Actuarial Section

TCRS
TENNESSEE CONSOLIDATED RETIREMENT SYSTEM
A Program of the Tennessee Treasury Department

ACTUARIAL VALUATIONS

Actuarial valuations of the TCRS are performed by an independent actuarial consulting firm to assess the funded status of the system and to determine employer contribution rates for its various components. The valuation performed as of June 30, 2017 set employer rates effective July 1, 2018 through June 30, 2019. The June 30, 2018 valuation established contribution rates beginning July 1, 2019. The Board of Trustees of the system is responsible for adopting the employer contribution rates after reviewing the actuarial results.

FUNDING OF PENSIONS

It is the policy of the state to fund pensions by actuarially-determined contributions which are intended to provide funding for both the normal liability cost and the unfunded actuarial accrued liability cost. This policy seeks to ensure that sufficient assets will be available to pay the benefits as promised by the pension plan.

ACCRUED LIABILITY

Unfunded accrued liability is equal to the excess of the Entry Age Normal Past Service Liability over the valuation assets for each group. A tier approach is utilized with new actuarial gains and losses from each actuarial valuation.

SPECIFICS

Valuations are based on demographic data (employees' ages, salaries and service credits), economic projections (salary increases, interest rates and investment earnings) and decrement estimates (mortality and disability rates).

The economic projections and decrement estimates used for valuation purposes utilized the assumptions recommended by the actuary and adopted by the Board of Trustees based on an actuarial experience study conducted every four years. The earnings rate assumption adopted by the Board is subject to the approval of the Council on Pensions and Insurance.

QUADRENNIAL EXPERIENCE STUDY

A quadrennial experience study was conducted as of June 30, 2016. The system made adjustments to the mortality assumptions to reflect TCRS experience, including an assumption for future mortality improvement. In addition, the system lowered the long-term inflation assumption, which also lowered other economic assumptions such as the discount rate, COLA and salary scale for all groups. Assumptions developed from the June 30, 2016 experience study were used in the June 30, 2018 actuarial valuation. The next experience study will occur as of June 30, 2020.

FUNDING POLICY

The TCRS Board of Trustees adopted a funding policy for TCRS on September 26, 2014. The policy outlines the procurement of actuarial services, the assumptions to be used in the experience study, the components of the actuarial valuation, and performance of an actuarial audit. The funding policy can be found in the Reporting and Investment Policies section of the TCRS website at *treasury.tn.gov/TCRS/*.

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Justin C. Thacker, F.S.A.
Direct Line: (615) 665-5387
Email: Justin.Thacker@Findley.com

November 8, 2019

Mr. David H. Lillard, Jr.
Chairman, Board of Trustees
Tennessee Consolidated Retirement System
502 Deaderick Street
Nashville, Tennessee 37243-0201

Re: Actuary's Certification Letter

Dear Mr. Lillard:

The purpose of this letter is to certify the actuarial adequacy of contributions being made by the State of Tennessee, Local Education Agencies and participating Political Subdivisions to the Tennessee Consolidated Retirement System and to discuss the approach currently being taken toward meeting the financing objectives of the Plan.

The most recent actuarial valuation for funding purposes completed as of the year ending June 30, 2019 for the Tennessee Consolidated Retirement System was performed as of June 30, 2018. In addition, a valuation for accounting purposes pursuant to GASB 67 and 68 was performed as of June 30, 2018 and was used to satisfy June 30, 2019 reporting date requirements. These valuations were based on a set of actuarial assumptions (described in detail in the section headed "Summary of Actuarial Assumptions and Methods") which was adopted by the Board of Trustees on the recommendation of the actuary after a study of actual experience under the TCRS during the four-year period ending June 30, 2016. Actuarial valuations are performed annually for both funding and accounting purposes.

The Tennessee Consolidated Retirement System implemented a new hybrid plan design for all new employees hired on or after July 1, 2014. Employees hired prior to this date continue to participate in the legacy plans. The funding and accounting valuations reflect this change and provide separate reporting for each plan. There have been no significant changes in the level of benefits provided by the plans since the date of the preceding valuation.

In performing the 2018 valuations, we relied on employee data and asset information provided by the administrative staff of the Tennessee Consolidated Retirement System. In the case of employee data, each individual record was audited for reasonableness and internal consistency, although the validity of the information was not traced to source documents. With respect to plan assets, a general review for consistency with the information furnished for prior valuations was performed.

(*continued*)

Mr. David H. Lillard, Jr.
Chairman, Board of Trustees
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Certain tables presented in the Comprehensive Annual Financial Report are derived from the 2018 actuarial valuation reports prepared by Findley. The tables were prepared by the staff of the Tennessee Consolidated Retirement System and examined by our firm. These tables include the following –

Financial Section

- Schedules of Changes in Net Pension Liability
- Schedules of Net Pension Liability
- Schedule of Contributions

Actuarial Section

- Summary of Actuarial Assumptions and Methods
- Actuarial Data
- Actuarial Balance Sheet
- Short-Term Solvency Test
- Summary of Accrued and Unfunded Accrued Liabilities
- Selected Actuarial Funding Information
- Analysis of Financial Experience

The Schedule of Retired Member Activity in the Actuarial Data section was prepared by our firm using information gathered from prior actuarial valuations.

The 2018 actuarial funding valuations were prepared in accordance with accepted actuarial standards, including the overall appropriateness of the assumptions and methods, and conformed to appropriate Standards of Practice as promulgated from time to time by the Actuarial Standards Board. The funding valuations were also in accordance with the pension funding policy adopted by the TCRS Board of Trustees. In addition, the 2018 actuarial valuations for accounting purposes were prepared in accordance with the Governmental Accounting Standards Board Statements 67 and 68. I am a Member of the American Academy of Actuaries and a consulting actuary with Findley of Brentwood, Tennessee, with experience in performing valuations for public retirement systems and have met the Qualification Standards of the American Academy of Actuaries. All calculations were performed either by me or by other qualified actuaries under my direct supervision.

Based upon the valuation results and the contribution rates adopted by the Board of Trustees, it is our opinion that the Tennessee Consolidated Retirement System continues to fund its liabilities in accordance with standard actuarial principles of advance funding, continuing a program first adopted in 1975.

Sincerely,

Justin Thacker

Justin C. Thacker, F.S.A.

The following assumptions were adopted by the Board of Trustees for use with actuarial valuations beginning with the July 1, 2017 valuation. The assumptions used are based on the consulting actuary's recommendations resulting from the June 30, 2016 actuarial experience study.

General Actuarial Methods

- ***Actuarial Cost Method (Entry Age Normal)*** — Unfunded accrued liability tiers by year are being amortized over various periods not to exceed 20 years using the level dollar amortization method in accordance with the funding policy. The amortization period related to local government unfunded accrued liabilities varies by entity.

- ***Treatment of Actuarial Gains and Losses*** — Under the Entry Age Normal method, a tier approach is utilized with new actuarial gains and losses from each actuarial valuation. Each new tier of unfunded accrued liabilities is amortized over a period in accordance with the TCRS funding policy.

- ***Asset Valuation Method*** — Assets are valued on a basis which reflects a ten-year moving average of the fair value. The actuarial value of assets must be within 80-120 percent of the fair value of assets.

- ***Valuation Data*** — The administrative staff of TCRS furnishes the actuary with demographic data relating to the active life members and the retired life members. The fair value of system assets are also provided by retirement system staff. All data is reviewed for reasonableness and consistency from year to year, but is not audited by the actuary.

- ***Post-Retirement Adjustments*** — Retirement benefits are assumed to increase at the geometric rate of 2.25 percent annually, reflecting the 1997 adoption of compounded cost-of-living adjustments.

Economic Assumptions

- ***Investment Return Rate*** — 7.25 percent per annum, compounded annually.

- ***Employee Salary Increases*** — Graded scale that reflects the plan experience pattern of declining escalation rates as participant ages increase. No explicit assumption is made regarding the portion attributable to the effects of inflation on salaries. Active membership is assumed to remain constant. For the legacy pension plan, increase in Social Security Wage Base — 3.0 percent annual increase.

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Decrement Assumptions

Post-Retirement Mortality — Mortality assumptions utilize the RP-2014 industry standard base table for annuitants adjusted for TCRS experience, with mortality improvements projected six years beyond each actuarial valuation date for the Legacy Plan and projected generationally for the Hybrid Plan.

Pre-Retirement Mortality — Mortality assumptions utilize the RP-2014 industry standard base table for non-annuitants adjusted for TCRS experience, with mortality improvements projected fifteen years beyond each actuarial valuation date for the Legacy Plan and projected generationally for the Hybrid Plan.

Withdrawal Due to Disability — Sample rates of disability based on experience:

Male

Age	Teachers	State	Political Subdivisions
Age 30	0.01%	0.07%	0.03%
Age 40	0.08%	0.16%	0.08%
Age 50	0.17%	0.27%	0.38%

Female

Age	Teachers	State	Political Subdivisions
Age 30	0.01%	0.04%	0.03%
Age 40	0.08%	0.14%	0.08%
Age 50	0.17%	0.33%	0.38%

Turnover Assumption — Tables for probabilities of separation due to termination of employment are developed utilizing a "two-year select and ultimate" approach.

Teachers

	1st Year Employment	2nd Year Employment	Ultimate
Male			
Age 30	18.0%	13.5%	6.0%
Age 40	18.0%	13.5%	2.0%
Age 50	19.7%	14.2%	2.0%
Female			
Age 30	18.0%	13.5%	7.6%
Age 40	18.0%	13.5%	2.3%
Age 50	19.7%	14.2%	1.6%

State

	1st Year Employment	2nd Year Employment	Ultimate
Male			
Age 30	23.0%	18.6%	9.6%
Age 40	18.6%	13.8%	2.6%
Age 50	14.8%	11.1%	2.2%
Female			
Age 30	23.0%	18.6%	10.3%
Age 40	18.6%	13.8%	3.4%
Age 50	14.8%	11.1%	2.3%

Political Subdivisions

	1st Year Employment	2nd Year Employment	Ultimate
Male			
Age 30	21.8%	17.9%	7.4%
Age 40	19.2%	15.9%	3.5%
Age 50	17.0%	13.0%	2.8%
Female			
Age 30	21.8%	17.9%	11.1%
Age 40	19.2%	15.9%	5.4%
Age 50	17.0%	13.0%	3.8%

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Retirement — The probabilities of retirement for members eligible to retire:

Male			
Age	**Teachers**	**State**	**Political Subdivisions**
Age 60	15.0%	8.5%	10.5%
Age 61	16.0%	11.0%	15.0%
Age 62	22.0%	16.0%	20.0%
Age 63	16.0%	12.0%	17.5%
Age 64	18.0%	14.0%	17.5%
Age 65	35.0%	22.0%	24.0%
Age 70	16.0%	15.5%	18.0%
Age 75	100.0%	100.0%	100.0%

Female			
Age	**Teachers**	**State**	**Political Subdivisions**
Age 60	17.0%	9.0%	11.0%
Age 61	20.0%	12.0%	13.0%
Age 62	26.0%	18.0%	18.0%
Age 63	19.5%	12.0%	16.0%
Age 64	24.0%	14.0%	16.0%
Age 65	37.5%	22.0%	22.0%
Age 70	34.0%	17.0%	19.0%
Age 75	100.0%	100.0%	100.0%

In addition, for members younger than age 60, a loading factor of 12.5 percent for teachers and 7.5 percent for state and political subdivision employees is added during the year the member is first eligible for unreduced retirement. After age 60, for those members with 15 or more years of service, an 8.0 percent load is added for teachers and 2.0 percent for state employees and political subdivision employees.

SCHEDULE OF ACTIVE MEMBER VALUATION DATA

Actuarial Valuation July 1		Number	Annual Payroll In Thousands	Average Annual Pay	Average Annual Percentage Increase In Average Pay
2005	SETHEEPP	132,026	$ 5,245,988	$ 39,735	3.49%
	PSPP	74,124	1,890,968	25,511	2.96%
2007	SETHEEPP	136,337	5,742,858	42,123	2.96%
	PSPP	76,388	2,081,965	27,255	3.36%
2009	SETHEEPP	136,158	6,054,528	44,467	2.74%
	PSPP	78,792	2,282,081	28,963	3.09%
2011	SETHEEPP	135,588	6,058,348	44,682	0.24%
	PSPP	79,488	2,354,939	29,626	1.14%
2013	SETHEEPP	132,900	6,236,930	46,929	2.48%
	PSPP	77,064	2,374,948	30,818	1.99%
2015	TLPP	69,125	3,542,059	51,241	0.84%
	TRP	5,524	225,219	40,771	N/A
	PERP	134,426	4,987,326	37,101	1.70%
2016	TLPP	65,458	3,465,946	52,949	3.33%
	TRP	11,079	464,122	41,892	2.75%
	PERP	136,524	5,241,126	38,390	3.47%
2017	TLPP	62,320	3,414,741	54,794	3.48%
	TRP	15,607	674,906	43,244	3.23%
	PERP	139,397	5,566,390	39,932	4.02%
2018	TLPP	59,487	3,460,664	58,175	6.17%
	TRP	19,634	905,280	46,108	6.62%
	PERP	140,238	5,816,152	41,473	3.86%

SCHEDULE OF RETIRED MEMBER VALUATION DATA

Actuarial Valuation July 1		Number	Annual Allowances In Thousands	Average Annual Allowances	Average Annual Percentage Increase In Annual Allowances
2005	SETHEEPP	65,094	$ 939,549	$ 14,434	4.63%
	PSPP	24,799	143,275	5,777	4.24%
2007	SETHEEPP	70,703	1,117,789	15,810	4.66%
	PSPP	27,527	174,211	6,329	4.67%
2009	SETHEEPP	77,310	1,281,514	16,576	2.39%
	PSPP	30,565	205,326	6,718	3.03%
2011	SETHEEPP	83,041	1,457,974	17,557	2.92%
	PSPP	33,544	241,910	7,212	3.61%
2013	SETHEEPP	90,414	1,682,792	18,612	2.96%
	PSPP	37,157	286,338	7,706	3.37%
2015	TLPP	47,979	1,103,163	22,993	1.30%
	TRP	0	0	0	N/A
	PERP	94,704	1,143,883	12,079	1.60%

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SCHEDULE OF RETIRED MEMBER VALUATION DATA *(continued)*

Actuarial Valuation July 1		Number	Annual Allowances In Thousands	Average Annual Allowances	Average Annual Percentage Increase In Annual Allowances
2016	TLPP	49,336	1,142,552	23,159	0.72%
	TRP	1	0	0	N/A
	PERP	100,011	1,218,115	12,180	0.84%
2017	TLPP	50,230	1,187,624	23,644	2.09%
	TRP	2	2	797	N/A
	PERP	103,277	1,286,131	12,453	2.24%
2018	TLPP	50,922	1,227,139	24,098	1.92%
	TRP	3	2	801	0.50%
	PERP	106,448	1,353,198	12,712	2.08%

SCHEDULE OF RETIRED MEMBER ACTIVITY

Actuarial Valuation July 1		Added to Rolls No.	Added to Rolls Annual Allowances	Removed from Rolls No.	Removed from Rolls Annual Allowances	Rolls - End of Year No.	Rolls - End of Year Annual Allowances	Percentage Increase in Annual Allowances	Average Annual Allowances
2005	SETHEEPP	8,453	$ 179,572	4,359	$ 56,689	65,094	$ 939,549	17.59%	$ 14,434
	PSPP	3,705	29,169	1,976	11,048	24,799	143,275	18.85%	5,777
2007	SETHEEPP	9,427	219,034	4,826	64,619	70,703	1,117,789	18.97%	15,810
	PSPP	4,396	38,751	2,245	12,559	27,527	174,211	21.59%	6,329
2009	SETHEEPP	10,677	212,772	4,826	64,619	77,310	1,281,514	14.65%	16,576
	PSPP	4,752	39,522	2,245	12,559	30,565	205,326	17.86%	6,718
2011	SETHEEPP	10,090	233,149	4,359	56,689	83,041	1,457,974	13.77%	17,557
	PSPP	4,955	47,632	1,976	11,048	33,544	241,910	17.82%	7,212
2013	SETHEEPP	12,199	289,437	4,826	64,619	90,414	1,682,792	15.42%	18,612
	PSPP	5,858	56,987	2,245	12,559	37,157	286,338	18.37%	7,706
2015	TLPP	6,582	167,537	2,376	45,115	47,979	1,103,163	12.48%	22,993
	TRP	0	0	0	0	0	0	N/A	N/A
	PERP	15,885	203,829	4,979	48,335	94,704	1,143,883	15.73%	12,079
2016	TLPP	2,305	58,165	948	18,776	49,336	1,142,552	3.57%	23,159
	TRP	1	0	0	0	1	0	N/A	0
	PERP	7,884	100,366	2,577	26,134	100,011	1,218,115	6.49%	12,180
2017	TLPP	2,137	69,114	1,243	24,042	50,230	1,187,624	3.94%	23,644
	TRP	1	1	0	0	2	2	237.95%	797
	PERP	6,538	102,361	3,272	34,345	103,277	1,286,131	5.58%	12,453
2018	TLPP	1,805	62,874	1,113	23,359	50,922	1,227,139	3.33%	24,098
	TRP	1	0	0	0	3	2	50.75%	801
	PERP	6,127	99,291	2,956	32,224	106,448	1,353,198	5.21%	12,712

Legislative changes modified the plans presented beginning July 1, 2014. The July 1, 2015 Actuarial Valuation was the first performed after this change.

Note: Timing differences exist between the data utilized for statistical information and that used for actuarial valuation purposes.

Notes applicable to the schedules in this section:

SETHEEPPP - State Employees, Teachers, Higher Education Employees Pension Plan
PSPP - Political Subdivisions Pension Plan
TLPP - Teacher Legacy Pension Plan
TRP - Teacher Retirement Plan
PERP - Public Employee Retirement Plan

ACTUARIAL BALANCE SHEET
as of June 30, 2018

	Teacher Legacy Pension Plan	Teacher Retirement Plan	Public Employee Retirement Plan	Total
ASSETS				
Present assets creditable to:				
Employer accumulation fund	$ 19,663,115,437	$ 48,453,534	$ 22,813,334,291	$ 42,524,903,262
Members' accumulation fund	3,509,632,277	111,482,711	1,706,815,076	5,327,930,064
Total present assets	23,172,747,714	159,936,245	24,520,149,367	47,852,833,326
Present value of prospective contributions payable to:				
Employer accumulation fund				
Normal	1,680,191,346	151,856,750	2,846,939,816	4,678,987,912
Accrued liability	503,884,213	8,253,746	2,344,674,537	2,856,812,496
Total employer accumulation	2,184,075,559	160,110,496	5,191,614,353	7,535,800,408
Member's accumulation fund	1,653,080,602	619,879,656	1,160,421,977	3,433,382,235
Total prospective contributions	3,837,156,161	779,990,152	6,352,036,330	10,969,182,643
TOTAL ASSETS	$ 27,009,903,875	$ 939,926,397	$ 30,872,185,697	$ 58,822,015,969
LIABILITIES				
Present value of prospective benefits payable on account of:				
Present retired members and beneficiaries	$ 13,754,852,811	$ 29,570	$ 14,539,125,310	$ 28,294,007,691
Present active members	12,739,176,328	926,689,836	14,295,028,571	27,960,894,735
Former members	515,874,736	13,206,991	2,038,031,816	2,567,113,543
TOTAL LIABILITIES	$ 27,009,903,875	$ 939,926,397	$ 30,872,185,697	$ 58,822,015,969

Short-Term Solvency Test

The financing objective of the Tennessee Consolidated Retirement System is to pay for the benefits provided by the plan through contributions that remain approximately level from year to year as a percentage of payroll, except that the strategy to fund the unfunded accrued liability is to make level-dollar payments over an established amortization period. A short-term solvency test is one means of checking a system's progress under its funding program. In a short-term solvency test, the plan's present assets are compared with: (1) active member contributions on deposit; (2) the liabilities for future benefits to present retired lives; and (3) the liabilities for service already rendered by active members. In a system that has been following the approach of level percent of payroll financing for some time, the liabilities for active member contributions on deposit (liability 1) and the liabilities for future benefits to present retired lives (liability 2) should be fully covered by present assets. In addition, the liabilities for service already rendered by active members (liability 3) should be partially covered by the remainder of present assets. Generally, if the system has been using level cost financing, the funded portion of liability 3 will increase over time.

Dollar Amounts Expressed in Millions

Actuarial Valuation July 1		Actuarial Accrued Liabilities for: (1) Active Member Contributions	(2) Retirees and Beneficiaries	(3) Active Members (Employer Financed)	Valuation Assets	Portion of Actuarial Accrued Liabilities Covered by Assets (1)	(2)	(3)
2013	SETHEEPP	$ 3,759.9	$ 18,747.4	$ 11,616.3	$ 31,851.0	100%	100%	80%
	PSPP	1,196.3	3,075.7	1,991.6	7,398.3	100%	100%	100%
	Total	$ 4,956.2	$ 21,823.1	$ 13,607.9	$ 39,249.3	100%	100%	92%
2015	TLPP	$ 3,340.9	$ 12,534.5	$ 5,433.7	$ 21,040.2	100%	100%	95%
	TRP	10.4	0	4.3	15.7	100%	100%	100%
	PERP	1,753.7	12,202.0	9,292.9	21,682.8	100%	100%	83%
	Total	$ 5,105.0	$ 24,736.5	$ 14,730.9	$ 42,738.7	100%	100%	88%
2016	TLPP	$ 3,229.3	$ 12,858.9	$ 5,728.3	$ 21,681.8	100%	100%	98%
	TRP	32.6	0	15.0	49.90	100%	100%	100%
	PERP	1,606.6	12,944.2	9,554.9	22,512.8	100%	100%	83%
	Total	$ 4,868.5	$ 25,803.1	$ 15,298.2	$ 44,244.5	100%	100%	89%
2017	TLPP	$ 3,351.9	$ 13,485.7	$ 6,003.4	$ 22,330.7	100%	100%	92%
	TRP	66.0	0.0	32.4	96.11	100%	100%	93%
	PERP	1,640.8	13,940.9	10,231.2	23,379.2	100%	100%	76%
	Total	$ 5,058.6	$ 27,426.6	$ 16,267.0	$ 45,806.1	100%	100%	82%
2018	TLPP	$ 3,509.6	$ 13,754.9	$ 6,412.1	$ 23,172.7	100%	100%	92%
	TRP	111.5	0.0	56.7	159.9	100%	100%	85%
	PERP	1,706.8	14,539.1	10,618.9	23,936.8	100%	100%	72%
	Total	$ 5,327.9	$ 28,294.0	$ 17,087.7	$ 47,269.4	100%	100%	80%

The unfunded accrued liability represents the excess of the accrued actuarial liability over the actuarial value of assets. For funding purposes, the Board of Trustees of TCRS has adopted the frozen initial liability method.

Under this method, the unfunded accrued liability is being funded by level-dollar contributions. Also, actuarial gains and losses are absorbed in normal cost rather than as part of the unfunded liability. The statute governing TCRS allows the Board of Trustees to reestablish the unfunded accrued liability for actuarial gains and losses.

For the July 1, 2013 actuarial valuation, the Board reestablished the unfunded accrued liability. In an inflationary economy where the covered payroll continues to grow, the level-dollar amounts which are being contributed to fund the unfunded accrued liability will, if expressed as a percentage of payroll, continue to decrease.

While concern is generally expressed regarding the dollar amount of the unfunded accrued liability, an analysis should also include the method being used to fund this liability as well as a review of this liability expressed as a percentage of active member payroll. The smaller the ratio of unfunded liabilities to the active member payroll, the stronger the system. A review of this ratio over a period of years will give an indication of whether the system is becoming financially stronger or weaker with respect to its unfunded liabilities.

SUMMARY OF ACCRUED AND UNFUNDED ACCRUED LIABILITIES

Dollar Amounts Expressed in Millions

Actuarial Valuation Jun 30	Actuarial Accrued Liabilities (AAL)	Valuation Assets	Ratio Assets to AAL	Unfunded Actuarial Accrued Liabilities (UAAL)	Active Member Payroll	UAAL as a Percentage of Active Member Payroll
2009						
SETHEEP	$ 29,054.9	$ 26,335.2	90.64%	$ 2,719.7	$ 6,054.5	44.92%
PSPP	$ 6,143.8	$ 5,304.5	86.34%	$ 839.3	$ 2,282.1	36.78%
2011						
SETHEEP	$ 32,707.6	$ 30,118.2	92.08%	$ 2,589.4	$ 6,058.3	42.74%
PSPP	$ 7,361.7	$ 6,562.6	89.15%	$ 799.1	$ 2,354.9	33.93%
2013						
SETHEEP	$ 34,123.6	$ 31,851.0	93.34%	$ 2,272.6	$ 6,236.9	36.44%
PSPP	$ 7,789.8	$ 7,398.3	94.97%	$ 391.5	$ 2,375.0	16.49%
2015						
TLPP	$ 21,309.0	$ 21,040.2	98.74%	$ 268.8	$ 3,542.1	7.59%
TRP	$ 14.7	$ 15.7	106.80%	$ (1.0)	$ 239.5	-0.42%
PERP	$ 23,248.7	$ 21,682.9	93.26%	$ 1,565.8	$ 5,009.6	31.26%
2016						
TLPP	$ 21,816.5	$ 21,681.8	99.38%	$ 134.7	$ 3,465.9	3.89%
TRP	$ 47.6	$ 49.9	104.83%	$ (2.3)	$ 493.2	-0.47%
PERP	$ 24,105.8	$ 22,512.8	93.39%	$ 1,593.0	$ 5,262.4	30.27%
2017						
TLPP	$ 22,330.7	$ 22,840.9	102.28%	$ (510.2)	$ 3,414.7	-14.94%
TRP	$ 98.4	$ 96.1	97.66%	$ 2.3	$ 715.0	0.32%
PERP	$ 25,812.9	$ 23,379.2	90.57%	$ 2,433.7	$ 5,598.0	43.47%
2018						
TLPP	$ 23,676.6	$ 23,172.7	97.87%	$ 503.9	$ 3,460.7	14.56%
TRP	$ 168.2	$ 159.9	95.09%	$ 8.3	$ 958.2	0.86%
PERP	$ 26,864.8	$ 24,520.1	91.27%	$ 2,344.7	$ 5,857.4	40.03%

SELECTED ACTUARIAL FUNDING INFORMATION

Actuarial Valuation Year	Earnings Assumptions	Salary Assumptions		Unfunded Liability (Asset)		State Amortization Period
				SETHEEP	PSPP	
2005	7.50%	4.75%	(2)	39,806,610	326,114,462	10
2007	7.50%	4.75%	(2)	1,025,156,148	577,645,568	20
2009	7.50%	4.75%	(2)	2,719,767,478	839,320,076	20
2011	7.50%	4.75%	(2)	2,589,446,292	799,102,966	9
2013	7.50%	4.25%	(2)	2,272,526,399	391,589,555	13

Actuarial Valuation Year		Earnings Assumptions	Salary Assumptions		Unfunded Liability (Asset)			State Amortization Period	
					TLPP	TRP	PERP		
2015	(3)	7.50%	4.25%	(2)	$ 268,857,872	$ (1,092,784)	$ 1,565,808,774	14.37	(1)
2016		7.50%	4.25%	(2)	134,716,133	(2,323,148)	1,592,928,253	8.46	(1)
2017		7.25%	4.00%	(2)	510,205,267	2,307,714	2,433,632,446	13.64	(1)
2018		7.25%	4.00%	(2)	503,884,213	8,253,746	2,344,674,537	12.85	(1)

Notes:

(1) At each actuarial valuation, the new tier of unfunded liability is established over a period not to exceed 20 years per the TCRS funding policy. The tier for prior years is amortized over a period not to exceed the remaining period.

(2) Graded scale

(3) The information in this schedule is based upon legislative changes. The legislative changes modified the plans presented beginning July 1, 2014.

GAIN AND LOSS ANALYSIS, JUNE 30, 2017 VALUATION

	Consolidated State	Teacher
Contribution Rate		
Effective Employer Contribution Rate Pursuant to 2016 Valuation	18.87%	9.08%
Investment Results	0.68%	0.73%
Salary Increases: The annual weighted-average of salary increase during the 2016-2017 period was above the assumed age-based rate used in preparing the 2016 valuation report. This resulted in an increase in the contribution rate	0.07%	-0.12%
Cost of Living Escalation: COLA in 2017 was 2.1%, which is less than the assumed 2.5% per year	-0.16%	-0.14%
Prior Service Purchases: Employee purchases of prior service credits result in liabilities to the plan that are not fully offset by related employee contributions	0.10%	0.10%
Contributions Rate Change Delay: Since the contribution rate utilized during the fiscal year ending June 30, 2017 (from the 2015 valuation) for the State group was lower than the rate produced from the 2016 valuation, there was an increase in the current contribution rate for the State group to make up for the one-year delay.	0.40%	0.00%
Effect of turnover on total payroll: Total payroll declined during the review period for both groups as the reduction due to turnover was greater than the growth due to salary increases. The lower payroll base led to an increase in the contribution rate for both groups.	0.44%	0.04%
Other	-0.06%	-0.17%
Assumption Changes resultiing from 2016 Experience Study	1.79%	0.94%
Re-amortization of unfunded liability	-2.90%	0.00%
Effective Employer Contribution Rate Pursuant to 2017 Valuation	19.23%	10.46%

ACTUARIAL VS. RECOMMENDED CONTRIBUTION RATES

The Board adopted the contribution rates as recommended by the actuary.

HISTORY AND ADMINISTRATION

The TCRS was established in 1972 by an Act of the Tennessee General Assembly. Seven existing retirement systems were consolidated to provide retirement, disability and death benefits to state employees, public school teachers, higher education employees and the employees of participating local governments. State laws governing the plan may be found in Chapters 34-37, 39 of Title 8, Tennessee Code Annotated. Amendments to the plan can only be made by legislation enacted by the General Assembly of the State of Tennessee.

A 20-member Board of Trustees has the responsibility to manage and oversee the operation of the consolidated system. The Board consists of nine ex-officio members from the executive, legislative and judicial branches of state government, nine representatives of the active TCRS membership and two representatives for retirees. Employee representation consists of three teachers, one from each grand division of the state; two state employees from departments other than those represented by ex-officio members; three representatives of local governments; one public safety officer; one retired state employee representative; and one retired teacher representative. Local government representatives are appointed for two-year terms by each of the following organizations: the Tennessee County Services Association, the Tennessee Municipal League and the Tennessee County Officials Association. All employee representatives must be vested members of TCRS.

TCRS is administered by the Treasury Department under the legislative branch of state government. By state law, the State Treasurer serves as chairman of the Board of Trustees and as custodian of the funds of the system. The Director of the retirement system is appointed by the Treasurer and serves as the chief administrative officer of the plan.

The state is responsible for the pension cost of state employees; pension costs for teachers are the responsibility of the local education agencies in Tennessee; costs for the participation of local government employees are paid by political subdivisions. Administrative expenses are paid from employers' account balances. The operating budget is funded through fees charged to the employer.

MEMBERSHIP

Membership in the retirement system is a condition of employment for full-time state employees, K-12 teachers, higher education general employees and the employees of participating local governments. Membership is optional for part-time state employees and the part-time employees of political subdivisions which have authorized such coverage.

Interim teachers and part-time teachers have optional membership. The exempt faculty and staff of institutions of higher education may elect participation in either TCRS or an optional retirement program (ORP), a defined contribution plan for higher education faculty.

State employees, higher education employees and K-12 public school teachers hired after June 30, 2014 will participate in a Hybrid Pension Plan for State Employees and Teachers.

CONTRIBUTIONS

TCRS membership became noncontributory on July 1, 1981 for most state employees, teachers in state supported institutions of higher education and teachers employed in the Department of Education. At that time, the contributions, up to 5.0 percent of compensation payable to these employees, were assumed by the state, but this amount continued to be credited to the individual members' accounts from employer funds. State employees hired after July 1, 1981 join TCRS as noncontributory members with no funds credited to their individual accounts. Public school teachers contribute at a rate of 5.0 percent of gross salary. State employees, teachers in state supported institutions of higher education and teachers employed by the Department of Education hired after June 30, 2014 contribute at a rate of 5.0 percent of gross salary.

(continued)

Participating political subdivisions may either adopt noncontributory retirement provisions or require employee contributions, at 2.5% or 5.0% of salary. The contribution rate for local government employees is 5.0 percent up to the Social Security wage base and 5.5 percent above that base, unless the employing government has authorized a level 5.0 percent rate.

Individual accounts are maintained for all contributory members with interest credited annually at a rate of 5.0 percent. Since TCRS is a defined benefit plan, benefits are based upon the member's average final compensation and years of creditable service. The member's account balance including interest accrued has no bearing on the monthly benefit amount payable at retirement. Account balances plus interest are fully refundable upon termination of service or death.

Contributory members are covered by Section 414(h) of the Internal Revenue Code. Under this provision, retirement contributions are made on a tax-deferred basis, with income tax due only when contributions are returned to members as benefits or refunds. Political subdivisions may adopt the 414(h) provision for their employees.

The state also makes contributions on behalf of higher education faculty members who select membership in the ORP. These contributions are equal to 10 percent of salary up to Social Security wage base and 11 percent of any excess salary.

For ORP participants hired after June 30, 2014, the state will contribute 9.0 percent of salary to the ORP. The employee will contribute 5.0 percent of gross salary to the ORP.

BENEFITS

General

TCRS provides three valuable benefits to its members: disability, death and service retirement benefits. Disability benefits are available to qualified TCRS members who become totally and permanently disabled before meeting the requirements for service retirement. Two types of disability retirement are available: ordinary and accidental.

To qualify for ordinary disability, a member must have a minimum of five years of TCRS service credit. The ordinary disability benefit is equal to 90 percent of what the member would receive under service retirement. If a disabled retiree has less than 20 years of service credit, the service is projected to age 60 or 20 years, whichever comes first. When service is projected, the actual and projected service combined cannot exceed 20 years. If the member's actual service credit exceeds 20 years, the benefit is based on actual service only.

There is no minimum service requirement to qualify for an accidental disability benefit. However, the disability must be the result of a job-related accident that occurs without negligence on the part of the member during the performance of duty. Prior to the onset of Social Security benefits, an accidental disability benefit is equal to 50 percent of the member's average final compensation (AFC). Once Social Security benefits begin, the accidental benefit is 33.3 percent of AFC. For members joining TCRS on or after July 1, 1997, accidental disability benefits are determined in the same manner as ordinary disability using the projection of service method. Disability benefits are increased by 5.0 percent for state employees, teachers and employees of participating political subdivisions which have authorized the 5.0 percent benefit improvement. The accidental benefit is adjusted if the member's combined benefits from Social Security and/or workers' compensation exceed 75 percent of his AFC.

(continued)

One of several death benefits may be payable to the designated beneficiary of an active member who dies prior to retirement. The type of death benefit payable will be determined by whether or not death occurred while in service, who is named as beneficiary and the member's length of service.

A member may designate one or more persons, his estate, an institution or any combination of such as his beneficiary. However, estates and institutions are only eligible for a lump-sum refund of the member's accumulated contributions and interest unless one of the beneficiaries named is the surviving spouse. Other death benefits offered by TCRS include a 100 percent Joint and Surviving Spouse Annuity for certain vested members, a 100 percent Joint and Survivor Annuity for any beneficiary under certain conditions and a Line-of-Duty Benefit. Any beneficiary of a member who had ten years of service and who is eligible for a lump-sum death benefit may elect a benefit to be paid over ten years.

Legacy Plan for Members Before July 1, 2014

All members hired prior to July 1, 2014, with the exception of state judges, joining TCRS after 1976 entered the same membership group. The benefit formula for this group provides 1.5 percent of AFC computed over five years for each year of service credit. If a member's AFC exceeds the Social Security integration level (SSIL) applicable at retirement, the formula provides an additional .25 percent of the amount of the excess for each service year. These benefits are increased by 5.0 percent for state employees, teachers and employees of participating political subdivisions which have authorized the 5.0 percent benefit improvement. State judges joining TCRS after September 1, 1990 become Group IV members. The benefit formula for Group IV members is 2.5 percent of AFC computed over five years for each year of service credit.

Members become eligible for regular service retirement at age 60 if vested or at any age with 30 years of service. Vested members are eligible for reduced early retirement benefits when they have reached age 55 or have completed 25 years of service. Members joining TCRS after June 30, 1979 attain vesting rights after five years of service; the vesting period for members who joined prior to July 1, 1979 is four years. Five-year vesting and 25-year retirement are benefits that are optional to local governments. Otherwise, vesting for local governments is ten years of service.

Hybrid Plan for Members After June 30, 2014

State employees, higher education employees and K-12 teachers, with the exception of state judges, the State Attorney General, elected District Attorneys General, and elected Public Defenders, becoming members after June 30, 2014 enter the same membership group. The benefit formula for this group provides 1.0 percent of AFC computed over five years for each year of service credit. The benefit formula for State judges, the State Attorney General, elected District Attorneys General, and elected Public Defenders provides 1.6 percent of AFC computed over five years for each year of service credit. Local governments have the option to join the State and Teacher Hybrid Retirement Plan. The hybrid plan also has a defined contribution component.

Members become eligible for regular service retirement at age 65 if vested or the Rule of 90. The Rule of 90 refers to a combination of age and service that total 90. Vested members are eligible for reduced early retirement benefits at age 60 if vested or the Rule of 80. Members attain vesting rights after five years of service.

SERVICES FOR ACTIVE MEMBERS

TCRS provides a number of services for active members through its various sections. Member self-service is available at *www.mytcrs.com*. Detailed member information, salary and service history, and the ability to apply for retirement benefits is available on the secured portal.

Outreach

- TCRS contracts with Empower Retirement Services to conduct employee presentations on all aspects of the retirement system.
- Employer seminars are conducted annually to educate payroll officers on legislation affecting TCRS and inform them of the employer contribution rates effective for the next fiscal year.

Membership

- Comprehensive membership statements are provided to all members annually at *mytcrs.com*.
- Welcome packets are mailed to all new members.
- Membership guides are available to members on the TCRS website.
- Member self-service can be accessed at *www.mytcrs.com* in order to update contact and beneficiary information.

Prior Service

- An automated calculation and eligibility system generates billings for members who wish to establish prior service.
- An installment program is available to purchase certain types of prior service.
- Prior Service may be purchased with a rollover from a tax-deferred 401(a) plan, 401(k) plan, 403(b) plan, 457 plan or a traditional or Roth IRA.

Benefits

- RetireReady TN website - TCRS and Deferred Compensation Information
- Customer Service Call Center
- Counseling Services - Retirement Counselors available to meet in all regions of the state

SERVICES FOR RETIRED MEMBERS

A number of services are made available to TCRS retirees.

- Retiree identification cards
- Semiannual retiree newsletter: The Retiree Advisor
- Direct deposit or debit card payments
- Deduction of medical insurance
- Deduction of dental insurance
- Deduction of Medicare supplement coverage
- Income tax information
- Certification of monthly benefits
- Certification of student discounts
- Retiree self-service at *www.mytcrs.com* allows a member to update account information, view and change direct deposit and tax withholding information, and a number of other easy actions.

SERVICES FOR EMPLOYERS

- Accounting entries, notes, and required supplementary information regarding pensions to comply with GASB Standard 68.
- Available online at *publicreports.treasury.tn.gov*
- Actuarial Report
- Employer education regarding reporting and participation in TCRS.

TCRS Legacy Plan and Social Security Benefits *for Calendar Year 2019*

Five-Year AFC*	Projected Annual Retirement Income	15 Years Service	% of AFC	20 Years Service	% of AFC	25 Years Service	% of AFC	30 Years Service	% of AFC	35 Years Service	% of AFC
	TCRS	$ 7,088		$ 9,450		$ 11,813		$ 14,175		$ 16,538	
$30,000	Social Security	14,820		14,820		14,820		14,820		14,820	
	Total	$ 21,908	73.0%	$ 24,270	80.9%	$ 26,633	88.8%	$ 28,995	96.7%	$ 31,358	104.5%
	TCRS	$ 9,450		$ 12,600		$ 15,750		$ 18,900		$ 22,050	
$40,000	Social Security	17,820		17,820		17,820		17,820		17,820	
	Total	$ 27,270	68.2%	$ 30,420	76.1%	$ 33,570	83.9%	$ 36,720	91.8%	$ 39,870	99.7%
	TCRS	$ 11,813		$ 15,750		$ 19,688		$ 23,625		$ 27,563	
$50,000	Social Security	20,820		20,820		20,820		20,820		20,820	
	Total	$ 32,633	65.3%	$ 36,570	73.1%	$ 40,508	81.0%	$ 44,445	88.9%	$ 48,383	96.8%
	TCRS	$ 14,175		$ 18,900		$ 23,625		$ 28,350		$ 33,075	
$60,000	Social Security	23,820		23,820		23,820		23,820		23,820	
	Total	$ 37,995	63.3%	$ 42,720	71.2%	$ 47,445	79.1%	$ 52,170	87.0%	$ 56,895	94.8%
	TCRS	$ 16,538		$ 22,050		$ 27,563		$ 33,075		$ 38,588	
$70,000	Social Security	25,992		25,992		25,992		25,992		25,992	
	Total	$ 42,530	60.8%	$ 48,042	68.6%	$ 53,555	76.5%	$ 59,067	84.4%	$ 64,580	92.3%

TCRS Hybrid Plan and Social Security Benefits *for Calendar Year 2019*

Five-Year AFC*	Projected Annual Retirement Income	15 Years Service	% of AFC	20 Years Service	% of AFC	25 Years Service	% of AFC	30 Years Service	% of AFC	35 Years Service	% of AFC
	TCRS	$ 4,500		$ 6,000		$ 7,500		$ 9,000		$ 10,500	
$30,000	Social Security	14,820		14,820		14,820		14,820		14,820	
	Total	$ 19,320	64.4%	$ 20,820	69.4%	$ 22,320	74.4%	$ 23,820	79.4%	$ 25,320	84.4%
	TCRS	$ 6,000		$ 8,000		$ 10,000		$ 12,000		$ 14,000	
$40,000	Social Security	17,820		17,820		17,820		17,820		17,820	
	Total	$ 23,820	59.6%	$ 25,820	64.6%	$ 27,820	69.6%	$ 29,820	74.6%	$ 31,820	79.6%
	TCRS	$ 7,500		$ 10,000		$ 12,500		$ 15,000		$ 17,500	
$50,000	Social Security	20,820		20,820		20,820		20,820		20,820	
	Total	$ 28,320	56.6%	$ 30,820	61.6%	$ 33,320	66.6%	$ 35,820	71.6%	$ 38,320	76.6%
	TCRS	$ 9,000		$ 12,000		$ 15,000		$ 18,000		$ 21,000	
$60,000	Social Security	23,820		23,820		23,820		23,820		23,820	
	Total	$ 32,820	54.7%	$ 35,820	59.7%	$ 38,820	64.7%	$ 41,820	69.7%	$ 44,820	74.7%
	TCRS	$ 10,500		$ 14,000		$ 17,500		$ 21,000		$ 24,500	
$70,000	Social Security	25,992		25,992		25,992		25,992		25,992	
	Total	$ 36,492	52.1%	$ 39,992	57.1%	$ 43,492	62.1%	$ 46,992	67.1%	$ 50,492	72.1%

** Average Final Compensation*

A key component of the Hybrid Plan is a 401(k) plan, which allows the member to invest pre-tax or after-tax (Roth) dollars in investment options of his or her choice that are offered by the plan. A member is immediately vested in the 401(k) and can decide how the contributions should be invested given individual goals, risk tolerance, and timeline. The amount a member receives in retirement from his or her 401(k) account is based on the amount saved, plus any accumulated earnings from investments. The employer contributes 5% of the employee's earnable compensation directly to the 401(k) for the member to invest.

This chart is based on a date of retirement in 2019. Social security benefits have been calculated by Findley, Inc., actuarial consultants for the TCRS, utilizing the following assumptions: (1) retirement is taking place at age 65 in 2019; (2) the retiree has worked a full career (TCRS plus other employers, if necessary) of 35 years or more; and (3) salary increases throughout the retiree's career have followed the same pattern as National Average Earnings.

1972
Benefit formula improved from 1.12 percent of salary up to the SSIL to 1.5 percent of salary up to the SSIL.

1973
Annual cost-of-living increase based on the CPI with a cap of 1.5 percent adopted for retirees.

1974
Disability retirement eligibility requirement reduced from ten years to five years of service.

Maximum annual cost-of-living increase raised to 3.0 percent.

Provision to increase retirees' benefits whenever the benefit formula is improved.

Service credit authorized for unused accumulated sick leave.

1976
Service retirement eligibility requirements reduced from age 65 or 35 years of service to age 60 or 30 years of service.

Early retirement eligibility requirements reduced from age 60 or 30 years of service to age 55.

1978
A bonus cost-of-living increase granted to retirees at a lump-sum cost of $15.3 million.

An optional retirement plan established for teachers in the Board of Regents system.

1980
Death benefits for members dying in-service with ten years of service improved by offering a 100 percent joint and survivor annuity of the member's accrued benefit for the spouse.

1981
Noncontributory retirement for state employees and higher education employees adopted. Employees' contributions, up to 5.0 percent, were assumed by the state.

1983
An actuarially-reduced retirement benefit at any age with 25 years of service authorized.

1984
Credit for out-of-state service for the purpose of determining retirement eligibility authorized.

Retirement credit for armed conflict approved.

Part-time employees permitted to participate in TCRS and members allowed to establish credit for previous part-time employment.

1985
$22 million ad-hoc increase granted to retirees.

1987
Service credit for half of peacetime military service made available.

$17 million ad-hoc increase granted to retirees.

Retirement incentive for state employees.

Section 414(h) of the IRC adopted, allowing employee contributions to be made on a tax-deferred basis.

1990
Retirement incentive for state employees.

1991
3.6 percent indexing of salaries for noncontributory employees extended one year. Each succeeding year up to 1997, the 3.6 percent indexing was extended. In 1997, it was extended indefinitely.

(continued)

1992
Minimum number of years required to qualify for retirement was reduced from ten years to five years.

1993
Salary portability for service in different classifications authorized effective January 1, 1994.

Benefit improvement up to 5.0 percent authorized.

1997
Compounded COLA for retirees approved.

1998
Group 2 and Group 3 service requirements amended to permit service retirement with 30 years of service, regardless of age.

Group 1 and Prior Class C benefit limitations increased to 80 percent.

Mandatory retirement established with supplemental bridge benefit for all state public safety officers.

1999
Group 1 benefit maximum increased to 90 percent.

2000
Group 2 benefit maximum increased to 80 percent.

2001
Line-of-Duty Death Benefits adopted to guarantee a minimum $50,000 death benefit.

2005
Return-to-Work statutes were reformed, including a temporary employment increase to 120 days.

2006
Ad-hoc increase granted to members retired prior to 1989.

2007
Public Safety Officer benefits were enhanced.

2012
New pension plan design options offered to local governments.

2013
Hybrid retirement plan enacted for state employees and teachers hired after July 1, 2014.

2014
Allow teachers participating in the Legacy Pension Plan to transfer membership prospectively to the Hybrid Retirement Plan.

2016
Qualified Domestic Relations Orders (QDROs) recognized by the retirement system.

Allow employees of political subdivision's that transferred to the Hybrid Retirement Plan to transfer membership prospectively to the Hybrid Retirement Plan if the employee contributions are the same.

2017
Allow members to designate multiple beneficiaries at retirement.

2019
Added 25-year early retirement option for all public safety officers.

Changed service requirement for some death benefits from 10 years to vesting.