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**Connecticut State Teachers' Retirement System
Actuarial Valuation
as of June 30, 2016
(Revised as of November 15, 2017)**





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The experience and dedication you deserve

November 15, 2017

Board of Directors

Connecticut State Teachers' Retirement System

765 Asylum Avenue

Hartford, CT 06105

Members of the Board:

This revision of the June 30, 2016 valuation reflects changes contained in the enactment of Senate Bill 1502 (SB 1502), the State budget for the biennium ending June 30, 2019, which impact the valuation results for the fiscal years ending 2018 and 2019. The laws governing the operation of the Connecticut State Teachers' Retirement System provide that actuarial valuations of the assets and liabilities of the System shall be made at least once every two years. We have conducted the actuarial valuation of the System as of June 30, 2016 and the results of the valuation are contained in the following report.

In performing the valuation, we relied on data supplied by the System and performed limited tests on the data for consistency and reasonableness. The valuation was prepared in accordance with the funding objectives of the System as set forth in Chapter 167a, Section 10-183z of the Connecticut General Statutes. The normal cost and accrued liability of the System are developed using the entry age normal cost method. Under this method, the normal cost is the level percent of payroll necessary to fully fund the expected benefits to be earned over the career of each individual active member. The normal cost is partially funded with active member contributions with the remainder funded by employer contributions. In this valuation, and due to enactment of SB 1502, the member contribution is increased from 6.0% to 7.0% of member salary effective January 1, 2018. Further, the increased member amount partially offsets the required employer contribution amount during the biennium ending June 30, 2019.

In determining the System's liabilities, future events, such as investment returns, salary increases, deaths, retirements, etc., are anticipated based upon the set of actuarial assumptions as approved by the Board. Since the previous valuation, several assumptions have been revised or updated as a result of the Experience Study for the Five-Year Period Ending June 30, 2015. The assets of the system for valuation purposes are developed using an asset smoothing technique which spreads the recognition of the unexpected portion of market related gains and losses over a period of four years with the goal of dampening the impact of market volatility upon valuation results.

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An unfunded accrued liability exists in the amount equal to the excess of accrued liability over valuation assets. The accrued liability contribution was determined in accordance with subsections (b) and (c) of Section 10-183z of the Statutes. Based on the current valuation, the expected future contributions together with current assets will be sufficient to provide the planned benefits. Therefore, in our opinion, the System continues to operate on an actuarially sound basis.

Future actuarial results may differ significantly from the current results 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; and changes in plan provisions or applicable law. Since the potential impact of such factors is outside the scope of a normal annual actuarial valuation, an analysis of the range of results is not presented herein.

This actuarial valuation was performed to determine the recommended funding amount for the System. The asset values used to determine unfunded liabilities and funded ratios are not market values but less volatile market related values. A smoothing technique is applied to market values to determine the market related values. The unfunded liability amounts and funded ratios using the market value of assets would be different. The interest rate used for determining liabilities is based on the expected return of assets. Therefore, liability amounts in this report cannot be used to assess a settlement of the obligation.

This is to certify that the independent consulting actuary is a member of the American Academy of Actuaries and has experience in performing valuations for public retirement systems, that the valuation was prepared in accordance with principles of practice prescribed by the Actuarial Standards Board, and that the actuarial calculations were performed by qualified actuaries in accordance with accepted actuarial procedures, based on the current provisions of the retirement system and on actuarial assumptions and methods that are internally consistent and reasonable, based on the actual experience of the System.

Respectfully submitted,

A handwritten signature in blue ink, appearing to read 'John J. Garrett', with a stylized flourish at the end.

John J. Garrett, ASA, FCA, MAAA
Principal and Consulting Actuary

A handwritten signature in blue ink, appearing to read 'Cathy Turcot', with a stylized flourish at the end.

Cathy Turcot
Principal and Managing Director

A handwritten signature in blue ink, appearing to read 'Jonathan T. Craven', with a stylized flourish at the end.

Jonathan T. Craven, ASA, EA, FCA, MAAA
Consulting Actuary

A handwritten signature in blue ink, appearing to read 'Ben D. Mobley', with a stylized flourish at the end.

Ben D. Mobley, ASA, ACA, MAAA
Actuary



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Section I: Board Summary



The table below summarizes the results of the June 30, 2016 actuarial valuation as compared with the prior valuation.

Table I-1: Comparative Summary of Principal Results		
	June 30, 2014	June 30, 2016
Membership		
Active Members		
Number	51,433	50,877
Annual Payroll	\$3,831,624	\$3,949,926
Retirees and Beneficiaries		
Number	34,310	36,065
Annual Benefits	\$1,695,976	\$1,831,946
Inactive Members		
Vested	1,480	2,085
Non-Vested	11,531	12,667
Assets		
Market Value	\$16,220,889	\$15,584,564
Actuarial Value	\$15,546,516	\$16,712,316
Return on Market Value ¹	13.90%	1.70%
Return on Actuarial Value ¹	10.46%	7.56%
Ratio of Actuarial to Market Value	95.84%	107.24%
Actuarial Information		
Unfunded Actuarial Liability (UAL)	\$10,802,693	\$13,148,002
Funded Ratio	59.00%	55.97%
Computed Contribution Rates		
Normal Cost	9.73%	10.60%
Unfunded Accrued Liability	<u>19.92%</u>	<u>25.84%</u>
Total	29.65%	36.44%
Member	6.00%	7.00%
State	23.65%	29.44%
State Contribution Amount for Fiscal Year Ending		
June 30, 2016	\$975,578	
June 30, 2017	\$1,012,162	
June 30, 2018*		\$1,271,033
June 30, 2019*		\$1,292,314

All dollar amounts are in thousands.

*Amounts for these fiscal years are impacted by the 1.0% increase in member contributions beginning 1/1/2018.

¹ Two-year compound average return.



Section I: Board Summary

Summary of Key Findings

The employer contribution rate for the System is used to pay the employer's portion of the normal cost and to amortize the unfunded actuarial accrued liability (UAAL). The revision due to SB 1502 increased the rate of salary members are required to contribute which will increase the amount member's accumulate contribution accounts. The expected larger future contribution accounts will result in small increases to the accrued liability of active members and their normal cost rate. The net effect of SB 1502 was to increase the total cost of the program by 0.09% and increase the member contribution by 1.00% which results in a decrease to the actuarially determined employer contribution (ADEC) of 0.91% of total expected payroll over the period from January 1, 2018 to June 30, 2019.

The actuarially determined normal cost contribution rate was 9.73% as of June 30, 2014 and increased to 10.60% as of June 30, 2016. The unfunded actuarial accrued liability increased from \$10.803 billion to \$13.148 billion over the two year period. The unfunded actuarial accrued liability rate increased from 19.92% to 25.84%. We note the following key findings:

- The UAAL grew by \$2.213 billion due to changes in assumptions adopted by the board as a result of the Experience Study for the Five-Year Period Ending June 30, 2015. The changes are summarized in Appendix B.
- The UAAL grew by \$1.776 billion due to interest and decreased by \$1.654 billion due to the amortization payments over the two year period.
- The System experienced actuarial losses on plan assets of \$140 million for fiscal year 2015 and \$153 million for fiscal year 2016 as a result of the investment return on the actuarial value of assets being less than the assumed rate. Table III-3 provides the calculation of the investment losses for the two- year period.
- The System experienced net actuarial gains of \$73 million as of June 30, 2015 and \$231 million as of June 30 2016 on plan liabilities due to non-investment related experience. Table IV-2 provides the reconciliation of the UAAL which is summarized as follows:
 1. The System provides post-retirement Cost-of-Living Adjustments based upon certain criteria set forth in the statutes. For purposes of the valuation, the benefits paid to eligible retirees and beneficiaries are expected to increase at a rate of 3.00% annually for members retired before September 1992 and 2.00% for members retired on and after September 1, 1992 (1.75% for members hired on or after July 1, 2007). The actual COLAs granted for members retired before September 1, 1992 were 3.0% for 2015 and 3.0% for 2016. The actual COLAs granted for members retired on and after September 1, 1992 were 1.7% for 2015 and 0.0% for 2016. This resulted in a \$42 million gain to the System in 2015 and a \$270 million gain to the system in 2016.
 2. In years where the salaries of active members increase less than expected, an actuarial gain occurs. The System experienced a \$109 million gain due to salary experience for 2015 and a \$96 million gain due to salary experience for 2016.



Section I: Board Summary

3. In addition, there were other gains and losses primarily attributable to the System demographic experience. The loss for 2015 was \$78 million and the loss for 2016 increased plan liabilities by \$135 million.

Section II of the report provides summarized information on the membership data used in the valuation. Section III of the report covers the System's assets and Section IV of the report covers the System's liabilities. The results of the valuation are provided in Section V of the report and the accounting information is in Section VI. The appendices provide additional information on: A) the System members; B) the actuarial assumptions and methods; and C) the summary of plan provisions. In addition, Appendix D provides a glossary of actuarial terminology. It should be noted that all information contained in this report for periods prior to June 30, 2009 was produced by a prior actuarial consulting firm.



Section II: Membership Data

Data regarding the membership of the System for use in the valuation were furnished by the Retirement Systems. The following table summarizes the membership data as of June 30, 2016 and is compared with that reported for the prior valuation.

Table II-1: Summary of Membership Data		
	June 30, 2014	June 30, 2016
Active Members		
Total Number of Active Members	51,433	50,877
Total Annual Compensation	\$3,831,624	\$3,949,926
Retirees and Beneficiaries		
Number of Service Retirements	32,272	33,920
Total Annual Benefit Payments	\$1,638,223	\$1,768,348
Number of Disability Retirements	267	283
Total Annual Benefit Payments	\$6,407	\$6,874
Number of Beneficiaries	1,771	1,862
Total Annual Benefit Payments	\$51,346	\$56,724
Inactive Members		
Number of Non-vested Inactive Members	11,531	12,667
Number of Vested Inactive Members	1,480	2,085

All dollar amounts are in thousands.

Section III: System Assets



The following tables provide information on the System's assets.

Table III-1: Market Value Reconciliation		
	2014 - 2015	2015 - 2016
Net Market Value as of July 1	\$16,220,889	\$16,225,777
Additions		
State Contributions	\$984,110	\$975,578
ERIP Contributions	\$ 669	\$ 510
Employee Contributions	\$275,568	\$290,557
Change in Net Appreciation	\$202,079	(\$259,813)
Interest and Dividends	\$6,695	\$8,587
Gain on Sale of Securities	<u>\$359,504</u>	<u>\$232,435</u>
Total Additions	\$1,828,625	\$1,247,854
Deductions		
Benefit Payments	(\$1,823,737)	(\$1,889,067)
Net Increase	\$4,888	(\$641,213)
Net Market Value as of June 30	\$16,225,777	\$15,584,564
Rate of Return on Market Value	3.55%	(0.11)%
Two Year Compounded Return		1.70%

All dollar amounts are in thousands.



Section III: System Assets

Development of Actuarial Value of Assets

The Actuarial Value of Assets represents a "smoothed" value developed with the purpose to dampen the impact of market volatility on the assets used in determining valuation results. The Actuarial Value of Assets has been calculated by spreading the recognition of excess investment income over four years. The amount of excess investment income in each year is the difference between expected investment income on actuarial value and the actual market value investment income. Table III-2 provides the development of the actuarial value of assets over the two year period since the previous valuation.

Table III-2: Development of Actuarial Value of Assets

	June 30, 2015	June 30, 2016
1. Actuarial Value Beginning of Year	\$15,546,516	\$16,143,461
2. Market Value End of Year	\$16,225,777	\$15,584,564
3. Market Value Beginning of Year	\$16,220,889	\$16,225,777
4. Cash Flow		
a. Contributions	\$1,263,111	\$1,265,138
b. Disbursements	<u>(\$1,823,737)</u>	<u>(\$1,889,067)</u>
c. Net: 4a + 4b	(\$560,626)	(\$623,929)
5. Investment Income		
a. Market Total: 2 – 3 – 4c	\$565,514	(\$17,284)
b. Assumed Rate of Return	8.50%	8.50%
c. Amount for Immediate Recognition: (1 x 5b) + (4c x 5b x 0.5)	\$1,297,627	\$1,345,677
d. Amount for Phased-In Recognition: 5a – 5c	(\$732,113)	(\$1,362,961)
6. Phased-In Recognition of Investment Income		
a. Current Year: 5d * .25	(\$183,028)	(\$340,740)
b. First Prior Year	\$260,525	(\$183,028)
c. Second Prior Year	\$110,350	\$260,525
d. Third Prior Year	<u>(\$327,903)</u>	<u>\$110,350</u>
e. Total Recognized Investment Gain	(\$140,056)	(\$152,893)
7. Total Recognized Investment Return: 5c + 6e	\$1,157,571	\$1,192,784
8. Actuarial Value End of Year: 1 + 4c + 7	\$16,143,461	\$16,712,316
9. Difference Between Market & Actuarial Values: 2 – 8	\$82,316	(\$1,127,752)
10. Rate of Return on Actuarial Value	7.58%	7.53%
11. Two Year Compounded Return		7.56%

All dollar amounts are in thousands.



Section III: System Assets

The actuarial valuation assumes the investment income on the assets of the System is 8.50% annually. This assumption is based upon the reasonable long-term expected return on the assets. In each year, the System will experience actuarial gains and losses due to the actual investment return of the assets.

Table III-3: Calculation of Actuarial Investment Gain/(Loss)

	June 30, 2015	June 30, 2016
1. Actuarial Value of Assets at Beginning of Year	\$15,546,516	\$16,143,461
2. Total Net Cash Flow	(\$560,626)	(\$623,929)
3. Expected Return on Actuarial Value of Assets: $(1 \times 8.50\% + 2 \times 8.50\% \times .5)$	<u>\$1,297,627</u>	<u>\$1,345,677</u>
4. Expected Actuarial Value of Assets at End of Year: $(1 + 2 + 3)$	\$16,283,517	\$16,865,209
5. Actual Actuarial Value of Assets at End of Year	<u>\$16,143,461</u>	<u>\$16,712,316</u>
6. Actuarial Gain/(Loss) Due to Investment Experience: $(5 - 4)$	(\$140,056)	(\$152,893)

All dollar amounts are in thousands.



Section IV: System Liabilities

The present value of benefits is the value as of the valuation date of all future benefits expected to be paid to current members of the System. An actuarial cost method allocates each individual's present value of benefits to past and future years of service. The actuarial accrued liability includes the portion of the active member present value of benefits allocated to past service as well as the entire present value of benefits for retirees, beneficiaries and inactive members. The unfunded actuarial accrued liability (UAAL) is the difference between the actuarial accrued liability and the actuarial value of assets. Table IV-1 shows the allocation of the present value of future benefits into components for future normal cost contributions and actuarial accrued liabilities and the determination of the UAAL as of the valuation date.

Table IV-1: Calculation and Allocation of Present Value of Future Benefits			
	Entry Age Actuarial Cost Method		
	(1)	(2)	(3)
	Present Value of Future Benefits	Portion Covered By Future Normal Cost Contributions	Actuarial Accrued Liabilities (1) - (2)
Active Members			
Service Retirement	\$13,789,464	\$3,124,829	\$10,664,635
Disability Retirement	154,988	97,428	57,560
Survivors' Benefits	250,513	76,640	173,873
Termination	<u>757,190</u>	<u>646,144</u>	<u>111,046</u>
Total for Active Members	14,952,155	3,945,041	11,007,114
Inactive Members			
Non-Vested (Refund only)	248,034	0	248,034
Vested	<u>376,252</u>	<u>0</u>	<u>376,252</u>
Total for Inactive Members	624,286	0	624,286
Retirees and Beneficiaries			
Service Retirements	17,664,665	0	17,664,665
Disability Retirements	79,134	0	79,134
Beneficiaries	<u>485,119</u>	<u>0</u>	<u>485,119</u>
Total for Retirees and Beneficiaries	18,228,918	0	18,228,918
Total	\$33,805,359	\$3,945,041	\$29,860,318
Actuarial Value of Assets			\$16,712,316
Unfunded Actuarial Accrued Liability			\$13,148,002
Funded Ratio			55.97%

All dollar amounts are in thousands.



Section IV: System Liabilities

The funded ratio of the System is the ratio of the actuarial value of assets divided by the actuarial accrued liability as of the valuation date. As of June 30, 2016, the funded ratio of the System is 55.97% as compared to the ratio in the prior valuation of 59.00%. The decrease in the funded ratio is primarily attributable to the impact of the changes made in the experience study. The ratio is a commonly used measure of the funding progress of a System and can be useful in reviewing the historical trend of a System's funding progress. Such a review should also consider the impact to this measure over the historical period due to changes to plan benefits, changes to the actuarial assumptions and methods, and the significant impact that investment experience can have on the ratio over short-term periods. We caution that no single "point in time" measure can provide a universal basis for comparing one System to another.

Although the terminology used to describe the excess of the System's actuarial accrued liability over the System's actuarial value of assets is called the "unfunded" actuarial accrued liability, there is a dedicated source of funding for this liability. The scheduled employer and employee contributions are expected to completely fund the System's liabilities (pay off the UAAL) based on statutory funding requirements.

The calculation of the System's actuarial liabilities require the use of several assumptions concerning the future experience of the System and its members. In each valuation, the latest year of actual experience is compared to that expected by the prior valuation. The differences are actuarial gains and losses which decrease or increase the UAAL. Table IV-2 provides for the reconciliation of the UAAL and shows the primary sources of this year's gains and losses due to actuarial experience.



Table IV-2: Reconciliation of the UAAL

1.	UAAL as of June 30, 2014	\$10,802,693
2.	Expected Amortization Payment	(831,963)
3.	Expected Interest (1 x 8.50% + 2 x 8.50% x 0.5)	<u>882,870</u>
4.	Expected End of Year UAAL (1 + 2 + 3)	\$10,853,600
5.	Actuarial Experience (Gain)/Loss	
	Asset Experience	140,056
	COLA	(42,252)
	Salary Experience	(108,529)
	Post-retirement Mortality	68,936
	Retirements	50,163
	Turnover and Other	<u>(40,904)</u>
	Total Actuarial (Gain)/Loss	\$67,470
6.	UAAL as of June 30, 2015 (4 + 5)	\$10,921,070
7.	Expected Amortization Payment	(821,738)
8.	Expected Interest (6 x 8.50% + 7 x 8.50% x 0.5)	<u>893,367</u>
9.	Expected End of Year UAAL (6 + 7 + 8)	\$10,992,699
10.	Actuarial Experience (Gain)/Loss	
	Assumption Change	2,213,190
	Asset Experience	152,893
	COLA	(270,068)
	Salary Experience	(96,405)
	Post-retirement Mortality	65,345
	Retirements	(8,272)
	Turnover and Other	78,227
	Changes due to SB 1502	<u>20,393</u>
	Total Actuarial (Gain)/Loss	\$2,155,303
11.	UAAL as of June 30, 2016 (9 + 10)	\$13,148,002

All dollar amounts are in thousands.



Section V: Actuarial Valuation Results

Section IV of this report presented the System’s total present value of future benefits allocated between the present value of future normal cost contributions and actuarial accrued liability. The portion of the active members’ present value of benefits allocated to future years of service is funded through annual normal cost contributions comprised of both active member and employer contributions. The System’s annual normal cost rate is calculated as a percent of covered payroll, which is expected to remain level over all future years of service. The portion of the total normal cost rate in excess of the active member contribution rate is the state normal cost rate. The normal cost rate developed as of the valuation date is presented in Table V-1. Table V-1 also shows the state contribution rates necessary to amortize the UAAL in accordance with the funding requirements in the statutes.

Table V-1: State Contribution Rate	
Normal Cost Rate of Active Members by Expected Benefit Type	
Service Retirement	8.40%
Termination	1.71%
Disability Retirement	0.28%
Survivors' Benefits	0.21%
Total Normal Cost Rate for Active Members	10.60%
Less: Active Member Contribution Rate	7.00%
State Normal Cost Rate	3.60%
Unfunded Actuarial Accrued Liabilities	
Plan in effect 6/30/1991 (15 years)	28.72%
Public Act 87-381 (1 years)	0.01%
Public Act 92-205 (6 years)	(4.84)%
Public Act 98-251 (11 years)	0.02%
Public Act 07-186 (21 years)	1.93%
Total	25.84%
State Contribution Rate*	29.44%

* Rate applies only for period from 1/1/2018 to 6/30/2019. State Contribution Rate is expected to be 1.00% higher for periods thereafter.



Section VI: Accounting Statement Information

The Governmental Accounting Standards Board has issued Statement No. 67 which replaces Statement No. 25 for plan years beginning after June 15, 2013. The information required under GASB 67 will be issued in a separate report.

We are providing the schedule of funding progress as shown below for informational purposes. This schedule is no longer required under GASB 67

Table VI-2: Schedule of Funding Progress						
Actuarial Valuation as of June 30	Actuarial Value of Assets (a)	Actuarial Accrued Liability (AAL) (b)	Unfunded AAL (UAAL) (b) - (a)	Funded Ratio (a) / (b)	Covered Payroll (c)	UAAL as a % of Active Member Payroll [(b) - (a)] / (c)
2002	\$10,387.3	\$13,679.9	\$3,292.6	75.9%	\$2,698.3	122.0%
2004	9,846.7	15,070.5	5,223.8	65.3	2,930.8	178.2
2006	10,190.3	17,112.8	6,922.5	59.5	3,137.7	220.6
2008	15,271.0	21,801.0	6,530.0	70.0	3,399.3	192.1
2010	14,430.2	23,495.9	9,065.7	61.4	3,646.0	248.6
2012	13,734.8	24,862.2	11,127.4	55.2	3,652.5	304.7
2014	15,546.5	26,349.2	10,802.7	59.0	3,831.6	281.9
2016	16,712.3	29,860.3	13,148.0	56.0	3,949.9	332.9

All dollar amounts are in millions

All figures prior to 6/30/2010 were reported by the prior actuarial firm.



Section VI: Accounting Statement Information

The information presented above was determined as part of the actuarial valuation as of June 30, 2016. Additional information as of the latest actuarial valuation follows.

Table VI-4: Additional Information	
Valuation date	June 30, 2016
Actuarial cost method	Entry Age
Amortization period	Level percent closed
Remaining amortization periods	
Plan in effect 6/30/1991	15 years
Public Act 87-381	1 years
Public Act 92-205	6 years
Public Act 98-251	11 years
Public Act 07-186	21 years
Equivalent single amortization period	17.6 years
Asset valuation method	Four-year smoothed market value
Actuarial assumptions:	
Investment rate of return (includes inflation)	8.00%
Projected salary increases (includes inflation)	3.25% - 6.50%
Inflation	2.75%
Cost-of-living adjustments	
Retirements prior to September 1, 1992	3.00%
Retirements on or after September 1, 1992	
Hired prior to July 1, 2007	2.00%
Hired on or after July 1, 2007	1.75%



Appendix A: Additional Membership Data

Table A-1: Schedule of Active Participant Data as of June 30, 2016									
AGE	Years of Service								Total
	Under 5	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 & up	
Under 25	577	1							578
Avg. Pay	46,643	76,300							46,694
25 to 29	3,991	605	2						4,598
Avg. Pay	50,872	56,304	65,620						51,593
30 to 34	2,502	3,410	832						6,744
Avg. Pay	54,865	62,091	72,820						60,734
35 to 39	1,148	1,932	3,692	599	1				7,372
Avg. Pay	59,270	66,857	77,193	88,020	87,012				72,574
40 to 44	693	993	2,005	2,886	256				6,833
Avg. Pay	61,606	70,797	80,605	90,993	99,736				82,357
45 to 49	636	818	1,423	2,250	1,758	144			7,029
Avg. Pay	59,199	69,435	81,312	90,675	97,800	98,765			85,407
50 to 54	417	671	1,075	1,192	1,031	1,034	278		5,698
Avg. Pay	60,734	69,233	80,054	89,762	96,188	96,967	98,227		86,272
55 to 59	244	403	889	1,096	759	773	1,070	235	5,469
Avg. Pay	62,512	69,962	79,576	89,048	94,287	95,173	96,145	97,345	88,256
60 to 64	129	207	541	901	768	589	556	773	4,464
Avg. Pay	68,698	74,780	80,025	88,794	94,086	94,830	97,497	99,133	91,082
65 to 69	30	46	181	328	321	289	227	346	1,768
Avg. Pay	72,404	80,550	85,768	88,418	97,319	96,358	95,413	99,692	93,689
70 & up	3	7	17	45	53	48	53	98	324
Avg. Pay	75,856	103,382	90,887	89,015	95,113	103,244	96,565	101,412	97,392
Total	10,370	9,093	10,657	9,297	4,947	2,877	2,184	1,452	50,877
Avg. Pay	54,719	65,622	78,840	90,024	96,386	96,181	96,689	99,131	77,637

Table A-2: Comparative Summary of Active Data		
	June 30, 2014	June 30, 2016
Average Age	44.7 years	44.6 years
Average Service	13.7 years	13.7 years
Average Pay	\$74,497	\$77,637



Appendix A: Additional Membership Data

Table A-3: Number of Monthly Retirement Allowances Of Benefit Recipients as of June 30, 2016		
Payee Type	Number	Monthly Retirement Allowances
Service Retirement		
A (Life Annuity)	30	\$77,330
B (100% Cash Refund)	40	115,939
C (Period Certain and Life)	673	2,404,060
D (Joint and Survivor)	6,972	33,002,727
N (25% Cash Refund)	26,205	111,762,294
Total	33,920	\$147,362,350
Disability Retirement		
A (Life Annuity)	0	\$0
B (100% Cash Refund)	0	0
C (Period Certain and Life)	2	3,571
D (Joint and Survivor)	0	0
N (25% Cash Refund)	1	1,798
W (Disability)	280	567,467
Total	283	\$572,836
Beneficiaries	1,862	\$4,727,000
GRAND TOTAL	36,065	\$152,662,186



Appendix B: Actuarial Assumptions and Methods

Investment Rate of Return

Assumed annual rate of 8.00% net of investment expenses.

Rates of Annual Salary Increase

Rates of Annual Salary Increase Assumption	
Years of Service	
0	6.50%
1	6.50
2	6.25
3	6.25
4	6.25
5	6.25
6	6.25
7	6.25
8	6.25
9	6.25
10	5.50
11	5.50
12	5.00
13	5.00
14	5.00
15	4.75
16	4.50
17	4.25
18	4.00
19	3.75
20	3.50
21+	3.25



Appendix B: Actuarial Assumptions and Methods

Active Member Decrement Rates

- a. Table below provides a summary of the assumed rates of service retirement.

Annual Rates of Retirement						
Age	Unreduced		Proratable		Reduced	
	<u>Male</u>	<u>Female</u>	<u>Male</u>	<u>Female</u>	<u>Male</u>	<u>Female</u>
50	27.5%	27.5%			1.00%	1.00%
55	38.5%	27.5%			4.00%	4.75%
60	22.0%	27.5%	6.0%	5.5%		
65	36.3%	32.5%	13.0%	12.5%		
70	100.0%	32.5%	30.0%	14.5%		
75	100.0%	32.5%	30.0%	18.0%		
80	100.0%	100.0%	100.0%	100.0%		

- b. Table below provides a summary of the assumed rates of mortality while actively employed and disability.

Annual Rates of Death and Disability				
Age	Pre-Retirement Mortality		Disability	
	<u>Male</u>	<u>Female</u>	<u>Male</u>	<u>Female</u>
20	0.0377%	0.0147%	0.0341%	0.0500%
25	0.0412%	0.0162%	0.0341%	0.0500%
30	0.0404%	0.0205%	0.0341%	0.0410%
35	0.0448%	0.0272%	0.0341%	0.0410%
40	0.0539%	0.0375%	0.0536%	0.0720%
45	0.0818%	0.0622%	0.1219%	0.1200%
50	0.1476%	0.1116%	0.2438%	0.2630%
55	0.2800%	0.1927%	0.5363%	0.4380%
60	0.4557%	0.2914%	0.9604%	0.5000%
64	0.6572%	0.4272%		



Appendix B: Actuarial Assumptions and Methods

- c. Table below provides a summary of the assumed rates of withdrawal for active members prior to eligibility for retirement.

Annual Rates of Withdrawal					
10 or more years of service					
Years of Service	Male	Female	Age	Male	Female
0	14.00%	12.00%	25	1.50%	4.00%
1	11.00	10.50	30	1.50	4.00
2	8.00	8.75	35	1.50	3.50
3	6.50	7.50	40	1.50	2.30
4	4.50	6.75	45	1.59	1.50
5	3.50	6.00	50	2.04	2.00
6	3.00	5.25	55	3.44	2.50
7	2.75	4.75	59	4.00	2.90
8	2.50	4.25			
9	2.50	4.00			

Post-Retirement Mortality

For healthy retirees and beneficiaries, the RPH-2014 White Collar table with employee and annuitant rates blended from ages 50 to 80 projected to the year 2020 using the BB improvement scale and further adjusted to grade in increases (5% for females and 8% for males) to rates over age 80. For disabled retirees, the RPH-2014 Disabled Mortality table projected to 2017 using the BB improvement scale. The following are sample rates for the retirees, beneficiaries, and disabled:

Annual Rates of Death				
Age	Healthy		Disabled	
	Male	Female	Male	Female
50	0.1476%	0.1116%	1.8406%	1.1487%
55	0.2800%	0.1927%	2.2661%	1.3727%
60	0.4557%	0.2914%	2.7070%	1.5886%
65	0.7214%	0.4747%	3.2573%	1.9356%
70	1.1906%	0.8584%	4.0909%	2.6165%
75	2.0499%	1.5897%	5.4230%	3.8159%
80	3.6764%	2.9756%	7.5768%	5.7047%
85	6.9254%	5.4419%	11.1066%	8.5219%

Marriage Assumption

85% of males and 75% of females assumed to be married, with female spouses 3 years younger than males.

Asset Valuation Method

The actuarial value of assets recognizes a portion of the difference between the actual market value of assets and the expected actuarial value of assets, based on the assumed rate of investment return. The amount recognized each year is 25% of the difference between market value and expected actuarial value.



Appendix B: Actuarial Assumptions and Methods

Actuarial Cost Method

The Entry Age Normal actuarial cost method allocates the plan's actuarial present value of future benefits to various periods based upon service. The portion of the present value of future benefits allocated to years of service prior to the valuation date is the actuarial accrued liability, and the portion allocated to years following the valuation date is the present value of future normal costs. The normal cost is determined for each active member as the level percent of payroll necessary to fully fund the expected benefits to be earned over the career of each individual active member. The normal cost is partially funded with active member contributions with the remainder funded by employer contributions.

The unfunded accrued liability is determined by subtracting the actuarial value of assets from the actuarial accrued liability.

Future Cost-of-living Increases

Members who retired prior to September 1, 1992 are assumed to receive an annual Cost-of-Living Adjustment (COLA) of 3.0%. Members who retired on or after September 1, 1992 and were hired prior to July 1, 2007 are assumed to receive an annual Cost-of-Living Adjustment (COLA) of 2.0%. Members who retired on or after September 1, 1992 and were hired on or after July 1, 2007 are assumed to receive an annual Cost-of-Living Adjustment (COLA) of 1.75%.

Administrative and Investment Expenses

The investment return assumption represents the expected return net of all administrative and investment expenses.

Payroll Growth Rate

The total annual payroll of active members is assumed to increase at an annual rate of 3.25%. This rate does not anticipate increases in the number of members.

Changes from Prior Valuation

Since the prior valuation, the Board adopted new assumptions based on the 2015 Experience Study. The changes in assumptions are summarized below:

Economic Assumptions

1. Reduce the inflation assumption from 3.00% to 2.75%.
2. Reduce the real rate of return assumption from 5.50% to 5.25% which, when combined with the inflation assumption change results in a decrease in the investment rate of return assumption from 8.50% to 8.00%.
3. Reduce the annual rate of wage increase assumption from 0.75% to 0.50%.
4. Slightly modify the merit portion of the salary scale.
5. Reduce the payroll growth assumption from 3.75% to 3.25%.

Demographic Assumptions

6. Update mortality tables to projected versions of the RPH-2014 mortality tables.
7. Increase normal retirement rates for females at most ages and proratable retirement rates for males at most ages. Decrease early retirement rates for both males and females.
8. Increase rates of withdrawal.
9. Decrease rates of disability for males.



Appendix C: Summary of Plan Provisions

Outlined below are the principal provisions of the system which were reflected in the results shown in this report.

Covered Employees

Any teacher, principal, superintendent or supervisor engaged in service of public schools, plus professional employees at State schools of higher education if they choose to be covered.

Annual Salary

Annual Salary rate for service as a Connecticut teacher during a school year excluding amounts paid for extra duty assignments, coaching, unused sick time, unused vacation or terminal pay.

Average Annual Salary

Average of Annual Salary received during three years of highest salary.

Credited Service

One month for each month of service as a teacher in Connecticut public schools, maximum 10 months for each school year. Ten months of credited service constitutes one year of Credited Service. Certain other types of teaching service, State employment, or war-time military service may be purchased prior to retirement, if the Member pays one-half the cost.

Normal Retirement

Eligibility - Age 60 with 20 years of Credited Service in Connecticut, or 35 years of Credited Service including at least 25 years of service in Connecticut.

Benefit - 2% of Average Annual Salary times years of Credited Service (maximum benefit is 75% of Average Annual Salary)

In addition, amounts derived from the accumulation of 6% contributions made prior to July 1, 1989 and voluntary contributions by the teacher are payable.

Minimum Benefit: Effective January 1, 1999, Public Act 98-251 provides a minimum monthly retirement benefit of \$1,200 to teachers who retire under the Normal Retirement provisions and who have completed at least 25 years of full time Connecticut service at retirement.

Early Retirement

Eligibility - 25 years of Credited Service including 20 years of Connecticut service, or age 55 with 20 years of Credited Service including 15 years of Connecticut service.

Benefit - Reduced normal retirement benefit. The early retirement factors currently in effect are 6% per year for the first five years by which early retirement precedes the minimum normal retirement age and 4% per year for the next five years by which early retirement precedes the minimum normal retirement age. Effective July 1, 1999, the reduction for individuals with 30 or more years of service is 3% for each year by which early retirement precedes the minimum retirement age.



Appendix C: Summary of Plan Provisions

Proratable Retirement

Eligibility - Age 60 with 10 years of Credited Service.

Benefit - 2% less 0.1% for each year less than 20 years of Average Annual Salary times years of Credited Service in Connecticut, plus 1% of Average Annual Salary times years of additional Credited Service time.

Disability Retirement

Eligibility - 5 years of Credited Service in Connecticut if not incurred in the performance of duty and no service requirement if incurred in the performance of duty.

Benefit - 2% of Average Annual Salary times Credited Service to date of disability, but not less than 15% of Average Annual Salary, nor more than 50% of Average Annual Salary. In addition, disability benefit under this plan (without regard to any cost-of-living adjustments) plus any initial award of Social Security benefits and workers' compensation cannot exceed Average Annual Salary.

Termination of Employment

Less than 5 years of Credited Service - Return 6% contributions with interest.

5 or more years of Credited Service - Return 6% contributions with interest and 1% contributions made prior to July 1, 1989 without interest.

10 or more years of Credited Service - Member is 100% vested in the accrued benefit based on Credited Service and Average Annual Salary as of the date of termination of covered employment. Benefits are payable at age 60 and early retirement reductions are based on the number of years of service the member would have had if they had continued to work until age 60.

Member may elect return of all contributions plus interest on 6% contributions in lieu of vested benefit.

Pre-Retirement Death Benefits

A lump sum plus one of the following: survivor's benefit, return of all contributions with interest, or surviving spouse's benefit.

- Lump Sum: \$1,000 for the first 5 years of Connecticut service plus \$200 per year thereafter. Maximum benefit: \$2,000.
- Survivor's Benefit: For active teachers who die while in service, the family maximum benefit payable to survivors is \$1,500 per month. Each minor child is entitled to \$300 per month. The surviving spouse's benefit is \$300 per month if the member has 12 or less years of service. For each additional year of service, the surviving spouse's monthly benefit is increased \$25, up to a maximum of \$600.
- Accumulated contributions with interest plus dependent children's benefits as described in the "Survivor's Benefit" paragraph.
- Surviving Spouse's Benefit: An active member who is eligible for immediate retirement and who has named his or her spouse as primary beneficiary will be covered by a 100% Plan D co-participant option in the event of his or her death prior to retirement.



Appendix C: Summary of Plan Provisions

Benefit Options

Normal form: Partial Refund Option – 75% of total benefit is paid as a life annuity. If 25% of the benefits paid prior to death do not exceed the Member's 6% contributions plus interest frozen at the date of the benefit commencement, the difference is paid to the Member's beneficiary.

Optional Forms: 5-, 10-, 20-, or 25-year certain and life and 33-1/3%, 50%, 66-2/3%, 75%, or 100% co-participant annuity (if co-participant dies first, benefit reverts to unreduced amount).

Amounts payable under the optional forms are determined on an actuarially equivalent basis. Actuarial equivalence is determined using mortality as described in Section F of the report, 8.5% interest, and 2% compound COLA. A unisex mortality blend of 60% male was used for certain benefit forms, and a blend of 80% male was used for co-participant annuity forms.

Cost-of-Living Allowance

For teachers who retired prior to September 1, 1992, pension benefit adjustments are made in accordance with increases in the Consumer Price Index, with a minimum of 3% and a maximum of 5% per annum.

For teachers who were members of the Teachers' Retirement System before July 1, 2007, and retire on or after September 1, 1992, pension benefit adjustments are made that are consistent with those provided for Social Security benefits on January 1 of the year granted, with a maximum of 6% per annum. If the return on assets in the previous year was less than 8.5%, the maximum increase is 1.5%.

For teachers who were members of the Teachers' Retirement System after July 1, 2007, pension benefit adjustments are made that are consistent with those provided for Social Security benefits on January 1 of the year granted, with a maximum of 5% per annum. If the return on assets in the previous year was less than 11.5%, the maximum increase is 3%, and if the return on the assets in the previous year was less than 8.5%, the maximum increase is 1.0%

Teachers' Required Contribution

Effective July 1, 1992, each teacher is required to contribute 6% of annual salary for the pension benefit. Beginning January 1, 2018, each teacher is required to contribute 7% of annual salary.

State Contribution

The State's contribution requirement is determined in accordance with Section 10-183z (which reflects Public Act 79-436 as amended). The additional 1% teachers' required contribution (above) offsets State required contribution only for the biennium ending June 30, 2019.

Early Retirement Incentive

A local or regional board of education may establish a retirement incentive plan. The plan shall provide for purchase of additional credited service by a board of education and a member of the system who chooses to participate in the plan, of additional credited service for such member and for payment by the board of education of not less than fifty per cent of the entire cost of such total cost. Any such plan shall specify a maximum number of years to be purchased, not to exceed five. Members must have attained age 50 and be eligible for retirement with the additional purchased service. The amount of service purchased cannot exceed the lesser of five years and one-fifth of the member's credited service.



Appendix C: Summary of Plan Provisions

Actuarial Accrued Liability - The difference between the actuarial present value of future benefits payments and the actuarial present value of future normal costs. Also referred to as “accrued liability.”

Actuarial Assumptions - Estimates of expected future experience with respect to rates of mortality, disability, turnover, retirement, rate or rates of investment income and salary increases. Demographic estimates (rates of mortality, disability, turnover and retirement) are generally based on past experience, modified for projected changes in conditions. Fiscal estimates (salary increases, inflation and real investment return) consist of the underlying rates 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 payments” between future normal cost and actuarial accrued liability.

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. Also referred to as “present value.”

Actuarial Value of Assets - The value of current plan assets recognized for valuation purposes.

Amortization - Paying off an interest-discounted amount with periodic payments of interest and principal, as opposed to paying off with a lump sum payment.

Experience Gain (Loss) - A measure of difference between actual experience and that expected based upon a set of actuarial assumptions during the period between two actuarial valuation dates, in accordance with the actuarial cost method being used.

Normal Cost - The annual cost assigned, under the actuarial funding method, to current and subsequent plan years.

Unfunded Actuarial Accrued Liability - The difference between the actuarial accrued liability and actuarial value of assets. Also referred to as “unfunded accrued liability.”