# Tennessee Consolidated Retirement System

Legacy Pension Plans and Aggregate Local Government Agent Pension Plans:

Teacher Legacy Pension Plan

Closed State and Higher Education Employee Pension Plan

Aggregate Local Government Agent Pension Plans (Political Subdivisions)

Actuarial Valuation and Report (for cash funding purposes)

June 30, 2020

October 31, 2021

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

Dear Mr. Lillard:

Submitted herewith are the results of an actuarial valuation of the Tennessee Consolidated Retirement System prepared as of June 30, 2020, pursuant to the provisions of TCA Section 8-34-506. Also included are the actuary's recommendations with respect to contributions by the employers.

We trust that this report will be helpful in formulation of policy with respect to the operation and financing of the System. We very much appreciate the opportunity to serve the Board of Trustees, and will be pleased to supplement this report in any way, as you request.

The staff of the Tennessee Consolidated Retirement System has been extremely helpful and cooperative in developing the information required for this valuation. Their cooperation has been greatly appreciated, and is hereby acknowledged.

Respectfully submitted,

Justin C. Thacker, F.S.A.

Enclosures

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# A. INTRODUCTION

An actuarial valuation of the Tennessee Consolidated Retirement System was performed as of June 30, 2020. The purpose of the valuation was to determine the funding requirements of the various components of the System, with the intention that the funding requirements indicated by the valuation would be used as the basis for contributions commencing on July 1, 2021.

The Tennessee Consolidated Retirement System (TCRS) was established as of July 1, 1972 as a successor to the following superseded retirement systems:

Tennessee State Retirement System

Tennessee Teachers' Retirement System

Tennessee Judges Retirement System

Retirement System for County Paid Judges of Tennessee

Attorneys General Retirement System of Tennessee

Public Service Commissioners' Retirement System

Tennessee Retirement System for County Officials

As of the date of establishment, all members and beneficiaries of the superseded systems were covered under the Consolidated System. The assets of each superseded system were transferred to the credit of the Consolidated System, and no further contributions have been made to the superseded systems by either the members or the employers. Separate accounting is maintained under the Consolidated System for the assets and liabilities attributable to the various classes of members and beneficiaries. Benefits under the System are funded by contributions made by members and employers (including the State). The level of such contributions is determined annually by an actuarial valuation (determined biennially prior to 2015). This report presents the results of the actuarial valuation of the System performed as of June 30, 2020.

The following sections of this report discuss the membership in the System as of the valuation date; the funding levels generated under the approach to funding adopted by the Board; the current financial status of the System as a whole and of each major subdivision of the System; an analysis of the factors causing change in the required contribution levels; the validity of the records on which the study was based; the benefits provided by current and superseded systems; and the data on which the valuation was based and the actuarial assumptions utilized in the valuation.

# B. MEMBERSHIP

The statute which established the Tennessee Consolidated Retirement System in 1972 specified the three following classifications of employment:

| | |
|---|---|
| Group I | Teachers and General Employees (State and Political Subdivisions) |
| Group II | State Policemen, Wildlife Officers, Firemen and Policemen |
| Group III | State Judges, County Judges, Attorneys General, County Officials, and Public Service Commissioners |

Any person who was a member of a superseded system as of June 30, 1972 became a member of the Consolidated System on the date of establishment. Such a member could elect to remain covered by the benefit and contribution provisions of the superseded system of which he was a member, in which case he was classified as a "prior class member". If he did not so elect, he was classified as a member of Group I, Group II or Group III on the basis of his employment category.

Effective July 1, 1976, all new entrants to the System, without regard to their employment category, entered the System as Group I employees. Despite this change, several small groups (those previously classified as "Group III") are treated differently from the bulk of the general employees with respect to funding levels for various reasons.

Effective September 1, 1990, a new Group IV category became available to State Judges. State Judges previously participating in Group I or Group III became eligible to transfer to the new category, and those becoming State Judges on or after the effective date automatically enter Group IV.

The following tables show the number of active and retired members included in the June 30, 2019 and June 30, 2020 valuations.

## THE NUMBER AND ANNUAL COMPENSATION OF ACTIVE MEMBERS

| | Number | | | Compensation | | |
|---|---|---|---|---|---|---|
| GROUP | 2019 | 2020 | *Pct Change* | 2019 | 2020 | *Pct Change* |
| **Group I** | | | | | | |
| Contributory Teachers | 56,294 | 53,582 | (4.8%) | 3,248,209,652 | 3,219,651,049 | (0.9%) |
| **General Employees:** | | | | | | |
| State | 36,985 | 34,381 | (7.0%) | 2,063,300,374 | 2,027,042,151 | (1.8%) |
| University of Tennessee (TIAA) | 36 | 22 | (38.9%) | 5,156,248 | 2,874,404 | (44.3%) |
| Separately Funded Systems | 513 | 481 | (6.2%) | 52,710,570 | 52,104,752 | (1.1%) |
| Sub-Total | 37,534 | 34,884 | (7.1%) | 2,121,167,192 | 2,082,021,307 | (1.8%) |
| Political Subdivisions | 82,296 | 82,979 | 0.8% | 2,955,357,313 | 3,047,597,420 | 3.1% |
| Total - Group I | 176,124 | 171,445 | (2.7%) | 8,324,734,157 | 8,349,269,776 | 0.3% |
| **Group II** | | | | | | |
| State Policemen and Wildlife Officers | 0 | 0 | -- | 0 | 0 | -- |
| Firemen and Policemen | 5 | 3 | (40.0%) | 455,553 | 296,071 | (35.0%) |
| Total - Group II | 5 | 3 | (40.0%) | 455,553 | 296,071 | (35.0%) |
| **Group III (including Superseded Systems)** | | | | | | |
| State Judges - Group III | 0 | 0 | -- | 0 | 0 | -- |
| Attorneys General - Group III | 0 | 0 | -- | 0 | 0 | -- |
| County Judges - Group III | 0 | 0 | -- | 0 | 0 | -- |
| County Officials - Group III | 1 | 1 | -- | 122,770 | 125,889 | 2.5% |
| State Judges - Superseded | 0 | 0 | -- | 0 | 0 | -- |
| Attorneys General - Superseded | 1 | 1 | -- | 159,924 | 163,128 | 2.0% |
| County Judges - Superseded | 0 | 0 | -- | 0 | 0 | -- |
| County Officials - Superseded | 1 | 1 | -- | 72,069 | 73,971 | 2.6% |
| Total - Group III | 3 | 3 | -- | 354,763 | 362,988 | 2.3% |
| **Group IV - Judges** | 142 | 138 | (2.8%) | 25,330,745 | 25,149,513 | (0.7%) |
| State - All Groups | 93,973 | 88,607 | (5.7%) | 5,395,062,352 | 5,327,184,857 | (1.3%) |
| Political Subdivisions- All Groups | 82,301 | 82,982 | 0.8% | 2,955,812,866 | 3,047,893,491 | 3.1% |
| Grand Total - All Groups | 176,274 | 171,589 | (2.7%) | 8,350,875,218 | 8,375,078,348 | 0.3% |

## THE NUMBER AND ANNUAL RETIREMENT ALLOWANCES CURRENTLY PAYABLE TO BENEFICIARIES ON THE RETIREMENT ROLLS

| | Number | | | Amount | | |
|---|---|---|---|---|---|---|
| GROUP | 2019 | 2020 | *Pct Change* | 2019 | 2020 | *Pct Change* |
| **Group I** | | | | | | |
| Contributory Teachers | 52,400 | 52,913 | 1.0% | 1,285,072,754 | 1,324,474,551 | 3.1% |
| **General Employees:** | | | | | | |
| State | 56,358 | 57,400 | 1.8% | 893,375,674 | 930,545,062 | 4.2% |
| University of Tennessee (TIAA) | 1,435 | 1,371 | (4.5%) | 32,218,320 | 32,946,433 | 2.3% |
| Separately Funded Systems | 450 | 483 | 7.3% | 10,072,928 | 10,859,471 | 7.8% |
| Sub-Total | 58,243 | 59,254 | 1.7% | 935,666,922 | 974,350,966 | 4.1% |
| Political Subdivisions | 50,952 | 52,799 | 3.6% | 436,792,014 | 464,367,885 | 6.3% |
| Total - Group I | 161,595 | 164,966 | 2.1% | 2,657,531,690 | 2,763,193,402 | 4.0% |
| **Group II** | | | | | | |
| State Policemen and Wildlife Officers | 451 | 422 | (6.4%) | 17,213,427 | 16,726,429 | (2.8%) |
| Firemen and Policemen | 467 | 455 | (2.6%) | 14,525,229 | 14,645,489 | 0.8% |
| Total - Group II | 918 | 877 | (4.5%) | 31,738,656 | 31,371,918 | (1.2%) |
| **Group III (including Superseded Systems)** | | | | | | |
| State Judges - Group III | 2 | 2 | -- | 106,003 | 108,441 | 2.3% |
| Attorneys General - Group III | 14 | 13 | (7.1%) | 847,896 | 826,397 | (2.5%) |
| County Judges - Group III | 19 | 19 | -- | 460,637 | 471,278 | 2.3% |
| County Officials - Group III | 50 | 44 | (12.0%) | 1,277,448 | 1,085,785 | (15.0%) |
| State Judges - Superseded | 36 | 33 | (8.3%) | 3,092,092 | 2,849,793 | (7.8%) |
| Attorneys General - Superseded | 89 | 87 | (2.2%) | 5,265,215 | 5,235,461 | (0.6%) |
| County Judges - Superseded | 47 | 43 | (8.5%) | 2,266,085 | 2,034,040 | (10.2%) |
| County Officials - Superseded | 69 | 64 | (7.2%) | 1,959,339 | 1,858,138 | (5.2%) |
| Total - Group III | 326 | 305 | (6.4%) | 15,274,715 | 14,469,333 | (5.3%) |
| **Group IV - Judges** | 200 | 202 | 1.0% | 9,733,148 | 10,335,166 | 6.2% |
| State - All Groups | 111,620 | 113,096 | 1.3% | 2,262,960,966 | 2,340,356,445 | 3.4% |
| Political Subdivisions - All Groups | 51,419 | 53,254 | 3.6% | 451,317,243 | 479,013,374 | 6.1% |
| Grand Total - All Groups | 163,039 | 166,350 | 2.0% | 2,714,278,209 | 2,819,369,819 | 3.9% |

# C. DETERMINATION OF FUNDING LEVELS

## General Method

The statute which established the Tennessee Consolidated Retirement System prescribed a "frozen initial liability" method of valuation, under which an initial unfunded accrued liability is established for each major cost group, and the remainder of the cost of the System is borne by a "normal cost" contribution. Under that method as it is usually utilized, the "normal cost" calculated as a part of each subsequent valuation absorbs any variation of actual from expected experience.

Prior to 1975, the unfunded accrued liability was not being amortized. In that year, a 40-year amortization of the unfunded accrued liability was begun, except that (in accordance with the statute at that time) cost of living benefits remained on a "pay-as-you-go" basis.

In 1977, the statute was changed to provide for advance funding of cost of living benefits. It was decided to amortize the additional accrued liability arising from these benefits as a percent of payroll, rather than by level dollar annual payments. The result was to arrive at a contribution rate consisting of three segments: a "normal cost"; an "accrued liability level dollar" amortization of the unfunded accrued liability for basic benefits; and an "accrued liability percent of payroll" amortization for the additional accrued liability arising from cost of living benefits. For closed groups, all of the unfunded accrued liability was amortized on a level dollar basis.

Prior to the 2015 valuation, the Trustees decided whether to freeze the prior valuation's unfunded accrued liability, or to reestablish that figure. From time to time, the unfunded accrued liability was reestablished rather than frozen. Reestablishment generally occurred when there were significant changes in benefits or actuarial experience and was elected in order to more accurately portray the unfunded liability of the system.

In 2014, the TCRS Board of Trustees adopted a funding policy applicable to all employers. The funding policy requires actuarial valuations to be performed annually beginning as of June 30, 2015, utilizing the entry-age normal actuarial funding method. In addition, the funding policy requires unfunded liabilities to be amortized utilizing the level dollar amortization method over a closed period not to exceed 20 years. A tier approach is required for new actuarial gains and losses created from each actuarial valuation. The amortization period of each tier may be shortened or extended from valuation to valuation to manage volatility but the specific tier must be completely amortized within 20 years of its original creation.

## Funding History

In 1981, the State began making the contributions previously made by State Group I employees and teachers associated with higher education, in lieu of part of the salary increase these participants would otherwise have received. Separate contribution rates were developed for "contributory" (K-12) teachers and "non-contributory" (higher education) teachers. These rates were artificially adjusted so as to retain a reasonable relationship between the two rates; exact separate calculations were not made because the total pool of assets accumulated for teachers was not being accumulated separately for the two groups.

In 1983, several improvements were made to the funding program:

1. The unfunded accrued liability was treated as if it had been frozen in 1981, rather than being reestablished. This action had little effect on 1983 contribution rates, but established the desired precedent — once frozen, the unfunded accrued liability would decrease regularly until it disappeared in 2015.
2. All of the "percent of payroll" amortization piece for State employees and 70% of the equivalent piece for teachers were shifted to the stronger "level dollar" amortization basis.
3. Contribution rates for several of the smaller groups were recombined to reflect more accurately the sources of the money used to fund them.

Separate rates were again computed for "contributory" and "non-contributory" teachers, involving an artificial differential intended to keep the relationship of the two rates reasonable.

In 1984 and again in 1985, the Legislature allocated excess general State funds to the TCRS. Some of these funds were allocated to the superseded ("prior class") State Judges and Attorney General Systems, for which existing funding was not proving adequate. The intention of this infusion of funds was to make it feasible to fund the remaining liabilities of these closed systems in reasonably level dollar amounts over the next 30 years. Other funds were intended to fund in advance the "bonus", "aged teacher" and "aged State employee" programs that had previously been funded on a year-by-year basis from the operating budget.

In 1985, the remaining 30% of the frozen accrued liability for teachers was shifted to the "level dollar" amortization basis. A new set of actuarial assumptions was adopted, based on the 1984 study of actual experience under the TCRS. The rates called for by the 1985 valuation were generally somewhat lower than the rates then being contributed. As a conservative measure, the Board of Trustees voted to continue utilizing the then-current rates, rather than allowing the rates to drop.

Between 1985 and 1987, the TCRS experienced large actuarial gains due to investment earnings substantially in excess of the actuarial assumption of 8.5%. Even when the smoothing procedure utilized since 1981 was applied to plan assets, to avoid undue fluctuations in contribution rates, the strong investment performance of the two-year period generated actuarial gains, lowering the required contribution rates. The Board of Trustees, unsure how the stock market would react to a 500 point decline of the Dow Jones Industrial Average on October 19, 1987, adopted contribution rates which "split the difference" between the then-current rates and the much lower rates called for by the 1987 valuation. Contribution rates for the major groups still dropped significantly; nevertheless, the adopted rates included considerable margins over the "required" rates, in order to minimize the likelihood of having to increase the rates in 1989.

Also in 1987, a "consolidated State" contribution rate covering all groups for whom the State was directly responsible was adopted. This group included higher education (non-contributory) teachers and a closed group of University of Tennessee teachers whose TIAA benefits are supplemented by the TCRS, as well as all Group I and Group II State employees. This change was made for purposes of administrative simplicity, and also to avoid questions concerning classification of higher education employees which had arisen in the past. Teachers who were still contributing to the TCRS (K-12 teachers) remained as a separate group.

Between 1987 and 1989, the valuation "target" rates necessary to continue the 40-year funding program begun in 1975 decreased still further. Several factors contributed to this decline. First, the unfunded accrued liability frozen in 1981 was being amortized by level dollar annual contributions; as the covered payroll increases, as it had each year since 1983, these level dollar amounts represent a decreasing percentage of each year's covered payroll. Second, actuarial gains had emerged. Third, the fact that contributions during the two years actually exceeded the targets called for by the 1987 valuation meant that current assets exceeded the amounts which would have been on hand if the valuation "target" rates had actually been adopted. For all these reasons, the 1989 valuation rates declined significantly from the 1987 rates.

A 1988 study of experience under the TCRS had led to the adoption by the Board of Trustees of a new set of actuarial assumptions for the 1989 valuation. While some of the new assumptions would require less money to go into the trust (for example, it was assumed that continuing participants would receive annual salary increases of 7% each year, rather than 8%), overall the new set of assumptions was more conservative than the old set. Therefore, the "1989 valuation rates" were somewhat higher than they would have been if the new, more conservative set of assumptions had not been adopted.

Because it was felt that most of the conditions which had caused the required contribution rates to decline from 1987 to 1989 would continue to apply after 1989, the Board of Trustees voted to adopt the 1989 "target" rates as the actual contribution rates, effective July 1, 1990.

As expected, the required contribution rates developed in 1991 were lower than the 1989 rates. The Board of Trustees again voted to adopt the 1991 "target" rates as the actual contribution rates, effective July 1, 1992.

The quadrennial experience study performed in 1992 indicated that the demographic assumptions which had been used in the 1989 and 1991 valuations had turned out to be accurate. Investment performance during the preceding few years had substantially exceeded the 8% interest assumption, and salary increases during the last few years had fallen short of the 7% salary assumption. Therefore, the Board of Trustees took the position that continuing to utilize the same set of actuarial assumptions was an appropriate practice, retaining a reasonable yet conservative approach to the calculation of required contribution rates.

From 1991 to 1993, the System generated unusually large actuarial gains. Investment earnings exceeded expected earnings (on the 8% basis) by over $675,000,000. Freezes on salaries had minimized salary increases during the valuation period, leading to additional large actuarial gains. The effect of these two large sources of gains was to lower required contribution rates substantially.

A further result of these actuarial gains was to create several anomalies in the funding method; the most prominent of which was a "negative normal cost" for the Consolidated State. The unfunded accrued liability of each group for which a contribution rate is obtained had not been reestablished since 1981. During that period, there had been substantial actuarial gains, culminating in the large gains from 1991 to 1993. All of the gains had been absorbed into the "normal cost" component of the contribution. As a result, the remaining unfunded accrued liability had become the major component of the remaining employer liability; in the case of the Consolidated State, the unfunded accrued liability, which had been brought forward as a dollar amount from year to year, exceeded the State's total liability for the group.

In order to remove these anomalies, the Board of Trustees decided, as authorized by TCA Section 8-37-304, to reestablish the unfunded accrued liability for each group. The result was that a much smaller unfunded accrued liability remained for teachers, that unfunded accrued liabilities increased for County Judges and Officials and for State Judges and Attorneys General (Superseded), and that there was no longer an unfunded accrued liability for the other contribution groups.

Actual contributions for the two smaller groups which still had unfunded accrued liabilities were not affected by the reestablishment. Benefits for County Judges and Officials are funded through litigation taxes, so the actuarially determined contribution rate serves only as a benchmark. Superseded State Judges and Attorneys General were being funded by level annual contributions which were intended to pay off the group's total liability by 2015, without regard to the subdivision between "normal cost" and "accrued liability."

Rather than allowing the rates to drop substantially, the Board of Trustees followed the course which had been authorized in previously-approved legislation:

1. Portability among members who had service in more than one membership classification was improved.
2. The base benefit of active and retired members in most categories was increased by 5%.
3. The amortization period for the Contributory Teachers was decreased to 10 years. However, the Board retained the right to increase the amortization period in the future.

Even after these benefit and funding improvements, the 1993 contribution rates for the major groups decreased slightly.

From 1993 to 1995, actuarial experience was not as favorable as it had been in prior years. Although the required contribution rate for Contributory Teachers decreased further, the required contribution rate for the Consolidated State group increased for the first time in several years.

The Trustees adopted the actuary's recommendation that unfunded accrued liabilities be reestablished for the three groups for which such liabilities existed. Since Section 8-37-305 of the TCA specifies that the accrued liability contribution is to be discontinued for any member classification as soon as the unfunded accrued liability becomes zero, the unfunded accrued liabilities were not reestablished for the groups which had reached that goal in 1993. Reestablishment for the three entities with remaining liabilities was elected in order to maintain a more realistic balance between the accrued liability contribution and the normal cost contribution.

As mentioned above, the Board retained the right to extend the amortization period for Contributory Teachers from the eight-year period remaining from the ten-year amortization schedule adopted in 1993 to a period that in 1995 was permitted to be as much as twenty years. The primary purpose of retaining this right was as a safety valve to avoid undue strain on the State's resources in the event of a future increase in required contributions due to actuarial losses. Reversion to the twenty-year amortization schedule was elected in order to mitigate contribution volatility associated with the leveraged position as plan assets equaled approximately 80% of projected benefit values.

The quadrennial experience study conducted in 1996 led the Trustees to adopt a set of more conservative withdrawal and mortality assumptions for the Contributory Teacher group. The study also concluded that economic assumptions should be revised to reflect lower prevailing rates of inflation, as inflation had declined significantly since the previous review was conducted. Consequently, the assumed investment return rate was revised downward from the 8% per annum rate used in the 1995 valuation to 7.5%. The assumed annual rate of salary increase, which is also expected to contain an inflation component, was revised downward from 7% to 5.5%.

Unrelated to the assumption changes resulting from the experience study was a recommended modification in the asset valuation method. An asset smoothing procedure had been applied in determining the asset value upon which contributions are based since 1981. The purpose of the smoothing process was to dampen the effect of investment volatility so that contributions were not unduly affected by short-term changes in investment results. Under the procedure used in prior plan valuations, fixed income investments had been treated differently than equities and had been valued at book value. Equities were valued by adjusting the book value of the equity portion of the portfolio by a factor which reflected the five-year moving average ratio of the equity market to book values.

While the previous methodology had served the purpose of reducing volatility adequately, the procedure differed from the methods mandated by the then recently applicable Governmental Accounting Standards Board (GASB) Statements 25 and 27. Under the GASB standards, the entire portfolio, rather than the equity portion only, must be adjusted to recognize changes in market value. The revised methodology approved for the plan expanded the moving average procedure then in use to apply to all plan assets.

The 1997 valuation recognized benefit modifications that were adopted by the legislature in the 1997 Appropriation Act as follows –

1. The arithmetic, or simple, form of cost-of-living adjustment was replaced by a geometric, or compounded, adjustment. The modification was effective January 1, 1998 and included a "catch-up" feature for then current retirees.

2. Salary "loading" for Consolidated State employees hired prior to July 1, 1981 and for whom employee contributions had been eliminated was permanently extended.

3. Contribution rates related to the geometric cost-of-living adjustment and permanent salary extension were implemented effective as of January 1, 1998 and July 1, 1998, respectively.

As of July 1, 1997, an unfunded accrued liability remained for the Contributory Teacher group and two other small groups. The Trustees elected to reestablish the liability for all three groups resulting in the elimination of the unfunded accrued liability for Contributory Teachers and leaving an unfunded accrued liability for only the County Judges and Officials and State Judges and Attorneys General (Superseded).

Contribution rates produced by the 1999 valuation continued to benefit from favorable investment experience. Lower than expected salary increases to Teachers also contributed to lower contribution rates. Factors influencing higher contributions were the addition of new entrants for whom contribution rates were higher because they did not benefit from prior accumulated gains and modifications in valuation programming to accommodate improvements in valuation techniques. The trend for the Teachers employer contribution rate continued to decline. An increase in the State employer contribution rate resulted in the State rate for the first time exceeding that for Teachers.

Between 1997 and 1999, TCRS record keeping procedures were revised to eliminate maintenance of the fund book value. Since prior asset valuation methods were based on a historical comparison of the relationship between book and market value, the valuation asset method was revised for the 1999 valuation. A primary consideration in selecting the revised method was that the prior method should not be altered more than necessary. Under the revised method, the asset value used in computing plan contributions was determined by recognizing “excess earnings” occurring in each preceding year over a five year period following the year of recognition. Excess earnings in a year are earnings above the investment returns that would have occurred if the plan earned the actuarially assumed rate for the year. Excess earnings or losses so computed for each year were phased in ratably over five years. For conservatism, excess gains or losses for a year were applied first to offset accumulated excess earnings on a dollar for dollar basis before phasing in the remainder.

During 1999, an actuarial audit of the primary calculations underlying the valuation was conducted by Buck Consultants. Conclusions and opinions resulting from the audit were discussed in a report prepared by Buck Consultants. Significantly, the audit endorsed the actuarial valuation methodology and the basic liability results used in computing contributions for the TCRS.

A quadrennial experience study conducted in 2000 concluded that economic assumptions including the assumed rate of investment return and the inflation assumption should be unchanged. Modifications were recommended for the salary increase rate and many of the demographic assumptions.

The assumed rate of salary increase employed in the 1999 actuarial valuation was a uniform rate of 5.5% that was applied to all ages. The assumed rate was higher than actual aggregate experience. Also, the pattern of actual salary increase rates was such that increases for younger participants were considerably higher than those for older participants. An age graded scale was recommended to replace the uniform scale. The revised scale was slightly lower than the prior scale but more accurately reflected career salary patterns.

In the four-year period covered by the experience study, post retirement mortality rates improved extending the precedent established in earlier studies. Improvement was observed for both Teacher and State groups. Since the standard tables did not appear to represent the TCRS retiree mortality pattern, a revised table modeled after TCRS experience was developed.

Predicted rates of termination and retirement of both State and Teacher groups were modified significantly to recognize separation patterns measured on the basis of liabilities. The revised tables recommended by the study resulted in increased contribution rates for both groups. Following a policy of gradual absorption of significant contribution rate changes, the Board elected to phase-in the termination rates for the State and Political Subdivision groups ratably over a cycle of three actuarial biennial valuations beginning in 2001.

The aggregate effect of recommended salary and demographic changes (including the decision to phase-in State termination rates) in the 2001 actuarial valuation was to increase Teacher and State employer contribution rates by 0.3% and 1.1% respectively.

Administrative factors for survivorship, early reduction and delayed retirement had been last revised prior to 1990. Since the time of their adoption, the assumed actuarial valuation interest rate was reduced from 8.0% to 7.5%, and mortality improvements had been implemented. Accordingly, the Board recommended modification of the administrative factors as of July 1, 2002.

Plan contributions established by the 2003 actuarial valuation suffered from continued adverse investment experience. Rates of investment return for fiscal years ending in both 2002 and 2003 were below that assumed in the valuation. Contribution rates for the Teacher and State groups increased by 2.1% and 2.8%, respectively, due primarily to the unfavorable investment performance.

In addition, the 2003 valuation recognized the second step in the phase-in process of adopting the recommended termination rates for the State and Political Subdivision groups. Consolidated State contributions increased by 0.40% due to the 2003 change in termination assumptions.

A quadrennial experience study was conducted in 2004 covering the period of plan operations from July 1, 2000 through June 30, 2004. The review concluded that economic assumptions including the assumed rate of investment return and the inflation assumption should be unchanged. The study also validated the salary increase rates developed with the previous experience study. Modifications, however, were recommended for many of the demographic assumptions.

In the four-year period covered by the experience study, post retirement mortality rates were noted to have improved predominantly in the male population of both the State and Teacher groups, extending the precedent established in earlier studies. As a result, new post retirement mortality rates were recommended to better reflect the actual experience.

Modifications were also recommended with the 2004 experience study to the termination and retirement rates. The new study validated the need to recognize the final phase-in of termination rates for the State group recommended from the 2000 study, with only a minor additional change recommended in 2004. Retirement rates dropped sharply during the study period from 2000 – 2004. Since retirement rate experience could be temporarily related to recent economic cycles, the 2004 study recommended that approximately one half of the reduction in retirement rates be reflected in the actuarial valuation, with further review again during the next experience study.

The 2005 actuarial valuation resulted in continued contribution rate increases for both groups. Contribution rates for Teacher and State groups increased by 2.63% and 3.18%, respectively, due to actuarial experience primarily from the recognition of prior investment performance. The aggregate effect of the recommended assumption changes in the 2005 actuarial valuation was to reduce the Teacher and State employer contribution rates by 2.0% and 0.14% respectively.

As of July 1, 2005, the unfunded liability was eliminated for the County Judges and Officials group as it became fully funded. An unfunded accrued liability was only recognized for the State Judges and Attorneys General (Superseded) group.

Rates of investment return for fiscal years ending in 2006 and 2007 were 6.9% and 13.2%, respectively. While these market returns exceeded our assumed return for the two-year period, prior losses were still being phased-in with the valuation asset smoothing method for the 2007 valuation. Actuarial experience in the aggregate between 2005 and 2007 resulted in an increase in the contribution level; however, the increase was much smaller than in recent valuations. Contribution rates for Teacher and State groups increased by 0.29% and 0.52%, respectively, due to actuarial experience, primarily the recognition of prior investment performance.

Additional steps were taken with the 2007 valuation in an effort to curb contribution rate volatility going forward. First, the unfunded actuarial accrued liability was reestablished for all groups and amortized over a 20-year period. Even though the unfunded accrued liability had been eliminated in prior years for the State and Teacher groups (mostly due to excess asset performance on the 1990's), adverse investment performance since the 1990's had created an unfunded accrued liability as of the valuation date. The net effect of this change was to reduce the State contribution rate by 0.99%. Since the Teacher group had a relatively small unfunded accrued liability after reestablishment, the change did not impact the Teacher contribution rate.

In addition, a ten-year asset smoothing method was adopted to be used prospectively for fiscal years beginning after June 30, 2007. The purpose of this change was to more adequately smooth investment performance since the plan's contribution rates are so highly leveraged on the volatility of plan assets. It was believed that a ten-year method would more adequately smooth contribution rate volatility than the previous five-year smoothing method. Since this change was prospective only, it did not affect either the unfunded accrued liability or the contribution rates with the 2007 valuation.

The 2007 valuation also recognized benefit modifications that were adopted by the legislature during the prior period as follows –

1. An ad hoc increase for retirees with retirement dates on or before July 1, 1989. This increase was effective prospectively for retired State and Teacher participants on January 1, 2007. Each political subdivision was given the choice of offering the increase to its retirees.
2. Increase in the minimum benefit calculation to General Assembly members. The minimum benefit of $70 per year of service began being indexed with the same percentage as the COLA paid to retirees effective July 1, 2006.
3. Benefits for public safety officers increased allowing for an unreduced benefit at age 55 with 25 years of service. In addition, the bridge benefit for public safety officers will begin at age 55 instead of age 60. Each political subdivision was given the choice of offering the increase to its public safety officers.

The impact on the State contribution rate due to these benefit improvements was minimal since the number of employees affected were small relative to the entire group.

Since the County Judges and Officials group was deemed to be fully funded as of July 1, 2005, this group was combined with the Consolidated State group for reporting purposes as of July 1, 2007. In addition, the three groups of State Judges and Attorneys General were combined for reporting purposes as of July 1, 2007.

Plan contributions established by the 2009 valuation were again impacted by adverse investment experience. Rates of investment return for fiscal years ending in 2008 and 2009 were negative 1.2% and negative 15.3%, respectively. The market returns between 2007 and 2009 created significant losses for the plan. Actuarial experience in the aggregate resulted in an increase in the contribution level. Contribution rates for Teacher and State groups increased by 4.28% and 5.16%, respectively, due to actuarial experience, primarily the recognition of prior investment performance.

A quadrennial experience study was conducted in 2008 covering the period of plan operations from July 1, 2004 through June 30, 2008. The study compared the actuarial assumptions used to determine contribution rates with the actual experience of the plan. The review concluded that economic assumptions including the assumed rate of investment return and the core inflation assumption should be unchanged. The study also validated the salary increase rates developed in a prior experience study. It was, however, recommended to change the future Cost of Living Adjustment assumption applicable to retiree benefits. The future COLA assumption was changed from 3.0% to 2.5% to better reflect expected experience since the annual COLA is limited to 3.0%. Historical experience validated this change. The effect on employer contributions of adopting the 2.5% future COLA assumption was to decrease the State rate by 2.74% and the Teacher rate by 2.88%.

In the four-year period covered by the experience study, post retirement mortality rates were noted to have improved in both the State and Teacher groups (unlike the 2004 study which reflected little mortality improvement among the Teacher group). As a result, new post retirement mortality rates were recommended to better reflect the actual experience. The effect on employer contributions of adopting the recommended mortality rates was to increase the State rate by 1.61% and increase the Teacher rate by 1.85%.

Modifications were also recommended with the 2008 experience study to the retirement rates. Retirement rates dropped sharply during the study period from 2000 to 2004. The 2004 study reflected only a portion of the change at that time in order to monitor the delayed retirement trend. Retirement rate experience continued to reflect later retirements during the 2004 – 2008 study period. As a result, changes to retirement rates were recommended in order to match experience. As a result of adopting recommended retirement rates, employer contribution rates for the State and Teacher groups decreased by 1.40% and 0.42%, respectively. Other changes to the demographic assumptions were minor and did not result in a significant change in employer contribution rates.

Due to the significant asset losses experienced between the 2007 and 2009 valuations, the valuation assets determined according to the asset smoothing method as of July 1, 2009 were limited to 120% of the market value of assets. In addition, the unfunded actuarial accrued liability was reestablished again for all groups and amortized over a 20-year period. The net effect of the reestablishment was to reduce the State contribution rate by 0.72% and the Teacher contribution rate by 0.30%.

During 2010, an actuarial audit of the primary calculations underlying the valuation was conducted by Gabriel Roeder Smith & Company. Conclusions and opinions resulting from the audit were discussed in a report prepared by Gabriel Roeder Smith & Company. Significantly, the audit endorsed the actuarial valuation results used in computing contributions for the TCRS.

Administrative factors for survivorship, early reduction and delayed retirement had been last revised in 2002. Since the time of their adoption, the assumed actuarial valuation cost of living assumption was reduced from 3.0% to 2.5%, and mortality improvements had been implemented. Accordingly, the Board recommended modification of the administrative factors as of July 1, 2011. No material change to liabilities occurred from this update.

The 2011 actuarial valuation was impacted by strong investment performance during the previous two years. Rates of investment return for fiscal years ending in 2010 and 2011 were 10.2% and 19.6%, respectively. The market returns created significant gains for the plan. Contribution rates in 2011 for Teacher and State groups would have decreased by 3.20% and 3.11%, respectively, due to the actuarial experience and due to the 120% asset corridor that applied in 2009. However, prior investment losses were still being smoothed into the valuation assets. Specifically, $3,020,000,000 of net investment losses were excluded from valuation assets to be recognized over the next five valuation cycles (ten years). In order to maintain contribution rate stability with the understanding that contribution rates would still need to increase in the future, the amortization periods were lowered to prevent a sharp decline in the contribution rates (6 years for Teachers and 9 years for the State). The net effect of the actuarial experience and resetting the amortization periods was to reduce the Teacher contribution rate by only 0.17% and increase the State contribution rate by only 0.13%.

The 2011 valuation recognized a benefit modification that was adopted by the legislature during the prior period. Political subdivisions may voluntarily elect to establish minimum benefits of $8, $14 (indexed), or $20 (indexed) per year of service for county commissioners, school board members, and other such positions. The effect of this benefit improvement was minimal.

A quadrennial experience study was conducted in 2012 covering the period of plan operations from July 1, 2008 through June 30, 2012. The study compared the actuarial assumptions used to determine contribution rates with the actual experience of the plan. The review concluded that economic assumptions including the assumed rate of investment return, the core inflation assumption and the COLA assumption should be unchanged. The study concluded that salary increase rates should be modified based on recent experience. Salary increase rates were not changed to exactly match the experience observed during the study period, but were reduced by 0.50% at each age to better reflect future expectations. The effect on employer contributions in the 2013 valuation of adopting the lower salary increase assumption was to decrease the Teacher rate by 1.41% of payroll and to decrease the State rate by 1.14% of payroll.

In the four-year period covered by the experience study, post retirement mortality rates were noted to have improved in both the State and Teacher groups (consistent with results observed in the 2008 study). As a result, new post retirement mortality rates were recommended to better reflect the actual experience. The new post retirement mortality rates included a 2-year mortality projection to reflect continued mortality improvements. It was determined that mortality improvements would continue to be monitored in future experience studies with longer projection periods to be considered when appropriate. Pre-retirement mortality rates were modified to be based on the standard IRS tables as provided for by the Pension Protection Act of 2008 (which includes a 15-year projection of future mortality improvements). Disabled mortality rates were also modified to more closely match actual experience. The effect on employer contributions in the 2013 valuation of adopting the recommended mortality rates was to increase the Teacher rate by 1.73% of payroll and increase the State rate by 1.34% of payroll.

Modifications were not recommended with the 2012 experience study to the withdrawal, retirement and disability rates. Since the 2008-2012 study period reflected a difficult economic cycle, it was determined that the demographic experience observed during the period would not appropriately reflect long-term expectations.

The 2013 actuarial valuation saw investment performance during the prior period that was consistent with assumed returns for the plan but contribution rates continued to be impacted by the deferred investments losses from 2008 and 2009. Rates of investment return for fiscal years ending in 2012 and 2013 were 5.6% and 9.9%, respectively. Actual salary increases since the 2011 valuation were less than assumed in the actuarial valuation providing gains, but higher turnover during the period resulted in lower total payroll. Since contribution rates are expressed as a percent of pay, the lower payroll base created upward pressure on the contribution rates. Contribution rates for Teacher and State groups would have increased by 2.17% and 3.05%, respectively, due to the actuarial experience. However, since amortization periods in 2011 were set lower than normal to maintain contribution rate stability, the amortization periods were reset again in 2013 to continue to manage volatility in the contribution rates. The amortization period was reset to 8 years for Teachers and 13 years for the State. The net effect of the actuarial experience, assumption changes from the 2012 experience study and resetting the amortization periods was to increase the Teacher contribution rate from 2011 by 0.16% and to cause no change to the State contribution rate between 2011 and 2013. The administrative charge applied to contribution rates was decreased in the 2013 valuation to 0.14% of payroll (the charge was 0.16% in the 2011 valuation).

The 2013 valuation recognized a benefit modification that was adopted by the legislature to remove the “AE-65 provision” for all participants who become members on or after July 1, 2011. This change allows participants to continue to receive credit for service after age 65, but removes the comparison of the benefit to the actuarial equivalent of the age 65 benefit upon the final age at retirement. The effect of this change was negligible on the contribution rates.

TCRS pension reform was adopted during the 2013 legislative session that created a new hybrid pension plan for participants hired on or after July 1, 2014 (including different defined benefit formulas, a defined contribution component, cost control features and a stabilization reserve fund). The new plan had no impact on the 2013 actuarial valuation and did not impact benefits for any participant in the original plan (the Legacy Plan). The Legacy Plan was closed to new entrants effective June 30, 2014 but continued to accrue benefits for future service earned by all employees already participating in the Legacy Plan.

Administrative factors for survivorship, early reduction and delayed retirement were updated as of July 1, 2014 to reflect the mortality assumption adopted by the most recent experience study performed in 2012. No material change to liabilities occurred from this update.

The 2015 actuarial valuation reflected investment performance that exceeded assumed returns for the plan, but the asset smoothing method continued to recognize prior losses putting upward pressure on the contribution rates. Rates of investment return for fiscal years ending in 2014 and 2015 were 16.7% and 3.3%, respectively. Cost of living adjustments for the prior period created actuarial gains since the actual COLA’s of 1.5% (2014) and 1.0% (2015) were less than the assumed 2.5% COLA. Total payroll declined since the previous valuation mainly for the following two reasons: 1) actual salary increases since the prior valuation were less than assumed and 2) all new employees after June 30, 2014 enter the new Hybrid Plan.

Effective with the 2015 valuation, the plan began using the entry-age normal funding method pursuant to the funding policy adopted by the TCRS Board of Trustees. Changing to the entry-age normal funding method did not impact the results in 2015 as compared to the prior valuation since the unfunded accrued liability had been reestablished in 2013 using the frozen initial liability method (with the entry-age normal method used to determine the accrued liability). Pursuant to the funding policy, the amortization schedule of each gain/loss tier (2013 and 2015) was adjusted with the 2015 valuation to maintain stability in the contribution rates as compared to the 2013 valuation. Annual contribution rates continued to include an administrative charge assumption of 0.14% of payroll.

As required by the funding policy adopted by the TCRS Board of Trustees, actuarial valuations will be performed annually after June 30, 2015.

The 2016 actuarial valuation reflected investment performance during the prior period that was less than the assumed return for the plan. The rate of investment return for the fiscal year ending in 2016 was 2.8%. The cost of living adjustment for the prior period created an actuarial gain since the actual COLA of 1.0% was less than the assumed 2.5% COLA. Total payroll continued to decline as compared to the previous valuation since all new employees after June 30, 2014 entered the new Hybrid Plan. Amortization schedules for each gain/loss tier were adjusted according to the funding policy. Annual contribution rates included an administrative charge assumption of 0.17% of payroll.

A quadrennial experience study was conducted in 2016 covering the period of plan operations from July 1, 2012 through June 30, 2016. The study compared the actuarial assumptions used to determine contribution rates with the actual experience of the plan. The review concluded that economic assumptions, including the assumed rate of investment return, the core inflation assumption and the COLA assumption, should be changed to reflect lower long-term inflation expectations (most notably, the discount rate was reduced to 7.25% for the 6/30/2017 actuarial valuation). The study concluded that salary increase rates should also be lowered based on recent experience and longer-term inflation expectations.

In the four-year period covered by the experience study, post retirement mortality rates were generally observed to have not improved as compared to the 2012 experience study results. Based on the results of the 2016 experience study, TCRS specific mortality tables were created by using a percentage of the RP-2014 White Collar Table (Healthy Annuitants) for Teachers and a percentage of the RP-2014 Blue Collar Table (Healthy Annuitants) for other groups. In order to balance the general expectation that mortality rates may continue to improve with the recent plan experience, post retirement mortality rates will be updated with each actuarial valuation to reflect mortality improvements projected to 6 years beyond each actuarial valuation date (using scale MP-2016 or updates to this scale as available at each actuarial valuation date). It was determined that mortality improvements would continue to be monitored in future experience studies with other projection periods to be considered as appropriate. Pre-retirement mortality rates were modified to be based on the RP-2014 Table for Non-annuitants (with a 15-year projection of future mortality improvements beyond each actuarial valuation date). Disabled mortality rates were not modified from the previous study. Modifications were not recommended with the 2016 experience study to the withdrawal, retirement and disability rates but will continue to be monitored in future experience studies.

The 2017 actuarial valuation reflected investment performance during the prior period that was greater than the assumed return for the plan. The rate of investment return for the fiscal year ending in 2017 was 11.4%, which exceeded the assumed return for the plan. However, due to the operation of the plan's asset smoothing method, the plan reflected an overall asset loss for the period ending 6/30/2017. Assumption change recommendations from the 2016 experience study were reflected and amortization schedules for each gain/loss tier were adjusted according to the funding policy. Annual contribution rates included an administrative charge assumption of 0.19% of payroll.

The 2018 actuarial valuation reflected a rate of investment return of 8.2% for the fiscal year ending in 2018, which exceeded the assumed return for the plan of 7.25% per annum. Due to the operation of the plan's asset smoothing method, the rate of return on valuation assets during the period was 7.2%, which was very close but slightly under the assumed return. Amortization schedules for each gain/loss tier were adjusted according to the funding policy. Annual contribution rates included an administrative charge assumption of 0.22% of payroll.

The 2019 actuarial valuation reflected a rate of investment return of 7.45% for the fiscal year ending in 2019, which exceeded the assumed return for the plan of 7.25% per annum. Due to the operation of the plan's asset smoothing method, the rate of return on valuation assets during the period was 8.8%, which also exceeded the assumed return. Amortization schedules for each gain/loss tier were adjusted according to the funding policy. Annual contribution rates included an administrative charge assumption of 0.21% of payroll.

## 2020 Valuation

Plan contribution rates resulting from the current and preceding valuations are shown in the schedule on page C-17. The rate of investment return for the fiscal year ending in 2020 was 4.9%, which was less than the assumed return for the plan of 7.25% per annum. Due to the operation of the plan's asset smoothing method, the rate of return on valuation assets during the period was 8.3%, which exceeded the assumed return.

The funding policy requires unfunded liabilities to be amortized utilizing the level dollar amortization method over a closed period not to exceed 20 years. A tier approach is required for new actuarial gains and losses created from each actuarial valuation. The amortization period of each tier may be shortened or extended from valuation to valuation to manage volatility, but each tier must be completely amortized within 20 years of its original creation. Pursuant to the funding policy, the amortization schedule of each gain/loss tier was adjusted with the 2020 valuation. Amortization periods are shown on pages H-24 and H-25. Annual contribution rates include an administrative charge assumption of 0.17% of payroll.

The impact of plan experience is discussed further in the Gain and Loss Analysis section of the report.

As gains and losses accumulate over time, political subdivisions may experience fluctuations in future contribution rates. In order to reduce contribution volatility, it is recommended that sponsors be permitted to reset the amortization period upon which payments are based to a new schedule in accordance with the funding policy adopted by the TCRS Board of Trustees.

## Future expectations

TCRS assets are based upon a valuation asset method that endeavors to reduce contribution volatility by recognizing investment gains and losses ratably over a ten-year period from the date of occurrence. However, investment performance is the most likely source of future contribution rate volatility. Since current TCRS amortization periods are less than those required by the maximums allowable by TCRS funding policy, this volatility can be managed by resetting the amortization period for the unfunded accrued liability in light of long-term contribution rate expectations, budget planning and actuarially sound funding levels.

Additionally, future contribution rate increases will occur if mortality improves more rapidly than projected. The mortality improvement scale is expected to be updated annually with each valuation based on the most recently available information from the Society of Actuaries.

Legacy plan costs and liabilities will gradually change over time since the legacy plan was closed to new entrants effective June 30, 2014. While any large changes should take many years to develop, costs and liabilities will be monitored with each future valuation. It will become necessary to set budget expectations based on the expected dollar contribution requirements of normal cost and amortization of the unfunded liability amounts, rather than a percentage of declining payroll.

# Risk Discussion – Actuarial Standards of Practice No. 51

Effective November 1, 2018, actuarial funding valuation reports are required to include a discussion of the risk associated with measuring pension obligations and determining pension plan contributions. The risks that may reasonably be anticipated to significantly affect the plan's future financial condition are discussed below. It is recommended that the plan sponsor continues to monitor these risks. Further analysis will be provided as requested separate from this report.

## Investment Risk

The investment risk is expected to be the single most important factor in determining the future cost of the plan. Due to the plan's significant equity exposure and low correlation between fixed income assets and liabilities, there is risk that the funded status (and required cash contributions) of the plan could be very volatile. The history of annual investment returns (on a market value basis) is shown on page H-21. The historical returns highlight the substantial volatility from year to year.

## Interest Rate Risk

Related to the investment risk section above, the assumed future returns implied in the interest rate used to value the liabilities is a significant factor in determining the plan's funded status. Due to the plan's liability duration (a measurement of how sensitive the liability is to a change in the interest rate) of around 11-12, a 1% decrease in the assumed interest rate would increase the liability by approximately 11-12%.

## Inflation Risk

Since benefit amounts are pay-related, pay increases in excess of the valuation assumption will result in an increase in the liabilities (and required cash contributions) of the plan. An increase in inflation is one factor that could lead to higher pay increases. Further, an increase in inflation will also result in a higher COLA to retirees, which will increase the liabilities of the plan. However, the inflation risk is dampened due to inflation being a component of the interest rate used to value the liabilities. An increase in inflation would likely result in an increase in the interest rate, which could mitigate the pay and COLA increases.

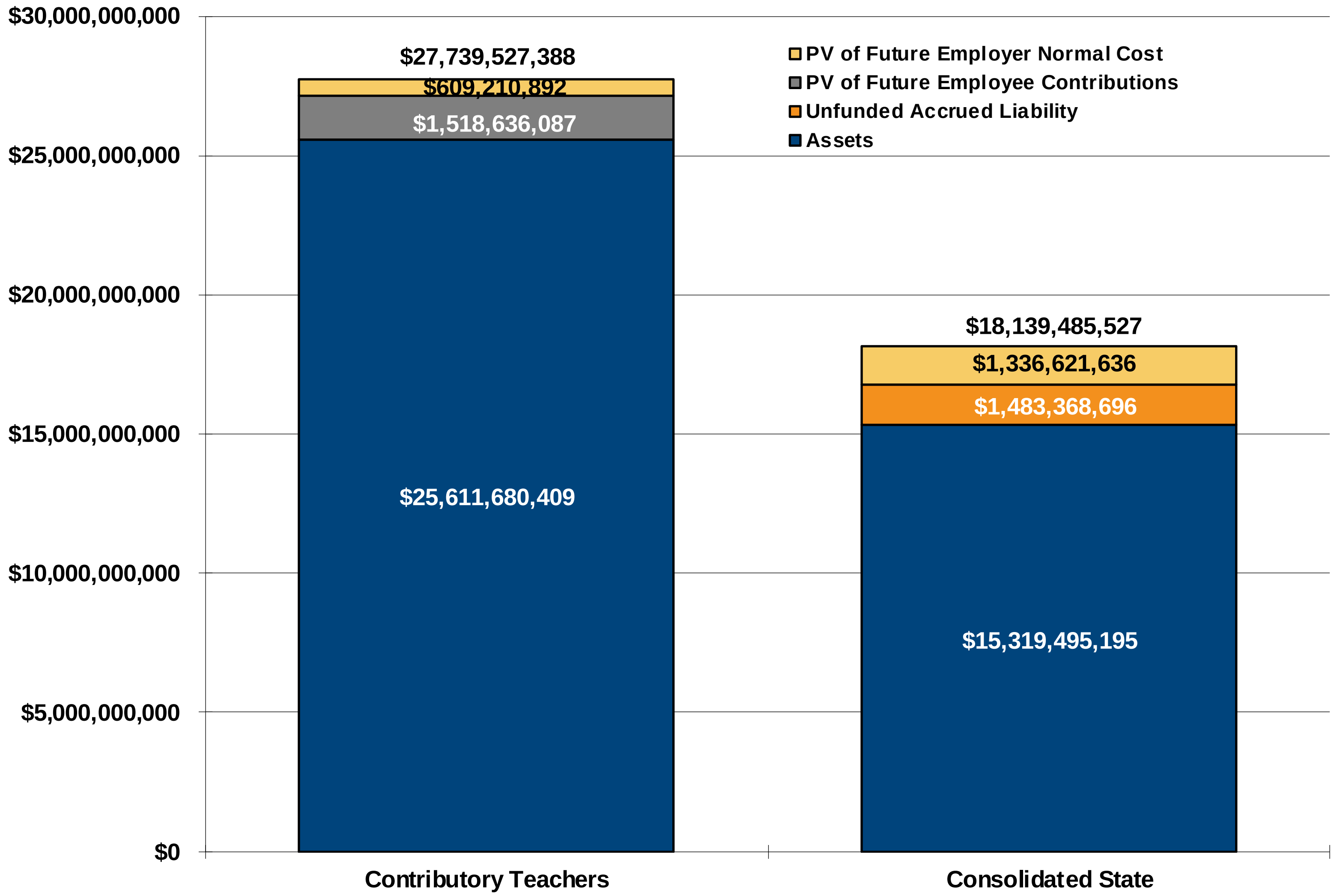
## Mortality Risk

Since the primary benefits of the plan are paid as annuities, the plan is sensitive to changes in the longevity of the population. As a result, the liabilities (and required cash contributions) of the plan will increase if the participants live longer than expected and decrease if they live shorter than expected. The current mortality assumption projects future longevity improvements, which generally dampens the mortality risk.

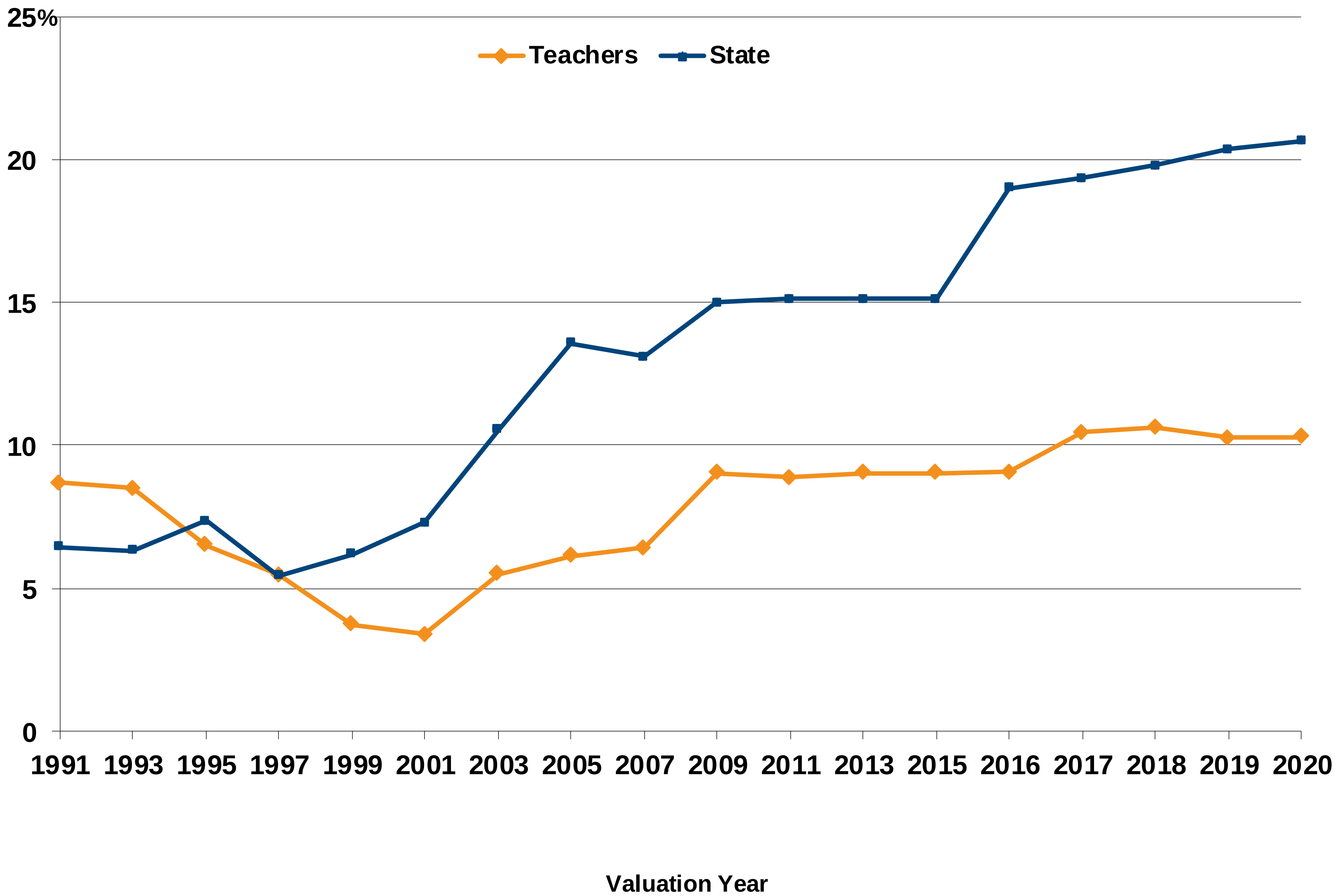
## Contribution Risk

The required contributions calculated in this report are based on the actuarial methods and assumptions as documented in the Summary of Actuarial Methods and Assumptions section of the appendix. The required contribution includes the normal cost for new benefits being earned during the year, plus an amortization to cover any unfunded accrued liability over a period of 20 years or less. Based on this contribution method, all plan benefits are projected to be systematically funded. This method is not expected to cause additional volatility in the required contribution beyond the underlying risk factors discussed above. However, since the legacy plan is closed to new entrants, expected contribution requirements as a percentage of payroll will likely increase as payroll declines.

# VALUE OF BENEFITS
June 30, 2020



# HISTORY OF TCRS CONTRIBUTION RATES



# COMPARISON OF TCRS EMPLOYER CONTRIBUTION RATES

| | 2020 Active Payroll | 2019 Contribution Rate | 2020 Contribution Rate |
|---|---|---|---|
| Contributory Teachers | $3,219,651,049 | 10.27% | 10.30% |
| Consolidated State [1, 2] | 2,030,213,243 | 20.37% | 20.65% |
| State Judges (Groups I, III & IV), Attorneys General (Groups I & III), State Judges and Attorneys General (Superseded) [3] | 77,320,565 | 25.94% | 25.94% |

[1] The Consolidated State contribution rate includes the costs attributable to bridge and service retirement benefits for public safety officers. A separate contribution rate for this group will be collected and will offset the Consolidated State contribution rate.

[2] The University of Tennessee pays an additional 10% of covered payroll for TIAA coverage. The rates shown relate only to TCRS benefits.

[3] State Judges (Groups I, III & IV), Attorneys General (Groups I & III) and State Judges and Attorneys General (Superseded) are combined for reporting purposes.

## VALUATION BALANCE SHEET
## TENNESSEE CONSOLIDATED RETIREMENT SYSTEM
*June 30, 2020*

| ASSETS | Contributory Teachers | Consolidated State (A) | State Judges & Attorneys-General (B) | Total State (A) + (B) |
|---|---|---|---|---|
| Present assets creditable to: | | | | |
| State Accumulation Fund | $21,894,277,719 | $15,100,700,716 | $497,220,952 | $15,597,921,668 |
| Members' Fund | 3,717,402,690 | 218,794,479 | 25,422,836 | 244,217,315 |
| Total Present Assets | $25,611,680,409 | $15,319,495,195 | $522,643,788 | $15,842,138,983 |
| Present value of prospective contributions payable to: | | | | |
| State Accumulation Fund: | | | | |
| Normal | $609,210,892 | $1,336,621,636 | $47,790,494 | $1,384,412,130 |
| Accrued Liability | 0 | 1,483,368,696 | 58,915,438 | 1,542,284,134 |
| Total | $609,210,892 | $2,819,990,332 | $106,705,932 | $2,926,696,264 |
| Members' Fund | 1,518,636,087 | 0 | 967,840 | 967,840 |
| Total Prospective Contributions | $2,127,846,979 | $2,819,990,332 | $107,673,772 | $2,927,664,104 |
| **Total Assets** | **$27,739,527,388** | **$18,139,485,527** | **$630,317,560** | **$18,769,803,087** |
| **LIABILITIES** | | | | |
| Present value of prospective benefits payable on accounts of: | | | | |
| Present retired members and contingent annuitants | $14,552,707,349 | $10,400,649,571 | $304,949,991 | $10,705,599,562 |
| Present active members* | 12,533,798,274 | 6,959,706,741 | 311,273,841 | 7,270,980,582 |
| Former members | 653,021,765 | 779,129,215 | 14,093,728 | 793,222,943 |
| **Total Liabilities** | **$27,739,527,388** | **$18,139,485,527** | **$630,317,560** | **$18,769,803,087** |

* Active members for each group include members who were formerly employed by the group but are currently employed by another group within TCRS.

**Political Subdivisions**

An actuarial balance sheet showing the assets and liabilities relating to the participating political subdivisions will be added as an appendix to this report when it is available.

# D. GAIN AND LOSS ANALYSIS

The contribution rate for any defined benefit pension plan is based on a set of actuarial assumptions. It is assumed that investments will increase in value at a certain rate, that salary increases will be granted according to a certain schedule, and that, in the aggregate, participants will withdraw, become disabled, die, and retire in certain patterns. Assumptions must also be made concerning other events — for example, the pattern of future social security increases, or the percentage of participants who are married at the time of death.

It is possible to predict what would happen to the present value of benefits, the plan's assets, the normal cost rate, and the unfunded accrued ("past service" or "supplemental") liability from one valuation date to the next if all the actuarial assumptions prove to be exactly correct. Variations from these predicted values arise whenever actual experience differs from the actuarial assumptions. Analysis of these variations can reveal the degree to which actual experience has differed from assumed and can, over a period of years, provide an indication as to the validity of the various actuarial assumptions. Variations from "predicted" values also can arise from external sources, such as benefit changes and refinement of programming techniques.

A complete gain and loss analysis is a complex, technical task. It requires that the initial valuation be reproduced, predicting the amount of reserve expected to be released due to each type of decrement (death, disability, retirement, withdrawal) and the amount of liability expected to be incurred as a result of those terminations. Similar "expected" values must be obtained for increases in liability due to salary increases, and for changes in assets due to contributions, benefit payments, and interest earnings.

All these quantities must then be compared to actual experience. This process requires tracing each individual from the first valuation, determining if he is still active or, if not, why not and what benefit was paid and/or what liability remains for him.

Because of the complexity of this task, the primary procedure for analyzing TCRS experience has been the experience study. The most recent experience study covers the period for July 1, 2012 through June 30, 2016 and is set forth in a separate report.

One of the difficulties with a gain and loss analysis is the lack of intermediate check points at which progress can be determined. An initial value is projected, and is compared to an actual value at the end of the period. As a completely separate process, the "gain" or "loss" from each of a number of separate sources is calculated. It is then hoped that the net effect of the various gains and losses will approximately equal the difference between the projected value and the actual value. There is no method by which an individual gain or loss item can be "checked" against an intermediate figure.

Gains and losses may be measured with respect to the present value of benefits, the accrued liability, or the contribution rate. The gain and loss analyses with each valuation are conducted with respect to the normal cost percentage and the unfunded accrued liability amortization percentage in order to measure the impact on the contribution rate.

The availability of a detailed analysis of past actuarial experience through the experience analysis process mitigates the need for a comparable analysis in the valuation. Due to the availability of accurate detailed information in the experience report, the scope of valuation experience analyses was limited to the more accessible sources of gain and loss. Specifically, gains and losses due to death, disability, and turnover were not analyzed, since it was felt that doing so involved time and expense disproportionate to the attention given the results. Similarly, effects of early and delayed retirement were not quantified.

The Teachers had a total gain on the unfunded accrued liability during the year of $305,710,454 (including a gain on the actuarial value of assets of $242,195,042 and a gain on the accrued liability of $63,515,412). The Consolidated State had a total gain on the unfunded accrued liability during the year of $95,572,106 (including a gain on the actuarial value of assets of $145,918,351 and a loss on the accrued liability of $50,346,245).

The table below indicates the effect of each measured assumption upon the 2020 valuation contribution rates.

## CAUSES OF CHANGE IN CONTRIBUTION RATE

| | Teachers | Consolidated State |
|---|---|---|
| Investment results | (0.70%) | (0.67%) |
| Salary increases | (0.02) | 0.10 |
| New entrants | 0.00 | 0.00 |
| Cost of living escalation | 0.02 | 0.02 |
| Contribution rate change delay | (0.04) | 0.06 |
| Effect of turnover on total payroll | 0.05 | 0.43 |
| Update Mortality Projection | (0.09) | (0.11) |
| Other | (0.14) | (0.16) |
| Subtotal | (0.92%) | (0.33%) |
| End of amortization for 2013 tier | (3.65%) | 0.00% |
| Re-amortization of unfunded liability (period change) | 4.60 | 0.61 |
| Subtotal | 0.95% | 0.61% |
| Total Change | 0.03% | 0.28% |

Presented below is a brief discussion regarding items in the table. Comparisons to assumptions and methods are made to the assumptions and methods used in the previous valuation conducted in 2019.

***Investment results*** - Market value returns on plan assets during the fiscal year ending June 30, 2020 was 4.9%. Investment performance is not reflected immediately in the valuation asset amount. Valuation assets are based on a ten year moving average of market values. The rate of return on valuation assets during the same period was approximately 8.3% per annum (over 1% greater than the assumed return of 7.25% per annum), which resulted in a decrease in the contribution rate.

*Salary Increases* - The annual weighted-average rate of salary increase during the 2019-2020 period for the Teacher group was slightly less than the assumed age-based rate, which resulted in a small reduction in the contribution rate. The annual weighted-average rate of salary increase during the 2019-2020 period for the State group was above the assumed age-based rate, which resulted in an increase in the contribution rate.

*New Entrants* - Rate pressure attributable to new entrants exists when the overall contribution rate is higher or lower than the contribution rate associated with only the new entrants. Contribution rates can be different for new entrants in comparison to rates for continuing participants, who benefit from past accumulated actuarial gains or losses. Since the Legacy Plan was closed to new entrants effective June 30, 2014, there is no impact on the contribution rates for new entrants.

*Cost of Living Escalation* - The inflation experienced during the review period produced a COLA increase of 2.3% as of July 1, 2020, which was barely above the assumed rate of 2.25% per year. Higher than anticipated COLA adjustments among retirees resulted in a higher liability for these participants than expected.

*Contribution Rate Change Delay* - The policy of delaying the application of contribution rates produced by a valuation for one year means that contributions in the year following the valuation are greater or less than those actually required by the valuation. Since the contribution rate for the Teacher group utilized during the fiscal year ending June 30, 2020 (from the 2018 valuation) was higher than the rate produced from the 2019 valuation, there was a decrease in the current contribution rate due to the one-year delay. Since the contribution rate for the State group utilized during the fiscal year ending June 30, 2020 (from the 2018 valuation) was lower than the rate produced from the 2019 valuation, there was an increase in the current contribution rate to make up for the one-year delay.

*Effect of turnover on total payroll* - Total payroll declined during the review period for both the Teacher and State groups as the reduction due to turnover was greater than the growth due to salary increases. Since contribution rates are expressed as a percent of pay, the lower payroll base led to an increase in the contribution rate for both groups.

*Update Mortality Projection* - The mortality improvement assumption adopted with the 2016 experience study utilizes the most current projection scale published by the Society of Actuaries as of the actuarial valuation date. As of June 30, 2020, the projection scale was updated from Scale MP-2018 to Scale MP-2019. This change resulted in a decrease in the liabilities and contribution rates.

*Other* - The "other" category in the table above incorporates items that are not separately identified or are relatively insignificant. Included in the “other” category are minor census changes and differences between assumed and actual rates of retirement, termination, death and disability.

*Re-amortization of unfunded liability* - The amortization period of each tier of prior gains and losses may be shortened or extended from valuation to valuation to manage volatility, but each tier must be completely amortized within 20 years of its original creation. For the Teacher group, the amortization period for the 2017 tier was shortened as of the current valuation date from 3.00 years to 1.35 years. For the State group, the amortization period for the 2013 tier was shortened as of the current valuation date from 5.90 years to 5.40 years. Shorter amortization periods led to an increase in the contribution rate for both groups. Amortization periods for all tiers are shown on pages H-24 and H-25.

# E. FUNDING STATUS

The schedule presented herein is based upon valuation results for the current valuation period. Information for earlier periods is presented in the TCRS Annual Comprehensive Financial Report. Results displayed in the following table are based upon the entry-age normal actuarial funding method. Assets shown are the Actuarial Value of Assets. The Market Value of Assets and the amortization schedule for the unfunded amounts can be found in Section H.

# Tennessee Consolidated Retirement System
## Schedule of Funded Ratios
## June 30, 2020

| Funding Group | Actuarial Value of Assets | Actuarial Accrued Liability | Unfunded Actuarial Accrued Liability | Funded Ratio | Covered Payroll | Unfunded Actuarial Accrued Liability as a Pct of Covered Payroll |
|---|---|---|---|---|---|---|
| Consolidated State | $15,319,495,195 | $16,802,863,891 | $1,483,368,696 | 91.17% | $2,030,213,243 | 73.06% |
| State Judges & Attorneys General | 522,643,788 | 581,559,226 | 58,915,438 | 89.87% | 77,320,565 | 76.20% |
| Total State | $15,842,138,983 | $17,384,423,117 | $1,542,284,134 | 91.13% | $2,107,533,808 | 73.18% |
| Teachers | 25,611,680,409 | 24,693,863,023 | -917,817,386 | 103.72% | 3,219,651,049 | -28.51% |
| Total | $41,453,819,392 | $42,078,286,140 | $624,466,748 | 98.52% | $5,327,184,857 | 11.72% |

**Political Subdivisions**

The schedule of funding progress for the participating political subdivisions will be added as an appendix to this report whe n it is available.

# F. VALIDITY OF DATA

The quality of the records available on retired members and on active members was excellent. Almost every record relating to a retired life was used in the valuation. Similarly, very few records on active participants had to be excluded due to questionable data. A list of the records containing apparent discrepancies has been furnished to the staff of the System.

In addition to retired and active members, the master records of the System contain approximately 46,400 records for former members with deferred vested benefits and approximately 59,100 records on other terminated members. Of this latter group, about 22,100 relate to those who terminated without vested benefits, but who have not withdrawn their contributions, and the remaining 37,000 relate to those for whom records are incomplete for various reasons, such as failure to complete membership cards, reporting contradictory social security numbers, etc.

For inactive members with vested benefits, the vested benefit was calculated and the value of the benefit was compared with the current value of the member's accumulated contributions; the larger of the two amounts was established as a liability of the System. For all other "miscellaneous" categories, the amount of each member's accumulated contributions was established as a liability of the System; thus, some liability was established for each of these records.

| | Contributory Teachers | Total State (Including State Judges & Attorneys-General) | Political Subdivisions |
|---|---|---|---|
| Number of Deferred Vested | 10,409 | 20,456 | 15,556 |
| Average Age of Deferred Vested | 46.6 | 52.8 | 51.7 |
| Average Earnings of Deferred Vested | $44,208 | $33,616 | $27,854 |
| Average Service of Deferred Vested | 9.8 | 9.3 | 9.6 |

# G. OUTLINE OF BENEFIT AND CONTRIBUTION PROVISIONS

(As Amended through June 30, 2020)

Any person who becomes a teacher not participating in a local retirement fund, a general employee of the State, a state policeman, or a wildlife officer on or after July 1, 1972 becomes a member of the Tennessee Consolidated Retirement System as a condition of employment. Membership is optional for any person who becomes a state judge, a part-time employee, a commissioner, a county judge or county official in a participating political subdivision, an attorney general, an assistant attorney general, a criminal investigator, or an elected or appointed official of the general assembly. Membership is mandatory for any person employed on or after July 1, 1993 as an attorney general in the office of the Attorney General and reporter. Membership is compulsory for other employees of participating political subdivisions, except that for employees in service on the date the political subdivision commences participation, membership is optional.

A member of a superseded system as of June 30, 1972 had the choice of becoming a Group I, II, or III member of the Consolidated System according to his employment classification, or remaining subject to the benefit and contribution provisions of the superseded system as a "prior class" member with all rights, benefits and privileges under the superseded system. This choice was extended to members eligible to enter Group III prior to September 1, 1974. A transferred former Class A or Class B member of the System who is not a prior class member receives the greater of the retirement allowance provided under the Consolidated System or the superseded system. Effective July 1, 1976, all new members began to enter Group I, regardless of employment classification. Effective September 1, 1990, new state judges began to enter a new Group IV; Group I and Group III state judges could elect to transfer to this new category.

"Creditable service" means membership service under the Consolidated System for which contributions are made by the member, plus prior service credited under a superseded system as of June 30, 1972. Additional service may also be credited for certain periods of military service and service before the date of membership for which the member makes the required contributions.

The term "Average Final Compensation" (AFC) means average compensation during the five consecutive years of creditable service producing the highest average. "Social Security Integration Level" (SSIL) means, for the calendar year in which a member retires, the average annual amount of earnings (rounded to the nearest multiple of $600) with respect to which old age and survivors' benefits would be provided under Title II of the Federal Social Security Act for a male employee attaining age 65 in such calendar year, computed as though for each year prior to such calendar year, annual earnings are at least equal to the maximum amount of earnings subject to contributions under the provisions of the Federal Insurance Contributions Act. The SSIL is $83,400 in 2020 and will be $85,800 in 2020. "Social Security Base" (SSB) means for each calendar year the amount of a member's compensation subject to Social Security contributions, except that for years prior to 1966 SSB means $6,600 for the superseded Teachers' System. For the period prior to July 1, 1963 SSB means $4,200 and for the period between July 1, 1963 and January 1, 1966 SSB means $4,800 under the superseded State System. "Benefit Base" (BB) means the annual salary in the position from which certain prior class members in a superseded system covering elected officials retired, as of the dates of their retirement; except that for members who are eligible for escalation, the Benefit Base is increased to reflect any post-retirement changes in annual salary for the position from which the member retired.

The regular form of benefit under the System is a monthly annuity payable to the member for life, with all payments ceasing at his death. In lieu of the regular benefit, a member may elect an optional plan to convert his allowance into a reduced benefit of equivalent actuarial value in accordance with one of the following options:

> Option I - In the event of the member's death, the designated beneficiary will receive 100% of the member's reduced monthly benefit for life.
>
> Option II - In the event of the member's death, the designated beneficiary will receive 50% of the member's reduced monthly benefit for life.
>
> Option III - In the event of the member's death, the designated beneficiary will receive 100% of the member's reduced monthly benefit for life. Should the beneficiary die before the member, the benefit payable to the member reverts to the unreduced regular benefit.
>
> Option IV - In the event of the member's death, the designated beneficiary will receive 50% of the member's reduced monthly benefit for life. Should the beneficiary die before the member, the benefit payable to the member reverts to the unreduced regular benefit.
>
> Social Security Adjustment - A member may convert his retirement allowance into an increased benefit payable prior to the date he is eligible to receive Social Security benefits and a reduced allowance payable after that date, so that his total income will be approximately the same before and after the commencement of Social Security payments.

Benefits payable to retired members are increased on each July 1 according to the percentage increase in the Consumer Price Index during the preceding calendar year, provided that the increase will not exceed 3% of the current benefit in any year, and provided that the member has been retired for at least 12 months. Prior to July 1, 1998, the CPI increase percentage was applied to the initial base, rather than the current benefit.

Every member is guaranteed the return of his account balance arising from his own contributions (including interest) either as benefit payments to him or his designated beneficiary, or upon his death or termination as a lump sum amount equal to the excess of his accumulated contributions over any benefits paid on his behalf.

Effective July 1, 1981, the System became non-contributory (or, for classes of employees who previously contributed more than 5%, contribution rates were reduced by 5%) for State employees and for teachers in higher education. Teachers in grades K-12 and political subdivisions remained contributory, except that political subdivisions were given the option of electing to become non-contributory.

For employees who moved from "contributory" to "non-contributory" on July 1, 1981, withdrawals in the event of termination have been calculated as though their personal contributions had continued, and retirement benefits have been calculated by loading each of the next 15 years' salaries by 3.6%. This provision, which otherwise would have expired on June 30, 1996, has been extended permanently effective July 1, 1998 by the Legislature for those members in the system at the onset of non-contributory retirement.

The following summaries give the main provisions of the Tennessee Consolidated Retirement System on which the valuation was based. Summaries are also given of the various superseded systems, whose provisions are applicable for certain members. Throughout these summaries, the symbol # means that the actual benefit (or minimum or maximum) is 105% of the indicated amount for State employees (including teachers) in these categories, and that participating political subdivisions may elect this improvement as an optional provision.

TCRS pension reform was adopted during the 2013 legislative session that created a new hybrid pension plan for participants hired on or after July 1, 2014 (including different defined benefit formulas, a defined contribution component, cost control features and a stabilization reserve fund). The Legacy Plan was closed to new entrants effective June 30, 2014 but continues to accrue benefits for future service earned by all employees already participating in the Legacy Plan as described in this section.

Note: In the following tables, minimum benefits are described as $96.00 per year or $103.92 per year for various classifications. These amounts apply to members with at least 10 years of creditable service. If a benefit is calculated for a member with less than 10 years of creditable service, minimum benefits of $84.00 per year and $91.92 per year, respectively, apply instead of the amounts shown in the tables.

TENNESSEE CONSOLIDATED RETIREMENT SYSTEM

| | GROUP | | | |
|---|---|---|---|---|
| | I | II | III | IV |
| SERVICE RETIREMENT | | | | |
| Full Benefit: | | | | |
| Eligibility conditions (Age and years of creditable service) | Age 60 and vested, or 30 years | Age 60 and vested, or 55 with 25 years or 30 years of service* | Age 65 and vested, or age 55 with 24 years or 30 years | Age 55 with 24 years, or Age 60 with 8 years |
| Benefit percentages (% of AFC for each year of Creditable service): | | | | |
| % up to SSIL | 1.50%# | 1.75%# | 2.00% | 2.50% |
| % over SSIL | 1.75# | 2.25# | 2.50 | 2.50 |
| Early Reduced Benefit: | | | | |
| Eligibility conditions | 55 with 10 years | 55 with 10 years | Age 55 with 8 years | N/A |
| Benefit | Full benefit reduced by 4/10 of 1% for each month prior to eligibility for full benefit. | | | |
| 25 Year Benefit: | | | | |
| Eligibility Conditions | 25 years | N/A | N/A | N/A |
| Benefit | Full benefit is reduced 4/10 of 1% for each of first 60 months prior to 30 years of service. Benefit so calculated is further reduced by actuarial factor if member's age at commencement of benefits is less than 55. | | | |

*See note on next page.

#See explanation on page G-3.

# TENNESSEE CONSOLIDATED RETIREMENT SYSTEM
(Continued)

| | GROUP | | | |
|---|---|---|---|---|
| | I | II | III | IV |
| <u>Vested Benefit</u>: | | | | |
| Eligibility conditions | 5 years** | 10 years | 8 years | 8 years |
| Benefit | Reduced benefit payable at age 55 or later<br>Benefit further reduced by 15% for each year of service less than 10 years | | | |
| <u>Maximum Benefit</u>:<br>(before reduction) | 90%# of average final compensation | 80% | 75% | 75% |
| <u>Minimum Benefit</u>: | $96.00# for each year of creditable service, but not in excess of 100% of average final compensation. | | | |
| <u>ORDINARY DISABILITY RETIREMENT</u> | | | | |
| Eligibility conditions | 5 years | 5 years | 8 years | 8 years |
| Benefit percentages:* | | | | |
| % up to SSIL | 1.350%# | 1.575%# | 1.800% | 2.250% |
| % over SSIL | 1.575# | 2.025# | 2.250 | 2.250 |

* Benefit % for each year of creditable service. If service to date of disability retirement is less than 20 years, projected years of service to the full benefit date are added to creditable service, but not to bring total years of creditable service to more than 20 years, nor less than ten years of creditable service. Benefit changes to normal service benefit (including projected years of service) when the conditions for normal service retirement are met.

NOTE: During certain time restricted periods, certain Group II members could elect to become covered by a special provision whereby the eligibility condition for service retirement is age 55 (and vested) or 25 years of service. In order to elect this provision of the law, the Group II member must make additional contributions to the retirement system at the rate of 5% of salary.

**If membership date is prior to 7-1-79, 4 years.

TENNESSEE CONSOLIDATED RETIREMENT SYSTEM
(Continued)

| | GROUP | | | |
|---|---|---|---|---|
| | I | II | III | IV |
| ORDINARY DISABILITY RETIREMENT (Continued) | | | | |
| Maximum Benefit: | 75%# of average final compensation | | | |
| Minimum Benefit: (no reduction) | $96.00# for each year of creditable service to date of disability retirement, but not in excess of 100% of final compensation. | | | |
| ACCIDENTAL DISABILITY RETIREMENT | | | | |
| Eligibility condition | In performance of duty | In performance of duty | N/A | N/A |
| Benefit: | | | | |
| To age 62 or receipt of Social Security Disability | 50%# of average final compensation | 50%# of average final compensation | N/A | N/A |
| After age 62 or receipt of Social Security Disability | 33-1/3%# of average final compensation | 33-1/3%# of average final compensation | N/A | N/A |
| For members joining on or after 7/1/97, benefit is determined in same manner as ordinary disability. | | | | |
| INACTIVE DISABILITY | | | | |
| Eligibility condition | 5 years | 5 years | 8 years | 8 years |
| Benefit: | Actuarial equivalent of age 55 benefit | | | |
| ORDINARY DEATH BENEFITS | | | | |
| 1. Eligibility condition | Eligible for early or service retirement benefit | | | |
| Benefit | Survivor benefit as if member had retired and elected joint and 100% survivor annuity | | | |

TENNESSEE CONSOLIDATED RETIREMENT SYSTEM
(Continued)

| | GROUP | | | |
|---|---|---|---|---|
| | I | II | III | IV |
| ORDINARY DEATH BENEFITS (Continued) | | | | |
| 2. Eligibility condition* | 5 years | 10 years | 8 years | 10 years |
| Benefit | To surviving spouse, as if member had retired and elected immediate joint and 100% survivor annuity (Option I) | | | |
| 3. Eligibility condition | In service within 150 days and no other benefit | | | |
| Benefit | Lump sum equal to the member's account balance plus an equal amount payable from the employer fund. | | | |
| ACCIDENTAL DEATH BENEFITS | | | | |
| Eligibility condition | Death in performance of duty | | | |
| Benefit | 50% of average final compensation to eligible dependent(s). The aggregate total death benefit payable on account of a member who dies in the line of duty shall have a value of not less than $50,000. If the death benefit is payable to a single beneficiary, the guaranteed minimum value shall be paid in monthly installments calculated on a sixty-month basis.<br><br>If no surviving spouse exists on the date of the member’s death and if the projected payments to be made to all the minor children do not exceed a minimum total value of $50,000 the projected excess shall be paid to the member’s estate for the benefit of all the member’s surviving children regardless of age. (All death benefits are assumed to be ordinary death benefits for valuation purposes.) | | | |
| INACTIVE DEATH BENEFITS | | | | |
| Eligibility condition* | 10 years | 10 years | 10 years | 10 years |
| Benefit | To surviving spouse as if member had retired and elected Option II (50%) | | | |

* Optional to political subdivisions

TENNESSEE CONSOLIDATED RETIREMENT SYSTEM
(Continued)

| | GROUP | | | |
|---|---|---|---|---|
| | I | II | III | IV |
| MEMBER CONTRIBUTION RATES | | | | |
| Contributory | | | | |
| % of compensation up to SSB | 5.0% | 5.5% | 5.5% | N/A |
| % of compensation in excess of SSB | 5.0% | 5.5% | 7.0% | N/A |
| Non-Contributory | | | | |
| % of compensation up to SSB | 0.0% | 0.5% | 0.5% | 0.5% |
| % of compensation in excess of SSB | 0.0% | 0.5% | 2.0% | 2.0% |

# SUPERSEDED SYSTEMS
# TENNESSEE TEACHERS' RETIREMENT SYSTEM

| | PRIOR CLASS A | TRANSFERRED CLASS B | PRIOR CLASS B |
|---|---|---|---|
| SERVICE RETIREMENT | | | |
| Full Benefit: | | | |
| Eligibility conditions (Age and years of creditable service) | Age 60 or 30 years | | |
| Benefit percentages (% of AFC for each year of creditable service): | | | |
| % up to SSB | 1.125%# | 1.875%# | 1.875%# |
| % over SSB | 1.875# | 1.875# | 1.875# |
| Vested Benefit: | | | |
| Eligibility conditions | 10 years or 4 years at higher learning institute (only Class A) | | |
| Benefit | Full benefit deferred to age 60 | | |
| Minimum Benefit (No reduction) | $96.00# | $103.92# | $103.92# |
| DISABILITY RETIREMENT | | | |
| Eligibility conditions | 10 years | 10 years | 10 years |
| Benefit percentages: | | | |
| % up to SSB | 1.0125%*# | 1.6875%**# | 1.6875%**# |
| % over SSB | 1.6875# | 1.6875# | 1.6875# |
| Minimum Benefit (No reduction) | $96.00# | $103.92# | $103.92# |

* If service to date of disability retirement is less than 20 years, projected years of service to the full benefit date are added to creditable service, but not to bring total years of creditable service to more than 20 years, nor less than 10 years.

** Total benefit package percentage based on years of service not to be less than 25%.#

# SUPERSEDED SYSTEMS

## TENNESSEE TEACHERS' RETIREMENT SYSTEM
(Continued)

| | PRIOR CLASS A | TRANSFERRED CLASS B | PRIOR CLASS B |
|---|---|---|---|
| DEATH BENEFITS | | | |
| 1. Eligibility condition | Eligible for early or service retirement | | |
| Benefit | Joint and 100% survivor option as if member had retired and elected this option | | |
| 2. Eligibility condition | 10 years | 10 years | 10 years |
| Benefit | To surviving spouse, as if member had retired and elected immediate joint and 100% survivor annuity (Option I) | | |
| 3. Eligibility condition | In service within 120 days and no other benefit | | |
| Benefit | Lump sum equal to the member's account balance plus an equal amount payable from the employer fund | | |
| INACTIVE DEATH BENEFITS | | | |
| Eligibility condition* | 10 years | 10 years | 10 years |
| Benefit | To surviving spouse as if member had retired and elected Option II (50%) | | |
| MEMBER CONTRIBUTION RATES | | | |
| Contributory | | | |
| % of compensation up to SSB | 3.0% | 5.0% | 7.0% |
| % of compensation in excess of SSB | 3.0% | 5.0% | 7.0% |
| Non-Contributory | 0.0% | 0.0% | 2.0% |

*Optional to political subdivisions

## SUPERSEDED SYSTEMS

## TENNESSEE STATE RETIREMENT SYSTEM

| | GENERAL EMPLOYEES | | |
|---|---|---|---|
| | PRIOR CLASS A | TRANSFERRED CLASS B | PRIOR CLASS B |
| <u>SERVICE RETIREMENT</u> | | | |
| <u>Full Benefit</u>: | | | |
| Eligibility conditions (Age and years of creditable service) | Age 65 | Age 60 with 20 years or 30 years | Age 60 with 20 years or 30 years |
| Benefit percentages (% of AFC for each year of creditable service): | | | |
| % up to SSB | 1.125%# | 1.875%# | 1.875%# |
| % over SSB | 1.750# | 1.875# | 1.875# |
| <u>Vested Benefit</u>: | | | |
| Eligibility conditions | 10 years<br>Payable at age 55 or later | 10 years | 10 years |
| Benefit | Full benefit reduced by 4/10 of 1% for each month prior to eligibility for full benefit | | |
| <u>Maximum Benefit</u>: | 75%# of average final compensation | | |
| <u>Minimum Benefit</u>: | | | |
| (Per year of creditable service) No reduction | $96.00# | $103.92# | $103.92# |
| <u>Death Benefits</u>: | | | |
| 1. Eligibility condition | Eligible for early or service retirement | | |
| Benefit | Joint and 100% survivor option as if member had retired and elected this option. | | |
| 2. Eligibility condition* | 10 years | 10 years | 10 years |
| Benefit | To surviving spouse, as if member had retired and elected immediate joint and 100% survivor annuity (Option I) | | |

* Optional to political subdivisions.

## SUPERSEDED SYSTEMS

## TENNESSEE STATE RETIREMENT SYSTEM
(Continued)

| | GENERAL EMPLOYEES | | |
|---|---|---|---|
| | PRIOR CLASS A | TRANSFERRED CLASS B | PRIOR CLASS B |
| 3. Eligibility condition | In service within 120 days and no other benefit | | |
| Benefit | Lump sum equal to the member's account balance plus an equal amount payable from the employer fund. | | |
| INACTIVE DEATH BENEFITS | | | |
| Eligibility condition*** | 10 years | 10 years | 10 years |
| Benefit | To surviving spouse as if member had retired and elected Option II (50%) | | |
| DISABILITY RETIREMENT | | | |
| Eligibility conditions | 10 years | 5 years | 5 years |
| Benefit percentages: | | | |
| % up to SSB | 1.0125%*# | 1.6875%**# | 1.6875%**# |
| % over SSB | 1.5750# | 1.6875# | 1.6875# |
| Maximum Benefit | 75% of average final compensation | | |
| Minimum Benefit (No reduction) | $96.00# | $103.92# | $103.92# |
| MEMBER CONTRIBUTION RATES | | | |
| Contributory | | | |
| % of compensation up to SSB | 3.0% | 5.5% | 7.0% |
| % of compensation in excess of SSB | 5.0% | 5.5% | 7.0% |
| Non-Contributory | 0.0% | 0.0% | 2.0% |

* If service to date of disability retirement is less than 20 years, projected years of service to the full benefit date are added to creditable service, but not to bring total years of creditable service to more than 20 years.

** Total benefit percentage based on years of service not to be less than 25%.#

*** Optional to political subdivisions

## SUPERSEDED SYSTEMS

## TENNESSEE STATE RETIREMENT SYSTEM
(Continued)

| | GAME AND FISH OFFICERS | STATE POLICEMEN | FIREMEN AND POLICEMEN |
|---|---|---|---|
| SERVICE RETIREMENT | | | |
| Full Benefit: | | | |
| Eligibility conditions (Age and years of creditable service) | Age 60 or 55 with 25 years, or 30 years | Age 50 or 25 years | Age 55 with 25 years, or 30 years |
| Benefit percentages (% of AFC for each year of creditable service) | 2.125%# | 2.250%# | 2.250%# |
| Vested Benefit: | | | |
| Eligibility conditions | 10 years | 10 years | 10 years |
| | Payable at age 55 or later for Class A<br>Payable upon completion of 10 years for Class B | | |
| Benefit | Full benefit reduced by 4/10 of 1% for each month prior to eligibility for full benefit | | |
| Maximum Benefit | 75%# of average final compensation | | |
| Minimum Benefit (Per year of creditable service) | Class A - $96.00#<br>Class B - $103.92# | N/A | Class A - $96.00#<br>Class B - $103.92# |
| DISABILITY RETIREMENT | | | |
| Eligibility conditions | Class A - 10 years<br>Class B - 5 years | 5 years | Class A - 10 years<br>Class B - 5 years |
| Benefit percentages | 1.9125%*# | 2.025%**# | 2.025%*# |
| Maximum Benefit | 75% of average final compensation | | |
| Minimum Benefit (No projected service) | Class A - $96.00#<br>Class B - $103.92# | N/A | Class A - $96.00#<br>Class B - $103.92# |

* For Class A, if service to date of disability retirement is less than 20 years, projected years of service to age 55 are added to creditable service, but not to bring total years of creditable service to more than 20 years. Class B does not get projected years.

** Total benefit percentage based on years of service (without projection) not to be less than 25%.#

## SUPERSEDED SYSTEMS

## TENNESSEE STATE RETIREMENT SYSTEM
(Continued)

| | GAME AND FISH OFFICERS | STATE POLICEMEN | FIREMEN AND POLICEMEN |
|---|---|---|---|
| ACCIDENTAL DISABILITY | | | |
| Eligibility conditions | N/A | In performance of duty | N/A |
| Benefit | N/A | 50% of AFC# | N/A |
| ORDINARY DEATH BENEFITS | | | |
| 1. Eligibility conditions | In service within 120 days and no other benefit | | |
| Benefit | Lump sum equal to the member's account balance plus an equal amount payable from the employer fund. | | |
| 2. Eligibility conditions* | 10 years | 10 years | 10 years |
| Benefit | To surviving spouse, as if member had retired and elected immediate joint and 100% survivor annuity (Option I) | | |
| 3. Eligibility conditions | Eligible for early or service retirement | | |
| Benefit | Joint and 100% survivor option as if member had retired and elected this option. | | |
| INACTIVE DEATH BENEFITS | | | |
| Eligibility condition | 10 years | 10 years | 10 years |
| Benefit | To surviving spouse as if member had retired and elected Option II (50%) | | |
| DEATH IN PERFORMANCE OF DUTY | N/A | 50% of AFC# | N/A |

(All death benefits are assumed to be ordinary death benefits for valuation purposes.)

| | GAME AND FISH OFFICERS | STATE POLICEMEN | FIREMEN AND POLICEMEN |
|---|---|---|---|
| MEMBER CONTRIBUTION RATES | | | |
| % of compensation to SSB | 5.0% | 6.63% | Class A - 3.0%<br>Class B - 7.0% |
| % of compensation in excess of SSB | 5.0% | 6.63% | Class A - 5.0%<br>Class B - 7.0% |

*Optional to political subdivisions.

## SUPERSEDED SYSTEMS

| | STATE JUDGES | ATTORNEYS GENERAL | COUNTY JUDGES |
|---|---|---|---|
| SERVICE RETIREMENT | | | |
| Full Benefit: | | | |
| Eligibility conditions (Age and years of service) | Age 65 or age 54 with 8 years | Age 54 with 10 years | Age 55 with 8 years |
| Benefit percentages (% of BB for each year of creditable service) | 3.75% | 3.75% | 3.0%* |
| Vested Benefit: | | | |
| Eligibility conditions | Immediate | 10 years | 8 years |
| Benefit | Full benefit deferred to age 54 with 8 years or age 65 | Full benefit deferred to age 54 | Full benefit deferred to age 55 |
| Maximum Benefit | 75% of BB | 75% of BB | 75% of BB |
| DISABILITY RETIREMENT | | | |
| Eligibility conditions | 10 years | 10 years | 8 years |
| Benefit | Full service benefit | Full service benefit | Full service benefit |
| Minimum Benefit | N/A | N/A | 25% of AFC |

BB (Benefit Base) definition:

(1) If member's benefit is subject to escalation, the BB is the salary the retired member would have received had he remained in office.
(2) If member's benefit is not subject to escalation, the BB is the salary at the time the member retired or the salary in effect May 1, 1975, whichever is greater.

* Minimum total rate of 75% of average final compensation after 24 years of creditable service.

# SUPERSEDED SYSTEMS
(Continued)

| | STATE JUDGES | ATTORNEYS GENERAL | COUNTY JUDGES |
|---|---|---|---|
| DEATH BENEFIT | | | |
| Eligibility conditions | | | |
| 1. Eligible for service retirement | If elected, survivorship option as if member retired; otherwise 100% joint and survivor option to designated beneficiary | If elected, survivorship option as if member retired; otherwise 100% joint and survivor option to designated beneficiary | If elected, survivorship option as if member retired; otherwise 50% joint and survivor option to designated beneficiary |
| 2. Eligibility conditions | 10 years | 10 years | 10 years |
| Benefit | To surviving spouse, as if member had retired and elected immediate joint and 100% survivor annuity (Option I) | | |
| 3. 10 years | N/A | Optional benefit paid at age 54 if elected | N/A |
| 4. Age 54 with 10 years or 18 years | N/A | 50% joint and survivor option as if member had retired | N/A |
| 5. Eligibility condition | In service within 120 days and no other benefit | | |
| Benefit | Lump sum equal to the member's account balance plus an equal amount payable from the employer fund. | | |
| INACTIVE DEATH BENEFITS | | | |
| Eligibility condition | 10 years | 10 years | 10 years |
| Benefit | To surviving spouse as if member had retired and elected Option II (50%) | | |
| MEMBER CONTRIBUTION RATES | 3.0% | 8.0% contributory<br>3.0% non-contributory | 8.0% contributory<br>3.0% non-contributory |

## SUPERSEDED SYSTEMS
(Continued)

| | COUNTY OFFICIALS | PUBLIC SERVICE COMMISSIONERS |
|---|---|---|
| <u>SERVICE RETIREMENT</u> | | |
| <u>Full Benefit</u>: | | |
| Eligibility conditions (Age and years of service) | Age 55 with 12 years | Age 65 or age 54 with 12 years |
| Benefit percentages (% of BB or AFC for each year of creditable service) | 2.5% of AFC | 3.75% of salary at retirement |
| <u>Maximum Benefit</u> | 75% of AFC | 75% of salary at retirement |
| <u>Vested Benefit</u>: | | |
| Eligibility conditions | 12 years | Immediate |
| Benefit | Full benefit deferred to age 55 | Deferred to age 65 or to age 54 with 12 years |
| <u>DISABILITY RETIREMENT</u> | | |
| Eligibility conditions | N/A | 10 years |
| Benefit | N/A | Full benefit |
| <u>DEATH BENEFITS</u> | | |
| 1. Eligibility conditions | 12 years | Eligible for full benefit |
| Benefit | Full benefit payable to beneficiary for 10 years; if eligible for service retirement, beneficiary may elect joint and 100% survivor option | If elected, survivorship option as if member retired; otherwise 100% joint and survivor option to designated beneficiary |
| 2. Eligibility conditions | 10 years | 10 years |
| Benefit | To surviving spouse, as if member had retired and elected immediate joint and 100% survivor annuity (Option I) | |
| 3. Eligibility condition | In service within 120 days and no other benefit | |
| Benefit | Lump sum equal to the member's account balance plus an equal amount payable from the employer fund. | |

# SUPERSEDED SYSTEMS
(Continued)

| | COUNTY OFFICIALS | PUBLIC SERVICE COMMISSIONERS |
|---|---|---|
| INACTIVE DEATH BENEFITS | | |
| 1. Eligibility conditions | 10 years | 10 years |
| Benefit | To surviving spouse as if member had retired and elected Option II (50%) | |
| 2. Eligibility conditions | Out of service more than 120 days | |
| Benefit | Lump sum payment equal to member's account balance | |
| MEMBER CONTRIBUTION RATES | 8.0% | 8.0% |

# H. APPENDIX

TABLE I-1

CONTRIBUTORY TEACHERS

DISTRIBUTION OF ACTIVE PARTICIPANTS' EARNINGS
BY AGE

| Age | | Earnings | |
|---|---|---|---|
| Group | Number | Total | Average |
| 1-20 | 0 | $0 | $0 |
| 21-25 | 4 | 117,397 | 29,349 |
| 26-30 | 1,423 | 67,819,074 | 47,659 |
| 31-35 | 6,288 | 324,315,531 | 51,577 |
| 36-40 | 8,531 | 480,701,540 | 56,348 |
| 41-45 | 9,669 | 587,395,901 | 60,750 |
| 46-50 | 10,434 | 658,131,423 | 63,076 |
| 51-55 | 7,916 | 502,115,112 | 63,430 |
| 56-60 | 5,472 | 347,001,134 | 63,414 |
| 61-65 | 2,946 | 191,491,240 | 65,000 |
| 66-70 | 699 | 47,129,995 | 67,425 |
| 71-75 | 175 | 11,736,032 | 67,063 |
| 76-80 | 19 | 1,281,252 | 67,434 |
| 81-85 | 6 | 415,418 | 69,236 |
| 86-90 | 0 | 0 | 0 |
| Total | 53,582 | $3,219,651,049 | $60,088 |

TABLE I-2

STATE GENERAL EMPLOYEES
(INCLUDES NON-CONTRIBUTORY TEACHERS AND SEPARATELY-FUNDED SYSTEMS)

DISTRIBUTION OF ACTIVE PARTICIPANTS' EARNINGS
BY AGE

| Age | | Earnings | |
|---|---|---|---|
| Group | Number | Total | Average |
| 1-20 | 0 | $0 | $0 |
| 21-25 | 16 | 653,143 | 40,821 |
| 26-30 | 690 | 33,487,987 | 48,533 |
| 31-35 | 2,271 | 123,002,265 | 54,162 |
| 36-40 | 3,576 | 206,753,484 | 57,817 |
| 41-45 | 4,456 | 268,031,052 | 60,151 |
| 46-50 | 5,375 | 328,695,586 | 61,153 |
| 51-55 | 5,605 | 343,832,984 | 61,344 |
| 56-60 | 6,059 | 360,732,346 | 59,537 |
| 61-65 | 4,433 | 269,333,312 | 60,756 |
| 66-70 | 1,735 | 117,774,558 | 67,882 |
| 71-75 | 588 | 39,300,761 | 66,838 |
| 76-80 | 160 | 10,583,632 | 66,148 |
| 81-85 | 36 | 2,115,306 | 58,759 |
| 86-90 | 0 | 0 | 0 |
| Total | 35,000 | $2,104,296,416 | $60,123 |

TABLE I-3

POLITICAL SUBDIVISION GENERAL EMPLOYEES

DISTRIBUTION OF ACTIVE PARTICIPANTS' EARNINGS
BY AGE

| Age Group | Number | Earnings Total | Earnings Average |
|---|---|---|---|
| 1-20 | 584 | $14,995,795 | $25,678 |
| 21-25 | 4,167 | 129,937,327 | 31,182 |
| 26-30 | 6,865 | 234,823,137 | 34,206 |
| 31-35 | 7,217 | 260,404,766 | 36,082 |
| 36-40 | 8,261 | 305,019,767 | 36,923 |
| 41-45 | 9,181 | 348,465,648 | 37,955 |
| 46-50 | 11,296 | 443,204,883 | 39,236 |
| 51-55 | 11,577 | 447,316,819 | 38,638 |
| 56-60 | 11,432 | 426,171,123 | 37,279 |
| 61-65 | 7,660 | 281,710,304 | 36,777 |
| 66-70 | 2,999 | 101,498,016 | 33,844 |
| 71-75 | 1,219 | 39,224,085 | 32,177 |
| 76-80 | 414 | 11,935,558 | 28,830 |
| 81-85 | 107 | 2,890,192 | 27,011 |
| 86-90 | 0 | 0 | 0 |
| Total | 82,979 | $3,047,597,420 | $36,727 |

TABLE I-4

UNIVERSITY OF TENNESSEE (TIAA)

DISTRIBUTION OF ACTIVE PARTICIPANTS' EARNINGS
BY AGE

| Age | | Earnings | |
|---|---|---|---|
| Group | Number | Total | Average |
| 1-20 | 0 | $0 | $0 |
| 21-25 | 0 | 0 | 0 |
| 26-30 | 0 | 0 | 0 |
| 31-35 | 0 | 0 | 0 |
| 36-40 | 0 | 0 | 0 |
| 41-45 | 0 | 0 | 0 |
| 46-50 | 0 | 0 | 0 |
| 51-55 | 0 | 0 | 0 |
| 56-60 | 0 | 0 | 0 |
| 61-65 | 0 | 0 | 0 |
| 66-70 | 1 | 101,863 | 101,863 |
| 71-75 | 6 | 685,209 | 114,202 |
| 76-80 | 9 | 1,362,961 | 151,440 |
| 81-85 | 6 | 724,371 | 120,729 |
| 86-90 | 0 | 0 | 0 |
| Total | 22 | $2,874,404 | $130,655 |

TABLE I-5

GROUP II

DISTRIBUTION OF ACTIVE PARTICIPANTS' EARNINGS
BY AGE

| Age Group | Number | Earnings Total | Earnings Average |
|---|---|---|---|
| 1-20 | 0 | $0 | $0 |
| 21-25 | 0 | 0 | 0 |
| 26-30 | 0 | 0 | 0 |
| 31-35 | 0 | 0 | 0 |
| 36-40 | 0 | 0 | 0 |
| 41-45 | 0 | 0 | 0 |
| 46-50 | 0 | 0 | 0 |
| 51-55 | 0 | 0 | 0 |
| 56-60 | 0 | 0 | 0 |
| 61-65 | 0 | 0 | 0 |
| 66-70 | 3 | 296,071 | 98,690 |
| 71-75 | 0 | 0 | 0 |
| 76-80 | 0 | 0 | 0 |
| 81-85 | 0 | 0 | 0 |
| 86-90 | 0 | 0 | 0 |
| Total | 3 | $296,071 | $98,690 |

# TABLE I-6

## GROUP III

## DISTRIBUTION OF ACTIVE PARTICIPANTS' EARNINGS BY AGE

| Age Group | Number | Earnings Total | Earnings Average |
|---|---|---|---|
| 1-20 | 0 | $0 | $0 |
| 21-25 | 0 | 0 | 0 |
| 26-30 | 0 | 0 | 0 |
| 31-35 | 0 | 0 | 0 |
| 36-40 | 0 | 0 | 0 |
| 41-45 | 0 | 0 | 0 |
| 46-50 | 0 | 0 | 0 |
| 51-55 | 0 | 0 | 0 |
| 56-60 | 0 | 0 | 0 |
| 61-65 | 0 | 0 | 0 |
| 66-70 | 0 | 0 | 0 |
| 71-75 | 0 | 0 | 0 |
| 76-80 | 1 | 163,128 | 163,128 |
| 81-85 | 2 | 199,860 | 99,930 |
| 86-90 | 0 | 0 | 0 |
| Total | 3 | $362,988 | $120,996 |

TABLE I-7

TOTAL

DISTRIBUTION OF ACTIVE PARTICIPANTS' EARNINGS
BY AGE

| Age Group | Number | Earnings Total | Earnings Average |
|---|---|---|---|
| 1-20 | 584 | $14,995,795 | $25,678 |
| 21-25 | 4,187 | 130,707,867 | 31,218 |
| 26-30 | 8,978 | 336,130,198 | 37,439 |
| 31-35 | 15,776 | 707,722,562 | 44,861 |
| 36-40 | 20,368 | 992,474,791 | 48,727 |
| 41-45 | 23,306 | 1,203,892,601 | 51,656 |
| 46-50 | 27,105 | 1,430,031,892 | 52,759 |
| 51-55 | 25,098 | 1,293,264,915 | 51,529 |
| 56-60 | 22,963 | 1,133,904,603 | 49,380 |
| 61-65 | 15,039 | 742,534,856 | 49,374 |
| 66-70 | 5,437 | 266,800,503 | 49,071 |
| 71-75 | 1,988 | 90,946,087 | 45,748 |
| 76-80 | 603 | 25,326,531 | 42,001 |
| 81-85 | 157 | 6,345,147 | 40,415 |
| 86-90 | 0 | 0 | 0 |
| Total | 171,589 | $8,375,078,348 | $48,809 |

TABLE II-1

CONTRIBUTORY TEACHERS

DISTRIBUTION OF ACTIVE PARTICIPANTS' EARNINGS
BY LENGTH OF SERVICE

| Service Group | Number | Earnings Total | Earnings Average |
|---|---|---|---|
| 0 | 66 | $4,245,671 | $64,328 |
| 1 | 45 | 2,531,108 | 56,247 |
| 2 | 41 | 2,396,801 | 58,459 |
| 3 | 43 | 2,393,695 | 55,667 |
| 4 | 21 | 1,087,895 | 51,805 |
| 0-4 | 216 | 12,655,170 | 58,589 |
| 5-9 | 11,121 | 578,849,482 | 52,050 |
| 10-14 | 12,885 | 729,649,515 | 56,628 |
| 15-19 | 10,876 | 673,060,624 | 61,885 |
| 20-24 | 9,259 | 606,889,098 | 65,546 |
| 25-29 | 5,669 | 376,622,119 | 66,435 |
| 30-34 | 2,269 | 151,966,954 | 66,975 |
| 35-39 | 893 | 61,490,033 | 68,858 |
| 40-44 | 294 | 21,005,237 | 71,446 |
| 45-49 | 100 | 7,462,817 | 74,628 |
| Total | 53,582 | $3,219,651,049 | $60,088 |

TABLE II-2

STATE GENERAL EMPLOYEES
(INCLUDES NON-CONTRIBUTORY TEACHERS AND SEPARATELY-FUNDED SYSTEMS)

DISTRIBUTION OF ACTIVE PARTICIPANTS' EARNINGS
BY LENGTH OF SERVICE

| Service Group | Number | Earnings Total | Earnings Average |
|---|---|---|---|
| 0 | 48 | $3,045,728 | $63,453 |
| 1 | 69 | 4,449,453 | 64,485 |
| 2 | 51 | 3,783,431 | 74,185 |
| 3 | 50 | 3,856,125 | 77,123 |
| 4 | 33 | 2,553,465 | 77,378 |
| 0-4 | 251 | 17,688,202 | 70,471 |
| 5-9 | 7,824 | 446,157,280 | 57,024 |
| 10-14 | 7,281 | 413,799,826 | 56,833 |
| 15-19 | 6,680 | 391,676,788 | 58,634 |
| 20-24 | 5,049 | 307,767,389 | 60,956 |
| 25-29 | 3,346 | 221,620,660 | 66,235 |
| 30-34 | 2,428 | 159,193,142 | 65,566 |
| 35-39 | 1,429 | 95,036,019 | 66,505 |
| 40-44 | 529 | 37,070,147 | 70,076 |
| 45-49 | 183 | 14,286,963 | 78,071 |
| Total | 35,000 | $2,104,296,416 | $60,123 |

TABLE II-3

POLITICAL SUBDIVISION GENERAL EMPLOYEES

DISTRIBUTION OF ACTIVE PARTICIPANTS' EARNINGS
BY LENGTH OF SERVICE

| Service Group | Number | Earnings Total | Earnings Average |
|---|---|---|---|
| 0 | 8,775 | $234,342,871 | $26,706 |
| 1 | 7,701 | 236,095,195 | 30,658 |
| 2 | 5,944 | 183,081,381 | 30,801 |
| 3 | 5,311 | 170,351,204 | 32,075 |
| 4 | 4,363 | 140,933,997 | 32,302 |
| 0-4 | 32,094 | 964,804,648 | 30,062 |
| 5-9 | 14,958 | 528,562,041 | 35,336 |
| 10-14 | 11,867 | 455,616,062 | 38,394 |
| 15-19 | 8,985 | 373,578,174 | 41,578 |
| 20-24 | 7,532 | 338,658,184 | 44,963 |
| 25-29 | 4,094 | 201,062,860 | 49,112 |
| 30-34 | 2,204 | 114,889,250 | 52,128 |
| 35-39 | 813 | 44,454,342 | 54,679 |
| 40-44 | 334 | 19,486,472 | 58,343 |
| 45-49 | 98 | 6,485,387 | 66,177 |
| Total | 82,979 | $3,047,597,420 | $36,727 |

TABLE II-4

UNIVERSITY OF TENNESSEE (TIAA)

DISTRIBUTION OF ACTIVE PARTICIPANTS' EARNINGS
BY LENGTH OF SERVICE

| Service Group | Number | Earnings Total | Earnings Average |
|---|---|---|---|
| 0 | 0 | $0 | $0 |
| 1 | 0 | 0 | 0 |
| 2 | 1 | 113,136 | 113,136 |
| 3 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 |
| 0-4 | 1 | 113,136 | 113,136 |
| 5-9 | 0 | 0 | 0 |
| 10-14 | 0 | 0 | 0 |
| 15-19 | 0 | 0 | 0 |
| 20-24 | 0 | 0 | 0 |
| 25-29 | 0 | 0 | 0 |
| 30-34 | 0 | 0 | 0 |
| 35-39 | 0 | 0 | 0 |
| 40-44 | 8 | 1,025,765 | 128,221 |
| 45-49 | 13 | 1,735,503 | 133,500 |
| Total | 22 | $2,874,404 | $130,655 |

TABLE II-5

GROUP II

DISTRIBUTION OF ACTIVE PARTICIPANTS' EARNINGS
BY LENGTH OF SERVICE

| Service Group | Number | Earnings Total | Earnings Average |
|---|---|---|---|
| 0 | 0 | $0 | $0 |
| 1 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 |
| 0-4 | 0 | 0 | 0 |
| 5-9 | 0 | 0 | 0 |
| 10-14 | 0 | 0 | 0 |
| 15-19 | 0 | 0 | 0 |
| 20-24 | 0 | 0 | 0 |
| 25-29 | 0 | 0 | 0 |
| 30-34 | 0 | 0 | 0 |
| 35-39 | 0 | 0 | 0 |
| 40-44 | 1 | 98,510 | 98,510 |
| 45-49 | 2 | 197,561 | 98,781 |
| Total | 3 | $296,071 | $98,690 |

TABLE II-6

GROUP III

DISTRIBUTION OF ACTIVE PARTICIPANTS' EARNINGS
BY LENGTH OF SERVICE

| Service Group | Number | Earnings Total | Earnings Average |
|---|---|---|---|
| 0 | 0 | $0 | $0 |
| 1 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 |
| 4 | 0 | 0 | 0 |
| 0-4 | 0 | 0 | 0 |
| 5-9 | 0 | 0 | 0 |
| 10-14 | 0 | 0 | 0 |
| 15-19 | 0 | 0 | 0 |
| 20-24 | 0 | 0 | 0 |
| 25-29 | 0 | 0 | 0 |
| 30-34 | 0 | 0 | 0 |
| 35-39 | 0 | 0 | 0 |
| 40-44 | 1 | 125,889 | 125,889 |
| 45-49 | 2 | 237,099 | 118,550 |
| Total | 3 | $362,988 | $120,996 |

TABLE II-7

TOTAL

DISTRIBUTION OF ACTIVE PARTICIPANTS' EARNINGS
BY LENGTH OF SERVICE

| Service Group | Number | Earnings Total | Earnings Average |
|---|---|---|---|
| 0 | 8,889 | $241,634,270 | $27,184 |
| 1 | 7,815 | 243,075,756 | 31,104 |
| 2 | 6,037 | 189,374,749 | 31,369 |
| 3 | 5,404 | 176,601,024 | 32,680 |
| 4 | 4,417 | 144,575,357 | 32,732 |
| 0-4 | 32,562 | 995,261,156 | 30,565 |
| 5-9 | 33,903 | 1,553,568,803 | 45,824 |
| 10-14 | 32,033 | 1,599,065,403 | 49,919 |
| 15-19 | 26,541 | 1,438,315,586 | 54,192 |
| 20-24 | 21,840 | 1,253,314,671 | 57,386 |
| 25-29 | 13,109 | 799,305,639 | 60,974 |
| 30-34 | 6,901 | 426,049,346 | 61,737 |
| 35-39 | 3,135 | 200,980,394 | 64,109 |
| 40-44 | 1,167 | 78,812,020 | 67,534 |
| 45-49 | 398 | 30,405,330 | 76,395 |
| Total | 171,589 | $8,375,078,348 | $48,809 |

TABLE III

DISTRIBUTION OF CURRENT BENEFITS BY AGE GROUPS

RETIRED LIVES

| Age Group | Number | Annual Benefit Total | Annual Benefit Average |
|---|---|---|---|
| 1-20 | 0 | $0 | $0 |
| 21-25 | 0 | 0 | 0 |
| 26-30 | 0 | 0 | 0 |
| 31-35 | 9 | 74,497 | 8,277 |
| 36-40 | 51 | 458,015 | 8,981 |
| 41-45 | 129 | 1,230,735 | 9,541 |
| 46-50 | 462 | 4,665,776 | 10,099 |
| 51-55 | 2,146 | 33,243,458 | 15,491 |
| 56-60 | 10,590 | 169,204,020 | 15,978 |
| 61-65 | 26,647 | 414,227,986 | 15,545 |
| 66-70 | 39,548 | 670,309,149 | 16,949 |
| 71-75 | 36,225 | 657,404,527 | 18,148 |
| 76-80 | 22,785 | 411,735,407 | 18,070 |
| 81-85 | 14,295 | 247,305,897 | 17,300 |
| 86-90 | 13,463 | 209,510,352 | 15,562 |
| Total | 166,350 | $2,819,369,819 | $16,948 |

# TABLE IV

## DISTRIBUTION OF CURRENT BENEFITS BY YEARS SINCE RETIREMENT

## RETIRED LIVES

| Years Since Retirement | Number | Annual Benefit Total | Annual Benefit Average |
|---|---|---|---|
| 0 | 5,290 | $81,505,001 | $15,407 |
| 1 | 9,135 | 138,528,337 | 15,165 |
| 2 | 8,374 | 131,106,316 | 15,656 |
| 3 | 8,504 | 130,603,008 | 15,358 |
| 4 | 9,492 | 151,762,812 | 15,988 |
| 0- 4 | 40,795 | 633,505,474 | 15,529 |
| 5-9 | 44,303 | 745,176,775 | 16,820 |
| 10-14 | 31,295 | 557,923,752 | 17,828 |
| 15-19 | 22,030 | 404,672,072 | 18,369 |
| 20-24 | 14,918 | 271,779,404 | 18,218 |
| 25-29 | 7,806 | 133,573,743 | 17,112 |
| 30-34 | 3,390 | 51,429,914 | 15,171 |
| 35-39 | 1,308 | 16,445,933 | 12,573 |
| 40-44 | 363 | 3,627,743 | 9,994 |
| 45-49 | 142 | 1,235,009 | 8,697 |
| Total | 166,350 | $2,819,369,819 | $16,948 |

## TABLE V-1

## MARKET VALUE OF ASSETS – ASSET ALLOCATION
*June 30, 2020*

| Asset Class | Allocation |
|---|---|
| Domestic Equity | 29.7% |
| Domestic Fixed Income | 28.2% |
| International Equity | 14.1% |
| International Fixed Income | 0.1% |
| Short-Term Securities | 6.4% |
| Real Estate | 8.0% |
| Private Equity & Strategic Lending | 13.5% |
| Total | 100.0% |

Note: The above breakdown was provided by the TCRS.

TABLE V-2

CHANGE IN MARKET VALUE OF ASSETS
*June 30, 2020*

| | Contributory Teachers | Consolidated State | State Judges & Attorneys-General | Polisubs | Grand Total |
|---|---|---|---|---|---|
| Market Value of Assets at June 30, 2019 | $25,033,820,128 | $15,044,674,694 | $502,902,164 | $11,011,828,389 | $51,593,225,375 |
| Employer Contributions | 353,793,001 | 416,147,573 | 20,307,511 | 280,735,505 | 1,070,983,590 |
| Employee Contributions | 167,207,552 | 57,289 | 317,119 | 95,644,278 | 263,226,238 |
| Investment Income | 1,221,877,835 | 732,573,909 | 24,741,821 | 543,272,756 | 2,522,466,321 |
| Benefit Payments | (1,296,997,698) | (962,823,898) | (28,732,106) | (468,649,750) | (2,757,203,452) |
| Refunds of Employee Contributions | (18,482,926) | (806,786) | (4,465) | (18,413,036) | (37,707,213) |
| Administrative Expense | (4,781,175) | (3,113,849) | (56,231) | (7,279,179) | (15,230,434) |
| Net Transfers | 0 | (71,954) | 0 | 69,737 | (2,217) |
| Market Value of Assets at June 30, 2020 | $25,456,436,717 | $15,226,636,978 | $519,475,813 | $11,437,208,700 | $52,639,758,208 |

Net transfers within a given year may not reconcile to zero due to timing.

TABLE V-3

## HISTORY OF INVESTMENT RETURNS
*June 30, 2020*

| Year Ending | Investment Return |
|---|---|
| June 30, 2020 | 4.94 % |
| June 30, 2019 | 7.45 |
| June 30, 2018 | 8.19 |
| June 30, 2017 | 11.42 |
| June 30, 2016 | 2.79 |
| June 30, 2015 | 3.33 |
| June 30, 2014 | 16.65 |
| June 30, 2013 | 9.92 |
| June 30, 2012 | 5.61 |
| June 30, 2011 | 19.59 |
| June 30, 2010 | 10.24 |
| June 30, 2009 | (15.27) |
| June 30, 2008 | (1.21) |
| June 30, 2007 | 13.15 |
| June 30, 2006 | 6.94 |
| June 30, 2005 | 7.30 |
| June 30, 2004 | 9.32 |
| June 30, 2003 | 4.90 |
| June 30, 2002 | (1.92) |
| June 30, 2001 | (1.57) |

Note: The above investment returns are on a market value basis.

# TABLE V-4

## ACTUARIAL VALUE OF ASSETS
*June 30, 2020*

| Year Ending | Actual Investment Return | Expected Investment Return | Excess Income Base | Recognized as of June 30, 2020 | Deferred as of June 30, 2020 |
|---|---|---|---|---|---|
| June 30, 2020 | $2,522,466,321 | $3,687,006,251 | ($1,164,539,930) | ($116,453,993) | ($1,048,085,937) |
| June 30, 2019 | 3,622,837,426 | 3,527,490,402 | 95,347,024 | 19,069,404 | 76,277,620 |
| June 30, 2018 | 3,830,776,889 | 3,345,923,249 | 484,853,640 | 145,456,092 | 339,397,548 |
| June 30, 2017 | 4,826,376,132 | 3,194,464,519 | 1,631,911,613 | 652,764,644 | 979,146,969 |
| June 30, 2016 | 1,131,293,590 | 3,198,952,742 | (2,067,659,152) | (1,033,829,575) | (1,033,829,577) |
| June 30, 2015 | 1,306,179,721 | 3,180,729,134 | (1,874,549,413) | (1,124,729,646) | (749,819,767) |
| June 30, 2014 | 6,203,093,548 | 2,786,652,754 | 3,416,440,794 | 2,391,508,553 | 1,024,932,241 |
| June 30, 2013 | 3,382,126,742 | 2,592,507,858 | 789,618,884 | 631,695,104 | 157,923,780 |
| June 30, 2012 | 1,834,485,860 | 2,504,100,892 | (669,615,032) | (602,653,527) | (66,961,505) |
| June 30, 2011 | 5,560,368,166 | 2,126,617,957 | 3,433,750,209 | 3,433,750,209 | 0 |
| | | | | Total Deferred Income: | ($321,018,628) |

| | |
|---|---|
| 1. Market Value of Assets | $52,639,758,208 |
| 2. Total Deferred Income | (321,018,628) |
| 3. Preliminary Actuarial Value of Assets, (1) – (2) | $52,960,776,836 |
| 4. Actuarial Value of Assets, (3) but not less than 80% of (1) or greater than 120% of (1) | $52,960,776,836 |
| 5. Ratio of Actuarial Value to Market Value, (4) / (1) | 100.61% |

| | Contributory Teachers | Consolidated State | State Judges & Attorneys-General | Polisubs | Grand Total |
|---|---|---|---|---|---|
| Market Value of Assets at June 30, 2020 | $25,456,436,717 | $15,226,636,978 | $519,475,813 | $11,437,208,700 | $52,639,758,208 |
| Ratio of Actuarial Value to Market Value | 100.61% | 100.61% | 100.61% | 100.61% | 100.61% |
| Actuarial Value of Assets at June 30, 2020 | $25,611,680,409 | $15,319,495,195 | $522,643,788 | $11,506,957,444 | $52,960,776,836 |

TABLE VI-1

AMOUNTS TO BE AMORTIZED

CALCULATION OF UNFUNDED ACCRUED LIABILITY
*June 30, 2020*

| | Contributory Teachers | Consolidated State | State Judges & Attorneys General |
|---|---|---|---|
| **1. Entry Age Past Service Liability** | 24,693,863,023 | 16,802,863,891 | 581,559,226 |
| **2. Valuation Assets** | 25,611,680,409 | 15,319,495,195 | 522,643,788 |
| **3. Unfunded Accrued Liability ((1)-(2))** | -917,817,386 | 1,483,368,696 | 58,915,438 |

## TABLE VI-2

## AMOUNTS TO BE AMORTIZED

## SCHEDULE OF PRE-EXISTING UNFUNDED ACCRUED LIABILITY AMORTIZATIONS

*June 30, 2020*

| Date Established | Maximum Remaining Years | Contributory Teachers | | | Consolidated State | | | State Judges & Attorneys General | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Present Value | Years | Amortization | Present Value | Years | Amortization | Present Value | Years | Amortization |
| June 30, 2013 | 13.00 | - | N/A | - | 801,545,378 | 5.40 | 172,153,209 | 70,959,386 | 6.25 | 13,537,985 |
| June 30, 2015 | 15.00 | (326,305,408) | 15.00 | (33,934,135) | 123,674,210 | 15.00 | 12,861,501 | (1,386,903) | 15.00 | (144,231) |
| June 30, 2016 | 16.00 | (21,188,428) | 16.00 | (2,126,109) | 132,835,120 | 16.00 | 13,329,066 | (1,545,271) | 16.00 | (155,057) |
| June 30, 2017 | 17.00 | 364,072,265 | 1.35 | 272,960,905 | 663,149,153 | 17.00 | 64,432,562 | 20,282,160 | 17.00 | 1,970,645 |
| June 30, 2018 | 18.00 | 125,971,735 | 18.00 | 11,888,159 | 90,988,725 | 18.00 | 8,586,755 | (4,723,857) | 18.00 | (445,798) |
| June 30, 2019 | 19.00 | (754,657,096) | 19.00 | (69,361,248) | (233,251,784) | 19.00 | (21,438,392) | (12,210,386) | 19.00 | (1,122,268) |
| Total | | (612,106,932) | -- | 179,427,572 | 1,578,940,802 | -- | 249,924,701 | 71,375,129 | -- | 13,641,276 |

The amortization period of each tier of prior gains and losses may be shortened or extended from valuation to valuation to manage volatility, but each tier must be completely amortized within 20 years of its original creation. All amortization periods remained on the same schedule as the prior valuation (with the period declining by 1 year due to the elapsed time), except for the following adjustments. For the Teacher group, the amortization period for the 2017 tier was shortened as of the current valuation date from 3.00 years to 1.35 years. For the State group, the amortization period for the 2013 tier was shortened as of the current valuation date from 5.90 years to 5.40 years. For the Judges group, the amortization period for the 2013 tier was shortened as of the current valuation date from 7.00 years to 6.25 years .

TABLE VI-3

AMOUNTS TO BE AMORTIZED

TOTAL UNFUNDED ACCRUED LIABILITY AMORTIZATION

| | Contributory Teachers | Consolidated State | State Judges & Attorneys General |
|---|---|---|---|
| **1. Unfunded Accrued Liability (UAL)** | (917,817,386) | 1,483,368,696 | 58,915,438 |
| **2. PV of Pre-Existing UAL Amortizations** | (612,106,932) | 1,578,940,802 | 71,375,129 |
| **3. New UAL Amortization Base ((1)-(2))** | (305,710,454) | (95,572,106) | (12,459,691) |
| **4. New UAL Amortization Period** | 20 years | 20 years | 20 years |
| **5. New UAL Amortization** | (27,431,232) | (8,575,633) | (1,118,001) |
| **6. Pre-Existing UAL Amortizations** | 179,427,572 | 249,924,701 | 13,641,276 |
| **7. Total UAL Amortization ((5)+(6))** | 151,996,340 | 241,349,068 | 12,523,275 |
| **8. Eligible Payroll** | 3,219,651,049 | 2,030,213,243 | 77,320,565 |
| **9. Total UAL Amortization as % of Pay ((7) / (8))** | 4.72% | 11.89% | 16.20% |

PV = Present Value

TABLE VII

CALCULATION OF CONTRIBUTION RATES

| | Contributory Teachers | Consolidated State | State Judges & Attorneys General |
|---|---|---|---|
| **1. Normal Cost** | 162,908,306 | 159,834,512 | 6,707,573 |
| **2. Eligible Payroll** | 3,219,651,049 | 2,030,213,243 | 77,320,565 |
| **3. Normal Cost as % of Pay ((1) / (2))** | 5.06% | 7.87% | 8.68% |
| **4. Total UAL Amortization as % of Pay (Table VI-3)** | 4.72% | 11.89% | 16.20% |
| **5. Total Contribution Rate ((3)+(4)) x 1.03625 + 0.17%** | 10.30% | 20.65% | 25.94% |

TABLE VIII

SUMMARY OF ACTUARIAL METHODS AND ASSUMPTIONS

The actuarial assumptions and methods set forth below have been selected by the actuary based on results of an actuarial experience study covering the period from July 1, 2012 through June 30, 2016 and expectations regarding future events and economic conditions.

The assumptions and methods were adopted as of June 30, 2017 unless otherwise noted.

## Actuarial Funding Method:

(Effective June 30, 2015):

Entry-Age Normal. The funding policy requires unfunded liabilities to be amortized utilizing the level dollar amortization method over a closed period not to exceed 20 years. A tier approach is required for new actuarial gains and losses created from each actuarial valuation. The amortization period of each tier may be shortened or extended from valuation to valuation to manage volatility but the specific tier must be completely amortized within 20 years of its original creation.

## Asset Valuation Method:

(Effective prospectively for fiscal years ending after June 30, 2007):

Ten-year moving market value average. Earnings in excess of or below expected investment returns are recognized over a ten year period. In no event will the actuarial value of assets be less than 80% of the market value of assets or greater than 120% of the market value of assets.

## Interest Rate:

7.25% per annum, compounded annually

TABLE VIII (Continued)

SUMMARY OF ACTUARIAL METHODS AND ASSUMPTIONS

## Salary Increases:

Salary increase rates vary by age. Sample rates are shown below.

| Age | Rate |
|---|---|
| 20 | 8.72% |
| 30 | 6.48 |
| 40 | 5.10 |
| 50 | 4.02 |
| 60 | 3.54 |
| 65 | 3.46 |

## Increase in Social Security Wage Base:

3.00% annual increase

## Cost of Living Adjustment:

2.25% annual increase in monthly retirement benefits

## Inflation:

2.50% annual rate of inflation is assumed in establishing economic assumptions

## Marital Status:

(a) Percent married –

Eligible for service retirement – 80%

Ineligible for service retirement – 75%

(b) Age difference – males are assumed to be four years older than spouse

TABLE VIII (Continued)

SUMMARY OF ACTUARIAL METHODS AND ASSUMPTIONS

## Post-Retirement Mortality (Base Rates):

(a) Service Retirement – base rates developed in the 2016 experience study as follows:

1. Teachers and Group III –

Males – 111% of RP-2006 White Collar Mortality Table for Healthy Annuitants

Females – 98% of RP-2006 White Collar Mortality Table for Healthy Annuitants

2. Others –

Males – 102% of RP-2006 Blue Collar Mortality Table for Healthy Annuitants

Females – 97% of RP-2006 Blue Collar Mortality Table for Healthy Annuitants

(b) Disability Retirement – 110% of mortality rates published in IRS Revenue Ruling 96-7 for disabilities occurring before January 1, 1995

## Post-Retirement Mortality Improvement:

The mortality tables for service retirement include projected mortality improvement from 2006 to 2014 (the mid-year of the last TCRS experience study) using Scale MP-2016 and from 2014 to 6 years beyond the valuation date using the most current projection scale published by the Society of Actuaries as of the actuarial valuation date (Scale MP-2019 as of June 30, 2020)

## Pre-Retirement Mortality and Mortality Improvement:

RP-2006 Mortality Table for Employees with mortality improvement projected from 2006 to 15 years beyond the valuation date using the most current projection scale published by the Society of Actuaries as of the actuarial valuation date (Scale MP-2019 as of June 30, 2020)

## Separations from Service:

Representative values of the assumed annual rates of disability, withdrawal and service retirement for the various membership groups are shown on the following pages.

All disablements are assumed to be regular disablements (not in the line-of-duty) without any offset for worker's compensation benefits.

TABLE VIII (Continued)

SUMMARY OF ACTUARIAL METHODS AND ASSUMPTIONS

GROUP I

TEACHERS

*MALE*

| Age | Disability | Annual Rate of Withdrawal | | |
|---|---|---|---|---|
| | | First Year | Second Year | Later |
| 20 | 0.01% | 18.0% | 13.5% | 10.0% |
| 25 | 0.01 | 18.0 | 13.5 | 8.5 |
| 30 | 0.01 | 18.0 | 13.5 | 6.0 |
| 35 | 0.03 | 18.0 | 13.5 | 3.6 |
| 40 | 0.08 | 18.0 | 13.5 | 2.0 |
| 45 | 0.14 | 18.4 | 13.5 | 1.5 |
| 50 | 0.17 | 19.7 | 14.2 | 2.0 |
| 55 | 0.17 | 22.1 | 16.8 | 3.1 |
| 60 | – | 25.5 | 21.6 | 4.7 |
| 65 | – | 28.0 | 23.5 | – |

TABLE VIII (Continued)

SUMMARY OF ACTUARIAL METHODS AND ASSUMPTIONS

GROUP I

TEACHERS

*FEMALE*

| Age | Disability | Annual Rate of Withdrawal | | |
|---|---|---|---|---|
| | | First Year | Second Year | Later |
| 20 | 0.01% | 18.0% | 13.5% | 10.5% |
| 25 | 0.01 | 18.0 | 13.5 | 10.0 |
| 30 | 0.01 | 18.0 | 13.5 | 7.6 |
| 35 | 0.03 | 18.0 | 13.5 | 4.6 |
| 40 | 0.08 | 18.0 | 13.5 | 2.3 |
| 45 | 0.14 | 18.4 | 13.5 | 1.1 |
| 50 | 0.17 | 19.7 | 14.2 | 1.6 |
| 55 | 0.17 | 22.1 | 16.8 | 3.8 |
| 60 | – | 25.5 | 21.6 | 5.0 |
| 65 | – | 28.0 | 23.5 | – |

TABLE VIII (Continued)

SUMMARY OF ACTUARIAL METHODS AND ASSUMPTIONS

GROUP I

GENERAL EMPLOYEES

MALE

| Age | Disability | | Annual Rate of Withdrawal | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | First Year | | Second Year | | Later | |
| | State | Polisubs | State | Polisubs | State | Polisubs | State | Polisubs |
| 20 | 0.06% | 0.03% | 30.0% | 26.2% | 24.6% | 21.8% | 17.8% | 13.7% |
| 25 | 0.06 | 0.03 | 25.4 | 23.0 | 21.4 | 19.1 | 14.4 | 10.3 |
| 30 | 0.07 | 0.03 | 23.0 | 21.8 | 18.6 | 17.9 | 9.6 | 7.4 |
| 35 | 0.11 | 0.03 | 20.8 | 20.7 | 16.1 | 17.0 | 5.2 | 5.1 |
| 40 | 0.16 | 0.08 | 18.6 | 19.2 | 13.8 | 15.9 | 2.6 | 3.5 |
| 45 | 0.22 | 0.20 | 16.5 | 17.7 | 12.0 | 14.1 | 1.8 | 2.8 |
| 50 | 0.27 | 0.38 | 14.8 | 17.0 | 11.1 | 13.0 | 2.2 | 2.8 |
| 55 | 0.27 | 0.49 | 15.3 | 17.4 | 11.6 | 13.0 | 2.6 | 3.6 |
| 60 | – | – | 17.9 | 20.4 | 14.4 | 14.9 | 4.3 | 4.6 |
| 65 | – | – | 24.0 | 26.3 | 20.5 | 19.1 | – | – |

TABLE VIII (Continued)

SUMMARY OF ACTUARIAL METHODS AND ASSUMPTIONS

GROUP I

GENERAL EMPLOYEES

FEMALE

| Age | Disability | | Annual Rate of Withdrawal | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | First Year | | Second Year | | Later | |
| | State | Polisubs | State | Polisubs | State | Polisubs | State | Polisubs |
| 20 | 0.03% | 0.03% | 30.0% | 26.2% | 24.6% | 21.8% | 18.3% | 19.6% |
| 25 | 0.03 | 0.03 | 25.4 | 23.0 | 21.4 | 19.1 | 14.8 | 15.1 |
| 30 | 0.04 | 0.03 | 23.0 | 21.8 | 18.6 | 17.9 | 10.3 | 11.1 |
| 35 | 0.06 | 0.03 | 20.8 | 20.7 | 16.1 | 17.0 | 6.3 | 7.7 |
| 40 | 0.14 | 0.08 | 18.6 | 19.2 | 13.8 | 15.9 | 3.4 | 5.4 |
| 45 | 0.24 | 0.20 | 16.5 | 17.7 | 12.0 | 14.1 | 2.2 | 4.1 |
| 50 | 0.33 | 0.38 | 14.8 | 17.0 | 11.1 | 13.0 | 2.3 | 3.8 |
| 55 | 0.38 | 0.49 | 15.3 | 17.4 | 11.6 | 13.0 | 3.4 | 4.3 |
| 60 | – | – | 17.9 | 20.4 | 14.4 | 14.9 | 4.9 | 5.3 |
| 65 | – | – | 24.0 | 26.3 | 20.5 | 19.1 | – | – |

TABLE VIII (Continued)

SUMMARY OF ACTUARIAL METHODS AND ASSUMPTIONS

GROUP II

| Age | Disability | | Withdrawal | |
|---|---|---|---|---|
| | Male | Female | Male | Female |
| 20 | 0.06% | 0.03% | 7.50% | 7.50% |
| 25 | 0.06 | 0.03 | 7.50 | 7.50 |
| 30 | 0.07 | 0.04 | 7.50 | 7.50 |
| 35 | 0.11 | 0.06 | 7.50 | 7.50 |
| 40 | 0.16 | 0.14 | 7.50 | 7.50 |
| 45 | 0.22 | 0.24 | 7.50 | 7.50 |
| 50 | 0.27 | 0.33 | 7.50 | 7.50 |
| 55 | 0.27 | 0.38 | 7.50 | 7.50 |
| 60 | – | – | 7.50 | 7.50 |
| 65 | – | – | – | – |

## TABLE VIII (Continued)

## SUMMARY OF ACTUARIAL METHODS AND ASSUMPTIONS

## GROUP III

| Age | Disability | | Withdrawal | |
|---|---|---|---|---|
| | Male | Female | Male | Female |
| 20 | 0.01% | 0.01% | – | – |
| 25 | 0.01 | 0.01 | – | – |
| 30 | 0.01 | 0.01 | – | – |
| 35 | 0.03 | 0.03 | – | – |
| 40 | 0.08 | 0.08 | – | – |
| 45 | 0.14 | 0.14 | – | – |
| 50 | 0.17 | 0.17 | – | – |
| 55 | 0.17 | 0.17 | – | – |
| 60 | – | – | – | – |
| 65 | – | – | – | – |

## TABLE VIII (Continued)

## SUMMARY OF ACTUARIAL METHODS AND ASSUMPTIONS

### SERVICE RETIREMENT RATES

The following rates are applied at each age at which a member is eligible for an unreduced service retirement benefit.

MALE

| Age | Teachers | State | Polisubs | Group II | Group III |
|---|---|---|---|---|---|
| 50 | 6.5% | 6.0% | 9.0% | 10.0% | – |
| 51 | 7.0 | 6.0 | 9.0 | 10.0 | 8.0% |
| 52 | 7.0 | 6.0 | 9.0 | 15.0 | 8.0 |
| 53 | 8.5 | 6.0 | 9.0 | 15.0 | 8.0 |
| 54 | 9.0 | 6.5 | 9.0 | 20.0 | 8.0 |
| 55 | 10.0 | 6.5 | 9.0 | 20.0 | 9.6 |
| 56 | 12.0 | 7.0 | 9.0 | 20.0 | 9.6 |
| 57 | 12.0 | 7.0 | 9.5 | 20.0 | 9.6 |
| 58 | 13.0 | 7.5 | 9.5 | 25.0 | 9.6 |
| 59 | 14.0 | 8.0 | 10.0 | 25.0 | 9.6 |
| 60 | 15.0 | 8.5 | 10.5 | 30.0 | 9.6 |
| 61 | 16.0 | 11.0 | 15.0 | 30.0 | 9.6 |
| 62 | 22.0 | 16.0 | 20.0 | 45.0 | 20.0 |
| 63 | 16.0 | 12.0 | 17.5 | 35.0 | 9.6 |
| 64 | 18.0 | 14.0 | 17.5 | 35.0 | 9.6 |
| 65 | 35.0 | 22.0 | 24.0 | 40.0 | 20.0 |
| 66 | 16.0 | 15.5 | 18.5 | 40.0 | 20.0 |
| 67 | 16.0 | 15.5 | 16.0 | 40.0 | 20.0 |
| 68 | 16.0 | 15.5 | 16.0 | 100.0 | 20.0 |
| 69 | 16.0 | 15.5 | 16.5 | 100.0 | 20.0 |
| 70 | 16.0 | 15.5 | 18.0 | 100.0 | 20.0 |
| 71 | 17.0 | 15.5 | 18.0 | 100.0 | 100.0 |
| 72 | 17.0 | 15.5 | 18.0 | 100.0 | 100.0 |
| 73 | 17.0 | 15.5 | 18.0 | 100.0 | 100.0 |
| 74 | 17.0 | 15.5 | 18.0 | 100.0 | 100.0 |
| 75 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Additional increments for retirees who have fifteen or more years of service at retirement on or after age 60

| | Teachers | State | Polisubs | Group II | Group III |
|---|---|---|---|---|---|
| | 8.0% | 2.0% | 2.0% | na | na |

Additional increments for retirees in the year in which they are first eligible for unreduced retirement prior to age 60

| | Teachers | State | Polisubs | Group II | Group III |
|---|---|---|---|---|---|
| | 12.5% | 7.5% | 7.5% | 15.0% | na |

# TABLE VIII (Continued)

## SUMMARY OF ACTUARIAL METHODS AND ASSUMPTIONS

## SERVICE RETIREMENT RATES

The following rates are applied at each age at which a member is eligible for an unreduced service retirement benefit.

FEMALE

| Age | Teachers | State | Polisubs | Group II | Group III |
|---|---|---|---|---|---|
| 50 | 6.5% | 7.5% | 8.0% | 10.0% | – |
| 51 | 7.0 | 7.5 | 8.0 | 10.0 | 8.0% |
| 52 | 8.0 | 7.5 | 8.0 | 15.0 | 8.0 |
| 53 | 9.0 | 7.5 | 8.0 | 15.0 | 8.0 |
| 54 | 10.0 | 7.5 | 8.0 | 20.0 | 8.0 |
| 55 | 10.0 | 7.5 | 8.0 | 20.0 | 9.6 |
| 56 | 12.0 | 8.0 | 9.0 | 20.0 | 9.6 |
| 57 | 14.0 | 8.0 | 9.5 | 20.0 | 9.6 |
| 58 | 14.0 | 8.0 | 10.0 | 25.0 | 9.6 |
| 59 | 15.0 | 8.0 | 11.0 | 25.0 | 9.6 |
| 60 | 17.0 | 9.0 | 11.0 | 30.0 | 9.6 |
| 61 | 20.0 | 12.0 | 13.0 | 30.0 | 9.6 |
| 62 | 26.0 | 18.0 | 18.0 | 45.0 | 20.0 |
| 63 | 19.5 | 12.0 | 16.0 | 35.0 | 9.6 |
| 64 | 24.0 | 14.0 | 16.0 | 35.0 | 9.6 |
| 65 | 37.5 | 22.0 | 22.0 | 40.0 | 20.0 |
| 66 | 24.0 | 17.0 | 19.0 | 40.0 | 20.0 |
| 67 | 24.0 | 17.0 | 19.0 | 40.0 | 20.0 |
| 68 | 24.0 | 17.0 | 19.0 | 100.0 | 20.0 |
| 69 | 24.0 | 17.0 | 19.0 | 100.0 | 20.0 |
| 70 | 34.0 | 17.0 | 19.0 | 100.0 | 20.0 |
| 71 | 40.0 | 17.0 | 19.0 | 100.0 | 100.0 |
| 72 | 40.0 | 17.0 | 19.0 | 100.0 | 100.0 |
| 73 | 40.0 | 17.0 | 19.0 | 100.0 | 100.0 |
| 74 | 40.0 | 17.0 | 19.0 | 100.0 | 100.0 |
| 75 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

Additional increments for retirees who have fifteen or more years of service at retirement on or after age 60

| | Teachers | State | Polisubs | Group II | Group III |
|---|---|---|---|---|---|
| | 8.0% | 2.0% | 2.0% | na | na |

Additional increments for retirees in the year in which they are first eligible for unreduced retirement prior to age 60

| | Teachers | State | Polisubs | Group II | Group III |
|---|---|---|---|---|---|
| | 12.5% | 7.5% | 7.5% | 15.0% | na |

TABLE VIII (Continued)

SUMMARY OF ACTUARIAL METHODS AND ASSUMPTIONS

## Commencement Dates and Forms of Payment

Retiring participants are assumed to elect the normal form of payment commencing immediately.

Terminating participants and inactive participants who are entitled to future benefits are assumed to elect the normal form of payment commencing at the age at which a member is eligible for an unreduced service retirement benefit.

## Expenses

The assumed Interest Rate disclosed above is net of investment expenses. A 0.17% load is included in the Actuarially Determined Contribution Rates for administrative expenses.

## TABLE IX

## EFFECT OF REVISED ACTUARIAL METHODS AND ASSUMPTIONS ON KEY VALUATION RESULTS

The mortality improvement assumption adopted with the 2016 experience study utilizes the most current projection scale published by the Society of Actuaries as of the actuarial valuation date. As of June 30, 2020, the projection scale was updated from Scale MP-2018 to Scale MP-2019. This change resulted in a decrease in the liabilities and contribution rates.

The load included in the Actuarially Determined Contribution Rates for administrative expenses was decreased from 0.21% to 0.17% effective June 30, 2020. This change resulted in a decrease in the contribution rates.

There were no other changes in actuarial methods and assumptions since the previous valuation that impacted results.

# TABLE X-1

## INFORMATION ON POLITICAL SUBDIVISIONS

## VALUATION BALANCE SHEET

*June 30, 2020*

| ASSETS | Legacy Plan | Alternative Plan | Hybrid Plan No Controls | Hybrid Plan With Controls | Total Polisubs |
|---|---|---|---|---|---|
| Present assets creditable to: | | | | | |
| State Accumulation Fund | $10,068,185,301 | $277,835 | $6,366,143 | $5,838,160 | $10,080,667,439 |
| Members' Fund | 1,404,932,828 | 471,518 | 4,337,796 | 16,548,330 | 1,426,290,472 |
| Total Present Assets | $11,473,118,129 | $749,353 | $10,703,939 | $22,386,490 | $11,506,957,911 |
| Present value of prospective contributions payable to: | | | | | |
| State Accumulation Fund: | | | | | |
| Normal | $1,311,636,446 | $499,410 | $10,924,371 | $21,401,475 | $1,344,461,702 |
| Accrued Liability | (314,377,228) | 18,662 | (512,253) | 727,291 | (314,143,528) |
| Total | $997,259,218 | $518,072 | $10,412,118 | $22,128,766 | $1,030,318,174 |
| Members' Fund | 715,527,105 | 1,337,606 | 7,647,286 | 72,347,579 | 796,859,576 |
| Total Prospective Contributions | $1,712,786,323 | $1,855,678 | $18,059,404 | $94,476,345 | $1,827,177,750 |
| **Total Assets** | **$13,185,904,452** | **$2,605,031** | **$28,763,343** | **$116,862,835** | **$13,334,135,661** |
| **LIABILITIES** | | | | | |
| Present value of prospective benefits payable on accounts of: | | | | | |
| Present retired members and contingent annuitants | $5,124,640,839 | $0 | $751,072 | $24,595 | $5,125,416,506 |
| Present active members | 6,732,832,689 | 2,564,539 | 27,041,756 | 113,449,421 | 6,875,888,405 |
| Former members | 1,328,430,924 | 40,492 | 970,515 | 3,388,819 | 1,332,830,750 |
| **Total Liabilities** | **$13,185,904,452** | **$2,605,031** | **$28,763,343** | **$116,862,835** | **$13,334,135,661** |

# TABLE X-2

## INFORMATION ON POLITICAL SUBDIVISIONS

## SCHEDULE OF FUNDED RATIOS

*June 30, 2020*

| Funding Group | Actuarial Value of Assets | Actuarial Accrued Liability | Unfunded Actuarial Accrued Liability | Funded Ratio | Covered Payroll | Unfunded Actuarial Accrued Liability as a Pct of Covered Payroll |
|---|---|---|---|---|---|---|
| **Legacy Plan** | $11,473,118,129 | $11,158,740,901 | ($314,377,228) | 102.82% | $2,871,749,450 | (10.95%) |
| **Alternative Plan** | 749,353 | 768,015 | 18,662 | 97.57% | 2,437,761 | 0.77% |
| **Hybrid Plan - No Controls** | 10,703,939 | 10,191,686 | (512,253) | 105.03% | 30,951,272 | (1.66%) |
| **Hybrid Plan - With Controls** | 22,386,490 | 23,113,781 | 727,291 | 96.85% | 142,723,958 | 0.51% |
| **Total Polisubs** | $11,506,957,911 | $11,192,814,383 | ($314,143,528) | 102.81% | $3,047,862,441 | (10.31%) |

# TABLE XI

## LETTER RELATED TO THE PUBLIC SAFETY OFFICER BRIDGE BENEFIT

December 22, 2020

Mr. Jamie Wayman
Director
Tennessee Consolidated Retirement System
502 Deaderick Street
Nashville, TN 37243-0201

Re: Supplement to TCRS June 30, 2020 Actuarial Valuation (Legacy Pension Plans)

Dear Jamie:

The purpose of this letter is to finalize the contribution rate associated with the public safety officer bridge benefit and to document the net contribution rate for the Consolidated State group from the June 30, 2020 TCRS actuarial valuation of the Closed State and Higher Education Employee Pension Plan.

Communications associated with the June 30, 2020 actuarial valuation disclose the total Consolidated State contribution rate, including the cost associated with the public safety officer bridge payments. The total contribution rate can be separated into a public safety officer contribution rate and a general Consolidated State contribution rate to reflect contributions specifically collected to fund the public safety officer bridge benefit.

According to calculations determined in conjunction with the June 30, 2020 actuarial valuation, the public safety office bridge benefit results in an extra contribution rate to be applied only to public safety officer payroll of 3.78%. The anticipated collection of this amount reduces the total Consolidated State contribution rate by 0.15% of payroll, resulting in a net contribution rate for the Consolidated State group of 20.50% (20.65% – 0.15%) according to the June 30, 2020 actuarial valuation.

As a result, a contribution rate of 24.28% (20.50% + 3.78%) should be charged to the public safety officer payroll, while 20.50% should be used as the general Consolidated State contribution rate in order to satisfy the total contribution rate recommendations of the June 30, 2020 actuarial valuation.

Please advise if we may provide additional information or be of assistance in any way.

Kindest regards,

Justin Thacker

Justin C. Thacker, F.S.A.

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# TABLE XII

# ACTUARIAL CERTIFICATION

## Purpose and Use:

This report has been prepared exclusively for the Tennessee Consolidated Retirement System to determine the funding level of the plan based on the June 30, 2020 valuation, and may not be appropriate for other purposes. A separate report will provide the financial disclosure items required by the Governmental Accounting Standards Board. Findley is not responsible for consequences resulting from the use of any part of this report without prior authorization or approval. This report provides actuarial advice and does not constitute legal, accounting, tax or investment advice. Determinations for other purposes, such as bond ratings or judging benefit security, may be significantly different from the results shown in this report.

Actuarial findings in this report are based on actuarial assumptions which reflect expected plan experience. Although the deviation of the actual future plan experience and the expected experience inherently creates some uncertainty with the results, in our opinion the actuarial assumptions reasonably reflect the expected future experience of the plan. Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period or additional cost or contribution requirements based on the plan's funded status); and changes in plan provisions or applicable law. Due to the limited scope of the assignment, we did not perform an analysis of the potential range of such future measurements.

## Data:

The calculations shown in this report have been prepared using employee data and plan documentation furnished by the Tennessee Consolidated Retirement System as of June 30, 2020 and plan assets furnished by the Tennessee Consolidated Retirement System for the twelve month period ending June 30, 2020. While we have not audited the data, we have reviewed it for reasonableness and internal consistency, and to the best of our knowledge, there are no material limitations to the data provided.

## Subsequent Events:

We are unaware of any subsequent event after the dates above which would have a material effect on the results presented in this report.

## Assumptions, Methods and Procedures:

The actuarial calculations contained in the report are built on deterministic actuarial modeling, making a single determination of liabilities and costs. Further, these actuarial calculations are based on a combination of demographic and asset data, as well as assumptions concerning future changes in these data. As such, the actuarial calculations contained herein are an estimate of projected future occurrences.

## Changes in Plan Provisions, Actuarial Assumptions and Methods:

The mortality improvement assumption adopted with the 2016 experience study utilizes the most current projection scale published by the Society of Actuaries as of the actuarial valuation date. As of June 30, 2020, the projection scale was updated from Scale MP-2018 to Scale MP-2019. This change resulted in a decrease in the liabilities and contribution rates.

The load included in the Actuarially Determined Contribution Rates for administrative expenses was decreased from 0.21% to 0.17% effective June 30, 2020. This change resulted in a decrease in the contribution rates.

No other changes were made to the plan provisions, actuarial assumptions and methods effective June 30, 2020.

Summaries of the plan provisions, actuarial assumptions and methods can be found in Sections G and H of this report.

## TCRS Funding Policy:

This report was prepared in accordance with the funding policy adopted by the TCRS Board of Trustees.

## Professional Qualifications:

This report has been prepared under the supervision of Justin C. Thacker, a member of the American Academy of Actuaries, a Fellow of the Society of Actuaries, and a consulting actuary with Findley, who has met the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions herein. To the best of our knowledge this report has been prepared in accordance with generally accepted actuarial standards, including the overall appropriateness of the analysis, assumptions, and results and conforms to appropriate Standards of Practice as promulgated from time to time by the Actuarial Standards Board, which standards form the basis for the actuarial report. We are not aware of any direct or material indirect financial interest or relationship, including investment management or other services that could create, or appear to create, a conflict of interest that would impair the objectivity of our work. The undersigned are available to provide supplemental information or explanation.

Justin Thacker

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October 31, 2021
Date

Tim Lavender

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Date