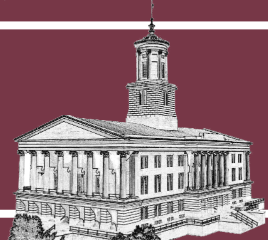

# Actuarial Section



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 funding status of the system and to determine employer contribution rates for its various components. The valuation performed as of June 30, 2015 set employer rates effective July 1, 2016 through June 30, 2017. The June 30, 2016 valuation established contribution rates beginning July 1, 2017. 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, 2012. The system noted improvements in mortality and included an adjustment for projected mortality. In addition, the system lowered the salary scale for all groups. Assumptions developed from the June 30, 2012 experience study were used in the July 1, 2015 actuarial valuation. The next experience study was performed June 30, 2016. Assumptions developed from the June 30, 2016 experience study will be used for actuarial valuations dated June 30, 2017 and after.

## 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 on the TCRS website at http://www.treasury.tn.gov/tcrs/PDFs/FundingPolicy.pdf.

BPS&M

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

November 15, 2017

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, 2017 for the Tennessee Consolidated Retirement System was performed as of June 30, 2016. In addition, a valuation for accounting purposes pursuant to GASB 67 and 68 was performed as of June 30, 2016 and was used to satisfy June 30, 2017 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, 2012. 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 2016 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.

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(*continued*)

Mr. David H. Lillard, Jr.
Chairman, Board of Trustees
November 15, 2017
Page Two

Certain tables presented in the Comprehensive Annual Financial Report are derived from the 2016 actuarial valuation reports prepared by Bryan, Pendleton, Swats and McAllister, LLC. 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 2016 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 2016 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 Bryan, Pendleton, Swats and McAllister, LLC 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, 2013 valuation. The assumptions used are based on the consulting actuary's recommendations resulting from the June 30, 2012 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 market value. The actuarial value of assets must be within 80-120 percent of the market 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 2.5 percent annually, reflecting the 1997 adoption of compounded cost-of-living adjustments.

**Economic Assumptions**

- ***Investment Return Rate*** — 7.5 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 — 3.5 percent annual increase.

*(continued)*

## Decrement Assumptions

***Post-Retirement Mortality*** — Specifically adopted tables have been created to accurately reflect patterns that occur among TCRS retirees. Sample rates are below.

| Male | | |
|---|---|---|
| **Age** | **Teachers** | **State and Political Subdivisions** |
| Age 50 | 0.2% | 0.3% |
| Age 60 | 0.4% | 0.9% |
| Age 70 | 1.4% | 2.0% |

| Female | | |
|---|---|---|
| **Age** | **Teachers** | **State and Political Subdivisions** |
| Age 50 | 0.1% | 0.2% |
| Age 60 | 0.4% | 0.7% |
| Age 70 | 0.9% | 1.2% |

***Pre-Retirement Mortality*** — All groups are based on the 2012 Static Non-annuitant mortality table published by the IRS.

***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% |

*(continued)*

***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 |
|---|---|---|---|---|---|
| 2007 | SETHEEPP | 136,284 | $ 5,739,878 | $ 42,117 | 3.01% |
| | PSPP | 79,441 | 2,084,945 | 27,275 | 3.40% |
| 2009 | SETHEEPP | 136,123 | 6,052,325 | 44,462 | 2.78% |
| | PSPP | 78,827 | 2,284,284 | 28,978 | 3.12% |
| 2011 | SETHEEPP | 135,569 | 6,057,161 | 44,680 | 0.25% |
| | PSPP | 79,507 | 2,356,126 | 29,634 | 1.13% |
| 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% |

## 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 |
|---|---|---|---|---|---|
| 2007 | SETHEEPP | 70,113 | $ 1,103,826 | $ 15,744 | 4.80% |
| | PSPP | 28,117 | 188,173 | 6,692 | 4.41% |
| 2009 | SETHEEPP | 76,720 | 1,266,979 | 16,514 | 2.45% |
| | PSPP | 31,155 | 219,860 | 7,057 | 2.73% |
| 2011 | SETHEEPP | 82,456 | 1,442,780 | 17,498 | 2.98% |
| | PSPP | 34,129 | 257,105 | 7,533 | 3.37% |
| 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% |
| 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% |

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

*(continued)*

## SCHEDULE OF RETIRED MEMBER ACTIVITY

| Actuarial Valuation July 1 | | Added to Rolls | | Removed from Rolls | | Rolls - End of Year | | Percentage Increase in Annual Allowances | Average Annual Allowances |
|---|---|---|---|---|---|---|---|---|---|
| | | No. | Annual Allowances | No. | Annual Allowances | No. | Annual Allowances | | |
| 2007 | SETHEEPP | 9,427 | $ 219,034 | 3,818 | $ 40,794 | 70,703 | $ 1,117,789 | 18.97% | $ 15,810 |
| | PSPP | 4,396 | 38,751 | 1,668 | 7,815 | 27,527 | 174,211 | 21.59% | 6,329 |
| 2009 | SETHEEPP | 10,677 | 212,772 | 4,070 | 49,047 | 77,310 | 1,281,514 | 14.65% | 16,576 |
| | PSPP | 4,752 | 39,522 | 1,714 | 8,407 | 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 |

Legislative changes changed 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 July 1, 2016

| | Teacher Legacy Pension Plan | Teacher Retirement Plan | Public Employee Retirement Plan | Total |
|---|---|---|---|---|
| ASSETS | | | | |
| Present assets creditable to: | | | | |
| Employer accumulation fund | $ 18,452,458,702 | $ 17,287,839 | $ 20,906,161,520 | $ 39,375,908,061 |
| Members' accumulation fund | 3,229,342,935 | 32,614,581 | 1,606,665,488 | 4,868,623,004 |
| Total present assets | 21,681,801,637 | 49,902,420 | 22,512,827,008 | 44,244,531,065 |
| Present value of prospective contributions payable to: | | | | |
| Employer accumulation fund | | | | |
| Normal | 1,780,553,988 | 57,858,514 | 2,778,823,537 | 4,617,236,039 |
| Accrued liability | 134,716,133 | (2,323,148) | 1,592,928,253 | 1,725,321,238 |
| Total employer accumulation | 1,915,270,121 | 55,535,366 | 4,371,751,790 | 6,342,557,277 |
| Member's accumulation fund | 1,720,744,537 | 302,202,833 | 821,196,124 | 2,844,143,494 |
| Total prospective contributions | 3,636,014,658 | 357,738,199 | 5,192,947,914 | 9,186,700,771 |
| TOTAL ASSETS | $ 25,317,816,295 | $ 407,640,619 | $ 27,705,774,922 | $ 53,431,231,836 |
| LIABILITIES | | | | |
| Present value of prospective benefits payable on account of: | | | | |
| Present retired members and beneficiaries | 12,858,860,573 | - | 12,944,180,621 | 25,803,041,194 |
| Present active members | 12,031,441,122 | 180,762,543 | 12,904,798,905 | 25,117,002,570 |
| Former members | 427,514,600 | 545,387 | 1,705,006,067 | 2,133,066,054 |
| TOTAL LIABILITIES | $ 25,317,816,295 | $ 181,307,930 | $ 27,553,985,593 | $ 53,053,109,818 |

## 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.

| 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) |
|---|---|---|---|---|---|---|---|---|
| 2007 | SETHEEPP | $ 3,386.8 | $ 12,544.7 | $ 11,308.6 | $ 26,215.0 | 100% | 100% | 91% |
| | PSPP | 896.8 | 1,902.9 | 2,676.0 | 4,898.0 | 100% | 100% | 78% |
| | Total | $ 4,283.6 | $ 14,447.6 | $ 14,314.8 | $ 31,113.0 | 100% | 100% | 89% |
| 2009 | SETHEEPP | $ 3,559.8 | $ 14,122.8 | $ 11,372.4 | $ 26,335.2 | 100% | 100% | 76% |
| | PSPP | 1,011.3 | 2,190.0 | 2,942.4 | 5,304.5 | 100% | 100% | 71% |
| | Total | $ 4,571.1 | $ 16,312.8 | $ 14,314.8 | $ 31,639.7 | 100% | 100% | 75% |
| 2011 | SETHEEPP | $ 3,707.0 | $ 15,941.3 | $ 13,059.3 | $ 30,118.2 | 100% | 100% | 80% |
| | PSPP | 1,100.8 | 2,560.6 | 3,700.3 | 6,562.6 | 100% | 100% | 78% |
| | Total | $ 4,807.8 | $ 18,501.9 | $ 16,759.6 | $ 36,680.8 | 100% | 100% | 80% |
| 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% |

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 Jul 1 | 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 |
|---|---|---|---|---|---|---|
| 2013 | $ 41,913.4 | 39,249.3 | 93.64% | 2,664.1 | 8,611.9 | 30.94% |
| 2015 | $ 44,572.4 | 42,738.8 | 95.89% | 1,833.6 | 8,754.6 | 20.94% |
| 2016 | $ 45,894.7 | 44,165.2 | 96.23% | 1,726.5 | 8,334.2 | 20.72% |

Note: This schedule is the aggregate of all TCRS plans.

## SELECTED ACTUARIAL FUNDING INFORMATION

| Actuarial Valuation Year | Earnings Assumptions | Salary Assumptions | | Unfunded Liability (Asset) SETHEEP | Unfunded Liability (Asset) PSPP | State Amortization Period |
|---|---|---|---|---|---|---|
| 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) TLPP | Unfunded Liability (Asset) TRP | Unfunded Liability (Asset) PERP | State Amortization Period | |
|---|---|---|---|---|---|---|---|---|---|
| 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) |

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.

(2) Graded scale

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

## GAIN AND LOSS ANALYSIS, JULY 1, 2015 VALUATION

| | Consolidated State | Teacher |
|---|---|---|
| Contribution Rate | | |
| Effective Employer Contribution Rate Pursuant to 2013 Valuation | 15.14% | 9.04% |
| Investment Results | 1.00% | 0.92% |
| Salary Increases:The annual weighted-average rate of salary increase during the 2013-2015 period was below the assumed age-based rated used in preparing the 2013 valuation report. This resulted in a reduction in the contribution rate. | -0.26% | -0.94% |
| New Entrants: Includes the effect where normal cost for new entrants since the previous valuation differs from the normal cost of the group. | -0.29% | 0.07% |
| Cost of Living Escalation: COLA in 2014 and 2015 were 1.5% and 1.0%, respectively for combined effect of 1.2%, which is less than the assumed 2.5% per year. | -1.16% | -0.93% |
| 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% |
| Effect of turnover on total payroll: Turnover during the 2013-2015 period was above the assumed rates, which resulted in lower payroll than expected for the 2015 valuation. The lower payroll base led to an increase in the contribution rate. | 1.05% | 0.10% |
| Other | 0.59% | -0.43% |
| Re-amortization of unfunded liability | -1.03% | 0.87% |
| Effective Employer Contribution Rate Pursuant to 2015 Valuation | 15.14% | 9.04% |

## 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 the 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**

<u>General</u>

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, institutions and/or multiple beneficiaries 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 after ten years of service, a 100 percent Joint and Survivor Annuity for any beneficiary 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.

<u>Legacy Plan for Members Before July 1, 2014</u>

All members hired prior to July 1, 2014, with the exception of state judges, joining TCRS after 1976 enter 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. 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.

<u>Hybrid Plan for Members After June 30, 2014</u>

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 this 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, including salary and service history, 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 biennially 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.
- Computer-generated membership letters are mailed to all new members.
- Membership booklets are available to members on the TCRS website.
- Member self-service can be accessed at www.mytcrs.com

### *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 entires, notes, and required supplementary information regarding pensions to comply with GASB Standard 68.
- Available online at www.treasury.tn.gov/GASB68
- Actuarial Report
- Employer education regarding reporting and participation in TCRS.

## TCRS Legacy Plan and Social Security Benefits
### *for Calendar Year 2017*

| 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 | % ofAFC | 35 Years Service | % of AFC |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | TCRS | $ 3,544 | | $ 4,725 | | $ 5,906 | | $ 7,088 | | $ 8,269 | |
| $15,000 | Social Security | 9,708 | | 9,708 | | 9,708 | | 9,708 | | 9,708 | |
| | Total | $ 13,252 | 88.3% | $ 14,433 | 96.2% | $ 15,614 | 104.1% | $ 16,796 | 112.0% | $ 17,977 | 119.8% |
| | TCRS | $ 4,725 | | $ 6,300 | | $ 7,875 | | $ 9,450 | | $ 11,025 | |
| $20,000 | Social Security | 11,184 | | 11,184 | | 11,184 | | 11,184 | | 11,184 | |
| | Total | $ 15,909 | 79.5% | $ 17,484 | 87.4% | $ 19,059 | 95.3% | $ 20,634 | 103.2% | $ 22,209 | 111.0% |
| | TCRS | $ 5,906 | | $ 7,875 | | $ 9,844 | | $ 11,813 | | $ 13,781 | |
| $25,000 | Social Security | 12,660 | | 12,660 | | 12,660 | | 12,660 | | 12,660 | |
| | Total | $ 18,566 | 74.3% | $ 20,535 | 82.1% | $ 22,504 | 90.0% | $ 24,473 | 97.9% | $ 26,441 | 105.8% |
| | TCRS | $ 7,088 | | $ 9,450 | | $ 11,813 | | $ 14,175 | | $ 16,538 | |
| $30,000 | Social Security | 14,124 | | 14,124 | | 14,124 | | 14,124 | | 14,124 | |
| | Total | $ 21,212 | 70.7% | $ 23,574 | 78.6% | $ 25,937 | 86.5% | $ 28,299 | 94.3% | $ 30,662 | 102.2% |
| | TCRS | $ 8,269 | | $ 11,025 | | $ 13,781 | | $ 16,538 | | $ 19,294 | |
| $35,000 | Social Security | 15,600 | | 15,600 | | 15,600 | | 15,600 | | 15,600 | |
| | Total | $ 23,869 | 68.2% | $ 26,625 | 76.1% | $ 29,381 | 83.9% | $ 32,138 | 91.8% | $ 34,894 | 99.7% |
| | TCRS | $ 9,450 | | $ 12,600 | | $ 15,750 | | $ 18,900 | | $ 22,050 | |
| $40,000 | Social Security | 17,076 | | 17,076 | | 17,076 | | 17,076 | | 17,076 | |
| | Total | $ 26,526 | 66.3% | $ 29,676 | 74.2% | $ 32,826 | 82.1% | $ 35,976 | 89.9% | $ 39,126 | 97.8% |
| | TCRS | $ 10,631 | | $ 14,175 | | $ 17,719 | | $ 21,263 | | $ 24,806 | |
| $45,000 | Social Security | 18,540 | | 18,540 | | 18,540 | | 18,540 | | 18,540 | |
| | Total | $ 29,171 | 64.8% | $ 32,715 | 72.7% | $ 36,259 | 80.6% | $ 39,803 | 88.5% | $ 43,346 | 96.3% |
| | TCRS | $ 11,813 | | $ 15,750 | | $ 19,688 | | $ 23,625 | | $ 27,563 | |
| $50,000 | Social Security | 20,016 | | 20,016 | | 20,016 | | 20,016 | | 20,016 | |
| | Total | $ 31,829 | 63.7% | $ 35,766 | 71.5% | $ 39,704 | 79.4% | $ 43,641 | 87.3% | $ 47,579 | 95.2% |
| | TCRS | $ 12,994 | | $ 17,325 | | $ 21,656 | | $ 25,988 | | $ 30,319 | |
| $55,000 | Social Security | 21,492 | | 21,492 | | 21,492 | | 21,492 | | 21,492 | |
| | Total | $ 34,486 | 62.7% | $ 38,817 | 70.6% | $ 43,148 | 78.5% | $ 47,480 | 86.3% | $ 51,811 | 94.2% |
| | TCRS | $ 14,175 | | $ 18,900 | | $ 23,625 | | $ 28,350 | | $ 33,075 | |
| $60,000 | Social Security | 22,944 | | 22,944 | | 22,944 | | 22,944 | | 22,944 | |
| | Total | $ 37,119 | 61.9% | $ 41,844 | 69.7% | $ 46,569 | 77.6% | $ 51,294 | 85.5% | $ 56,019 | 93.4% |
| | TCRS | $ 15,356 | | $ 20,475 | | $ 25,594 | | $ 30,713 | | $ 35,831 | |
| $65,000 | Social Security | 23,640 | | 23,640 | | 23,640 | | 23,640 | | 23,640 | |
| | Total | $ 38,996 | 60.0% | $ 44,115 | 67.9% | $ 49,234 | 75.7% | $ 54,353 | 83.6% | $ 59,471 | 91.5% |
| | TCRS | $ 16,538 | | $ 22,050 | | $ 27,563 | | $ 33,075 | | $ 38,588 | |
| $70,000 | Social Security | 24,324 | | 24,324 | | 24,324 | | 24,324 | | 24,324 | |
| | Total | $ 40,862 | 58.4% | $ 46,374 | 66.2% | $ 51,887 | 74.1% | $ 57,399 | 82.0% | $ 62,912 | 89.9% |

** Average Final Compensation*

This chart is based on a date of retirement in 2017. Social security benefits have been calculated by Bryan, Pendleton, Swats & McAllister, actuarial consultants for the TCRS, utilizing the following assumptions: (1) retirement is taking place at age 65 in 2017; (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 plan options offered to local governments.

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