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May 13, 2020

Dr. L. C. Evans
Executive Director
Teachers Retirement System of Georgia
Suite 100, Two Northside 75
Atlanta, GA 30318

Dear Dr. Evans:

Enclosed are 25 bound copies and one unbound copy of the "Teachers Retirement System of Georgia Report of the Actuary on the Valuation Prepared as of June 30, 2019".

The valuation indicates that employer contributions at the rate of 19.81% of compensation for the fiscal year ending June 30, 2022 are sufficient to support the benefits of the System. The valuation takes into account the effect of all amendments to the System enacted through the 2019 Session of the General Assembly.

Please let us know if there are any questions concerning the report.

Sincerely yours,

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

Cathy Turcot
Principal and Managing Director

Edward Koebel, EA, FCA, MAAA
Chief Executive Officer

Enclosure



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TEACHERS RETIREMENT SYSTEM OF GEORGIA

REPORT OF THE ACTUARY ON THE VALUATION PREPARED AS OF JUNE 30, 2019





Cavanaugh Macdonald

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May 13, 2020

Board of Trustees
Teachers Retirement System of Georgia
Suite 100, Two Northside 75
Atlanta, GA 30318

Members of the Board:

Section 47-3-23 of the law governing the operation of the Teachers Retirement System of Georgia provides that the actuary shall make annual valuations of the contingent assets and liabilities of the Retirement System on the basis of regular interest and the tables last adopted by the Board of Trustees. We have submitted the report giving the results of the actuarial valuation of the System prepared as of June 30, 2019. The report indicates that annual employer contributions at the rate of 19.81% of compensation for the fiscal year ending June 30, 2022 are sufficient to support the benefits of the System. Our firm, as actuary, is responsible for all of the actuarial trend data in the financial section of the annual report and the supporting schedules in the actuarial section of the annual report.

Since the previous valuation, various assumptions and methods have been revised to reflect the results of the experience investigation for the five-year period ending June 30, 2018. A summary of these changes can be found on page 2 of this report.

In our opinion, the valuation is complete and accurate, and the methodology and assumptions are reasonable as a basis for the valuation. The valuation takes into account the effect of all amendments to the System enacted through the 2019 Session of the General Assembly. In preparing the valuation, the actuary relied on data provided by the System. While not verifying data at the source, the actuary performed tests for consistency and reasonableness.

The System is funded on an actuarial reserve basis. The actuarial assumptions recommended by the actuary and adopted by the Board are both individually and in the aggregate reasonably related to the experience under the System and to reasonable expectations of anticipated experience under the System. The assumptions and methods used for financial reporting purposes meet the parameters set by Actuarial Standards of Practice (ASOPS). The funding objective of the plan is that contribution rates over time will remain level as a percent of payroll. The valuation method used is the entry age normal cost method. The normal contribution rate to cover current cost has been determined as a level percent of payroll. Gains and losses are reflected in the unfunded accrued liability, which is amortized as a level percent of payroll in accordance with the funding policy adopted by the Board.

The Plan and the employers are required to comply with the financial reporting requirements of GASB Statements No. 67 and 68. The necessary disclosure information is provided in separate supplemental reports.



May 13, 2020
Board of Trustees
Page 2

We have provided the following information and supporting schedules for the Actuarial Section of the Comprehensive Annual Financial Report:

- Summary of Actuarial Assumptions and Methods
- Schedule of Active Members
- Schedule of Retirees and Beneficiaries Added to and Removed from Rolls
- Schedule of Funding Progress
- Analysis of Financial Experience

The System is being funded in conformity with the minimum funding standard set forth in Code Section 47-20-10 of the Public Retirement Systems Standards Law. In our opinion, the System is operating on an actuarially sound basis. Assuming that contributions to the System are made by the employer from year to year in the future at the rates recommended on the basis of the successive actuarial valuations, the continued sufficiency of the retirement fund to provide the benefits called for under the System may be safely anticipated.

Future actuarial results may differ significantly from the current results presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period or additional cost or contribution requirements based on the plan's funded status); and changes in plan provisions or applicable law. Since the potential impact of such factors is outside the scope of a normal annual actuarial valuation, an analysis of the range of results is not presented herein.

The actuarial computations presented in this report are for purposes of determining the recommended funding amounts for the System. Use of these computations for purposes other than meeting these requirements may not be appropriate.

This is to certify that John Garrett and Edward Koebel are members of the American Academy of Actuaries and have experience in performing valuations for public retirement systems, that the valuation was prepared in accordance with principles of practice prescribed by the Actuarial Standards Board, and that the actuarial calculations were performed by qualified actuaries in accordance with accepted actuarial procedures, based on the current provisions of the retirement system and on actuarial assumptions that are internally consistent and reasonably based on the actual experience of the System.

Sincerely yours,

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

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

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

Edward Koebel, EA, FCA, MAAA
Chief Executive Officer

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

Cathy Turcot
Principal and Managing Director



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Section I – Summary of Principal Results

- For convenience of reference, the principal results of the valuation and a comparison with the preceding year's results are summarized below (all dollar amounts are in thousands):

Valuation Date	June 30, 2019	June 30, 2018
Number of active members	226,366	226,039
Annual earnable compensation	\$ 11,882,828	\$ 11,704,334
Number of retired members and beneficiaries	131,820	127,300
Annual allowances	\$ 5,021,003	\$ 4,773,703
Assets:		
Fair value	\$ 78,788,937	\$ 75,532,925
Actuarial value	78,126,922	75,024,364
Unfunded actuarial accrued liability	\$ 23,712,477	\$ 21,880,889
Blended amortization period (years)	24.9	25.6
Funded ratio based on Actuarial Value of Assets	76.7%	77.4%
Contributions for Fiscal Year Ending	June 30, 2022	June 30, 2021
Member contribution rate	6.00%	6.00%
Actuarially Determined Employer Contribution Rates (ADEC):		
Normal*	7.45%	7.25%
Unfunded actuarial accrued liability	<u>12.36</u>	<u>11.81</u>
Total	19.81%	19.06%

*The normal contribution includes administrative expenses of 0.25% of payroll for the 6/30/2018 valuation and 0.20% of payroll for the 6/30/2019 valuation.

- The valuation takes into account the effect of amendments of the System enacted through the 2019 session of the General Assembly. The major benefit and contribution provisions of the System as reflected in the current valuation are summarized in Schedule H. There have been no changes since the previous valuation.
- Comments on the valuation results as of June 30, 2019 are given in Section IV and further discussion of the employer contribution levels is provided in Section V.



Section I – Summary of Principal Results

4. Schedule D of this report outlines the full set of actuarial assumptions and asset method used to prepare the current valuation. Since the previous valuation, various assumptions and methods have been revised to reflect the results of the experience investigation for the five-year period ending June 30, 2018. These revised assumptions were adopted by the Board on May 13, 2020, and are summarized below:

Summary of Assumptions and Methods	
Economic Assumptions	
Price Inflation	No change in current assumption of 2.50%.
Investment Return (net of investment expenses)	No change in current assumption of 7.25% .
Real Rate of Wage Increase	No change in current assumption of 0.50% annual rate of real wage increases.
Payroll Growth Rate	No change in current assumption of 3.00%.
Demographic Assumptions	
Withdrawal	Changed assumed rates in order to increase the overall number of expected withdrawals.
Retirement	Changed assumed rates in order to increase the overall number of expected retirements.
Mortality	Changed to the Pub 2010 Teachers Headcount Weighted Below Median mortality tables with ages set forward one year and increased 6%. Future improvement in mortality rates is assumed using the adjusted MP-2019 projection scale generationally.
Disability	Lowered rates of expected disability retirement.
Salary Scale	No change in assumption.
Other Assumptions and Methods and Administrative Changes	
Administrative Expenses	Changed the current assumption from 0.25% to 0.20% of payroll.
Amortization Method	No change to current method.
Asset Smoothing	No change to current method.
Option Factors	Changed option factors to reflect change in mortality rate table.
Percent Married	No change in current assumption.
Unused Sick Leave	Change in assumption.
Termination Benefits	Change in assumption.
Valuation Cost Method	No change to current method.
All others	No change to other actuarial assumptions and methods.



Section I – Summary of Principal Results

6. The entry age actuarial cost method was used to prepare the valuation. Schedule E contains a brief description of this method.
7. The funded ratio shown in the Summary of Principal Results is the ratio of the actuarial value of assets to the accrued liability and would be different if based on fair value of assets. The funded ratio is an indication of progress in funding the promised benefits. Since the ratio is less than 100%, there is a need for additional contributions toward payment of the unfunded actuarial accrued liability. In addition, this funded ratio does not have any relationship to measuring sufficiency if the plan had to settle its liabilities.



Section II – Membership

1. The data we received for the 2019 valuation was provided by the Retirement System. While not verifying the data at its source, we performed tests for consistency and reasonableness.
2. The following table shows the number of teachers and their annual earnable and average compensation as of June 30, 2019 on whose account benefits may be payable under the Retirement System. The annual compensation for each active member was provided by the Retirement System and was used without adjustment.

**THE NUMBER AND ANNUAL EARNABLE AND AVERAGE COMPENSATION
OF ACTIVE MEMBERS AS OF JUNE 30, 2019**

TOTAL NUMBER	ANNUAL COMPENSATION (\$1,000's)	AVERAGE COMPENSATION
226,366	\$11,882,828	\$52,494

The results of the valuation include liabilities for 113,807 terminated employees not yet receiving benefits.



Section II – Membership

3. The following table shows the number of beneficiaries on the roll as of June 30, 2019, together with the amount of their annual retirement allowances payable under the System as of that date.

**THE NUMBER AND ANNUAL RETIREMENT ALLOWANCES
OF BENEFICIARIES ON THE ROLL AS OF JUNE 30, 2019**

GROUP	NUMBER	ANNUAL RETIREMENT ALLOWANCES (\$1,000's)
Service Retirements	118,495	\$ 4,697,734
Disability Retirements	4,646	106,805
Beneficiaries of Deceased Active and Retired Members	<u>8,679</u>	<u>216,464</u>
Total	131,820	\$ 5,021,003



Section III – Assets

1. The retirement law provides for the maintenance of two funds for the purpose of recording the financial transactions of the System; namely, the Annuity Savings Fund and the Pension Accumulation Fund.

- (a) Annuity Savings Fund

The Annuity Savings Fund is the fund to which are credited all contributions made by members together with regular interest thereon. When a member retires, or if a death benefit allowance becomes payable to his beneficiary, his accumulated contributions are transferred from the Annuity Savings Fund to the Pension Accumulation Fund. The annuity which these contributions provide is then paid from the Pension Accumulation Fund. On June 30, 2019, the value of assets credited to the Annuity Savings Fund amounted to \$9,791,208,000.

- (b) Pension Accumulation Fund

The Pension Accumulation Fund is the fund to which all income from investments and all contributions made by employers of members of the System and by the State for members of local retirement funds are credited. All retirement allowance and death benefit allowance payments are disbursed from this fund. Upon the retirement of a member, or upon his death if a death benefit allowance is payable, his accumulated contributions are transferred from the Annuity Savings Fund to this fund to provide the annuity portion of the allowance. On June 30, 2019, the fair value of assets credited to the Pension Accumulation Fund amounted to \$68,997,729,000.

2. As of June 30, 2019, the total fair value of assets amounted to \$78,788,937,000 as reported by the auditor of the System. The actuarial value of assets as of June 30, 2019 was determined to be \$78,126,922,000 based on a 5-year smoothing of investment gains and losses. Schedule B shows the development of the actuarial value of assets.
3. Schedule C shows receipts and disbursements of the System for the two years preceding the valuation date and a reconciliation of the fund balances at fair value.



Section IV – Comments on Valuation

1. Schedule A of this report contains the valuation balance sheet which shows the present and prospective assets and liabilities of the System as of June 30, 2019 (all amounts are in thousands).
2. The valuation balance sheet shows that the System has total liabilities of \$113,823,728, of which \$61,856,920 is for the prospective benefits payable on account of present retired members and beneficiaries of deceased members and \$51,966,808 is for the prospective benefits payable on account of present active and inactive members and members entitled to deferred vested benefits. Against these liabilities, the System has total present assets for valuation purposes of \$78,126,922 as of June 30, 2019. The difference of \$35,696,806 between the total liabilities and the total present assets represents the present value of contributions to be made in the future. Of this amount, \$5,493,366 is the present value of future contributions expected to be made by members to the Annuity Savings Fund, and the balance of \$30,203,440 represents the present value of future contributions payable by the employer.
3. The employer contributions to the System consist of normal contributions and unfunded actuarial accrued liability (UAAL) contributions. The valuation indicates that employer normal contributions at the rate of 7.45% of payroll are required, in addition to member contributions, to provide the benefits of the System for the average new member.
4. Prospective normal contributions, excluding administrative expenses, have a present value of \$6,490,963. When this amount is subtracted from \$30,203,440, which is the present value of the total future contributions to be made by the employer, there remains \$23,712,477 as the amount of future UAAL contributions.
5. The funding policy adopted by the Board, as shown in Schedule F, provides that the UAAL as of June 30, 2013 (Transitional UAAL) will be amortized as a level percent of pay over a closed period equal to the amortization period determined in the valuation preceding the adoption of the funding policy not to exceed 30 years. In each subsequent valuation all benefit changes, assumption and method changes and experience gains and/or losses that have occurred since the previous valuation will determine a New Incremental UAAL. Each New Incremental UAAL will



Section IV – Comments on Valuation

be amortized as a level percent of payroll over a closed 30-year period from the date it is established.

6. The total UAAL contribution rate is 12.36% of payroll, determined in accordance with the Board's funding policy. The UAAL contribution rate has been calculated on the assumption that the aggregate amount of the accrued liability contribution will increase by 3.00% each year.
7. Schedule G of this report shows the amortization schedules for the Transitional UAAL and New Incremental UAALs.
8. The following table shows the components of the total UAAL and the derivation of the UAAL contribution rate in accordance with the funding policy:

TABLE 4
TOTAL UAAL AND UAAL CONTRIBUTION RATE
(Dollar amounts in thousands)

	<u>UAAL</u>	<u>REMAINING AMORTIZATION PERIOD (YEARS)</u>	<u>AMORTIZATION PAYMENT</u>
Transitional	\$14,648,705	24	\$1,002,414
New Incremental 6/30/2014	(167,814)	25	(11,212)
New Incremental 6/30/2015	3,503,117	26	228,871
New Incremental 6/30/2016	6,295,894	27	402,759
New Incremental 6/30/2017	944,760	28	59,252
New Incremental 6/30/2018	(3,199,299)	29	(196,935)
New Incremental 6/30/2019	<u>1,687,114</u>	30	<u>102,039</u>
Total UAAL	\$23,712,477		\$1,587,188
Amortization payment adjusted for timing			\$1,531,664
Blended amortization period (years)			24.9
Estimated payroll			\$12,394,134
UAAL contribution rate			12.36%



Section V – Contributions Payable by Employers

1. The Teachers Retirement System funding policy provides for periodic employer contributions at rates which, expressed as a percent of annual covered payroll, are sufficient to provide resources to pay benefits when due without being increased for future generations of taxpayers.
2. The retirement law provides that the contributions of employers shall be a percentage of the compensation of active members consisting of a normal contribution rate and an unfunded actuarial accrued liability (UAAL) contribution rate as determined by actuarial valuation.
3. Normal contributions include 0.20% of compensation that is required to meet the expenses of administering the System.
4. Based on the total employer contribution rate of 19.81% of payroll, the UAAL contribution rate is 12.36% of payroll, which will amortize the UAAL in accordance with the Board's funding policy.
5. The following table summarizes the employer contribution rates, which were determined by the June 30, 2019 valuation and are recommended for use.

**ACTUARIALLY DETERMINED EMPLOYER CONTRIBUTION RATES (ADEC)
FOR FISCAL YEAR ENDING JUNE 30, 2022**

CONTRIBUTION	PERCENTAGE OF ACTIVE MEMBERS' COMPENSATION
Normal	7.45%
Unfunded Actuarial Accrued Liability	<u>12.36</u>
Total	19.81%



Section VI – Accounting Information

The information required under Governmental Accounting Standard Board (GASB) Statements No. 67 and No. 68 will be issued in separate reports. The following information is provided for informational purposes only.

- The following is a distribution of the number of employees by type of membership:

NUMBER OF ACTIVE AND RETIRED MEMBERS AS OF JUNE 30, 2019

GROUP	NUMBER
Retirees and beneficiaries currently receiving benefits	131,820
Terminated employees not yet receiving benefits	113,807
Active plan members	<u>226,366</u>
Total	<u>471,993</u>

- The schedule of funding progress is shown below.

SCHEDULE OF FUNDING PROGRESS (Dollar amounts in thousands)

Actuarial Valuation Date	Actuarial Value of Assets (a)	Actuarial Accrued Liability (AAL) - Entry Age (b)	Unfunded AAL (UAAL) (b - a)	Funded Ratio (a / b)	Covered Payroll (c)	UAAL as a Percentage of Covered Payroll ((b - a) / c)
6/30/2014	\$62,061,722	\$75,772,117	\$13,710,395	81.9%	\$9,993,686	137.2%
6/30/2015	65,514,119	82,791,010	17,276,891	79.1	10,347,332	167.0
6/30/2016	68,161,710	91,721,775	23,560,065	74.3	10,783,277	218.5
6/30/2017	71,212,660	95,981,031	24,768,371	74.2	11,333,997	218.5
6/30/2018	75,024,364	96,905,253	21,880,889	77.4	11,704,334	186.9
6/30/2019	78,126,922	101,839,399	23,712,477	76.7	11,882,828	199.6



Section VI – Accounting Information

3. The following shows the schedule of employer contributions.

<u>Year Ending</u>	<u>Actuarially Determined Employer Contribution (ADEC)</u>	<u>Percentage Contributed</u>
6/30/2014	\$ 1,270,963	100%
6/30/2015	1,406,706	100
6/30/2016	1,580,532	100
6/30/2017	1,654,844	100
6/30/2018	2,018,724	100
6/30/2019	2,566,403	100

4. The information presented above was determined as part of the actuarial valuation at June 30, 2019. Additional information as of the latest actuarial valuation follows.

Valuation date	6/30/2019
Actuarial cost method	Entry age
Amortization method	Level percent of pay, closed
Remaining amortization period	24.9 years
Asset valuation method	5-year smoothed fair
Actuarial assumptions:	
Investment rate of return (discount rate)*	7.25%
Projected salary increases*	3.00 – 8.75%
Cost-of-living adjustments	3.00% Annually

* Includes inflation at 2.50%



Section VII – Experience

1. Section 47-3-23 of the act governing the operation of the System provides that as an aid to the Board in adopting service and mortality tables, the actuary will prepare an experience investigation at least once in each 5-year period. The last investigation was prepared for the 5-year period ending June 30, 2018 and, based on the results of the investigation, new rates of separation and mortality were adopted by the Board on May 13, 2020. The next experience investigation will be prepared for the 5-year period July 1, 2018 through June 30, 2023.
2. The following table shows the estimated gain or loss from various factors that resulted in an increase of \$1,831,588,000 in the unfunded actuarial accrued liability from \$21,880,889,000 to \$23,712,477,000 during the fiscal year ending June 30, 2019.

ANALYSIS OF THE CHANGE IN UNFUNDED ACTUARIAL ACCRUED LIABILITY
(Dollar amounts in millions)

ITEM	AMOUNT OF INCREASE/ (DECREASE)
Interest (7.25%) added to previous UAAL	\$ 1,586.4
Accrued liability contribution	(1,834.2)
Experience (Gain)/Loss:	
Valuation asset growth	558.1
Pensioners' mortality	53.9
Turnover and retirements	147.8
New entrants	151.3
Salary increases	(213.2)
Assumption and Method changes	1,204.2
Miscellaneous	<u>177.3</u>
Total Change in UAAL	\$ <u>1,831.6</u>



Section VII – Experience

3. The following is a brief description of the items contributing to the change in the unfunded actuarial accrued liability (UAAL) for the year:

Interest: The increase in the UAAL due to interest based on the assumed rate in effect for the year was \$1,586.4 million (7.25% assumed for July 1, 2018 through June 30, 2019).

Accrued Liability Contribution: The decrease due to the contribution made during the year that was allocated to amortization of the UAAL was \$1,834.2 million. This is the portion of the total employer contribution received during the year in excess of the employer normal cost.

Valuation Asset Growth: The increase in the UAAL due to valuation asset growth for the year ending June 30, 2019 is \$558.1 million. This loss represents the difference between the expected actuarial value of assets and the actual actuarial value of assets. The expected actuarial value of assets is determined by adding the actuarial value of assets from the prior valuation, non-investment related cash flow during the year and interest expected to be earned during the year at the assumed rate (7.25%). The estimated return on actuarial value of assets is 6.50% for the fiscal year ending June 30, 2019.

Pensioner Mortality: The increase in the UAAL due to pensioner mortality for the year is \$53.9 million. This is primarily due to fewer members dying during the year than anticipated based on the mortality tables adopted by the Board.

Turnover and Retirements: There was an increase in the UAAL due to turnover and retirements during the year of \$147.8 million. This loss occurred because the number of actual terminations was less than expected and the number of service retirements and disability retirements were greater than expected based on the assumed probabilities adopted by the Board. In addition, this item includes the impact of benefits for new retired members that were greater than anticipated based on the prior year's valuation data (this includes unexpected service increases due to sick leave conversion and service purchase and unanticipated salary increases in the year of retirement).

New Entrants: The increase in the liability due to new entrants was \$151.3 million. This represents the accrued liability at the valuation date for new entrants hired during the year. This includes members who returned to service with prior service credit.

Salary Increases: There was a decrease in the UAAL of \$213.2 million because the salary increases actually received by active members during the year were less than those anticipated based on the assumed salary increase rates adopted by the Board.

Assumption and Method Changes: There was an increase in the UAAL of \$1,204.2 million due to assumption changes adopted by the Board on May 13, 2020.

Miscellaneous: Other items contributing to the change in the UAAL totaled to an increase in the UAAL of \$177.3 million. This includes all gains or losses not specified above. One such item is the loss that occurred for members who purchased service at less than full actuarial cost (such as withdrawn service). Another item is a loss that occurred because the data received to prepare the valuation was different than expected from the previous year (items such as birth dates or service for active members and birth dates, options, or benefit amounts for retired members).



Section VIII – Risk Assessment

Overview

Actuarial Standards of Practice (ASOP) No. 51, issued by the Actuarial Standards Board, provides guidance on assessing and disclosing risks related to pension plan funding. This guidance is binding on all credentialed actuaries practicing in the United States. This standard was issued as final in September 2017 with application to measurement dates on or after November 1, 2018.

The term “risk” frequently has a negative connotation, but from an actuarial perspective, it may be thought of as simply the fact that what actually happens in the real world will not always match what was expected, based on actuarial assumptions. Of course, when actual experience is better than expected, the favorable risk is easily absorbed. The risk of unfavorable experience will likely be unpleasant, and so there is an understandable focus on aspects of risk that are negative.

Risk usually can be reduced or eliminated at some cost. Consumers, for example, buy auto and home insurance to reduce the risk of accidents or catastrophes. Another way to express this concept, however, is that there is generally some reward for assuming risk. Thus, retirement plans invest not just in US Treasury bonds which have almost no risk, but also in equities which are considerably riskier – because they have an expected reward of a higher return that justifies the risk.

Under ASOP 51, the actuary is called on to identify the significant risks to the pension plan and provide information to help those sponsoring and administering the plan understand the implications of these risks. In this section, we identify some of the key risks for the System and provide information to help interested parties better understand these risks.



Section VIII – Risk Assessment

Investment Risk

The investment return on assets is the most obvious risk – and usually the largest risk – to funding a pension plan. To illustrate the magnitude of this risk, the following chart shows the Asset Volatility Ratio (AVR), defined as the fair value of assets divided by covered payroll.

(\$ in thousands)

Valuation	Fair Value of Assets	Covered Payroll	Asset Volatility Ratio
2014	\$66,466,091	\$9,993,686	6.65
2015	\$66,799,111	\$10,347,332	6.46
2016	\$65,552,411	\$10,783,277	6.08
2017	\$71,340,972	\$11,333,997	6.29
2018	\$75,532,925	\$11,704,334	6.45
2019	\$78,788,937	\$11,882,828	6.63

The asset volatility ratio is especially useful to compare across plans or through time. It is also frequently useful to consider how the AVR translates into changes in the Required Contribution Rate (actuarially determined employer contribution rate). For example, in the table below with an AVR of 6.00, if the market value return is 10% below assumed, or negative 2.75% (7.25% minus 10.00%) for the System, there will be an increase in the Required Contribution Rate of 0.70% of payroll in the first year. Without asset smoothing or without returns above the expected return in the next four years, the impact on the Required Contribution Rate would be 3.52%. A higher AVR would produce more volatility in the Required Contribution Rate.

AVR	Unsmoothed Amortization	Smoothed Amortization
5.0	2.94%	0.59%
6.0	3.52%	0.70%
7.0	4.11%	0.82%



Section VIII – Risk Assessment

Sensitivity Measures

Valuations are generally performed with a single set of assumptions that reflects the best estimate of future conditions, in the opinion of the actuary and typically the governing board. Note that under actuarial standards of practice, the set of economic assumptions used for funding must be consistent. To enhance the understanding of the importance of an assumption, a sensitivity test can be performed where the valuation results are recalculated using a different assumption or set of assumptions.

The following tables contains the key measures for the System using the valuation assumption for investment return of 7.25%, along with the results if the assumption were 6.25% or 8.25%. In this analysis, only the investment return assumption is changed. Consequently, there may be inconsistencies between the investment return and other economic assumptions such as inflation or payroll increases. In addition, simply because the valuation results under alternative assumptions are shown here, it should not be implied that CMC believes that either assumption (6.25% or 8.25%) would comply with actuarial standards of practice.

(\$ in thousands)

As of June 30, 2019	Current Discount Rate (7.25%)	-1% Discount Rate (6.25%)	+1% Discount Rate (8.25%)
Accrued Liability	\$101,839,399	\$115,707,866	\$90,482,433
Unfunded Liability	\$23,712,477	\$37,580,944	\$12,355,511
Funded Ratio (AVA)	76.7%	67.5%	86.3%
ADEC Rate*	19.81%	28.17%	12.33%

* Contribution rates are determined based on the Board's current Funding Policy



Section VIII – Risk Assessment

Mortality Risk

The mortality assumption is a significant assumption for valuation results, second only to the investment assumption in most situations. The System's mortality assumption utilizes a mortality table (with separate rates for males and females, as well as different rates by status) and a generational projection scale to build in an expected degree of improvement to the member's mortality experience through time.

The future, however, is not known, and actual mortality improvements may occur at a faster rate than expected, or at a slower rate than expected. Although changes in mortality will affect the benefits paid, this assumption is carefully studied during the regular experience studies that the System conducts so that incremental changes can be made to smoothly reflect emerging experience. The risk to the System due to mortality is significantly reduced due to the use of the generational improvement method.

Contribution Risk

The System is primarily funded by member and employer contributions to the trust fund, together with the earnings on those accumulated contributions. Each year in the valuation, the Actuarial Determined Employer Contribution (ADEC) rate is determined, based on the System's funding policy. This rate is the sum of the rates for the normal cost for the plan (which includes expected administrative expenses), and the rate necessary to amortize the UAAL. Since the level percentage of payroll method is utilized to determine the UAAL amortization amounts, there is an expectation that future payments will grow at the assumed 3.00% annual rate of increase in covered payroll. If payroll grows at a slower rate, under this amortization method, less than expected UAAL amortization payments would result in a greater UAAL in future years and may require increases to either the amortization rate or the amortization period. From a policy perspective, since the ADEC rate has always been made by the plan sponsors, and that procedure is expected to continue, there is no risk to the System associated with the contribution amounts being less than the ADEC.



Schedule A – Valuation Balance Sheet

**THE PRESENT AND PROSPECTIVE ASSETS AND LIABILITIES OF
THE TEACHERS RETIREMENT SYSTEM OF GEORGIA
AS OF JUNE 30, 2019
(Dollar amounts in thousands)**

<u>ASSETS</u>	
Actuarial value of assets	\$ 78,126,922
Present value of future member contributions to Annuity Savings Fund	5,493,366
Present value of future employer contributions to the Pension Accumulation Fund:	
Normal contributions	\$ 6,490,963
Unfunded actuarial accrued liability contributions	<u>23,712,477</u>
Total Prospective Employer Contributions	<u>30,203,440</u>
Total Assets	<u>\$ 113,823,728</u>
<u>LIABILITIES</u>	
Present value of prospective benefits payable on account of present retired members and beneficiaries of deceased members	\$ 61,856,920
Present value of prospective benefits payable on account of present active and inactive members and members entitled to deferred vested benefits	<u>51,966,808</u>
Total Liabilities	<u>\$ 113,823,728</u>



Schedule B – Development of Actuarial Value of Assets

(Dollar amounts in thousands)

(1)	Actuarial Value Beginning of Year	\$ 75,024,364
(2)	Fair Value End of Year	78,788,937
(3)	Fair Value Beginning of Year	75,532,925
(4)	Cash Flow	
(a)	Contributions	3,325,877
(b)	Benefit Payments	5,027,008
(c)	Administrative Expenses	15,276
(d)	Investment Expenses	<u>46,033</u>
(e)	Net: (4)(a) - (4)(b) - 4(c) - 4(d)	(1,762,440)
(5)	Investment Income	
(a)	Fair Total: (2) - (3) - (4)(e)	5,018,452
(b)	Assumed Rate	7.25%
(c)	Amount for Immediate Recognition: [(3) x (5)(b)] + [(4)(a) - (4)(b) - 4(c)] x (5)(b) x 0.5 + (4)(d)	5,459,950
(d)	Amount for Phased-In Recognition: 5(a) - (5)(c)	(441,498)
(6)	Phased-In Recognition of Investment Income	
(a)	Current Year: 5(d) / 5	(88,300)
(b)	First Prior Year	194,938
(c)	Second Prior Year	627,423
(d)	Third Prior Year	(824,442)
(e)	Fourth Prior Year	<u>(504,571)</u>
(f)	Total Recognized Investment Gain	(594,952)
(7)	Preliminary Value End of Year: (1) + (4)(e) + 5(c) + (6)(f)	<u>\$ 78,126,922</u>
(8)	Corridor	
(a)	75% of Fair Value: 0.75 x (2)	\$ 59,091,703
(b)	125% of Fair Value: 1.25 x (2)	\$ 98,486,171
(9)	Actuarial Value End of Year: (7), but not less than (8)(a) and not greater than (8)(b)	\$ 78,126,922
(10)	Difference Between Fair & Actuarial Values: (2) - (9)	\$ 662,015
(11)	Rate of Return on Actuarial Value	6.50%



Schedule C – Summary of Receipts and Disbursements

(Dollar amounts in thousands)

	YEAR ENDING	
	June 30, 2019	June 30, 2018
<u>Receipts for the Year</u>		
Contributions:		
Member	\$ 759,474	\$ 745,574
Employer	2,560,989	2,014,308
Non-Employer	<u>5,414</u>	<u>4,416</u>
Subtotal	\$ 3,325,877	\$ 2,764,298
Investment Income (Net of Investment Expenses)	1,659,841	1,521,874
Unrealized Appreciation/(Depreciation)	<u>3,312,578</u>	<u>4,725,281</u>
TOTAL	\$ 8,298,296	\$ 9,011,453
<u>Disbursements for the Year</u>		
Benefit Payments	\$ 4,950,465	\$ 4,699,920
Refunds to Members	76,543	76,061
Administrative Expenses	<u>15,276</u>	<u>15,865</u>
TOTAL	\$ 5,042,284	\$ 4,791,846
<u>Excess of Receipts over Disbursements</u>	\$ 3,256,012	\$ 4,219,607
<u>Reconciliation of Asset Balances</u>		
Asset Balance as of the Beginning of Year (Fair Value)	\$ 75,532,925	\$ 71,313,318
Excess of Receipts over Disbursements	<u>3,256,012</u>	<u>4,219,607</u>
Asset Balance as of the End of Year (Fair Value)	<u>\$ 78,788,937</u>	<u>\$ 75,532,925</u>



Schedule D – Outline of Actuarial Assumptions & Methods

All assumptions, with the exception of the discount rate, payroll growth and the inflation component of the rates of salary increases, were adopted by the Board on May 13, 2020.

INVESTMENT RATE OF RETURN (Discount Rate): 7.25% per annum, net of investment expenses, compounded annually (including inflation of 2.50%).

SALARY INCREASES*:

<u>Service</u>	<u>Annual Rate</u>	<u>Service</u>	<u>Annual Rate</u>	<u>Service</u>	<u>Annual Rate</u>
0	8.75 %	7	4.25 %	14	3.25 %
1	7.25	8	3.75	15	3.25
2	5.75	9	3.75	16	3.00
3	5.25	10	3.50	17	3.00
4	5.00	11	3.50	18	3.00
5	5.00	12	3.50	19	3.00
6	5.00	13	3.50	20 or more	3.00

*includes price inflation component of 2.50% and a real rate of salary increase component of 0.50%

SERVICE RETIREMENT:

<u>AGE</u>	<u>Annual Rate</u>			
	<u>Male</u>		<u>Female</u>	
	<u>Less than 30 years of service</u>	<u>30 or more years of service*</u>	<u>Less than 30 years of service</u>	<u>30 or more years of service**</u>
50	3.00 %	52.00 %	2.75 %	50.00 %
55	5.00	37.00	5.75	35.00
60	20.00	34.00	25.00	40.00
61	18.00	30.00	25.00	40.00
62	25.00	35.00	25.00	43.00
63	22.00	28.00	25.00	43.00
64	22.00	28.00	24.00	43.00
65	27.00	27.00	32.00	32.00
66	32.00	32.00	32.00	32.00
67	30.00	30.00	32.00	32.00
68	30.00	30.00	30.00	30.00
69	30.00	30.00	30.00	30.00
70	30.00	30.00	30.00	30.00

*An additional 10% are assumed to retire at 30 years of service for ages between 50 and 64.

**An additional 15% are assumed to retire at 30 years of service for ages between 50 and 61.



Schedule D – Outline of Actuarial Assumptions & Methods

SEPARATION BEFORE SERVICE RETIREMENT:

Age	Death*	Disability	Annual Rate of		
			Withdrawal		
			Years of Service		
			0-4	5-9	10+
Male					
20	0.0375%	-	27.00%	-	-
25	0.0336	-	17.00	13.00%	-
30	0.0437	-	14.00	6.50	6.00%
35	0.0549	0.0165%	14.00	6.25	3.50
40	0.0714	0.0275	13.00	6.25	2.75
45	0.1087	0.0720	13.00	6.00	2.50
50	0.1799	0.1360	11.25	5.75	2.75
55	0.2828	0.2400	11.75	5.50	3.25
60	0.4441	-	12.00	6.00	-
64	0.6475	-	15.00	7.50	-
Female					
20	0.0139%	-	28.00%	-	-
25	0.0148	-	13.50	12.00%	-
30	0.0235	-	13.50	7.00	6.00%
35	0.0345	0.0152	13.00	7.00	4.00
40	0.0493	0.0312	12.00	6.50	3.00
45	0.0728	0.0650	10.75	6.00	2.50
50	0.1107	0.1400	10.75	5.50	3.00
55	0.1687	0.3400	10.75	5.00	3.00
60	0.2554	-	11.50	5.50	-
64	0.3665	-	15.00	7.50	-

* The Pub-2010 Teachers Headcount Weighted Below Median Employee mortality table with ages set forward one year and adjusted 106% is used for death prior to retirement. Future improvement in mortality rates is assumed using the MP-2019 projection scale generationally. These rates of improvement have been reduced by 20% for all years prior to the ultimate rate. The proposed rates shown above are based on a projection to 2015. Actual mortality rates would be projected generationally.



Schedule D – Outline of Actuarial Assumptions & Methods

DEATHS AFTER RETIREMENT: The Pub-2010 Teachers Headcount Weighted Below Median Healthy Retiree mortality table (ages set forward one year and adjusted 106%) with the MP-2019 Projection scale applied generationally is used for death after service retirement and beneficiaries. The rates of improvement have been reduced by 20% for all years prior to the ultimate rate. The Pub-2010 Teachers Mortality Table for Disabled Retirees (ages set forward one year and adjusted 106%) with the MP-2019 Projection scale applied generationally is used for death after disability retirement. The rates of improvement have been reduced by 20% for all years prior to the ultimate rate. The representative rates shown below are based on a projection to 2015. Actual mortality rates are projected generationally to the year of the measurement.

Age	Annual Rate of Death After			
	Service Retirement*		Disability Retirement*	
	Men	Women	Men	Women
40	0.0714%	0.0493%	0.8444%	0.7386%
45	0.1087	0.0728	1.2146	1.1004
50	0.1799	0.1107	1.8432	1.6181
55	0.5241	0.3901	2.4790	1.9679
60	0.6440	0.4136	3.0569	2.2548
65	0.8433	0.5260	3.7177	2.6170
70	1.4580	0.9329	4.6328	3.3740
75	2.7028	1.7905	6.1798	4.7842
80	4.9635	3.4310	8.8648	7.2311
85	9.0522	6.5905	13.0223	11.2015
90	16.0712	12.3050	18.8001	16.0832
95	26.1186	21.7258	27.0439	22.7586

*Rates as of 2015

COST OF LIVING: Increases of 1.5% semi-annually.

PAYROLL GROWTH ASSUMPTION: 3.00%

ADMINISTRATIVE EXPENSES: 0.20% of active members' payroll included in normal contribution.

ASSET METHOD: Actuarial Value, as developed in Schedule B. The actuarial value of assets recognizes a portion of the difference between the fair value of assets and the expected fair value of assets, based on the investment rate of return. In accordance with the funding policy adopted by the Board, the actuarial value was set equal to the fair value as of June 30, 2013. The amount recognized each year beginning June 30, 2014 will be based on 5-year smoothing of assets, where 20% of the difference between fair value and expected fair value will be recognized each year. The actuarial value of assets is limited to a range between 75% and 125% of the fair value of assets.

PERCENTAGE MARRIED: 100% of active members were assumed to be married with the husband 4 years older than his wife.

UNUSED SICK LEAVE: 1.50% for members who retire on early retirement and for members who retire with unreduced retirement before 30 years of service and a 2.00% load for members who retire with 30 or more years of service.

TERMINATING VESTED MEMBERS: Prior to age 50, 30% of active vested members who terminate are assumed to elect a refund in lieu of a benefit; on or after age 50, 20% of active vested members who terminate are assumed to elect a refund in lieu of a benefit. Benefits are assumed to begin at age 60.



Schedule E – Actuarial Cost Method

1. The valuation is prepared on the projected benefit basis, under which the present value, at the interest rate assumed to be earned in the future (currently 7.25%), of each active member's expected benefit at retirement or death is determined, based on his age, service, sex and compensation. The calculations take into account the probability of a member's death or termination of employment prior to becoming eligible for a benefit, as well as the possibility of his terminating with a service, disability or survivor's benefit. Future salary increases and post-retirement cost-of-living adjustments are also anticipated. The present value of the expected benefits payable on account of the active members is added to the present value of the expected future payments to retired members and beneficiaries and inactive members to obtain the present value of all expected benefits payable from the System on account of the present group of members and beneficiaries.
2. The employer contributions required to support the benefits of the System are determined following a level funding approach, and consist of a normal contribution and an accrued liability contribution.
3. The normal contribution is determined using the "entry age normal" method. Under this method, a calculation is made to determine the uniform and constant percentage rate of employer contribution which, if applied to the compensation of the average new member during the entire period of his anticipated covered service, would be required in addition to the contributions of the member to meet the cost of all benefits payable on his behalf.
4. The unfunded actuarial accrued liability is determined by subtracting the present value of prospective employer normal contributions and member contributions, together with the current actuarial value of assets held, from the present value of expected benefits to be paid from the System.



Schedule F – Funding Policy of the TRS Board of Trustees

The purpose of the funding policy is to state the overall funding objectives for the Teachers Retirement System of Georgia (the “System”), the benchmarks that will be used to measure progress in achieving those goals, and the methods and assumptions that will be employed to develop the benchmarks. It is intended that the funding policy will remain unchanged until the objectives below are met.

I. Funding Objectives

The goal in requiring employer and member contributions to the System is to accumulate sufficient assets during a member’s employment to fully finance the benefits the member is expected to receive throughout retirement. In meeting this objective, the System will strive to meet the following funding objectives:

- To develop a pattern of contribution rates expressed as a percentage of member payroll as measured by valuations prepared in accordance with applicable State laws and the principles of practice prescribed by the Actuarial Standards Board.
- To maintain an increasing funded ratio (ratio of actuarial value of assets to actuarial accrued liabilities) that reflects a trend of improved actuarial condition. The long-term objective is to attain a 100% funded ratio over a reasonable period of future years.
- To maintain adequate asset levels to finance the benefits promised to members and to monitor the future demand for liquidity.
- To promote intergenerational equity for taxpayers with respect to contributions required for the benefits provided by the System.

II. Measures of Funding Progress

To track progress in achieving the System’s funding objectives, the following measures will be determined annually as of the actuarial valuation date (with due recognition that a single year’s results may not be indicative of long-term trends):

Funded ratio

The funded ratio, defined as the actuarial value of assets divided by the actuarial accrued liability, should increase over time, before adjustments for changes in benefits, actuarial methods, and/or actuarial assumptions.

Unfunded Actuarial Accrued Liability (UAAL)

- Transitional UAAL - The UAAL established as of the initial valuation date for which this funding policy is adopted shall be known as the Transitional UAAL.
- New Incremental UAAL - Each subsequent valuation will produce a New Incremental UAAL consisting of all benefit changes, assumption and method changes and experience gains and/or losses that have occurred since the previous valuation.
- Total UAAL - In each valuation year, this is the sum of the remaining balance of the Transitional UAAL and the remaining balance of each New Incremental UAAL.

UAAL Amortization Period

- The Transitional UAAL will be amortized over a closed period equal to the amortization period determined in the valuation preceding the adoption of the funding policy not to exceed 30 years.
- Each New Incremental UAAL shall be amortized over a closed 30-year period.



Schedule F – Funding Policy of the TRS Board of Trustees

Employer Contribution Rates

- Employer Normal Contribution Rate – the contribution rate determined as of the valuation date each year based on the provisions of Georgia Code Section 47-3-43.
- In each valuation subsequent to the adoption of this funding policy, the required employer contribution rate will be determined by the summation of the employer Normal Contribution Rate, a contribution rate for administrative expenses, the amortization rate for the Transitional UAAL and the individual amortization rate for each of the New Incremental UAAL bases.

Stability of Employer Contribution Rates

The valuation methodology, including the amortization of the UAAL would be expected to maintain reasonably stable contribution rates. In each valuation, a single equivalent UAAL amortization period will be determined equal to the number of years that the sum of all of the individual amortization payments for the Transitional UAAL and each New Incremental UAAL determined above would be expected to fully amortize the Total UAAL. The employer contribution rate established in the prior valuation can be maintained provided that the payment of this rate results in a reduction from the prior valuation of at least one-year to the single equivalent UAAL amortization period.

III. Methods and Assumptions

The annual actuarial valuations providing the measures to assess funding progress will utilize the actuarial methods and assumptions last adopted by the Board based upon the advice and recommendation of the System's actuary. These include the following primary methods and assumptions:

- The actuarial cost method used to develop the benchmarks will be the Entry Age Normal actuarial cost method.
- The long-term investment rate of return assumption will be based on the discount rate adopted by the Board of Trustees.
- The actuarial value of assets will be set equal to the market value of assets as of the valuation date immediately preceding the adoption of this funding policy. The actuarial value of assets in subsequent valuations will be determined by recognizing the annual differences between actual and expected market value of assets over a 5-year period.

In order to insure the sufficiency of long-term funding of benefits, the annual employer contribution rate determined in each actuarial valuation shall not be less than the employer normal cost contribution rate plus a contribution rate for administrative expenses.

The actuary shall conduct an investigation into the System's experience at least every five years and utilize the results of the investigation to form the basis for recommended assumptions and methods.

IV. Funding Policy Progress

The Board will periodically have actuarial projections of the valuation results performed to assess the current and expected future progress towards the overall funding goals of the System. These periodic projections will provide the expected valuation results over at least a 30-year period. The projected measures of funding progress and the recent historical trend provided in valuations will provide important information for the Board's assessment of the System's funding progress.



Schedule G – Amortization of UAAL

TRANSITIONAL UAAL (Dollar amounts in thousands)

Valuation Date	Balance of Transitional UAAL	Expected UAAL Contribution
6/30/2013	\$ 13,626,028	\$ 779,710
6/30/2014	13,868,270	808,949
6/30/2015	14,099,441	885,395
6/30/2016	14,271,505	914,170
6/30/2017	14,427,698	943,880
6/30/2018	14,565,895	973,217
6/30/2019	14,648,705	1,002,414
6/30/2020	14,708,322	1,032,486
6/30/2021	14,742,189	1,063,461
6/30/2022	14,747,536	1,095,365
6/30/2023	14,721,368	1,128,226
6/30/2024	14,660,441	1,162,073
6/30/2025	14,561,251	1,196,935
6/30/2026	14,420,007	1,232,843
6/30/2027	14,232,615	1,269,828
6/30/2028	13,994,651	1,307,923
6/30/2029	13,701,341	1,347,161
6/30/2030	13,347,527	1,387,575
6/30/2031	12,927,648	1,429,203
6/30/2032	12,435,700	1,472,079
6/30/2033	11,865,209	1,516,241
6/30/2034	11,209,196	1,561,728
6/30/2035	10,460,134	1,608,580
6/30/2036	9,609,914	1,656,838
6/30/2037	8,649,795	1,706,543
6/30/2038	7,570,363	1,757,739
6/30/2039	6,361,475	1,810,471
6/30/2040	5,012,211	1,864,785
6/30/2041	3,510,811	1,920,729
6/30/2042	1,844,616	1,978,351
6/30/2043	0	0



Schedule G – Amortization of UAAL

2014 NEW INCREMENTAL UAAL (Dollar amounts in thousands)

Valuation Date	Balance of New Incremental UAAL 6/30/2014	Expected UAAL Contribution
6/30/2014	\$ (157,875)	\$ (9,034)
6/30/2015	(160,681)	(9,903)
6/30/2016	(162,829)	(10,225)
6/30/2017	(164,816)	(10,557)
6/30/2018	(166,620)	(10,886)
6/30/2019	(167,814)	(11,212)
6/30/2020	(168,768)	(11,549)
6/30/2021	(169,455)	(11,895)
6/30/2022	(169,845)	(12,252)
6/30/2023	(169,907)	(12,620)
6/30/2024	(169,605)	(12,998)
6/30/2025	(168,904)	(13,388)
6/30/2026	(167,761)	(13,790)
6/30/2027	(166,133)	(14,204)
6/30/2028	(163,975)	(14,630)
6/30/2029	(161,233)	(15,069)
6/30/2030	(157,854)	(15,521)
6/30/2031	(153,777)	(15,986)
6/30/2032	(148,940)	(16,466)
6/30/2033	(143,272)	(16,960)
6/30/2034	(136,700)	(17,469)
6/30/2035	(129,142)	(17,993)
6/30/2036	(120,512)	(18,533)
6/30/2037	(110,716)	(19,088)
6/30/2038	(99,655)	(19,661)
6/30/2039	(87,218)	(20,251)
6/30/2040	(73,291)	(20,859)
6/30/2041	(57,746)	(21,484)
6/30/2042	(40,448)	(22,129)
6/30/2043	(21,252)	(22,793)
6/30/2044	0	0



Schedule G – Amortization of UAAL

2015 NEW INCREMENTAL UAAL (Dollar amounts in thousands)

Valuation Date	Balance of New Incremental UAAL 6/30/2015	Expected UAAL Contribution
6/30/2015	\$ 3,338,131	\$ 202,141
6/30/2016	3,386,350	208,710
6/30/2017	3,431,616	215,493
6/30/2018	3,473,494	222,205
6/30/2019	3,503,117	228,871
6/30/2020	3,528,222	235,737
6/30/2021	3,548,281	242,810
6/30/2022	3,562,721	250,094
6/30/2023	3,570,925	257,597
6/30/2024	3,572,220	265,325
6/30/2025	3,565,881	273,284
6/30/2026	3,551,124	281,483
6/30/2027	3,527,097	289,927
6/30/2028	3,492,884	298,625
6/30/2029	3,447,493	307,584
6/30/2030	3,389,853	316,811
6/30/2031	3,318,805	326,316
6/30/2032	3,233,103	336,105
6/30/2033	3,131,398	346,188
6/30/2034	3,012,236	356,574
6/30/2035	2,874,049	367,271
6/30/2036	2,715,146	378,289
6/30/2037	2,533,705	389,638
6/30/2038	2,327,760	401,327
6/30/2039	2,095,196	413,367
6/30/2040	1,833,730	425,768
6/30/2041	1,540,907	438,541
6/30/2042	1,214,082	451,697
6/30/2043	850,406	465,248
6/30/2044	446,812	479,206
6/30/2045	0	0



Schedule G – Amortization of UAAL

2016 NEW INCREMENTAL UAAL (Dollar amounts in thousands)

Valuation Date	Balance of New Incremental UAAL 6/30/2016	Expected UAAL Contribution
6/30/2016	\$ 6,065,039	\$ 367,269
6/30/2017	6,152,648	379,205
6/30/2018	6,234,892	391,028
6/30/2019	6,295,894	402,759
6/30/2020	6,349,587	414,841
6/30/2021	6,395,091	427,287
6/30/2022	6,431,448	440,105
6/30/2023	6,457,623	453,309
6/30/2024	6,472,492	466,908
6/30/2025	6,474,840	480,915
6/30/2026	6,463,351	495,342
6/30/2027	6,436,601	510,203
6/30/2028	6,393,052	525,509
6/30/2029	6,331,039	541,274
6/30/2030	6,248,766	557,512
6/30/2031	6,144,289	574,238
6/30/2032	6,015,512	591,465
6/30/2033	5,860,172	609,209
6/30/2034	5,675,826	627,485
6/30/2035	5,459,838	646,310
6/30/2036	5,209,367	665,699
6/30/2037	4,921,347	685,670
6/30/2038	4,592,475	706,240
6/30/2039	4,219,190	727,427
6/30/2040	3,797,654	749,250
6/30/2041	3,323,734	771,727
6/30/2042	2,792,977	794,879
6/30/2043	2,200,589	818,726
6/30/2044	1,541,406	843,287
6/30/2045	809,870	868,586
6/30/2046	0	0



Schedule G – Amortization of UAAL

2017 NEW INCREMENTAL UAAL (Dollar amounts in thousands)

Valuation Date	Balance of New Incremental UAAL 6/30/2017	Expected UAAL Contribution
6/30/2017	\$ 921,225	\$ 55,785
6/30/2018	934,532	57,526
6/30/2019	944,760	59,252
6/30/2020	954,003	61,029
6/30/2021	962,140	62,860
6/30/2022	969,035	64,746
6/30/2023	974,544	66,688
6/30/2024	978,510	68,689
6/30/2025	980,763	70,750
6/30/2026	981,119	72,872
6/30/2027	979,378	75,058
6/30/2028	975,325	77,310
6/30/2029	968,726	79,629
6/30/2030	959,329	82,018
6/30/2031	946,862	84,479
6/30/2032	931,031	87,013
6/30/2033	911,518	89,623
6/30/2034	887,980	92,312
6/30/2035	860,046	95,081
6/30/2036	827,318	97,934
6/30/2037	789,364	100,872
6/30/2038	745,721	103,898
6/30/2039	695,888	107,015
6/30/2040	639,325	110,225
6/30/2041	575,450	113,532
6/30/2042	503,638	116,938
6/30/2043	423,214	120,446
6/30/2044	333,451	124,060
6/30/2045	233,566	127,782
6/30/2046	122,718	131,615
6/30/2047	0	0



Schedule G – Amortization of UAAL

2018 NEW INCREMENTAL UAAL (Dollar amounts in thousands)

Valuation Date	Balance of New Incremental UAAL 6/30/2018	Expected UAAL Contribution
6/30/2018	\$ (3,161,304)	\$ (191,199)
6/30/2019	(3,199,299)	(196,935)
6/30/2020	(3,234,313)	(202,843)
6/30/2021	(3,265,957)	(208,929)
6/30/2022	(3,293,810)	(215,197)
6/30/2023	(3,317,415)	(221,652)
6/30/2024	(3,336,275)	(228,302)
6/30/2025	(3,349,853)	(235,151)
6/30/2026	(3,357,566)	(242,206)
6/30/2027	(3,358,784)	(249,472)
6/30/2028	(3,352,824)	(256,956)
6/30/2029	(3,338,948)	(264,665)
6/30/2030	(3,316,357)	(272,605)
6/30/2031	(3,284,189)	(280,783)
6/30/2032	(3,241,510)	(289,206)
6/30/2033	(3,187,313)	(297,882)
6/30/2034	(3,120,511)	(306,819)
6/30/2035	(3,039,929)	(316,023)
6/30/2036	(2,944,301)	(325,504)
6/30/2037	(2,832,258)	(335,269)
6/30/2038	(2,702,328)	(345,327)
6/30/2039	(2,552,919)	(355,687)
6/30/2040	(2,382,319)	(366,358)
6/30/2041	(2,188,679)	(377,348)
6/30/2042	(1,970,010)	(388,669)
6/30/2043	(1,724,167)	(400,329)
6/30/2044	(1,448,840)	(412,339)
6/30/2045	(1,141,542)	(424,709)
6/30/2046	(799,595)	(437,450)
6/30/2047	(420,115)	(450,574)
6/30/2048	0	0



Schedule G – Amortization of UAAL

2019 NEW INCREMENTAL UAAL (Dollar amounts in thousands)

Valuation Date	Balance of New Incremental UAAL 6/30/2019	Expected UAAL Contribution
6/30/2019	\$ 1,687,114	\$ 102,039
6/30/2020	1,707,391	105,100
6/30/2021	1,726,077	108,253
6/30/2022	1,742,965	111,500
6/30/2023	1,757,830	114,845
6/30/2024	1,770,427	118,291
6/30/2025	1,780,492	121,839
6/30/2026	1,787,738	125,495
6/30/2027	1,791,855	129,259
6/30/2028	1,792,505	133,137
6/30/2029	1,789,324	137,131
6/30/2030	1,781,919	141,245
6/30/2031	1,769,863	145,483
6/30/2032	1,752,695	149,847
6/30/2033	1,729,918	154,343
6/30/2034	1,700,995	158,973
6/30/2035	1,665,344	163,742
6/30/2036	1,622,339	168,654
6/30/2037	1,571,304	173,714
6/30/2038	1,511,510	178,925
6/30/2039	1,442,169	184,293
6/30/2040	1,362,433	189,822
6/30/2041	1,271,388	195,517
6/30/2042	1,168,047	201,382
6/30/2043	1,051,348	207,424
6/30/2044	920,148	213,646
6/30/2045	773,212	220,056
6/30/2046	609,214	226,657
6/30/2047	426,725	233,457
6/30/2048	224,206	240,461
6/30/2049	0	0



Schedule H – Summary of Main Plan Provisions

SUMMARY OF MAIN PLAN PROVISIONS AS INTERPRETED FOR VALUATION PURPOSES

The Teachers Retirement System of Georgia began operation as of January 1, 1945. The System is supported by the joint contributions of the members and their employers. All teachers employed by an agency of and within the State of Georgia are eligible for membership in the System. The State makes contributions for certain retired members of local funds and certain benefits are payable by the System to them or on their account.

The following summary describes the main benefit and contribution provisions of the System as interpreted for the valuation.

1 - DEFINITIONS

"Prior service" means service rendered prior to January 1, 1945 for which credit is allowed. "Creditable service" means the sum of membership service and prior service. "Earnable compensation" means the full rate of compensation that would be payable to a member teacher if he worked the full normal working time and shall include compensation paid to a member by an employer from grants or contracts made by outside agencies with the employer. "Employer" means the State of Georgia, the county or independent board of education, the State Board of Education, the Board of Regents of the University System of Georgia, or any other agency of and within the State by which a teacher is paid.

2 - BENEFITS

MEMBERS OF THE RETIREMENT SYSTEM

Service Retirement Benefit

Condition for Allowance

Any member may retire on a service retirement allowance upon the attainment of age 60 and the completion of 10 years of creditable service or upon the completion of 25 years of creditable service.



Schedule H – Summary of Main Plan Provisions

Amount of Allowance

The service retirement allowance consists of:

- (a) An annuity which is the actuarial equivalent of the member's accumulated contributions at the time of his retirement; and
- (b) A pension which, together with the annuity, will provide a total annual allowance equal to 2.00% of the member's average annual compensation during the two consecutive years of his creditable service as a contributing member producing the highest such average, multiplied by the number of years of his creditable service limited to 40 years.

If the member has less than 30 years of creditable service and has not attained age 60 at the time of retirement, his allowance is reduced by the lesser of 1/12 of 7% for each month that retirement precedes age 60 or 7% for each year or fraction of a year by which the member has less than 30 years of creditable service at the time of retirement.

The minimum service retirement allowance is \$17 per month for each year of creditable service, not to exceed 40 years of such service.

In no event will a teacher who was a member on June 30, 1961 receive a smaller retirement allowance than he would have received under the benefit provisions of the System in effect on that date.

Disability Retirement Benefit

Condition for Allowance

A disability retirement allowance is payable to any member who becomes permanently incapacitated, mentally or physically, for the further performance of duty, after having rendered 10 or more years of creditable service.

Amount of Allowance

If a member qualifies for either service retirement or disability retirement and a service retirement calculation exceeds the amount that he would receive on disability, he shall receive a service retirement allowance. Otherwise he receives a disability retirement allowance determined as a service retirement allowance on the basis of the member's creditable service and compensation up to the time of disability, but with no reduction for age.



Schedule H – Summary of Main Plan Provisions

Death Benefit

Condition for Allowance

A death benefit is payable on account of a member who dies after having completed 10 or more years of creditable service provided there is a named living beneficiary.

Amount of Allowance

The death benefit is the amount which would have become payable to the member's beneficiary had the member retired on the date of his death on either a service retirement allowance or a disability retirement allowance, whichever is larger, and died after an election of Option 2 had become effective.

Vesting Benefit

Condition for Allowance

A member who withdraws from service prior to attaining age 60 after having rendered at least 10 years of creditable service and who elects to leave his accumulated contributions in the System is eligible for a vesting retirement allowance upon application therefore upon the attainment of age 60 or at any time thereafter.

Amount of Allowance

The vesting allowance is determined as a service retirement allowance on the basis of the member's creditable service and compensation up to the time of withdrawal from service and on the basis of his age at the time the allowance commences.

Return of Contributions Prior to Retirement

Upon a member's withdrawal from service or death prior to retirement, his accumulated contributions together with the accumulated interest are returned to him, or are paid to his designated beneficiary or estate, provided no other benefit is payable under the System.

Return of Contributions After Retirement Under Maximum Plan

Benefits are payable to a member retired on service or disability for the remainder of his lifetime under the maximum plan. In the event total monthly benefits paid at the time of death are less than the contributions which the member made to the System, the difference between the benefits paid and the amount of contributions is refunded to the member's designated beneficiary or estate, provided no optional allowance has been selected.



Schedule H – Summary of Main Plan Provisions

Optional Allowances

Upon retirement, any member may elect to convert the retirement allowance otherwise payable to him, except any additional pension payable under the minimum provision, to a reduced retirement allowance of equivalent actuarial value in one of the following optional forms:

Option 1. If he dies before receiving in annuity payments the amount of his accumulated contributions at retirement, the balance is paid to his designated beneficiary or to his estate; or

Option 2. Upon his death his reduced retirement allowance is continued throughout the life of and paid to his designated beneficiary; or

Option 2 Pop-up. A member may elect Option 2 with the added provision that in the event the designated beneficiary predeceases the member, the retirement allowance payable to the member after the designated beneficiary's death shall be equal to the retirement allowance which would have been payable had the member not elected the option; or

Option 3. Upon his death one-half of his reduced retirement allowance is continued throughout the life of and paid to his designated beneficiary; or

Option 3 Pop-up. A member may elect Option 3 with the added provision that in the event the designated beneficiary predeceases the member, the retirement allowance payable to the member after the designated beneficiary's death shall be equal to the retirement allowance which would have been payable had the member not elected the option; or

Option 4. A reduced retirement allowance payable during the life of the retired member, with the provision that upon his death some other benefit shall be payable; provided that the total value of such benefits is the actuarial equivalent of the retirement allowance he would have received without optional modification and provided the benefit is approved by the Board of Trustees; or

Option 5. A reduced retirement allowance together with a partial lump sum distribution not to exceed the sum of 36 months of the member's monthly retirement allowance that would have been payable if this option was not elected. This option may be elected with any other option described above. This option is not available to disability retirements or members subject to the minimum benefit formula.



Schedule H – Summary of Main Plan Provisions

Cost-of-Living Adjustment

The retirement allowances of members or of any beneficiary of a member who died in service will be subject to adjustment as of each January 1 and July 1 based upon the change in the average CPI during the previous six-month period. The maximum increase in retirement allowances for any such six-month period will be 1-1/2%. If the CPI decreases, no reduction in allowance will be made for the first 2-1/2% of a reduction and retirement allowances will not be reduced below the amounts initially paid upon retirement.

In addition, for members who retired prior to January 1, 2013, a one-time 3% increase on the first \$37,500 of members' allowances is made at retirement. Members who retire on or after January 1, 2013 do not receive this increase.

A member who retires prior to age 60 with less than 30 years of creditable service is not eligible for post-retirement adjustments until such time as the member reaches age 60 or would have obtained 30 years of creditable service, whichever occurs earlier.

3 - CONTRIBUTIONS

By Members

Each member contributes 6.00% of his earnable compensation. However, no contributions are payable after the attainment of age 65 and the completion of 40 years of creditable service unless the member elects to continue to make contributions. Members may elect to cease making contributions after the completion of 40 years of creditable service.

By Employers

The employer contributes at a specified percentage of active member payroll determined annually by actuarial valuation.



Schedule I – Tables of Membership Data

THE NUMBER AND AVERAGE ANNUAL COMPENSATION OF ACTIVE MEMBERS BY AGE AND SERVICE AS OF JUNE 30, 2019

Age	Years of Service										
	Under 1	1 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 & Up	Total
Under 25	321	3,806	14								4,141
Avg. Pay	19,369	31,877	29,210								30,899
25 to 29	437	15,875	3,724	7							20,043
Avg. Pay	23,567	37,782	45,989	40,364							38,998
30 to 34	350	10,632	10,814	2,558	9						24,363
Avg. Pay	27,878	39,304	49,066	56,083	47,636						45,238
35 to 39	312	8,931	6,865	10,191	2,708	8					29,015
Avg. Pay	29,731	40,754	50,467	58,935	64,851	42,049					51,569
40 to 44	257	7,841	5,865	6,957	9,014	2,261	14				32,209
Avg. Pay	30,644	41,731	50,384	58,432	67,505	71,657	63,284				56,149
45 to 49	255	7,279	5,803	6,904	6,653	8,182	2,278	31			37,385
Avg. Pay	31,535	41,897	49,037	56,417	64,328	73,044	75,661	55,984			58,493
50 to 54	193	5,465	4,513	5,982	5,394	4,867	5,208	883	4		32,509
Avg. Pay	32,950	41,486	47,029	52,910	58,985	67,671	74,921	73,483	36,925		57,356
55 to 59	149	3,772	3,320	4,859	4,994	4,342	3,195	1,386	189	4	26,210
Avg. Pay	33,757	41,194	46,719	50,066	54,930	59,300	66,817	73,122	76,048	42,194	54,176
60 to 64	49	1,929	1,887	2,721	2,780	2,436	1,686	737	279	55	14,559
Avg. Pay	31,488	39,333	46,004	49,389	54,214	57,235	62,408	67,422	78,097	61,604	52,809
65 to 69	31	622	649	863	743	666	484	307	130	54	4,549
Avg. Pay	23,788	40,542	47,554	49,545	57,201	59,990	64,408	64,345	92,873	101,264	55,066
70 & up	6	234	161	240	209	200	140	100	52	41	1,383
Avg. Pay	20,463	35,474	41,504	48,030	51,754	59,027	61,718	76,641	91,355	131,000	54,723
Total Count	2,360	66,386	43,615	41,282	32,504	22,962	13,005	3,444	654	154	226,366
Avg. Pay	27,652	39,566	48,619	55,443	61,809	66,981	70,891	71,161	81,244	93,482	52,494

Average Age: 44.57

Average Service: 10.97



Schedule I – Tables of Membership Data

NUMBER OF RETIRED MEMBERS AND THEIR BENEFITS BY AGE

Age	Number of Members	Total Annual Benefits	Average Annual Benefits
Under 50	56	\$ 1,617,200	\$ 28,879
50 – 54	1,519	61,790,689	40,679
55 – 59	6,004	264,223,812	44,008
60 – 64	18,933	664,503,419	35,098
65 – 69	30,313	1,121,703,355	37,004
70 – 74	28,054	1,148,603,415	40,943
75 – 79	16,752	714,417,426	42,647
80 – 84	9,101	393,395,614	43,226
85 – 89	5,101	218,089,258	42,754
90 – 94	2,078	87,887,062	42,294
95 & Over	584	21,502,937	36,820
Total	118,495	\$ 4,697,734,187	\$ 39,645

NUMBER OF BENEFICIARIES AND THEIR BENEFITS BY AGE

Age	Number of Members	Total Annual Benefits	Average Annual Benefits
Under 25	184	\$ 1,890,869	\$ 10,276
25 – 29	174	1,974,779	11,349
30 – 34	247	3,180,595	12,877
35 – 39	335	4,068,742	12,145
40 – 44	417	5,303,026	12,717
45 – 49	448	6,875,146	15,346
50 – 54	452	7,178,209	15,881
55 – 59	571	10,897,891	19,086
60 – 64	729	16,005,753	21,956
65 – 69	1,017	26,391,679	25,951
70 – 74	1,156	34,033,286	29,441
75 – 79	1,027	32,436,334	31,584
80 – 84	866	29,432,999	33,987
85 – 89	656	23,158,776	35,303
90 – 94	313	10,821,107	34,572
95 & Over	87	2,814,680	32,353
Total	8,679	\$ 216,463,871	\$ 24,941



Schedule I – Tables of Membership Data

NUMBER OF DISABLED RETIREES AND THEIR BENEFITS BY AGE

Age	Number of Members	Total Annual Benefits	Average Annual Benefits
Under 50	292	\$ 5,132,858	\$ 17,578
50 – 54	403	8,351,492	20,723
55 – 59	762	15,882,236	20,843
60 – 64	1,075	23,429,144	21,795
65 – 69	895	21,930,819	24,504
70 – 74	636	16,929,055	26,618
75 – 79	333	8,666,241	26,025
80 – 84	143	3,701,668	25,886
85 – 89	64	1,743,425	27,241
90 – 94	37	885,115	23,922
95 & Over	6	152,729	25,455
Total	4,646	\$ 106,804,782	\$ 22,989



Schedule J – CAFR Schedules

Active Members				
Fiscal Year	Number of Members	Annual Payroll (000's)	Average Pay	% Increase
2010	222,020	\$ 10,437,703	\$ 47,012	0.1%
2011	216,137	10,099,278	46,726	-0.6%
2012	213,648	10,036,023	46,975	0.5%
2013	209,854	9,924,682	47,293	0.7%
2014	209,828	9,993,686	47,628	0.7%
2015	213,990	10,347,332	48,354	1.5%
2016	218,193	10,783,277	49,421	2.2%
2017	222,902	11,333,997	50,847	2.9%
2018	226,039	11,704,334	51,780	1.8%
2019	226,366	11,882,828	52,494	1.4%

Retirants and Beneficiaries								
Fiscal Year	Added to Roll		Removed from Roll		Roll – End of Year		% Increase In Annual Allowances	Average Annual Income
	Number of Members	Annual Allowances (000's)	Number of Members	Annual Allowances (000's)	Number of Members	Annual Allowances (000's)		
2010	6,383	\$ 279,009	1,763	\$ 46,853	86,978	\$ 2,862,477	8.8 %	\$ 32,910
2011	7,136	295,192	1,937	55,062	92,177	3,102,607	8.4	33,659
2012	7,055	298,471	1,915	55,565	97,317	3,345,513	7.8	34,377
2013	7,937	322,853	1,983	59,453	103,271	3,608,913	7.9	34,946
2014	7,078	291,066	2,195	68,324	108,154	3,831,655	6.2	35,428
2015	7,207	306,751	2,237	72,818	113,124	4,065,588	6.1	35,939
2016	7,225	312,063	2,392	80,359	117,957	4,297,292	5.7	36,431
2017	7,189	318,594	2,459	84,596	122,687	4,531,290	5.4	36,934
2018	7,345	341,242	2,732	98,829	127,300	4,773,703	5.3	37,500
2019	7,247	347,533	2,727	100,233	131,820	5,021,003	5.2	38,090



Schedule J – CAFR Schedules

Solvency Test							
Fiscal Year	Aggregate Accrued Liabilities For			Actuarial Value of Assets (000's)	Portion of Accrued Liabilities Covered by Assets		
	(1) Active Member Contributions (000's)	(2) Retirants and Beneficiaries (000's)	(3) Active Members (Employer-Financed Portion) (000's)		(1)	(2)	(3)
2010	\$ 6,705,274	\$ 34,264,548	\$ 22,622,215	\$ 54,529,416	100.0%	100.0%	59.9%
2011	6,973,343	37,271,020	21,734,277	55,427,716	100.0	100.0	51.5
2012	7,242,569	39,759,145	21,346,964	56,262,332	100.0	100.0	43.4
2013	7,480,767	43,152,402	21,587,696	58,594,837	100.0	100.0	36.9
2014	7,815,630	45,841,742	22,114,745	62,061,722	100.0	100.0	38.0
2015	8,153,958	50,251,964	24,385,088	65,514,119	100.0	100.0	29.1
2016	8,522,267	55,186,998	28,012,510	68,161,710	100.0	100.0	15.9
2017	8,936,010	57,659,259	29,385,762	71,212,660	100.0	100.0	15.7
2018	9,350,031	58,993,494	28,561,728	75,024,364	100.0	100.0	23.4
2019	9,791,208	61,856,920	30,191,271	78,126,922	100.0	100.0	21.5