841,876	7,200,438	7,305,592	19.0133	384,237	368,572	2.60%
2017	30	28	4,645,879	4,719,963	4,789,746	20.0563	238,815	229,630	1.62%

This schedule is maintained to arrive at the amortization amount shown on page A-2.

Actuarial Assumptions in the Valuation Process

Contribution requirements and actuarial present values for a retirement system are computed by applying actuarial assumptions to the benefit provisions and member data of the system, using the actuarial cost methods described on page C-5.

The principal areas of risk which require assumptions about future experience are:

(i) long-term rates of investment return to be generated by the assets of the system.
(ii) patterns of pay increases to members.
(iii) rates of mortality among members, retirees and beneficiaries.
(iv) rates of withdrawal of active members.
(v) rates of disability among active members.
(vi) the age patterns of actual retirements.

In making a valuation, the monetary effect of each assumption is computed for as long as a present covered person survives - - a period of time which can be as long as a century.

The employer contribution rate has been computed to remain level from year to year so long as benefits and the basic experience and make-up of members do not change. Examples of favorable experience which would tend to reduce the employer contribution rate are:

(1) Investment returns in excess of 6.50% per year.

(2) Member non-vested terminations at a higher rate than outlined on page C-14.

(3) Mortality among retirees and beneficiaries at a higher rate than indicated by the RP-2014 Standard Mortality Tables Projected to 2019 using the MP-2014 mortality improvement scale.

(4) Increases in the number of active members.

Examples of unfavorable experience which would tend to increase the employer contribution rate are:

(1) Pay increases in excess of the rates outlined on page C-9.
(2) An increase in the rate of retirement over the rates outlined on page C-15.
(3) A pattern of hiring employees at older ages than in the past.

Actuarial Assumptions in the Valuation Process (Concluded)

Actual experience of the System will not coincide exactly with assumed experience, regardless of the choice of the assumptions, the skill of the actuary and the precision of the calculations. Each valuation provides a complete recalculation of assumed future experience and takes into account all past differences between assumed and actual experience. The result is a continual series of adjustments (usually small) to the computed contribution rate.

From time to time one or more of the assumptions is modified to reflect experience trends (but not random or temporary year-to-year fluctuations).

Actuarial Assumptions Used for the Valuation

Investment Return (net of administrative expenses). 6.50% per year, compounded annually. This rate consists of a real rate of return of 2.50% a year plus a long-term rate of wage growth of 4.00% a year. There is no specific assumption about price inflation needed for this valuation. The assumptions made would be consistent with a price inflation assumption of 2.75%.

This assumption is used to equate the value of payments due at different points in time and was first used for the June 30, 2017 valuation. Approximate rates of investment return, for the purpose of comparisons with assumed rates, are shown below:

	Year Ended June 30				
	2019	2018	2017	2016	2015
Rate of Investment Return	5.6 %	6.8 %	7.3 %	6.1 %	8.8 %

The nominal rate of return was computed using the approximate formula i = I divided by 1/2 (A + B - I), where I is recognized investment income net of expenses, A is the beginning of year asset value, and B is the end of year asset value.

These rates of return should not be used for measurement of an investment advisor's performance or for comparisons with other systems -- ***to do so will mislead***.

Pay Projections. These assumptions are used to project current pays to those upon which benefits will be based. The assumptions were first used for the June 30, 2015 valuation.

Sample Years of Service at Beginning of the Year	Annual Rate of Pay Increase for Sample Years of Service		
	Base (Economic)	Merit & Longevity	Total
0	4.00%	12.00%	16.00%
1	4.00%	9.00%	13.00%
2	4.00%	4.30%	8.30%
3	4.00%	3.50%	7.50%
4	4.00%	2.30%	6.30%
5	4.00%	2.00%	6.00%
6	4.00%	1.00%	5.00%
7	4.00%	1.00%	5.00%
8	4.00%	1.00%	5.00%
9 and over	4.00%	0.50%	4.50%
Ref.		299	

Actuarial Assumptions Used for the Valuation (Continued)

If the number of active members remains constant, the total active member payroll and the average pay will increase 4.00% annually, the base portion of the individual pay increase assumptions. This increasing payroll was recognized in amortizing unfunded actuarial accrued liabilities.

Changes actually experienced in average pay and total payroll have been as follows:

	Year Ended June 30					3-Year	5-Year
	2019	2018	2017	2016	2015	Average	Average
Average Pay	0.8 %	2.9 %	5.0 %	(0.2)%	3.8 %	2.9 %	2.4 %
Total Payroll	(0.9)%	0.8 %	5.5 %	(0.2)%	6.6 %	1.8 %	2.3 %

Post-Retirement Mortality Table. The RP-2014 Healthy Annuitant Mortality Table projected to 2019 using the MP-2014 mortality improvement scale. Sample values follow:

Sample Attained Ages	Single Life Retirement Values			
	Present Value of $1 Monthly for Life		Future Life Expectancy (years)	
	Men	Women	Men	Women
50	$158.65	$163.74	33.25	35.95
55	150.69	156.51	28.92	31.44
60	141.14	147.43	24.73	27.02
65	129.54	136.26	20.70	22.74
70	115.76	122.92	16.85	18.67
75	99.89	107.49	13.26	14.86
80	82.44	90.38	10.01	11.41
Ref:	1208 x 1.00	1209 x 1.00		

Actuarial Assumptions Used for the Valuation (Continued)

Disabled Mortality Table. The RP-2014 Disabled Retirees projected to 2019 using the MP-2014 mortality improvement scale. This table was first used for the June 30, 2015 valuation. Sample values follow:

Sample Attained Ages	Single Life Retirement Values			
	Present Value of $1 Monthly for Life		Future Life Expectancy (years)	
	Men	Women	Men	Women
50	$131.52	$144.11	23.75	28.16
55	124.51	137.02	20.96	24.79
60	116.58	128.79	18.26	21.51
65	107.11	118.47	15.56	18.23
70	96.00	106.00	12.93	15.02
75	83.33	92.13	10.41	12.06
80	69.60	77.92	8.08	9.45
Ref:	1258 x 1.00	1259 x 1.00		

Pre-Retirement Mortality Table. The RP-2014 Mortality Table for Employees projected to 2019 using the MP-2014 mortality improvement scale. This table was first used for the June 30, 2015 valuation. Sample values follow:

Sample Attained Ages	Single Life Retirement Values			
	Present Value of $1 Monthly for Life		Future Life Expectancy (years)	
	Men	Women	Men	Women
50	$163.62	$170.53	35.05	39.48
55	155.39	164.31	30.36	34.71
60	145.18	156.33	25.81	30.01
65	132.93	146.02	21.48	25.39
70	118.67	132.96	17.41	20.87
75	102.26	116.83	13.64	16.54
80	83.85	97.19	10.20	12.42
Ref:	1158 x 1.00	1159 x 1.00		

This assumption is used to measure the probabilities of members dying before retirement and the probabilities of each benefit payment being made after retirement.

Actuarial Assumptions Used for the Valuation (Continued)

Proposed Post-Retirement Mortality Table. The RP-2014 Healthy Annuitant Mortality Table with 2-dimensional, fully generational improvements with the MP-2019 Mortality Improvement Scales. Sample values follow:

Sample Attained Ages	Single Life Retirement Values			
	Present Value of $1 Monthly for Life		Future Life Expectancy (years)	
	Men	Women	Men	Women
50	$158.88	$164.04	34.03	36.67
55	150.60	156.24	29.34	31.76
60	140.40	146.64	24.83	27.04
65	128.40	135.12	20.56	22.56
70	114.00	121.08	16.54	18.26
75	97.08	104.40	12.79	14.24
80	78.84	85.92	9.45	10.64
Ref:	2135 x 1.00	2136 x 1.00		

Applicable to calendar year 2019. Values for future years are determined using the MP-2019 projection scale.

Proposed Disabled Mortality Table. The RP-2014 Disabled Retirees with 2-dimensional, fully generational improvements with the MP-2019 Mortality Improvement Scales. Sample values follow:

Sample Attained Ages	Single Life Retirement Values			
	Present Value of $1 Monthly for Life		Future Life Expectancy (years)	
	Men	Women	Men	Women
50	$130.08	$143.16	23.86	28.38
55	122.88	135.00	20.85	24.60
60	114.12	126.36	17.91	21.15
65	104.52	116.28	15.14	17.84
70	93.12	103.32	12.45	14.50
75	79.80	88.20	9.84	11.35
80	65.40	72.72	7.48	8.63
Ref:	2137 x 1.00	2138 x 1.00		

Applicable to calendar year 2019. Values for future years are determined using the MP-2019 projection scale.

Actuarial Assumptions Used for the Valuation (Continued)

Proposed Pre-Retirement Mortality Table. The RP-2014 Mortality Table for Employees with 2-dimensional, fully generational improvements with the MP-2019 Mortality Improvement Scales. Sample values follow:

Sample Attained Ages	Single Life Retirement Values			
	Present Value of $1 Monthly for Life		Future Life Expectancy (years)	
	Men	Women	Men	Women
50	$164.28	$171.00	35.96	40.30
55	155.64	164.52	30.89	35.19
60	144.84	156.12	25.99	30.20
65	132.00	145.44	21.40	25.33
70	117.12	131.76	17.14	20.59
75	99.72	114.48	13.19	16.02
80	80.40	93.36	9.65	11.73
Ref:	2133 x 1.00	2134 x 1.00		

Applicable to calendar year 2019. Values for future years are determined using the MP-2019 projection scale.

This assumption is used to measure the probabilities of members dying before retirement and the probabilities of each benefit payment being made after retirement.

Actuarial Assumptions Used for the Valuation (Continued)

Rates of separation from active membership. The rates do not apply to members eligible to retire and do not include separation on account of death or disability. This assumption measures the probabilities of members separating from employment. Fire rates were first used for the June 30, 2002 valuation. Police rates were first used for the June 30, 2009 valuation.

Sample Ages	% of Active Members Separating Within Next Year	
	Police	Fire
30	3.68%	2.90%
35	3.16%	1.50%
40	1.88%	0.60%
45	1.40%	0.50%
50	1.40%	0.50%
55	0.40%	0.50%
60	0.40%	0.50%
Ref.	235 x 0.8	54 x 1

Rates of Disability. These assumptions represent the probabilities of active members becoming disabled. These rates were first used for the June 30, 2015 valuation.

Sample Ages	% of Active Members Becoming Disabled Within Next Year	
	Male	Female
20	0.06%	0.08%
25	0.06%	0.08%
30	0.06%	0.08%
35	0.06%	0.08%
40	0.15%	0.27%
45	0.20%	0.30%
50	0.37%	0.43%
55	0.67%	0.57%
60	1.06%	0.76%
Ref.	9	10

Actuarial Assumptions Used for the Valuation (Concluded)

Rates of Retirement. These rates are used to measure the probabilities of an eligible member retiring during the next year.

Percent of Active Members Retiring Within Next Year			
Retirement Ages	Police	Fire IAAF	Fire OSP
50-55			20%
56			15%
57-59			10%
60-61	35%	20%	10%
62	35%	20%	15%
63	35%	20%	25%
64	35%	20%	30%
65	35%	20%	100%
66	25%	15%	100%
67	20%	10%	100%
68-71	15%	10%	100%
72	15%	15%	100%
73	25%	25%	100%
74	30%	30%	100%
75 & Over	100%	100%	100%
Ref	552	553	553

Percent of Active Members Retiring Within Next Year			
Service	Police	Fire IAFF, OSP, and Police Lieutenants	Fire Non-Represented
25	60%	30%	60%
26	30%	15%	35%
27	30%	15%	35%
28	30%	15%	20%
29	20%	15%	20%
30	20%	50%	20%
31	20%	40%	20%
32	20%	30%	20%
33	20%	20%	20%
34	20%	20%	20%
35 & Over	100%	100%	100%
Ref	1788	999	821

Fire (OSP) members were assumed to be eligible for retirement after attaining age 50 with 25 or more years of service, or age 60 with 10 or more years of service. All others are eligible with 25 years of service at any age or at age 60 regardless of service.

These rates were first used for the June 30, 2009 valuation.

Service based rates for Fire IAFF were adjusted in conjunction with the adoption of the DROP and were first used for the June 30, 2017 valuation. These changes were incorporated with the introduction of the DROP for Police Lieutenants in the June 30, 2018 valuation and for OSP Chiefs in the June 30, 2019 valuation.

Active Member Group Size. The number of active members was assumed to remain constant. This assumption is unchanged from previous valuations.

Pensions in an Inflationary Environment

Value of $1,000/month Retirement Benefit to an Individual Who Retires at Age 55 in an Environment of 2.75% Price Inflation

Age	COLA Rate	
	2.5%	0%
55	$1,000	$1,000
56	998	973
57	995	947
58	993	922
59	990	897
60	988	873
65	976	762
70	964	666
75	952	581
80	941	508
85	930	443

The life expectancy of a 60-year-old male is to age 85. The life expectancy for a 60-year-old female is to age 87. Half of the people will outlive their life expectancy. The effects of even moderate amounts of inflation can be significant for those who live to an advanced age.

Miscellaneous and Technical Assumptions
June 30, 2019

Marriage Assumption:	100% of males and 100% of females are assumed to be married for purposes of death-in-service benefits. Male spouses are assumed to be three years older than female spouses. 80% of retirees are assumed to have a spouse eligible for the 60% death after retirement survivor benefit.
Pay Increase Timing:	Beginning of (Fiscal) year. This is equivalent to assuming that reported pays represent amounts paid to members during the year ended on the valuation date.
Decrement Timing:	All decrements are assumed to occur at the middle of the year.
Eligibility Testing:	Eligibility for benefits is determined using the age nearest birthday and the service nearest whole year on the date the decrement is assumed to occur.
Decrement Relativity:	Decrement rates are used directly from the experience study, without adjustment for multiple decrement table effects.
Decrement Operation:	Disability and mortality decrements do not operate during the first five years of service. Disability also does not operate during retirement eligibility.
Normal Form of Benefit:	The assumed normal form of benefit is the 60% joint and survivor form.
Incidence of Contributions:	Contributions are assumed to be received continuously throughout the year based upon the computed percent-of-payroll shown in this report, and the actual payroll payable at the time contributions are made.
Approximation:	Age and service benefits were increased by the following percentages to account for lump sums included in final average pay at retirement: Police Officers: 5%. Police Lieutenants: 8%. Police Sergeants, Fire OSP and IAFF: 8.33%.

Summary of Actuarial Methods and Assumptions

The information presented in the required supplementary schedules was determined as part of the actuarial valuations at the dates indicated. Additional information as of the latest actuarial valuation follows:

Valuation date	June 30, 2019
Actuarial cost method	Entry-age actuarial cost method
Amortization method	Level percent-of-payroll
Remaining amortization period	30-year closed for benefit improvements and assumption changes 25-year closed for all other liabilities
Asset valuation method	5-year smoothed market with 20% corridor
Actuarial assumptions:	
Investment rate of return	6.50%
Projected salary increases	4.00% - 16.00%
Assumed rate of payroll growth	4.00%
Assumed rate of membership growth	0%
Cost-of-living adjustments	N/A

Definitions of Technical Terms

***Accrued Service*.** Service credited under the system which was rendered before the date of the actuarial valuation.

***Actuarial Accrued Liability*.** The difference between the actuarial present value of system benefits and the actuarial present value of future normal costs. Also referred to as "past service liability."

***Actuarial Assumptions*.** Estimates of future experience with respect to rates of mortality, disability, turnover, retirement, rate or rates of investment income and salary increases. Decrement assumptions (rates of mortality, disability, turnover and retirement) are generally based on past experience, often modified for projected changes in conditions. Economic assumptions (salary increases and investment income) consist of an underlying rate in an inflation-free environment plus a provision for a long-term average rate of inflation.

***Actuarial Cost Method*.** A mathematical budgeting procedure for allocating the dollar amount of the "actuarial present value of future benefit" between future normal cost and actuarial accrued liabilities. Sometimes referred to as the "actuarial funding method."

***Actuarial Equivalent*.** One series of payments is said to be actuarially equivalent to another series of payments if the two series have the same actuarial present value.

Actuarial Gain (Loss). The difference between actual unfunded actuarial accrued liabilities and anticipated unfunded actuarial accrued liabilities -- during the period between two valuation dates. It is a measurement of the difference between actual and expected experience.

***Actuarial Present Value*.** The amount of funds currently required to provide a payment or series of payments in the future. It is determined by discounting future payments at predetermined rates of interest, and by probabilities of payment.

***Actuary*.** A person who is trained in the applications of probability and compound interest to problems in business and finance that involve payment of money in the future, contingent upon the occurrence of future events. Most actuaries in the United States are Members of the American Academy of Actuaries. The Society of Actuaries is an international research, education and membership organization for actuaries in the life and health insurance, employee benefits, and pension fields. It administers a series of examinations leading initially to Associateship and the designation A.S.A., and ultimately to Fellowship with the designation of F.S.A.

***Amortization*.** Paying off an interest-discounted amount with periodic payments of interest and (generally) principal -- as opposed to paying it off with a lump sum payment.

***Credited Projected Benefit*.** The portion of a member's projected benefit attributable to service before the valuation date - allocated based on the ratio of accrued service to projected total service and based on anticipated future compensation.

Normal Cost. The portion of the actuarial present value of future benefits that is assigned to the current year by the actuarial cost method. Sometimes referred to as "current service cost."

Definitions of Technical Terms (Concluded)

***Unfunded Actuarial Accrued Liabilities*.** The difference between actuarial accrued liabilities and valuation assets. Sometimes referred to as "unfunded past service liability" or "unfunded supplemental present value."

Most retirement systems have unfunded actuarial accrued liabilities. They arise each time new benefits are added and each time an actuarial loss occurs.

The existence of unfunded actuarial accrued liabilities is not in itself bad, any more than a mortgage on a house is bad. Unfunded actuarial accrued liabilities do not represent a debt that is payable today. What is important is the ability to amortize the unfunded actuarial accrued liabilities and the trend in their amount (after due allowance for devaluation of the dollar).

***Valuation Assets*.** The value of cash, investments and other property belonging to a pension plan, as used for the purpose of an actuarial valuation.