



Fiscal Year 2019
Actuarial Valuation Report
for the
New York City
Teachers' Retirement System

JUNE 30, 2017 (LAG) ACTUARIAL VALUATION

prepared by the
New York City
Office of the Actuary

2019



OFFICE OF THE ACTUARY

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SHERRY S. CHAN
CHIEF ACTUARY

December 31, 2019

Board of Trustees
New York City Teachers' Retirement System
55 Water Street, 16th Floor
New York, NY 10041

Re: Fiscal Year 2019 Actuarial Valuation Report (Report)

Dear Trustees:

This Report presents the results of the June 30, 2017 actuarial valuation of the benefits under both the New York City Teachers' Retirement System (TRS) and Group Life Insurance Plan (collectively, the Plan). These results form the basis for determining the statutorily-required contribution (Statutory Contribution) of \$3,696,685,559 for Fiscal Year 2019 (i.e. for the period beginning July 1, 2018 and ending June 30, 2019). It is not intended, nor necessarily suitable, for other purposes. Calculations made for other purposes may differ significantly from those shown herein.

Results of the June 30, 2016 (Lag) actuarial valuation are shown in this Report for comparative purposes. Other historical information that the Actuary believes useful is also included.

The June 30, 2017 (Lag) and June 30, 2016 (Lag) actuarial valuations are based upon census data as of those dates submitted by the Plan's administrative staff and the employer's payroll facilities. Financial information was provided by TRS and the Office of the Comptroller as of June 30, 2017 and June 30, 2016.

Consistent with Actuarial Standards of Practice, the Office of the Actuary has reviewed census data and financial information for consistency and reasonability but has not audited it. The accuracy of the results and calculations presented in this Report are dependent on the accuracy of this census data and financial information. To the extent any such data or information provided is materially inaccurate or incomplete, the results contained herein will require revision.

A summary of the benefits available under the terms of the Plan is shown in SECTION VIII – SUMMARY OF PLAN PROVISIONS. The benefits under the Plan are unchanged from the prior valuation.


A summary of the actuarial methods and assumptions used in the valuation of the Plan is shown in SECTION XI – ACTUARIAL ASSUMPTIONS AND METHODS. The assumptions and

methods have changed from the prior valuation. These new assumptions and methods were presented in the report entitled, "Proposed Changes in Actuarial Assumptions and Methods Used in Determining Employer Contributions for Fiscal Years Beginning on and After July 1, 2018 for the New York City Teachers' Retirement System" dated January 17, 2019 which was adopted by the Board of Trustees at the February 28, 2019 Board meeting.

This report does not present Governmental Accounting Standards Board (GASB) results. The Office of the Actuary published Fiscal Year 2019 GASB67 and GASB68 results in a report dated September 27, 2019 which is available on the website of the Office of the Actuary (www.nyc.gov/actuary).

I, Sherry S. Chan, am the Chief Actuary for, and independent of, the New York City Retirement Systems and Pension Funds. I am a Fellow of the Society of Actuaries, an Enrolled Actuary under the Employee Retirement Income and Security Act of 1974, a Member of the American Academy of Actuaries, and a Fellow of the Conference of Consulting Actuaries. I meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein. To the best of my knowledge, the results contained herein have been prepared in accordance with generally accepted actuarial principles and procedures and with the Actuarial Standards of Practice issued by the Actuarial Standards Board.

Best Regards,



Sherry S. Chan, FSA, EA, MAAA, FCA
Chief Actuary

SSC/eh

cc: Ms. Dolores Capone - New York City Office of the Actuary
Mr. Craig Chu - New York City Office of the Actuary
Ms. Valerie Budzik - New York City Teachers' Retirement System
Mr. Thad McTigue - New York City Teachers' Retirement System
Ms. Patricia Reilly - New York City Teachers' Retirement System
Mr. Michael Samet - New York City Office of the Actuary
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SECTION I – EXECUTIVE SUMMARY

This report presents the results of the June 30, 2017 (Lag) actuarial valuation of the New York City Teachers' Retirement System (TRS) Qualified Pension Plan and Group Life Insurance Plan (collectively, the Plan).

The purposes of the valuation are:

- To determine the actuarially-required contribution (Actuarial Contribution) for Fiscal Year 2019 (i.e. July 1, 2018 to June 30, 2019),
- To measure the funding progress of the Plan,
- To disclose the census data and financial information used in the valuation, and
- To disclose the actuarial assumptions and actuarial methods used to determine the Actuarial Contribution.

The statutorily-required contribution (Statutory Contribution) is also shown, and compared to the Actuarial Contribution in historical years.

This Report does not provide financial and accounting information required by current GASB standards. That information is provided in a separate report.

Future measurements of this information may differ from current measurements for many reasons including, but not limited to, experience differing from economic or demographic assumptions, changes in actuarial assumptions and methods, and changes in applicable statute and plan provisions. These and additional risks may be present for the Plan. A further discussion is presented in SECTION VII – RISK AND UNCERTAINTY for consideration.

Table I-1 Executive Summary

Presented in **Table I-1** are the principal results of the June 30, 2017 (Lag) actuarial valuation and, for comparative purposes, the June 30, 2016 (Lag) actuarial valuation.

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM		
SUMMARY OF VALUATION RESULTS		
Valuation Date	June 30, 2017 (Lag)	June 30, 2016 (Lag)
Fiscal Year	2019	2018
Funded Status		
1. Accrued Liability	\$ 69,552,380,259	\$ 69,964,411,998
2. Actuarial Value of Assets (AVA) ¹	<u>44,381,706,000</u>	<u>41,015,087,000</u>
3. Unfunded Accrued Liability (AVA Basis) (1. - 2.)	\$ 25,170,674,259	\$ 28,949,324,998
4. Funded Ratio (AVA Basis) (2. / 1.)	63.8%	58.6%
5. Market Value of Assets (MVA) ¹	50,095,723,000	43,629,545,000
6. Unfunded Accrued Liability (MVA Basis) (1. - 5.)	\$ 19,456,657,259	\$ 26,334,866,998
7. Funded Ratio (MVA Basis) (5. / 1.)	72.0%	62.4%
Contribution		
1. Normal Cost	\$ 1,305,407,961	\$ 1,172,161,054
2. Unfunded Accrued Liability	2,358,531,955	2,663,071,096
3. Administrative Expenses	58,245,643	54,477,777
4. ASAF Credit	<u>(25,500,000)</u>	<u>N/A</u>
5. Actuarial Contribution (1. + 2. + 3. + 4.)	\$ 3,696,685,559	\$ 3,889,709,927
6. Statutory Contribution	\$ 3,696,685,559	\$ 3,889,709,927
Participant Data		
1. Active Members		
a. Number	120,826	118,201
b. Annual Salary	\$ 9,848,899,232	\$ 9,224,267,647
c. Average Salary	\$ 81,513	\$ 78,039
2. Active Off Payroll Members ²	7,997	7,401
3. Terminated Vested Members	15,279	14,393
4. Retirees and Beneficiaries		
a. Number	84,770	84,093
b. Total Annual Benefits	\$ 4,097,647,362	\$ 3,954,653,723
c. Average Benefit	\$ 48,338	\$ 47,027

¹ Actuarial Value of Assets and Market Value of Assets are rounded to the nearest thousand.

² Represents members no longer on payroll, but not otherwise classified.

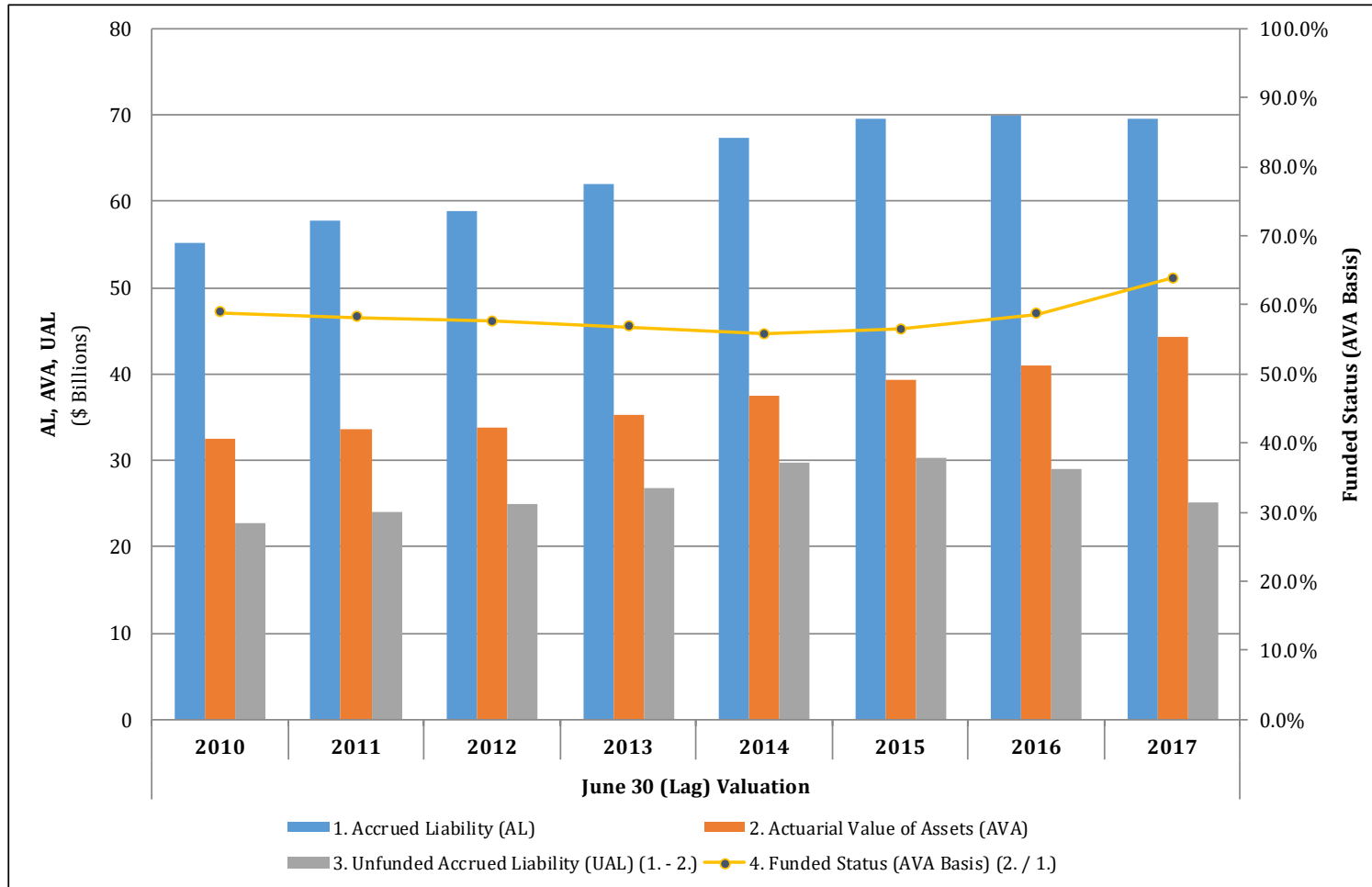
Table I-2
Actuarial Liabilities

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM		
ACTUARIAL LIABILITIES BY STATUS		
Valuation Date	June 30, 2017 (Lag)	June 30, 2016 (Lag)
Fiscal Year	2019	2018
Accrued Liability		
1. Active Members	\$ 25,446,203,461	\$ 23,738,166,660
2. Active Off Payroll Members ¹	620,993,800	535,870,232
3. Terminated Vested Members	1,125,301,165	972,023,664
4. Retirees and Beneficiaries	<u>42,149,683,579</u>	<u>41,651,524,250</u>
5. Accrued Liability Pre-Adjustments (1. to 4.)	\$ 69,342,182,005	\$ 66,897,584,806
6. Actuarial Adjustments ²	<u>210,198,254</u>	<u>3,066,827,192</u>
7. Total Accrued Liability (AL) (5. + 6.)	\$ 69,552,380,259	\$ 69,964,411,998
Present Value of Benefits		
1. Active Members	\$ 41,904,123,400	\$ 39,535,995,292
2. Active Off Payroll Members ¹	620,993,800	535,870,232
3. Terminated Vested Members	1,125,301,165	972,023,664
4. Retirees and Beneficiaries	<u>42,149,683,579</u>	<u>41,651,524,250</u>
5. Present Value of Benefits (1. to 4.)	\$ 85,800,101,944	\$ 82,695,413,438
6. Actuarial Adjustments ²	<u>210,198,254</u>	<u>3,066,827,192</u>
7. Total Present Value of Benefits (5. + 6.)	\$ 86,010,300,198	\$ 85,762,240,630

¹ Represents members no longer on payroll, but not otherwise classified.

² Related to actuarial loading adjustments.

Graph I-3
Historical Funded Status



SECTION II – MARKET AND ACTUARIAL VALUES OF ASSETS

Information on the Market Value of Assets (MVA) of the Plan is provided by the Office of the Comptroller. An Actuarial Asset Valuation Method (AAVM) is used to determine the Actuarial Value of Assets (AVA) of the Plan.

In accordance with this AAVM, actual Unexpected Investment Returns (UIR) are phased into the AVA at rates of 15%, 15%, 15%, 15%, 20%, and 20% per year (i.e. cumulative rates of 15%, 30%, 45%, 60%, 80%, and 100% over a period of six years).

UIR is defined as the excess of net investment return over the Expected Investment Return (EIR) based on the expected rate of return and the AVA, where EIR equals the sum of beginning-of-fiscal-year AVA plus one-half of net cash flow, multiplied by the expected rate of return.

Beginning with the June 30, 2014 (Lag) actuarial valuation, the AVA is further constrained to be within a corridor of 80% to 120% of the MVA.

Table II-1
Statement of Plan Net Assets

(\$ Thousands)		
	June 30, 2017	June 30, 2016
ASSETS		
Cash	\$ 101,499	\$ 5,157
Receivables		
Investment Securities Sold	\$ 989,725	\$ 1,772,521
Member Loans	298,146	275,704
Accrued Interest and Dividends	<u>164,163</u>	<u>151,330</u>
Total Receivables	\$ 1,452,034	\$ 2,199,555
INVESTMENTS AT FAIR VALUE		
Pooled NYC Pension Fund Assets (Fixed-Return Fund)		
Short-Term Investments		
Commercial Paper	\$ 230,093	\$ 1,070,574
Short-term Investment Fund	557,945	1,025,446
U.S. Treasury Bills & Agencies	0	0
Discount Notes	282,248	83,294
Debt Securities		
U.S. Government	7,947,669	5,924,318
Corporate & Other	7,753,224	8,730,691
Equity Securities		
Alternative Investments	7,523,885	6,872,850
Collective Trust Funds		
Fixed Income	1,791,033	1,691,577
International Equity	15,734,149	11,507,149
Mortgage Debt Security	495,540	485,191
Treasury Inflation Protected Securities	2,682,432	2,399,270
Collateral from securities lending (Fixed Return Fund)	1,530,310	1,774,456
Diversified Equity Fund		
Short-Term Investments	65,825	29,570
Equity securities	6,031,258	2,206,416
Debt Securities	106,307	50,541
Bond Fund		
Short-Term Investments	3,576	432
Debt Securities	83,333	24,393
International Equity Fund		
Short-Term Investments	53	75
International equity	12,436	8,012
Inflation Protection Fund		
Short-Term Investments	23	12
Equity securities	4,761	3,960
Socially Responsive Equity Fund		
Short-Term Investments	662	24
Equity securities	11,320	7,650
International equity	516	158
Collateral from securities lending (Variable Return Fund)	<u>80,011</u>	<u>84,226</u>
TOTAL INVESTMENTS	\$ 74,014,611	\$ 66,264,869
OTHER ASSETS		
TOTAL ASSETS	<u>38,932</u>	<u>49,873</u>
	\$ 75,607,076	\$ 68,519,454
LIABILITIES		
Accounts Payable	\$ 529,059	\$ 417,408
Payable for Investment Securities Purchased	1,353,803	2,308,523
Accrued Benefits Payable	13,987	12,563
Due to TDA Program's Fixed Return Fund	22,004,183	20,292,733
Security Lending	<u>1,610,321</u>	<u>1,858,682</u>
TOTAL LIABILITIES	\$ 25,511,353	\$ 24,889,909
PLAN ASSETS HELD IN TRUST FOR PENSION BENEFITS	\$ 50,095,723	\$ 43,629,545

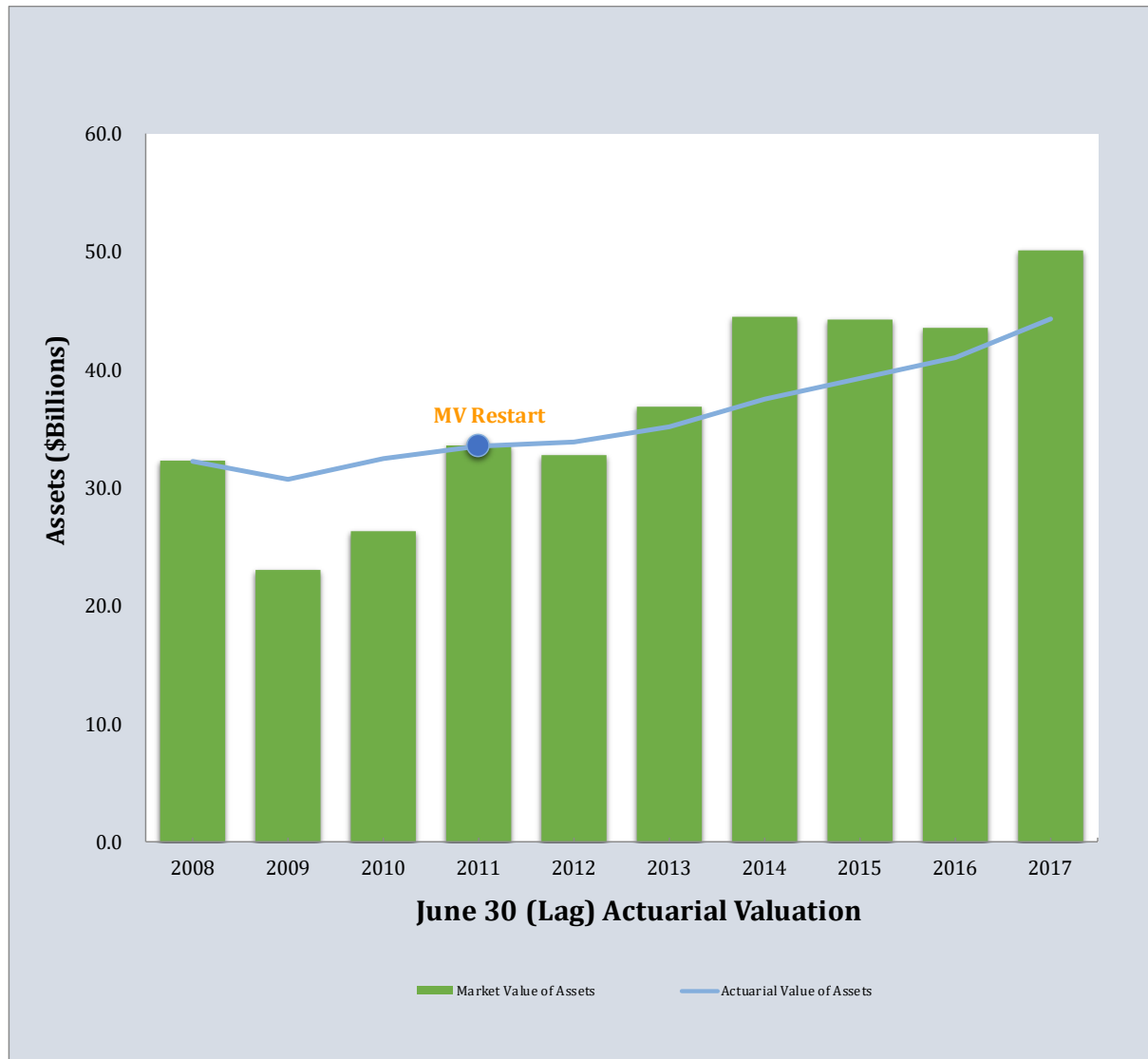
Table II-2
Statement of Changes in Plan Net Assets

(\$ Thousands)		
	June 30, 2017	June 30, 2016
ADDITIONS		
Contributions		
Member Contributions	\$ 180,076	\$ 173,696
Employer Contributions	3,888,399	3,702,569
Other Employer Contributions	<u>57,369</u>	<u>58,145</u>
Total Contributions	\$ 4,125,844	\$ 3,934,410
Investment Income		
Interest Income	\$ 932,169	\$ 860,223
Dividend Income	981,087	896,208
Net Appreciation in Fair Value of Investments	<u>6,516,379</u>	<u>(598,443)</u>
Total Investment Income	\$ 8,429,635	\$ 1,157,988
Less:		
Investment Expenses	\$ 316,180	\$ 222,163
Net (Decrease) in Fair Variable Expense Provision	<u>(2,379)</u>	<u>(7,095)</u>
Net Investment Income	\$ 8,115,834	\$ 942,920
Securities Lending Transactions		
Securities Lending Income	\$ 18,806	\$ 18,742
Securities Lending Fees	<u>(1,360)</u>	<u>(1,395)</u>
Net Securities Lending Income (Loss)	\$ 17,446	\$ 17,347
Other		
Net Receipts from (to) Other Retirement Systems	\$ (2,291)	\$ 1,233
TOTAL ADDITIONS	\$ 12,256,833	\$ 4,895,910
DEDUCTIONS		
Benefit Payments and Withdrawals	\$ 4,219,312	\$ 4,107,455
Administrative Expenses	<u>60,790</u>	<u>59,367</u>
Other		
Interest from (to) TDA Program's Fixed Return Fund	\$ 1,466,615	\$ 1,354,207
TDA Rebalance	\$ 43,938	N/A
TOTAL DEDUCTIONS	\$ 5,790,655	\$ 5,521,029
NET INCREASE (DECREASE) IN PLAN NET ASSETS	\$ 6,466,178	\$ (625,119)
PLAN NET ASSETS HELD IN TRUST FOR PENSION BENEFITS		
Beginning of Year	\$ 43,629,545	\$ 44,254,664
End of Year	\$ 50,095,723	\$ 43,629,545

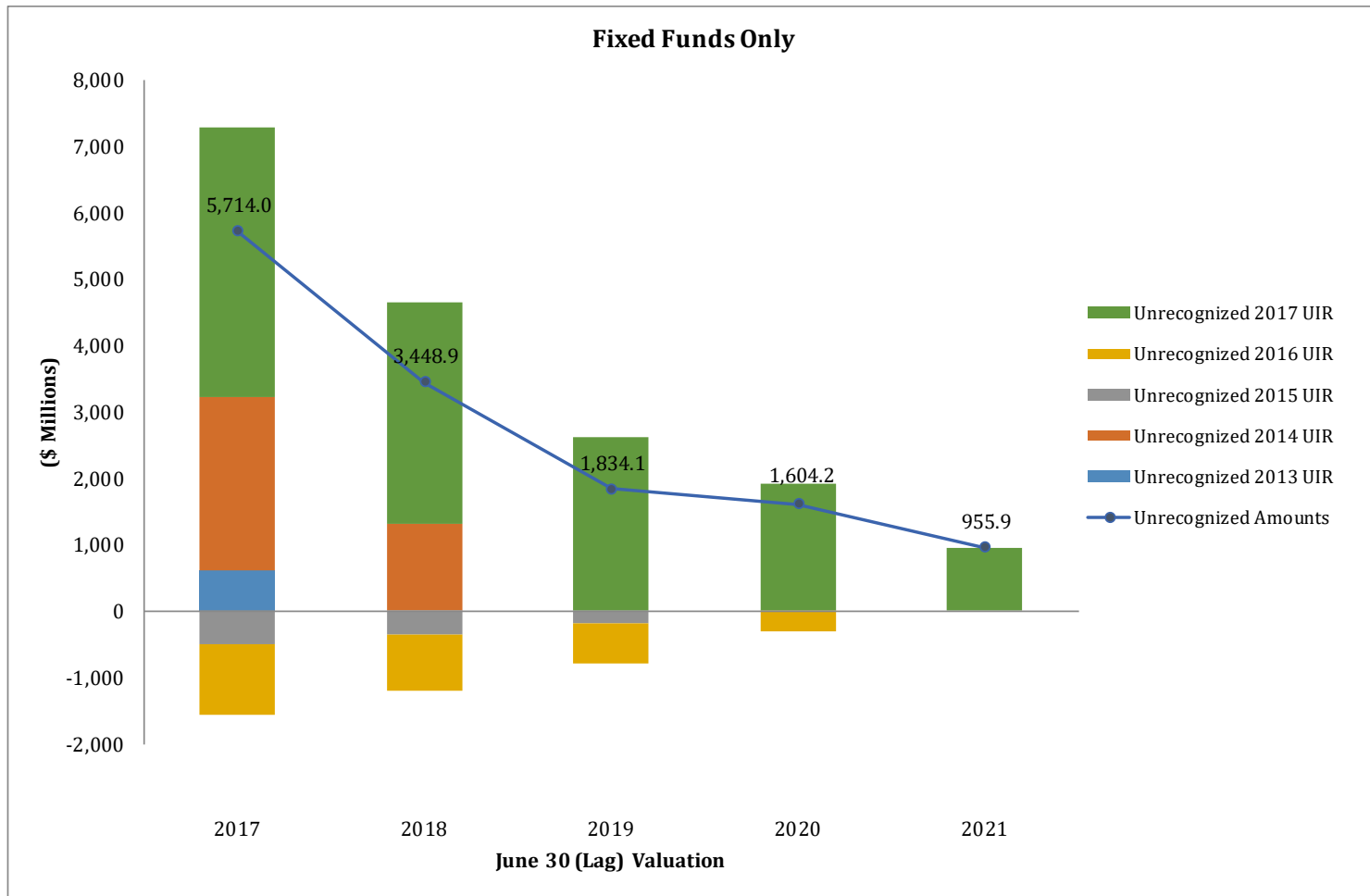
Table II-3
Development of Actuarial Value of Assets

(\$ Thousands)		
Valuation Date	June 30, 2017	June 30, 2016
Fixed Fund		
Market Value of Assets (MVA)		
Beginning of Year (BOY)	\$ 41,440,456	\$ 41,452,045
End of Year (EOY)	\$ 43,920,339	\$ 41,440,456
1. Contributions		
a. Employee	\$ 179,753	\$ 173,287
b. Employer	3,888,399	3,702,569
c. Other	<u>57,340</u>	<u>58,105</u>
d. Total Contributions	\$ 4,125,492	\$ 3,933,961
2. Net Investment Income		
a. Investment Income	\$ 7,638,086	\$ 1,197,299
b. Investment Expenses	<u>(310,246)</u>	<u>(216,240)</u>
c. Total Net Investment Income	\$ 7,327,840	\$ 981,059
3. Cash Flow (Other)	\$ (8,973,449)	\$ (4,926,609)
4. Net Cash Flow (1.d. + 3.)	\$ (4,847,957)	\$ (992,648)
5. Average invested assets		
a. AVA @ BOY	\$ 38,825,998	\$ 36,487,453
b. 1/2 Net Cash Flow ((1.d. + 3.) / 2)	<u>(2,423,979)</u>	<u>(496,324)</u>
c. Total	\$ 36,402,019	\$ 35,991,129
6. Expected Rate of Return (AIR)	7.00%	7.00%
7. Expected Investment Return (EIR) (5.c. x 6.)	\$ 2,548,141	\$ 2,519,379
8. Unexpected Investment Return (UIR) (2.c. - 7.)	\$ 4,779,699	\$ (1,538,320)
9. AVA @ EOY		
a. AVA @ BOY (prior to corridor limit)	\$ 38,825,998	\$ 36,487,453
b. Net Cash Flow (4.)	(4,847,957)	(992,648)
c. Expected Investment Return (7.)	2,548,141	2,519,379
d. Phase in of UIR		
15% * UIR for prior year	716,955	(230,748)
15% * UIR for second prior year	(230,748)	(134,530)
15% * UIR for third prior year	(134,530)	980,958
15% * UIR for fourth prior year	980,958	454,115
20% * UIR for fifth prior year	605,486	(257,981)
20% * UIR for sixth prior year	<u>(257,981)</u>	<u>N/A</u>
Total	\$ 1,680,140	\$ 811,814
e. Preliminary AVA (9.a. + 9.b. + 9.c. + 9.d.)	\$ 38,206,322	\$ 38,825,998
10. Corridor		
a. 80% of MVA	\$ 35,136,271	\$ 33,152,365
b. 120% of MVA	\$ 52,704,407	\$ 49,728,547
11. Final AVA of EOY (9e. bounded by 10)	\$ 38,206,322	\$ 38,825,998
12. Variable Assets	\$ 6,175,384	\$ 2,189,089
13. Total AVA @ EOY (11. + 12.)	\$ 44,381,706	\$ 41,015,087

Graph II-4
Historical Market and Actuarial Value of Assets



Graph II-5
Future Recognition of UIR as of June 30, 2017



SECTION III - CONTRIBUTION DEVELOPMENT AND HISTORY

Table III-1
Statutory Contributions

Table III-1 shows the components of the Fiscal Year 2019 and the Fiscal Year 2018 Statutory Contributions.

COMPONENTS OF CURRENT AND PRIOR FISCAL YEAR STATUTORY CONTRIBUTIONS		
Valuation Date	June 30, 2017 (Lag)	June 30, 2016 (Lag)
Fiscal Year	2019	2018
Normal Cost ¹	\$ 1,305,407,961	\$ 1,172,161,054
Amortization of Unfunded Accrued Liability		
-Initial UAL	1,896,480,672	1,841,243,371
-2011 (Gain)/Loss	157,298,501	157,298,501
-2012 (Gain)/Loss	92,094,332	92,094,332
-2013 (Gain)/Loss	244,357,693	244,357,693
-2014 (Gain)/Loss	117,417,036	117,417,036
-2014 Assumption Changes	224,142,498	224,142,498
-2015 (Gain)/Loss	86,869,581	86,869,581
-2016 (Gain)/Loss	(100,351,916)	(100,351,916)
-2017 (Gain)/Loss	(264,357,362)	N/A
-2017 ASAF Method Change	11,633,517	N/A
-2017 Assumption Changes	(107,961,163)	N/A
-2017 Method Changes	908,566	N/A
Total	2,358,531,955	2,663,071,096
Administrative Expenses	58,245,643	54,477,777
ASAF Credit ²	(25,500,000)	N/A
Total Contribution to the New York City Teachers' Retirement System	\$ 3,696,685,559	\$ 3,889,709,927

¹ Includes amounts necessary, if any, to provide for financing of the Excess Benefit Plan established by Chapter 623/04.

² Estimated contribution made by the Department of Education to the Annuity Savings Accumulation Fund (ASAF) of certain eligible members for Fiscal Year 2019.

Table III-2
Schedule of Unfunded Accrued Liability Bases

The Initial UAL is being amortized over a closed 22-year period using Increasing Dollar Payments (IDP). Under IDP, amortization payments increase by 3.0% per year, consistent with the assumed rate of General Wage Increases. Increments to the UAL established after June 30, 2010 are generally amortized using Level Dollar Payments (LDP) as follows:

- Benefit Changes – Over the remaining working lifetimes of those impacted, unless the amortization period is determined by statute.
- Assumption and Method Changes – Over a closed 20-year period.
- Actuarial Gains and Losses – Over a closed 15-year period.

Under the One-Year Lag methodology (OYLM), the number of payments is one fewer than the number of years in the amortization period (e.g. 14 payments over a closed 15-year amortization period).

Table III-2
Schedule of Unfunded Accrued Liability Bases (cont'd)

Table III-2 shows the Schedule of Unfunded Accrued Liability (UAL) Bases as of June 30, 2017. Note that a change to the schedule at June 30, 2017 reduced amounts remaining to be amortized by the prior fiscal year's amortization payments, which are now included as a receivable in plan assets. This change has no impact on the determination of the amortization payments or the Employer Contribution.

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM SCHEDULE OF UNFUNDED ACCRUED LIABILITY BASES						
Amortization Base	Date Established	Original Amount	Amortization Years	Amortization Payment	Payments Remaining	OYLM UAL June 30, 2017
Initial UAL	6/30/10	\$ 20,524,022,955	22	\$ 1,896,480,672	14	\$ 18,947,774,869
(Gain)/Loss	6/30/11	\$ 1,329,890,090	15	\$ 157,298,501	8	\$ 908,032,679
(Gain)/Loss	6/30/12	\$ 778,617,335	15	\$ 92,094,332	9	\$ 580,057,325
(Gain)/Loss	6/30/13	\$ 2,065,937,513	15	\$ 244,357,693	10	\$ 1,659,177,142
(Gain)/Loss	6/30/14	\$ 992,709,734	15	\$ 117,417,036	11	\$ 851,184,523
Assumption Change ¹	6/30/14	\$ 2,239,586,352	20	\$ 224,142,498	16	\$ 2,046,963,409
(Gain)/Loss	6/30/15	\$ 734,444,345	15	\$ 86,869,581	12	\$ 667,026,745
(Gain)/Loss	6/30/16	\$ (848,431,601)	15	\$ (100,351,916)	13	\$ (810,807,953)
(Gain)/Loss	6/30/17	\$ (2,235,025,973)	15	\$ (264,357,362)	14	\$ (2,235,025,973)
ASAF Method Change	6/30/17	\$ 116,239,745	20	\$ 11,633,517	19	\$ 116,239,745
Assumption Change ²	6/30/17	\$ (1,078,725,991)	20	\$ (107,961,163)	19	\$ (1,078,725,991)
Method Changes ³	6/30/17	\$ 9,078,212	20	\$ 908,566	19	\$ 9,078,212

¹ Change in post-retirement mortality assumptions including the change to the mortality improvement scale MP-2015.

² Changes in demographic assumptions to better align with future experience and change to the mortality improvement scale MP-2018.

³ Refinements to valuation methodologies.

Graph III-3
Remaining UAL Amortizations as of June 30, 2017

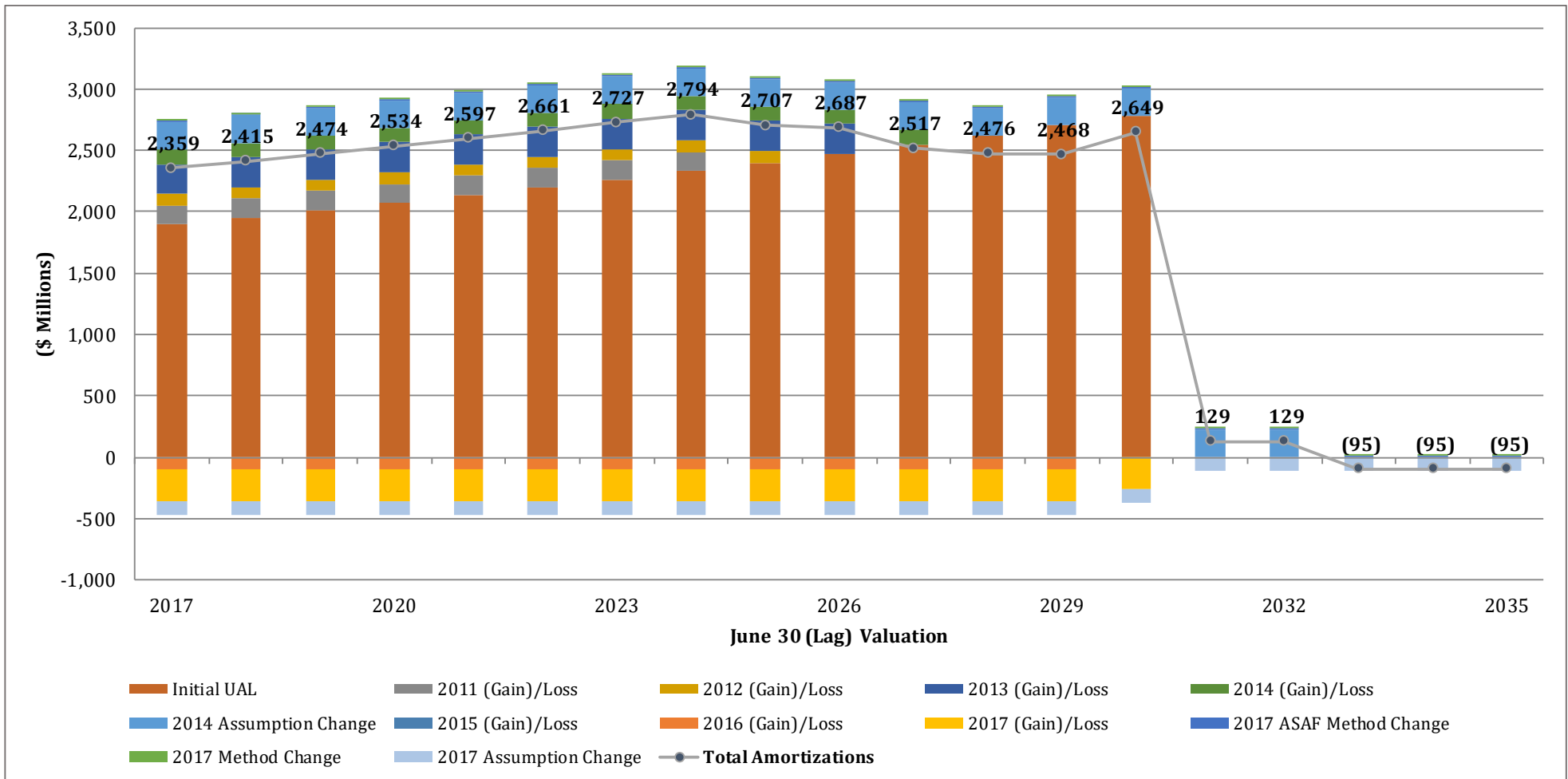


Table III-4
Reconciliation of Outstanding UAL Bases

June 30 (Lag) Valuation Date	Amounts (\$ Thousands) Remaining to be Amortized, as of							
	2010	2011	2012	2013	2014	2015	2016	2017 ¹
Initial UAL Amortization Base	\$ 20,524,023	\$ 21,960,705	\$ 21,902,884	\$ 21,793,164	\$ 21,626,476	\$ 21,397,353	\$ 21,099,902	\$ 18,947,775
2010-2011 (Gain)/Loss		1,329,890	1,422,983	1,359,880	1,292,361	1,220,116	1,142,813	908,033
ERI		5,793	6,199	4,803	3,309	1,710	0	0
2011-2012 (Gain)/Loss			778,617	833,121	796,176	756,645	714,347	580,057
2012-2013 (Gain)/Loss				2,065,937	2,210,553	2,112,526	2,007,638	1,659,177
2013-2014 (Gain)/Loss					992,710	1,062,200	1,015,096	851,185
Assumption Change at June 30, 2014					2,239,586	2,396,357	2,332,248	2,046,963
2014-2015 (Gain)/Loss						734,444	785,855	667,027
2015-2016 (Gain)/Loss							(848,432)	(810,808)
2016-2017 (Gain)/Loss								(2,235,026)
2017 ASAF Method Change								116,240
Assumption Change at June 30, 2017								(1,078,726)
Method Change at June 30, 2017								9,078
Sum of Outstanding Amortization Amounts	\$ 20,524,023	\$ 23,296,388	\$ 24,110,683	\$ 26,056,905	\$ 29,161,171	\$ 29,681,351	\$ 28,249,467	\$ 21,660,975

June 30 (Lag) Valuation Date	2010	2011	2012	2013	2014	2015	2016	2017
1. Accrued Liability (AL)	\$ 55,138,366	\$ 57,702,731	\$ 58,783,399	\$ 61,988,933	\$ 67,309,977	\$ 69,625,608	\$ 69,964,412	\$ 69,552,380
2. Actuarial Value of Assets (AVA)	32,477,527	33,601,537	33,871,180	35,186,072	37,521,424	39,290,072	41,015,087	44,381,706
3. Due (To)/From TDA ²	(250,030)	(322,818)	(304,649)	(363,493)	(464,899)	(486,005)	(488,763)	(303,249)
4. Unfunded Accrued Liability (UAL) (1. - 2. - 3.)	22,910,869	24,424,012	25,216,868	27,166,354	30,253,452	30,821,541	29,438,088	25,473,924
5. PV 1-year Adjusted Employer Contribution ³	2,386,846	1,055,636	1,034,859	1,037,450	1,015,997	1,050,590	1,088,218	3,707,659
6. PV Future Administrative Expense Reimbursement	0	71,988	71,326	71,999	76,284	89,600	100,403	105,290
7. Adjusted UAL (4. - 5. - 6.)	\$ 20,524,023	\$ 23,296,388	\$ 24,110,683	\$ 26,056,905	\$ 29,161,171	\$ 29,681,351	\$ 28,249,467	\$ 21,660,975

¹ Beginning at June 30, 2017, amounts remaining to be amortized have been reduced by the prior valuation year's amortization payments. When considered with (3) below, this change has no effect.

² Represents difference between TDA assets and actuarial present value of benefits for members who elect to annuitize their TDA account.

³ Beginning at June 30, 2017, the PV 1-year Adjusted Employer Contribution includes amounts used to pay UAL bases and one year of administrative expenses. When considered with (1) above, this change has no effect.

Table III-5
Actuarial and Statutory Contribution History

Table III-5 compares the Statutory Contributions to the Actuarial Contributions for Fiscal Years 2010 through 2019.

(\$ Thousands)			
Fiscal Year Ended June 30	Actuarial Contribution Certified	Statutory Contribution Contributed	Percentage of Actuarial Contribution Contributed
2010	\$2,484,074	\$2,484,074	100.0%
2011	2,468,973	2,468,973	100.0%
2012	2,673,078	2,673,078	100.0%
2013	2,855,640	2,855,640	100.0%
2014	2,998,694	2,998,694	100.0%
2015	3,270,007	3,270,007	100.0%
2016	3,702,569	3,702,569	100.0%
2017	3,888,399	3,888,399	100.0%
2018	3,889,710	3,889,710	100.0%
2019	3,696,686	3,696,686	100.0%

Table III-6
City Rates: Contributions as a Percentage of Salary

Table III-6 shows the City Rates defined to be the contributions as a percentage of salary for the Fiscal Years 2010 through 2019.

CITY RATES (\$ Thousands)			
Fiscal Year Ended June 30	Actuarial Contribution ¹	Salary ² at Beginning of Fiscal Year	City Rate
2010	\$2,484,074	\$7,859,931	31.6%
2011	2,468,973	7,935,195	31.1%
2012	2,673,078	7,920,820	33.7%
2013	2,855,640	7,833,398	36.5%
2014	2,998,694	7,964,149	37.7%
2015	3,270,007	8,074,522	40.5%
2016	3,702,569	8,256,100	44.8%
2017	3,888,399	8,818,537	44.1%
2018	3,889,710	9,200,180	42.3%
2019	3,722,186	9,874,119	37.7%

¹ Starting in Fiscal Year 2019 reflects the estimate of the contribution made by the Department of Education to the Annuity Savings Accumulation Fund (ASAF).

² Includes the impact of recent labor contract settlements and certain non-union salary increases with retroactive effective dates, if any.

SECTION IV - RESULTS BY CONTRIBUTING ENTITY

**Table IV-1
Employer Contributions by Obligor**

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM							
EMPLOYER CONTRIBUTION BY OBLIGOR							
Valuation Date	June 30, 2017 (Lag)						
Fiscal Year	2019						
Obligor	Future Leaders	Harriet Tubman	Imagine Me Leadership ¹	KIPP Academy	KIPP NYC	Opportunity	Renaissance
Contribution							
1. Normal Cost	\$ 319,839	\$ 413,057	\$ 92,042	\$ 642,751	\$ 604,899	\$ 509,960	\$ 731,021
2. Amortization of Unfunded Accrued Liability	132,972	139,216	0	80,187	129,694	259,730	838,955
3. Administrative Expenses	13,488	22,141	0	34,102	20,614	25,703	19,087
4. Actuarial Contribution (1. + 2. + 3.)	\$ 466,299	\$ 574,414	\$ 92,042	\$ 757,040	\$ 755,207	\$ 795,393	\$ 1,589,063
5. Statutory Contribution	\$ 466,299	\$ 574,414	\$ 92,042	\$ 757,040	\$ 755,207	\$ 795,393	\$ 1,589,063
Obligor	South Bronx Early College Academy	UFT	University Prep Charter HS	Voice	Wildcat		Charter School Subtotal
Contribution							
1. Normal Cost	\$ 171,586	\$ 389,485	\$ 457,706	\$ 358,051	\$ 415,726		\$ 5,106,123
2. Amortization of Unfunded Accrued Liability	29,179	443,737	302,123	71,038	187,887		2,614,718
3. Administrative Expenses	7,126	16,287	13,233	18,323	9,671		199,775
4. Actuarial Contribution (1. + 2. + 3.)	\$ 207,891	\$ 849,509	\$ 773,062	\$ 447,412	\$ 613,284		\$ 7,920,616
5. Statutory Contribution	\$ 207,891	\$ 849,509	\$ 773,062	\$ 447,412	\$ 613,284		\$ 7,920,616

¹ The Imagine Me Leadership Charter School joined TRS in September 2017 and only has a Normal Cost component of employer contribution as of June 30, 2017.

Table IV-1
Employer Contributions by Obligor (cont'd)

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM						
EMPLOYER CONTRIBUTION BY OBLIGOR						
Valuation Date	June 30, 2017 (Lag)					
Fiscal Year	2019					
Obligor	Charter School Subtotal	CUNY: Senior Colleges	CUNY: Community Colleges / Others	CUNY Subtotal	Department of Education	Total
Contribution						
1. Normal Cost	\$ 5,106,123	\$ 35,081,264	\$ 21,108,311	\$ 56,189,575	\$ 1,244,112,263	\$ 1,305,407,961
2. Amortization of Unfunded Accrued Liability	2,614,718	58,308,986	24,116,345	82,425,331	2,273,491,906	2,358,531,955
3. Administrative Expenses	199,775	1,632,808	919,727	2,552,535	55,493,333	58,245,643
4. ASAF Credit	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>(25,500,000)</u>	<u>(25,500,000)</u>
5. Actuarial Contribution (1. + 2. + 3. + 4.)	\$ 7,920,616	\$ 95,023,058	\$ 46,144,383	\$ 141,167,441	\$ 3,547,597,502	\$ 3,696,685,559
6. Statutory Contribution	\$ 7,920,616	\$ 95,023,058	\$ 46,144,383	\$ 141,167,441	\$ 3,547,597,502	\$ 3,696,685,559

Table IV-2
Accrued Liabilities by Obligor

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM							
ACCRUED LIABILITIES BY OBLIGOR							
Valuation Date	June 30, 2017 (Lag)						
Fiscal Year	2019						
Obligor	Future Leaders	Harriet Tubman	Imagine Me Leadership ³	KIPP Academy	KIPP NYC	Opportunity	Renaissance
Accrued Liability							
1. Active Members	\$ 3,103,143	\$ 4,219,520	\$ 0	\$ 6,726,720	\$ 8,465,720	\$ 5,678,818	\$ 13,635,073
2. Active Off Payroll Members ¹	52,649	429,329	0	276,791	403,740	262,051	31,123
3. Terminated Vested Members	285,527	701,123	0	1,336,862	799,828	1,394,073	490,767
4. Retirees and Beneficiaries	1,115,162	274,251	0	630,122	0	1,886,784	4,893,875
5. Accrued Liability Pre-Adjustments (1. to 4.)	\$ 4,556,481	\$ 5,624,223	\$ 0	\$ 8,970,495	\$ 9,669,288	\$ 9,221,726	\$ 19,050,838
6. Actuarial Adjustments ²	4,417	0	0	4,417	0	0	8,834
7. Total Accrued Liability (AL) (5. + 6.)	\$ 4,560,898	\$ 5,624,223	\$ 0	\$ 8,974,912	\$ 9,669,288	\$ 9,221,726	\$ 19,059,672
Present Value of Benefits							
1. Active Members	\$ 10,183,919	\$ 12,101,505	\$ 0	\$ 21,478,088	\$ 16,500,462	\$ 14,824,689	\$ 22,372,973
2. Active Off Payroll Members ¹	52,649	429,329	0	276,791	403,740	262,051	31,123
3. Terminated Vested Members	285,527	701,123	0	1,336,862	799,828	1,394,073	490,767
4. Retirees and Beneficiaries	1,115,162	274,251	0	630,122	0	1,886,784	4,893,875
5. Present Value of Benefits (1. to 4.)	\$ 11,637,257	\$ 13,506,208	\$ 0	\$ 23,721,863	\$ 17,704,030	\$ 18,367,597	\$ 27,788,738
6. Actuarial Adjustments ²	4,417	0	0	4,417	0	0	8,834
7. Total Present Value of Benefits (5. + 6.)	\$ 11,641,674	\$ 13,506,208	\$ 0	\$ 23,726,280	\$ 17,704,030	\$ 18,367,597	\$ 27,797,572
Obligor	South Bronx Early College Academy	UFT	University Prep Charter HS	Voice	Wildcat	Charter School Subtotal	
Accrued Liability							
1. Active Members	\$ 898,596	\$ 5,201,040	\$ 6,156,401	\$ 2,959,329	\$ 6,164,958	\$ 63,209,318	
2. Active Off Payroll Members ¹	4,948	759,641	54,515	46,215	147,917	2,468,919	
3. Terminated Vested Members	0	1,271,669	538,498	45,800	300,516	7,164,663	
4. Retirees and Beneficiaries	0	2,383,113	610,923	0	928,133	12,722,363	
5. Accrued Liability Pre-Adjustments (1. to 4.)	\$ 903,544	\$ 9,615,463	\$ 7,360,337	\$ 3,051,344	\$ 7,541,524	\$ 85,565,263	
6. Actuarial Adjustments ²	0	0	0	0	0	17,668	
7. Total Accrued Liability (AL) (5. + 6.)	\$ 903,544	\$ 9,615,463	\$ 7,360,337	\$ 3,051,344	\$ 7,541,524	\$ 85,582,931	
Present Value of Benefits							
1. Active Members	\$ 4,825,736	\$ 11,136,826	\$ 14,407,033	\$ 12,704,702	\$ 10,365,347	\$ 150,901,280	
2. Active Off Payroll Members ¹	4,948	759,641	54,515	46,215	147,917	2,468,919	
3. Terminated Vested Members	0	1,271,669	538,498	45,800	300,516	7,164,663	
4. Retirees and Beneficiaries	0	2,383,113	610,923	0	928,133	12,722,363	
5. Present Value of Benefits (1. to 4.)	\$ 4,830,684	\$ 15,551,249	\$ 15,610,969	\$ 12,796,717	\$ 11,741,913	\$ 173,257,225	
6. Actuarial Adjustments ²	0	0	0	0	0	17,668	
7. Total Present Value of Benefits (5. + 6.)	\$ 4,830,684	\$ 15,551,249	\$ 15,610,969	\$ 12,796,717	\$ 11,741,913	\$ 173,274,893	

¹ Represents members no longer on payroll, but not otherwise classified.

² Includes actuarial loading adjustments.

³ The Imagine Me Leadership Charter School joined TRS in September 2017.

Table IV-2
Accrued Liabilities by Obligor (cont'd)

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM						
ACCRUED LIABILITIES BY OBLIGOR						
Valuation Date	June 30, 2017 (Lag)					
Fiscal Year	2019					
Obligor	Charter School Subtotal	CUNY: Senior Colleges	CUNY: Community Colleges / Others	CUNY Subtotal	Department of Education	Total
Accrued Liability						
1. Active Members	\$ 63,209,318	\$ 454,089,303	\$ 234,217,424	\$ 688,306,727	\$ 24,694,687,416	\$ 25,446,203,461
2. Active Off Payroll Members ¹	2,468,919	27,108,414	21,759,296	48,867,710	569,657,171	620,993,800
3. Terminated Vested Members	7,164,663	12,474,476	6,540,660	19,015,136	1,099,121,366	1,125,301,165
4. Retirees and Beneficiaries	<u>12,722,363</u>	<u>1,006,322,569</u>	<u>320,507,228</u>	<u>1,326,829,797</u>	<u>40,810,131,419</u>	<u>42,149,683,579</u>
5. Accrued Liability Pre-Adjustments (1. to 4.)	\$ 85,565,263	\$ 1,499,994,762	\$ 583,024,608	\$ 2,083,019,370	\$ 67,173,597,372	\$ 69,342,182,005
6. Actuarial Adjustments ²	<u>17,668</u>	<u>8,244,027</u>	<u>2,192,110</u>	<u>10,436,137</u>	<u>199,744,449</u>	<u>210,198,254</u>
7. Total Accrued Liability (AL) (5. + 6.)	\$ 85,582,931	\$ 1,508,238,789	\$ 585,216,718	\$ 2,093,455,507	\$ 67,373,341,821	\$ 69,552,380,259
Present Value of Benefits						
1. Active Members	\$ 150,901,280	\$ 814,795,309	\$ 480,166,576	\$ 1,294,961,885	\$ 40,458,260,235	\$ 41,904,123,400
2. Active Off Payroll Members ¹	2,468,919	27,108,414	21,759,296	48,867,710	569,657,171	620,993,800
3. Terminated Vested Members	7,164,663	12,474,476	6,540,660	19,015,136	1,099,121,366	1,125,301,165
4. Retirees and Beneficiaries	<u>12,722,363</u>	<u>1,006,322,569</u>	<u>320,507,228</u>	<u>1,326,829,797</u>	<u>40,810,131,419</u>	<u>42,149,683,579</u>
5. Present Value of Benefits (1. to 4.)	\$ 173,257,225	\$ 1,860,700,768	\$ 828,973,760	\$ 2,689,674,528	\$ 82,937,170,191	\$ 85,800,101,944
6. Actuarial Adjustments ²	<u>17,668</u>	<u>8,244,027</u>	<u>2,192,110</u>	<u>10,436,137</u>	<u>199,744,449</u>	<u>210,198,254</u>
7. Total Present Value of Benefits (5. + 6.)	\$ 173,274,893	\$ 1,868,944,795	\$ 831,165,870	\$ 2,700,110,665	\$ 83,136,914,640	\$ 86,010,300,198

¹ Represents members no longer on payroll, but not otherwise classified.

² Includes actuarial loading adjustments.

Table IV-3
Participant Data by Obligor

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM							
PARTICIPANT DATA BY OBLIGOR							
Valuation Date	June 30, 2017 (Lag)						
Fiscal Year	2019						
Obligor	Future Leaders	Harriet Tubman	Imagine Me Leadership ³	KIPP Academy	KIPP NYC	Opportunity	Renaissance
Participant Data							
1. Active Members							
a. Number	42	62	0	86	39	61	59
b. Annual Salary ¹	\$ 3,198,331	\$ 3,923,509	\$ 0	\$ 6,841,975	\$ 3,864,783	\$ 4,771,713	\$ 5,194,362
c. Average Salary	\$ 76,151	\$ 63,282		\$ 79,558	\$ 99,097	\$ 78,225	\$ 88,040
2. Active Off Payroll Members ²	4	17	0	19	13	18	3
3. Terminated Vested Members	6	7	0	27	29	19	4
4. Retirees and Beneficiaries							
a. Number	1	1	0	2	0	3	9
b. Total Annual Benefits	\$ 95,160	\$ 24,587	\$ 0	\$ 60,723	\$ 0	\$ 155,677	\$ 410,296
c. Average Annual Benefit	\$ 95,160	\$ 24,587		\$ 30,362		\$ 51,892	\$ 45,588
Obligor	South Bronx Early College Academy	UFT	University Prep Charter HS	Voice	Wildcat	Charter School Subtotal	
Participant Data							
1. Active Members							
a. Number	27	34	41	60	29		540
b. Annual Salary ¹	\$ 1,885,261	\$ 2,957,959	\$ 3,974,294	\$ 4,326,832	\$ 2,797,806		\$ 43,736,825
c. Average Salary	\$ 69,824	\$ 86,999	\$ 96,934	\$ 72,114	\$ 96,476		\$ 80,994
2. Active Off Payroll Members ²	1	4	3	9	3		94
3. Terminated Vested Members	0	23	7	3	4		129
4. Retirees and Beneficiaries							
a. Number	0	3	1	0	2		22
b. Total Annual Benefits	\$ 0	\$ 179,593	\$ 48,400	\$ 0	\$ 75,963		\$ 1,050,399
c. Average Annual Benefit		\$ 59,864	\$ 48,400		\$ 37,982		\$ 47,745

¹ Salaries shown reflect the impact of recent labor contract settlements and certain non-union salary increases with retroactive effective dates, if any.

² Represents members no longer on payroll, but not otherwise classified.

³ The Imagine Me Leadership Charter School joined TRS in September 2017. There were no members as of June 30, 2017.

Table IV-3
Participant Data by Obligor (cont'd)

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM						
PARTICIPANT DATA BY OBLIGOR						
Valuation Date	June 30, 2017 (Lag)					
Fiscal Year	2019					
Obligor	Charter School Subtotal	CUNY: Senior Colleges	CUNY: Community Colleges / Others	CUNY Subtotal	Department of Education	Total
Participant Data						
1. Active Members						
a. Number	540	3,948	2,236	6,184	114,102	120,826
b. Annual Salary ¹	\$ 43,736,825	\$ 241,377,923	\$ 149,239,419	\$ 390,617,342	\$ 9,414,545,065	\$ 9,848,899,232
c. Average Salary	\$ 80,994	\$ 61,139	\$ 66,744	\$ 63,166	\$ 82,510	\$ 81,513
2. Active Off Payroll Members ²	94	311	641	952	6,951	7,997
3. Terminated Vested Members	129	165	82	247	14,903	15,279
4. Retirees and Beneficiaries						
a. Number	22	1,992	655	2,647	82,101	84,770
b. Total Annual Benefits	\$ 1,050,399	\$ 121,421,590	\$ 34,279,784	\$ 155,701,374	\$ 3,940,895,589	\$ 4,097,647,362
c. Average Annual Benefit	\$ 47,745	\$ 60,955	\$ 52,336	\$ 58,822	\$ 48,001	\$ 48,338

¹ Salaries shown reflect the impact of recent labor contract settlements and certain non-union salary increases with retroactive effective dates, if any.

² Represents members no longer on payroll, but not otherwise classified.

SECTION V - (GAIN)/LOSS ANALYSIS

Table V-1
Development of Experience (Gain)/Loss

Table V-1 develops the asset and liability (Gain)/Loss between the June 30, 2016 (Lag) actuarial valuation and the June 30, 2017 (Lag) actuarial valuation.

DEVELOPMENT OF EXPERIENCE (GAIN) / LOSS	
June 30, 2017	
(\$ Thousands)	
1. Expected Accrued Liability (AL)	
a. AL at June 30, 2016	\$ 69,964,412
b. Total Normal Cost and Administrative Expenses at June 30, 2016	1,282,305
c. Interest on 1.a. and 1.b. to June 30, 2017	4,987,270
d. Fiscal Year 2016 Benefit Payments with Interest to June 30, 2017	<u>(4,364,490)</u>
e. Expected AL at June 30, 2017	\$ 71,869,497
2. Actual AL at June 30, 2017 (prior to Method Changes & Assumption Changes)	\$ 70,495,860
3. Expected Total Actuarial Value of Assets (AVA) ¹	
a. Total at June 30, 2016	\$ 40,526,324
b. Interest on 3.a. to June 30, 2017	2,836,843
c. Total Contributions Paid in Fiscal Year 2017	4,068,475
d. Interest on 3.c. to June 30, 2017	139,988
e. Fiscal Year 2016 Benefit Payments with Interest to June 30, 2017 (1.d.)	<u>(4,364,490)</u>
f. Expected Total at June 30, 2017	\$ 43,207,140
4. Actual Total AVA at June 30, 2017 (prior to Method Changes & Assumption Changes) ²	\$ 44,068,529
5. Accrued Liability (Gain) / Loss (2. - 1.e.)	\$ (1,373,637)
6. Actuarial Asset (Gain) / Loss (3.f. - 4.)	\$ (861,389)
7. Total Actuarial (Gain) / Loss (5. + 6.)	\$ (2,235,026)

¹ Includes amount due from TDA of \$(488,763).

² Includes amount due from TDA of \$(313,177).

SECTION VI – SCHEDULE OF FUNDING PROGRESS

A schedule of funding progress is provided below. This schedule of funding progress was previously required by GASB 25, which has been superseded by GASB 67, and is provided for historical context. These liability and asset measures are used to develop the Actuarial Contribution and are not suitable for other purposes including, but not limited to, settlement of plan obligations. For more information, see SECTION II – MARKET AND ACTUARIAL VALUES OF ASSETS.

Table VI-1
Schedule of Funding Progress

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM (\$ Thousands)						
June 30 (Lag) Valuation Date	(1) Actuarial Value of Assets (AVA)	(2) Accrued Liability (AL)	(3) Unfunded AL (UAL) (2) - (1)	(4) Funded Ratio (1) / (2)	(5) Covered Payroll	(6) UAL as a % of Covered Payroll (3) / (5)
2008	\$32,227,375	\$49,400,762	\$17,173,387	65.2%	\$7,926,648	216.7%
2009	30,774,981	47,988,459	17,213,478	64.1%	8,016,636	214.7%
2010	32,477,527	55,138,366	22,660,839	58.9%	7,979,671	284.0%
2011	33,601,537	57,702,731	24,101,194	58.2%	7,888,204	305.5%
2012	33,871,180	58,783,399	24,912,219	57.6%	8,013,395	310.9%
2013	35,186,072	61,988,933	26,802,861	56.8%	8,128,378	329.7%
2014	37,521,424	67,309,977	29,788,553	55.7%	8,274,686	360.0%
2015	39,290,072	69,625,608	30,335,536	56.4%	8,844,651	343.0%
2016	41,015,087	69,964,412	28,949,325	58.6%	9,224,268	313.8%
2017	44,381,706	69,552,380	25,170,674	63.8%	9,848,899	255.6%

Effective June 30, 2010, AL is based on the Entry Age Normal cost method. Previously, the Frozen Initial Liability cost method was used. Salaries reflect the impact of recent labor contract settlements and certain non-union salary increases with retroactive effective dates, if any.

SECTION VII - RISK AND UNCERTAINTY

The actuarial assumptions and methods adopted by the Board of Trustees during Fiscal Year 2019 are referred to as the "2019 A&M." The Fiscal Year 2019 employer contribution is based on the census data reported as of June 30, 2017 and on the 2019 A&M.

The funded status of TRS depends highly on the realization of the actuarial assumptions used, as well as certain demographic characteristics of the Plan and other exogenous factors. Many of the risks faced by the Plan are described in fuller detail below; quantifying these risks for the Plan is beyond the scope of this valuation but may be undertaken in future years.

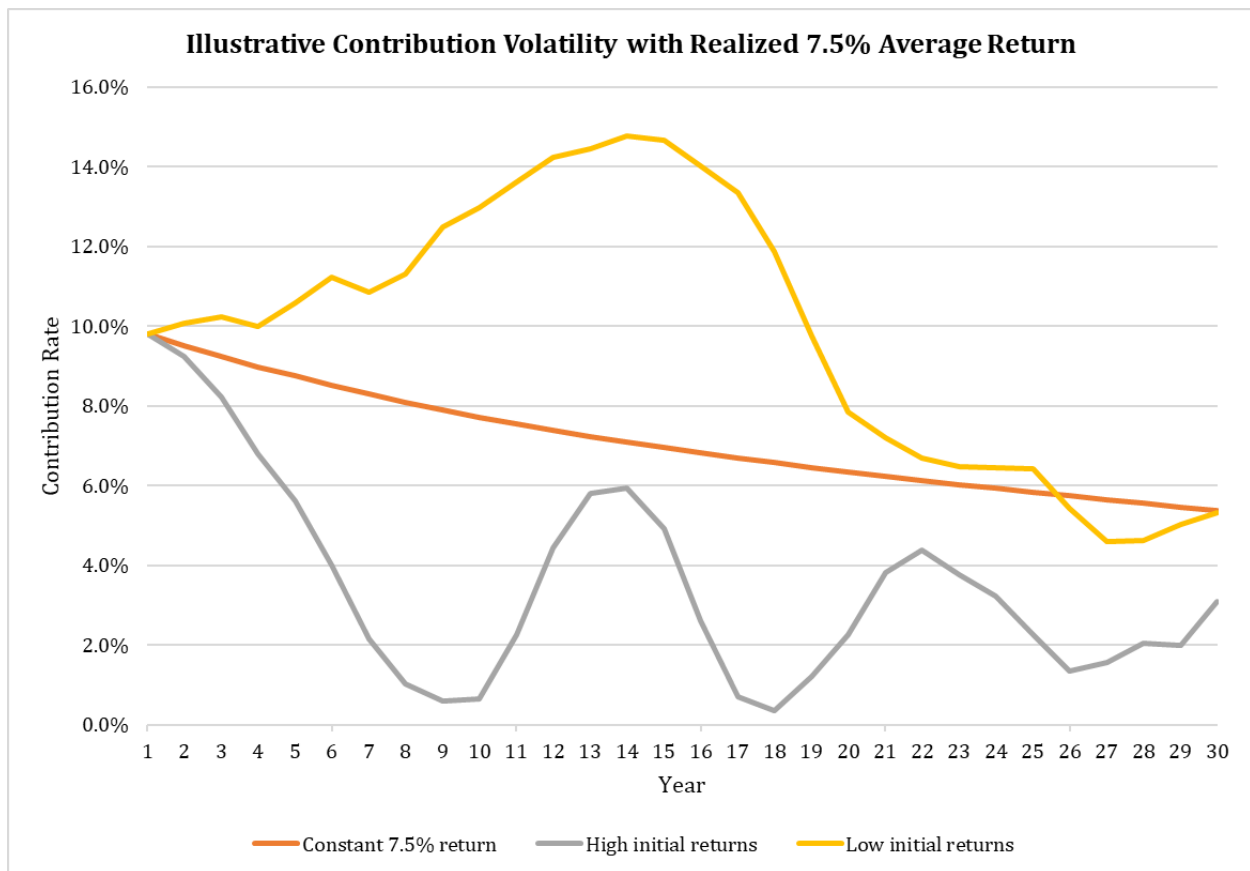
These risks have been separated, based on the Actuary's professional judgement, into high, medium, and low risks.

High Risk Types

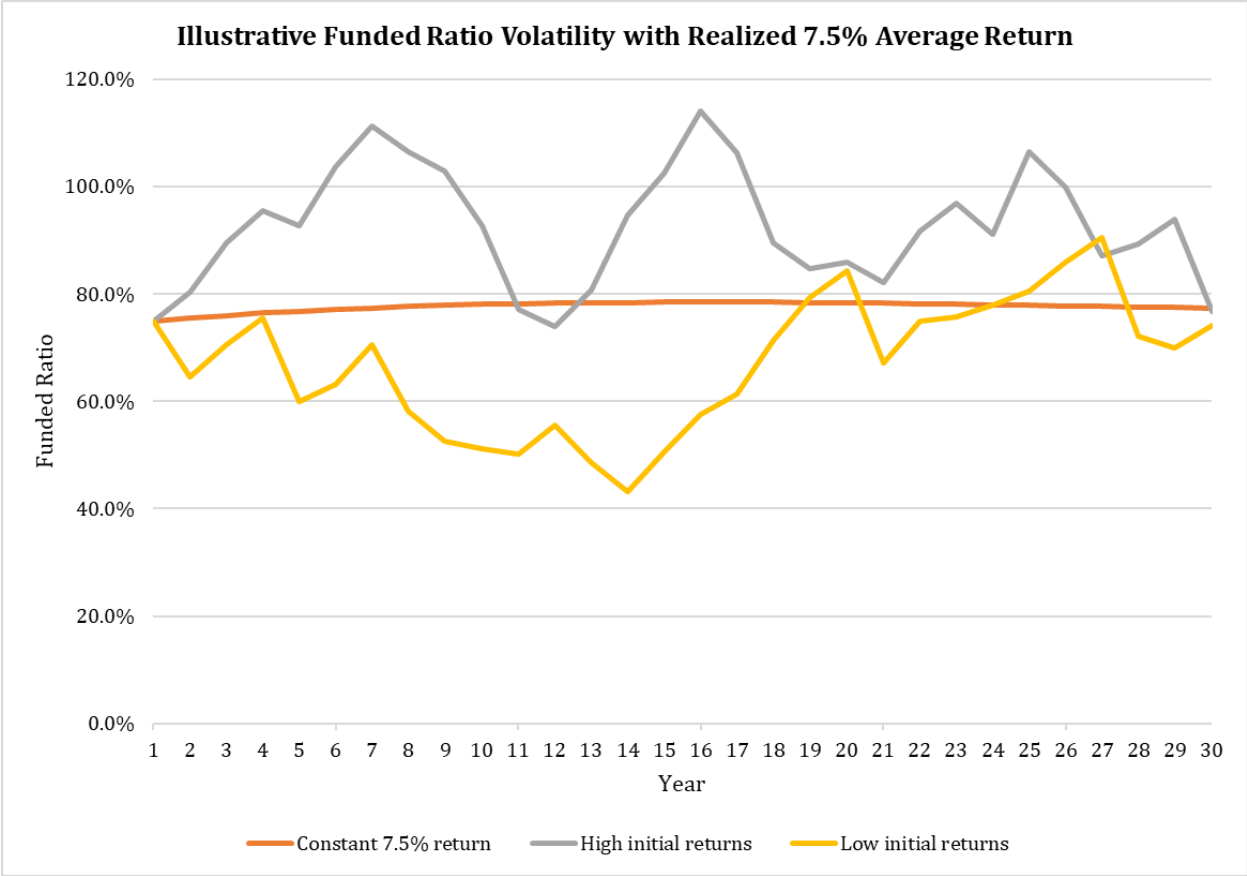
Investment Risk

The most substantial risk for TRS is that investment returns may be different than assumed. As risk-free investment return rates have fallen in recent decades, more aggressive asset allocations have become necessary to achieve long-term rates of return commensurate with the actuarial assumption of 7.0%.

This investment return volatility can contribute substantially to contribution and funded status volatility, even if the long-term investment return assumption of 7.0% is realized. While not yet available specifically for the Plan at this time, recent research demonstrates this volatility based on a sample public plan with typical characteristics, a typical contribution policy, and a long-term return assumption of 7.5%, which can be realized in different patterns.¹ Similar scenario analysis could be done for TRS.



¹ Yin, Yimeng; Boyd, Don. Pension Simulation Project. *The Nelson A. Rockefeller Institute of Government*.



Note that these illustrations show volatility even if the long-term expected rate of return is realized. Further risk exists that long-term expected rates of return may not be realized.

Maturity Risk

With respect to future fiscal years, it should be noted that TRS is a mature retirement system. A mature retirement system has a significant ratio of retirees to active members and, usually, of assets to active member payroll and of Accrued Liability (AL) to active member payroll. These latter two ratios, sometimes known as volatility ratios, for the Plan can be found in the chart below.

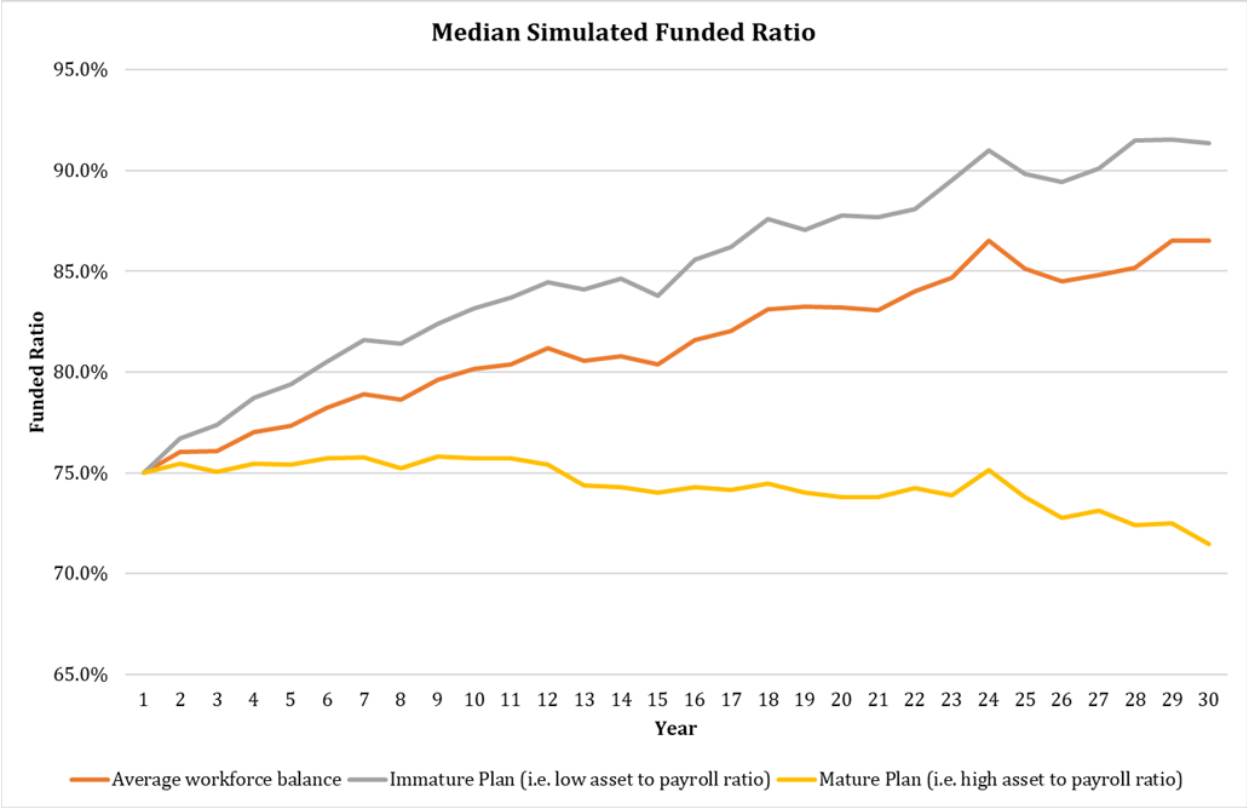
Valuation Date	June 30, 2017 (Lag)	June 30, 2016 (Lag)
Fiscal Year	2019	2018
Volatility Ratios		
1. Market Value of Assets (MVA)	\$ 50,095,723,000	\$ 43,629,545,000
2. Actuarial Value of Assets (AVA)	44,381,706,000	41,015,087,000
3. Accrued Liability	69,552,380,259	69,964,411,998
4. Active Salary	9,848,899,232	9,224,267,647
5. Asset Volatility Ratio (MVA basis) (1. / 4.)	5.1	4.7
6. Asset Volatility Ratio (AVA basis) (2. / 4.)	4.5	4.4
7. Liability Volatility Ratio (3. / 4.)	7.1	7.6

As a plan becomes more mature, Asset Volatility and Liability Volatility Ratios increase, and the plan's contribution becomes more sensitive to investment losses and changes in liabilities. For example, the same percentage of investment losses in more mature plans can increase contributions as a percentage of payroll more than in less mature plans. Therefore, mature plans may need to consider more conservative investment strategies.

Similarly, assumption changes that affect retiree liabilities will impact contributions to a greater degree in more mature plans.

While not available specifically for the Plan, illustrative forecasts of sample plans of various maturities can demonstrate these effects.¹

¹ Boyd, Donald J. and Yin, Yimeng. "How Public Pension Plan Demographic Characteristics Affect Funding and Contribution Risk." Pension Simulation Project. *The Nelson A. Rockefeller Institute of Government*.



As mentioned above, a plan’s Support Ratio (i.e. the ratio of retired members to active members) is a measure of maturity risk. A high Support Ratio implies that contributions support the benefit payments of many retirees. A high Support Ratio also generally implies an actuarial liability with shorter duration. The plan sponsor should take this into account in order to avoid an asset/liability mismatch with respect to duration (see page 63).

Medium Risk Types

Interest Rate Risk

The Accrued Liability for the Plan depends heavily on the actuarial assumption used for future investment returns. While the returns themselves can produce substantial volatility, as detailed in the Investment Risk subsection above, the long-term rate of return assumption of 7.0% depends itself on the allocation of Plan assets.

If market conditions or the allocation of Plan assets no longer justifies a long-term rate of return assumption of 7.0%, a reduction in the Actuarial Interest Rate (AIR) would significantly increase the Accrued Liability and Unfunded Accrued Liability of the Plan, as well as the Normal Cost and resulting contribution. The sensitivity of the Accrued Liability, Unfunded Accrued Liability, Funded Ratio, and Normal Cost of the Plan are shown below:

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM	
SENSITIVITY ANALYSIS AS OF JUNE 30, 2017	
Valuation Date	June 30, 2017
Results at 7.0%	
1. Accrued Liability	\$ 69,552,380,259
2. Actuarial Value of Assets (AVA)	44,381,706,000
3. Unfunded Accrued Liability (AVA Basis) (1.-2.)	25,170,674,259
4. Funded Ratio (2./1.)	63.8%
5. Normal Cost	1,305,407,961
Results at 6.0%	
1. Accrued Liability	\$ 77,158,283,546
2. Actuarial Value of Assets (AVA)	44,381,706,000
3. Unfunded Accrued Liability (AVA Basis) (1.-2.)	32,776,577,546
4. Funded Ratio (2./1.)	57.5%
5. Normal Cost	1,976,087,451
Sensitivity Analysis for 1.0% Reduction in Interest Rate	
1. Increase in Accrued Liability	10.9%
2. Increase in Unfunded Accrued Liability (AVA Basis)	30.2%
3. Decrease in Funded Ratio	6.3%
4. Increase in Normal Cost	51.4%

Inflation Risk

TRS faces risk in the event that inflation is higher than expected. Inflation is a key driver of the salary increase assumptions (affecting active members) and COLA assumptions (affecting both active members and pensioners/beneficiaries). More granular analysis is not currently available but will be considered in future years.

Longevity Risk

TRS faces risk in its assumption of future mortality rates. Actuarial experience studies were used to develop the base mortality rates assumed in the valuation; Society of Actuaries mortality improvement scale MP-2018 was subsequently applied to these base rates.¹

This scale MP-2018 is an assumption regarding the *improvement* of future mortality rates as compared to mortality when the experience studies were completed. The scale was developed using large amounts of historical data from the Social Security Administration. Risk therefore exists that the mortality improvement inherent in the Plan population is higher than the improvement seen in the population provided by the Social Security Administration.

Furthermore, while the scale uses recent experience to develop short-term mortality improvement rates, an actuarial assumption is applied to long-term mortality improvement rates based on expert opinion. A rate of 1.0% is assumed, which the Society of Actuaries characterizes as “neither overly optimistic nor too pessimistic with respect to future longevity improvements.”² Risk to the Plan exists, however, if Plan mortality experience shows higher levels of long-term mortality improvement; expert opinion can in some cases be flawed, particularly when past experience is not indicative or predictive of future experience.

In a letter dated June 28, 2019, Buck analyzed historical Plan experience and noted “it appears that historical mortality improvement in NYC pensioners has kept pace with, and in some cases may have exceeded slightly, the mortality improvement trends in historical Social Security Administration (SSA) graduated rates that are based on a broad US population” and that “continued use of MP-20xx mortality improvement scales seems reasonable.” It may be prudent in future years, after longer trends can be observed, to quantify the effect of changing the ultimate mortality improvement rate to be higher than 1.0%.

¹ Retirement Plans Experience Committee. “Mortality Improvement Scale MP-2018 Report” *Society of Actuaries*.

² Retirement Plans Experience Committee. “Mortality Improvement Scale BB Report” *Society of Actuaries*.

Low Risk Types

Credit/Solvency Risk

All public pension systems face credit risk in the event their sponsoring entities become unable to pay their debts and obligations. Credit rating agencies currently consider New York City bonds to be of high quality, and the Actuary believes the City and TRS face low solvency risk.

Contribution Risk

Many public pension systems suffer from high contribution risk, wherein sponsoring governmental entities fail to make contributions as determined by the actuary under their funding policies. A recent study found that in 2010, the Annual Required Contribution¹ was not made for over 35% of the 110 public plans in the study.²

The New York City Retirement Systems and Pension Funds face low contribution risk. City benefits are constitutionally protected, and participating employers have historically contributed to the actuarial contribution as certified by the Actuary. The Actuary believes the City will continue to do so in future years. See Table III-5 ACTUARIAL AND STATUTORY CONTRIBUTION HISTORY.

Contribution risk may also increase in future years if the actuarial contribution determined for the Plan grows to be a larger part of the City budget. The five New York City Retirement Systems and Pension Funds currently require contributions of over 10% of the City's annual budget, and contribution risk may increase if this contribution rate becomes untenable.

Agency Risk

Because of long-term asset returns and the gradual amortization of unfunded liabilities, the long-term funded status of the Plan is expected to improve. Many public pension systems suffer from agency risk, wherein different stakeholders or agents want to influence the cost calculations in directions favorable to their interests. Agents may also downplay other risks (e.g. investment risk) to advance specific agendas.

Intergenerational Equity Risk

Intergenerational inequity could exist for certain stakeholders (e.g. public taxpayers). If, for example, liabilities are valued using overly conservative assumptions, aggressive funding patterns may occur, thus causing current taxpayers to shoulder a disproportionately high share of the funding burden, as compared to future taxpayers. The reverse can also be true if aggressive or unrealistic assumptions are used. As the Plan is ongoing, current and future taxpayers should be expected to offer similar funding contributions over the lifetime of the Plan.

¹ As defined at the time in GASB 25/27.

² Shnitser, Natalya. "Funding Discipline for U.S. Public Pension Plans: An Empirical Analysis of Institutional Design." *Iowa Law Review*, Vol. 100 (2015).

In future years of higher funded status, this risk could increase as current taxpayers and plan members may receive preferential treatment over taxpayers and plan members prior to and subsequent to them when considering changes in statute and plan provisions.

SECTION VIII - SUMMARY OF PLAN PROVISIONS

A. Covered Employment

Membership in TRS is open to eligible teachers and administrative personnel employed by the Department of Education and certain employees of New York City Charter Schools and the City University of New York. Membership in TRS may be voluntary or mandated.

B. Tier Membership

Tier membership is based on the date that the member joined TRS. The tier status of earlier membership in TRS or another New York City or New York State public employee retirement system is reflected, but only if the service associated with that membership is purchased and included in Credited Service.

Tier 1: Prior to July 1, 1973

Tier 2: July 1, 1973 through July 26, 1976

Tier 4: July 27, 1976 through March 31, 2012

Tier 6: April 1, 2012

Tier 4 members who joined TRS before September 1, 1983 may elect a Tier 3 benefit. Unless otherwise noted, Tier 1 and Tier 2 provisions are hereafter omitted for brevity.¹ For more information about plan provisions, see the applicable Summary Plan Descriptions at www.trsnyc.org. In the event of a conflict between this summary and applicable law, the applicable laws will govern.

C. Basic Member Contributions (BMC)

Basic Member Contributions earn 5% interest per year compounded annually.

Tier 4: The contribution rate is 3% of Salary. Tier 4 members contribute BMCs for the first 10 years of Service except that members of the Chapter 504 55/27 plan contribute BMCs for the first 27 years of Credited Service.

¹ Less than 0.4% of active members as of June 30, 2017 are members of Tier 1 and Tier 2.

Tier 6: BMC are made for all years of Credited Service according to the following schedule:

Lookback Wages	BMC Contribution Rate
Less than \$45,000	3.00%
\$45,001 up to \$55,000	3.50%
\$55,001 up to \$75,000	4.50%
\$75,001 up to \$100,000	5.75%
Greater than \$100,000	6.00%

The lookback wages used for determining the Tier 6 BMC contribution rate for a plan year are the actual wages earned two plan years prior to the plan year. A projected salary is used during the first 3 years of Credited Service. The BMC contribution rate was limited to 3% from April 1, 2012 through March 31, 2013.

D. Additional Member Contributions (AMC)

Additional Member Contributions earn 5% interest per year, compounded annually.

Tier 4: Members of the Basic 62/5 plan do not make AMC. For other Tier 4 members, the AMC contribution rate is 1.85% of Salary and are made in accordance with the following schedule:

Plan Description	AMC Contribution Rate	Years Required
Chapter 19 55/25	1.85%	25
Chapter 19 55/27	1.85%	27
Chapter 504 55/27 plan	1.85%	All years

Tier 6: Members of the 63/10 plan do not make AMC.

E. Credited Service

Credited Service is comprised of Membership Service, Prior Service, Amman Service, Transferred Service, Part-time Service, and Military Service:

- **Membership Service:** Service earned while a member of TRS.
- **Prior Service:** Any creditable service earned as an employee of New York City or New York State before joining TRS that was not transferred to TRS.
- **Amman Service:** Creditable service earned as a regular substitute teacher and/or for per diem employment during a leave of absence or after separating from service.
- **Transferred Service:** Service earned as a member of another public retirement system in the City or State of New York.

- **Part-time Service:** Service that is prorated based on the number of hours or days worked in the year.
- **Military Service:** Service for qualified time served in one of the armed forces of the United States.

Prior Service, Amman Service, Transferred Service, and Military Service must be purchased to count as Credited Service. Payments made for purchasing Military Service are considered Employer contributions.

F. Salary

Salary is based on the annual wages earned in covered employment including overtime pay. Some limitations apply for the Salary used to determine Final Average Salary (FAS).

Tier 4: Wages greater than 110% of the average of the previous two years are excluded for purposes of determining Final Average Salary.

Tier 6: Wages greater than 110% of the average of the previous four years are excluded for purposes of determining Final Average Salary. In addition, the following payments are also excluded from wages for purposes of determining Final Average Salary:

1. Wages greater than the annual salary paid to the Governor of the State of New York;
2. Lump sum payments for deferred compensation, sick leave, accumulated vacation or other credits for time not worked;
3. Overtime greater than the overtime ceiling of \$15,000, effective April 1, 2012 and indexed annually by the Consumer Price Index (CPI-U);
4. Any form of termination pay;
5. Any additional compensation paid in anticipation of retirement; and
6. In the case of employees who receive wages from three or more employers in a twelve-month period, the wages paid by the third and each successive employer.

G. Final Average Salary (FAS)

Service retirement, early retirement, disability retirement, and vested retirement benefits are based on Final Average Salary (FAS).

Tier 4: FAS is the highest average Salary earned in any three consecutive years or in the final 36 months of employment (excluding periods while on an authorized leave of absence at partial pay or no pay) if greater.

Tier 6: FAS is the highest average Salary earned in any five consecutive years or in the final 60 months of employment (excluding periods while on an authorized leave of absence at partial pay or no pay) if greater.

H. Service Retirement

1. Eligibility: The eligibility requirements for an unreduced service retirement benefit are summarized in the table below:

Tier	Plan Description	Minimum Age	Minimum Service
4	Basic 62/5 Plan	Earlier of Age 55 with 30 years of Service And Age 62 with 5 years of Service	
4	Chapter 19 55/25	55	25
4	Chapter 19 55/27	55	27
4	Chapter 504 55/27 plan	55	27
6	Basic 63/10 Plan	63	10

2. Benefits:

- a. Tier 4 Plans:

- i. Less than 20 years of Credited Service: 1/60 times FAS times Credited Service;
- ii. 20 or more years of Credited Service: Sum of 2.0% times FAS times Credited Service up to 30 years plus 1.5% times FAS times Credited Service in excess of 30 years.

- b. Basic Tier 6 63/10 Plan:

- i. 20 years of Credited Service: 1/60 times FAS times Credited Service;
- ii. 20 or more years of Credited Service: Sum of 35% times FAS plus 2.0% times FAS times Credited Service in excess of 20 years.

- c. Annuity Savings Accumulation Fund (ASAF):

- i. Annuitized value of the ASAF balance, if any, is added to the benefit.

I. Early Retirement

1. Eligibility: The eligibility requirements for early retirement plans are summarized in the table below:

Tier	Plan Description	Minimum Age	Minimum Service
4	All Tier 4 plans except the Chapter 504 55/27 plan	55	5
4	Chapter 504 55/27	55	10
6	Basic 63/10 plan	55	10

2. Benefits:

The service retirement benefit is reduced for early retirement based on the age at commencement.

a. Tier 4 Basic 62/5 Plan:

The service retirement benefit is reduced by 0.50% for each of the first 24 months that the age at commencement precedes age 62, and further reduced 0.25% for each of the next 60 months that the age of commencement precedes age 60. Tier 4 members with Tier 3 rights may elect early retirement based on the provisions of the Tier 3 Basic 62/5 Plan.

b. Tier 6 Basic 63/10 Plan:

The service retirement benefit is reduced by $\frac{13}{2400}$ for each month (i.e. 6.5% per year) that the age of commencement precedes age 63.

c. Annuity Savings Accumulation Fund (ASAF):

The annuitized value of the ASAF balance, if any, is added to the benefit.

J. Disability Retirement

1. Accidental Disability (ADR)

- a. Eligibility: Accident in the performance of duties while a member.
- b. Benefits: Greater of $\frac{1}{60}$ times FAS times Credited Service or $\frac{2}{3}$ times FAS. The member may elect a service retirement benefit, if eligible.

2. Ordinary Disability (ODR)

- a. Eligibility: 10 years of Credited Service.
- b. Benefits: Greater of $1/60$ times FAS times Credited Service or $1/3$ times FAS. The member may elect a service retirement benefit, if eligible.

3. Annuity Savings Accumulation Fund (ASAF):

The annuitized value of the ASAF balance, if any, is added to the benefit.

K. Death Benefits

1. Accidental Death Benefits – Active Members

- a. Eligibility: Death due to the performance of duties while an active member.
- b. Benefits: A monthly pension is payable to the beneficiary equal to 50% of annual wages earned during the year prior to death. The benefit is based on 50% of the annual wage rate if the member had less than one year of Credited Service.

2. Ordinary Death Benefits

- a. Eligibility:
 - i. Active members: Death while not in the performance of duties.
 - ii. Terminated vested and retired members: All.
- b. Benefits:
 - i. Active members: Refund of BMC and the employee portion of AMC, if any, with interest plus a salary-based death benefit. The salary-based death benefit is equal to one year's wages times completed years of Credited Service up to 3 years. The salary-based portion of the death benefit is reduced 5% for each year the member remains in service beyond age 60 (to a maximum reduction of 50% at age 70).
 - ii. Terminated vested members with 10 or more years of Credited Service: Refund of BMC and the employee portion of AMC, if any, with interest plus one half of the salary-based death benefit that would have been payable had the member died on the last day of active service as described above.

- iii. Terminated vested members with less than 10 years of Credited Service: Refund of BMC and the employee portion of AMC, if any, with interest.
- iv. Retirees: Ordinary Death benefit that would have been payable had the member died the day before retirement times an Adjustment Factor described in the table below:

Year of Death	Adjustment Factor
Post-retirement - 1 st year	50%
Post-retirement - 2 nd year	25%
Post-retirement - 3 rd year and from then on	10% times the benefit in effect at age 60 or at retirement if earlier

- c. Form of Payment: Lump sum.

L. Vested Retirement After Termination

1. Eligibility:

- a. Tier 4 Chapter 504 55/27 plan: 10 years of Credited Service.
- b. All other Tier 4 plans: 5 years of Credited Service.
- c. Tier 6 plan: 10 years of Credited Service.

2. Benefits:

- a. Tier 4 plans:

A vested member may elect a service retirement benefit payable at age 62 or an early retirement benefit payable as early as age 55. The eligibility and benefit provisions for a benefit that commences prior to age 62 are the same as those for early retirement except that benefits are unreduced at age 55 if the member has earned the minimum service required for a Service Retirement benefit shown in part H of this section.

- b. Tier 6 Plan:

The service retirement benefit is payable at age 63, but in no cases can be less than the annuity equivalent of the BMC.

3. Annuity Savings Accumulation Fund (ASAF):

The annuitized value of the ASAF balance, if any, is added to the benefit.

M. Forms of Payment

1. Normal Form of Payment: Single Life Annuity
2. Optional Forms of Payment: Joint and Survivor Annuities, Certain and Life Annuities, and Pop-up Annuities.

Optional forms of payment are reduced to provide a benefit that is actuarially equivalent to the Normal Form of Payment (Single Life Annuity).

N. Cost of Living Adjustments (COLA)

Annuity payments are increased annually on September 1st, but only after a pensioner has attained the applicable eligibility threshold. Some beneficiaries are not eligible for COLA increases. The COLA increase is equal to a base benefit times a COLA percentage. The COLA increase for a spouse receiving a joint & survivor annuity is one half of the COLA increase that would have been applicable to the member had he or she survived.

1. Eligibility Thresholds:
 - a. Service Retirement and Vested Retirement: The earlier of (i) and (ii):
 - i. Attainment of age 62 and 5 years since commencement
 - ii. Attainment of age 55 and 10 years since commencement
 - b. Disability Retirement: 5 years since commencement
 - c. Beneficiaries of an Accidental Death benefit: 5 years since commencement
2. Eligible beneficiaries: Spouses receiving a joint & survivor annuity. All others are non-eligible.
3. Base Benefit: The lesser of \$18,000 and the maximum retirement allowance plus the sum of prior years' COLA increases.
4. COLA percentage: 50% of the Consumer Price Index (CPI-U), not less than 1.0% and not greater than 3.0%.

O. Refund of BMC and AMC

Refunded with interest under some circumstances. Only the employee portion of AMC are refunded.

1. Employee Portion of AMC: The employee portion of AMC is 50% for all plans that require AMC.
2. Non-vested termination: BMC and employee portion of AMC are refunded with interest.
3. Vested termination: A member may elect a refund of BMC and the employee portion of AMC with interest in lieu of a pension benefit, but only if he or she has less than 10 years of Credited Service.
4. Ordinary death: BMC and the employee portion of AMC are refunded with interest.
5. Accidental death: The employee portion of AMC are refunded with interest.
6. Disability retirement: The employee portion of AMC are refunded with interest.
7. Service retirement: The employee portion of AMC are refunded with interest if the member retires on or after age 62.

P. Service and Early Retirement for Tier 1 and Tier 2 Members

1. Eligibility:
 - a. Tier 1: Age 55
 - b. Tier 2: Age 55 and 5 years of Credited Service
2. Benefits:
 - a. 50% times FAS, plus 1.70% times FAS times Credited Service greater than 20 years plus the annuity equivalent of employee contributions in excess of required contributions until the later of age 55 and the attainment of 25 years of Credited Service; or
 - b. 1.20% times FAS times Credited earned prior to 7/1/1970 plus 1.53% times FAS times Credited Service earned from 7/1/1970 plus the annuity equivalent of employee contributions for less than 25 years of Credited Service.

3. FAS:

1-year final average salary for Tier 1 members and 3-year final average salary for Tier 2 members.

4. Early Commencement:

Tier 2 benefits are reduced for early commencement prior to age 62 based on the same factors applicable to the Basic Tier 4 62/5 plan.

5. COLA:

Retirement benefits are increased by the same COLA applicable to Tier 4 retirement benefits.

Q. Service and Early Retirement for Tier 4 Members with Tier 3 Rights

1. Eligibility:

- a. Age 55 and 5 years of Credited Service.

2. Benefits:

- a. Tier 4 members with Tier 3 rights may elect a Tier 3 benefit instead of a Tier 4 benefit. The benefit formula for Tier 3 is the same as the benefit formula for the Tier 4 Basic 62/5 plan except that:
 - i. Credited Service under the Tier 3 benefit formula is capped at 30 years
 - ii. The Tier 3 benefit formula includes an offset starting at age 62 equal to 50% of the Primary Social Security benefit, and
 - iii. The Tier 3 reduction factors for early commencement are less than the factors applicable to the Basic Tier 4 62/5 plan.

3. COLA and Escalation:

The COLA provisions applicable to Tier 4 retirement benefits are not applicable to Tier 3 retirement benefits.

Tier 3 retirement benefits may be adjusted annually by escalation. Benefits commencing on or after age 65 are eligible for full escalation. Full escalation is equal to the lesser of 3% and the Consumer Price Index (CPI-U) for increases in the CPI-U and the greater of -3% and the Consumer Price Index (CPI-U) for decreases in the CPI-U. Partial escalation is applicable for benefits commencing after age 62. Partial

escalation is equal to full escalation reduced by 1/36 times the number of months that the age at commencement precedes age 65. A Tier 3 retirement benefit cannot be less than the Tier 3 retirement benefit without escalation.

R. Loans

A member may borrow up to 75% of the accumulated BMC with interest. A member's unpaid loan balance will reduce his or her retirement benefit.

S. Tax-deferred Annuity Program (TDA)

Members may elect to make voluntary employee contributions to the TRS TDA. A member's contributions to a TDA account are capped by the dollar limitations under §402(g)(1) of the Internal Revenue Code on the exclusion for elective deferrals described in §402(g)(3) and the dollar limitation under §414(v)(2)(B)(i) of the Internal Revenue Code for catch-up contributions for members who have attained aged 50.

A member may withdraw his or her TDA account balance as a lump sum or convert the total accumulated balance into an annuity upon retirement.

T. Changes Since the Prior Valuation

None.

SECTION IX - CHAPTER AMENDMENTS

The Chapter amendments enacted during the past five years that had a significant impact on the June 30, 2017 (Lag) actuarial valuation results include:

- **Chapter 41 of the Laws of 2016** (Chapter 41/16) provides up to three years of service credit to members of public retirement systems of the State of New York for military service. Chapter 41/16 removes the requirement that such military service occur during specified periods of hostilities.
- **Chapter 438 of the Laws of 2016** (Chapter 438/16), enacted on November 14, 2016, amended Retirement and Social Security Law Section 43 to eliminate restrictions upon transferring between public retirement systems.
- **Chapter 510 of the Laws of 2015** (Chapter 510/15), clarifies for Tier 6 the definition of multiple employers for the purpose of exclusion of wages and changes the plan year for contributions from plan year April 1 to March 31 to plan year January 1 to December 31.
- **Chapter 427 of the Laws of 2014** (Chapter 427/14), amended Military Law Section 243-d, effective November 4, 2014, to provide non-contributory retirement service credit for members of the New York City Retirement Systems called to active military duty on or after September 11, 2001 and prior to January 1, 2006 who did not receive his or her full salary from a participating employer and is otherwise eligible to receive retirement service credit for such service.
- **Chapter 489 of the Laws of 2013** (Chapter 489/13) addressed limitations in existing disability provisions intended to protect public employees who suffered injuries or illnesses in WTC rescue, recovery, and cleanup operations.
- **Chapter 3 of the Laws of 2013** (Chapter 3/13), effective retroactive to July 1, 2011, enacted new actuarial assumptions and methods that require State legislation.
- **Chapter 18 of the Laws of 2012** (Chapter 18/12), placed certain limitations on the Tier 3 and Tier 4 benefits available to participants hired on and after April 1, 2012 in most New York State Public Employee Retirement Systems, including TRS, and is generally referred to as Tier 6.

SECTION X - SUBSEQUENT EVENTS

The Board of Trustees, based on recommendations of the Actuary, adopted new factors that provide the adjustment necessary for a retiree to choose an alternative form of benefit payment that is actuarially equivalent to the benefit payable for only the retiree's own lifetime (i.e. Maximum Retirement Allowance). The new Option Factors are effective for retirements on and after April 1, 2019 and produce, in almost all cases, a benefit that is greater than the benefit provided under the prior set of Option Factors.

For virtually all retirees who would have elected an Optional Retirement Allowance prior to these new Option Factors and were to elect an Optional Retirement Allowance under the new Option Factors, there will be a reduction in the actuarial gains. For those retirees who would have declined an Optional Retirement Allowance, but would now elect an Optional Retirement Allowance in light of more favorable new factors, no additional cost is expected.

SECTION XI - ACTUARIAL ASSUMPTIONS AND METHODS

The Actuary issued a Report entitled, "Proposed Changes in Actuarial Assumptions and Methods Used in Determining Employer Contributions for Fiscal Years Beginning on and After July 1, 2018 for the New York City Teachers' Retirement System," dated January 17, 2019. The actuarial assumptions and methods described in that report were adopted by the Board of Trustees at the February 28, 2019 Board meeting and are referred to as the "2019 A&M."

The actuarial assumptions and a description of the actuarial methods follow.

Table XI-1
Active Retirement Rates

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM					
PROBABILITIES OF SERVICE RETIREMENT					
Age	Reduced Service Retirement	Unreduced Service Retirement Probabilities For Members Who Did Not Elect an Improved Retirement Program		Unreduced Service Retirement Probabilities For Members Who Did Elect an Improved Retirement Program	
		Year 1	Ultimate	Year 1	Ultimate
55	2.50%	18.00%	0.00%	37.50%	0.00%
56	2.50%	18.00%	20.00%	37.50%	22.00%
57	2.50%	18.00%	20.00%	37.50%	22.00%
58	2.50%	18.00%	20.00%	37.50%	22.00%
59	3.75%	18.00%	20.00%	37.50%	22.00%
60	5.00%	18.00%	20.00%	37.50%	22.00%
61	6.25%	18.00%	20.00%	37.50%	22.00%
62	7.50% *	27.00%/18.00% **	20.00%	50.00%	33.00%
63	0.00%	18.00%/27.00% ***	20.00%	37.50%	22.00%
64	0.00%	18.00%	20.00%	37.50%	22.00%
65	0.00%	27.00%	20.00%	50.00%	33.00%
66	0.00%	18.00%	20.00%	37.50%	22.00%
67	0.00%	18.00%	20.00%	37.50%	22.00%
68	0.00%	18.00%	20.00%	37.50%	22.00%
69	0.00%	18.00%	20.00%	37.50%	22.00%
70	0.00%	20.00%	20.00%	37.50%	22.00%
71	0.00%	20.00%	20.00%	37.50%	22.00%
72	0.00%	20.00%	20.00%	37.50%	22.00%
73	0.00%	20.00%	20.00%	37.50%	22.00%
74	0.00%	20.00%	20.00%	37.50%	22.00%
75	0.00%	20.00%	20.00%	37.50%	22.00%
76	0.00%	20.00%	20.00%	37.50%	22.00%
77	0.00%	20.00%	20.00%	37.50%	22.00%
78	0.00%	20.00%	20.00%	37.50%	22.00%
79	0.00%	20.00%	20.00%	37.50%	22.00%
80+	N/A	100.00%	100.00%	100.00%	100.00%

* 7.50% only applies to Tier 6 members; 0.00% otherwise.

** 27.00% for Tier 1, 2, & 4 members and 18.00% for Tier 6 members.

*** 18.00% for Tier 1, 2, & 4 members and 27.00% for Tier 6 members.

Table XI-2
Active Termination Rates

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM	
PROBABILITIES OF TERMINATION	
Years of Service	Probability of Termination
0	9.00%
1	8.00%
2	7.00%
3	6.00%
4	5.00%
5	4.00%
6	3.50%
7	3.05%
8	2.65%
9	2.30%
10	2.00%
11	1.75%
12	1.55%
13	1.40%
14	1.30%
15	1.25%
16	1.20%
17	1.15%
18	1.10%
19	1.05%
20	1.00%
21	0.90%
22	0.80%
23	0.70%
24	0.60%
25+	0.50%

Table XI-3
Active Disability Rates

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM				
PROBABILITIES OF DISABILITY RETIREMENT				
	Ordinary Disability		Accidental Disability	
Age	Males	Females	Males	Females
15	0.01%	0.01%	0.00%	0.00%
16	0.01%	0.01%	0.00%	0.00%
17	0.01%	0.01%	0.00%	0.00%
18	0.01%	0.01%	0.00%	0.00%
19	0.01%	0.01%	0.00%	0.00%
20	0.01%	0.01%	0.00%	0.00%
21	0.01%	0.01%	0.00%	0.00%
22	0.01%	0.01%	0.00%	0.00%
23	0.01%	0.01%	0.00%	0.00%
24	0.01%	0.01%	0.00%	0.00%
25	0.01%	0.01%	0.00%	0.00%
26	0.01%	0.01%	0.00%	0.00%
27	0.01%	0.01%	0.00%	0.00%
28	0.01%	0.01%	0.00%	0.00%
29	0.01%	0.01%	0.00%	0.00%
30	0.01%	0.01%	0.00%	0.00%
31	0.02%	0.01%	0.00%	0.00%
32	0.03%	0.02%	0.00%	0.00%
33	0.04%	0.03%	0.01%	0.00%
34	0.05%	0.04%	0.01%	0.00%
35	0.06%	0.05%	0.01%	0.01%
36	0.07%	0.06%	0.01%	0.01%
37	0.08%	0.07%	0.01%	0.01%
38	0.08%	0.08%	0.02%	0.01%
39	0.09%	0.09%	0.02%	0.01%
40	0.10%	0.10%	0.02%	0.01%
41	0.11%	0.11%	0.02%	0.01%
42	0.12%	0.12%	0.02%	0.01%
43	0.13%	0.13%	0.02%	0.02%
44	0.14%	0.14%	0.02%	0.02%
45	0.15%	0.15%	0.03%	0.02%
46	0.15%	0.16%	0.03%	0.02%
47	0.15%	0.17%	0.03%	0.02%
48	0.15%	0.18%	0.03%	0.03%
49	0.15%	0.19%	0.03%	0.03%
50	0.15%	0.20%	0.03%	0.03%
51	0.15%	0.20%	0.03%	0.03%
52	0.15%	0.20%	0.03%	0.03%
53	0.15%	0.20%	0.03%	0.03%
54	0.15%	0.20%	0.03%	0.03%
55	0.15%	0.20%	0.04%	0.04%
56	0.15%	0.20%	0.04%	0.04%
57	0.15%	0.20%	0.04%	0.04%
58	0.15%	0.20%	0.04%	0.04%
59	0.15%	0.20%	0.04%	0.04%
60	0.15%	0.20%	0.04%	0.04%
61	0.15%	0.20%	0.04%	0.04%
62	0.15%	0.20%	0.04%	0.04%
63	0.15%	0.20%	0.04%	0.04%
64	0.15%	0.20%	0.04%	0.04%
65	0.15%	0.20%	0.04%	0.04%
66	0.15%	0.20%	0.04%	0.04%
67	0.15%	0.20%	0.04%	0.04%
68	0.15%	0.20%	0.04%	0.04%
69	0.15%	0.20%	0.04%	0.04%
70	0.15%	0.20%	0.04%	0.04%
71	0.15%	0.20%	0.04%	0.04%
72	0.15%	0.20%	0.04%	0.04%
73	0.15%	0.20%	0.04%	0.04%
74	0.15%	0.20%	0.04%	0.04%
75	0.15%	0.20%	0.04%	0.04%
76	0.15%	0.20%	0.04%	0.04%
77	0.15%	0.20%	0.04%	0.04%
78	0.15%	0.20%	0.04%	0.04%
79	0.15%	0.20%	0.04%	0.04%
80+	N/A	N/A	N/A	N/A

Table XI-4
Active Mortality Rates

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM			
PROBABILITIES OF MORTALITY FOR ACTIVE MEMBERS			
Age	Ordinary Death		Accidental Death
	Males	Females	
15	0.040%	0.025%	0.000%
16	0.040%	0.025%	0.000%
17	0.040%	0.025%	0.000%
18	0.040%	0.025%	0.000%
19	0.040%	0.025%	0.000%
20	0.040%	0.025%	0.000%
21	0.040%	0.025%	0.000%
22	0.040%	0.025%	0.000%
23	0.040%	0.025%	0.000%
24	0.040%	0.025%	0.000%
25	0.040%	0.025%	0.000%
26	0.040%	0.025%	0.000%
27	0.040%	0.025%	0.000%
28	0.040%	0.025%	0.000%
29	0.040%	0.025%	0.000%
30	0.040%	0.025%	0.000%
31	0.042%	0.026%	0.000%
32	0.044%	0.028%	0.000%
33	0.046%	0.029%	0.000%
34	0.048%	0.030%	0.000%
35	0.050%	0.031%	0.000%
36	0.052%	0.033%	0.000%
37	0.054%	0.034%	0.000%
38	0.056%	0.035%	0.000%
39	0.058%	0.036%	0.000%
40	0.060%	0.038%	0.000%
41	0.070%	0.044%	0.000%
42	0.080%	0.050%	0.000%
43	0.090%	0.056%	0.000%
44	0.100%	0.063%	0.000%
45	0.110%	0.069%	0.000%
46	0.120%	0.075%	0.000%
47	0.130%	0.081%	0.000%
48	0.140%	0.088%	0.000%
49	0.150%	0.094%	0.000%
50	0.160%	0.100%	0.000%
51	0.170%	0.106%	0.000%
52	0.180%	0.113%	0.000%
53	0.190%	0.119%	0.000%
54	0.200%	0.125%	0.000%
55	0.210%	0.131%	0.000%
56	0.220%	0.138%	0.000%
57	0.230%	0.144%	0.000%
58	0.240%	0.150%	0.000%
59	0.250%	0.156%	0.000%
60	0.260%	0.163%	0.000%
61	0.270%	0.169%	0.000%
62	0.280%	0.175%	0.000%
63	0.290%	0.181%	0.000%
64	0.300%	0.188%	0.000%
65	0.320%	0.200%	0.000%
66	0.350%	0.219%	0.000%
67	0.390%	0.244%	0.000%
68	0.440%	0.275%	0.000%
69	0.500%	0.313%	0.000%
70	0.540%	0.350%	0.000%
71	0.600%	0.388%	0.000%
72	0.650%	0.425%	0.000%
73	0.700%	0.463%	0.000%
74	0.750%	0.525%	0.000%
75	0.800%	0.588%	0.000%
76	0.890%	0.650%	0.000%
77	0.980%	0.713%	0.000%
78	1.070%	0.775%	0.000%
79	1.160%	0.925%	0.000%
80+	N/A	N/A	N/A

Table XI-5
Service Retiree Mortality

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM					
PROBABILITIES OF MORTALITY FOR SERVICE RETIREES					
Age	Males	Females	Age	Males	Females
15	0.0108%	0.0105%	68	1.3827%	0.8399%
16	0.0146%	0.0128%	69	1.5070%	0.8992%
17	0.0197%	0.0140%	70	1.6306%	0.9855%
18	0.0222%	0.0145%	71	1.7953%	1.1072%
19	0.0235%	0.0151%	72	1.9579%	1.2311%
20	0.0246%	0.0153%	73	2.1191%	1.3549%
21	0.0263%	0.0162%	74	2.2784%	1.4775%
22	0.0278%	0.0171%	75	2.4370%	1.5961%
23	0.0295%	0.0181%	76	2.7233%	1.8356%
24	0.0309%	0.0193%	77	3.0074%	2.0765%
25	0.0320%	0.0206%	78	3.2885%	2.3162%
26	0.0335%	0.0220%	79	3.5677%	2.5533%
27	0.0347%	0.0234%	80	3.8824%	2.7842%
28	0.0364%	0.0249%	81	4.4474%	3.3221%
29	0.0386%	0.0267%	82	5.0193%	3.8708%
30	0.0418%	0.0286%	83	5.5977%	4.4089%
31	0.0476%	0.0348%	84	6.1798%	5.0027%
32	0.0532%	0.0401%	85	6.7676%	5.5878%
33	0.0583%	0.0449%	86	7.7139%	6.2981%
34	0.0629%	0.0489%	87	8.6843%	6.9333%
35	0.0673%	0.0527%	88	9.6857%	7.5758%
36	0.0698%	0.0557%	89	10.7135%	8.5620%
37	0.0720%	0.0591%	90	11.7744%	9.6778%
38	0.0745%	0.0626%	91	13.6049%	10.8390%
39	0.0782%	0.0672%	92	15.5105%	11.9717%
40	0.0837%	0.0726%	93	17.4679%	13.1425%
41	0.0941%	0.0775%	94	19.5105%	15.1670%
42	0.1051%	0.0838%	95	21.6689%	17.3761%
43	0.1167%	0.0918%	96	23.7343%	19.5275%
44	0.1294%	0.1013%	97	25.7571%	21.6213%
45	0.1432%	0.1132%	98	27.8633%	23.3643%
46	0.1582%	0.1271%	99	29.8272%	23.8705%
47	0.1744%	0.1429%	100	31.5152%	23.9898%
48	0.1918%	0.1597%	101	33.0771%	24.9134%
49	0.2102%	0.1774%	102	34.4234%	26.0067%
50	0.2317%	0.1950%	103	35.6398%	27.2992%
51	0.2657%	0.2130%	104	36.6357%	28.7614%
52	0.3011%	0.2304%	105	37.3430%	30.3385%
53	0.3373%	0.2472%	106	37.7004%	31.9944%
54	0.3744%	0.2638%	107	37.8599%	33.6898%
55	0.4112%	0.2806%	108	38.0314%	35.3785%
56	0.4578%	0.3034%	109	38.1998%	37.0129%
57	0.5025%	0.3264%	110	50.0000%	50.0000%
58	0.5448%	0.3498%	111	50.0000%	50.0000%
59	0.5843%	0.3732%	112	50.0000%	50.0000%
60	0.6211%	0.3973%	113	50.0000%	50.0000%
61	0.7018%	0.4321%	114	50.0000%	50.0000%
62	0.7804%	0.4686%	115	50.0000%	50.0000%
63	0.8588%	0.5072%	116	50.0000%	50.0000%
64	0.9371%	0.5479%	117	50.0000%	50.0000%
65	0.9994%	0.5912%	118	50.0000%	50.0000%
66	1.1295%	0.6619%	119	50.0000%	50.0000%
67	1.2569%	0.7367%	120	100.0000%	100.0000%

Table XI-6
Disabled Retiree Mortality

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM					
PROBABILITIES OF MORTALITY FOR DISABLED RETIREES					
Age	Males	Females	Age	Males	Females
15	0.3819%	0.3483%	68	2.8007%	2.0012%
16	0.5167%	0.4712%	69	2.8946%	2.0043%
17	0.6964%	0.5141%	70	3.0268%	2.0073%
18	0.7863%	0.5351%	71	3.1148%	2.0103%
19	0.8312%	0.5569%	72	3.2684%	2.1811%
20	0.8353%	0.5649%	73	3.3926%	2.3760%
21	0.8659%	0.5961%	74	3.5875%	2.5968%
22	0.8978%	0.6295%	75	3.7271%	2.8417%
23	0.9464%	0.6597%	76	3.9657%	3.0808%
24	0.9977%	0.6908%	77	4.2691%	3.3373%
25	1.0424%	0.7150%	78	4.5349%	3.6085%
26	1.0960%	0.7387%	79	4.8252%	3.8944%
27	1.1348%	0.7520%	80	5.1378%	4.1909%
28	1.1774%	0.7625%	81	5.6917%	4.6921%
29	1.2163%	0.7686%	82	6.2841%	5.1536%
30	1.2878%	0.7763%	83	6.8835%	5.5061%
31	1.3554%	0.9885%	84	7.7954%	6.1180%
32	1.3755%	1.1922%	85	8.8286%	6.7342%
33	1.3953%	1.3874%	86	9.9032%	7.3088%
34	1.4153%	1.3942%	87	10.8837%	8.2536%
35	1.4357%	1.4012%	88	11.9567%	9.3264%
36	1.4563%	1.4082%	89	13.8059%	10.3734%
37	1.4772%	1.4152%	90	15.7270%	11.4459%
38	1.4985%	1.4223%	91	17.7012%	12.6271%
39	1.5200%	1.4294%	92	19.6428%	14.1350%
40	1.5418%	1.4366%	93	21.9234%	15.4424%
41	1.5640%	1.4436%	94	24.0761%	16.9560%
42	1.5865%	1.4509%	95	26.0577%	18.4261%
43	1.6093%	1.4581%	96	28.3614%	20.1727%
44	1.6324%	1.4654%	97	30.3483%	21.6213%
45	1.6559%	1.5299%	98	31.8739%	23.3643%
46	1.6797%	1.6016%	99	33.6652%	23.8705%
47	1.7038%	1.6623%	100	35.0392%	23.9898%
48	1.7283%	1.7238%	101	36.0496%	24.9134%
49	1.7531%	1.7485%	102	37.0460%	26.0067%
50	1.7783%	1.7736%	103	37.7767%	27.2992%
51	1.8039%	1.7991%	104	38.1460%	28.7614%
52	1.9408%	1.8530%	105	38.3076%	30.3385%
53	2.0713%	1.8909%	106	38.4698%	31.9944%
54	2.2040%	1.9173%	107	38.6325%	33.6898%
55	2.3207%	1.9622%	108	38.8076%	35.3785%
56	2.4304%	1.9652%	109	38.9794%	37.0129%
57	2.4937%	1.9681%	110	50.0000%	50.0000%
58	2.5070%	1.9711%	111	50.0000%	50.0000%
59	2.5245%	1.9741%	112	50.0000%	50.0000%
60	2.5362%	1.9770%	113	50.0000%	50.0000%
61	2.5394%	1.9801%	114	50.0000%	50.0000%
62	2.5426%	1.9831%	115	50.0000%	50.0000%
63	2.5480%	1.9861%	116	50.0000%	50.0000%
64	2.5797%	1.9891%	117	50.0000%	50.0000%
65	2.6258%	1.9921%	118	50.0000%	50.0000%
66	2.6510%	1.9951%	119	50.0000%	50.0000%
67	2.7083%	1.9982%	120	100.0000%	100.0000%

Table XI-7
Beneficiary Mortality

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM					
PROBABILITIES OF MORTALITY FOR BENEFICIARIES					
Age	Males	Females	Age	Males	Females
15	0.0105%	0.0092%	68	1.8256%	1.3605%
16	0.0142%	0.0112%	69	1.9386%	1.4332%
17	0.0191%	0.0122%	70	2.0542%	1.5007%
18	0.0222%	0.0133%	71	2.2359%	1.6745%
19	0.0240%	0.0143%	72	2.4230%	1.8463%
20	0.0251%	0.0145%	73	2.6165%	2.0157%
21	0.0268%	0.0153%	74	2.8157%	2.1838%
22	0.0284%	0.0161%	75	3.0220%	2.3492%
23	0.0301%	0.0171%	76	3.4928%	2.6652%
24	0.0315%	0.0183%	77	3.9787%	2.9831%
25	0.0327%	0.0195%	78	4.4792%	3.3011%
26	0.0342%	0.0208%	79	4.9963%	3.6207%
27	0.0354%	0.0221%	80	5.5282%	3.9391%
28	0.0371%	0.0236%	81	6.1051%	4.4386%
29	0.0394%	0.0252%	82	6.6894%	4.9473%
30	0.0427%	0.0270%	83	7.2805%	5.4665%
31	0.0495%	0.0330%	84	7.8749%	5.9942%
32	0.0562%	0.0384%	85	8.4753%	6.5354%
33	0.0625%	0.0431%	86	9.6136%	7.4659%
34	0.0682%	0.0471%	87	10.8005%	8.3995%
35	0.0743%	0.0511%	88	12.0443%	9.3428%
36	0.0780%	0.0542%	89	13.3397%	10.2918%
37	0.0818%	0.0579%	90	14.6958%	11.2477%
38	0.0861%	0.0618%	91	16.4185%	12.8868%
39	0.0917%	0.0666%	92	18.1416%	14.4887%
40	0.0997%	0.0719%	93	19.8574%	16.0801%
41	0.1394%	0.0775%	94	21.6187%	17.5854%
42	0.1774%	0.0859%	95	23.5884%	19.0626%
43	0.2143%	0.0968%	96	25.4266%	20.2474%
44	0.2507%	0.1111%	97	27.2119%	21.2937%
45	0.2875%	0.1287%	98	29.0202%	22.0663%
46	0.3207%	0.1501%	99	30.6654%	22.5443%
47	0.3534%	0.1748%	100	32.1584%	22.6473%
48	0.3849%	0.2022%	101	33.7521%	23.5294%
49	0.4150%	0.2319%	102	35.1259%	24.5619%
50	0.4431%	0.2633%	103	36.3671%	25.7825%
51	0.5156%	0.2999%	104	37.3834%	27.1635%
52	0.5928%	0.3376%	105	38.1051%	28.6530%
53	0.6740%	0.3762%	106	38.4698%	30.2169%
54	0.7583%	0.4151%	107	38.6325%	31.8182%
55	0.8440%	0.4540%	108	38.8076%	33.4131%
56	0.9048%	0.5132%	109	38.9794%	34.9566%
57	0.9604%	0.5735%	110	50.0000%	50.0000%
58	1.0101%	0.6353%	111	50.0000%	50.0000%
59	1.0536%	0.6981%	112	50.0000%	50.0000%
60	1.0919%	0.7631%	113	50.0000%	50.0000%
61	1.1835%	0.8329%	114	50.0000%	50.0000%
62	1.2676%	0.8908%	115	50.0000%	50.0000%
63	1.3473%	0.9493%	116	50.0000%	50.0000%
64	1.4238%	1.0146%	117	50.0000%	50.0000%
65	1.4985%	1.0876%	118	50.0000%	50.0000%
66	1.6059%	1.1681%	119	50.0000%	50.0000%
67	1.7146%	1.2609%	120	100.0000%	100.0000%

Table XI-8
Salary Scale

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM		
ANNUAL RATES OF MERIT AND SALARY INCREASE		
Years of Service	Merit Increase	Salary Increase*
0	10.00%	13.00%
1	8.00%	11.00%
2	6.00%	9.00%
3	5.00%	8.00%
4	6.00%	9.00%
5	5.00%	8.00%
6	5.00%	8.00%
7	4.00%	7.00%
8	2.00%	5.00%
9	5.00%	8.00%
10	1.00%	4.00%
11	1.00%	4.00%
12	3.00%	6.00%
13	1.00%	4.00%
14	5.00%	8.00%
15	1.00%	4.00%
16	1.00%	4.00%
17	2.00%	5.00%
18	1.00%	4.00%
19	9.00%	12.00%
20	1.00%	4.00%
21	5.00%	8.00%
22+	1.00%	4.00%

*Salary Increase is the General Wage Increase of 3.00% plus the Merit Increase.

Additional Assumptions and Methods

1. **Post-commencement Mortality Assumption:** The service retiree mortality, disabled retiree mortality, and beneficiary mortality base tables are projected from 2012 using mortality improvement scale MP-2018. The base tables are also multiplied by adjustment factors to convert them from lives-weighted to amounts-weighted tables to account for socioeconomic effects on mortality. The adjustment factors used are as follows:

	Adjustment Factor	
	Male	Female
Service Retiree	0.908	0.944
Disabled Retiree	0.940	0.962
Beneficiary	0.890	0.951

2. **Marital Assumption:** All active members are assumed to be married and females are assumed to be three years younger than their male spouses.
3. **Credited Service:** Calculated in whole year increments for valuation purposes.
4. **Actuarial Interest Rate:** 7.0% per annum, net of investment expenses.
5. **COLA:** Based on an assumed long-term Consumer Price Index Inflation rate of 2.5% per year. 1.5% per year for Auto COLA, 2.5% per year for Escalation.
6. **Actuarial Asset Valuation Method (AAVM):** The AAVM recognizes investment returns greater or less than expected over a period of six years.

In accordance with this AAVM, actual Unexpected Investment Returns (UIR) are phased into the Actuarial Value of Assets (AVA) at rates of 15%, 15%, 15%, 15%, 20%, and 20% per year (i.e. cumulative rates of 15%, 30%, 45%, 60%, 80%, and 100% over a period of six years).

The AVA is constrained to be within a corridor of 80% to 120% of the MVA.

For more information, see SECTION II – MARKET AND ACTUARIAL VALUES OF ASSETS.

7. **Actuarial Cost Method:** The Entry Age Normal (EAN) cost method of funding is used by the Actuary to calculate the Employer Contribution.

Under this method, the Present Value (PV) of Future Benefits (PVFB) of each individual included in the actuarial valuation is allocated on a level basis over the earnings (or service) of the individual between entry age and the assumed exit age(s). The employer

portion of this PVFB allocated to a valuation year is the Normal Cost. The portion of this PVFB not provided for at a valuation date by the PV of Future Normal Costs or future member contributions is the Accrued Liability (AL).

The excess, if any, of the AL over the Actuarial Value of Assets (AVA) is the Unfunded Accrued Liability (UAL).

Under this method, actuarial gains and losses, as they occur, reduce and increase the UAL, respectively, and are explicitly identified and amortized.

Increases or decreases in obligations due to benefit changes, actuarial assumption changes, and actuarial method changes are also explicitly identified and amortized.

Under EAN, the explicit UALs that are developed each year are generally financed over fixed periods. Ideally, these periods are reasonably consistent with the expected future working lifetimes of all active participants. For more information see Page 12.

Under EAN, the Normal Cost as a percentage of pay remains constant by individual and changes gradually over time for the entire plan as the characteristics of the group changes (e.g. more Tier 6 active members decrease the average Normal Cost as a percentage of pay).

8. **Lump Sum Death Benefits:** Liabilities for group life lump sum death benefits are calculated under the One-Year Term Cost method.
9. **Allowances for Administrative Expenses:** The Employer Contribution for a fiscal year is increased by the interest-adjusted amount of administrative expenses paid from TRS during the second prior fiscal year.
10. **WTC Disability and Death Benefits:** Obligations attributable to the WTC Disability Benefits Law and to the WTC Death Benefits Law are determined through the use of explicit assumptions in the 2019 A&M, and through estimation techniques for post-retirement reclassifications.
11. **One-Year Lag Methodology:** One-Year Lag methodology uses a June 30, XX-2 valuation date to determine Fiscal Year XX employer contributions.

This methodology requires adjustments to certain components used to determine Fiscal Year XX employer contributions.

a. Normal Cost:

The normal cost as of June 30, XX-2 is rolled forward with the assumed AIR of 7.0% to derive the normal cost as of December 31, XX-1.

b. UAL Payments

For determining the UAL payments for Fiscal Year XX, and to be consistent with the OYLM, the UAL as of June 30, XX-2 is adjusted by the discounted value of employer normal cost and UAL payments paid during Fiscal Year XX-1 and the discounted value of Administrative Expenses reimbursed during Fiscal Years XX-1 and XX.

12. **Excess Benefit Plan:** The valuation includes liabilities and costs, if any, associated with the Excess Benefit Plan administered by the Teachers' Retirement System in the case that members exceed the Internal Revenue Code Section 415 limitation.

13. **Term Cost for TDA Fixed Fund:** Beginning with the June 30, 2016 (Lag) actuarial valuation, a cost is added to each year's Normal Cost for providing a guaranteed 8.25% return on the TDA Fixed Fund for non-UFT members.

SECTION XII - SUMMARY OF DEMOGRAPHIC DATA

The June 30, 2017 (Lag) and June 30, 2016 (Lag) actuarial valuations are based upon census data as of those dates submitted by the Plan's administrative staff and the employer's payroll facilities. Financial information was provided by the Office of the Comptroller as of June 30, 2017 and June 30, 2016.

Consistent with Actuarial Standards of Practice, the Office of the Actuary has reviewed census data and financial information for consistency and reasonability but has not audited it. The accuracy of the results and calculations contained in this Report are dependent on the accuracy of this census data and financial information. To the extent any such data or information provided is materially inaccurate or incomplete, the results contained herein will require revision.

Table XII-1
Status Reconciliation

CHANGES IN THE NUMBER OF ACTIVES AND PENSIONERS DURING THE FISCAL YEAR CLASSIFIED BY STATUS										
Status	(1) Active Members	(2) Active Off Payroll	(3) Deferred Vested	(4) Service Pension	(5) Ordinary Disability	(6) Accidental Disability	(7) Accidental Death	(8) Other Beneficiary	(9) Pensioners Subtotal (4) to (8)	(10) Grand Total (1) + (2) + (3) + (9)
1. Number at June 30, 2016	118,201	7,401	14,393	76,346	2,541	745	0	4,461	84,093	224,088
New Entrants	9,466	0	0	0	0	0	0	0	0	9,466
Rehires	1,472	(1,056)	(143)	0	0	0	0	0	0	273
Leaving Active Payroll	(4,366)	4,366	0	0	0	0	0	0	0	0
Vested Termination	(895)	(328)	1,223	0	0	0	0	0	0	0
Non-Vested Termination / Cashout	(593)	(1,864)	(1)	0	0	0	0	0	0	(2,458)
Accidental Death (from Active)	0	0	0	0	0	0	0	0	0	0
Ordinary Death (from Active)	(107)	(22)	(16)	0	0	0	0	0	0	(145)
Service Retirement	(2,308)	(417)	(172)	2,897	0	0	0	0	2,897	0
Ordinary Disability Retirement	(41)	(70)	(4)	0	115	0	0	0	115	0
Accidental Disability Retirement	(3)	(13)	(1)	0	0	17	0	0	17	0
Death with Beneficiary	0	0	0	(422)	(24)	(2)	0	448	0	0
Death without Beneficiary	0	0	0	(1,708)	(74)	(17)	0	(402)	(2,201)	(2,201)
On/(Off) Pension Payroll	0	0	0	(140)	(9)	1	0	(3)	(151)	(151)
Net Change	2,625	596	886	627	8	(1)	0	43	677	4,784
2. Number at June 30, 2017	120,826	7,997	15,279	76,973	2,549	744	0	4,504	84,770	228,872

Graph XII-2
Headcount Summary by Status

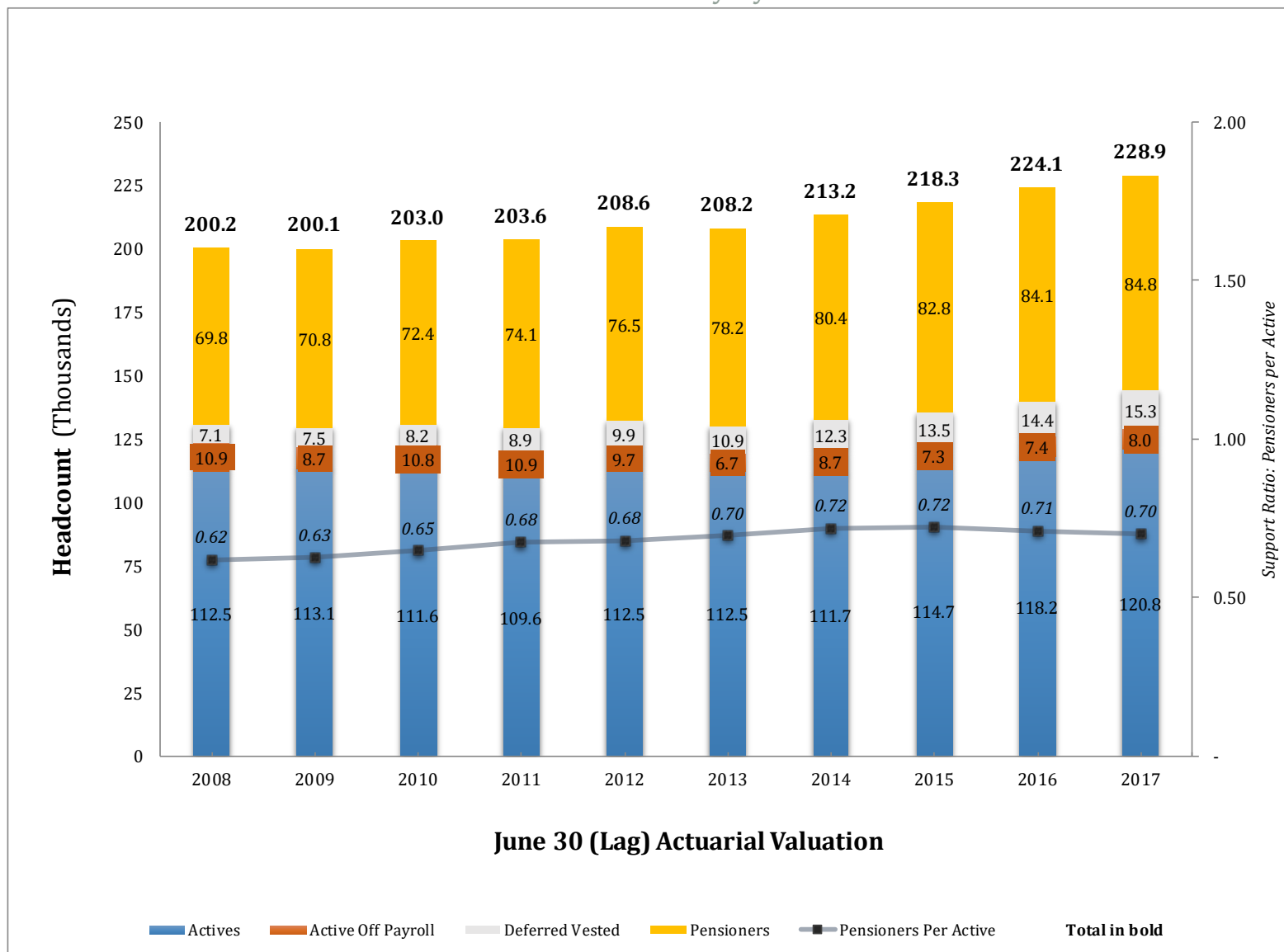


Table XII-3
Summary of Active Membership

NEW YORK CITY TEACHERS' RETIREMENT SYSTEM		
ACTIVE MEMBERS INCLUDED IN THE JUNE 30, 2017 (LAG) AND THE JUNE 30, 2016 (LAG) ACTUARIAL VALUATIONS		
	June 30, 2017 (Lag)	June 30, 2016 (Lag)
Number		
Males	27,312	26,649
Females	93,514	91,552
Total	120,826	118,201
Annual Salary ¹		
Males	\$ 2,362,727,020	\$ 2,219,964,658
Females	7,486,172,212	7,004,302,989
Total	\$ 9,848,899,232	\$ 9,224,267,647
Average Salary ¹		
Males	\$ 86,509	\$ 83,304
Females	80,054	76,506
Total Average	\$ 81,513	\$ 78,039
Average Age		
Males	44.0	44.1
Females	43.8	44.0
Total Average	43.9	44.0
Average Past Service		
Males	11.4	11.1
Females	11.4	11.3
Total Average	11.4	11.2

¹Salaries reflect the impact of recent labor contract settlements and certain non-union salary increases with retroactive effective dates, if any.

Graph XII-4
Active Membership by Tier

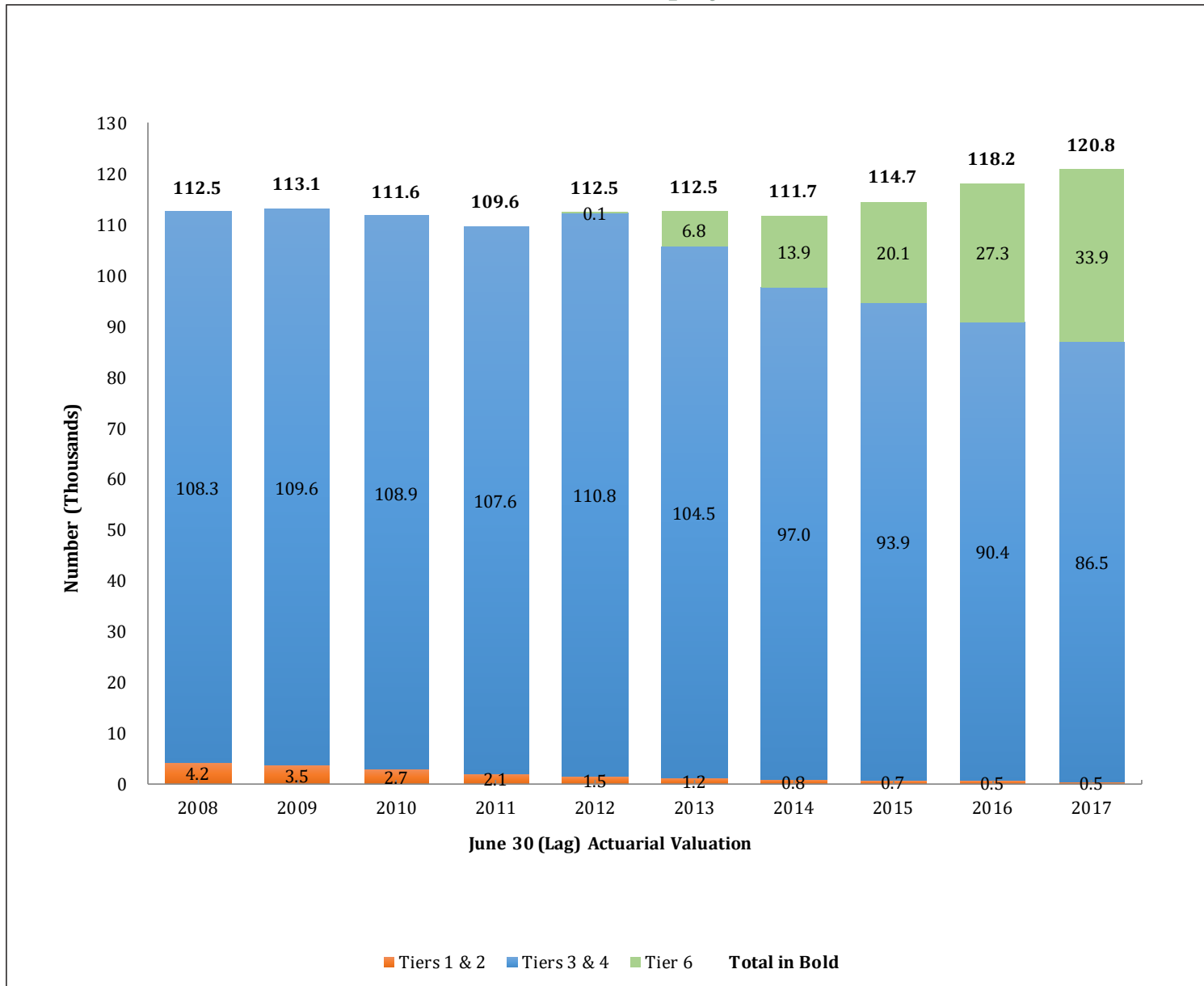


Table XII-5
Historical Active Member Salary Data

June 30 (Lag) Actuarial Valuation	Number	Annual Salary	Average Annual Salary	Percentage Increase/ (Decrease) In Avg. Salary
2008	112,472	7,926,647,584	70,477	7.2%
2009	113,132	8,016,635,700	70,861	0.5%
2010	111,647	7,979,671,378	71,472	0.9%
2011	109,636	7,888,203,642	71,949	0.7%
2012	112,460	8,013,395,184	71,256	- 1.0%
2013	112,481	8,128,378,071	72,264	1.4%
2014	111,726	8,274,685,657	74,062	2.5%
2015	114,652	8,844,650,633	77,143	4.2%
2016	118,201	9,224,267,647	78,039	1.2%
2017	120,826	9,848,899,232	81,513	4.5%

Salaries reflect the impact of recent labor contract settlements and certain non-union salary increases with retroactive effective dates, if any.

Table XII-6
Detailed Active Membership and Salaries as of June 30, 2017

AGE \ SVC	Male Total									
	UNDER 5	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40 & UP	ALL YEARS
<i>NUMBER:</i>										
UNDER 20	2	0	0	0	0	0	0	0	0	2
20 TO 24	441	1	0	0	0	0	0	0	0	442
25 TO 29	2,596	277	6	0	0	0	0	0	0	2,879
30 TO 34	2,020	1,565	331	1	0	0	0	0	0	3,917
35 TO 39	1,092	1,216	1,639	208	2	0	0	0	0	4,157
40 TO 44	642	727	1,322	943	92	2	0	0	0	3,728
45 TO 49	470	559	911	936	656	88	6	0	0	3,626
50 TO 54	298	403	610	604	574	488	101	0	0	3,078
55 TO 59	217	322	465	476	408	375	230	15	0	2,508
60 TO 64	103	280	320	346	274	228	121	70	6	1,748
65 TO 69	49	153	180	159	106	81	69	36	26	859
70 & UP	10	61	64	54	52	33	24	15	55	368
TOTAL	7,940	5,564	5,848	3,727	2,164	1,295	551	136	87	27,312

<i>SALARIES (IN THOUSANDS):</i>										
UNDER 20	52	0	0	0	0	0	0	0	0	52
20 TO 24	21,784	55	0	0	0	0	0	0	0	21,839
25 TO 29	158,651	19,152	685	0	0	0	0	0	0	178,488
30 TO 34	135,105	128,035	31,919	102	0	0	0	0	0	295,161
35 TO 39	74,917	100,006	161,551	21,946	268	0	0	0	0	358,688
40 TO 44	45,816	55,875	132,114	101,983	11,061	268	0	0	0	347,116
45 TO 49	32,485	39,599	87,014	99,441	77,794	10,698	787	0	0	347,818
50 TO 54	19,436	27,695	54,617	62,111	67,050	60,090	12,845	0	0	303,844
55 TO 59	14,824	18,640	40,380	46,023	45,868	45,422	28,567	2,008	0	241,731
60 TO 64	5,551	15,777	27,641	33,051	29,941	26,615	15,186	8,961	611	163,334
65 TO 69	2,617	7,422	12,878	14,192	11,293	9,579	8,106	4,679	3,305	74,070
70 & UP	362	2,193	4,537	3,909	4,652	3,848	3,021	1,643	6,421	30,587
TOTAL *	511,599	414,450	553,336	382,755	247,928	156,520	68,511	17,292	10,336	2,362,727

<i>AVERAGE SALARIES: **</i>										
UNDER 20	25,767	0	0	0	0	0	0	0	0	25,767
20 TO 24	49,397	54,694	0	0	0	0	0	0	0	49,409
25 TO 29	61,113	69,142	114,232	0	0	0	0	0	0	61,997
30 TO 34	66,883	81,812	96,433	101,501	0	0	0	0	0	75,354
35 TO 39	68,605	82,242	98,567	105,510	134,099	0	0	0	0	86,285
40 TO 44	71,365	76,857	99,935	108,147	120,225	133,887	0	0	0	93,111
45 TO 49	69,118	70,839	95,515	106,240	118,588	121,565	131,202	0	0	95,923
50 TO 54	65,221	68,723	89,535	102,832	116,813	123,136	127,174	0	0	98,715
55 TO 59	68,311	57,889	86,838	96,686	112,422	121,124	124,202	133,892	0	96,384
60 TO 64	53,894	56,346	86,378	95,523	109,272	116,734	125,501	128,021	101,832	93,440
65 TO 69	53,414	48,508	71,542	89,255	106,540	118,262	117,475	129,967	127,100	86,228
70 & UP	36,178	35,955	70,897	72,385	89,468	116,600	125,884	109,566	116,739	83,116
TOTAL	64,433	74,488	94,620	102,698	114,569	120,865	124,339	127,148	118,807	86,509

Note: Age is last birthday. Service is completed years.

* Total may not add up due to rounding.

** Average based on unrounded salary.

Table XII-6
Detailed Active Membership and Salaries as of June 30, 2017 (cont'd)

AGE \ SVC	Female Total									
	UNDER 5	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40 & UP	ALL YEARS
<i>NUMBER:</i>										
UNDER 20	8	0	0	0	0	0	0	0	0	8
20 TO 24	1,729	3	0	0	0	0	0	0	0	1,732
25 TO 29	9,943	1,001	5	0	0	0	0	0	0	10,949
30 TO 34	6,505	5,339	1,396	2	0	0	0	0	0	13,242
35 TO 39	3,309	3,574	5,605	898	4	0	0	0	0	13,390
40 TO 44	2,222	2,156	4,069	3,458	386	2	0	0	0	12,293
45 TO 49	1,854	1,804	2,722	3,118	2,000	394	7	0	0	11,899
50 TO 54	1,338	1,482	2,109	2,217	1,701	1,653	381	4	0	10,885
55 TO 59	756	1,093	1,742	2,166	1,421	1,142	732	79	0	9,131
60 TO 64	332	655	1,131	1,715	1,278	915	411	178	20	6,635
65 TO 69	91	241	393	583	526	348	189	89	72	2,532
70 & UP	17	104	116	147	120	100	90	34	90	818
TOTAL	28,104	17,452	19,288	14,304	7,436	4,554	1,810	384	182	93,514

SALARIES (IN THOUSANDS):

UNDER 20	264	0	0	0	0	0	0	0	0	264
20 TO 24	88,962	110	0	0	0	0	0	0	0	89,072
25 TO 29	622,013	73,340	392	0	0	0	0	0	0	695,745
30 TO 34	429,573	440,353	129,778	168	0	0	0	0	0	999,872
35 TO 39	213,991	283,990	527,869	88,688	383	0	0	0	0	1,114,919
40 TO 44	135,120	157,328	375,524	347,832	41,761	225	0	0	0	1,057,789
45 TO 49	105,847	116,062	232,812	305,088	223,319	42,766	836	0	0	1,026,731
50 TO 54	74,415	86,080	163,334	196,193	178,255	186,935	42,689	350	0	928,250
55 TO 59	41,699	59,887	128,692	176,136	138,747	121,834	85,485	9,082	0	761,563
60 TO 64	17,124	35,444	83,029	137,709	116,023	88,787	46,072	21,716	2,396	548,299
65 TO 69	5,230	11,863	27,669	45,046	44,498	32,002	19,395	10,173	8,316	204,194
70 & UP	732	3,446	6,633	9,948	9,411	8,204	8,328	3,157	9,616	59,474
TOTAL *	1,734,969	1,267,903	1,675,732	1,306,808	752,397	480,751	202,806	44,478	20,328	7,486,172

*AVERAGE SALARIES: ***

UNDER 20	32,999	0	0	0	0	0	0	0	0	32,999
20 TO 24	51,453	36,757	0	0	0	0	0	0	0	51,428
25 TO 29	62,558	73,266	78,403	0	0	0	0	0	0	63,544
30 TO 34	66,037	82,479	92,964	84,155	0	0	0	0	0	75,508
35 TO 39	64,669	79,460	94,178	98,761	95,636	0	0	0	0	83,265
40 TO 44	60,810	72,972	92,289	100,588	108,189	112,388	0	0	0	86,048
45 TO 49	57,091	64,336	85,530	97,847	111,659	108,543	119,427	0	0	86,287
50 TO 54	55,616	58,083	77,446	88,495	104,795	113,088	112,044	87,377	0	85,278
55 TO 59	55,158	54,791	73,876	81,319	97,641	106,684	116,783	114,962	0	83,404
60 TO 64	51,578	54,113	73,412	80,297	90,785	97,035	112,097	122,001	119,794	82,637
65 TO 69	57,477	49,224	70,406	77,266	84,598	91,959	102,620	114,306	115,502	80,645
70 & UP	43,030	33,136	57,178	67,671	78,429	82,036	92,538	92,843	106,849	72,707
TOTAL	61,734	72,651	86,880	91,360	101,183	105,567	112,047	115,827	111,694	80,054

Note: Age is last birthday. Service is completed years.

* Total may not add up due to rounding.

** Average based on unrounded salary.

Table XII-6
Detailed Active Membership and Salaries as of June 30, 2017 (cont'd)

AGE \ SVC	Total									
	UNDER 5	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40 & UP	ALL YEARS
<i>NUMBER:</i>										
UNDER 20	10	0	0	0	0	0	0	0	0	10
20 TO 24	2,170	4	0	0	0	0	0	0	0	2,174
25 TO 29	12,539	1,278	11	0	0	0	0	0	0	13,828
30 TO 34	8,525	6,904	1,727	3	0	0	0	0	0	17,159
35 TO 39	4,401	4,790	7,244	1,106	6	0	0	0	0	17,547
40 TO 44	2,864	2,883	5,391	4,401	478	4	0	0	0	16,021
45 TO 49	2,324	2,363	3,633	4,054	2,656	482	13	0	0	15,525
50 TO 54	1,636	1,885	2,719	2,821	2,275	2,141	482	4	0	13,963
55 TO 59	973	1,415	2,207	2,642	1,829	1,517	962	94	0	11,639
60 TO 64	435	935	1,451	2,061	1,552	1,143	532	248	26	8,383
65 TO 69	140	394	573	742	632	429	258	125	98	3,391
70 & UP	27	165	180	201	172	133	114	49	145	1,186
TOTAL	36,044	23,016	25,136	18,031	9,600	5,849	2,361	520	269	120,826

SALARIES (IN THOUSANDS):

UNDER 20	316	0	0	0	0	0	0	0	0	316
20 TO 24	110,746	165	0	0	0	0	0	0	0	110,911
25 TO 29	780,664	92,492	1,077	0	0	0	0	0	0	874,233
30 TO 34	564,677	568,389	161,697	270	0	0	0	0	0	1,295,033
35 TO 39	288,908	383,996	689,420	110,634	651	0	0	0	0	1,473,607
40 TO 44	180,936	213,203	507,638	449,815	52,822	493	0	0	0	1,404,905
45 TO 49	138,332	155,661	319,827	404,529	301,113	53,464	1,623	0	0	1,374,549
50 TO 54	93,850	113,775	217,951	258,304	245,306	247,025	55,534	350	0	1,232,093
55 TO 59	56,523	78,527	169,072	222,159	184,615	167,255	114,052	11,090	0	1,003,294
60 TO 64	22,675	51,221	110,670	170,760	145,963	115,402	61,258	30,678	3,007	711,633
65 TO 69	7,848	19,285	40,547	59,238	55,792	41,581	27,501	14,852	11,621	278,263
70 & UP	1,093	5,639	11,170	13,856	14,064	12,051	11,350	4,800	16,037	90,061
TOTAL *	2,246,568	1,682,352	2,229,069	1,689,563	1,000,325	637,271	271,317	61,770	30,665	9,848,899

*AVERAGE SALARIES: ***

UNDER 20	31,553	0	0	0	0	0	0	0	0	31,553
20 TO 24	51,035	41,242	0	0	0	0	0	0	0	51,017
25 TO 29	62,259	72,372	97,946	0	0	0	0	0	0	63,222
30 TO 34	66,238	82,327	93,629	89,937	0	0	0	0	0	75,473
35 TO 39	65,646	80,166	95,171	100,030	108,457	0	0	0	0	83,981
40 TO 44	63,176	73,952	94,164	102,207	110,506	123,137	0	0	0	87,691
45 TO 49	59,523	65,875	88,034	99,785	113,371	110,920	124,861	0	0	88,538
50 TO 54	57,366	60,358	80,158	91,565	107,827	115,378	115,215	87,377	0	88,240
55 TO 59	58,091	55,496	76,607	84,087	100,938	110,254	118,557	117,983	0	86,201
60 TO 64	52,127	54,782	76,271	82,853	94,049	100,964	115,146	123,700	115,649	84,890
65 TO 69	56,055	48,946	70,763	79,835	88,278	96,925	106,593	118,816	118,579	82,059
70 & UP	40,493	34,178	62,056	68,937	81,766	90,612	99,558	97,962	110,600	75,937
TOTAL	62,328	73,095	88,680	93,703	104,201	108,954	114,916	118,788	113,995	81,513

Note: Age is last birthday. Service is completed years.

* Total may not add up due to rounding.

** Average based on unrounded salary.

Table XII-7
Detailed Reconciliation of Active Membership

		<u>TOTAL ACTIVE MEMBERS AS OF JUNE 30, 2017</u>					<u>TOTAL ACTIVE MEMBERS AS OF JUNE 30, 2016</u>				
<u>TIER</u>	<u>GENDER</u>	<u>NUMBER</u>	<u>SALARY</u>	<u>AVG SAL</u>	<u>AVG AGE</u>	<u>AVG SVC</u>	<u>NUMBER</u>	<u>SALARY</u>	<u>AVG SAL</u>	<u>AVG AGE</u>	<u>AVG SVC</u>
I	M	99	11,845,551	119,652	74.1	41.2	116	13,494,032	116,328	73.0	41.9
I	F	200	22,900,307	114,502	71.0	37.7	254	28,052,917	110,445	70.0	35.3
		299	34,745,858	116,207	72.1	38.9	370	41,546,949	112,289	70.9	37.4
II	M	28	3,406,588	121,664	68.2	33.1	37	4,432,755	119,804	67.0	35.3
II	F	123	13,929,050	113,244	66.4	32.2	139	14,812,107	106,562	65.3	30.1
		151	17,335,638	114,806	66.7	32.4	176	19,244,862	109,346	65.6	31.2
IV	M	19,676	1,866,427,505	94,858	47.4	14.7	20,512	1,836,233,336	89,520	46.8	13.6
IV	F	66,780	5,823,268,154	87,201	47.5	14.9	69,882	5,721,902,401	81,879	47.0	14.0
		86,456	7,689,695,659	88,943	47.5	14.8	90,394	7,558,135,737	83,613	46.9	13.9
VI	M	7,509	481,047,376	64,063	34.6	2.4	5,984	365,804,535	61,130	33.9	1.8
VI	F	26,411	1,626,074,701	61,568	34.3	2.3	21,277	1,239,535,564	58,257	33.7	1.9
		33,920	2,107,122,077	62,120	34.4	2.4	27,261	1,605,340,099	58,888	33.7	1.8
ALL		120,826	9,848,899,232	81,513	43.9	11.4	118,201	9,224,267,647	78,039	44.0	11.2
<u>MEMBERS WITH SAME GENDER AND TIER IN BOTH VALUATION YEARS</u>						<u>MEMBERS WITH SAME GENDER AND TIER IN BOTH VALUATION YEARS</u>					
I	M	96	11,660,103	121,459	74.2	41.1	96	11,208,094	116,751	73.2	42.3
I	F	197	22,764,208	115,554	71.1	37.6	197	21,633,502	109,815	70.1	35.3
		293	34,424,311	117,489	72.1	38.8	293	32,841,596	112,087	71.1	37.6
II	M	27	3,318,985	122,925	68.3	33.9	27	3,175,379	117,607	67.3	33.8
II	F	117	13,243,276	113,190	66.2	32.3	117	12,400,110	105,984	65.2	29.7
		144	16,562,261	115,016	66.6	32.6	144	15,575,489	108,163	65.6	30.4
IV	M	19,006	1,814,145,002	95,451	47.5	14.8	19,006	1,703,840,638	89,648	46.5	13.4
IV	F	64,865	5,673,199,327	87,462	47.7	15.0	64,865	5,309,783,577	81,859	46.7	13.8
		83,871	7,487,344,329	89,272	47.7	15.0	83,871	7,013,624,215	83,624	46.7	13.7
VI	M	5,315	353,342,204	66,480	34.9	3.0	5,315	324,982,615	61,144	33.9	1.8
VI	F	18,983	1,207,290,334	63,599	34.7	2.9	18,983	1,100,809,772	57,989	33.7	1.8
		24,298	1,560,632,538	64,229	34.7	2.9	24,298	1,425,792,387	58,679	33.7	1.8
ALL		108,606	9,098,963,439	83,780	44.9	12.4	108,606	8,487,833,687	78,153	43.9	11.2
<u>ADDITIONS DURING THE YEAR *</u>						<u>SEPARATIONS FROM MEMBERSHIP DURING THE YEAR *</u>					
I	M	3	185,448	61,816	73.3	44.3	20	2,285,938	114,297	72.1	40.0
I	F	3	136,099	45,366	69.0	42.7	57	6,419,415	112,621	69.7	35.4
		6	321,547	53,591	71.2	43.5	77	8,705,353	113,057	70.4	36.6
II	M	1	87,603	87,603	65.0	13.0	10	1,257,376	125,738	66.0	39.3
II	F	6	685,774	114,296	69.5	31.3	22	2,411,997	109,636	65.5	32.1
		7	773,377	110,482	68.9	28.7	32	3,669,373	114,668	65.6	34.4
IV	M	670	52,282,503	78,034	45.7	11.2	1,506	132,392,698	87,910	50.8	16.1
IV	F	1,915	150,068,827	78,365	42.3	9.2	5,017	412,118,824	82,144	50.4	16.5
		2,585	202,351,330	78,279	43.2	9.8	6,523	544,511,522	83,476	50.5	16.4
VI	M	2,194	127,705,172	58,207	34.1	0.9	669	40,821,920	61,019	33.8	1.9
VI	F	7,428	418,784,367	56,379	33.4	0.9	2,294	138,725,792	60,473	33.7	2.0
		9,622	546,489,539	56,796	33.5	0.9	2,963	179,547,712	60,597	33.7	2.0
ALL		12,220	749,935,793	61,370	35.6	2.8	9,595	736,433,960	76,752	45.5	12.2

Note: Age is nearest birthday. Service is nearest year.

* Separations and additions do not include members who joined after June 30, 2016 and are no longer members on June 30, 2017.

Table XII-8
Summary of Non-Pensioner Membership as of June 30, 2017

STATUS	TIER 1		TIER 2		TIER 4		TIER 6		ALL TIERS	
	NUMBER	SALARY	NUMBER	SALARY	NUMBER	SALARY	NUMBER	SALARY	NUMBER	SALARY
<i>MALES:</i>										
ACTIVES	99	11,845,551	28	3,406,588	19,676	1,866,427,505	7,509	481,047,376	27,312	2,362,727,020
ACTIVE OFF PAYROLL	12	1,262,770	6	709,285	940	62,874,573	489	29,185,789	1,447	94,032,417
VESTED	79	2,476,939	11	552,089	3,300	224,787,189	0	0	3,390	227,816,217
ALL STATUS	190	15,585,260	45	4,667,962	23,916	2,154,089,267	7,998	510,233,165	32,149	2,684,575,654
<i>FEMALES:</i>										
ACTIVES	200	22,900,307	123	13,929,050	66,780	5,823,268,154	26,411	1,626,074,701	93,514	7,486,172,212
ACTIVE OFF PAYROLL	34	3,585,750	14	1,395,095	4,737	332,751,072	1,765	105,491,984	6,550	443,223,901
VESTED	117	3,081,045	67	2,223,045	11,705	713,245,716	0	0	11,889	718,549,806
ALL STATUS	351	29,567,102	204	17,547,190	83,222	6,869,264,942	28,176	1,731,566,685	111,953	8,647,945,919
<i>TOTAL:</i>										
ACTIVES	299	34,745,858	151	17,335,638	86,456	7,689,695,659	33,920	2,107,122,077	120,826	9,848,899,232
ACTIVE OFF PAYROLL	46	4,848,520	20	2,104,380	5,677	395,625,645	2,254	134,677,773	7,997	537,256,318
VESTED	196	5,557,984	78	2,775,134	15,005	938,032,905	0	0	15,279	946,366,023
ALL STATUS	541	45,152,362	249	22,215,152	107,138	9,023,354,209	36,174	2,241,799,850	144,102	11,332,521,573

Table XII-9
Summary of Pensioner Membership

Group	June 30, 2017 (Lag)					June 30, 2016 (Lag)				
	Number	Annual Amounts Payable				Number	Annual Amounts Payable			
		Fixed	Variable	Supplement	Total		Fixed	Variable	Supplement	Total
Service Pensioners	76,973	\$ 3,149,422,220	\$ 549,709,742	\$ 156,101,208	\$ 3,855,233,170	76,346	\$ 3,058,908,934	\$ 506,891,684	\$ 155,982,834	\$ 3,721,783,452
Ordinary Disability Pensioners	2,549	50,836,063	3,468,955	4,142,076	58,447,094	2,541	49,210,913	3,266,193	4,146,958	56,624,064
Accidental Disability Pensioners	744	26,500,027	2,470,138	2,500,296	31,470,461	745	26,125,336	2,323,589	2,462,548	30,911,473
Accidental Death Pensioners	0	0	0	0	0	0	0	0	0	0
Other Beneficiaries	4,504	108,251,436	34,500,944	9,744,257	152,496,637	4,461	103,571,969	31,799,222	9,963,543	145,334,734
Total	84,770	\$ 3,335,009,746	\$ 590,149,779	\$ 172,487,837	\$ 4,097,647,362	84,093	\$ 3,237,817,152	\$ 544,280,688	\$ 172,555,883	\$ 3,954,653,723

Table XII-10
Distribution of Pension Benefits by Cause and Age as of June 30, 2017

AGE	MALE			FEMALE			TOTAL		
	NUMBER	BENEFITS	AVERAGE	NUMBER	BENEFITS	AVERAGE	NUMBER	BENEFITS	AVERAGE
<i>SERVICE RETIREMENT:</i>									
UNDER 30	0	0	0	0	0	0	0	0	0
30 TO 34	0	0	0	0	0	0	0	0	0
35 TO 39	0	0	0	0	0	0	0	0	0
40 TO 44	0	0	0	0	0	0	0	0	0
45 TO 49	0	0	0	0	0	0	0	0	0
50 TO 54	0	0	0	0	0	0	0	0	0
55 TO 59	738	39,741,209	53,850	2,116	111,936,869	52,900	2,854	151,678,078	53,146
60 TO 64	1,837	96,075,219	52,300	6,267	307,445,762	49,058	8,104	403,520,981	49,793
65 TO 69	4,649	275,321,271	59,222	13,356	696,954,592	52,183	18,005	972,275,863	54,000
70 TO 74	6,569	414,979,298	63,172	12,662	637,679,185	50,362	19,231	1,052,658,483	54,738
75 TO 79	3,471	198,128,151	57,081	8,134	354,086,941	43,532	11,605	552,215,092	47,584
80 TO 84	2,331	129,272,201	55,458	5,428	210,647,350	38,808	7,759	339,919,551	43,810
85 TO 89	1,578	84,822,818	53,753	3,970	150,473,221	37,903	5,548	235,296,039	42,411
90 & UP	880	43,458,003	49,384	2,987	104,211,081	34,888	3,867	147,669,083	38,187
TOTAL	22,053	1,281,798,170	58,124	54,920	2,573,435,000	46,858	76,973	3,855,233,170	50,086
<i>ORDINARY DISABILITY:</i>									
UNDER 30	0	0	0	0	0	0	0	0	0
30 TO 34	0	0	0	0	0	0	0	0	0
35 TO 39	2	36,296	18,148	6	163,279	27,213	8	199,575	24,947
40 TO 44	11	316,577	28,780	35	799,250	22,836	46	1,115,827	24,257
45 TO 49	18	500,551	27,808	86	2,188,938	25,453	104	2,689,489	25,860
50 TO 54	38	1,040,788	27,389	156	4,166,630	26,709	194	5,207,418	26,842
55 TO 59	69	1,949,161	28,249	302	7,360,203	24,372	371	9,309,364	25,093
60 TO 64	97	2,266,452	23,365	364	8,157,778	22,411	461	10,424,230	22,612
65 TO 69	121	3,146,456	26,004	439	9,741,869	22,191	560	12,888,325	23,015
70 TO 74	121	3,112,379	25,722	298	6,273,289	21,051	419	9,385,668	22,400
75 TO 79	41	954,858	23,289	158	2,610,251	16,521	199	3,565,109	17,915
80 TO 84	21	410,327	19,539	74	1,267,372	17,127	95	1,677,699	17,660
85 TO 89	10	264,963	26,496	38	671,064	17,660	48	936,027	19,501
90 & UP	7	220,008	31,430	37	828,355	22,388	44	1,048,363	23,826
TOTAL	556	14,218,818	25,573	1,993	44,228,276	22,192	2,549	58,447,094	22,929
<i>ACCIDENTAL DISABILITY:</i>									
UNDER 30	0	0	0	0	0	0	0	0	0
30 TO 34	1	37,648	37,648	1	39,908	39,908	2	77,556	38,778
35 TO 39	0	0	0	3	91,847	30,616	3	91,847	30,616
40 TO 44	6	270,625	45,104	7	335,901	47,986	13	606,526	46,656
45 TO 49	6	311,842	51,974	14	655,866	46,848	20	967,708	48,385
50 TO 54	4	165,458	41,365	33	1,341,821	40,661	37	1,507,279	40,737
55 TO 59	15	757,133	50,476	57	2,366,085	41,510	72	3,123,218	43,378
60 TO 64	23	1,243,583	54,069	86	3,554,684	41,334	109	4,798,267	44,021
65 TO 69	44	1,974,113	44,866	124	5,002,235	40,341	168	6,976,348	41,526
70 TO 74	59	2,771,886	46,981	100	4,002,949	40,029	159	6,774,834	42,609
75 TO 79	25	1,250,095	50,004	37	1,624,340	43,901	62	2,874,435	46,362
80 TO 84	11	450,070	40,915	39	1,226,979	31,461	50	1,677,049	33,541
85 TO 89	7	265,382	37,912	18	704,765	39,154	25	970,146	38,806
90 & UP	8	345,708	43,213	16	679,540	42,471	24	1,025,248	42,719
TOTAL	209	9,843,542	47,098	535	21,626,919	40,424	744	31,470,461	42,299

Table XII-10
Distribution of Pension Benefits by Cause and Age as of June 30, 2017 (cont'd)

AGE	MALE			FEMALE			TOTAL		
	NUMBER	BENEFITS	AVERAGE	NUMBER	BENEFITS	AVERAGE	NUMBER	BENEFITS	AVERAGE
<i>ACCIDENTAL DEATH:</i>									
UNDER 30	0	0	0	0	0	0	0	0	0
30 TO 34	0	0	0	0	0	0	0	0	0
35 TO 39	0	0	0	0	0	0	0	0	0
40 TO 44	0	0	0	0	0	0	0	0	0
45 TO 49	0	0	0	0	0	0	0	0	0
50 TO 54	0	0	0	0	0	0	0	0	0
55 TO 59	0	0	0	0	0	0	0	0	0
60 TO 64	0	0	0	0	0	0	0	0	0
65 TO 69	0	0	0	0	0	0	0	0	0
70 TO 74	0	0	0	0	0	0	0	0	0
75 TO 79	0	0	0	0	0	0	0	0	0
80 TO 84	0	0	0	0	0	0	0	0	0
85 TO 89	0	0	0	0	0	0	0	0	0
90 & UP	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0
<i>OTHER BENEFICIARIES:</i>									
UNDER 30	4	105,802	26,451	5	121,498	24,300	9	227,300	25,256
30 TO 34	5	47,198	9,440	4	40,454	10,114	9	87,652	9,739
35 TO 39	11	322,195	29,290	17	373,195	21,953	28	695,390	24,835
40 TO 44	12	262,193	21,849	14	233,929	16,709	26	496,122	19,082
45 TO 49	15	235,774	15,718	21	394,294	18,776	36	630,068	17,502
50 TO 54	29	425,331	14,667	46	671,716	14,603	75	1,097,047	14,627
55 TO 59	34	595,775	17,523	87	2,076,990	23,873	121	2,672,765	22,089
60 TO 64	55	1,417,100	25,765	115	3,601,942	31,321	170	5,019,042	29,524
65 TO 69	130	3,856,108	29,662	302	12,315,359	40,779	432	16,171,467	37,434
70 TO 74	210	7,648,125	36,420	484	19,755,712	40,818	694	27,403,837	39,487
75 TO 79	176	5,491,184	31,200	490	20,250,604	41,328	666	25,741,788	38,651
80 TO 84	177	4,984,192	28,159	508	19,678,293	38,737	685	24,662,485	36,004
85 TO 89	191	5,053,695	26,459	512	18,477,009	36,088	703	23,530,703	33,472
90 & UP	253	6,466,882	25,561	597	17,594,089	29,471	850	24,060,971	28,307
TOTAL	1,302	36,911,554	28,350	3,202	115,585,083	36,098	4,504	152,496,637	33,858
<i>ALL PENSIONERS AND BENEFICIARIES:</i>									
UNDER 30	4	105,802	26,451	5	121,498	24,300	9	227,300	25,256
30 TO 34	6	84,846	14,141	5	80,362	16,072	11	165,208	15,019
35 TO 39	13	358,491	27,576	26	628,321	24,166	39	986,812	25,303
40 TO 44	29	849,395	29,289	56	1,369,080	24,448	85	2,218,475	26,100
45 TO 49	39	1,048,167	26,876	121	3,239,098	26,769	160	4,287,265	26,795
50 TO 54	71	1,631,577	22,980	235	6,180,167	26,299	306	7,811,744	25,529
55 TO 59	856	43,043,278	50,284	2,562	123,740,147	48,298	3,418	166,783,425	48,796
60 TO 64	2,012	101,002,354	50,200	6,832	322,760,166	47,242	8,844	423,762,519	47,915
65 TO 69	4,944	284,297,949	57,504	14,221	724,014,054	50,912	19,165	1,008,312,003	52,612
70 TO 74	6,959	428,511,689	61,577	13,544	667,711,134	49,299	20,503	1,096,222,823	53,466
75 TO 79	3,713	205,824,288	55,433	8,819	378,572,136	42,927	12,532	584,396,424	46,632
80 TO 84	2,540	135,116,790	53,196	6,049	232,819,995	38,489	8,589	367,936,785	42,838
85 TO 89	1,786	90,406,857	50,620	4,538	170,326,058	37,533	6,324	260,732,915	41,229
90 & UP	1,148	50,490,600	43,981	3,637	123,313,064	33,905	4,785	173,803,664	36,323
TOTAL	24,120	1,342,772,084	55,670	60,650	2,754,875,278	45,423	84,770	4,097,647,362	48,338

Graph XII-11
Pensioner Average Benefits

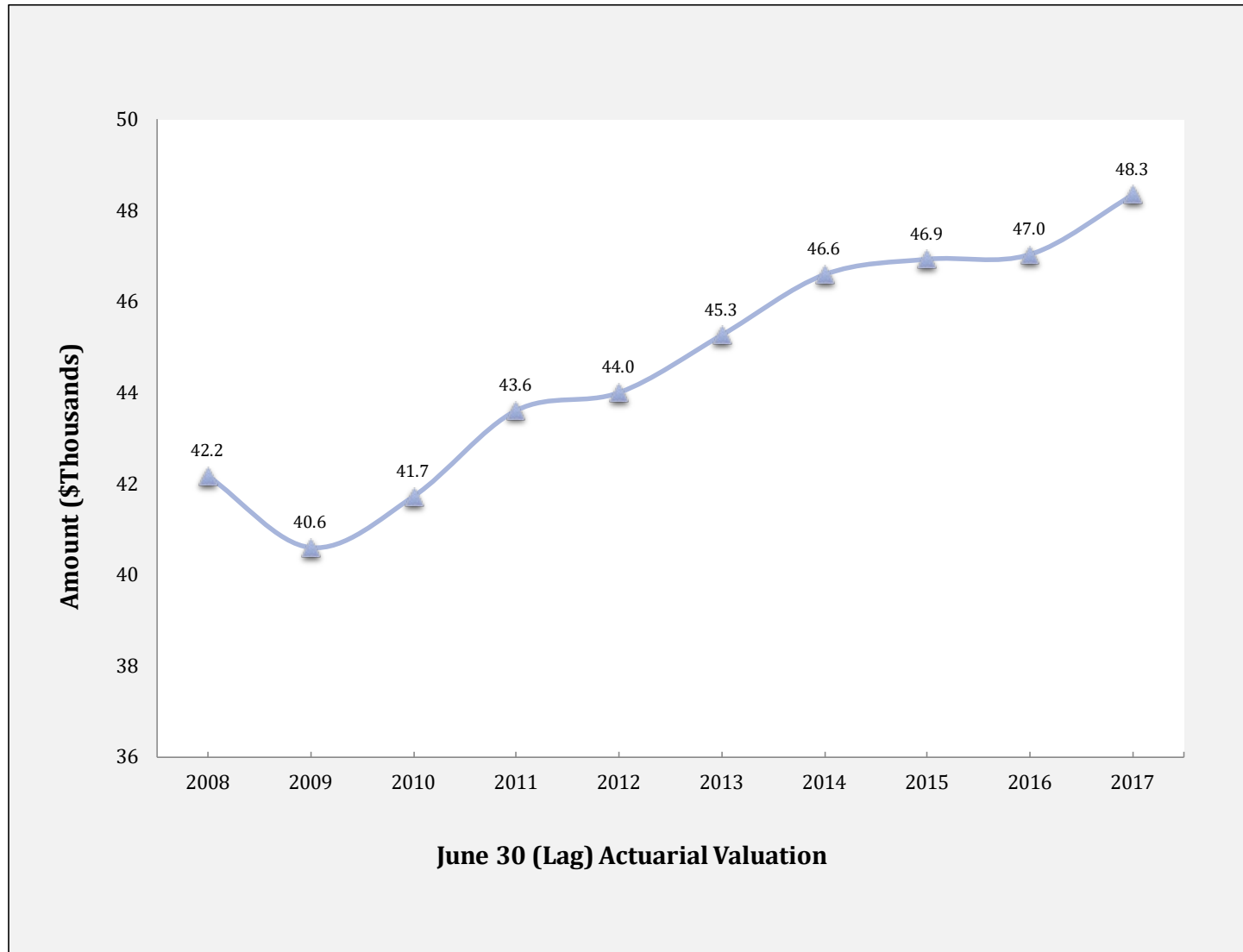


Table XII-12
Reconciliation of Pensioner and Beneficiary Data

SCHEDULE OF PENSIONERS AND BENEFICIARIES ADDED TO AND REMOVED FROM THE ROLLS								
June 30 (Lag) Actuarial Valuation	Added to Rolls		Removed from Rolls		End of Year Rolls		% Increase in Annual Allowances	Average Annual Allowances
	Number	Annual Allowances ¹	Number	Annual Allowances	Number	Annual Allowances		
2008	3,252	\$75,074,813	1,969	\$64,757,835	69,775	\$2,941,612,151	0.4%	\$42,159
2009	3,115	6,288,013	2,065	73,586,895	70,825	2,874,313,269	- 2.3%	40,583
2010	3,534	207,981,284	2,003	64,538,942	72,356	3,017,755,611	5.0%	41,707
2011	3,849	278,652,149	2,141	67,488,320	74,064	3,228,919,440	7.0%	43,596
2012	4,684	200,786,572	2,209	62,805,438	76,539	3,366,900,574	4.3%	43,989
2013	4,078	248,087,233	2,440	77,107,240	78,177	3,537,880,567	5.1%	45,255
2014	4,356	275,947,759	2,114	67,585,789	80,419	3,746,242,537	5.9%	46,584
2015	4,728	219,769,491	2,370	81,986,287	82,777	3,884,025,741	3.7%	46,922
2016	3,808	157,518,432	2,492	86,890,450	84,093	3,954,653,723	1.8%	47,027
2017	3,519	254,567,439	2,842	111,573,800	84,770	4,097,647,362	3.6%	48,338

¹ Amounts shown include changes due to benefit finalization, changes in benefit type (e.g. Service to Accident Disability), COLA increases and other changes.

APPENDIX: ACRONYMS AND ABBREVIATIONS

2019 A&M	Actuarial Assumptions and Methods proposed by the Actuary and adopted by the Board of Trustees during Fiscal Year 2019
AAVM	Actuarial Asset Valuation Method
ACCNY	Administrative Code of the City of New York
AIR	Actuarial Interest Rate
AL	Accrued Liability
AMC	Additional Member Contribution(s)
ASAF	Annuity Savings Accumulation Fund
AVA	Actuarial Value of Assets
BMC	Basic Member Contribution(s)
CAFR	Comprehensive Annual Financial Report
COLA	Cost-of-Living Adjustment
EAN	Entry Age Normal cost method
EIR	Expected Investment Return
FAS	Final Average Salary
FS	Final Salary
GASB	Governmental Accounting Standards Board
GASB5	Governmental Accounting Standards Board Statement No. 5
GASB67	Governmental Accounting Standards Board Statement No. 67
GASB68	Governmental Accounting Standards Board Statement No. 68
IRC	Internal Revenue Code
MVA	Market Value of Assets
OYLM	One-Year Lag Methodology
PV	Present Value
PVFB	Present Value of Future Benefits
PVFNC	Present Value of Future Normal Costs
PVFS	Present Value of Future Salary
TDA	Tax-Deferred Annuity Program
TRS	New York City Teachers' Retirement System
UAL	Unfunded Accrued Liability
UIR	Unexpected Investment Return
WTC	World Trade Center