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# Teachers' and State Employees' Retirement System Principal Results of Actuarial Valuation as of December 31, 2017

## October 25, 2018 Board of Trustees Meeting

**Larry Langer, ASA, FCA, EA, MAAA**
**Jonathan Craven, ASA, FCA, EA, MAAA**

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# Purpose of the Annual Actuarial Valuation

- As of the end of each calendar year:
  - An annual actuarial valuation is performed on TSERS
  - The actuary determines the amount of employer contributions to be made to TSERS during each member's career that, when combined with investment return and member contributions, are expected to be sufficient to pay for retirement benefits.
- • In addition, the annual actuarial valuation is performed to:
  - Determine the progress on funding TSERS
  - Explore why the results of the current valuation differ from the results of the valuation of the previous year
  - Satisfy regulatory and accounting requirements

# The Valuation Process

- The diagram to the right summarizes the inputs and results of the actuarial valuation process.
- A detailed summary of the valuation process and a glossary of actuarial terms are provided in Appendix A of the actuarial report.
- This diagram will appear throughout the presentation to designate where we are in the process.

**Inputs**

Member Data
Asset Data
Benefit Provisions
Assumptions
Funding Methodology

↓

**Results**

Actuarial Value of Assets
Actuarial Accrued Liability
Net Actuarial Gain or Loss
Funded Ratio
Benefit Enhancement
Additional Disclosures
Projections

# Member Data



The table below provides a summary of the membership data used in this valuation compared to the prior valuation.

| Number as of | 12/31/2017 | 12/31/2016 |
|---|---|---|
| Active Members | 304,554 | 305,013 |
| Members currently receiving Disability Income Plan benefits | 6,680 | 7,477 |
| Terminated members and survivors of deceased members entitled to benefits but not yet receiving benefits | 160,087 | 151,581 |
| Retired members and survivors of deceased members currently receiving benefits | 215,008 | 208,443 |
| Total | 686,329 | 672,514 |

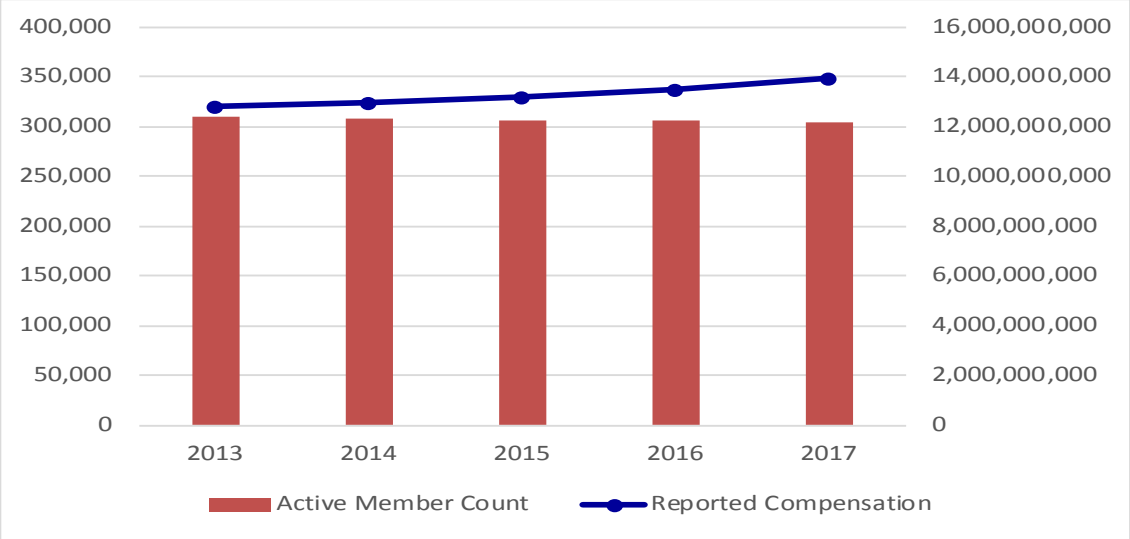
The number of active members decreased by 0.2% from the previous valuation date. The decrease in active members results in less benefits accruing, but also fewer contributions supporting the system. The number of retired members and survivors of deceased members currently receiving benefits increased by 3.1% from the previous valuation. The increase in retiree population is consistent with expectations.

A detailed summary of the membership data used in this valuation is provided in Section 3 and Appendix B.

# Active Members



The graph below provides a history of the number of active members and reported compensation over the past five years.



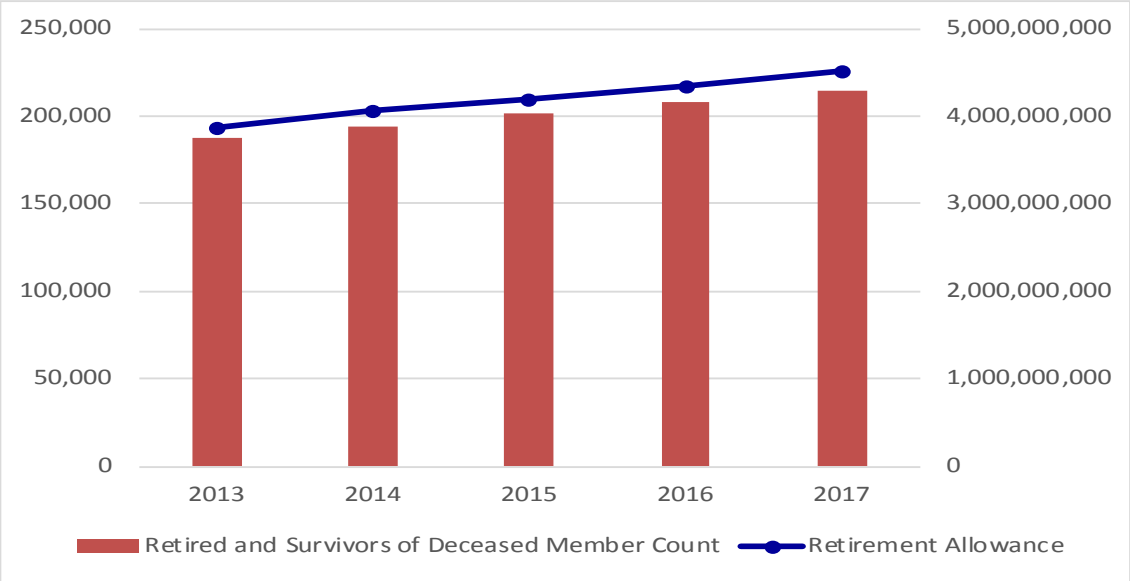

Reported compensation has increased by 3.1% and has slightly grown over the past five years. Covered payroll is expected to increase by approximately 3.5% annually in the future. Payroll that is not increasing as fast as we assume results in less benefits accruing than we anticipate, but also fewer contributions supporting the system.

A detailed summary of the membership data used in this valuation is provided in Section 3 and Appendix B.

# Membership Data



The graph below provides a history of the number of retired members and survivors of deceased members and benefit amounts payable over the past five years.




The number of retired members and survivors of deceased members and the benefits paid to these members has been increasing steadily, as expected based on plan assumptions.

A detailed summary of the membership data used in this valuation is provided in Section 3 and Appendix B.

# Asset Data



The table below provides details of the Market Value of Assets for the current and prior year's valuations.

| Asset Data as of | 12/31/2017 | 12/31/2016 |
|---|---|---|
| Beginning of Year Market Value of Assets | $ 64,246,523,614 | $ 62,669,341,716 |
| Contributions | 2,420,414,120 | 2,237,806,330 |
| Benefit Payments and Administrative Expense | (4,580,566,798) | (4,490,780,171) |
| Investment Income | 8,521,516,312 | 3,830,155,739 |
| Net Increase/(Decrease) | 6,361,363,634 | 1,577,181,898 |
| End of Year Value of Assets | $ 70,607,887,248 | $ 64,246,523,614 |
| Estimated Net Investment Return | 13.49% | 6.22% |

TSERS assets are held in trust and are invested for the exclusive benefit of plan members.

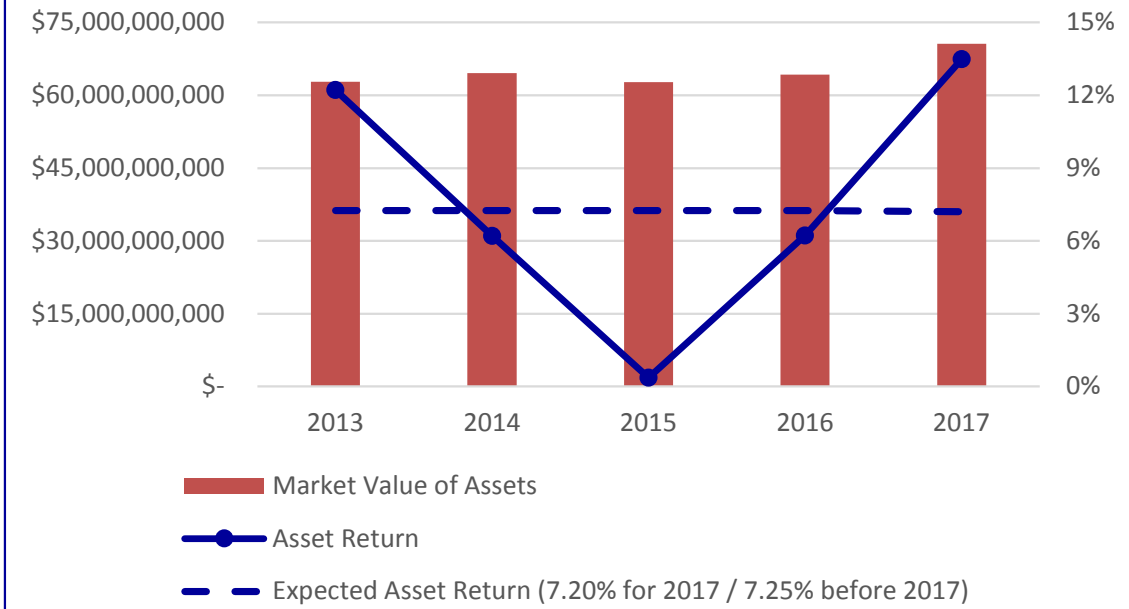
Incoming contributions cover roughly half of the outgoing benefit payments and administrative expenses. Over the long term, benefit payments and administrative expenses not covered by contributions are expected to be covered with investment income, illustrating the benefits of following actuarial pre-funding since inception.

A detailed summary of the market value of assets is provided in Section 4.

# Asset Data



The graph below provides a history of the market value of assets and asset returns over the past five years.



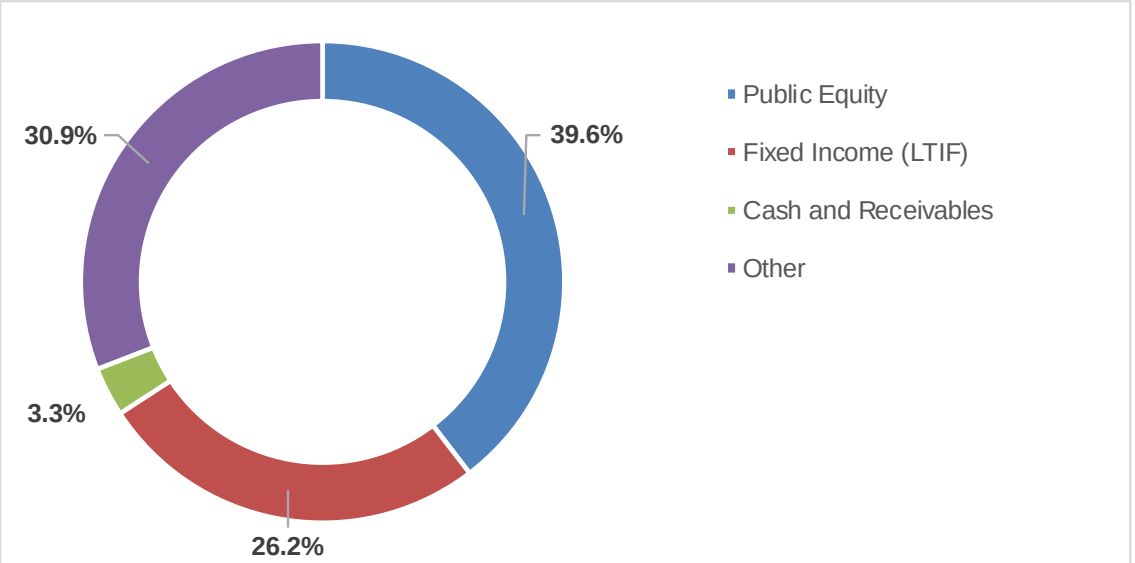

Market value returns exceeded the assumed rate of return for the first time since 2013. However, the return on the actuarial value of assets which is used to determine the contribution rates did not exceed the 7.20% assumed rate of return in 2017 because of delayed recognition of less than expected returns in 2015 and 2016.

A detailed summary of the market value of assets is provided in Section 4.

# Asset Data



The graph below provides the breakdown of the market value of assets at December 31, 2017 by asset category.




Based on historical market returns, the current asset allocation, the current investment policy, and the expectation of future asset returns, as reviewed in the last experience study, the 7.00% discount rate used in this valuation is reasonable and appropriate.

A detailed summary of the market value of assets is provided in Section 4.

# Benefit Provisions



Benefit provisions are described in North Carolina General Statutes, Chapter 135.

- This valuation reflects the following changes in benefit provisions from the prior year's valuation:
  - One-time pension supplement in the amount of 1.0% of the annualized benefit in effect on September 1, 2018 to be paid in October 2018.
  - Addition of eligibility for reduced benefits after 25 years of service for law enforcement officers. (We are assuming no one elects to retire under this provision since it would reduce the actuarial value of their benefit from this plan).

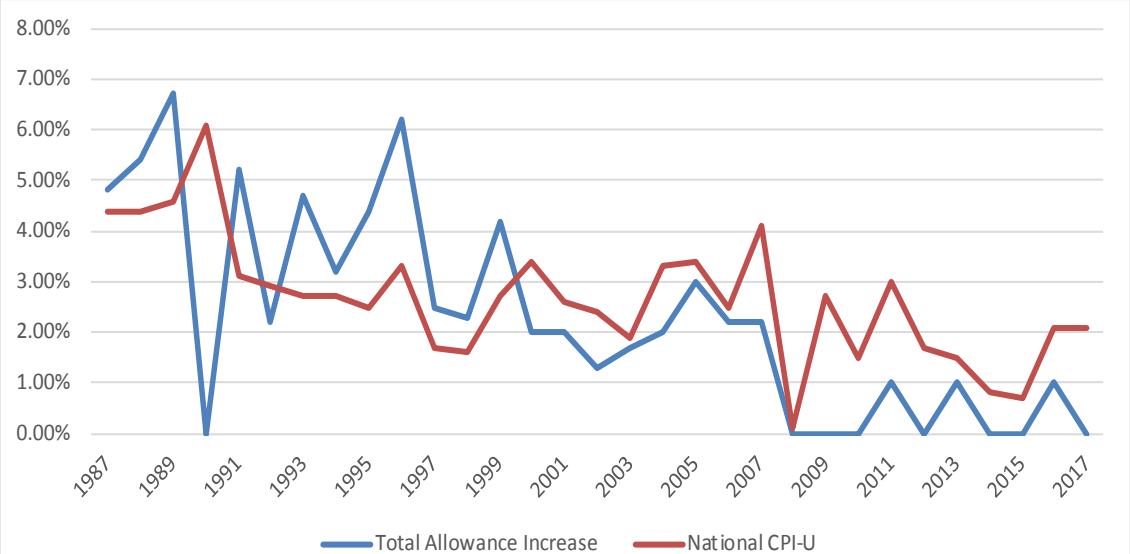
Many Public Sector Retirement Systems in the United States have undergone pension reform where the benefits of members (active or future members) have been reduced. Because of the well-funded status of TSERS due to the legislature contributing the actuarially determined employer contribution, benefit cuts have not been made in North Carolina as they have been in most other states. Instead, we have seen a modest expansion of benefits in recent years based on sound plan design.

A detailed summary of the benefit provisions is provided in Appendix C.

# Benefit Provisions



The graph below provides a 30-year history of allowance increases for TSERS and the national CPI-U. It does not include one-time supplements granted in recent years.




Generally the ad-hoc retirement allowance increase policy has helped retirees maintain purchasing power while helping to moderate contribution increases during times of down markets.

A detailed summary of the benefit provisions is provided in Appendix C of the actuarial report.

# Actuarial Assumptions



Actuarial assumptions bridge the gap between the information that we know with certainty as of the valuation date and what may happen in the future. The assumptions used include the following:

- Demographic
  - Retirement
  - Termination
  - Disability
  - Death
- Economic
  - Interest rate – 7.00% per year
  - Salary increase (individual, varies by service)
  - Inflation – 3.00%
  - Real wage growth – 0.50%

The assumptions used for the December 31, 2017 actuarial valuation are based on the experience study prepared as of December 31, 2014 and adopted by the Board of Trustees on January 21, 2016. The discount rate was updated to be 7.00%, as adopted by the Board of Trustees on April 26, 2018. The impact on the contribution rate will be direct-rate smoothed over a three year period.

A detailed summary of the actuarial assumptions and methods is provided in Appendix D.

# Funding Methodology



The Funding Methodology is the payment plan for TSERS and is composed of the Actuarial Cost Method, the Asset Valuation Method and Amortization Method.

- Actuarial Cost Methods allocate costs to the actuarial accrued liability (i.e. the amount of money that should be in the fund) for past service and normal cost (i.e. the cost of benefits accruing during the year) for current service.
  - The Board of Trustees has adopted Entry Age Normal as its actuarial cost method
  - Develops normal costs that stay level as a percent of payroll

"While in the past many actuarial cost methods were available, Entry Age has emerged as the practice of choice." - GFOA Best Practice "Core Elements of a Pension Funding Policy" http://www.gfoa.org/core-elements-funding-policy

A detailed summary of the actuarial assumptions and methods is provided in Appendix D.

# Funding Methodology

**Inputs**
Membership Data
Asset Data
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↓
**Results**
Actuarial Value of Assets
Actuarial Accrued Liability
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The Funding Methodology is the payment plan for TSERS and is composed of the Actuarial Cost Method, the Asset Valuation Method and Amortization Method.

- Asset Valuation Methods smooth or average the market value returns over time to alleviate contribution volatility that results from market returns.
  - Asset returns in excess of or less than the expected return on market value of assets reflected over a five-year period
  - Assets corridor: not greater than 120% of market value and not less than 80% of market value

"Asset smoothing methods (aka Actuarial Value of Assets) are still preferred for funding policies" - GFOA Best Practice "Core Elements of a Pension Funding Policy" http://www.gfoa.org/core-elements-funding-policy

A detailed summary of the actuarial assumptions and methods is provided in Appendix D.

# Funding Methodology



The Funding Methodology is the payment plan for TSERS and is composed of the Actuarial Cost Method, the Asset Valuation Method and Amortization Method.

- Amortization Methods determine the payment schedule for unfunded actuarial accrued liability (i.e. the difference between the actuarial accrued liability and actuarial value of assets)
  - Payment level: the payment is determined as a level dollar amount, similar to a mortgage payment
  - Payment period: a 12-year closed amortization period was adopted for fiscal year ending 2012. A new amortization base is created each year based on the prior years' experience.
- For fiscal years beginning subsequent to January 1, 2017, the sum of the "normal contribution" and the "accrued liability contribution" shall not be less than the employee contribution.

When compared to other Public Sector Retirement Systems in the United States, the funding policy for TSERS is quite aggressive in that the policy pays down the pension debt over a much shorter period of time (12 years) compared to the national average of around 24 years. In addition, payments are developed to stay level instead of the increasing policy many systems use which results in lower payments early on. As such it is a best practice among public retirement systems.

A detailed summary of the actuarial assumptions and methods is provided in Appendix D.

# Actuarial Value of Assets



The table below provides the calculation of the Actuarial Value of Assets (AVA) at the valuation date.

| Asset Data as of | 12/31/2017 |
|---|---|
| Beginning of Year Market Value of Assets | $ 64,246,523,614 |
| Contributions | 2,420,414,120 |
| Benefit Payments | (4,580,566,798) |
| Net Cash Flow | (2,160,152,678) |
| Expected Investment Return | 4,560,938,030 |
| Expected End of Year Market Value of Assets | 66,647,308,966 |
| End of Year Market Value of Assets | 70,607,887,248 |
| Excess of Market Value over Expected Marted Value of Assets | 3,960,578,282 |
| 80% of 2017 Asset Gain/(Loss) | 3,168,462,626 |
| 60% of 2016 Asset Gain/(Loss) | (379,020,740) |
| 40% of 2015 Asset Gain/(Loss) | (1,750,005,244) |
| 20% of 2014 Asset Gain/(Loss) | N/A |
| Total Deferred Asset Gain/(Loss) | 1,039,436,642 |
| Preliminary End of Year Actuarial Value of Assets | 69,568,450,606 |
| Final End of Year Actuarial Value of Asset (not less than 80% and not greater than 120% of Market Value) | 69,568,450,606 |
| Estimated Net Investment Return on Actuarial Value | 6.56% |

A detailed summary of the Actuarial Value of Assets is provided in Section 4.

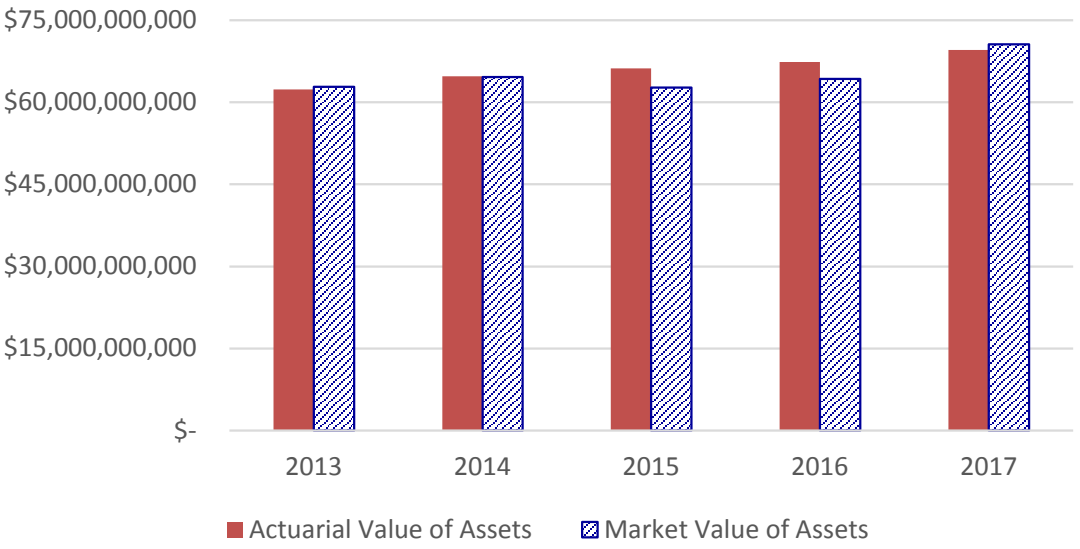
The actuarial value of assets smooths investment gains/losses, resulting in less volatility in the employer contribution. The asset valuation recognizes asset returns in excess of or less than the expected return on the market value of assets over a five-year period. Actuarial value of assets was reset to the market value of assets at December 31, 2014.

Lower than expected market returns in 2015 and 2016, which were partially offset by greater than expected market returns in 2017, resulted in an actuarial value of asset return for calendar year 2017 of 6.56% and a recognized actuarial asset loss of $0.4 billion during 2017.

# Actuarial Value of Assets



The graph below provides a history of the market value and actuarial value of assets over the past five years.




The market value of assets is higher than the actuarial value of assets, which is used to determine employer contributions. This indicates that overall there are unrecognized asset gains to be recognized in future valuations. However, if the investments earn the expected 7.00% over the next four years, a loss will be recognized in both the December 31, 2018 and the December 31, 2019 valuations, and a gain will be recognized in the December 31, 2020 and the December 31, 2021 valuations.

A detailed summary of the Actuarial Value of Assets is provided in Section 4.

# Actuarial Value of Assets



The table to the right provides a history of the Actuarial Value and Market Value of Asset returns.

| Calendar Year | Actuarial Value of Asset Return | Market Value of Asset Return |
|---|---|---|
| 1998 | 9.92% | 16.66% |
| 1999 | 10.60% | 10.15% |
| 2000 | 11.55% | 2.50% |
| 2001 | 8.51% | -1.87% |
| 2002 | 5.66% | -5.21% |
| 2003 | 7.98% | 18.23% |
| 2004 | 8.56% | 10.73% |
| 2005 | 8.26% | 6.97% |
| 2006 | 8.94% | 11.41% |
| 2007 | 8.87% | 8.38% |
| 2008 | 2.89% | -19.50% |
| 2009 | 4.74% | 14.84% |
| 2010 | 5.89% | 11.47% |
| 2011 | 5.15% | 2.19% |
| 2012 | 6.32% | 11.82% |
| 2013 | 7.43% | 12.21% |
| 2014 | 7.19% | 6.21% |
| 2015 | 5.87% | 0.36% |
| 2016 | 5.32% | 6.22% |
| 2017 | 6.56% | 13.49% |
| Average | 7.29% | 6.49% |
| Range | 8.66% | 37.73% |

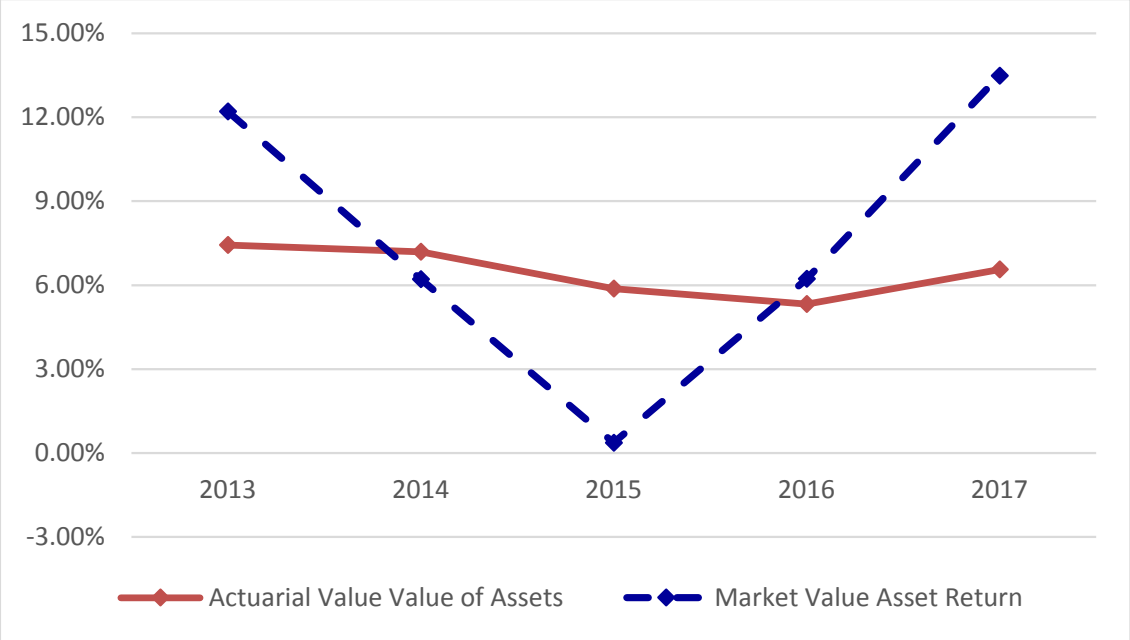
The average investment return recognized for purposes of determining the annual change in contribution each year is the actuarial value of assets return. Currently, the average actuarial return over the past 20 years of 7.31% tracks average market return of 6.86% relatively well. But the range of returns is markedly less 8.66% versus 37.73%. This results in much lower employer contribution volatility using the actuarial value of assets versus market, while ensuring that the actuarial needs of TSERS are met.

A detailed summary of the Actuarial Value of Assets is provided in Section 4.

# Actuarial Value of Assets



The graph below provides a history of the market value and actuarial value of asset returns over the past five years.



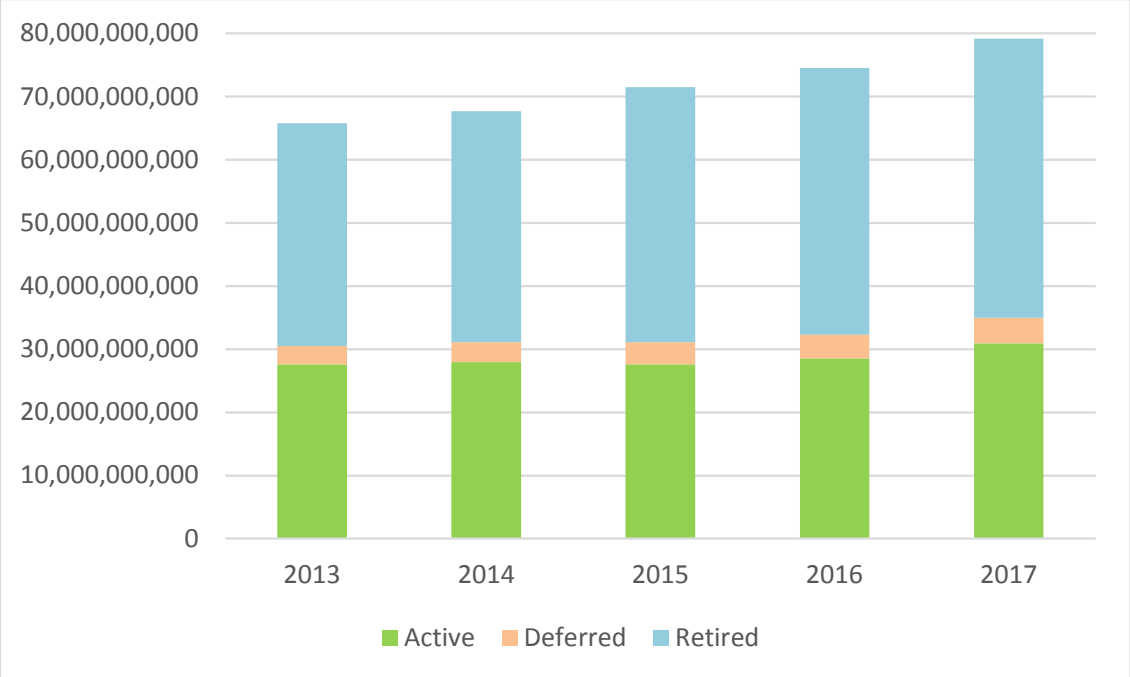

The investment return for the market value of assets for calendar year 2017 was 13.49%. The actuarial value of assets smooths investment gains and losses. Lower than expected market returns in 2015 and 2016 which were partially offset by greater than expected market returns for 2017 resulted in an actuarial value of asset return for calendar year 2017 of 6.56% and a recognized actuarial asset loss of $0.4 billion during 2017.

A detailed summary of the Actuarial Value of Assets is provided in Section 4.

# Actuarial Accrued Liability



The graph below provides a history of the actuarial accrued liability (AAL) over the past five years.



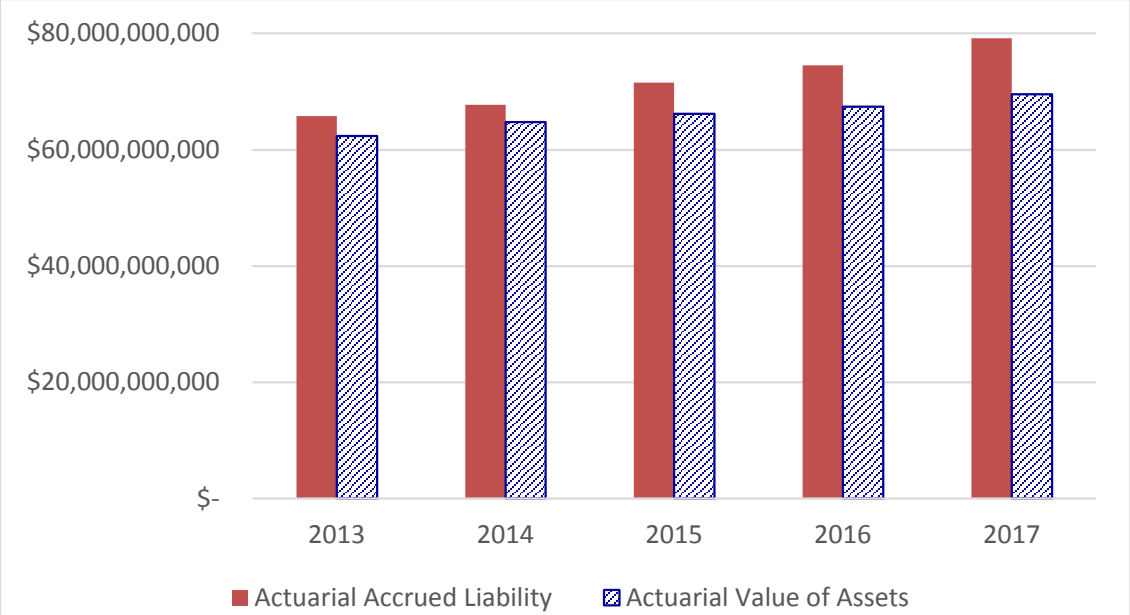

The AAL increased from $74.5 billion to $79.2 billion during 2017. The Retirement System is an open plan, which means that new members enter the plan each year. In an open plan, liabilities are expected to grow from one year to the next as more benefits accrue and the membership approaches retirement. The AAL prior to assumption and legislation changes was $178 million higher than expected, which resulted in a demographic loss of $178 million during 2017. Assumption changes increased the AAL by $1.623 billion. Legislation changes increased the AAL by $44 million.

A detailed summary of the Actuarial Accrued Liability is provided in Section 5.

# AVA and AAL



The graph below provides a history of the actuarial accrued liability and actuarial value of assets.




The difference in the actuarial accrued liability and the actuarial value of assets is known as the Unfunded Actuarial Accrued Liability, or the pension debt. The UAAL is $9.64 billion as of 12/31/2017 and is to be paid off in 12 years.

Detailed summaries of the AVA and AAL are provided in Sections 4 and 5 respectively.

# Net Actuarial Gain or Loss



The table below provides a reconciliation of the prior year's unfunded actuarial accrued liability to the current year's unfunded actuarial accrued liability.

| (in millions) | | |
|---|---|---|
| Unfunded Actuarial Accrued Liability (UAAL) as of 12/31/2016 | $ | 7,171 |
| Increase due to Transition to New Actuary | | 553 |
| Normal Cost and Administrative Expense during 2017 | | 1,492 |
| Reduction due to Actual Contributions during 2017 | | (2,420) |
| Interest on UAAL, Normal Cost, and Contributions | | 577 |
| Asset (Gain) / Loss | | 423 |
| Actuarial Accrued Liability (Gain) / Loss | | 178 |
| Impact of Assumption Changes | | 1,623 |
| Impact of Legislative Changes | | 44 |
| Unfunded Actuarial Accrued Liability (UAAL) as of 12/31/2017 | $ | 9,641 |

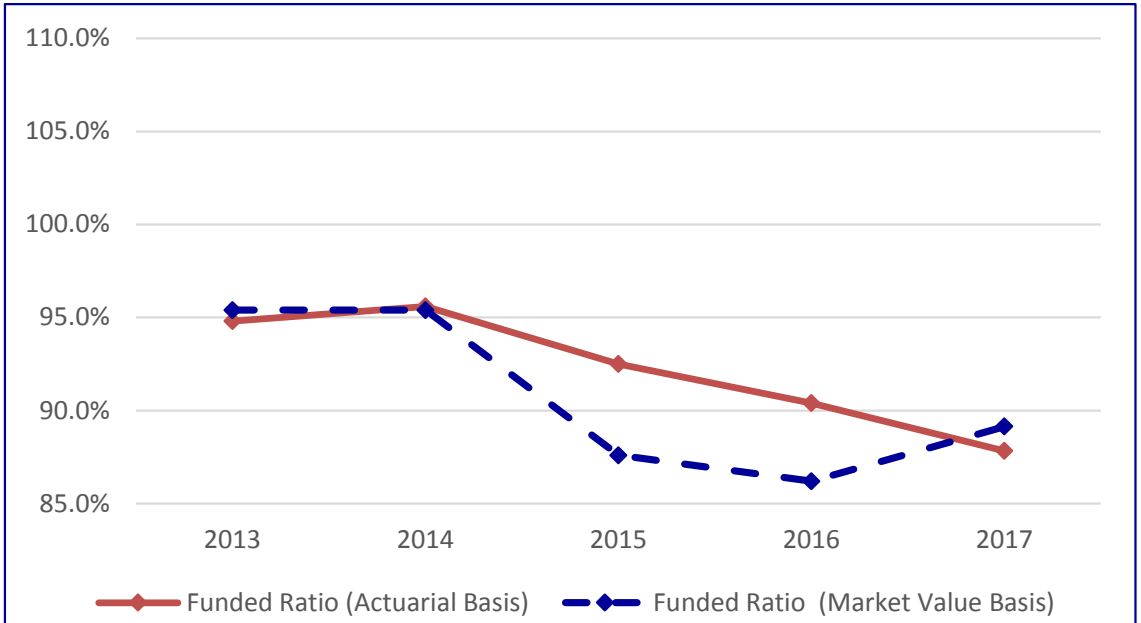
During 2017, there was a transition from the prior actuary to CMC, resulting in valuation programing, modifications and differences in methodologies, such as payroll increase timing, that increased the UAAL by $553 million. In addition, during 2017, the UAAL increased faster than expected primarily due to assumption changes. The change in assumption reflects the change in interest rate from 7.20% to 7.00% and increased the unfunded actuarial accrued liability (UAAL), or pension debt, by $1.623 billion. The loss recognized in the Actuarial Value of Assets during the year increased the UAAL by $423 million. Additionally, changes in plan provisions increased the UAAL by $44 million.

A detailed summary of the net actuarial gain or loss is provided in Section 5.

# Funded Ratio



The graph below provides a history of the funded ratio on a market and actuarial basis over the past five years.




The ratio of assets to liabilities shows the health of the plan on an accrued basis. The funded ratio on an actuarial basis decreased from 90.4% at December 31, 2016 to 87.4% at December 31, 2017.

A detailed summary of the funded ratio is provided in Section 5.

# Employer Contributions



The graph below provides a history of actuarially determined employer contribution rates over the past five years before applying funding policy minimums.


The rates are split into the normal rate, the accrued liability rate and a rate for changes due to legislation. The normal rate is the employer's portion of the cost of benefits accruing after reducing for the member contribution. The accrued liability rate is the payment toward the unfunded liability.

The actuarially determined employer contribution rate is the amount needed to pay for the cost of the benefits accruing and to pay off the pension debt over 12 years, offset for the 6% of pay contribution the members make. The 12-year period is a short period for Public Sector Retirement Systems in the United States, with the funding period for most of these Systems much longer. The shorter period results in higher contributions and more benefit security.

A detailed summary of the actuarially determined employer contribution rates is provided in Section 6.

# Employer Contributions



The ECRSP (Employer Contribution Rate Stabilization Plan) would result in a recommended contribution rate of 12.97% of payroll for fiscal year ending 2020.

- 14.16% is the actuarially determined employer contribution calculated in this most recent valuation prior to direct-rate smoothing of the assumption change. 12.97% is the actuarially determined contribution after direct-rate smoothing of the assumption change.
- The minimum is 12.64%; the appropriated contribution from last year of 12.29% plus 0.35%.
- The maximum is approximately 68.46%; the estimated actuarially determined employer contribution using a discount rate equal to the long-term Treasury bond yield (2.74%).

The ECRSP adopted by the Board of Trustees on January 21, 2016 requires that recommended contributions be 0.35% of payroll greater than the appropriated contribution during the prior year, with the following bounds: (1) contributions may not be less than the actuarially determined employer contribution (ADEC) calculated below and (2) contributions may not be greater than a contribution determined using the same assumptions used to calculate the ADEC based on the long-term Treasury bond yield.

A detailed summary of the actuarially determined employer contribution rates is provided in Section 6.

# Employer Contributions



The table below provides a history of the actuarially determined employer contribution and the corresponding appropriated rate.

| Valuation Date | Fiscal Year Ending | Normal Rate | Accrued Liability Rate | Change due to Legislation* | Final ADEC | Appropriated Rate |
|---|---|---|---|---|---|---|
| 12/31/2017 | 06/30/2020 | 4.87% | 8.10% | N/A | N/A | N/A |
| 12/31/2016 | 06/30/2019 | 4.48% | 7.50% | 0.31% | 12.29% | 12.29% |
| 12/31/2015 | 06/30/2018 | 4.31% | 5.77% | 0.45% | 10.53% | 10.78% |
| 12/31/2014 | 06/30/2017 | 5.21% | 3.26% | 1.49% | 9.96% | 9.98% |
| 12/31/2013 | 06/30/2016 | 5.19% | 3.50% | 0.00% | 8.69% | 9.15% |
| 12/31/2012 | 06/30/2015 | 5.15% | 3.61% | 0.39% | 9.15% | 9.15% |

* The change due to legislation for the contribution for fiscal year ending 6/30/2019 includes a 0.31% increase in the ADEC due to the one-time cost-of-living supplement payable in October, 2018.

The appropriated rate for fiscal year ending 2019 is 12.29% of payroll. The preliminary ADEC for fiscal year ending 2020 is 12.97% of payroll.

In addition to calculating the ADEC, we calculated the increase in ADEC for a 1% COLA to be 0.43% of payroll and the increase in UAAL to be $484,872,000. We also calculated the increase in ADEC for a 0.1% increase in the Defined Benefit Formula to be 0.43% of payroll and the increase in UAAL to be $412,702,000.

A detailed summary of the actuarially determined employer contribution rates is provided in Section 6.

# Employer Contributions



The table below provides a reconciliation of the actuarially determined employer contribution rate shown as a percentage of covered payroll.

| | |
|---|---|
| Fiscal year ending June 30, 2019 Preliminary ADEC (based on December 31, 2016 valuation) | 11.98% |
| Impact of Legislative Changes* | 0.00% |
| Fiscal year ending June 30, 2019 ADEC for Reconciliation | 11.98% |
| Change due to Transition to New Actuary | 0.26% |
| Change Due to Anticipated Reduction in UAAL** | (0.26%) |
| Change Due to Demographic (Gain)/Loss | 0.17% |
| Change Due to Investment (Gain)/Loss | 0.36% |
| Change Due to Contributions Greater than ADEC*** | (0.13%) |
| Impact of Assumption Change | 1.78% |
| Impact of Direct Rate Smoothing | (1.19%) |
| Fiscal year ending June 30, 2020 Preliminary ADEC (based on December 31, 2017 valuation) | 12.97% |

* The impact of legislative changes does not reflect the cost of the one-time pension supplement to be paid in October 2018, as the entire cost of this supplement was funded in the appropriated contribution for fiscal year ending June 30, 2019 and is not reflected in the ADEC for fiscal year ending June 30, 2020. In addition, House Bill 284 had no cost impact on the ADEC.
** Amortization of the UAAL is determined as a level dollar amount with payments expected to remain the same over the amortization period, but was calculated as a percentage of valuation payroll in the previous valuation. Payroll is expected to increase annually while the expected amortization payment does not increase. This causes the expected amortization payment to be a lesser percentage of the expected payroll.
***Includes impact of ECRSP rate in excess of ADEC

The change in rate due to investment loss is based on the actuarial value of assets return, which was less than the 7.20% assumed return.

The impact of the assumption change, the reduction from 7.20% assumed return to 7.00%, was a contribution rate increase of 1.78% of covered payroll. This will be phased in over the next three years, being fully reflected for the fiscal year ending June 30, 2022 results.

A detailed summary of the actuarially determined employer contribution rates is provided in Section 6.

# Potential COLAs



- Based on the actuarial losses recognized in this December 31, 2017, valuation, no Cost-of-Living Adjustment (COLA) effective July 1, 2019, could be funded by actuarial gains.
- Based on the methods and assumptions used for the projections discussed later in the presentation, we estimate that a potential COLA effective July 1, 2020, may be funded by actuarial investment gains following the December 31, 2018, valuation in the following circumstances:
  - If calendar year 2018 market value returns exceed 8.0% (or about $5.5B for TSERS), the plan is estimated to have an actuarial investment gain (rather than a loss) for 2017 and a COLA that would take effect on July 1, 2020, could be considered.
  - If calendar year 2018 market value returns exceed 11.5% (or about $8.0B for TSERS), the plan is estimated to have an actuarial investment gain (rather than a loss) for 2018 and such gain may be enough to consider providing a 1% COLA that would take effect on July 1, 2020.
    - Estimated actuarial investment gain of $484.9M
    - Estimated cost of 1% COLA payable to retirees effective July 1, 2019 of $484.9M
  - Estimates above assume no other offsetting actuarial losses in the December 31, 2018, valuation
- Note: CMC cannot provide legal advice. This slide should not be interpreted as legal advice as to the Board's ability to provide a COLA to retirees or recommend a COLA to the legislature

A detailed summary of the cost of benefit enhancements is provided in Section 6.

# Additional Disclosures



The table below illustrates the sensitivity of certain valuation results to changes in the discount rate on a market value of assets basis.

| Discount Rate | 2.74% | 4.87% | 7.00% | 9.13% | 11.26% |
|---|---|---|---|---|---|
| Market Value of Assets | $ 70,607,887,248 | $ 70,607,887,248 | $ 70,607,887,248 | $ 70,607,887,248 | $ 70,607,887,248 |
| Actuarial Accrued Liability | $131,033,504,596 | $100,412,644,167 | $ 79,209,347,668 | $ 64,613,996,514 | $ 54,226,841,071 |
| Unfunded Accrued Liabilty (AAL) | $ 60,425,617,348 | $ 29,804,756,919 | $ 8,601,460,420 | $ (5,993,890,734) | $ (16,381,046,177) |
| Funded Ratio | 53.9% | 70.3% | 89.1% | 109.3% | 130.2% |
| 20-Year Amortization of UAL | $ 4,073,171,158 | $ 2,480,501,439 | $ 868,744,141 | N/A | N/A |
| (as % of general state revenue) | 13.6% | 8.3% | 2.9% | N/A | N/A |

Section 6(c) of Session Law 2016-108 requires that the actuarial valuation report provide the valuation results using a 30-year Treasury rate as of December 31 of the year of the valuation as the discount rate. The 30-year treasury rate is 2.74% as of December 31, 2017.

The difference between the UAAL measured at 7.00% and 2.74% is $51.8 billion at December 31, 2017.

A detailed summary of the additional disclosures is provided in Appendix F.

# Additional Disclosures



The table below provides an estimate of future market value of asset returns based on the study performed in 2016.

| Horizon | 95% Chance (19 out of every 20 scenarios) | 75% Chance (3 out of every 4 scenarios) | 50% Chance (1 out of every 2 scenarios) | 25% Chance (1 out of every 4 scenarios) | 5% Chance (1 out of every 20 scenarios) |
|---|---|---|---|---|---|
| 10 Years (2025) | 0.2% | 4.0% | 5.9% | 8.0% | 11.5% |
| 20 Years (2035) | 2.2% | 4.8% | 6.7% | 8.5% | 11.8% |
| 30 Years (2045) | 3.1% | 5.3% | 7.1% | 8.7% | 12.0% |

These results are summarized in the "TSERS Asset-Liability and Investment Strategy Project" report dated April 19th, 2016 prepared by Conduent, the prior actuary.

The lower bound of 2.74% falls slightly below the 5th percentile of estimated future 30-year returns. In other words, there is less than a 5% chance of seeing a 30-year return of 2.74% or lower based on the current portfolio structure.

A detailed summary of the additional disclosures is provided in Appendix F.

# Projections



- Projections of contribution requirements and funded status into the future can be helpful planning tools for stakeholders. This section provides such projections. The projections of the actuarial valuation are known as deterministic projections. Deterministic projections are based on one scenario in the future. The baseline deterministic projection is based on December 31, 2017 valuation results as assumptions.

- Key Projection Assumptions
  - Valuation interest rate of 7.00% for all years in conjunction with direct rate smoothing of the employer contribution rate over a 3-year period beginning July 1, 2019.
  - 7.00% investment return on market value of assets
  - Actuarial assumptions and methods as described in Appendix D. All future demographic experience is assumed to be exactly realized.
  - The contribution rate under the Employer Contribution Rate Stabilization Policy (ECRSP) is contributed until fiscal year ending 2022.
  - The actuarially determined employer contribution rate is contributed for fiscal years ending 2023 and beyond.
  - 0% increase in the total active member population
  - No cost-of-living adjustments granted
  - Future pay increases based on long-term salary increase assumptions

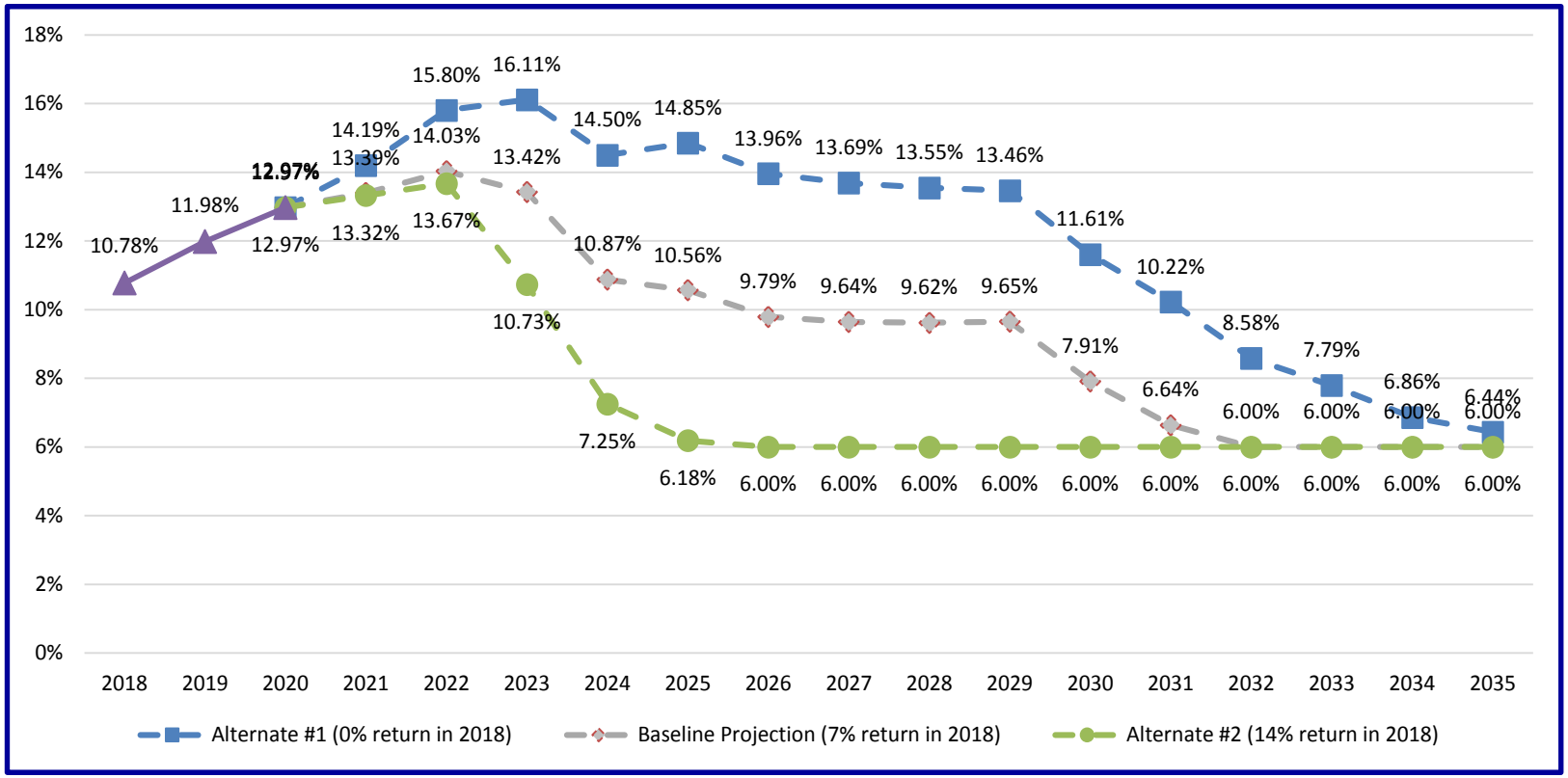
- The ECRSP adopted by the Board of Trustees on January 21, 2016 requires that recommended contributions be 0.35% of payroll greater than the appropriated contribution during the prior year, with the following bounds: (1) contributions may not be less than the actuarially determined employer contribution (ADEC) rate and (2) contributions may not be greater than a contribution determined using the same assumptions used to calculate the ADEC but using a discount rate equal to the long-term Treasury bond yield.

- In addition, we have provided two alternate deterministic projections. The first alternate deterministic projection is based on the same assumptions as the baseline deterministic projection except that it assumes a 0.0% asset return for calendar year 2018. The second alternate deterministic projection is based on the same assumptions as the baseline deterministic projection except that it assumes a 14.0% asset return for calendar year 2018.

A detailed summary of the deterministic projections is provided in Section 9.

# Projected Contribution Rates



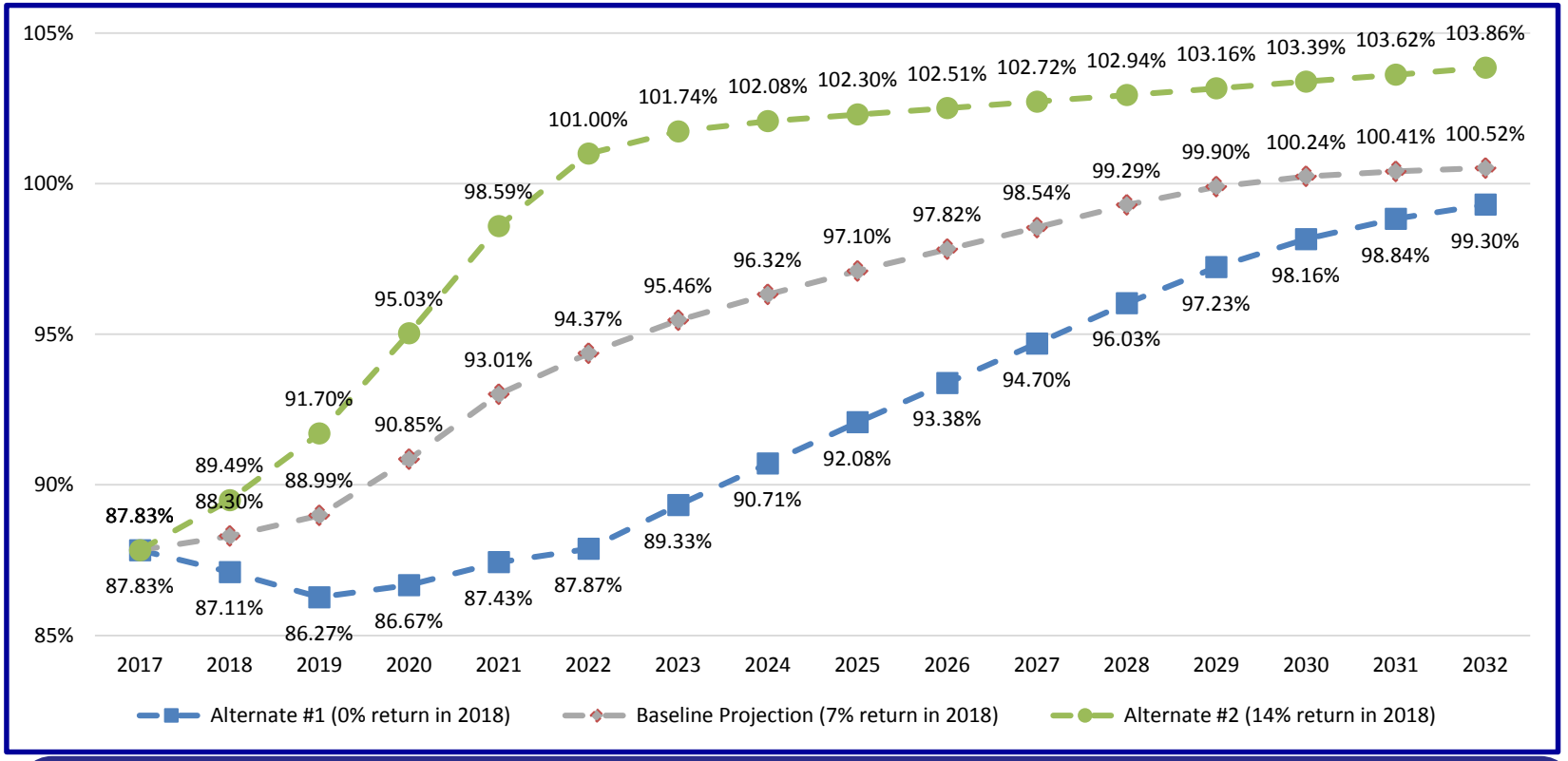



But for the floor of 6.00% on the employer contribution, the actuarially determined employer contribution rate trends to around 5.5%, which is the level of the cost of benefits accrued, or the long term employer cost of TSERS when there is no pension debt. The amounts above the long term employer cost of TSERS of 5.5% serves to increase the funded ratio above 100%.

A detailed summary of the deterministic projections is provided in Section 9.

# Projected Funded Ratio






Note that if the 7.00% return under the Baseline Projection is achieved, the funded ratio reaches the long term target of 100% within 15 years. This is a direct result of using a 12-year period to pay off the pension debt.

A detailed summary of the deterministic projections is provided in Section 9.

# Projections

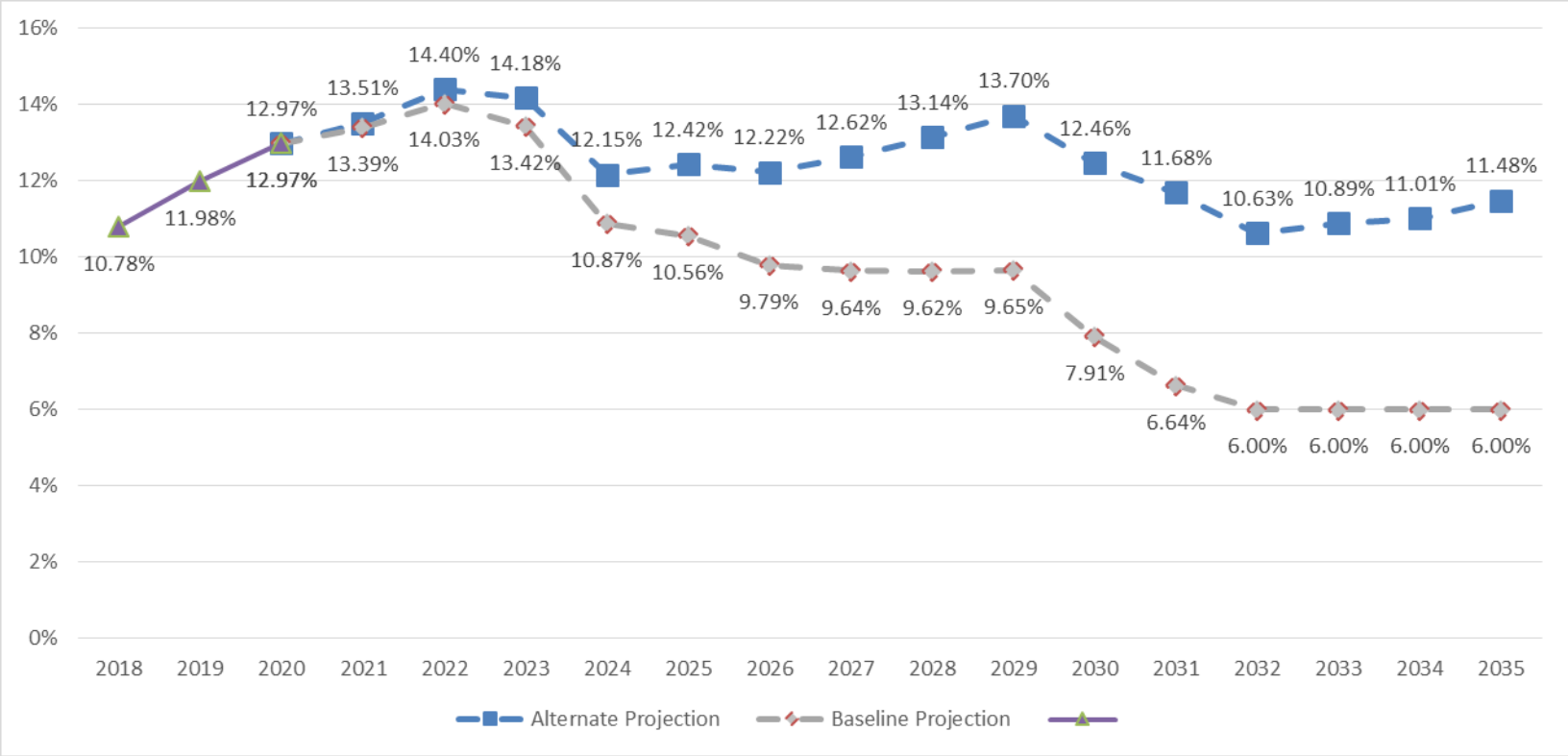


- The baseline projection uses the same basis described earlier in this presentation. The alternate deterministic projection is based on the same assumptions as the baseline deterministic projection except that it assumes a 6.0% investment return on market value of assets for all calendar years starting in 2018.

A detailed summary of the deterministic projections is provided in Section 9.

# Projected Contribution Rates



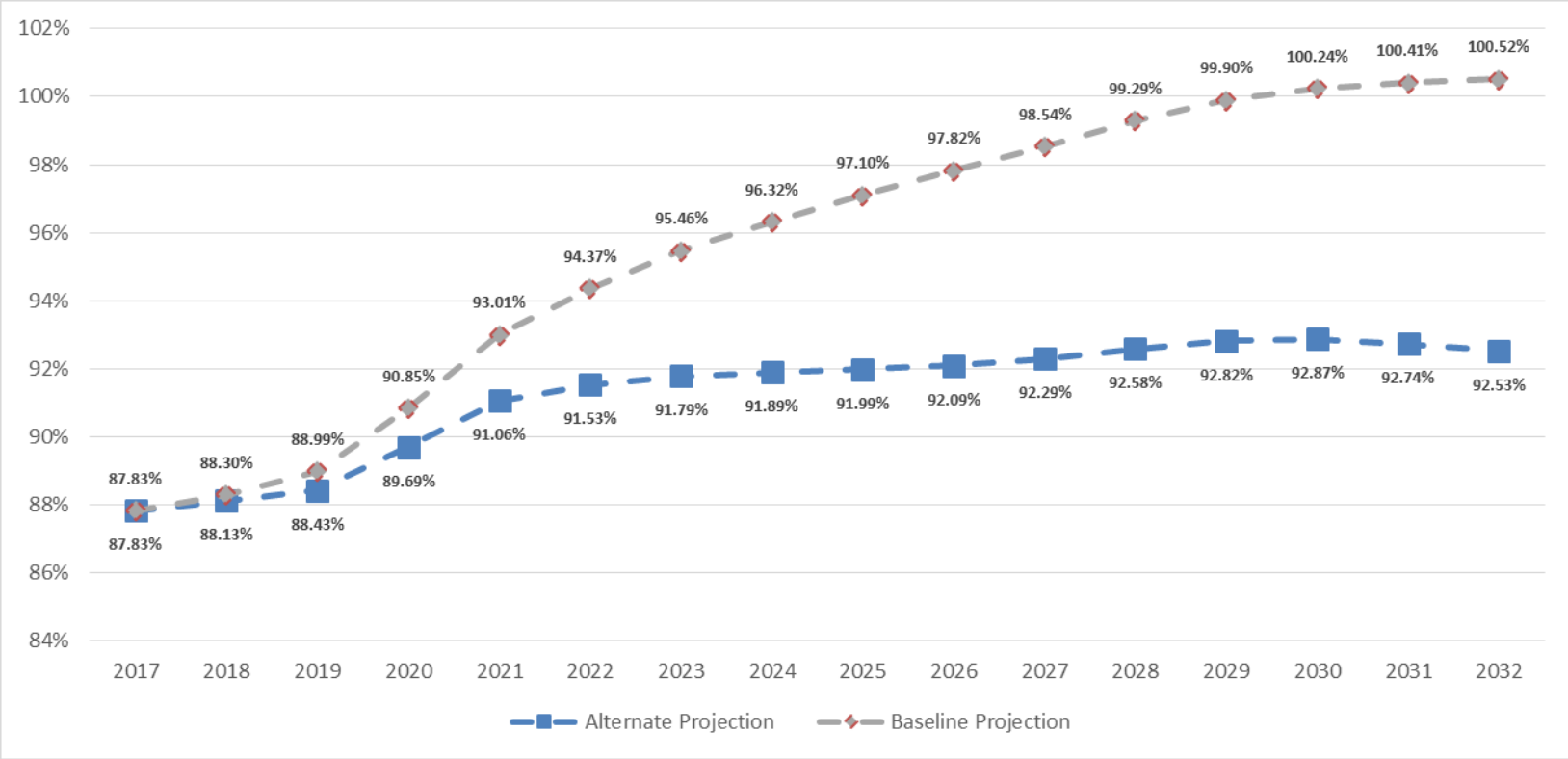



Alternate Projection assumes 6.00% asset returns every year starting in 2018 compared to the 7.00% assumption in the Baseline Projection. As a result, the unfunded accrued liability will be higher resulting in higher projected contributions.

A detailed summary of the deterministic projections is provided in Section 9.

# Projected Funded Ratio






Alternate Projection assumes 6.00% asset returns every year starting in 2017 compared to the 7.00% assumption in the Baseline Projection. As a result, the unfunded accrued liability will be higher resulting in a lower projected funded ratio.

A detailed summary of the deterministic projections is provided in Section 9.

# Key Takeaways

- Key results of the December 31, 2017 valuation were:
  - Market value returns of 13.49% compared to 7.20% assumed
  - Material legislative changes since the prior valuation:
    - One-time cost-of-living supplement equal to 1% of annual benefit payments for retired members and survivors of deceased members payable in October 2018
  - Change in discount rate from 7.20% to 7.00% as of December 31, 2017, with direct-rate smoothing of the change in the employer contributions rate over a three-year period

# Key Takeaways (continued)

- When compared to the December 31, 2016 baseline projections, the above resulted in:
  - A lower funded ratio as of December 31, 2017 (87.9% in the valuation compared to 89.7% in the baseline projection)
  - Higher actuarially determined employer contribution rate for fiscal year ending June 30, 2020 (12.97% in the valuation compared to 12.68% in the baseline projection)

# Key Takeaways (continued)

- TSERS is well funded compared to its peers. This is due to:
  - Stakeholders working together to keep TSERS well-funded since inception
  - A history of appropriating and contributing the recommended contribution requirements
  - Assumptions that in aggregate are more conservative than peers
  - A funding policy that aggressively pays down unfunded liability over a 12-year period
  - An ad hoc cost-of-living adjustment, which typically only provides benefit increases when certain financial conditions are met, supports the health of the system
  - Modest changes in benefits when compared to peers
- As has been done over the past 75+ years, continued focus on these measures will be needed to maintain the sustainability of TSERS well into the future

# Certification

Future actuarial measurements may differ significantly from current measurements due to plan experience differing from that anticipated by the economic and demographic assumptions, increases or decreases expected as part of the natural operation of the methodology used for these measurements, and changes in plan provisions or applicable law. Because of limited scope, Cavanaugh Macdonald performed no analysis of the potential range of such future differences, except for some limited analysis in financial projections or required disclosure information. Results prior to December 31, 2017 were provided by the prior consulting actuary.

We meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained in this report. This report has been prepared in accordance with all applicable Actuarial Standards of Practice, and we are available to answer questions about it.

Larry Langer, ASA, EA, FCA, MAAA
Principal and Consulting Actuary

Jonathan T. Craven, ASA, EA, FCA, MAAA
Consulting Actuary

Cavanaugh Macdonald
CONSULTING, LLC
*The experience and dedication you deserve*

# Teachers' and State Employees' Retirement System of North Carolina

## Report on the Seventy-Fifth Annual Valuation
## Prepared as of December 31, 2017

October 2018

www.CavMacConsulting.com

Cavanaugh Macdonald
CONSULTING, LLC
*The experience and dedication you deserve*

October 18, 2018

Board of Trustees
Teachers' and State Employees'
Retirement System of North Carolina
3200 Atlantic Avenue
Raleigh, NC 27604

Members of the Board:

We submit herewith our report on the seventy-fifth annual valuation of the Teachers' and State Employees' Retirement System of North Carolina (referred to as "TSERS" or the "State Plan") prepared as of December 31, 2017. The report has been prepared in accordance with North Carolina General Statute 135-6(o). Information contained in our report for plan years prior to December 31, 2017 is based upon valuations performed by the prior actuary.

The primary purpose of the valuation report is to determine the required member and employer contribution rates, to describe the current financial condition of TSERS, and to analyze changes in such condition. In addition, the report provides information that the Office of the State Controller (OSC) requires for its Comprehensive Annual Financial Report (CAFR) and it summarizes census data. Use of this report for any other purposes or by anyone other than OSC and its auditors, or North Carolina Retirement Systems Division and Department of State Treasurer staff may not be appropriate and may result in mistaken conclusions because of failure to understand applicable assumptions, methods, or inapplicability of the report for that purpose. The attached pages should not be provided without a copy of this cover letter. Because of the risk of misinterpretation of actuarial results, you should ask Cavanaugh Macdonald Consulting (CMC) to review any statement you wish to make on the results contained in this report. CMC will not accept any liability for any such statement made without prior review.

The valuation is based upon membership data and financial information as furnished by the Retirement Systems Division and the Financial Operations Division and as summarized in this report. Although reviewed for reasonableness and consistency with the prior valuation, these elements have not been audited by CMC and we cannot certify as to the accuracy and completeness of the data supplied. Sometimes assumptions are made by CMC to interpret membership data that is imperfect. The valuation is also based on benefit and contribution provisions as presented in this report. If you have reason to believe that the plan provisions are incorrectly described, that important plan provisions relevant to this valuation are not described, or that conditions have changed since the calculations were made, you should contact the authors of this actuarial report prior to relying on this information.

The valuation is further based on the actuarial valuation assumptions, approved by the Board of Trustees, as presented in this report. We believe that these assumptions are appropriate and reasonable and also comply with the requirements of GASB Statement No. 67. We prepared this valuation in accordance with the requirements of this standard and in accordance with all applicable ASOPs.

The assumptions used for the December 31, 2017 actuarial valuation are based on the experience study prepared as of December 31, 2014 and adopted by the Board of Trustees on January 21, 2016, as further updated to use a discount rate of 7.00% in conjunction with direct-rate smoothing of the employer contribution rate, as adopted by the Board of Trustees on April 26, 2018. The economic assumptions with respect to investment yield, salary increase and inflation have been based upon a review of the existing portfolio structure as well as recent and anticipated experience.

Where presented, references to "funded ratio" and "unfunded accrued liability" typically are measured on an actuarial value of assets basis. It should be noted that the same measurements using market value of assets would result in different funded ratios and unfunded accrued liabilities. Moreover, the funded ratio presented is appropriate for evaluating the need and level of future contributions but makes no assessment regarding the funded status of the plan if the plan were to settle (i.e. purchase annuities) for a portion or all of its liabilities. In various places in the report the results also show funded ratios and unfunded liabilities based upon varying sets of assumptions as well as market values of assets as that is required for certain disclosure information required per accounting rules or statutes. Where this has been done it has been clearly indicated.

Future actuarial results may differ significantly from the current results presented in this report due to such factors as the following: fund experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; and changes in plan provisions or applicable law. Such changes in law may include additional costs resulting from future legislated benefit improvements or cost-of-living pension increases or supplements, which are not anticipated in the actuarial valuation. Because of limited scope, CMC performed no analysis of the potential range of such future differences, except for some limited analysis in financial projections or required disclosure information.

We meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained in this report. This report has been prepared in accordance with all applicable Actuarial Standards of Practice, and we are available to answer questions about it.

Respectfully submitted,

Larry Langer, ASA, EA, FCA, MAAA
Principal and Consulting Actuary

Jonathan T. Craven, ASA, EA, FCA, MAAA
Consulting Actuary

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# Executive Summary

## Overview

The North Carolina Retirement Systems Division (RSD) was established in 1941 to provide retirement benefits for public servants in the State of North Carolina. Today, under the management of the Department of State Treasurer, RSD administers seven public pension plans (defined benefit plans), three supplemental retirement plans (voluntary defined contributions plans), a health trust fund, a disability income plan, death benefit funds and a number of other benefit programs. As of December 31, 2017, the RSD defined benefit plans cover over one million current and prior public servants of the state of North Carolina. During the fiscal year ending June 30, 2017, RSD paid over $6.0 billion in pensions to more than 300,000 retirees. And as of June 30, 2018, RSD's defined benefit plan assets were valued at over $98 billion.

Under the supplemental retirement plans, the amount of contributions in any given year is defined by law. The amount of benefits derived is dependent on the investment returns the individual achieves. Conversely, under the pension plans, the amount of the benefit paid to a member upon retirement, termination, death or disability is defined by law. The amount of contributions needed to fund these benefits cannot be known with certainty. In North Carolina, like other states, these contributions are paid during a public servant's career so that upon retirement, termination, death, or disability, there are funds available to pay these benefits. These amounts are determined through an actuarial valuation. Actuarial valuations are performed for each of the pension plans administered by RSD and the results are contained in actuarial valuation reports like this.

In 1941, the Teachers' and State Employees' Retirement System (referred to as "TSERS" or the "State Plan") was established. TSERS provides benefits to all full-time teachers and state employees in all public school systems, universities, departments, institutions and agencies of the state. With over $70 billion in assets and over 680,000 members as of December 31, 2017, it is the largest pension plan within the System. This actuarial valuation report is our annual analysis of the financial health of TSERS. This report, prepared as of December 31, 2017, presents the results of the seventy-fifth annual valuation of TSERS.

## Purpose

An actuarial valuation is performed on TSERS annually as of the end of the calendar year. The actuary determines the amount of contributions to be made to TSERS during each member's career that, when combined with investment return, will be sufficient to pay for retirement benefits.

In addition, the annual actuarial valuation is performed to:

- Determine the progress on funding TSERS,
- Explore why the results of the current valuation differ from the results of the valuation of the previous year, and
- Satisfy regulatory and accounting requirements.

A detailed summary of the valuation process and a glossary of actuarial terms are provided in Appendix A.

# Executive Summary (continued)

### Key Takeaways

The actuarial valuation is performed each year to replace the estimates the actuary assumed for the prior valuation with the actual events that happened. This past year, as expected, some of the assumptions used in the prior valuation were not realized. Key results of the December 31, 2016 valuation were:

- Market value returns during calendar year 2017 of 13.49% compared to 7.20% assumed
- Recent legislation signed into law since the prior valuation, including the following material provision:
  - One-time cost-of-living supplement equal to 1% of annual benefit payments for retired members and survivors of deceased members payable in October 2018
- Change in discount rate from 7.20% to 7.00% as of December 31, 2017, with direct-rate smoothing of the change in the employer contributions rate over a three-year period

When compared to the December 31, 2016 projections, the above resulted in:

- A lower funded ratio as of December 31, 2017 (87.8% in the valuation compared to 89.7% in the baseline projection)
- Higher actuarially determined employer contribution rate for fiscal year ending June 30, 2020 (12.97% in the valuation compared to 12.68% in the baseline projection)

TSERS is well funded compared to its peers. This is due to:

- Stakeholders working together to keep TSERS well-funded since inception
- A history of appropriating and contributing a minimum of the recommended contribution requirements
- Implementation of the ECRSP which provides additional funding of the System
- Assumptions that in aggregate are more conservative than peers
- A funding policy that aggressively pays down the unfunded liability over a 12-year period
- An ad hoc cost-of-living adjustment, which typically only provides benefit increases when certain financial conditions are met, supports the health of the system
- Modest changes in benefits when compared to peers

As has been done over the past 77 years, continued focus on these measures will be needed to maintain the solid status of TSERS well into the future.

More details can be found later in this report. We encourage readers to start with Sections 1 and 2 and refer to other sections for additional details as needed.

This report, prepared as of December 31, 2017, presents the results of the seventy-fifth annual valuation of the system. The principal results of the valuation and a comparison with the preceding year's results are summarized below.

# Section 1: Principal Results

## Table 1: Summary of Principal Results

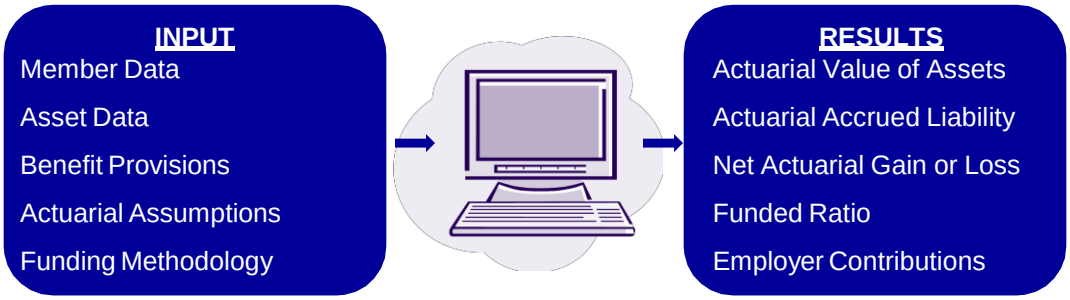
| Valuation Results as of | 12/31/2017 | 12/31/2016 |
|---|---|---|
| Active Members | | |
| Number | 304,554 | 305,013 |
| Reported Compensation | $ 13,914,085,325 | $ 13,497,815,754 |
| Valuation Compensation * | $ 15,058,805,483 | $ 14,282,093,846 |
| Retired Members and Survivors of Deceased Members Currently Receiving Benefits | | |
| Number | 215,008 | 208,443 |
| Annual Allowances | $ 4,521,393,822 | $ 4,343,259,132 |
| Assets | | |
| Actuarial Value (AVA) | $ 69,568,450,606 | $ 67,376,892,466 |
| Market Value (MVA) | $ 70,607,887,248 | $ 64,246,523,614 |
| Actuarial Accrued Liability (AAL) | $ 79,209,347,668 | $ 74,547,855,025 |
| Unfunded Accrued Liability (AAL - AVA) | $ 9,640,897,062 | $ 7,170,962,559 |
| Funded Ratio (AVA / AAL) ** | 87.8% | 90.4% |
| **Results for Fiscal Year Ending** | **6/30/2020** | **6/30/2019** |
| Actuarially Determined Employer Contribution (ADEC), as a percentage of payroll | | |
| Normal Cost | 5.17% | 4.48% |
| Accrued Liability | 8.99% | 7.50% |
| Total Preliminary ADEC | 14.16% | 11.98% |
| Total Based on Direct Rate Smoothing | 12.97% | N/A |
| Impact of Legislative Changes | N/A | 0.31% |
| Final ADEC | 12.97% | 12.29% |
| Board of Trustees Recommended Contribution under the Employer Contribution Rate Stabilization Policy (ECRSP) | 12.97% | 12.29% |
| Required Employer Contribution NCGS 135-8(d) | 12.97% | 12.29% |
| **Appropriation Act for Fiscal Year Ending** | **6/30/2019** | **6/30/2018** |
| Employer Contribution Rate as a percentage of payroll | | |
| Normal Cost | 5.17% | 4.48% |
| Accrued Liability | 7.12% | 6.30% |
| Total | 12.29% | 10.78% |
| Preliminary Reserve for Undistributed Gains/(Losses) | (0.68)% | (1.20)% |

*Reported compensation annualized for new hires and projected for valuation purposes.

**The Funded Ratio on a Market Value of Assets basis is 89.1% at December 31, 2017.

# Section 2: The Valuation Process

The following diagram summarizes the inputs and results of the actuarial valuation process.




A more detailed description of the valuation process is provided in Appendix A.

## Valuation Input: Membership Data

As with any estimate, the actuary collects information that we know now. Under the actuarial valuation process, current information about TSERS members is collected annually by the Retirement Systems Division staff at the direction of the actuary. Membership data will assist the actuary in estimating benefits that could be paid in the future. Information about benefit provisions and assets held in the trust as of the valuation date is also collected.

The member information the actuary collects includes data elements such as current service, salary and benefit group identifier for members that have not separated service, and actual benefit amounts and form of payment for members that have separated service. Data elements such as gender and date of birth are used to determine when a benefit might be paid and for how long.

# Section 2: The Valuation Process

## Valuation Input: Membership Data (continued)

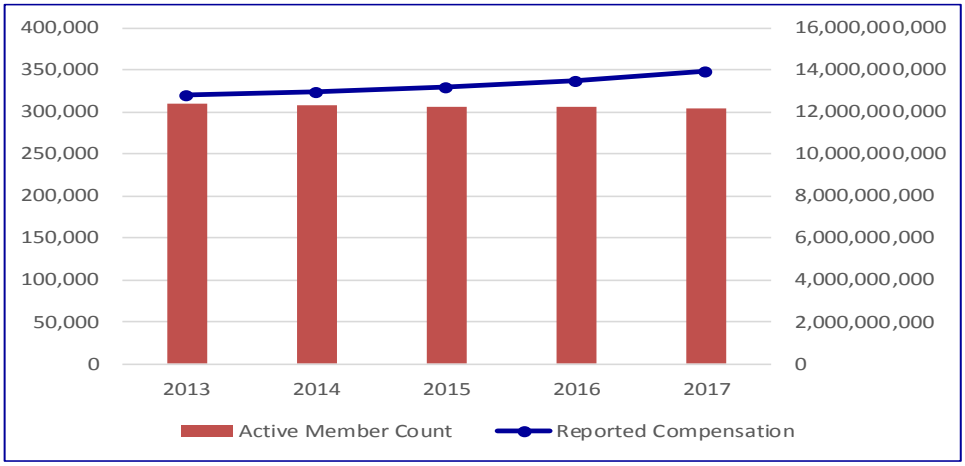
The table below provides a summary of the membership data used in this valuation compared to the prior valuation.

| Number as of | 12/31/2017 | 12/31/2016 |
|---|---|---|
| Active Members | 304,554 | 305,013 |
| Members currently receiving Disability Income Plan benefits | 6,680 | 7,477 |
| Terminated members and survivors of deceased members entitled to benefits but not yet receiving benefits | 160,087 | 151,581 |
| Retired members and survivors of deceased members currently receiving benefits | 215,008 | 208,443 |
| Total | 686,329 | 672,514 |

**Commentary:** The number of active members decreased by 0.2% from the previous valuation date. The decrease in active members results in less benefits accruing, but also fewer contributions supporting the system. The number of retired members and survivors of deceased members currently receiving benefits increased by 3.1% from the previous valuation. The increase in retiree population is consistent with expectations.

### Graph 1: Active Members

The graph below provides a history of the number of active members and reported compensation over the past five years.



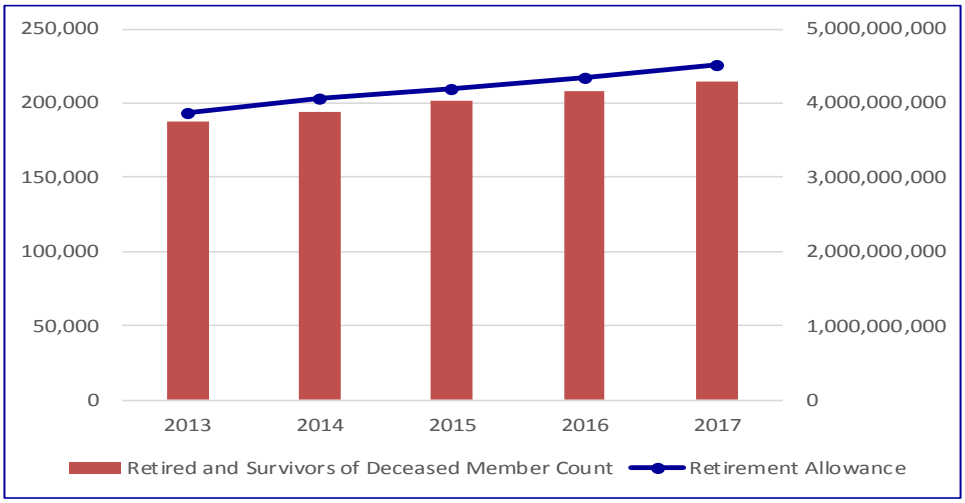

**Commentary:** Reported compensation has increased by 3.1% and has slightly grown over the past five years. Covered payroll is expected to increase by approximately 3.5% annually in the future. Payroll that is not increasing as fast as we assume results in less benefits accruing than we anticipate, but also fewer contributions supporting the system.

# Section 2: The Valuation Process

## Valuation Input: Membership Data (continued)

### Graph 2: Retired Members and Survivors of Deceased Members

The graph below provides a history of the number of retired members and survivors of deceased members and benefit amounts payable over the past five years.




**Commentary:** The number of retired members and survivors of deceased members and the benefits paid to these members has been increasing steadily, as expected based on plan assumptions.

A detailed summary of the membership data used in this valuation is provided in Section 3 and Appendix B of this report.

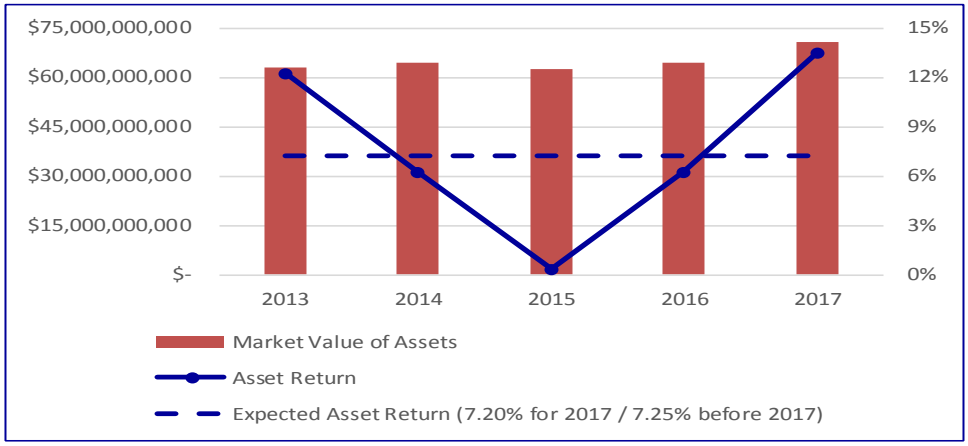
# Section 2: The Valuation Process

## Valuation Input: Asset Data

TSERS assets are held in trust and are invested for the exclusive benefit of plan members. The Market Value of Assets is $70.6 billion as of December 31, 2017 and was $64.2 billion as of December 31, 2016. The investment return for the market value of assets for calendar year 2017 was 13.49%.

### Graph 3: Market Value of Assets and Asset Returns

The graph below provides a history of the market value of assets and asset returns over the past five years.



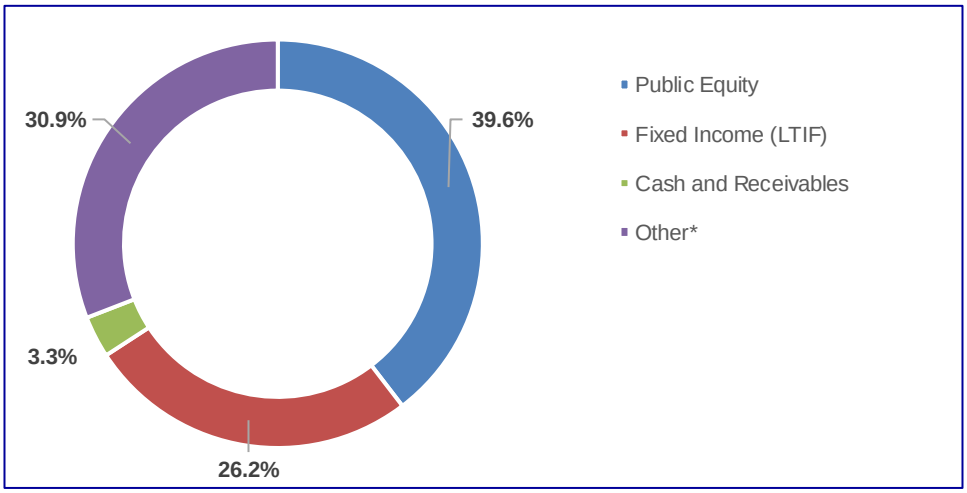

**Commentary:** Market value returns exceeded the assumed rate of return for the first time since 2013. However, the return on the actuarial value of assets which is used to determine the contribution rates did not exceed the 7.20% assumed rate of return in 2017 because of delayed recognition of less than expected returns in 2015 and 2016.

# Section 2: The Valuation Process

## Valuation Input: Asset Data (continued)

### Graph 4: Allocation of Investments by Category

The graph below provides the breakdown of the market value of assets at December 31, 2017 by asset category.




* Real Estate, Alternatives, Inflation and Credit

**Commentary:** Based on historical market returns, the current asset allocation, the current investment policy, and the expectation of future asset returns, as reviewed in the last experience study, the 7.00% discount rate used in this valuation is reasonable and appropriate.

A detailed summary of the market value of assets is provided in Section 4 of this report.

# Section 2: The Valuation Process

## Valuation Input: Benefit Provisions

Benefit provisions are described in North Carolina General Statutes, Chapter 135.

This valuation reflects the following changes in benefit provisions from the prior year's valuation:

- One-time pension supplement in the amount of 1.0% of the annualized benefit in effect on September 1, 2018 to be paid in October 2018.
- Addition of eligibility for reduced benefits after 25 years of service for law enforcement officers. (We are assuming no one elects to retire under this provision since it would reduce the actuarial value of their benefit from this plan).

Highlights of the benefit provisions are described below.

- An unreduced retirement allowance is payable to non-law enforcement members who retire from service:
  - after attaining age 65 and five years of creditable service;
  - after attaining age 60 and 25 years of creditable service; or
  - after attaining 30 years of creditable service
- An unreduced retirement allowance is payable to law enforcement members who retire from service:
  - after attaining age 55 and five years of creditable service; or
  - after attaining 30 years of creditable service
- The unreduced retirement allowance is equal to 1.82% of a member's final average compensation multiplied by the number of years of creditable service.
- A reduced retirement allowance is payable to non-law enforcement members who retire from service:
  - after attaining age 60 and five years of membership service; or
  - after attaining age 50 and 20 years of creditable service.
- A reduced retirement allowance is payable to law enforcement members who retire from service after attaining age 50 and 15 years of creditable service or after attaining 25 years of creditable service.
- Ancillary benefits are also payable upon the death or disability of a member.
- TSERS does not provide for explicit cost of living increases as part of the benefit package. Instead, increases may be provided if certain financial conditions are met and/or the legislature passes a budget that provides for a cost-of-living adjustment. More details on cost-of-living increases are provided in Graph 5.

**Commentary:** Many Public Sector Retirement Systems in the United States have undergone pension reform where the benefits of members (active or future members) have been reduced. Because of the well-funded status of TSERS due to the legislature contributing the actuarially determined employer contribution, benefit cuts have not been made in North Carolina as they have been in most other states. Instead, we have seen a modest expansion of benefits in recent years based on sound plan design. However, if North Carolina's investment policy shifts substantively or if the system incurs other unfavorable investment, economic, or demographic experience, the system should review likely impacts of the shift and consider corresponding changes to actuarial assumptions, funding policy and/or benefit levels.

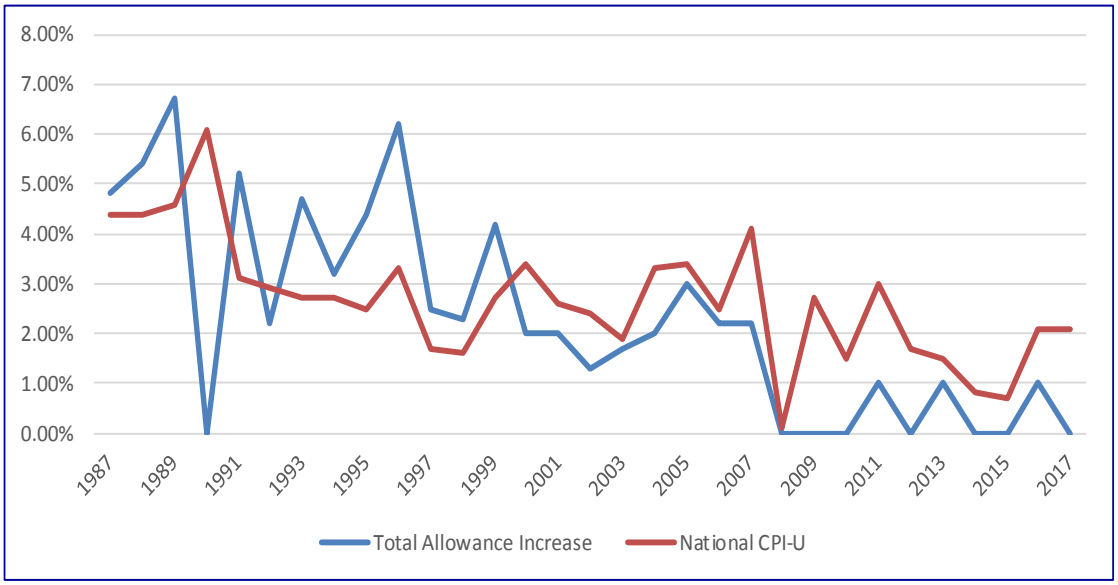
# Section 2: The Valuation Process

## Valuation Input: Benefit Provisions (continued)

As noted previously, cost-of-living increases are periodically considered to the extent that certain financial conditions are met and/or the legislature passes a budget that provides for a cost-of-living adjustment. Specifically, benefit allowance increases are generally considered when the employer contribution rate would not need to increase to pay for a cost-of-living adjustment (generally, limited to the lesser of the CPI increase year-over-year or 4%). Active member pay increases are also considered. In any case, the legislature makes the final decision. In addition to the legislature consistently appropriating the actuary's recommended contribution, this benefit increase policy has helped keep costs manageable when compared to other Public Sector Retirement Systems in the United States. That being said, it is important to provide a benefit in retirement that does not get eroded by inflation.

### Graph 5: Cost-of-Living Increase and CPI-U History

The graph below provides a 30-year history of allowance increases for TSERS and the national CPI-U.




* Allowance increases are effective at July 1 the following year.

**Commentary:** Generally the ad-hoc retirement allowance increase policy has helped retirees maintain purchasing power while helping to moderate contribution increases during times of down markets.

A detailed summary of the benefit provisions is provided in Appendix C of this report.

## Valuation Input: Actuarial Assumptions

Actuarial assumptions bridge the gap between the information that we know with certainty as of the valuation date (age, gender, service, pay, and benefits of the members) and what may happen in the future. The actuarial assumptions of TSERS are reviewed at least every five years. Based on this review, the actuary will make recommendations on the demographic and economic assumptions.

# Section 2: The Valuation Process

## Valuation Input: Actuarial Assumptions (continued)

Demographic assumptions describe future events such as retirement rates, termination rates, disability rates, and mortality rates. Economic assumptions describe future events such as the interest rate, salary increases, the real return, and payroll growth.

The assumptions used for the December 31, 2017 actuarial valuation, with the exception of the discount rate, are based on the experience study prepared as of December 31, 2014 and adopted by the Board of Trustees on January 21, 2016. The discount rate was updated to be 7.00%, as adopted by the Board of Trustees on April 26, 2018.

## Valuation Input: Funding Methodology

The Funding Methodology is the payment plan for TSERS and is composed of the following three components:

- Actuarial Cost Methods allocate costs to the actuarial accrued liability (i.e. the amount of money that should be in the fund) for past service and normal cost (i.e. the cost of benefits accruing during the year) for current service.
  - The Board of Trustees has adopted Entry Age Normal as its actuarial cost method
  - Develops normal costs that stays level as a percent of payroll
- Asset Valuation Methods smooth or average the market value returns over time to alleviate contribution volatility that results from market returns.
  - Asset returns in excess of or less than the expected return on market value of assets reflected over a five-year period
  - Assets corridor: not greater than 120% of market value and not less than 80% of market value
- Amortization Methods determine the payment schedule for unfunded actuarial accrued liability (i.e. the difference between the actuarial accrued liability and actuarial value of assets)
  - Payment level: the payment is determined as a level dollar amount, similar to a mortgage payment
  - Payment period: a 12-year closed amortization period was adopted for fiscal year ending 2012. A new amortization base is created each year based on the prior years' experience.

When compared to other Public Sector Retirement Systems in the United States, the funding policy for TSERS is quite aggressive in that the policy pays down the pension debt over a much shorter period of time (12 years) compared to the longer funding periods of most Public Sector Systems. As such it is a best practice in the industry.

A detailed summary of the actuarial assumptions and methods is provided in Appendix D of this report.

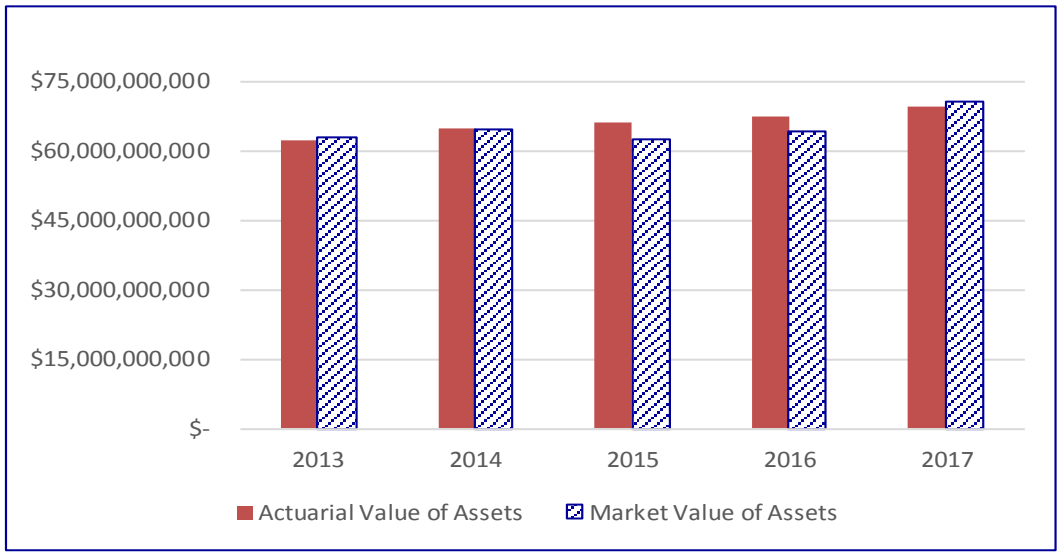
# Section 2: The Valuation Process

## Valuation Results: Actuarial Value of Assets

In order to reduce the volatility that investment gains and losses can have on required contributions and funded status of TSERS, the Board adopted an asset valuation method to determine the Actuarial Value of Assets used for funding purposes. The Actuarial Value of Assets is $69.6 billion as of December 31, 2017 and was $67.4 billion as of December 31, 2016.

### Graph 6: Actuarial Value and Market Value of Assets

The graph below provides a history of the market value and actuarial value of assets over the past five years.



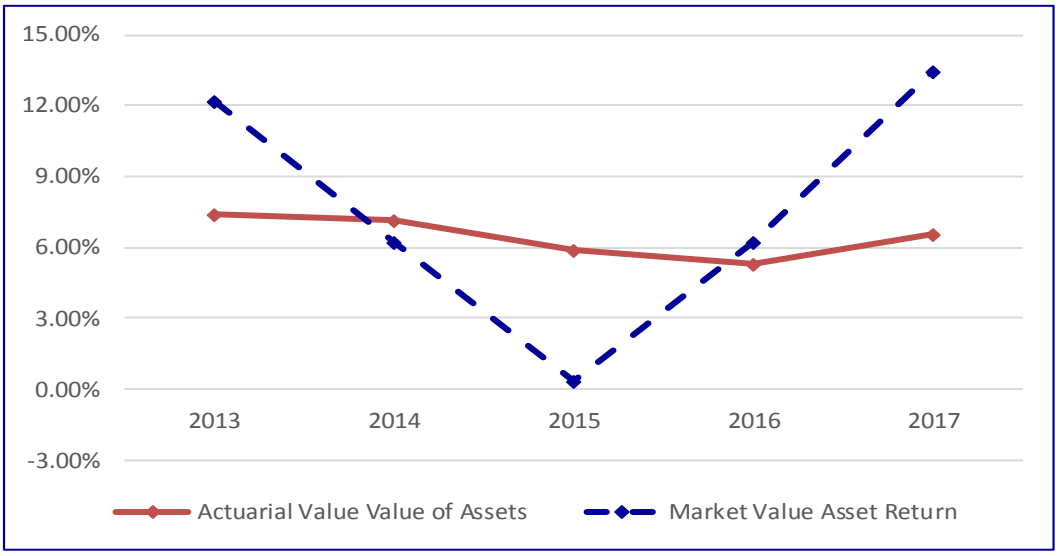

**Commentary:** The market value of assets is higher than the actuarial value of assets, which is used to determine employer contributions. This indicates that overall there are unrecognized asset gains to be recognized in future valuations. However, if the investments earn the expected 7.00% over the next four years, a loss will be recognized in both the December 31, 2018 and the December 31, 2019 valuations, and a gain will be recognized in the December 31, 2020 and the December 31, 2021 valuations.

# Section 2: The Valuation Process

## Valuation Results: Actuarial Value of Assets (continued)

### Graph 7: Asset Returns

The graph below provides a history of the market value and actuarial value of asset returns over the past five years.




**Commentary:** The investment return for the market value of assets for calendar year 2017 was 13.47%. The actuarial value of assets smooths investment gains and losses. Lower than expected market returns in 2015 and 2016 which were partially offset by greater than expected market returns for 2017 resulted in an actuarial value of asset return for calendar year 2017 of 6.56% and a recognized actuarial asset loss of $0.4 billion during 2017.

A detailed summary of the Actuarial Value of Assets is provided in Section 4 of this report.

# Section 2: The Valuation Process

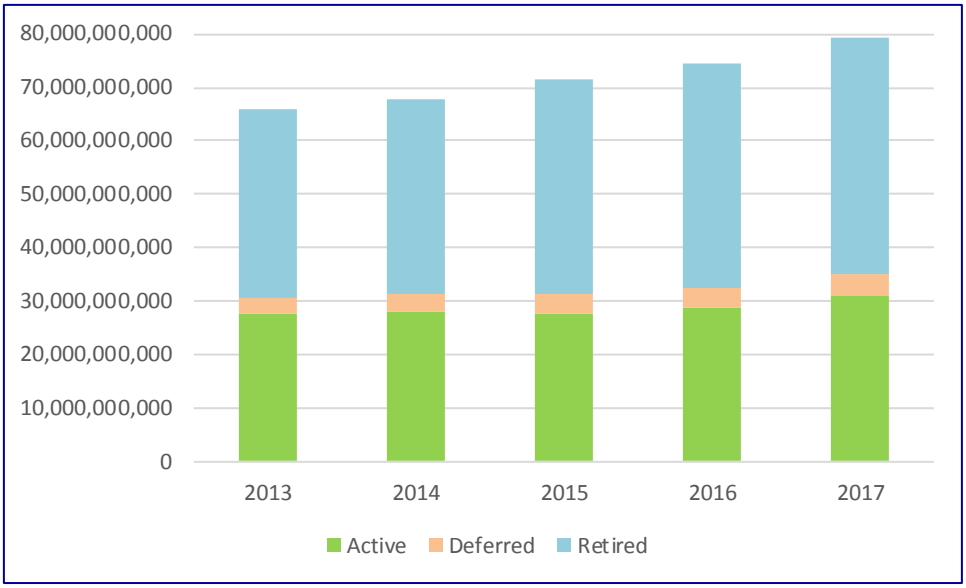
## Valuation Results: Actuarial Accrued Liability

Using the provided membership data, benefit provisions, and actuarial assumptions, the future benefit payments of TSERS are estimated. These projected future benefit payments are discounted into today's dollars using the assumed rate of investment return assumption to determine the Present Value of Future Benefits (PVFB) of TSERS. The PVFB is an estimate of the current value of the benefits promised to all members as of a valuation date.

Once the PVFB is developed, an actuarial cost method is used to allocate the PVFB. Under the actuarial cost method, the PVFB is allocated to past, current and future service, respectively known as the actuarial accrued liability (AAL), normal cost (NC) and present value of future normal costs (PVFNC). The AAL is also referred to as the amount of money TSERS should ideally have in the trust. The NC is also referred to as the cost of benefits accruing during the year.

### Graph 8: Actuarial Accrued Liability

The graph below provides a history of the actuarial accrued liability over the past five years.




**Commentary:** The AAL increased from $74.5 billion to $79.2 billion during 2017. The Retirement System is an open plan, which means that new members enter the plan each year. In an open plan, liabilities are expected to grow from one year to the next as more benefits accrue and the membership approaches retirement. The AAL prior to assumption and legislation changes was $178 million higher than expected, which resulted in a demographic loss of $178 million during 2017. Assumption changes increased the AAL by $1.623 billion. Legislation changes increased the AAL by $44 million.

A detailed summary of the AAL is provided in Section 5 of this report.

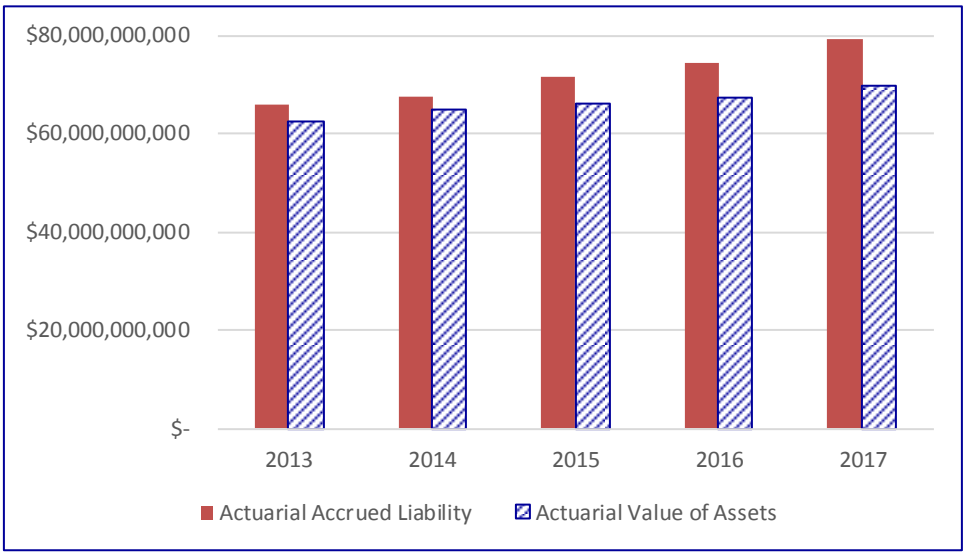
# Section 2: The Valuation Process

## Valuation Results: Funded Ratio

The funded ratio is a measure of the progress that has been made in funding the plan as of the valuation date. It is the ratio of how much money TSERS actually has in the fund to the amount TSERS should have in the fund.

### Graph 9: Actuarial Accrued Liability and Actuarial Value of Assets

The graph below provides a history of the actuarial accrued liability and actuarial value of assets.



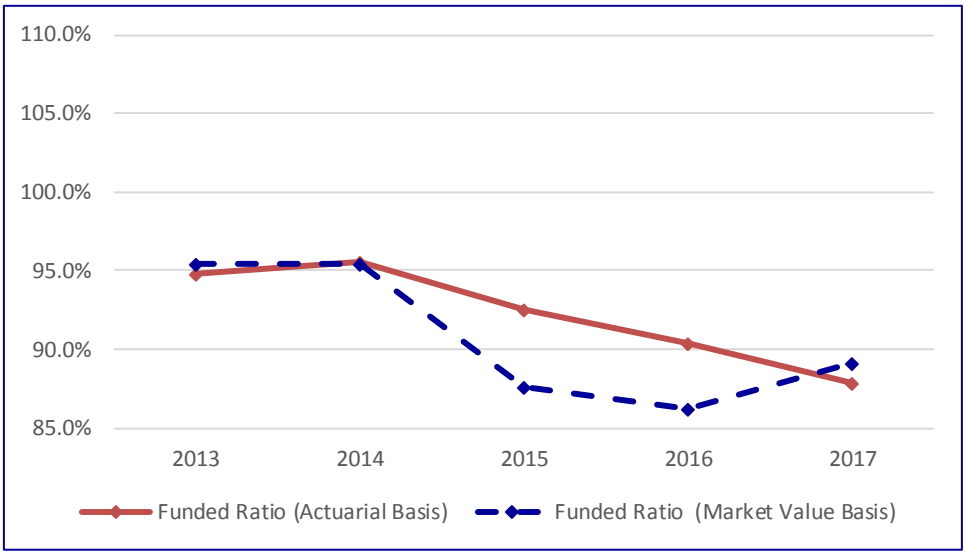

**Commentary:** The actuarial value of assets basis is used for computing contributions to alleviate contribution volatility. The difference in the actuarial accrued liability and the actuarial value of assets is the amount of pension debt to be paid off in 12 years.

# Section 2: The Valuation Process

## Valuation Results: Funded Ratio (continued)

### Graph 10: Funded Ratios

The graph below provides a history of the funded ratio on a market and actuarial basis over the past five years.




**Commentary:** The ratio of assets to liabilities shows the health of the plan on an accrued basis. The funded ratio on an actuarial basis decreased from 90.4% at December 31, 2016 to 87.8% at December 31, 2017.

# Section 2: The Valuation Process

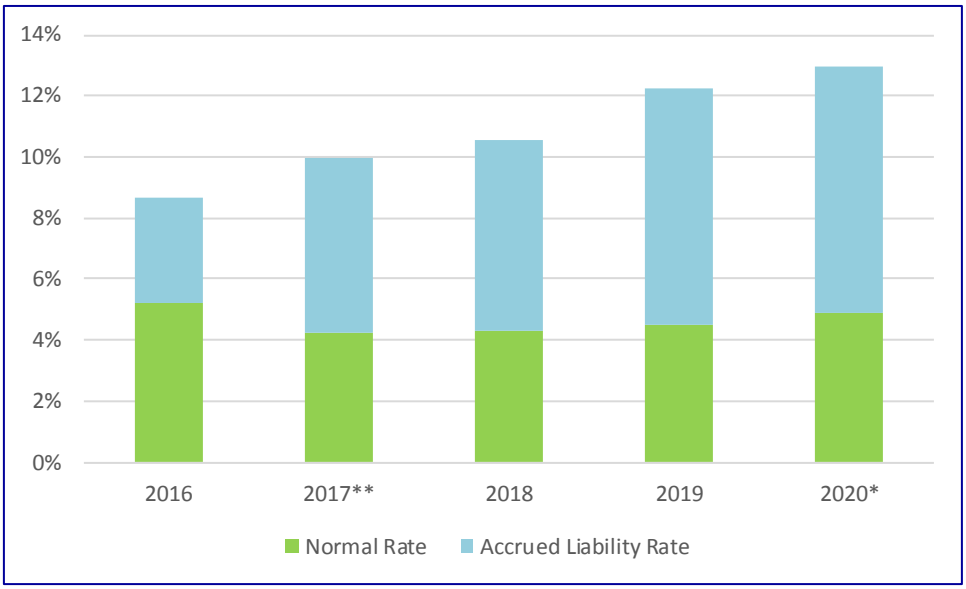
## Valuation Results: Employer Contributions

The North Carolina General Statutes provide that the contributions of employers shall consist of a normal contribution and an accrued liability contribution. G.S. 135-8(g) allows for the Board of Trustees of TSERS to make changes to accounting methods and procedures that, in its opinion, are in the interest of sound and proper administration of TSERS.

The December 31, 2016 valuation suggested that the preliminary total employer contribution rate be set at 11.98% of payroll for the fiscal year ending June 30, 2019. Subsequently, the 2018 Appropriations Act (Session Law 2018-5) set contributions at 12.29% of payroll effective for the fiscal year ending June 30, 2019, in order to account for recent legislation passed into law and the Employer Contribution Rate Stabilization Policy. As a result of this December 31, 2017 valuation, the preliminary actuarially determined employer contribution rate is 12.97% of payroll for the fiscal year ending June 30, 2020, subject to the impact of any future legislative changes effective during that fiscal year. On this basis, there is no preliminary reserve from undistributed gains that could be used for a cost-of-living adjustment or other benefit improvements.

### Graph 11: Actuarially Determined Employer Contribution Rates Before Applying Funding Policy Minimums

The graph below provides a history of actuarially determined employer contribution rates over the past five years. The rates are split into the normal rate and the accrued liability rate. The normal rate is the employer's portion of the cost of benefits accruing after reducing for the member contribution. The accrued liability rate is the payment toward the unfunded liability.




***** Subject to the impact of future legislative changes effective during that fiscal year
** Includes impact of the experience study

**Commentary:** The actuarially determined employer contribution rate is the amount needed to pay for the cost of the benefits accruing and to pay off the pension debt over 12 years, offset for the 6% of pay contribution the members make. The 12-year period is a short period for Public Sector Retirement Systems in the United States, with the funding period for most of these Systems much longer. The shorter period results in higher contributions and more benefit security. A detailed summary of the actuarially determined employer contribution rates is provided in Section 6 of this report.

# Section 2: The Valuation Process

## Valuation Results: Projections

Projections of contribution requirements and funded status into the future can be helpful planning tools for stakeholders. This section provides such projections. The projections of the actuarial valuation are known as deterministic projections. Deterministic projections are based on one scenario in the future. The baseline deterministic projection is based on December 31, 2017 valuation results as assumptions.

**Key Projection Assumptions:**

- Valuation interest rate of 7.00% for all years, with direct rate smoothing of the employer contribution rate over a three-year period beginning July 1, 2019
- 7.00% investment return on market value of assets
- Actuarial assumptions and methods as described in Appendix D. All future demographic experience is assumed to be exactly realized.
- The contribution rate under the Employer Contribution Rate Stabilization Policy (ECRSP) is contributed until fiscal year ending 2022
- The actuarially determined employer contribution rate is contributed for fiscal years ending 2023 and beyond
- 0% increase in the total active member population
- No cost-of-living adjustments granted
- Future pay increases based on long-term salary increase assumptions

The ECRSP adopted by the Board of Trustees on January 21, 2016 requires that recommended contributions be 0.35% of payroll greater than the appropriated contribution during the prior year, with the following bounds: (1) contributions may not be less than the actuarially determined employer contribution (ADEC) rate and (2) contributions may not be greater than a contribution determined using the same assumptions used to calculate the ADEC but using a discount rate equal to the long-term Treasury bond yield.

In addition, we have provided two alternate deterministic projections. The first alternate deterministic projection is based on the same assumptions as the baseline deterministic projection except that it assumes a 0.0% asset return for calendar year 2018. The second alternate deterministic projection is based on the same assumptions as the baseline deterministic projection except that it assumes a 14.0% asset return for calendar year 2018.

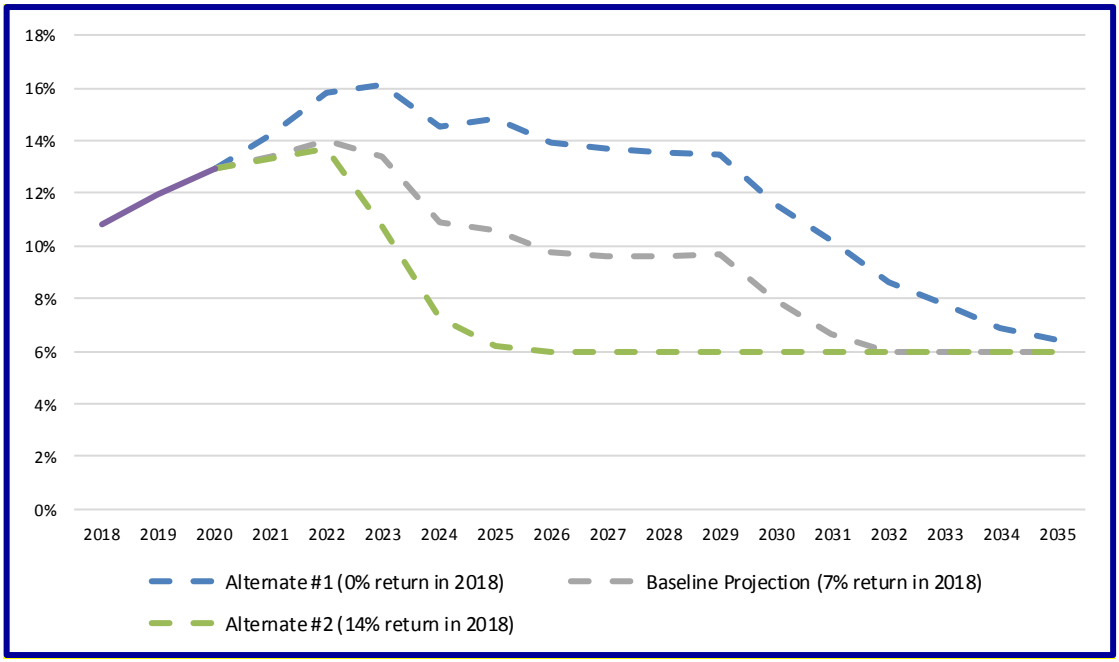
Finally, stochastic projections, where hundreds of projections based on varying rates of return are performed and results are ordered, are periodically performed by the Investment Management Division and shared with the Retirement Board and RSD staff.

# Section 2: The Valuation Process

## Valuation Results: Projections (continued)

### Graph 12: Projected Actuarially Determined Employer Contribution Rates

The graph below provides the actuarially determined employer contribution rates projected for 15 years.



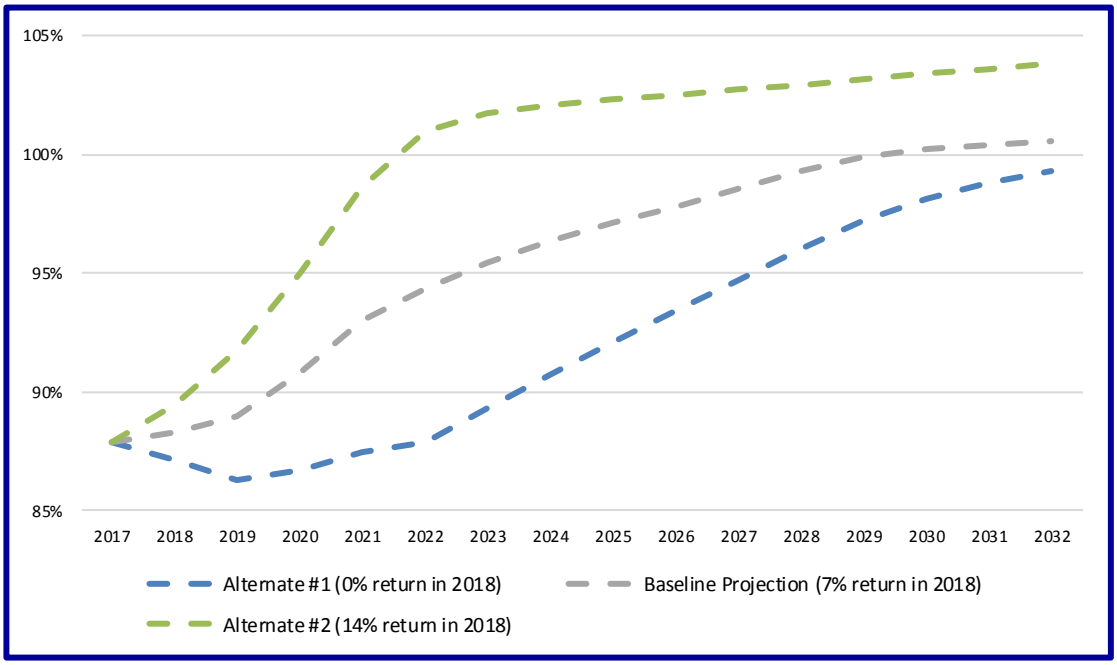

**Commentary:** The actuarially determined employer contribution rate trends to around 5%, which is the level of the cost of benefits accrued, or the long term employer cost of TSERS when there is no pension debt. However, the minimum employer contribution rate is equal to the employee contribution rate of 6.00%.

# Section 2: The Valuation Process

## Valuation Results: Projections (continued)

### Graph 13: Projected Funded Ratio

The graph below provides the funded ratio projected for 15 years.




**Commentary:** Note that if the 7.00% return under the Baseline Projection is achieved, the funded ratio reaches the long term target of 100% within 15 years. This is a direct result of using a 12 year period to pay off the pension debt.

A detailed summary of the deterministic projections is provided in Section 9 of this report.

## Valuation Results: Accounting Information

The Governmental Account Standards Board (GASB) issues statements which establish financial reporting standards for defined benefit pension plans and accounting for pension expenditures and expenses for governmental employers.

The valuation has been prepared in accordance with the parameters of Statement No. 67 of the GASB and all applicable Actuarial Standards of Practice. The Net Pension Liability (Asset) under GASB 67 for the fiscal year ending June 30, 2018, is $9,956,089,000 (compared to $7,934,441,000 for fiscal year ending June 30, 2017). The required financial reporting information for TSERS under GASB No. 67 can be found in Section 8 of this report.

# Section 3: Membership Data

The Retirement Systems Division provided membership data as of the valuation date for each member of TSERS. The membership data assists the actuary in estimating benefits that could be paid in the future. The tables below provide a summary of the membership data used in this valuation. Detailed tabulations of data are provided in Appendix B.

### Table 2: Active Member Data

| | Member Count | Average Age | Average Service | Reported Compensation |
|---|---|---|---|---|
| Teachers, Librarians and Counselors | 148,750 | 43.31 | 10.57 | $ 6,754,691,022 |
| Other Education | 48,850 | 49.30 | 11.32 | 1,974,550,197 |
| General Employees | 101,485 | 46.74 | 10.71 | 4,893,287,743 |
| Law Enforcement Officers | 5,469 | 40.16 | 11.77 | 291,556,363 |
| Total | 304,554 | 45.35 | 10.76 | $ 13,914,085,325 |

The table above includes members not in receipt of benefits who had reported compensation in 2017.

### Table 3: Disabled Member Data (Receiving Benefits from the Disability Income Plan of North Carolina)

| | Member Count | Average Age | Average Service | Valuation Compensation |
|---|---|---|---|---|
| Teachers, Librarians and Counselors | 1,997 | 54.85 | 13.73 | $ 70,138,273 |
| Other Education | 774 | 56.14 | 13.42 | 19,329,178 |
| General Employees | 3,873 | 55.54 | 12.86 | 125,893,295 |
| Law Enforcement Officers | 36 | 49.64 | 16.85 | 4,950,582 |
| Total | 6,680 | 55.37 | 13.21 | $ 220,311,328 |

The table above includes members not in receipt of benefits who did not have reported compensation in 2017 and who were reported as disabled in the current or prior valuations and not subsequently reported as returned to work.

# Section 3: Membership Data (continued)

### Table 4: Terminated Vested Member Data

| | Member Count | Average Age | Average Service | Accumulated Contributions |
|---|---|---|---|---|
| Teachers, Librarians and Counselors | 60,816 | 40.85 | 4.32 | $ 765,302,847 |
| Other Education | 14,405 | 45.88 | 4.27 | 167,088,365 |
| General Employees | 83,750 | 46.32 | 3.80 | 1,071,943,494 |
| Law Enforcement Officers | 1,116 | 42.25 | 5.54 | 22,321,122 |
| Total | 160,087 | 44.17 | 4.05 | $ 2,026,655,827 |

The table above includes members not in receipt of benefits who did not have reported compensation in 2017 and who were not valued as disabled members.

### Table 5: Data for Members Currently Receiving Benefits

| | Member Count | Average Age | Annual Retirement Allowances |
|---|---|---|---|
| Retired Members (Healthy at Retirement) | | | |
| Teachers and Other Education | 104,410 | 70.30 | $ 2,549,862,474 |
| General Employees | 80,309 | 71.78 | 1,444,505,773 |
| Law Enforcement Officers | 2,870 | 65.56 | 91,792,521 |
| Total | 187,589 | 70.86 | $ 4,086,160,768 |
| Retired Members (Disabled at Retirement)* | | | |
| Teachers and Other Education | 4,264 | 70.30 | $ 85,684,771 |
| General Employees | 7,937 | 70.00 | 123,227,427 |
| Law Enforcement Officers | 174 | 68.53 | 4,294,741 |
| Total | 12,375 | 70.08 | $ 213,206,939 |
| Survivors of Deceased Members | | | |
| Teachers and Other Education | 4,900 | 73.29 | $ 89,630,960 |
| General Employees | 9,703 | 73.72 | 122,969,020 |
| Law Enforcement Officers | 441 | 72.28 | 9,426,135 |
| Total | 15,044 | 73.54 | $ 222,026,115 |
| Grand Total | 215,008 | 70.84 | $ 4,521,393,822 |

* Includes retired members reported as disabled in a prior valuation and not subsequently reported as returned to work.

# Section 4: Asset Data

Assets are held in trust and are invested for the exclusive benefit of TSERS members. The tables below provide the details of the Market Value of Assets for the current and prior years' valuations.

### Table 6: Market Value of Assets

| Asset Data as of | 12/31/2017 | 12/31/2016 |
|---|---|---|
| Beginning of Year Market Value of Assets | $ 64,246,523,614 | $ 62,669,341,716 |
| Contributions | 2,420,414,120 | 2,237,806,330 |
| Benefit Payments | (4,580,566,798) | (4,490,780,171) |
| Investment Income | 8,521,516,312 | 3,830,155,739 |
| Net Increase/(Decrease) | 6,361,363,634 | 1,577,181,898 |
| End of Year Value of Assets | $ 70,607,887,248 | $ 64,246,523,614 |
| Estimated Net Investment Return | 13.49% | 6.22% |

### Table 7: Allocation of Investments by Category of the Market Value of Assets

| Asset Data as of | 12/31/2017 | 12/31/2016 |
|---|---|---|
| Allocation by Dollar Amount | | |
| Public Equity | $ 27,967,988,982 | $ 27,649,326,323 |
| Fixed Income (LTIF) | 18,496,611,481 | 17,194,764,771 |
| Cash and Receivables | 2,355,812,624 | 894,009,370 |
| Other* | 21,787,474,161 | 18,508,423,150 |
| Total Market Value of Assets | $ 70,607,887,248 | $ 64,246,523,614 |
| Allocation by Percentage of Asset Value | | |
| Public Equity | 39.6% | 43.0% |
| Fixed Income (LTIF) | 26.2% | 26.8% |
| Cash and Receivables | 3.3% | 1.4% |
| Other* | 30.9% | 28.8% |
| Total Market Value of Assets | 100.0% | 100.0% |

* Real Estate, Alternatives, Inflation and Credit

# Section 4: Asset Data (continued)

In order to reduce the volatility that investment gains and losses can have on the required contributions and funded status of TSERS, the Board adopted an asset valuation method to determine the Actuarial Value of Assets used for funding purposes. The table below provides the calculation of the Actuarial Value of Assets at the valuation date.

## Table 8: Actuarial Value of Assets

| Asset Data as of | 12/31/2017 |
|---|---|
| Beginning of Year Market Value of Assets | $ 64,246,523,614 |
| Contributions | 2,420,414,120 |
| Benefit Payments | (4,580,566,798) |
| Net Cash Flow | (2,160,152,678) |
| Expected Investment Return | 4,560,938,030 |
| Expected End of Year Market Value of Assets | 66,647,308,966 |
| End of Year Market Value of Assets | 70,607,887,248 |
| Excess of Market Value over Expected Marted Value of Assets | 3,960,578,282 |
| 80% of 2017 Asset Gain/(Loss) | 3,168,462,626 |
| 60% of 2016 Asset Gain/(Loss) | (379,020,740) |
| 40% of 2015 Asset Gain/(Loss) | (1,750,005,244) |
| 20% of 2014 Asset Gain/(Loss) | N/A |
| Total Deferred Asset Gain/(Loss) | 1,039,436,642 |
| Preliminary End of Year Actuarial Value of Assets | 69,568,450,606 |
| Final End of Year Actuarial Value of Asset (not less than 80% and not greater than 120% of Market Value) | 69,568,450,606 |
| Estimated Net Investment Return on Actuarial Value | 6.56% |

**Commentary:** The actuarial value of assets smooths investment gains/losses, resulting in less volatility in the employer contribution. The asset valuation recognizes asset returns in excess of or less than the expected return on the market value of assets over a five-year period. Actuarial value of assets was reset to the market value of assets at December 31, 2014.

Lower than expected market returns in 2015 and 2016, which were partially offset by greater than expected market returns in 2017, resulted in an actuarial value of asset return for calendar year 2017 of 6.56% and a recognized actuarial asset loss of $0.4 billion during 2017.

# Section 4: Asset Data (continued)

The valuation assumes that the funds will earn a 7.00% asset return. The table below provides a history of the Actuarial Value and Market Value of Asset returns.

**Table 9: Historical Asset Returns**

| Calendar Year | Actuarial Value of Asset Return | Market Value of Asset Return |
|---|---|---|
| 1998 | 9.92% | 16.66% |
| 1999 | 10.60% | 10.15% |
| 2000 | 11.55% | 2.50% |
| 2001 | 8.51% | -1.87% |
| 2002 | 5.66% | -5.21% |
| 2003 | 7.98% | 18.23% |
| 2004 | 8.56% | 10.73% |
| 2005 | 8.26% | 6.97% |
| 2006 | 8.94% | 11.41% |
| 2007 | 8.87% | 8.38% |
| 2008 | 2.89% | -19.50% |
| 2009 | 4.74% | 14.84% |
| 2010 | 5.89% | 11.47% |
| 2011 | 5.15% | 2.19% |
| 2012 | 6.32% | 11.82% |
| 2013 | 7.43% | 12.21% |
| 2014 | 7.19% | 6.21% |
| 2015 | 5.87% | 0.36% |
| 2016 | 5.32% | 6.22% |
| 2017 | 6.56% | 13.49% |
| Average | 7.29% | 6.49% |
| Range | 8.66% | 37.73% |

**Commentary:** The average investment return recognized for purposes of determining the annual change in contribution each year is the actuarial value of assets return. Currently, the average actuarial return over the past 20 years of 7.29% tracks average market return of 6.49% relatively well. But the range of returns is markedly less 8.66% versus 37.73%. This results in much lower employer contribution volatility using the actuarial value of assets versus market, while ensuring that the actuarial needs of TSERS are met.

# Section 5: Liability Results

Using the provided membership data, benefit provisions, and actuarial assumptions, the future benefit payments of TSERS are estimated. These projected future benefit payments are discounted into today's dollars using the assumed rate of investment return assumption to determine the Present Value of Future Benefits. The Present Value of Future Benefits is allocated to past, current and future service, respectively known as the actuarial accrued liability, normal cost and present value of future normal costs. The table below provides these liability numbers for the current and prior year's valuations.

**Table 10: Liability Summary**

| Valuation Results as of | 12/31/2017 | 12/31/2016 |
|---|---|---|
| (a) Present Value of Future Benefits | | |
| (1) Active Members | $ 43,997,634,462 | $ 40,130,495,231 |
| (2) Terminated Members | 4,053,311,655 | 3,764,216,305 |
| (3) Members Currently Receiving Benefits | 44,212,274,274 | 42,235,329,807 |
| (4) Total | $ 92,263,220,391 | $ 86,130,041,343 |
| (b) Present Value of Future Normal Costs | | |
| (1) Employee Future Normal Costs | $ 6,972,473,402 | $ 6,694,905,386 |
| (2) Employer Future Normal Costs | 6,081,399,321 | 4,887,280,932 |
| (3) Total | $ 13,053,872,723 | $ 11,582,186,318 |
| (c) Actuarial Accrued Liability: (a4) - (b3) | $ 79,209,347,668 | $ 74,547,855,025 |
| (d) Actuarial Value of Assets | $ 69,568,450,606 | $ 67,376,892,466 |
| (e) Unfunded Actuarial Accrued Liability: (c) - (d) | $ 9,640,897,062 | $ 7,170,962,559 |

# Section 5: Liability Results (continued)

The table below provides a reconciliation of the prior year's unfunded actuarial accrued liability to the current year's unfunded actuarial accrued liability.

### Table 11: Reconciliation of Unfunded Actuarial Accrued Liability

| (in millions) | |
|---|---|
| Unfunded Actuarial Accrued Liability (UAAL) as of 12/31/2016 | $ 7,171 |
| Increase due to Transition to New Actuary | 553 |
| Normal Cost and Administrative Expense during 2017 | 1,492 |
| Reduction due to Actual Contributions during 2017 | (2,420) |
| Interest on UAAL, Normal Cost, and Contributions | 577 |
| Asset (Gain) / Loss | 423 |
| Actuarial Accrued Liability (Gain) / Loss | 178 |
| Impact of Assumption Changes | 1,623 |
| Impact of Legislative Changes | 44 |
| Unfunded Actuarial Accrued Liability (UAAL) as of 12/31/2017 | $ 9,641 |

**Commentary:** During 2017, there was a transition from the prior actuary to CMC, resulting in valuation programing, modifications and differences in methodologies, such as payroll increase timing, that increased the UAAL by $553 million. In addition, during 2017, the UAAL increased faster than expected primarily due to assumption changes. The change in assumption reflects the change in interest rate from 7.20% to 7.00% and increased the unfunded actuarial accrued liability (UAAL), or pension debt, by $1.623 billion. The asset loss during the year increased the UAAL by $423 million. Additionally, changes in plan provisions increased the UAAL by $44 million.

# Section 6: Actuarially Determined Employer Contribution

The actuarially determined employer contribution consists of a normal cost rate and an accrued liability rate. The normal cost rate is the employer's portion of the cost of benefits accruing during the year after reducing for the member contribution. The accrued liability rate is the payment toward the unfunded accrued liability in order to pay off the unfunded accrued liability over 12 years.

The table below provides the calculation of the actuarially determined employer contribution for the current and prior years' valuations.

The Employer Contribution Rate Stabilization Policy (ECRSP) adopted by the Board of Trustees on January 21, 2016 requires that recommended contributions be 0.35% of payroll greater than the appropriated contribution during the prior year, with the following bounds: (1) contributions may not be less than the actuarially determined employer contribution (ADEC) calculated below and (2) contributions may not be greater than a contribution determined using the same assumptions used to calculate the ADEC but using a discount rate equal to the long-term Treasury bond yield.

The ECRSP would result in a recommended contribution rate of 12.97% of payroll for fiscal year ending 2020.

- 14.16% is the actuarially determined employer contribution calculated in this most recent valuation prior to direct-rate smoothing of the assumption change. 12.97% is the actuarially determined contribution after direct-rate smoothing of the assumption change.
- The minimum is 12.64%; the appropriated contribution from last year of 12.29% plus 0.35%.
- The maximum is approximately 68.46%; the estimated actuarially determined employer contribution using a discount rate equal to the long-term Treasury bond yield (2.74%).

**Table 12: Calculation of the Actuarially Determined Employer Contribution (ADEC)**

| Valuation Date<br>ADEC for Fiscal Year Ending | 12/31/2017<br>6/30/2020 | 12/31/2016<br>6/30/2019 |
|---|---|---|
| Normal Cost Rate Calculation | | |
| (a) Normal Cost Rate | 5.07% | 4.38% |
| (b) Expense Rate | 0.10% | 0.10% |
| (c) Total Normal Cost Rate | 5.17% | 4.48% |
| Accrued Liability Rate Calculation | | |
| (d) Total Annual Amortization Payments* | $ 1,405,896,562 | $ 1,070,547,881 |
| (e) Projected Compensation** | 15,635,747,845 | 14,282,093,846 |
| (f) Accrued Liability Rate: (d) / (e) | 8.99% | 7.50% |
| Preliminary ADEC: (c) + (f) | 14.16% | 11.98% |
| ADEC With Direct Rate Smoothing | 12.97% | N/A |
| Impact of Legislative Changes | N/A | 0.31% |
| Final ADEC | N/A | 12.29% |

* See Table 15 for more detail.

**Beginning with the December 31, 2017 valuation, compensation is projected to the fiscal year over which contributions will occur.

# Section 6: Actuarially Determined Employer Contribution (continued)

The table below provides a reconciliation of the actuarially determined employer contribution.

**Table 13: Reconciliation of the Change in the ADEC**

| | |
|---|---|
| Fiscal year ending June 30, 2019 Preliminary ADEC (based on December 31, 2016 valuation) | 11.98% |
| Impact of Legislative Changes* | 0.00% |
| Fiscal year ending June 30, 2019 ADEC for Reconciliation | 11.98% |
| Change due to Transition to New Actuary | 0.26% |
| Change Due to Anticipated Reduction in UAAL** | (0.26%) |
| Change Due to Demographic (Gain)/Loss | 0.17% |
| Change Due to Investment (Gain)/Loss | 0.36% |
| Change Due to Contributions Greater than ADEC*** | (0.13%) |
| Impact of Assumption Change | 1.78% |
| Impact of Direct Rate Smoothing | (1.19%) |
| Fiscal year ending June 30, 2020 Preliminary ADEC (based on December 31, 2017 valuation) | 12.97% |

* The impact of legislative changes does not reflect the cost of the one-time pension supplement to be paid in October 2018, as the entire cost of this supplement was funded in the appropriated contribution for fiscal year ending June 30, 2019 and is not reflected in the ADEC for fiscal year ending June 30, 2020. In addition, House Bill 284, as described at the end of Appendix C, had no cost impact on the ADEC.

** Amortization of the UAAL is determined as a level dollar amount with payments expected to remain the same over the amortization period, but was calculated as a percentage of valuation payroll in the previous valuation. Payroll is expected to increase annually while the expected amortization payment does not increase. This causes the expected amortization payment to be a lesser percentage of the expected payroll.

***Includes impact of ECRSP rate in excess of ADEC

# Section 6: Actuarially Determined Employer Contribution (continued)

Amortization methods determine the payment schedule for the unfunded actuarial accrued liability. TSERS adopted a 12-year closed amortization period for fiscal year ending 2012. A new amortization base is created each year based on the prior year's experience. The tables below provide the calculation of the new amortization base and the amortization schedule for the current year's valuation.

### Table 14: Calculation of the New Amortization Base

| Calculation as of | 12/31/2017 | 12/31/2016 |
|---|---|---|
| (a) Unfunded Actuarial Accrued Liability | $ 9,596,558,487 | $ 7,170,962,559 |
| (b) Prior Years' Outstanding Bases | $ 7,044,928,819 | $ 5,187,101,839 |
| (c) New Amortization Base: (a) - (b) | $ 2,551,629,668 | $ 1,983,860,720 |
| (d) New Amortization Payment | $ 343,738,824 | $ 270,613,120 |

*The unfunded actuarial accrued liability as of December 31, 2017 does not include the cost of the one-time cost-of-living supplement to be paid in October 2018, as the entire cost of this supplement was funded in the appropriated contribution for fiscal year ending June 30, 2019.

### Table 15: Amortization Schedule for Unfunded Accrued Liability

| Date Established | Original Balance | 12/31/2017 Outstanding Balance | Annual Payment |
|---|---|---|---|
| December 31, 2009 | $ 2,360,173,025 | $ 1,473,708,414 | $ 320,944,137 |
| December 31, 2010 | 242,581,914 | 173,276,705 | 32,954,055 |
| December 31, 2011 | 911,037,989 | 727,118,576 | 123,641,188 |
| December 31, 2012 | 78,277,759 | 68,592,858 | 10,613,353 |
| December 31, 2013 | (114,027,863) | (108,229,230) | (15,446,283) |
| December 31, 2014 | (206,952,282) | (210,489,964) | (28,008,711) |
| December 31, 2015 | 2,586,581,023 | 2,794,252,769 | 349,707,749 |
| December 31, 2016 | 1,983,860,720 | 2,126,698,692 | 267,752,250 |
| December 31, 2017 | 2,551,629,668 | 2,551,629,668 | 343,738,824 |
| Total | | $ 9,596,558,487 | $ 1,405,896,562 |

**Commentary:** This is the payment schedule for the pension debt of TSERS.

# Section 6: Actuarially Determined Employer Contribution (continued)

The table below provides a history of the actuarially determined employer contribution and the corresponding appropriated rate.

### Table 16: History of Actuarially Determined Employer Contributions and Appropriated Rates

| Valuation Date | Fiscal Year Ending | Normal Rate | Accrued Liability Rate | Change due to Legislation* | Final ADEC | Appropriated Rate |
|---|---|---|---|---|---|---|
| 12/31/2017 | 06/30/2020 | 4.87% | 8.10% | N/A | N/A | N/A |
| 12/31/2016 | 06/30/2019 | 4.48% | 7.50% | 0.31% | 12.29% | 12.29% |
| 12/31/2015 | 06/30/2018 | 4.31% | 5.77% | 0.45% | 10.53% | 10.78% |
| 12/31/2014 | 06/30/2017 | 5.21% | 3.26% | 1.49% | 9.96% | 9.98% |
| 12/31/2013 | 06/30/2016 | 5.19% | 3.50% | 0.00% | 8.69% | 9.15% |
| 12/31/2012 | 06/30/2015 | 5.15% | 3.61% | 0.39% | 9.15% | 9.15% |

* The change due to legislation for the contribution for fiscal year ending 6/30/2019 includes a 0.31% increase in the ADEC due to the one-time cost-of-living supplement payable in October, 2018.

The following table shows estimates of the potential cost of two types of benefit improvements if they were enacted based on the results of the December 31, 2017 or December 31, 2016 valuations. The first benefit improvement is a permanent one-time cost-of-living increase and the second is an increase in the defined benefit formula multiplier.

### Table 17: Cost of Benefit Enhancements

| Calculation as of | 12/31/2017 | 12/31/2016 |
|---|---|---|
| Increase in UAAL for a 1% COLA | $ 484,872,000 | N/A |
| Increase in ADEC for a 1% COLA | 0.43% | 0.43% |
| Increase in UAAL for a 0.1% Increase in the Defined Benefit Formula | $ 412,702,000 | N/A |
| Increase in ADEC for a 0.1% Increase in the Defined Benefit Formula | 0.43% | 0.44% |

The 1% COLA calculated at the December 31, 2017 valuation would be effective July 1, 2019. The COLA would be paid in full to retired members and survivors of deceased members on the retirement roll on July 1, 2018 and would be prorated for retired members and survivors of deceased members who commence benefits after July 1, 2018 but before June 30, 2019.

A corresponding increase in retirement allowances would be paid in the event of an increase the defined benefit formula.

# Section 7: Valuation Balance Sheet

The valuation balance sheet shows the assets and liabilities of TSERS. The items shown in the balance sheet are present values actuarially determined as of the relevant valuation date. The table below provides the valuation balance sheet for the current year and prior year.

**Table 18: Valuation Balance Sheet**

| Balance Sheet as of | 12/31/2017 | 12/31/2016 |
|---|---|---|
| **Assets** | | |
| Current Actuarial Value of Assets | | |
| Annuity Savings Fund | $ 12,976,432,877 | $ 12,563,041,657 |
| Pension Accumulation Fund | 56,592,017,729 | 54,813,850,809 |
| Total | $ 69,568,450,606 | $ 67,376,892,466 |
| Future Member Contributions to the Annuity Savings Fund | $ 6,972,473,402 | $ 6,694,905,386 |
| Prospective Contributions to the Pension Accumulation Fund | | |
| Normal Contributions | $ 6,081,399,321 | $ 4,887,280,932 |
| Unfunded Accrued Liability Contributions | 9,640,897,062 | 7,170,962,559 |
| Undistributed Gain / (Loss) Contributions | (2,533,332,003) | (1,143,926,783) |
| Total | $ 13,188,964,380 | $ 10,914,316,708 |
| Total Assets | $ 89,729,888,388 | $ 84,986,114,560 |
| **Liabilities** | | |
| Annuity Savings Fund | | |
| Past Member Contributions | $ 12,976,432,877 | $ 12,563,041,657 |
| Future Member Contributions | 6,972,473,402 | 6,694,905,386 |
| Total Contributions | $ 19,948,906,279 | $ 19,257,947,043 |
| Pension Accumulaton Fund | | |
| Benefits Currently in Payment | $ 44,167,935,699 | $ 41,805,044,990 |
| Benefits to be Paid to Currrent Active and Inactive Members | 28,102,039,838 | 24,636,764,493 |
| Reserve for Increases in Retirement Allowances | 44,338,575 | 430,284,817 |
| Reserve for Undistributed Gains / (Losses) | (2,533,332,003) | (1,143,926,783) |
| Total Benefits Payable | $ 69,780,982,109 | $ 65,728,167,517 |
| Total Liabilities | $ 89,729,888,388 | $ 84,986,114,560 |

Note: Reserve for Undistributed Gains/(Losses) represents the excess (shortfall) of the present value of future contributions for the current funding in effect based on the prior valuation to the present value of future contributions for the ADEC based on the current valuation. An undistributed gain in this balance sheet should not be construed as eligibility for payment of a COLA.

# Section 8: Accounting Results

The section contains the accounting information for Governmental Accounting Standards Board (GASB) Statement No. 67 for fiscal year ending June 30, 2018 based on a valuation date of December 31, 2017.

Please note that GASB Statement No. 67 (*Financial Reporting for Pension Plans)* is applicable for fiscal years ending 2014 and later.

The June 30, 2018 total pension liability presented in this section was determined by an actuarial valuation as of December 31, 2017, based on the assumptions, methods and plan provisions described in this report. The actuarial cost method used to develop the total pension liability is the Entry Age Normal Cost method, as required by GASB Statement No. 67.

GASB Statement No. 67 set forth certain items of information to be disclosed in the financial statements of the Plan. The tables below provide a distribution of the number of employees by type of membership.

**Table 19: Number of Active and Retired Members as of December 31, 2017**

| Group | Number |
|---|---|
| Retired members and survivors of deceased members currently receiving benefits | 215,008 |
| Terminated members and survivors of deceased members entitled to benefits but not yet receiving benefits | 160,087 |
| Active Members* | 311,234 |
| Total | 686,329 |

* Includes current recipients of DIP benefits.

# Section 8: Accounting Results (continued)

GASB Statement No. 67 set forth certain items of information to be disclosed in the financial statements of the Plan. The tables below provide the schedule of changes in Net Pension Liability (Asset).

## Table 20: Schedule of Changes in Net Pension Liability (Asset)

| Schedule of Changes in Net Pension Liability as of June 30, 2018 | |
|---|---|
| **Total Pension Liability** | |
| Service Cost | $ 1,630,323,000 |
| Interest | 5,281,004,000 |
| Changes of Benefit Terms* | 44,339,000 |
| Difference between Expected and Actual Experience | 815,911,000 |
| Change of Assumptions | 1,637,700,000 |
| Benefit Payments, including Refund of Member Contributions | (4,666,391,000) |
| Net Change in Total Pension Liability | 4,742,886,000 |
| Total Pension Liability - Beginning of Year | $ 75,639,901,000 |
| Total Pension Liability - End of Year | $ 80,382,787,000 |
| **Plan Fiduciary Net Position** | |
| Employer Contributions | $ 1,602,901,000 |
| Member Contributions | 910,797,000 |
| Net Investment Income | 4,885,354,000 |
| Benefit Payments, including Refund of Member Contributions | (4,666,391,000) |
| Administrative Expenses | (11,604,000) |
| Other | 181,000 |
| Net Change in Plan Fiduciary Net Position | 2,721,238,000 |
| Plan Fiduciary Net Position - Beginning of Year | $ 67,705,460,000 |
| Plan Fiduciary Net Position - End of Year | $ 70,426,698,000 |

## Table 21: Net Pension Liability (Asset)

| Net Pension Liability (Asset) | June 30, 2018 | June 30, 2017 |
|---|---|---|
| Total Pension Liability | $ 80,382,787,000 | $ 75,639,901,000 |
| Plan Fiduciary Net Position | 70,426,698,000 | 67,705,460,000 |
| Net Pension Liability (Asset) | $ 9,956,089,000 | $ 7,934,441,000 |
| Plan Fiduciary Net Position as a Percentage of the Total Pension Liability (Asset) | 87.61% | 89.51% |

# Section 8: Accounting Results (continued)

The table below is the sensitivity of the net pension liability to changes in the discount rate.

### Table 22: Sensitivity of the Net Pension Liability (Asset) at June 30, 2018 to Changes in the Discount Rate

| Sensitivity of the Net Pension Liability to Changes in the Discount Rate | | | |
|---|---|---|---|
| | 1% Decrease | Current | 1% Increase |
| Discount Rate | 6.00% | 7.00% | 8.00% |
| Net Pension Liability (Asset) | $ 18,987,949,000 | $ 9,956,089,000 | $ 2,377,464,000 |

The discount rate used to measure the total pension liability was 7.00%. The projection of cash flows used to determine the discount rate assumed that for fiscal year ending 2018 to fiscal year ending 2022, System contributions will follow the Employer Contribution Rate Stabilization Policy as adopted by the Board of Trustees on January 21, 2016, and "direct-rate smoothing" as adopted by the Board of Trustees on April 26, 2018. It is assumed that for fiscal years ending 2023 and beyond, System contributions will be based on the actuarially determined contribution rates. Based on those policies, the System's fiduciary net position was projected to be available to make all projected future benefit payments of current plan members. Please see Appendix E for additional details.

The table below provides the methods and assumptions used to calculate the actuarially determined contribution rate.

### Table 23: Additional Information for GASB Statement No. 67

| | |
|---|---|
| Valuation Date | 12/31/2017 |
| Actuarial Cost Method | Entry Age |
| Amortization Method | Level dollar closed |
| Amortization Period | 12 year closed periods |
| Asset Valuation Method | Asset returns in excess of or less than the expected return on market value of assets reflected over a five-year period (not greater than 120% of market value and not less than 80% of market value) |
| Actuarial Assumptions: | |
| Investment Rate of Return* | 7.00% |
| Projected Salary Increases** | 3.50% - 8.10% |
| *Includes Inflation of | 3.00% |
| **Includes Inflation and Productivity of | 3.50% |
| Cost-of-living Adjustments | N/A |

# Section 9: Projections

Projections of contribution requirements and funded status into the future can be helpful planning tools for stakeholders. This section provides such projections. The projections of the actuarial valuation are known as deterministic projections. Deterministic projections are based on one scenario in the future. The baseline deterministic projection is based on December 31, 2017 valuation results as assumptions.

## Key Projection Assumptions

- Valuation interest rate of 7.00% for all years in conjunction with direct rate smoothing of the employer contribution rate over a 3-year period beginning July 1, 2019.
- 7.00% investment return on market value of assets
- Actuarial assumptions and methods as described in Appendix D. All future demographic experience is assumed to be exactly realized.
- The contribution rate under the Employer Contribution Rate Stabilization Policy (ECRSP) is contributed until fiscal year ending 2022.
- The actuarially determined employer contribution rate is contributed for fiscal years ending 2023 and beyond.
- 0% increase in the total active member population
- No cost-of-living adjustments granted
- Future pay increases based on long-term salary increase assumptions

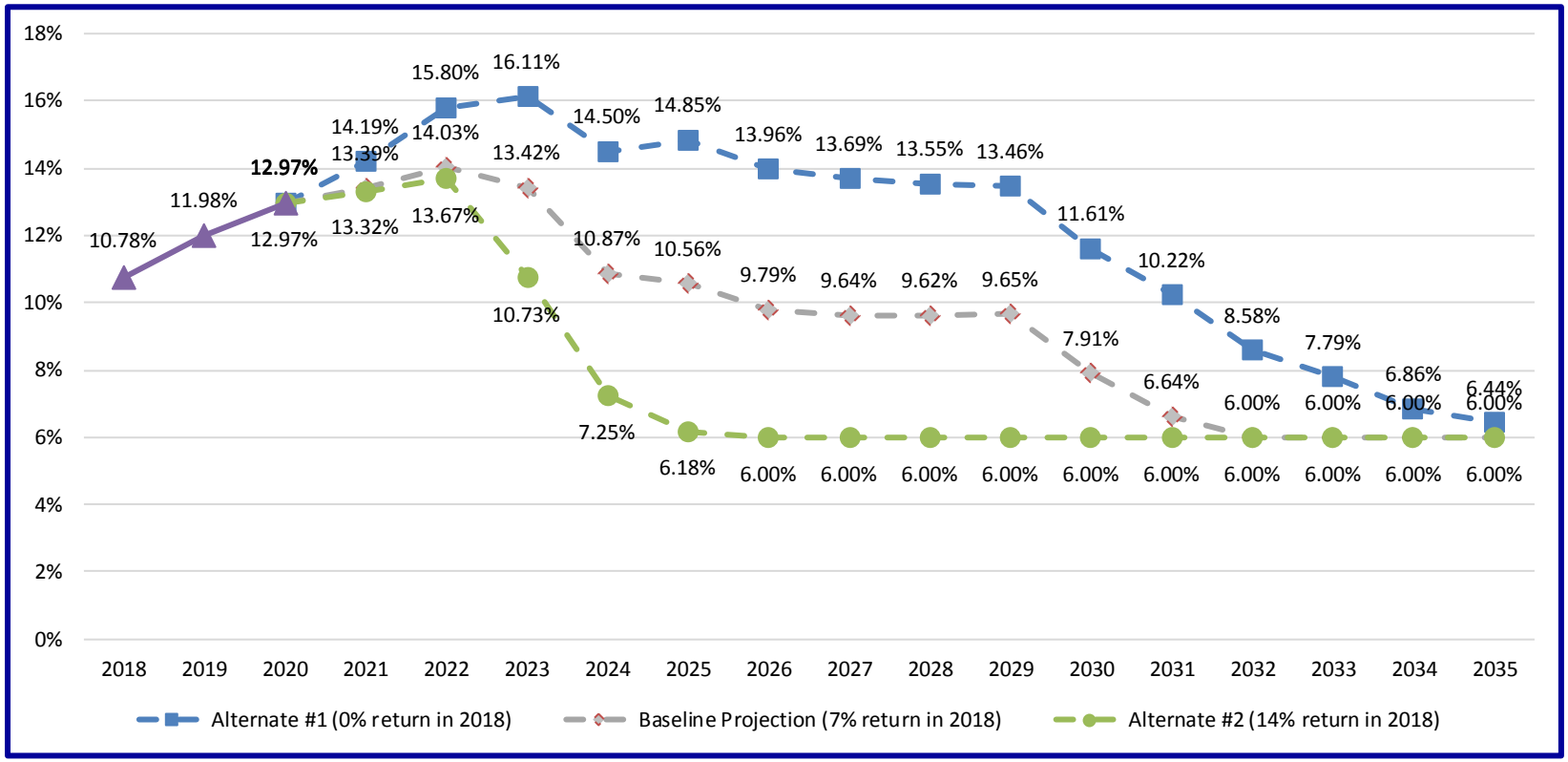
The ECRSP adopted by the Board of Trustees on January 21, 2016 requires that recommended contributions be 0.35% of payroll greater than the appropriated contribution during the prior year, with the following bounds: (1) contributions may not be less than the actuarially determined employer contribution (ADEC) rate and (2) contributions may not be greater than a contribution determined using the same assumptions used to calculate the ADEC but using a discount rate equal to the long-term Treasury bond yield.

In addition, we have provided two alternate deterministic projections. The first alternate deterministic projection is based on the same assumptions as the baseline deterministic projection except that it assumes a 0.0% asset return for calendar year 2018. The second alternate deterministic projection is based on the same assumptions as the baseline deterministic projection except that it assumes a 14.0% asset return for calendar year 2018.

# Section 9: Projections (continued)

The graph below provides the actuarially determined employer contribution rates projected for 15 years.

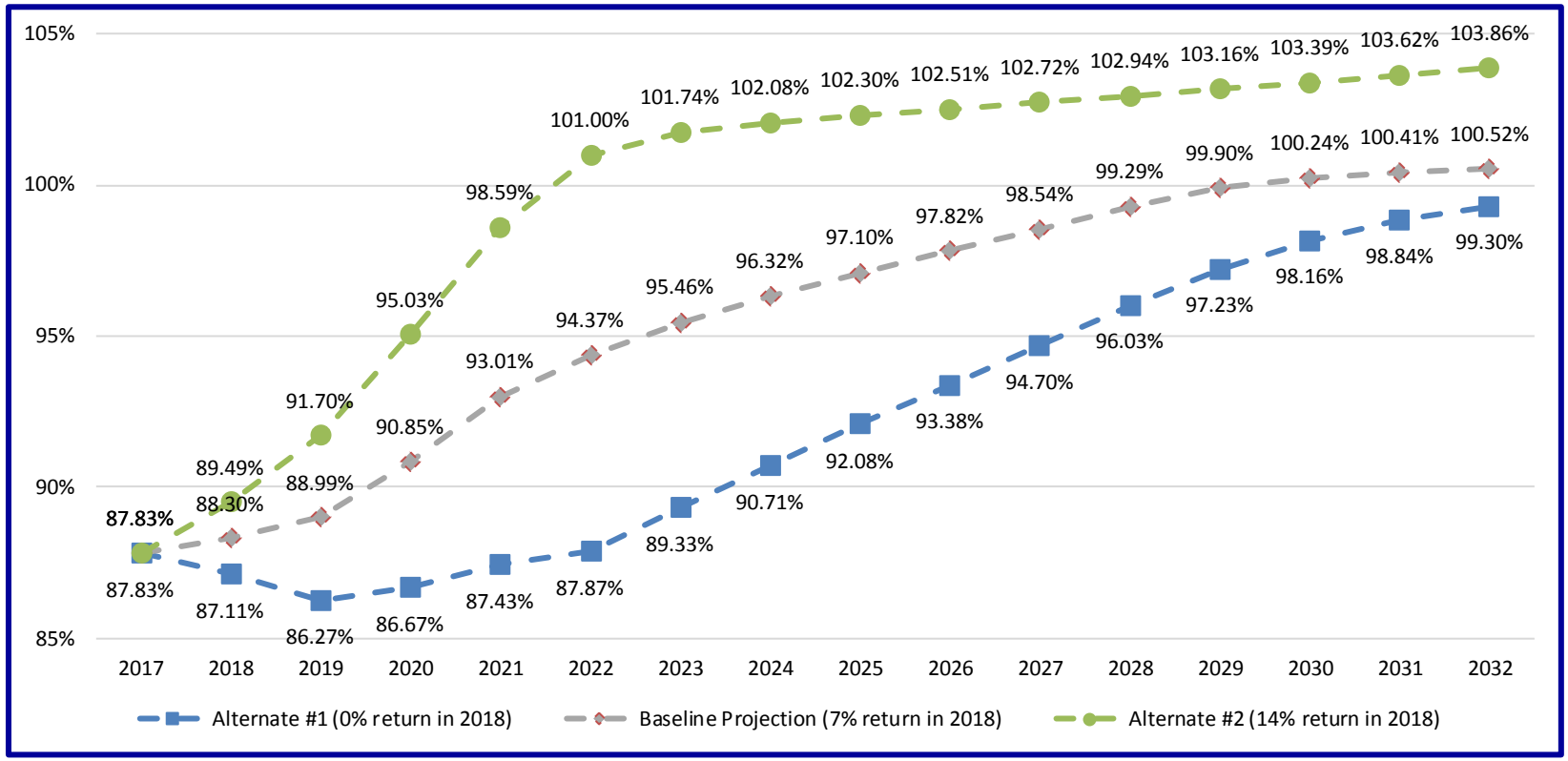
**Projected Actuarially Determined Employer Contribution Rates**



# Section 9: Projections (continued)

The graph below provides the funded ratio projected for 15 years.

**Projected Funded Ratio**



# Appendix A: Valuation Process and Glossary of Actuarial Terms

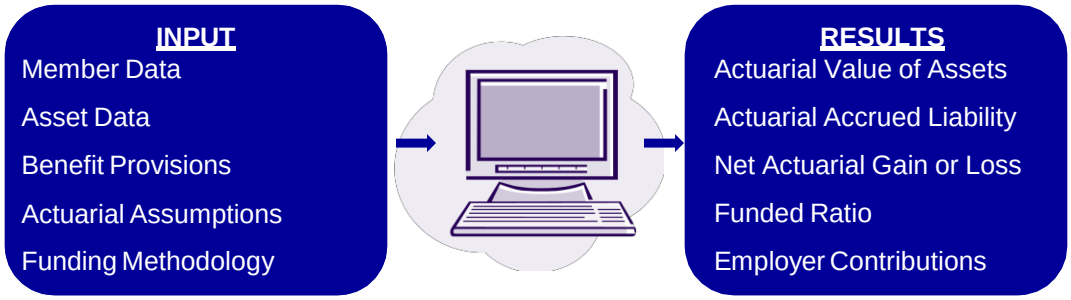
## Purpose of an Actuarial Valuation

The majority of Public Sector Retirement Systems in the State of North Carolina are defined benefit (DB) retirement systems. Under a DB retirement system, the amount of benefits payable to a member upon retirement, termination, death or disability is defined in various contracts and legal instruments and is based, in part, on the member's years of credited service and final compensation. The amount of contribution needed to fund these benefits cannot be known with certainty. A primary responsibility of the Board of Trustees of a Retirement System is to establish and monitor a funding policy for the contributions made to the Retirement System.

While somewhat uncommon, in some jurisdictions, contributions are made by the plan sponsor as benefits come due. This is known as pay-as-you-go financing. More commonly, contributions for benefits are made in advance during the course of active employment of the members. This is known as actuarial pre-funding. For example, the State of North Carolina mandates for the Teachers' and State Employees' Retirement System ("TSERS") that "on account of each member there shall be paid into the pension accumulation fund by employers an amount equal to a certain percentage of the actual compensation of each member to be known as the 'normal contribution' and an additional amount equal to a percentage of the member's actual compensation to be known as the 'accrued liability contribution'. The rate per centum of such contributions shall be fixed on the basis of the liabilities of the Retirement System as shown by actuarial valuation, duly approved by the Board of Trustees, and shall be called the 'actuarially determined employer contribution rate'. The actuarially determined employer contribution rate shall be calculated annually by the actuary using assumptions and a cost method approved by the Actuarial Standards Board of the American Academy of Actuaries and selected by the Board of Trustees."

## The Actuarial Valuation Process

The following diagram summarizes the inputs and results of the actuarial valuation process. A narrative of the process follows the diagram. The reader may find it worthwhile to refer to the diagram from time to time.




Under the actuarial valuation process, current information about Retirement System members is collected annually by staff at the direction of the actuary, namely member data, asset data and information on benefit provisions. Member data is collected for each member of the Retirement System. The member data will assist the actuary in estimating benefits that could be paid in the future. The member information the actuary collects to estimate the amount of benefit includes elements such as current service, salary and benefit group identifier for members that have not separated service; for those that have, the actual benefit amounts are collected. The actuary collects information such as gender and date of birth to determine when a benefit might be paid and for how long. The actuary collects summary information about assets as of the valuation date and information on cash flows for the year ending on the valuation date. Information about

# Appendix A: Valuation Process and Glossary of Actuarial Terms (continued)

benefit provisions as of the valuation date is also collected. To bridge the gap between the information collected and potential benefits to be paid in the future, the actuary must make assumptions about future activities. These assumptions are recommended by the actuary to the Boards based on the results of an experience review. An experience review is a review of the Retirement System over a period of time, typically five years, where the actuary analyzes the demographic and economic assumptions of the Retirement System. Based on this review, the actuary will make recommendations on the demographic assumptions, such as when members will be projected to retire, terminate, become disabled and/or die in the future, as well as the economic assumptions, such as what rate of return is projected to be earned by the fund based on the Retirement System investment policy and what level of future salary increases is expected for members. To maintain the assumptions, the Board should adopt a prudent policy of having an experience review being performed every five years. The next experience review for the North Carolina Retirement Systems will be based on the five-year period ending on December 31, 2019 and will be presented during 2020, however, the Board of Trustees may update assumptions outside of the five-year review. Using these assumptions, the actuary is able to use the member data, asset data and benefit provision information collected to project the benefits that will be paid from the Retirement System to current members. These projected future benefit payments are based not only on service and pay through the valuation date but includes future pay and service, which has not yet been earned by the members but is expected to be earned.

These projected future benefit payments are discounted into today's dollars using the assumed rate of investment return assumption to determine the Present Value of Future Benefits (PVFB) of the Retirement System. The PVFB is an estimate of the value of the benefits promised to all members as of a valuation date. If the Retirement System held assets equal to the PVFB and all the assumptions were realized, there would be sufficient funds to pay off all the benefits to be paid in the future for members in the Retirement System as of the valuation date.

The PVFB is a large sum of money, typically much larger than the amount of Retirement System assets held in the trust. The next step is for the actuary to apply the Funding Policy as adopted by the Board to determine the employer contributions to be made to the Retirement System so that the gap between the PVFB and assets is systematically paid off over time. The Funding Policy is adopted by the Board based on discussions with the actuary. When the Board develops a funding policy, a balance between contributions which are responsive to the needs of the Retirement System yet stable should be struck. There are many different funding policies for the Board to consider, and the actuary is responsible for discussing the various features of the funding policies under consideration. Funding Policies are generally reviewed during an experience review, but it is not uncommon to review a funding policy in between, particularly during periods where large increases or decreases in contributions are expected. The Funding Policy is composed of three components: the actuarial cost method, the asset valuation method, and the amortization method.

Once the PVFB is developed, an actuarial cost method is used to allocate the PVFB. Under the actuarial cost method, the PVFB is allocated to past, current and future service, respectively known as the actuarial accrued liability (AAL), normal cost (NC) and present value of future normal costs (PVFNC). The actuary computes the liability components (PVFB, NC, AAL, and PVFNC) for each participant in the Retirement System at the valuation date. These liability components are then totaled for the Retirement System. There are many actuarial cost methods. Different actuarial

# Appendix A: Valuation Process and Glossary of Actuarial Terms (continued)

methods will produce different contribution patterns, but do not change the ultimate cost of the benefits. The entry age normal cost method is the most prevalent method used for public sector plans in the United States, because the expected normal cost is calculated in such a way that it will tend to stay level as a percent of pay over a member's career. Most of the North Carolina Retirement Systems use the entry age normal cost method.

The actuarial accrued liability (AAL) is also referred to as the amount of money the Retirement System should ideally have in the trust. The unfunded actuarial accrued liability (UAAL) is the portion of actuarial accrued liability that is not covered by the assets of the Retirement System. The UAAL can be a negative number, which means that the Retirement System has more assets than actuarial accrued liability. We refer to this condition as overfunded liability in this summary. Having UAAL does not indicate that the Retirement System is in failing actuarial health. UAAL is a common occurrence. Currently, many retirement systems in the United States have UAAL as a result of the Great Recession of 2008. Another related statistic of the Retirement System is the funded ratio. The funded ratio is the percent of the actuarial accrued liabilities covered by the actuarial value of assets. The assets used for these purposes are an actuarial value of assets (AVA), not market. The actuarial value of assets is based on the asset valuation method as recommended by the actuary and adopted by the Board. An actuarial value of assets is a smoothed, or averaged, value of assets, which is used to limit employer contribution volatility. Typically, assets are smoothed, or averaged, over a period of 3 to 5 years, although longer periods are becoming more common. By averaging returns, the UAAL is not as volatile, which we will see later results in contributions that are not as volatile as well. The North Carolina Retirement Systems use an actuarial value of assets with a smoothing period of 5 years.

While having UAAL is common, it is acceptable only if it is systematically being paid off. The method by which the UAAL is paid off is known as the amortization method. The concept is similar to that of a mortgage payment. The Board adopts the amortization method used to pay off the UAAL over a period of time. The amortization method is composed of the amortization period, the amount of payment increase, whether the period is open or closed and by the amount of amortization schedules. The amortization period is the amount of time over which the UAAL will be paid off. This is generally a period of thirty years or less, but actuaries are beginning to recommend shorter periods. The payments can be developed to stay constant from year to year like a mortgage, but often they are developed to increase each year at the same level payroll increases. Amortization type can be closed or open. Under a closed period, the UAAL is expected to be paid off over the amortization period. This is similar to a typical mortgage. Under an open period, the amortization period remains unchanged year after year. The concept is similar to re-mortgaging annually. In many instances, an amortization schedule is developed, whereby the UAAL is amortized over a closed period from the point the UAAL is incurred. Finally, some amortization methods are defined by a schedule of payments, where a new schedule of payments is added with each valuation. Regardless of the amortization type or period, the funding policy should generate a contribution that pays off the UAAL, which results in the funded ratio trending to 100% over time. Caution should be used when an open method is used, because typically an open amortization policy does not result in the UAAL being paid off. North Carolina pays off a much larger amount of UAAL compared to other states. While many states struggle to pay a 30-year level percent of pay UAAL contribution, which doesn't even reduce the amount of UAAL, North Carolina pays down the UAAL with level dollar payments over 12 years. This aggressive payment schedule of the UAAL results in North Carolina being home to many of the best funded Public Retirement Systems in the United States.

# Appendix A: Valuation Process and Glossary of Actuarial Terms (continued)

To satisfy the requirements of the State of North Carolina, the actuary calculates the total annual contribution to the Retirement System as the normal cost plus a contribution towards UAAL. Said another way, this contribution is sufficient to pay for the cost of benefits accruing during the year (normal cost) plus the mortgage payment (UAAL payment). The total contribution is reduced by the amount of member contributions, if any, to arrive at the employer contribution. Continuing to follow the aggressive North Carolina contribution policy will keep the North Carolina Retirement Systems among the best funded in the United States.

An actuarial valuation report is produced annually, which contains the contribution for the fiscal year as well as the funded ratio of the Retirement System. The primary purpose of performing an actuarial valuation annually is to replace the estimated activities from the previous valuation, which were based on assumptions, with the actual experience of the Retirement System for the prior year. The experience gain (loss) is the difference between the expected and the actual UAAL of the Retirement System. An experience loss can be thought of as the amount of additional UAAL over and above the amount that was expected from the prior year due to deviation of actual experience from the assumption. Similarly, an experience gain can be thought of as having less UAAL than that which was expected from the prior year assumptions. As an example, if the Retirement System achieves an asset return of 15% when the assumption was a 7.00% return, an actuarial gain is said to have happened, which typically results in lower contributions and higher funded ratio, all else being equal. Alternatively, a return of 2% under the same circumstances would result in an actuarial loss, requiring an increase in contributions and a funded ratio that is lower than anticipated. Experience gains and losses are common within the valuation process. Typically gains and losses offset each other over time. To the extent that does not occur, the reasons for the gains and losses should be understood, and appropriate recommendations should be made by the actuary after an experience review to adjust the assumptions.

The actuarial valuation report will contain histories of key statistics from prior actuarial valuation reports. In particular, a history of the funded ratio of the Retirement System is an important exhibit. Trustees should understand the reason for the trend of the funded ratio of the Retirement System over time. The actuary will discuss the reasons for changes in the funded ratio of the Retirement System with each valuation report. To the extent that there are unexplained changes in funded ratio corrective action should be explored and the actuary will make recommendations as to whether there should be changes in the assumptions, funding policy, or some other portion of the actuarial valuation process.

In addition to historical information, projections of contributions and funded ratio based on current assumptions can sometimes be found in an actuarial valuation report. Projections of contributions can allow the employer to plan their budget accordingly. Surprises in Retirement System contributions to be paid by the employer serve no one. A one-year projection based on "bad" asset returns can provide ample time for the employer to plan, or allow for a discussion of changing the funding policy to occur. Contribution surprises are a primary contributor to employers considering pension reform. It is important to keep the employer apprised of future contribution requirements. A projection of funded ratio can serve the Trustees by illustrating the trend of the funded ratio over time. The funded ratio, under a prudent funding policy, should trend to 100% over a period of less than 30 years. (It is worthwhile to note that while 30 years has served as an industry standard for the longest period over which 100% funding should be achieved, that period is coming under scrutiny by the actuarial community and will likely be shortened.) If a projection of funded ratio does not trend to 100% over time, consideration should be given to fixing the funding policy to

# Appendix A: Valuation Process and Glossary of Actuarial Terms (continued)

achieve this goal. For the North Carolina Retirement Systems, projections are generally performed for the January board meetings. While the projection period has tended to be limited to five years, a longer projection would show the funded ratio trend to 100% much faster than other Public Retirement Systems.

The actuarial report will contain schedules of information about the census, plan and asset information submitted by Retirement System staff upon which the actuarial valuation is based. It is important that the Board of Trustees review that information and determine if the information is consistent with their understanding of the Retirement System. If after questioning staff, the Board of Trustees is not comfortable that the information provided is correct, the actuary should be notified to determine if the actuarial valuation report should be corrected.

Finally, the valuation report and/or presentation should contain sufficient information in an understandable fashion to allow the Board to take action and adopt the contribution rate for the upcoming year. It should also allow stakeholders to understand key observations over the past year that resulted in contributions increasing (or decreasing) and where contributions are headed. The actuary is always open to making the results understandable. CMC works with the North Carolina Retirement Systems Division to make your reports and presentations understandable and actionable. If something doesn't make sense – speak up!!

# Appendix A: Valuation Process and Glossary of Actuarial Terms (continued)

## Glossary

Note that the first definitions given are the "official" definitions of the term. For some terms there is a second definition, in italics, which is the unofficial definition.

Actuarial Accrued Liability (AAL). The portion of the Present Value of Projected Benefits (PVFB) allocated to past service. Also difference between (i) the actuarial present value of future benefits, and (ii) the present value of future normal cost. Sometimes referred to as "accrued liability" or "past service liability." *The amount of money that should be in the fund. The funding target.*

Actuarial Assumptions. Estimates of future plan experience with respect to rates of mortality, disability, retirement, investment income and salary increases. Demographic ("people") assumptions (rates of mortality, separation, and retirement) are generally based on past experience, often modified for projected changes in conditions. Economic ("money") assumptions (salary increases and investment income) consist of an underlying rate appropriate in an inflation-free environment plus a provision for a long-term average rate of inflation. *Estimates of future events used to project what we know now- current member data, assets, and benefit provisions – into an estimate of future benefits.*

Actuarial Cost Method. A mathematical budgeting procedure for allocating the dollar amount of the Present Value of Projected Benefits (PVFB) between the normal costs to be paid in the future and the actuarial accrued liability. Sometimes referred to as the "actuarial funding method."

Actuarial Methods. The collective term for the Actuarial Cost Method, the Amortization Payment for UAAL Method, and the Asset Valuation Method used to develop the contribution requirements for the Retirement System. *The funding policy*.

Actuarial Equivalent. Benefits whose actuarial present values are equal.

Actuarial Present Value. The amount of funds presently required to provide a payment or series of payments in the future. It is determined by discounting the future payments at a predetermined rate of interest, taking into account the probability of payment.

Actuarial Value of Assets (AVA). A smoothed value of assets which is used to limit contribution volatility. Also known as the funding value of assets. *Smoothed value of assets.*

# Appendix A: Valuation Process and Glossary of Actuarial Terms (continued)

Amortization Payment for UAAL. Payment of the unfunded actuarial accrued liability by means of periodic contributions of interest and principal, as opposed to a lump sum payment. The components of the amortization payment for UAAL includes:

- Amortization Period Length – Generally amortization periods of up to 15 to 25 years (and certainly not longer than 30). Similar to a mortgage, the shorter the amortization period, the higher the payment and the faster the UAAL is paid off.
- Amortization payment increases – Future payments can be level dollar, like a mortgage, or as a level percent of pay. Most Retirement Systems amortize UAAL as a level percent of pay which when combined with the employer normal cost that is developed as a level percent of pay can result in contributions that are easier to budget.
- Amortization type – An amortization schedule can be closed or open. A closed amortization schedule is similar to a mortgage – at the end of the amortization period the UAAL is designed to be paid off. An open amortization period is similar to refinancing the UAAL year after year.
- Amortization schedule – UAAL can be amortized over a single amortization period, or it can be amortized over a schedule.

*The amortization payment for UAAL can be thought of as the UAAL mortgage payment.*

Asset Valuation Method. The components of how the actuarial value of assets is to be developed. TSERS uses a five-year smoothing of asset gains and losses, which is the most commonly used method.

Experience Gain (Loss). A measure of the difference between actual experience and experience anticipated by a set of actuarial assumptions during the period between two actuarial valuation dates, in accordance with the actuarial cost method being used. *The experience Gain (Loss) represents how much the actuary missed the mark in a given year.*

Funded Ratio. The percent of the actuarial accrued liabilities covered by the actuarial value of assets. Also known as the funded status. *The ratio of how much money you actually have in the fund to the amount you should have in the fund.*

Normal Cost. The annual cost assigned, under the actuarial funding method, to current and subsequent plan years. Sometimes referred to as "current service cost." An amortization payment toward the unfunded actuarial accrued liability is paid in addition to the normal cost to arrive at the total contribution in a given year. *The cost of benefits accruing during the year*.

Present Value of Future Normal Cost (PVFNC). The portion of the Present Value of Projected Benefits (PVFB) allocated to future service. *The value in today's dollars of the amount of contribution to be made in the future for benefits accruing for members in the Retirement System as of the valuation date.*

# Appendix A: Valuation Process and Glossary of Actuarial Terms (continued)

Present Value of Future Benefits (PVFB). The projected future benefit payments of the plan are discounted into today's dollars using an assumed rate of investment return assumption to determine the Present Value of Future Benefits (PVFB) of the Retirement System. The PVFB is the discounted value of the projected benefits promised to all members as of a valuation date, including future pay and service for members which has not yet been earned. *If the Retirement System held assets equal to the PVFB and all the assumptions were realized, there would be sufficient funds to pay off all the benefits to be paid in the future for members in the Retirement System as of the valuation date.*

Reserve Account. An account used to indicate that funds have been set aside for a specific purpose and are not generally available for other uses.

Unfunded Actuarial Accrued Liability (UAAL). The difference between the actuarial accrued liability (AAL) and actuarial value of assets (AVA). The UAAL is sometimes referred to as "unfunded accrued liability." *Funding shortfall, or prefunded amount if negative.*

Valuation Date. The date that the actuarial valuation calculations are performed as of. *Also known as the "snapshot date".*

# Appendix B: Detailed Tabulations of Member Data

**Table B-1: The Number and Average Reported Compensation of Active Members Distributed by Age and Service as of December 31, 2017**

| Age | Years of Service | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Under 1 | 1 to 4 | 5 to 9 | 10 to 14 | 15 to 19 | 20 to 24 | 25 to 29 | 30 to 34 | 35 to 39 | 40 & Up | Total |
| Under 25 | 2,924 | 4,402 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7,339 |
| | 13,140 | 32,373 | 37,686 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24,720 |
| 25 to 29 | 3,201 | 19,032 | 4,684 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 26,945 |
| | 12,269 | 36,935 | 41,628 | 33,765 | 0 | 0 | 0 | 0 | 0 | 0 | 34,817 |
| 30 to 34 | 2,030 | 12,050 | 11,692 | 4,949 | 29 | 0 | 0 | 0 | 0 | 0 | 30,750 |
| | 11,735 | 38,448 | 44,352 | 46,844 | 42,814 | 0 | 0 | 0 | 0 | 0 | 40,285 |
| 35 to 39 | 1,667 | 9,437 | 7,826 | 11,912 | 4,066 | 42 | 0 | 0 | 0 | 0 | 34,950 |
| | 11,920 | 39,750 | 46,267 | 50,431 | 53,096 | 47,362 | 0 | 0 | 0 | 0 | 45,084 |
| 40 to 44 | 1,565 | 8,353 | 6,927 | 8,670 | 9,488 | 3,403 | 23 | 0 | 0 | 0 | 38,429 |
| | 11,904 | 39,227 | 45,956 | 50,476 | 56,332 | 57,973 | 43,979 | 0 | 0 | 0 | 47,751 |
| 45 to 49 | 1,401 | 8,455 | 7,526 | 9,461 | 8,195 | 9,288 | 3,000 | 42 | 0 | 0 | 47,368 |
| | 11,629 | 39,673 | 45,640 | 48,674 | 53,582 | 59,786 | 62,620 | 47,296 | 0 | 0 | 49,400 |
| 50 to 54 | 1,066 | 6,826 | 6,373 | 8,548 | 7,270 | 5,977 | 5,866 | 1,077 | 9 | 0 | 43,012 |
| | 11,405 | 39,202 | 44,671 | 45,871 | 49,619 | 55,376 | 63,283 | 64,502 | 47,852 | 0 | 48,577 |
| 55 to 59 | 886 | 5,490 | 5,480 | 8,046 | 7,186 | 5,814 | 4,080 | 2,009 | 311 | 3 | 39,305 |
| | 11,787 | 40,294 | 44,186 | 45,394 | 47,745 | 51,561 | 59,192 | 66,467 | 67,240 | 47,482 | 47,780 |
| 60 to 64 | 416 | 3,273 | 3,822 | 5,558 | 4,926 | 3,928 | 2,346 | 1,125 | 498 | 155 | 26,047 |
| | 12,570 | 42,511 | 45,452 | 46,784 | 49,059 | 52,484 | 59,335 | 67,307 | 74,609 | 67,982 | 49,470 |
| 65 to 69 | 123 | 986 | 1,389 | 1,878 | 1,302 | 949 | 544 | 341 | 172 | 189 | 7,873 |
| | 11,820 | 40,895 | 46,071 | 50,584 | 55,928 | 57,046 | 63,971 | 75,525 | 92,708 | 81,669 | 53,303 |
| 70 & Over | 58 | 338 | 385 | 596 | 459 | 248 | 167 | 79 | 86 | 120 | 2,536 |
| | 11,753 | 42,156 | 42,212 | 44,110 | 48,006 | 54,757 | 69,151 | 73,037 | 92,821 | 92,807 | 51,074 |
| Total | 15,337 | 78,642 | 56,117 | 59,646 | 42,921 | 29,649 | 16,026 | 4,673 | 1,076 | 467 | 304,554 |
| | 12,145 | 38,523 | 44,884 | 48,122 | 51,981 | 55,961 | 61,596 | 66,816 | 76,604 | 79,769 | 45,687 |

# Appendix B: Detailed Tabulations of Member Data (continued)

**Table B-2: The Number and Reported Compensation of Active Members Distributed by Age as of December 31, 2017**

| Age | Men | | Women | |
|---|---|---|---|---|
| | Number | Compensation | Number | Compensation |
| 18 | 1 | 11,873 | 3 | 37,285 |
| 19 | 26 | 238,682 | 23 | 231,863 |
| 20 | 67 | 954,849 | 69 | 869,754 |
| 21 | 158 | 2,986,465 | 138 | 2,039,631 |
| 22 | 330 | 7,477,741 | 525 | 9,086,948 |
| 23 | 672 | 16,110,506 | 1,713 | 37,005,690 |
| 24 | 1,004 | 28,036,522 | 2,610 | 76,330,616 |
| 25 | 1,239 | 38,841,081 | 3,068 | 99,175,838 |
| 26 | 1,434 | 46,864,928 | 3,599 | 120,089,829 |
| 27 | 1,614 | 56,484,008 | 4,095 | 142,713,167 |
| 28 | 1,768 | 63,709,005 | 4,171 | 149,855,761 |
| 29 | 1,791 | 68,038,521 | 4,166 | 152,384,077 |
| 30 | 1,741 | 66,258,810 | 4,208 | 158,267,652 |
| 31 | 1,834 | 74,454,261 | 4,163 | 162,179,962 |
| 32 | 1,862 | 79,255,010 | 4,310 | 169,632,739 |
| 33 | 1,943 | 84,202,535 | 4,344 | 175,870,306 |
| 34 | 1,938 | 86,431,863 | 4,407 | 182,198,931 |
| 35 | 2,058 | 93,634,709 | 4,558 | 195,780,446 |
| 36 | 2,102 | 96,559,222 | 4,815 | 208,088,334 |
| 37 | 2,140 | 100,996,697 | 4,899 | 215,842,532 |
| 38 | 2,216 | 108,945,982 | 4,937 | 217,722,896 |
| 39 | 2,151 | 107,807,195 | 5,074 | 230,315,126 |
| 40 | 2,241 | 113,748,846 | 5,206 | 237,081,381 |
| 41 | 2,245 | 116,686,121 | 5,296 | 241,261,235 |
| 42 | 2,216 | 116,609,064 | 5,152 | 237,971,183 |
| 43 | 2,313 | 121,406,306 | 5,630 | 258,928,201 |
| 44 | 2,472 | 128,524,017 | 5,658 | 262,808,463 |
| 45 | 2,555 | 136,050,315 | 5,964 | 277,105,143 |
| 46 | 2,796 | 151,005,695 | 6,424 | 302,880,491 |
| 47 | 3,097 | 166,735,969 | 7,111 | 332,697,650 |
| 48 | 2,938 | 164,912,185 | 6,990 | 333,702,751 |
| 49 | 2,860 | 160,601,568 | 6,633 | 314,269,693 |
| 50 | 2,701 | 149,788,971 | 6,257 | 290,886,562 |
| 51 | 2,593 | 142,968,292 | 6,160 | 286,040,706 |
| 52 | 2,591 | 144,206,469 | 5,893 | 269,134,434 |
| 53 | 2,498 | 133,670,547 | 5,931 | 268,829,710 |
| 54 | 2,541 | 136,415,091 | 5,847 | 267,423,287 |
| 55 | 2,528 | 135,491,557 | 5,732 | 259,504,660 |
| 56 | 2,415 | 127,717,724 | 5,766 | 261,872,446 |
| 57 | 2,428 | 128,542,367 | 5,512 | 251,972,637 |

# Appendix B: Detailed Tabulations of Member Data (continued)

**Table B-2: The Number and Reported Compensation of Active Members Distributed by Age as of December 31, 2017**
**(continued)**

| Age | Men | | Women | |
|---|---|---|---|---|
| | Number | Compensation | Number | Compensation |
| 58 | 2,227 | 116,292,656 | 5,374 | 247,010,550 |
| 59 | 2,254 | 117,981,602 | 5,069 | 231,606,935 |
| 60 | 2,170 | 114,801,456 | 4,858 | 225,800,258 |
| 61 | 1,955 | 106,362,167 | 4,213 | 194,895,030 |
| 62 | 1,731 | 93,022,110 | 3,506 | 165,660,519 |
| 63 | 1,452 | 83,262,082 | 2,694 | 126,839,852 |
| 64 | 1,256 | 70,814,815 | 2,212 | 107,084,447 |
| 65 | 979 | 56,968,409 | 1,735 | 84,125,302 |
| 66 | 758 | 45,279,953 | 1,172 | 59,470,205 |
| 67 | 591 | 36,837,142 | 833 | 41,720,028 |
| 68 | 439 | 26,028,324 | 575 | 26,572,461 |
| 69 | 378 | 23,602,902 | 413 | 19,051,296 |
| 70 | 289 | 18,985,624 | 349 | 15,946,976 |
| 71 | 277 | 17,745,106 | 285 | 12,053,683 |
| 72 | 151 | 8,704,545 | 146 | 6,056,958 |
| 73 | 124 | 6,480,669 | 128 | 5,276,708 |
| 74 | 105 | 6,337,537 | 103 | 4,444,853 |
| 75 | 83 | 4,352,752 | 85 | 3,235,909 |
| 76 | 59 | 3,080,039 | 60 | 2,668,568 |
| 77 | 39 | 2,176,349 | 39 | 1,351,212 |
| 78 | 36 | 2,520,418 | 26 | 1,165,914 |
| 79 | 26 | 1,299,062 | 17 | 736,035 |
| 80 | 20 | 848,355 | 11 | 347,253 |
| 81 | 11 | 433,332 | 9 | 266,161 |
| 82 | 7 | 380,773 | 8 | 370,759 |
| 83 | 6 | 408,691 | 3 | 68,599 |
| 84 | 9 | 482,404 | 3 | 130,745 |
| 85 | 2 | 203,258 | 5 | 156,920 |
| 86 | 3 | 263,906 | 2 | 120,344 |
| 87 | 1 | 54,982 | 0 | 0 |
| 88 | 2 | 107,558 | 0 | 0 |
| 89 | 1 | 31,663 | 0 | 0 |
| 90 | 1 | 78,537 | 0 | 0 |
| 91 | 0 | 0 | 1 | 22,184 |
| 92 | 0 | 0 | 1 | 22,771 |
| 93 | 1 | 21,943 | 1 | 40,505 |
| 98 | 0 | 0 | 1 | 42,679 |
| Total | 93,560 | 4,669,632,690 | 210,994 | 9,244,452,635 |

# Appendix B: Detailed Tabulations of Member Data (continued)

**Table B-3: The Number and Reported Compensation of Active Members Distributed by Service as of December 31, 2017**

| Service | Men | | Women | |
|---|---|---|---|---|
| | Number | Compensation | Number | Compensation |
| 0 | 4,184 | 49,516,076 | 11,153 | 136,756,885 |
| 1 | 7,930 | 279,624,117 | 16,640 | 538,214,583 |
| 2 | 6,596 | 288,314,620 | 13,909 | 528,838,792 |
| 3 | 5,729 | 256,530,049 | 12,196 | 484,905,313 |
| 4 | 5,067 | 226,273,599 | 10,575 | 426,795,919 |
| 5 | 4,779 | 218,447,306 | 10,346 | 426,471,305 |
| 6 | 4,160 | 196,526,567 | 8,498 | 364,063,368 |
| 7 | 3,522 | 173,301,562 | 7,253 | 319,154,036 |
| 8 | 3,093 | 153,946,002 | 6,193 | 277,609,848 |
| 9 | 2,594 | 136,716,300 | 5,679 | 252,491,869 |
| 10 | 4,052 | 203,709,568 | 9,087 | 407,239,389 |
| 11 | 3,655 | 194,502,653 | 8,712 | 396,576,641 |
| 12 | 3,615 | 192,000,457 | 8,884 | 412,242,334 |
| 13 | 3,326 | 176,132,387 | 7,924 | 372,932,589 |
| 14 | 2,997 | 162,021,210 | 7,394 | 352,946,009 |
| 15 | 2,716 | 150,298,011 | 6,450 | 318,484,234 |
| 16 | 2,319 | 134,599,666 | 5,884 | 291,824,466 |
| 17 | 2,398 | 141,686,133 | 6,406 | 318,222,170 |
| 18 | 2,381 | 137,530,120 | 6,262 | 311,675,018 |
| 19 | 2,231 | 133,632,557 | 5,874 | 293,092,421 |
| 20 | 2,064 | 123,453,695 | 5,200 | 266,272,085 |
| 21 | 1,828 | 111,277,559 | 4,494 | 236,906,452 |
| 22 | 1,766 | 111,768,623 | 4,090 | 220,980,673 |
| 23 | 1,560 | 97,050,515 | 3,586 | 197,392,292 |
| 24 | 1,696 | 107,102,053 | 3,365 | 186,988,662 |
| 25 | 1,306 | 86,864,016 | 2,853 | 164,976,805 |
| 26 | 1,245 | 82,118,194 | 2,445 | 143,214,998 |
| 27 | 899 | 61,510,645 | 1,840 | 111,484,350 |
| 28 | 1,026 | 68,817,447 | 1,920 | 115,201,910 |
| 29 | 750 | 49,819,410 | 1,742 | 103,129,673 |
| 30 | 528 | 36,450,391 | 1,223 | 73,184,062 |
| 31 | 369 | 27,507,995 | 698 | 45,430,077 |
| 32 | 243 | 19,457,493 | 495 | 32,210,150 |
| 33 | 196 | 15,345,021 | 431 | 27,994,245 |
| 34 | 172 | 13,463,334 | 318 | 21,188,339 |
| 35 | 114 | 9,758,889 | 206 | 14,058,287 |

# Appendix B: Detailed Tabulations of Member Data (continued)

**Table B-3: The Number and Reported Compensation of Active Members Distributed by Service as of December 31, 2017**
**(continued)**

| Service | Men | | Women | |
|---|---|---|---|---|
| | Number | Compensation | Number | Compensation |
| 36 | 82 | 8,018,229 | 137 | 10,099,078 |
| 37 | 84 | 7,412,580 | 114 | 7,337,011 |
| 38 | 57 | 5,180,525 | 122 | 8,398,795 |
| 39 | 60 | 5,600,530 | 100 | 6,562,084 |
| 40 | 35 | 4,047,045 | 91 | 6,170,126 |
| 41 | 32 | 2,587,042 | 58 | 4,375,502 |
| 42 | 20 | 1,758,589 | 36 | 2,738,110 |
| 43 | 18 | 1,308,336 | 27 | 2,197,504 |
| 44 | 19 | 1,740,967 | 28 | 1,721,175 |
| 45 | 8 | 725,689 | 13 | 849,498 |
| 46 | 14 | 1,310,273 | 14 | 894,504 |
| 47 | 3 | 391,740 | 8 | 548,795 |
| 48 | 6 | 643,966 | 10 | 701,107 |
| 49 | 3 | 361,614 | 1 | 55,664 |
| 50 | 10 | 1,067,028 | 2 | 111,282 |
| 51 | 1 | 97,076 | 0 | 0 |
| 52 | 1 | 208,596 | 0 | 0 |
| 53 | 0 | 0 | 1 | 64,475 |
| 55 | 0 | 0 | 3 | 249,608 |
| 56 | 0 | 0 | 1 | 39,542 |
| 57 | 1 | 98,625 | 1 | 50,651 |
| 58 | 0 | 0 | 1 | 64,933 |
| 62 | 0 | 0 | 1 | 72,942 |
| Total | 93,560 | 4,669,632,690 | 210,994 | 9,244,452,635 |

# Appendix B: Detailed Tabulations of Member Data (continued)

**Table B-4: The Number and Valuation Compensation of Disabled Members Distributed by Age as of December 31, 2017**

| Age | Men | | Women | |
|---|---|---|---|---|
| | Number | Compensation | Number | Compensation |
| 27 | 0 | 0 | 1 | 42,450 |
| 29 | 0 | 0 | 3 | 79,916 |
| 30 | 2 | 54,533 | 2 | 65,837 |
| 31 | 1 | 18,459 | 2 | 37,339 |
| 32 | 1 | 28,987 | 5 | 85,454 |
| 33 | 0 | 0 | 6 | 153,715 |
| 34 | 3 | 70,587 | 7 | 174,957 |
| 35 | 3 | 111,737 | 15 | 407,993 |
| 36 | 5 | 155,786 | 17 | 556,648 |
| 37 | 9 | 224,385 | 11 | 380,120 |
| 38 | 5 | 176,224 | 22 | 679,922 |
| 39 | 11 | 306,124 | 26 | 817,543 |
| 40 | 14 | 464,260 | 33 | 995,129 |
| 41 | 12 | 347,913 | 46 | 1,604,751 |
| 42 | 17 | 518,246 | 52 | 1,637,731 |
| 43 | 25 | 874,776 | 60 | 1,954,939 |
| 44 | 33 | 1,164,808 | 45 | 1,303,658 |
| 45 | 32 | 1,072,701 | 66 | 2,217,279 |
| 46 | 33 | 962,755 | 96 | 3,163,053 |
| 47 | 39 | 1,239,611 | 99 | 3,159,629 |
| 48 | 47 | 1,564,715 | 132 | 4,271,719 |
| 49 | 53 | 1,923,493 | 129 | 4,165,717 |
| 50 | 75 | 2,599,860 | 159 | 5,472,512 |
| 51 | 62 | 5,214,780 | 161 | 5,425,196 |
| 52 | 81 | 2,876,984 | 199 | 6,317,270 |
| 53 | 95 | 3,233,368 | 226 | 7,436,723 |
| 54 | 93 | 3,283,096 | 235 | 7,208,015 |
| 55 | 108 | 3,624,825 | 235 | 7,569,310 |

# Appendix B: Detailed Tabulations of Member Data (continued)

**Table B-4: The Number and Valuation Compensation of Disabled Members Distributed by Age as of December 31, 2017**
**(continued)**

| Age | Men | | Women | |
|---|---|---|---|---|
| | Number | Contributions | Number | Contributions |
| 56 | 110 | 3,454,892 | 257 | 7,789,546 |
| 57 | 104 | 3,439,097 | 337 | 10,180,026 |
| 58 | 129 | 4,489,056 | 289 | 9,345,922 |
| 59 | 154 | 5,060,398 | 299 | 9,297,724 |
| 60 | 134 | 4,572,987 | 286 | 8,963,919 |
| 61 | 135 | 4,543,395 | 245 | 7,740,227 |
| 62 | 113 | 3,827,325 | 248 | 7,962,206 |
| 63 | 108 | 3,824,345 | 241 | 7,800,615 |
| 64 | 102 | 3,703,447 | 236 | 7,958,712 |
| 65 | 63 | 2,032,765 | 121 | 4,355,766 |
| 66 | 2 | 43,589 | 4 | 67,836 |
| 67 | 1 | 22,081 | 1 | 14,957 |
| 68 | 1 | 32,111 | 3 | 108,350 |
| 70 | 0 | 0 | 2 | 49,356 |
| 71 | 0 | 0 | 2 | 36,993 |
| 73 | 0 | 0 | 1 | 17,512 |
| 74 | 0 | 0 | 3 | 78,635 |
| Total | 2,015 | 71,158,501 | 4,665 | 149,152,827 |

# Appendix B: Detailed Tabulations of Member Data (continued)

**Table B-5: The Number and Accumulated Contributions of Terminated Vested Members Distributed by Age as of December 31, 2017**

| Age | Men | | Women | |
|---|---|---|---|---|
| | Number | Contributions | Number | Contributions |
| 18 | 3 | 416 | 5 | 527 |
| 19 | 2 | 523 | 3 | 9,739 |
| 20 | 15 | 12,176 | 17 | 8,743 |
| 21 | 44 | 33,372 | 46 | 30,838 |
| 22 | 100 | 131,336 | 97 | 94,545 |
| 23 | 151 | 210,771 | 220 | 272,994 |
| 24 | 311 | 508,939 | 471 | 868,014 |
| 25 | 489 | 1,025,366 | 762 | 1,826,151 |
| 26 | 615 | 1,595,547 | 1,365 | 4,359,487 |
| 27 | 795 | 2,440,683 | 1,816 | 6,768,814 |
| 28 | 935 | 3,471,135 | 2,178 | 9,592,578 |
| 29 | 1,011 | 4,045,426 | 2,434 | 11,937,604 |
| 30 | 1,064 | 4,725,866 | 2,678 | 15,242,252 |
| 31 | 1,209 | 6,081,478 | 2,720 | 16,889,754 |
| 32 | 1,276 | 7,156,378 | 3,065 | 21,438,877 |
| 33 | 1,405 | 8,984,556 | 3,417 | 25,602,192 |
| 34 | 1,292 | 9,050,911 | 3,623 | 30,741,235 |
| 35 | 1,520 | 11,395,638 | 3,752 | 34,055,599 |
| 36 | 1,496 | 12,908,058 | 3,947 | 38,436,498 |
| 37 | 1,444 | 13,628,443 | 3,836 | 40,731,764 |
| 38 | 1,482 | 13,938,936 | 3,930 | 41,992,387 |
| 39 | 1,446 | 15,218,715 | 3,650 | 41,292,347 |
| 40 | 1,408 | 15,738,275 | 3,572 | 42,102,630 |
| 41 | 1,424 | 16,935,060 | 3,467 | 42,384,691 |
| 42 | 1,294 | 18,070,567 | 3,237 | 41,358,160 |
| 43 | 1,408 | 20,223,249 | 3,312 | 44,440,253 |
| 44 | 1,340 | 19,417,505 | 3,083 | 43,734,626 |
| 45 | 1,379 | 21,855,610 | 3,053 | 44,257,230 |
| 46 | 1,430 | 23,945,331 | 3,134 | 45,853,485 |
| 47 | 1,556 | 25,223,006 | 3,354 | 51,502,918 |
| 48 | 1,426 | 25,090,541 | 3,308 | 50,616,621 |
| 49 | 1,309 | 23,355,976 | 3,016 | 49,285,180 |
| 50 | 1,242 | 23,461,443 | 2,794 | 46,265,480 |
| 51 | 1,183 | 22,013,305 | 2,576 | 41,665,623 |
| 52 | 1,148 | 20,006,404 | 2,444 | 39,634,995 |
| 53 | 1,127 | 22,090,843 | 2,562 | 40,217,519 |
| 54 | 1,076 | 20,465,778 | 2,503 | 42,141,378 |
| 55 | 1,054 | 21,133,731 | 2,445 | 42,344,254 |
| 56 | 954 | 18,610,594 | 2,425 | 41,343,770 |
| 57 | 1,045 | 20,936,477 | 2,376 | 43,531,598 |
| 58 | 948 | 20,783,652 | 2,183 | 41,511,949 |
| 59 | 933 | 22,197,750 | 2,200 | 44,237,069 |
| 60 | 821 | 18,078,398 | 1,901 | 37,524,981 |

# Appendix B: Detailed Tabulations of Member Data (continued)

**Table B-5: The Number and Accumulated Contributions of Terminated Vested Members Distributed by Age as of December 31, 2017**
**(continued)**

| Age | Men | | Women | |
|---|---|---|---|---|
| | Number | Contributions | Number | Contributions |
| 61 | 674 | 13,566,164 | 1,461 | 28,773,432 |
| 62 | 620 | 11,220,699 | 1,327 | 24,519,367 |
| 63 | 611 | 10,861,013 | 1,305 | 22,182,502 |
| 64 | 527 | 8,581,292 | 1,116 | 19,189,332 |
| 65 | 453 | 7,779,315 | 886 | 15,103,267 |
| 66 | 392 | 5,698,490 | 563 | 7,363,555 |
| 67 | 301 | 3,511,500 | 519 | 6,699,855 |
| 68 | 259 | 2,005,982 | 534 | 5,258,050 |
| 69 | 266 | 2,349,135 | 423 | 4,143,970 |
| 70 | 199 | 1,925,529 | 313 | 3,187,211 |
| 71 | 114 | 1,726,929 | 164 | 1,756,046 |
| 72 | 41 | 666,941 | 53 | 687,728 |
| 73 | 36 | 394,317 | 41 | 367,678 |
| 74 | 25 | 337,319 | 19 | 203,444 |
| 75 | 18 | 150,913 | 23 | 206,637 |
| 76 | 15 | 54,099 | 22 | 219,067 |
| 77 | 14 | 384,659 | 16 | 196,823 |
| 78 | 13 | 86,188 | 13 | 90,215 |
| 79 | 13 | 156,477 | 10 | 50,708 |
| 80 | 10 | 102,907 | 11 | 133,600 |
| 81 | 8 | 39,983 | 4 | 39,678 |
| 82 | 7 | 43,516 | 3 | 20,193 |
| 83 | 7 | 54,054 | 6 | 72,324 |
| 84 | 3 | 2,378 | 1 | 1 |
| 85 | 3 | 24,273 | 1 | 252 |
| 86 | 5 | 78,160 | 2 | 2,386 |
| 87 | 2 | 5,308 | 3 | 666 |
| 88 | 2 | 1,699 | 0 | 0 |
| 89 | 2 | 6,395 | 0 | 0 |
| 90 | 1 | 1 | 0 | 0 |
| 91 | 1 | 17,074 | 2 | 6,055 |
| 92 | 1 | 33 | 2 | 234 |
| 93 | 0 | 0 | 2 | 54 |
| 94 | 1 | 2,078 | 2 | 26 |
| 95 | 0 | 0 | 1 | 87 |
| 96 | 0 | 0 | 2 | 242 |
| 97 | 1 | 138 | 1 | 345 |
| 98 | 0 | 0 | 1 | 250 |
| 99 | 0 | 0 | 1 | 57 |
| 100 | 0 | 0 | 2 | 19 |
| Total | 48,255 | 628,033,122 | 111,832 | 1,398,622,705 |

# Appendix B: Detailed Tabulations of Member Data (continued)

**Table B-6: The Number and Annual Retirement Allowances of Retired Members (Healthy at Retirement) and Survivors of Deceased Members Distributed by Age as of December 31, 2017**

| Age | Men | | Women | |
|---|---|---|---|---|
| | Number | Allowances | Number | Allowances |
| 18 | 1 | 7,712 | 3 | 1,747 |
| 19 | 4 | 26,834 | 2 | 16,779 |
| 20 | 3 | 50,569 | 1 | 2,463 |
| 21 | 3 | 9,505 | 1 | 15,519 |
| 22 | 3 | 36,645 | 3 | 71,135 |
| 23 | 3 | 33,093 | 3 | 41,744 |
| 24 | 3 | 20,006 | 2 | 46,194 |
| 25 | 1 | 10,532 | 5 | 74,724 |
| 26 | 3 | 63,898 | 5 | 30,719 |
| 27 | 4 | 36,369 | 5 | 65,465 |
| 28 | 7 | 90,629 | 10 | 80,315 |
| 29 | 9 | 80,899 | 5 | 66,519 |
| 30 | 8 | 115,371 | 9 | 125,467 |
| 31 | 4 | 42,983 | 10 | 121,219 |
| 32 | 6 | 35,239 | 8 | 84,482 |
| 33 | 8 | 108,654 | 11 | 140,310 |
| 34 | 9 | 95,618 | 10 | 110,048 |
| 35 | 11 | 140,939 | 14 | 177,995 |
| 36 | 18 | 151,325 | 19 | 272,758 |
| 37 | 18 | 289,265 | 16 | 96,238 |
| 38 | 9 | 89,078 | 12 | 144,608 |
| 39 | 8 | 71,897 | 13 | 153,339 |
| 40 | 14 | 155,990 | 23 | 278,650 |
| 41 | 20 | 269,936 | 26 | 262,111 |
| 42 | 13 | 188,015 | 24 | 364,236 |
| 43 | 18 | 181,303 | 24 | 325,029 |
| 44 | 19 | 212,140 | 23 | 206,791 |
| 45 | 21 | 212,505 | 31 | 351,163 |
| 46 | 24 | 278,004 | 32 | 323,262 |
| 47 | 33 | 380,601 | 44 | 515,929 |
| 48 | 51 | 950,873 | 42 | 556,219 |
| 49 | 64 | 1,502,523 | 66 | 939,108 |
| 50 | 105 | 2,556,140 | 92 | 1,528,477 |
| 51 | 203 | 5,311,519 | 219 | 4,353,123 |
| 52 | 308 | 8,875,517 | 375 | 9,144,456 |
| 53 | 392 | 11,365,900 | 580 | 15,105,321 |
| 54 | 516 | 15,176,606 | 738 | 20,562,907 |
| 55 | 643 | 19,483,509 | 959 | 27,012,306 |
| 56 | 725 | 22,747,623 | 1,165 | 33,434,508 |
| 57 | 785 | 24,634,059 | 1,456 | 41,433,602 |
| 58 | 828 | 26,211,580 | 1,634 | 47,298,190 |
| 59 | 905 | 28,736,307 | 1,850 | 53,170,837 |

# Appendix B: Detailed Tabulations of Member Data (continued)

**Table B-6: The Number and Annual Retirement Allowances of Retired Members (Healthy at Retirement) and Survivors of Deceased Members Distributed by Age as of December 31, 2017 (continued)**

| Age | Men | | Women | |
|---|---|---|---|---|
| | Number | Allowances | Number | Allowances |
| 60 | 1,066 | 32,595,598 | 2,494 | 71,691,953 |
| 61 | 1,405 | 39,631,730 | 3,613 | 96,652,971 |
| 62 | 1,668 | 44,454,929 | 4,248 | 103,226,365 |
| 63 | 2,060 | 48,086,799 | 5,167 | 112,761,383 |
| 64 | 2,268 | 52,536,931 | 6,067 | 129,005,752 |
| 65 | 2,571 | 60,170,990 | 6,685 | 142,421,245 |
| 66 | 2,938 | 67,402,145 | 7,152 | 148,168,475 |
| 67 | 3,085 | 68,834,590 | 7,182 | 148,882,645 |
| 68 | 3,076 | 70,721,014 | 7,092 | 142,611,411 |
| 69 | 3,229 | 73,879,547 | 7,104 | 140,520,503 |
| 70 | 3,296 | 75,170,234 | 7,061 | 136,648,385 |
| 71 | 3,579 | 83,346,832 | 7,504 | 145,931,029 |
| 72 | 2,479 | 56,699,988 | 5,175 | 96,898,807 |
| 73 | 2,465 | 55,758,177 | 4,837 | 89,538,884 |
| 74 | 2,251 | 51,560,809 | 4,854 | 89,925,755 |
| 75 | 2,302 | 55,688,876 | 4,792 | 87,530,397 |
| 76 | 1,879 | 43,772,488 | 3,957 | 71,086,096 |
| 77 | 1,693 | 40,036,854 | 3,616 | 63,973,505 |
| 78 | 1,556 | 37,020,907 | 3,300 | 57,783,679 |
| 79 | 1,456 | 34,759,113 | 3,000 | 52,266,724 |
| 80 | 1,353 | 31,713,030 | 2,905 | 49,214,481 |
| 81 | 1,190 | 29,748,400 | 2,631 | 44,847,252 |
| 82 | 1,135 | 27,346,895 | 2,528 | 42,314,596 |
| 83 | 983 | 23,920,055 | 2,509 | 41,513,620 |
| 84 | 915 | 22,347,630 | 2,012 | 32,059,863 |
| 85 | 807 | 19,377,495 | 1,897 | 30,729,349 |
| 86 | 730 | 17,572,901 | 1,789 | 28,188,750 |
| 87 | 650 | 16,246,529 | 1,618 | 26,285,313 |
| 88 | 579 | 14,373,797 | 1,408 | 22,732,652 |
| 89 | 427 | 10,594,044 | 1,288 | 19,902,314 |
| 90 | 358 | 8,412,914 | 1,089 | 16,744,641 |
| 91 | 285 | 6,679,247 | 907 | 13,836,247 |
| 92 | 207 | 4,760,857 | 794 | 11,530,003 |
| 93 | 169 | 3,484,955 | 622 | 8,893,543 |
| 94 | 111 | 2,385,495 | 490 | 6,763,961 |
| 95 | 90 | 1,804,129 | 363 | 4,736,814 |
| 96 | 52 | 1,806,953 | 299 | 4,061,862 |
| 97 | 58 | 1,256,996 | 222 | 2,759,032 |
| 98 | 19 | 375,364 | 153 | 1,885,820 |
| 99 | 23 | 490,255 | 109 | 1,380,976 |
| 100 | 16 | 280,834 | 221 | 3,028,782 |
| Total | 62,309 | 1,508,145,036 | 140,324 | 2,800,041,847 |

# Appendix B: Detailed Tabulations of Member Data (continued)

**Table B-7: The Number and Annual Retirement Allowances of Retired Members (Healthy at Retirement) and Survivors of Deceased Members Distributed by Annuity Type as of December 31, 2017**

| Annuity Type | Men | | Women | |
|---|---|---|---|---|
| | Number | Allowances | Number | Allowances |
| 0:Maximum | 21,620 | 503,450,456 | 76,919 | 1,506,934,281 |
| 1:Option 1: 10-year guaranteed | 753 | 21,232,344 | 3,142 | 51,555,585 |
| 2:Option 2: 100% joint and survivor | 10,568 | 251,340,352 | 6,089 | 99,746,830 |
| 3:Option 3: 50% joint and survivor | 3,344 | 99,168,858 | 3,115 | 63,879,812 |
| 4:Option 4: Social security leveling | 9,005 | 226,734,544 | 23,172 | 528,947,289 |
| 5:Option 5- 2:100% joint and surv. | 139 | 4,299,981 | 60 | 595,799 |
| 6:Option 5-3: 50% joint and surv. | 83 | 2,746,755 | 89 | 1,597,181 |
| 7:Option 6-2: 100% joint and surv. w/ pop-up | 9,186 | 228,617,132 | 9,005 | 187,220,175 |
| 8:Option 6-3: 50% joint and surv. w/ pop-up | 4,206 | 128,640,753 | 7,083 | 179,122,510 |
| 9:Special | 7 | 242,441 | 4 | 87,690 |
| Survivors of Deceased Members | 3,398 | 41,671,420 | 11,646 | 180,354,695 |
| Total | 62,309 | 1,508,145,036 | 140,324 | 2,800,041,847 |

# Appendix B: Detailed Tabulations of Member Data (continued)

**Table B-8: The Number and Annual Retirement Allowances of Retired Members (Disabled at Retirement) Distributed by Age of December 31, 2017**

| Age | Men | | Women | |
|---|---|---|---|---|
| | Number | Allowances | Number | Allowances |
| 50 | 3 | 63,861 | 0 | 0 |
| 51 | 6 | 137,511 | 2 | 35,796 |
| 52 | 6 | 110,965 | 0 | 0 |
| 53 | 17 | 338,918 | 15 | 306,662 |
| 54 | 17 | 381,257 | 22 | 469,330 |
| 55 | 22 | 485,525 | 35 | 747,108 |
| 56 | 30 | 564,867 | 48 | 1,052,874 |
| 57 | 29 | 632,427 | 59 | 1,237,412 |
| 58 | 33 | 751,917 | 47 | 1,003,456 |
| 59 | 41 | 864,402 | 77 | 1,579,050 |
| 60 | 70 | 1,598,879 | 119 | 2,569,904 |
| 61 | 96 | 2,040,224 | 159 | 3,166,524 |
| 62 | 102 | 2,095,673 | 240 | 4,907,789 |
| 63 | 117 | 2,333,012 | 266 | 5,327,474 |
| 64 | 135 | 2,713,655 | 316 | 6,414,097 |
| 65 | 195 | 3,635,195 | 456 | 8,780,275 |
| 66 | 269 | 4,600,678 | 606 | 10,811,307 |
| 67 | 264 | 4,572,762 | 653 | 11,393,391 |
| 68 | 283 | 4,727,337 | 571 | 9,643,996 |
| 69 | 267 | 4,499,843 | 544 | 9,873,465 |
| 70 | 316 | 5,694,043 | 543 | 9,282,174 |
| 71 | 280 | 5,265,217 | 557 | 9,604,363 |
| 72 | 195 | 3,420,347 | 400 | 6,537,822 |
| 73 | 160 | 2,647,328 | 394 | 6,240,975 |
| 74 | 160 | 2,604,387 | 353 | 5,138,124 |
| 75 | 158 | 2,801,981 | 352 | 5,628,750 |
| 76 | 111 | 1,956,295 | 281 | 4,173,461 |
| 77 | 115 | 1,712,200 | 224 | 3,019,350 |
| 78 | 113 | 1,765,959 | 172 | 2,437,679 |
| 79 | 59 | 770,624 | 183 | 2,376,532 |

# Appendix B: Detailed Tabulations of Member Data (continued)

**Table B-8: The Number and Annual Retirement Allowances of Retired Members (Disabled at Retirement) Distributed by Age of December 31, 2017 (continued)**

| Age | Men | | Women | |
|---|---|---|---|---|
| | Number | Allowances | Number | Allowances |
| 80 | 73 | 1,086,421 | 171 | 2,279,334 |
| 81 | 37 | 550,332 | 84 | 1,184,644 |
| 82 | 30 | 547,583 | 74 | 885,252 |
| 83 | 29 | 463,865 | 47 | 699,138 |
| 84 | 16 | 259,285 | 52 | 762,909 |
| 85 | 13 | 299,287 | 40 | 458,066 |
| 86 | 15 | 252,169 | 28 | 404,691 |
| 87 | 22 | 329,702 | 37 | 424,107 |
| 88 | 11 | 139,964 | 29 | 407,364 |
| 89 | 6 | 133,325 | 28 | 304,887 |
| 90 | 5 | 60,953 | 22 | 222,195 |
| 91 | 6 | 61,923 | 34 | 353,972 |
| 92 | 8 | 124,189 | 22 | 278,918 |
| 93 | 5 | 51,197 | 9 | 76,097 |
| 94 | 3 | 26,332 | 15 | 120,343 |
| 95 | 6 | 73,665 | 10 | 84,894 |
| 96 | 1 | 6,805 | 2 | 11,652 |
| 97 | 0 | 0 | 6 | 67,568 |
| 98 | 0 | 0 | 9 | 68,888 |
| 99 | 0 | 0 | 3 | 66,858 |
| 100 | 0 | 0 | 4 | 31,736 |
| Total | 3,955 | 70,254,286 | 8,420 | 142,952,653 |

# Appendix B: Detailed Tabulations of Member Data (continued)

**Table B-9: The Number and Annual Retirement Allowances of Retired Members (Disabled at Retirement) Distributed by Annuity Type of December 31, 2017**

| Annuity Type | Men | | Women | |
|---|---|---|---|---|
| | Number | Allowances | Number | Allowances |
| 0:Maximum | 2,046 | 38,771,663 | 6,086 | 106,269,676 |
| 1:Option 1: 10-year guaranteed | 80 | 1,462,164 | 267 | 4,044,373 |
| 2:Option 2: 100% joint and survivor | 687 | 9,425,125 | 531 | 6,757,145 |
| 3:Option 3: 50% joint and survivor | 226 | 4,203,639 | 248 | 3,718,311 |
| 4:Option 4: Social security leveling | 148 | 3,364,308 | 401 | 7,418,586 |
| 5:Option 5-2: 100% joint and surv. | 3 | 44,754 | 3 | 9,704 |
| 6:Option 5-3: 50% joint and surv. | 1 | 14,645 | 1 | 16,086 |
| 7:Option 6-2: 100% joint and surv. w/ pop-up | 530 | 8,148,935 | 501 | 7,644,346 |
| 8:Option 6-3: 50% joint and surv. w/ pop-up | 234 | 4,819,053 | 381 | 7,053,464 |
| 9:Special | 0 | 0 | 1 | 20,962 |
| Total | 3,955 | 70,254,286 | 8,420 | 142,952,653 |

# Appendix B: Detailed Tabulations of Member Data (continued)

**Table B-10: The Number and Annual Retirement Allowances of Retired Members and Survivors of Deceased Members Distributed by Amount of Annual Retirement Allowance as of December 31, 2017**

| Amount of Annual Retirement Allowance | Number of Retired Members and Suvivors | Sum of Annual Retirement Allowances |
|---|---|---|
| 0 - 4,999 | 29,744 | 87,879,747 |
| 5,000 - 9,999 | 34,538 | 255,420,558 |
| 10,000 - 14,999 | 28,961 | 360,079,262 |
| 15,000 - 19,999 | 23,338 | 406,103,503 |
| 20,000 - 24,999 | 20,974 | 472,808,556 |
| 25,000 - 29,999 | 20,811 | 571,676,922 |
| 30,000 - 34,999 | 19,603 | 635,345,490 |
| 35,000 - 39,999 | 13,775 | 514,209,160 |
| 40,000 - 44,999 | 8,672 | 366,683,512 |
| 45,000 - 49,999 | 5,109 | 241,381,889 |
| 50,000 & over | 9,483 | 609,805,223 |
| Total | 215,008 | 4,521,393,822 |

# Appendix C: Summary of Main Benefit and Contribution Provisions

A summary of the main benefit provisions of the Retirement System and of the sources of revenue from which benefits are paid is presented in the following digest. Items in parentheses in the text are the provisions applicable to law enforcement officers.

"Average final compensation" as used in the summary means the average annual compensation during the four consecutive years of membership service which afford the highest such average. "Membership service" means service represented by regular contributions. "Creditable service" means membership service and may also include certain special purchased service.

## BENEFITS

### Unreduced Retirement Allowance

**Condition for Allowance**

An unreduced retirement allowance is payable to any member who retires from service:

(a) after age 65 (55) and completion of five years of creditable service;

(b) after age 60 and completion of 25 years of creditable service (not applicable to law enforcement officers); or

(c) after completion of 30 years of creditable service.

**Amount of Allowance**

1.82% of average final compensation multiplied by the number of years of creditable service.

In no event will a member whose creditable service commenced on or before June 30, 1963 receive a smaller retirement allowance than he would have received under the benefit provisions of the system in effect on that date.

# Appendix C: Summary of Main Benefit and Contribution Provisions (continued)

Reduced Retirement Allowance

| | |
|---|---|
| Condition for Allowance | A reduced retirement allowance is payable to any member who retires from service prior to becoming eligible for an unreduced retirement allowance but after age 60 and completion of five years of membership service (age 55 and five years of creditable service). |
| Amount of Allowance | The member's reduced retirement allowance is equal to 1.82% of average final compensation multiplied by the number of years of creditable service at date of retirement reduced by 1/4 of 1% for each month by which the member's age at retirement is less than age 65.<br><br>In no event will a member whose creditable service commenced on or before June 30, 1963 receive a smaller retirement allowance than he or she would have received under the benefit provisions of the system in effect on that date. |

OR

| | |
|---|---|
| Condition for Allowance | A reduced retirement allowance is payable to any member who retires from service after age 50 and completion of 20 (15) years of creditable service, but prior to becoming eligible for a reduced or unreduced retirement allowance. |
| Amount of Allowance | The member's reduced retirement allowance is equal to 1.82% of average final compensation multiplied by the number of years of creditable service at date of retirement reduced by the lesser of:<br><br>(i) 5/12 (1/3) of 1% for each month by which his age is less than 60 (55), plus, if the member is not a law enforcement officer, 1/4 of 1% for each month by which his age is less than 65.<br><br>(ii) 5% times the difference between 30 years and creditable service at retirement. |

OR

| | |
|---|---|
| Condition for Allowance | A reduced retirement allowance is payable to any law enforcement officer who retires from service at any age with 25 years of service, but prior to becoming eligible for a reduced or unreduced retirement allowance. |
| Amount of Allowance | The member's reduced retirement allowance is equal to 1.82% of average final compensation multiplied by the number of years of creditable service at date of retirement reduced by the greater of:<br><br>(i) 5/12 (1/3) of 1% for each month by which his age is less than 55,<br><br>(ii) 5% times the difference between 30 years and creditable service at retirement plus 4% times the difference between age 50 and the member's age at retirement. |

# Appendix C: Summary of Main Benefit and Contribution Provisions (continued)

| | |
|---|---|
| Deferred Retirement Allowance | Any member who separates from service after completing five or more years of membership service prior to becoming eligible for an unreduced or reduced retirement allowance and who leaves his or her total accumulated contributions in the system may receive a deferred retirement allowance, beginning at age 60 (55), computed in the same way as a reduced retirement allowance, or, if the member has 20 or more years of service, at age 50 computed in the same way as a reduced service retirement allowance, on the basis of creditable service and compensation to the date of separation. |
| Return of Contributions | Upon the withdrawal of a member without a retirement allowance and upon his or her request, the member's contributions are returned, together with accumulated regular interest.<br><br>Upon the death of a member before retirement, his or her contributions, together with the full accumulated regular interest thereon, are paid to the estate or to person(s) designated by the member unless the designated beneficiary, if eligible, elects the survivor's alternate benefit described below.<br><br>The current interest rate on member contributions is 4%. |
| Survivor's Alternate Benefit | Upon the death of a member in service who has met conditions (a) or (b) below, his designated beneficiary may elect to receive a benefit equal to that which would have been payable under the provisions of Option 2 had the member retired on the first day of the month following his death and elected such option, in lieu of the member's accumulated contributions, provided the member had not instructed the Board of Trustees in writing that he or she did not wish the alternate benefit to apply. |

# Appendix C: Summary of Main Benefit and Contribution Provisions (continued)

| | |
|---|---|
| | (a) age 60 (55) and completion five years of membership (creditable) service; or<br><br>(b) completion of 20 years of creditable service.<br><br>Members receiving a benefit from the Disability Income Plan are eligible for this benefit. |
| Death After Retirement | Upon the death of a beneficiary who did not retire under an effective election of Option 2 or Option 3, an amount equal to the excess if any, of the member's accumulated contributions at retirement over the retirement allowance payments received is paid to a designated person or to the beneficiary's estate.<br><br>Upon the death of the survivor of a beneficiary who retired under an effective election of Option 2 or Option 3, an amount equal to the excess, if any, of the beneficiary's accumulated contributions at retirement over the total retirement allowance payments received is paid to such other person designated by the beneficiary or to the beneficiary's estate.<br><br>Upon the death of a beneficiary, a benefit may be provided by the Retirees' Contributory Death Benefit Plan. |
| Other Death Benefits | Upon the death of a member in service, other benefits may be provided by the Death Benefit Plan or Separate Insurance Benefit Plan for Law Enforcement Officers. |
| Optional Arrangements at Retirement | In lieu of the full retirement allowance, any member may elect to receive a reduced retirement allowance equal in value to the full allowance, with the provision that:<br><br>Option 1 - A member retiring prior to July 1, 1993, may elect that at his or her death within 10 years from retirement date, an amount equal to the member's accumulated contributions at retirement, less 1/120 for each month he or she has received a retirement allowance, is paid to the estate, or to a person(s) designated by the member, or |

# Appendix C: Summary of Main Benefit and Contribution Provisions (continued)

Option 2 - At the death of the member his or her allowance shall be continued throughout the life of such other person as the member shall have designated at the time of retirement, or

Option 3 - At the death of the member one-half of his or her allowance shall be continued throughout the life of such other person as the member shall have designated at the time of retirement.

Option 4 - A member may elect to receive a retirement allowance in such amount that, together with his Social Security benefit, he or she will receive approximately the same income per annum before and after the earliest age at which he or she becomes eligible to receive the Social Security benefit.

Option 5 - A member retiring prior to July 1, 1993 may elect to receive a reduced retirement allowance under the provisions of Option 2 or Option 3 in conjunction with the provisions of Option 1.

Option 6 - A member may elect either Option 2 or Option 3 with the added provision that in the event the designated beneficiary predeceases the member, the retirement allowance payable to the member after the designated beneficiary's death shall be equal to the retirement allowance which would have been payable had the member not elected the option.

**Post-Retirement Increases in Allowances**

Future increases in allowances may be granted at the discretion of the State.

**Service Reciprocity**

For the purpose of determining eligibility for a deferred, reduced or unreduced service retirement allowance, the membership and creditable service of a member shall include such prior service earned as a member of the Local Governmental Employees' Retirement System (LGERS), the Consolidated Judicial Retirement System (CJRS), or the Legislative Retirement System (LRS). In addition, if the member's accumulated contributions and reserves are transferred from the prior System to this System, the creditable service earned as a member of the prior System may be included for purposes of determining the amount of benefits payable under this System.

# Appendix C: Summary of Main Benefit and Contribution Provisions (continued)

| | |
|---|---|
| Military Service | Periods of active duty in the United States military may be counted as creditable service if the member was an employee upon entering the military and returned to employment within two years of discharge or for a period of 10 additional years. |
| Service Purchases | Additional creditable service may include service that the member purchased to restore a period of service for which the member (1) received a refund of contributions, (2) had a leave of absence for educational purposes, extended illness or parental or maternity reasons, (3) had full-time temporary or part-time local or State government employment, (4) was in a probationary or waiting period with a unit of the LGERS, (5) had a leave of absence under Workers' Compensation, (6) performed service with a unit of local government not covered by LGERS, (7) performed service with the federal government not covered by any other retirement system, (8) performed service with a public community service entity funded entirely with federal funds, (9) performed service as a member of the General Assembly, (10) performed service as a member of a charter school not participating in the system, (11) was employed by The University of North Carolina and participated in the Optional Retirement Program but not eligible to receive any benefits from that program, or (12) performed service which was omitted by reason of error. |
| Unused Sick Leave | Unused sick leave counts as creditable service at retirement. Sick leave which was converted from unused vacation leave is also creditable. One month of credit is allowed for each 20 days of unused sick leave, plus an additional month for any part of 20 days left over. |
| Transfer of Defined Contribution Balances (Special Retirement Allowances) | A member may make a one-time election to transfer any portion of their eligible accumulated contributions to this plan on or after retirement. Eligible accumulated contributions are those from the Supplemental Retirement Income Plan or Public Employee Deferred Compensation Plan, not including Roth after-tax contributions. A member who became a member of the Supplemental Retirement Income Plan prior to retirement and who remains a retirement and who remains a member of the Supplemental Retirement Income Plan may also make a one-time election to transfer eligible balances, not including any Roth after-tax contributions, from any of the following plans to the Supplemental Retirement Income Plan, subject to the applicable requirements of the Supplemental Retirement Income Plan, and then through the Supplemental Retirement Income Plan to this Retirement System: |

# Appendix C: Summary of Main Benefit and Contribution Provisions (continued)

(1) A plan participating in the North Carolina Public School Teachers' and Professional Educators' Investment Plan.

(2) A plan described in section 403(b) of the Internal Revenue Code.

(3) A plan described in section 457(b) of the Internal Revenue Code that is maintained by a state, political subdivision of a state, or any agency or instrumentality of a state or political subdivision of a state.

(4) An individual retirement account or annuity described in Section 408(a) or 408(b) of the Internal Revenue Code that is eligible to be rolled over and would otherwise be includible in gross income.

(5) A tax-qualified plan described in section 401(a) or 403(a) of the Internal Revenue Code.

The member may elect to convert the accumulated contributions to a life annuity with or without annual increases equal to the annual increase in the U.S. Consumer Price Index. Any ad-hoc COLA increases granted will not apply to benefits under this section. A member may elect Options 2, 3, or 6 under the Plan and may also elect either a guaranteed number of months of payments or a guarantee of total payments at least equal to the amount of contributions transferred to the Plan. In addition, any transfer may be paid in whole or in part with employer contributions paid directly to the Retirement System at the time of transfer.

Contributions

| | |
|---|---|
| Member Contributions | Each member contributes 6% of his or her compensation. |
| Employer Contributions | Employers make annual contributions consisting of a normal contribution and an accrued liability contribution. The normal contribution covers the liability on account of current service and is determined by the actuary after each valuation.<br><br>The accrued liability contribution covers the liability on account of service rendered before the establishment of the retirement system and the liability on account of increases in benefits for service rendered prior to the effective date of any amendment.<br><br>The minimum total employer contribution rate is 6.00% |
| Changes Since Prior Valuation | A one-time pension supplement was granted effective July 1, 2018 for retired members and survivors of deceased members receiving benefits as of September 1, 2018, payable in October 2018, pursuant to Session Law 2018-5 (Appropriations Act of 2018). House Bill 284 added eligibility for early reduced benefits at 25 years of creditable service for law enforcement officers. No one is assumed to retire under this provision, because it would reduce the actuarial value of their benefit under this plan. |

# Appendix D: Actuarial Assumptions and Methods

Assumptions are based on the experience investigation prepared as of December 31, 2014 and adopted by the Board of Trustees on January 21, 2016 for use beginning with the December 31, 2015 annual actuarial valuation. The interest rate of 7.00% was adopted by the Board of Trustees on April 26, 2018.

**Interest Rate**: 7.00% per annum, compounded annually.

**Inflation:** Both general and wage inflation are assumed to be 3.00% per annum.

**Real Wage Growth:** 0.50% per annum.

**Payroll Growth:** 3.50% per annum.

**Separations from Active Service:** Representative values of the assumed rates of separation from active service are as follows:

**Annual Rates of Withdrawal**

| | General Employees | | Teachers, Librarians, Counselors | | Law Enforcement Officers | | Other Education | |
|---|---|---|---|---|---|---|---|---|
| Service | Male | Female | Male | Female | Male | Female | Male | Female |
| 0 | .180 | .195 | .190 | .170 | .130 | .130 | 0.190 | 0.165 |
| 1 | .155 | .170 | .160 | .145 | .100 | .100 | 0.160 | 0.135 |
| 2 | .130 | .145 | .140 | .135 | .090 | .090 | 0.130 | 0.120 |
| 3 | .110 | .115 | .120 | .120 | .060 | .060 | 0.115 | 0.100 |
| 4 | .090 | .100 | .095 | .100 | .060 | .060 | 0.100 | 0.085 |

**General Employees**

| | Annual Rates of | | | | | |
|---|---|---|---|---|---|---|
| | Withdrawal and Vesting* | | Base Mortality** | | Disability | |
| Age | Male | Female | Male | Female | Male | Female |
| 25 | .0800 | .1100 | .0005 | .0002 | .0002 | .0002 |
| 30 | .0700 | .0850 | .0005 | .0002 | .0004 | .0004 |
| 35 | .0525 | .0600 | .0005 | .0003 | .0010 | .0010 |
| 40 | .0400 | .0450 | .0006 | .0004 | .0030 | .0018 |
| 45 | .0350 | .0375 | .0010 | .0007 | .0050 | .0032 |
| 50 | .0350 | .0375 | .0017 | .0011 | .0084 | .0050 |
| 55 | .0350 | .0375 | .0028 | .0017 | .0144 | .0088 |
| 60 | .0350 | .0375 | .0047 | .0024 | .0240 | .0138 |
| 65 | | | .0083 | .0037 | | |
| 69 | | | .0125 | .0057 | | |

* These rates apply only after five years of membership in the system.
** Base mortality rates as of 2014.

# Appendix D: Actuarial Assumptions and Methods (continued)

**Teachers, Librarians and Counselors**

| Age | Annual Rates of Withdrawal and Vesting* | | Base Mortality** | | Disability | |
|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female |
| 25 | .0800 | .0900 | .0003 | .0001 | .0001 | .0002 |
| 30 | .0700 | .0750 | .0003 | .0002 | .0001 | .0003 |
| 35 | .0450 | .0450 | .0004 | .0002 | .0003 | .0006 |
| 40 | .0350 | .0340 | .0004 | .0003 | .0007 | .0010 |
| 45 | .0325 | .0325 | .0007 | .0006 | .0014 | .0018 |
| 50 | .0325 | .0325 | .0012 | .0009 | .0023 | .0032 |
| 55 | .0325 | .0325 | .0020 | .0014 | .0047 | .0055 |
| 60 | .0325 | .0325 | .0033 | .0021 | .0077 | .0102 |
| 65 | | | .0058 | .0031 | | |
| 69 | | | .0092 | .0049 | | |

* These rates apply only after five years of membership in the system.
** Base mortality rates as of 2014.

**Other Education Employees**

| Age | Annual Rates of Withdrawal and Vesting* | | Base Mortality** | | Disability | |
|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female |
| 25 | .0800 | .1200 | .0003 | .0001 | .0002 | .0002 |
| 30 | .0600 | .0700 | .0003 | .0002 | .0004 | .0004 |
| 35 | .0450 | .0450 | .0004 | .0002 | .0010 | .0010 |
| 40 | .0400 | .0400 | .0004 | .0003 | .0030 | .0018 |
| 45 | .0400 | .0375 | .0007 | .0006 | .0050 | .0032 |
| 50 | .0400 | .0375 | .0012 | .0009 | .0084 | .0050 |
| 55 | .0400 | .0375 | .0020 | .0014 | .0144 | .0088 |
| 60 | .0400 | .0375 | .0033 | .0021 | .0240 | .0138 |
| 65 | | | .0058 | .0031 | | |
| 69 | | | .0092 | .0049 | | |

* These rates apply only after five years of membership in the system.
** Base mortality rates as of 2014.

# Appendix D: Actuarial Assumptions and Methods (continued)

**Law Enforcement Officers**

| Age | Annual Rates of Withdrawal and Vesting* | | Base Mortality** | | Disability | |
|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female |
| 25 | .0400 | .0400 | .0005 | .0002 | .0033 | .0033 |
| 30 | .0350 | .0350 | .0005 | .0002 | .0043 | .0043 |
| 35 | .0300 | .0300 | .0005 | .0003 | .0060 | .0060 |
| 40 | .0300 | .0300 | .0006 | .0004 | .0079 | .0079 |
| 45 | .0400 | .0400 | .0010 | .0007 | .0110 | .0110 |
| 50 | .0400 | .0400 | .0017 | .0011 | .0176 | .0176 |
| 55 | .0400 | .0400 | .0028 | .0017 | | |
| 60 | .0400 | .0400 | .0047 | .0024 | | |
| 65 | | | .0083 | .0037 | | |
| 69 | | | .0125 | .0057 | | |

* These rates apply only after five years of membership in the system.
** Base mortality rates as of 2014.

RETIREMENTS: Representative values of the assumed rates of retirement from active service are as follows:

**General Employees - Males**

| Age | Service 5 | 10 | 15 | 20 | 25 | 30 | 35 |
|---|---|---|---|---|---|---|---|
| 50 | | | | 0.0350 | 0.0800 | 0.3500 | 0.2000 |
| 55 | | | | 0.0500 | 0.1000 | 0.3500 | 0.2000 |
| 60 | 0.0850 | 0.0850 | 0.0850 | 0.0850 | 0.2750 | 0.3000 | 0.2250 |
| 65 | 0.2500 | 0.2750 | 0.2750 | 0.2750 | 0.2750 | 0.2750 | 0.2750 |
| 70 | 0.3250 | 0.2250 | 0.2250 | 0.2250 | 0.2250 | 0.2250 | 0.2250 |
| 75 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |

**General Employees - Females**

| Age | Service 5 | 10 | 15 | 20 | 25 | 30 | 35 |
|---|---|---|---|---|---|---|---|
| 50 | | | | 0.0350 | 0.0600 | 0.4000 | 0.3000 |
| 55 | | | | 0.0500 | 0.0800 | 0.3250 | 0.2250 |
| 60 | 0.0950 | 0.0950 | 0.0950 | 0.0950 | 0.2500 | 0.3000 | 0.2000 |
| 65 | 0.4000 | 0.3000 | 0.3000 | 0.3000 | 0.3000 | 0.3000 | 0.3000 |
| 70 | 0.2000 | 0.2000 | 0.2000 | 0.2000 | 0.2000 | 0.2000 | 0.2000 |
| 75 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |

# Appendix D: Actuarial Assumptions and Methods (continued)

**Teachers, Librarians and Counselors - Males**

| | Service | | | | | | |
|---|---|---|---|---|---|---|---|
| Age | 5 | 10 | 15 | 20 | 25 | 30 | 35 |
| 50 | | | | 0.0250 | 0.0650 | 0.3000 | 0.3000 |
| 55 | | | | 0.0450 | 0.0900 | 0.3250 | 0.2500 |
| 60 | 0.1200 | 0.1200 | 0.1200 | 0.1200 | 0.3000 | 0.2500 | 0.2500 |
| 65 | 0.3000 | 0.3250 | 0.3250 | 0.3250 | 0.2000 | 0.2000 | 0.2000 |
| 70 | 0.2250 | 0.2250 | 0.2250 | 0.2250 | 0.2250 | 0.2250 | 0.2250 |
| 75 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |

**Teachers, Librarians and Counselors - Females**

| | Service | | | | | | |
|---|---|---|---|---|---|---|---|
| Age | 5 | 10 | 15 | 20 | 25 | 30 | 35 |
| 50 | | | | 0.0350 | 0.0550 | 0.2750 | 0.2750 |
| 55 | | | | 0.0600 | 0.0950 | 0.4000 | 0.3000 |
| 60 | 0.1350 | 0.1350 | 0.1350 | 0.1350 | 0.4500 | 0.5000 | 0.3250 |
| 65 | 0.3500 | 0.3750 | 0.3750 | 0.3750 | 0.3500 | 0.3500 | 0.3500 |
| 70 | 0.3000 | 0.3000 | 0.3000 | 0.3000 | 0.3000 | 0.3000 | 0.3000 |
| 75 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |

**Other Education Employees - Males**

| | Service | | | | | | |
|---|---|---|---|---|---|---|---|
| Age | 5 | 10 | 15 | 20 | 25 | 30 | 35 |
| 50 | | | | 0.0350 | 0.0800 | 0.3000 | 0.1500 |
| 55 | | | | 0.0400 | 0.1000 | 0.2500 | 0.2000 |
| 60 | 0.0900 | 0.0900 | 0.0900 | 0.0900 | 0.2250 | 0.2500 | 0.2500 |
| 65 | 0.2750 | 0.3000 | 0.3000 | 0.3000 | 0.2750 | 0.2750 | 0.2750 |
| 70 | 0.2250 | 0.2250 | 0.2250 | 0.2250 | 0.2250 | 0.2250 | 0.2250 |
| 75 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |

**Other Education Employees - Females**

| | Service | | | | | | |
|---|---|---|---|---|---|---|---|
| Age | 5 | 10 | 15 | 20 | 25 | 30 | 35 |
| 50 | | | | 0.0400 | 0.0550 | 0.3250 | 0.2250 |
| 55 | | | | 0.0500 | 0.0900 | 0.2250 | 0.2250 |
| 60 | 0.1100 | 0.1100 | 0.1100 | 0.1100 | 0.2500 | 0.2500 | 0.2500 |
| 65 | 0.2500 | 0.2750 | 0.2750 | 0.2750 | 0.3500 | 0.3500 | 0.3500 |
| 70 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 |
| 75 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |

# Appendix D: Actuarial Assumptions and Methods (continued)

**Law Enforcement Officers**

| | Service | | | | | | |
|---|---|---|---|---|---|---|---|
| Age | 5 | 10 | 15 | 20 | 25 | 30 | 35 |
| 50 | | | 0.0900 | 0.0900 | 0.0900 | 0.6000 | 0.6000 |
| 55 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 | 0.5000 |
| 60 | 0.2000 | 0.2000 | 0.2000 | 0.2000 | 0.2000 | 0.5000 | 0.5000 |
| 65 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 | 0.2500 |
| 70 | 0.3000 | 0.3000 | 0.3000 | 0.3000 | 0.3000 | 0.3000 | 0.3000 |
| 75 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |

**Salary Increases:** Representative values of the assumed annual rates of salary increases are as follows:

| | Annual Rate of Salary Increase | | | |
|---|---|---|---|---|
| Service | Teachers Librarians, | Other Education Employees | General Employees | Law Enforcement Officers |
| 0 | 7.55% | 7.00% | 5.50% | 8.10% |
| 5 | 6.05 | 6.25 | 4.50 | 6.10 |
| 10 | 5.10 | 5.50 | 4.00 | 4.40 |
| 15 | 4.35 | 4.75 | 3.50 | 3.95 |
| 20 | 3.65 | 4.00 | 3.50 | 3.65 |
| 25 | 3.50 | 3.50 | 3.50 | 3.50 |
| 30 | 3.50 | 3.50 | 3.50 | 3.50 |
| 35 | 3.50 | 3.50 | 3.50 | 3.50 |
| 40 | 3.50 | 3.50 | 3.50 | 3.50 |
| 45 | 3.50 | 3.50 | 3.50 | 3.50 |
| 50 | 3.50 | 3.50 | 3.50 | 3.50 |

# Appendix D: Actuarial Assumptions and Methods (continued)

Representative values of the assumed post-retirement mortality rates in 2014 prior to any mortality improvements are as follows:

**Annual Rate of Death after Retirement**
(Members Healthy at Retirement)

| Age | Teachers & Other Education | | General Employees | | Law Enforcement Officers | |
|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | Male | Female |
| 55 | .0036 | .0021 | 0062 | .0029 | .0057 | .0036 |
| 60 | .0048 | .0030 | .0084 | .0042 | .0078 | .0052 |
| 65 | .0070 | .0051 | .0119 | .0065 | .0110 | .0080 |
| 70 | .0114 | .0082 | .0181 | .0104 | .0168 | .0129 |
| 75 | .0196 | .0137 | .0290 | .0170 | .0268 | .0209 |
| 80 | .0448 | .0329 | .0555 | .0394 | .0447 | .0348 |

**Annual Rate of Death after Retirement**
(Survivors of Deceased Members and Members Disabled at Retirement)

| Age | Male Survivors of Deceased Members | Female Survivors of Deceased Members | Male Retired Members Disabled at Retirement | Female Retired Members Disabled at Retirement |
|---|---|---|---|---|
| 55 | .0071 | .0045 | .0241 | .0143 |
| 60 | .0096 | .0064 | .0274 | .0168 |
| 65 | .0135 | .0099 | .0326 | .0207 |
| 70 | .0206 | .0158 | .0416 | .0279 |
| 75 | .0330 | .0258 | .0559 | .0406 |
| 80 | .0550 | .0429 | .0789 | .0604 |

**Deaths After Retirement (General Employees):** Mortality rates are based on the RP-2014 Total Data Set for Healthy Annuitants Mortality Table. Rates for male members are multiplied by 108% for ages 50-78 and by 124% for ages greater than 78. Rates for female members are multiplied by 81% for ages 50-78 and by 113% for ages greater than 78. The RP-2014 annuitant tables have no rates prior to age 50. The RP-2014 Total Data Set Employee Mortality Table (with no adjustments) is used for ages less than 50.

**Deaths After Retirement (Teachers and Other Education Employees):** Mortality rates are based on the RP-2014 Total Data Set for Healthy Annuitants Mortality Table (with White-Collar Adjustment). Rates for male members are multiplied by 92% for ages 50-78 and by 120% for ages greater than 78. Rates for female members are multiplied by 78% for ages 50-78 and by 108% for ages greater than 78. The RP-2014 annuitant tables have no rates prior to age 50. The RP-2014 Total Data Set Employee Mortality Table (with White Collar Adjustment) is used for ages less than 50.

# Appendix D: Actuarial Assumptions and Methods (continued)

**Deaths After Retirement (Law Enforcement Officers):** Mortality rates are based on the RP-2014 Total Data Set for Healthy Annuitants Mortality Table. The RP-2014 annuitant tables have no rates prior to age 50. The RP-2014 Total Data Set Employee Mortality Table (with no adjustments) is used for ages less than 50.

**Deaths After Retirement (Survivors of Deceased Members):** Mortality rates are based on the RP-2014 Total Data Set for Healthy Annuitants Mortality Table. Rates for all members are multiplied by 123% for ages greater than 50. The RP-2014 annuitant tables have no rates prior to age 50. The RP-2014 Total Data Set Employee Mortality Table (with no adjustments) is used for ages less than 50.

**Death After Retirement (Disabled Members at Retirement):** Mortality rates are based on the RP-2014 Total Data Set for Disabled Annuitants Mortality Table. Rates for male members are multiplied by 103% for all ages. Rates for female members are multiplied by 99% for all ages.

**Deaths Prior to Retirement:** Mortality Rates are based on the RP-2014 Total Data Set Employee Mortality Table for general employees and law enforcement officers. Mortality rates are based on the RP-2014 White Collar Employee Mortality Table for teachers and other education employees.

**Mortality Projection:** All mortality rates are projected from 2014 using generational improvement with Scale MP-2015.

**Timing of Assumptions:** All withdrawals, deaths, disabilities, retirements and salary increases are assumed to occur on July 1 of each year.

**Leave Conversions:** Sick leave can be converted to increase creditable service and used to meet the eligibility requirements for retirement. Unused vacation leave can be converted to increase creditable service or compensation, but does not add to the eligibility service. The assumed impact of these conversions is shown in the table below.

| | **Teachers, Librarians, And Counselors** | | **General** | | **Law Enforcement** | | **Other Education** | |
|---|---|---|---|---|---|---|---|---|
| | Males | Females | Males | Females | Males | Females | Males | Females |
| Increase in AFC | 2.00% | 2.00% | 2.50% | 2.50% | 1.75% | 1.75% | 1.75% | 1.75% |
| Increase in Creditable Service (years) | | | | | | | | |
| Credited | 1.10 | 0.85 | 1.00 | 0.70 | 1.50 | 1.50 | 1.30 | 1.00 |
| Eligibility | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

# Appendix D: Actuarial Assumptions and Methods (continued)

**Liability for Inactive Members:** The data provided for inactive members does not contain all the elements to calculate the member's deferred benefit. The liability for these members is estimated to be 200% of the member's accumulated contributions. The actuary is collecting data so that future members' deferred benefits can be estimated.

**Administrative Expenses:** 0.10% of payroll.

**Marriage Assumption:** 100% married with male spouses four years older than female spouses.

**Reported Compensation:** Calendar year compensation as furnished by the system's office.

**Valuation Compensation:** Reported compensation adjusted to reflect the assumed rate of pay as of the valuation date.

**Actuarial Cost Method:** Entry age normal cost method. Entry age is established on an individual basis.

**Normal Cost :** Normal cost rate reflects the impact of new entrants during the year

**Amortization Period:** 12-year closed, level-dollar amount. The first amortization base was created for the contribution payable for fiscal year ending 2012.

**Asset Valuation Method:** Actuarial value, as developed in Table 8. Actuarial value of assets is based upon a smoothed market value method. Under this method, asset returns in excess of or less than the expected return on market value of assets will be reflected in the actuarial value of assets over a five-year period. The Actuarial Value of Assets was reset to the market value of assets at December 31, 2014. The calculation of the Actuarial Value of Assets is based on the following formula:

$MV - 80\% \times G/(L)_1 - 60\% \times G/(L)_2 - 40\% \times G/(L)_3 - 20\% \times G/(L)_4$

MV = the market value of assets as of the valuation date

$G/(L)_i$ = the asset gain or (loss) for the i-th year preceding the valuation date

**Changes Since Prior Valuation:** The interest rate was changed from 7.20% to 7.00%, with this change phased into the employer contribution rate using direct-rate smoothing over a three-year period

# Appendix E: GASB 67 Fiduciary Net Position Projection

**Table E-1: Projection of Fiduciary Net Positions (in thousands)**

| Calendar Year | Beginning Fiduciary Position | Member Contributions | Employer Contributions | Benefit Payments | Administrative Expenses | Investment Earnings | Ending Fiduciary Position |
|---|---|---|---|---|---|---|---|
| 2018 | $ 70,607,887 | $ 903,528 | $ 1,724,875 | $ 5,196,566 | $ 15,059 | $ 4,853,668 | $ 72,878,333 |
| 2019 | 72,878,333 | 855,158 | 1,774,853 | 5,372,242 | 14,253 | 5,006,638 | 75,128,487 |
| 2020 | 75,128,487 | 813,977 | 1,787,217 | 5,502,101 | 13,566 | 5,158,713 | 77,372,728 |
| 2021 | 77,372,728 | 777,365 | 1,800,294 | 5,633,182 | 12,956 | 5,310,511 | 79,614,759 |
| 2022 | 79,614,759 | 743,419 | 1,652,484 | 5,771,313 | 12,390 | 5,456,466 | 81,683,424 |
| 2023 | 81,683,424 | 710,913 | 1,553,182 | 5,925,360 | 11,849 | 5,591,455 | 83,601,765 |
| 2024 | 83,601,765 | 678,797 | 1,552,752 | 6,095,325 | 11,313 | 5,718,789 | 85,445,466 |
| 2025 | 85,445,466 | 646,795 | 1,456,539 | 6,268,443 | 10,780 | 5,837,498 | 87,107,075 |
| 2026 | 87,107,075 | 614,711 | 1,429,826 | 6,444,644 | 10,245 | 5,945,744 | 88,642,466 |
| 2027 | 88,642,466 | 582,368 | 1,422,993 | 6,620,990 | 9,706 | 6,045,824 | 90,062,956 |
| 2028 | 90,062,956 | 550,165 | 1,233,941 | 6,241,021 | 9,169 | 6,150,738 | 91,747,609 |
| 2029 | 91,747,609 | 517,946 | 897,217 | 6,419,616 | 8,632 | 6,249,842 | 92,984,366 |
| 2030 | 92,984,366 | 485,637 | 645,012 | 6,596,973 | 8,094 | 6,320,542 | 93,830,489 |
| 2031 | 93,830,489 | 453,293 | 527,205 | 6,769,672 | 7,555 | 6,368,680 | 94,402,441 |
| 2032 | 94,402,441 | 421,212 | 500,492 | 6,933,729 | 7,020 | 6,401,067 | 94,784,463 |
| 2033 | 94,784,463 | 389,400 | 474,605 | 7,088,970 | 6,490 | 6,420,500 | 94,973,508 |
| 2034 | 94,973,508 | 358,095 | 449,957 | 7,155,786 | 5,968 | 6,429,527 | 95,049,333 |
| 2035 | 95,049,333 | 327,778 | 319,153 | 7,364,259 | 5,463 | 6,422,135 | 94,748,677 |
| 2036 | 94,748,677 | 298,183 | 189,476 | 7,483,350 | 4,970 | 6,391,528 | 94,139,544 |
| 2037 | 94,139,544 | 269,563 | 168,043 | 7,589,739 | 4,493 | 6,343,523 | 93,326,441 |
| 2038 | 93,326,441 | 241,951 | 148,633 | 7,677,532 | 4,033 | 6,281,983 | 92,317,443 |
| 2039 | 92,317,443 | 216,574 | 130,338 | 7,745,546 | 3,610 | 6,207,524 | 91,122,724 |
| 2040 | 91,122,724 | 192,609 | 112,685 | 7,801,345 | 3,210 | 6,120,556 | 89,744,018 |
| 2041 | 89,744,018 | 169,215 | 95,763 | 7,847,692 | 2,820 | 6,021,078 | 88,179,562 |
| 2042 | 88,179,562 | 146,344 | 79,363 | 7,885,608 | 2,439 | 5,908,923 | 86,426,146 |
| 2043 | 86,426,146 | 123,771 | 64,460 | 7,910,805 | 2,063 | 5,784,041 | 84,485,550 |
| 2044 | 84,485,550 | 102,623 | 50,971 | 7,918,281 | 1,710 | 5,646,762 | 82,365,914 |
| 2045 | 82,365,914 | 83,009 | 38,881 | 7,907,633 | 1,383 | 5,497,674 | 80,076,463 |
| 2046 | 80,076,463 | 64,956 | 28,050 | 7,877,573 | 1,083 | 5,337,463 | 77,628,276 |
| 2047 | 77,628,276 | 48,388 | 19,610 | 7,821,774 | 806 | 5,167,159 | 75,040,854 |
| 2048 | 75,040,854 | 34,818 | 14,118 | 7,729,638 | 580 | 4,988,562 | 72,348,134 |
| 2049 | 72,348,134 | 25,395 | 10,328 | 7,603,326 | 423 | 4,803,968 | 69,584,077 |
| 2050 | 69,584,077 | 18,820 | 7,474 | 7,454,065 | 314 | 4,615,300 | 66,771,292 |
| 2051 | 66,771,292 | 13,903 | 5,384 | 7,287,161 | 232 | 4,423,909 | 63,927,095 |
| 2052 | 63,927,095 | 10,232 | 3,841 | 7,104,299 | 171 | 4,230,930 | 61,067,627 |
| 2053 | 61,067,627 | 7,492 | 2,734 | 6,907,882 | 125 | 4,037,395 | 58,207,242 |
| 2054 | 58,207,242 | 5,465 | 1,945 | 6,700,118 | 91 | 3,844,221 | 55,358,663 |
| 2055 | 55,358,663 | 3,979 | 1,359 | 6,480,683 | 66 | 3,652,300 | 52,535,552 |
| 2056 | 52,535,552 | 2,881 | 953 | 6,249,240 | 48 | 3,462,595 | 49,752,693 |
| 2057 | 49,752,693 | 2,080 | 660 | 6,012,541 | 35 | 3,275,902 | 47,018,758 |
| 2058 | 47,018,758 | 1,499 | 452 | 5,773,828 | 25 | 3,092,713 | 44,339,569 |
| 2059 | 44,339,569 | 1,077 | 310 | 5,534,022 | 18 | 2,913,402 | 41,720,318 |
| 2060 | 41,720,318 | 771 | 201 | 5,294,146 | 13 | 2,738,294 | 39,165,425 |
| 2061 | 39,165,425 | 544 | 130 | 5,054,790 | 9 | 2,567,677 | 36,678,977 |
| 2062 | 36,678,977 | 380 | 78 | 4,816,471 | 6 | 2,401,819 | 34,264,777 |
| 2063 | 34,264,777 | 261 | 47 | 4,579,620 | 4 | 2,240,969 | 31,926,429 |
| 2064 | 31,926,429 | 176 | 23 | 4,344,758 | 3 | 2,085,362 | 29,667,229 |
| 2065 | 29,667,229 | 115 | 10 | 4,112,299 | 2 | 1,935,214 | 27,490,268 |
| 2066 | 27,490,268 | 73 | 1 | 3,882,694 | 1 | 1,790,725 | 25,398,372 |
| 2067 | 25,398,372 | 44 | - | 3,656,386 | 1 | 1,652,078 | 23,394,108 |

# Appendix E: GASB 67 Fiduciary Net Position Projection (continued)

**Table E-1: Projection of Fiduciary Net Positions (continued)**
**(in thousands)**

| Calendar Year | Beginning Fiduciary Position | Member Contributions | Employer Contributions | Benefit Payments | Administrative Expenses | Investment Earnings | Ending Fiduciary Position |
|---|---|---|---|---|---|---|---|
| 2068 | $ 23,394,108 | $ 24 | $ - | $ 3,433,839 | $ - | $ 1,519,437 | $ 21,479,730 |
| 2069 | 21,479,730 | 12 | - | 3,215,526 | - | 1,392,942 | 19,657,158 |
| 2070 | 19,657,158 | 5 | - | 3,001,937 | - | 1,272,710 | 17,927,936 |
| 2071 | 17,927,936 | 2 | - | 2,793,598 | - | 1,158,833 | 16,293,173 |
| 2072 | 16,293,173 | 1 | - | 2,591,035 | - | 1,051,370 | 14,753,509 |
| 2073 | 14,753,509 | - | - | 2,394,717 | - | 950,348 | 13,309,140 |
| 2074 | 13,309,140 | - | - | 2,205,080 | - | 855,767 | 11,959,828 |
| 2075 | 11,959,828 | - | - | 2,022,546 | - | 767,596 | 10,704,878 |
| 2076 | 10,704,878 | - | - | 1,847,468 | - | 685,774 | 9,543,184 |
| 2077 | 9,543,184 | - | - | 1,680,107 | - | 610,214 | 8,473,290 |
| 2078 | 8,473,290 | - | - | 1,520,684 | - | 540,807 | 7,493,412 |
| 2079 | 7,493,412 | - | - | 1,369,389 | - | 477,421 | 6,601,444 |
| 2080 | 6,601,444 | - | - | 1,226,391 | - | 419,903 | 5,794,956 |
| 2081 | 5,794,956 | - | - | 1,091,837 | - | 368,079 | 5,071,199 |
| 2082 | 5,071,199 | - | - | 965,855 | - | 321,751 | 4,427,094 |
| 2083 | 4,427,094 | - | - | 848,541 | - | 280,700 | 3,859,253 |
| 2084 | 3,859,253 | - | - | 739,951 | - | 244,687 | 3,363,990 |
| 2085 | 3,363,990 | - | - | 640,087 | - | 213,455 | 2,937,358 |
| 2086 | 2,937,358 | - | - | 548,896 | - | 186,729 | 2,575,191 |
| 2087 | 2,575,191 | - | - | 466,257 | - | 164,220 | 2,273,154 |
| 2088 | 2,273,154 | - | - | 391,990 | - | 145,633 | 2,026,798 |
| 2089 | 2,026,798 | - | - | 325,858 | - | 130,664 | 1,831,603 |
| 2090 | 1,831,603 | - | - | 267,568 | - | 119,006 | 1,683,041 |
| 2091 | 1,683,041 | - | - | 216,774 | - | 110,354 | 1,576,621 |
| 2092 | 1,576,621 | - | - | 173,077 | - | 104,408 | 1,507,952 |
| 2093 | 1,507,952 | - | - | 136,026 | - | 100,876 | 1,472,803 |
| 2094 | 1,472,803 | - | - | 105,110 | - | 99,480 | 1,467,172 |
| 2095 | 1,467,172 | - | - | 79,763 | - | 99,958 | 1,487,367 |
| 2096 | 1,487,367 | - | - | 59,368 | - | 102,073 | 1,530,072 |
| 2097 | 1,530,072 | - | - | 43,286 | - | 105,616 | 1,592,401 |
| 2098 | 1,592,401 | - | - | 30,881 | - | 110,406 | 1,671,925 |
| 2099 | 1,671,925 | - | - | 21,535 | - | 116,294 | 1,766,684 |
| 2100 | 1,766,684 | - | - | 14,668 | - | 123,163 | 1,875,178 |
| 2101 | 1,875,178 | - | - | 9,755 | - | 130,927 | 1,996,350 |
| 2102 | 1,996,350 | - | - | 6,338 | - | 139,526 | 2,129,538 |
| 2103 | 2,129,538 | - | - | 4,032 | - | 148,929 | 2,274,435 |
| 2104 | 2,274,435 | - | - | 2,522 | - | 159,124 | 2,431,037 |
| 2105 | 2,431,037 | - | - | 1,562 | - | 170,119 | 2,599,593 |
| 2106 | 2,599,593 | - | - | 969 | - | 181,938 | 2,780,562 |
| 2107 | 2,780,562 | - | - | 612 | - | 194,618 | 2,974,569 |
| 2108 | 2,974,569 | - | - | 399 | - | 208,206 | 3,182,376 |
| 2109 | 3,182,376 | - | - | 272 | - | 222,757 | 3,404,861 |
| 2110 | 3,404,861 | - | - | 194 | - | 238,334 | 3,643,001 |
| 2111 | 3,643,001 | - | - | 144 | - | 255,005 | 3,897,862 |
| 2112 | 3,897,862 | - | - | 109 | - | 272,847 | 4,170,600 |
| 2113 | 4,170,600 | - | - | 83 | - | 291,939 | 4,462,456 |
| 2114 | 4,462,456 | - | - | 64 | - | 312,370 | 4,774,762 |
| 2115 | 4,774,762 | - | - | 48 | - | 334,232 | 5,108,945 |
| 2116 | 5,108,945 | - | - | 36 | - | 357,625 | 5,466,534 |
| 2117 | 5,466,534 | - | - | 27 | - | 382,656 | 5,849,164 |

# Appendix E: GASB 67 Fiduciary Net Position Projection (continued)

**Table E-2: Actuarial Present Value of Projected Benefit Payments (in thousands)**

| Calendar Year | Beginning Fiduciary Position | Benefit Payments | Funded Benefit Payments | Unfunded Benefit Payments | Present Value of Benefit Payments: Funded Payments at 7.00% | Present Value of Benefit Payments: Unfunded Payments at 3.87% | Present Value of Benefit Payments: Using Single Discount Rate of 7.00% |
|---|---|---|---|---|---|---|---|
| 2018 | $ 70,607,887 | $ 5,196,566 | $ 5,196,453 | $ - | $ 5,023,710 | $ - | $ 5,023,710 |
| 2019 | 72,878,333 | 5,372,242 | 5,372,242 | - | 4,853,778 | - | 4,853,778 |
| 2020 | 75,128,487 | 5,502,101 | 5,502,101 | - | 4,645,892 | - | 4,645,892 |
| 2021 | 77,372,728 | 5,633,182 | 5,633,182 | - | 4,445,397 | - | 4,445,397 |
| 2022 | 79,614,759 | 5,771,313 | 5,771,313 | - | 4,256,451 | - | 4,256,451 |
| 2023 | 81,683,424 | 5,925,360 | 5,925,360 | - | 4,084,171 | - | 4,084,171 |
| 2024 | 83,601,765 | 6,095,325 | 6,095,325 | - | 3,926,470 | - | 3,926,470 |
| 2025 | 85,445,466 | 6,268,443 | 6,268,443 | - | 3,773,822 | - | 3,773,822 |
| 2026 | 87,107,075 | 6,444,644 | 6,444,644 | - | 3,626,075 | - | 3,626,075 |
| 2027 | 88,642,466 | 6,620,990 | 6,620,990 | - | 3,481,585 | - | 3,481,585 |
| 2028 | 90,062,956 | 6,241,021 | 6,241,021 | - | 3,067,086 | - | 3,067,086 |
| 2029 | 91,747,609 | 6,419,616 | 6,419,616 | - | 2,948,463 | - | 2,948,463 |
| 2030 | 92,984,366 | 6,596,973 | 6,596,973 | - | 2,831,702 | - | 2,831,702 |
| 2031 | 93,830,489 | 6,769,672 | 6,769,672 | - | 2,715,730 | - | 2,715,730 |
| 2032 | 94,402,441 | 6,933,729 | 6,933,729 | - | 2,599,574 | - | 2,599,574 |
| 2033 | 94,784,463 | 7,088,970 | 7,088,970 | - | 2,483,903 | - | 2,483,903 |
| 2034 | 94,973,508 | 7,155,786 | 7,155,786 | - | 2,343,284 | - | 2,343,284 |
| 2035 | 95,049,333 | 7,364,259 | 7,364,259 | - | 2,253,787 | - | 2,253,787 |
| 2036 | 94,748,677 | 7,483,350 | 7,483,350 | - | 2,140,406 | - | 2,140,406 |
| 2037 | 94,139,544 | 7,589,739 | 7,589,739 | - | 2,028,818 | - | 2,028,818 |
| 2038 | 93,326,441 | 7,677,532 | 7,677,532 | - | 1,918,025 | - | 1,918,025 |
| 2039 | 92,317,443 | 7,745,546 | 7,745,546 | - | 1,808,426 | - | 1,808,426 |
| 2040 | 91,122,724 | 7,801,345 | 7,801,345 | - | 1,702,294 | - | 1,702,294 |
| 2041 | 89,744,018 | 7,847,692 | 7,847,692 | - | 1,600,380 | - | 1,600,380 |
| 2042 | 88,179,562 | 7,885,608 | 7,885,608 | - | 1,502,909 | - | 1,502,909 |
| 2043 | 86,426,146 | 7,910,805 | 7,910,805 | - | 1,409,076 | - | 1,409,076 |
| 2044 | 84,485,550 | 7,918,281 | 7,918,281 | - | 1,318,138 | - | 1,318,138 |
| 2045 | 82,365,914 | 7,907,633 | 7,907,633 | - | 1,230,248 | - | 1,230,248 |
| 2046 | 80,076,463 | 7,877,573 | 7,877,573 | - | 1,145,394 | - | 1,145,394 |
| 2047 | 77,628,276 | 7,821,774 | 7,821,774 | - | 1,062,879 | - | 1,062,879 |
| 2048 | 75,040,854 | 7,729,638 | 7,729,638 | - | 981,644 | - | 981,644 |
| 2049 | 72,348,134 | 7,603,326 | 7,603,326 | - | 902,432 | - | 902,432 |
| 2050 | 69,584,077 | 7,454,065 | 7,454,065 | - | 826,838 | - | 826,838 |
| 2051 | 66,771,292 | 7,287,161 | 7,287,161 | - | 755,443 | - | 755,443 |
| 2052 | 63,927,095 | 7,104,299 | 7,104,299 | - | 688,305 | - | 688,305 |
| 2053 | 61,067,627 | 6,907,882 | 6,907,882 | - | 625,491 | - | 625,491 |
| 2054 | 58,207,242 | 6,700,118 | 6,700,118 | - | 566,989 | - | 566,989 |
| 2055 | 55,358,663 | 6,480,683 | 6,480,683 | - | 512,542 | - | 512,542 |
| 2056 | 52,535,552 | 6,249,240 | 6,249,240 | - | 461,904 | - | 461,904 |
| 2057 | 49,752,693 | 6,012,541 | 6,012,541 | - | 415,335 | - | 415,335 |
| 2058 | 47,018,758 | 5,773,828 | 5,773,828 | - | 372,753 | - | 372,753 |
| 2059 | 44,339,569 | 5,534,022 | 5,534,022 | - | 333,898 | - | 333,898 |
| 2060 | 41,720,318 | 5,294,146 | 5,294,146 | - | 298,528 | - | 298,528 |
| 2061 | 39,165,425 | 5,054,790 | 5,054,790 | - | 266,384 | - | 266,384 |
| 2062 | 36,678,977 | 4,816,471 | 4,816,471 | - | 237,220 | - | 237,220 |
| 2063 | 34,264,777 | 4,579,620 | 4,579,620 | - | 210,799 | - | 210,799 |
| 2064 | 31,926,429 | 4,344,758 | 4,344,758 | - | 186,905 | - | 186,905 |
| 2065 | 29,667,229 | 4,112,299 | 4,112,299 | - | 165,331 | - | 165,331 |
| 2066 | 27,490,268 | 3,882,694 | 3,882,694 | - | 145,888 | - | 145,888 |
| 2067 | 25,398,372 | 3,656,386 | 3,656,386 | - | 128,397 | - | 128,397 |

# Appendix E: GASB 67 Fiduciary Net Position Projection (continued)

**Table E-2: Actuarial Present Value of Projected Benefit Payments (continued)**
**(in thousands)**

| Calendar Year | Beginning Fiduciary Position | Benefit Payments | Funded Benefit Payments | Unfunded Benefit Payments | Present Value of Benefit Payments: Funded Payments at 7.00% | Present Value of Benefit Payments: Unfunded Payments at 3.87% | Present Value of Benefit Payments: Using Single Discount Rate of 7.00% |
|---|---|---|---|---|---|---|---|
| 2068 | $ 23,394,108 | $ 3,433,839 | $ 3,433,839 | $ - | $ 112,694 | $ - | $ 112,694 |
| 2069 | 21,479,730 | 3,215,526 | 3,215,526 | - | 98,625 | - | 98,625 |
| 2070 | 19,657,158 | 3,001,937 | 3,001,937 | - | 86,050 | - | 86,050 |
| 2071 | 17,927,936 | 2,793,598 | 2,793,598 | - | 74,840 | - | 74,840 |
| 2072 | 16,293,173 | 2,591,035 | 2,591,035 | - | 64,872 | - | 64,872 |
| 2073 | 14,753,509 | 2,394,717 | 2,394,717 | - | 56,034 | - | 56,034 |
| 2074 | 13,309,140 | 2,205,080 | 2,205,080 | - | 48,222 | - | 48,222 |
| 2075 | 11,959,828 | 2,022,546 | 2,022,546 | - | 41,336 | - | 41,336 |
| 2076 | 10,704,878 | 1,847,468 | 1,847,468 | - | 35,288 | - | 35,288 |
| 2077 | 9,543,184 | 1,680,107 | 1,680,107 | - | 29,992 | - | 29,992 |
| 2078 | 8,473,290 | 1,520,684 | 1,520,684 | - | 25,370 | - | 25,370 |
| 2079 | 7,493,412 | 1,369,389 | 1,369,389 | - | 21,351 | - | 21,351 |
| 2080 | 6,601,444 | 1,226,391 | 1,226,391 | - | 17,871 | - | 17,871 |
| 2081 | 5,794,956 | 1,091,837 | 1,091,837 | - | 14,869 | - | 14,869 |
| 2082 | 5,071,199 | 965,855 | 965,855 | - | 12,293 | - | 12,293 |
| 2083 | 4,427,094 | 848,541 | 848,541 | - | 10,093 | - | 10,093 |
| 2084 | 3,859,253 | 739,951 | 739,951 | - | 8,226 | - | 8,226 |
| 2085 | 3,363,990 | 640,087 | 640,087 | - | 6,650 | - | 6,650 |
| 2086 | 2,937,358 | 548,896 | 548,896 | - | 5,330 | - | 5,330 |
| 2087 | 2,575,191 | 466,257 | 466,257 | - | 4,231 | - | 4,231 |
| 2088 | 2,273,154 | 391,990 | 391,990 | - | 3,324 | - | 3,324 |
| 2089 | 2,026,798 | 325,858 | 325,858 | - | 2,583 | - | 2,583 |
| 2090 | 1,831,603 | 267,568 | 267,568 | - | 1,982 | - | 1,982 |
| 2091 | 1,683,041 | 216,774 | 216,774 | - | 1,501 | - | 1,501 |
| 2092 | 1,576,621 | 173,077 | 173,077 | - | 1,120 | - | 1,120 |
| 2093 | 1,507,952 | 136,026 | 136,026 | - | 823 | - | 823 |
| 2094 | 1,472,803 | 105,110 | 105,110 | - | 594 | - | 594 |
| 2095 | 1,467,172 | 79,763 | 79,763 | - | 421 | - | 421 |
| 2096 | 1,487,367 | 59,368 | 59,368 | - | 293 | - | 293 |
| 2097 | 1,530,072 | 43,286 | 43,286 | - | 200 | - | 200 |
| 2098 | 1,592,401 | 30,881 | 30,881 | - | 133 | - | 133 |
| 2099 | 1,671,925 | 21,535 | 21,535 | - | 87 | - | 87 |
| 2100 | 1,766,684 | 14,668 | 14,668 | - | 55 | - | 55 |
| 2101 | 1,875,178 | 9,755 | 9,755 | - | 34 | - | 34 |
| 2102 | 1,996,350 | 6,338 | 6,338 | - | 21 | - | 21 |
| 2103 | 2,129,538 | 4,032 | 4,032 | - | 12 | - | 12 |
| 2104 | 2,274,435 | 2,522 | 2,522 | - | 7 | - | 7 |
| 2105 | 2,431,037 | 1,562 | 1,562 | - | 4 | - | 4 |
| 2106 | 2,599,593 | 969 | 969 | - | 2 | - | 2 |
| 2107 | 2,780,562 | 612 | 612 | - | 1 | - | 1 |
| 2108 | 2,974,569 | 399 | 399 | - | 1 | - | 1 |
| 2109 | 3,182,376 | 272 | 272 | - | 1 | - | 1 |
| 2110 | 3,404,861 | 194 | 194 | - | - | - | - |
| 2111 | 3,643,001 | 144 | 144 | - | - | - | - |
| 2112 | 3,897,862 | 109 | 109 | - | - | - | - |
| 2113 | 4,170,600 | 83 | 83 | - | - | - | - |
| 2114 | 4,462,456 | 64 | 64 | - | - | - | - |
| 2115 | 4,774,762 | 48 | 48 | - | - | - | - |
| 2116 | 5,108,945 | 36 | 36 | - | - | - | - |
| 2117 | 5,466,534 | 27 | 27 | - | - | - | - |

# Appendix F: Additional Disclosures

Table F-1 illustrates the sensitivity of certain valuation results to changes in the discount rate on a market value of assets basis. Table F-2 summarizes historical actuarial value and market value asset returns. Table F-3 provides an estimate of future market value of asset returns based on the current portfolio structure and summarized in the "TSERS Asset-Liability and Investment Strategy Project" report dated April 19th, 2016.

Section 6(c) of Session Law 2016-108 requires that the actuarial valuation report provide the valuation results using a 30-year treasury rate as of December 31 of the year of the valuation as the discount rate. This is 2.74% at December 31, 2017 and has been used as the lower bound of the sensitivity analysis presented. The range between the current discount rate (7.00%) and the 30-year treasury rate (2.74%) was used to establish an upper bound for sensitivity analysis (11.26%). The remaining rates illustrated represent mid-points between the selected rates. Table F-3 illustrates our best estimate of the plausibility of such rates. The lower bound of 2.74% falls below the 5th percentile of estimated future 30-year returns while the upper bound of 11.26% falls between the 75th and 95th percentiles of estimated future 30-year returns.

The maximum employer contribution rate under ECRSP based on the 2.74% 20-year treasury rate as of December 31, 2017, is 68.46%.

**Table F-1: Sensitivity of Valuation Results as of December 31, 2017**

| Discount Rate | 2.74% | 4.87% | 7.00% | 9.13% | 11.26% |
|---|---|---|---|---|---|
| Market Value of Assets | $ 70,607,887,248 | $ 70,607,887,248 | $ 70,607,887,248 | $ 70,607,887,248 | $ 70,607,887,248 |
| Actuarial Accrued Liability | $131,033,504,596 | $100,412,644,167 | $ 79,209,347,668 | $ 64,613,996,514 | $ 54,226,841,071 |
| Unfunded Accrued Liabilty (AAL) | $ 60,425,617,348 | $ 29,804,756,919 | $ 8,601,460,420 | $ (5,993,890,734) | $ (16,381,046,177) |
| Funded Ratio | 53.9% | 70.3% | 89.1% | 109.3% | 130.2% |
| 20-Year Amortization of UAL | $ 4,073,171,158 | $ 2,480,501,439 | $ 868,744,141 | N/A | N/A |
| (as % of general state revenue)* | 13.6% | 8.3% | 2.9% | N/A | N/A |

* General state revenue amount of $29,891,956,000 is the sum of Primary Government and Component Unit general revenues from page 49 of the 2017 CAFR.

**Table F-2: Historical Asset Returns**

| Calendar Year | Actuarial Value of Asset Return | Market Value of Asset Return | Calendar Year | Actuarial Value of Asset Return | Market Value of Asset Return | Calendar Year | Actuarial Value of Asset Return | Market Value of Asset Return |
|---|---|---|---|---|---|---|---|---|
| 1998 | 9.92% | 16.66% | 2005 | 8.26% | 6.97% | 2012 | 6.32% | 11.82% |
| 1999 | 10.60% | 10.15% | 2006 | 8.94% | 11.41% | 2013 | 7.43% | 12.21% |
| 2000 | 11.55% | 2.50% | 2007 | 8.87% | 8.38% | 2014 | 7.19% | 6.21% |
| 2001 | 8.51% | -1.87% | 2008 | 2.89% | -19.50% | 2015 | 5.87% | 0.36% |
| 2002 | 5.66% | -5.21% | 2009 | 4.74% | 14.84% | 2016 | 5.32% | 6.22% |
| 2003 | 7.98% | 18.23% | 2010 | 5.89% | 11.47% | 2017 | 6.56% | 13.49% |
| 2004 | 8.56% | 10.73% | 2011 | 5.15% | 2.19% | | | |

The average investment return recognized for the purposes of determining the annual change in contribution each year is the Actuarial Value of Asset Return. The Actuarial Value of Assets smooths investment gains and losses over a five-year period and is used to reduce volatility that investment gains and losses can have on required contributions and the funded status of the Plan.

# Appendix F: Additional Disclosures (continued)

**Table F-3: Statistical Likelihood of Minimum Future Asset Returns as of 12/31/2015**

| Horizon | 95% Chance (19 out of every 20 scenarios) | 75% Chance (3 out of every 4 scenarios) | 50% Chance (1 out of every 2 scenarios) | 25% Chance (1 out of every 4 scenarios) | 5% Chance (1 out of every 20 scenarios) |
|---|---|---|---|---|---|
| 10 Years (2025) | 0.2% | 4.0% | 5.9% | 8.0% | 11.5% |
| 20 Years (2035) | 2.2% | 4.8% | 6.7% | 8.5% | 11.8% |
| 30 Years (2045) | 3.1% | 5.3% | 7.1% | 8.7% | 12.0% |

Other than the discount rate, these results are based on the other economic and demographic assumptions presented in the report. For purposes of simplicity in this disclosure, no adjustments to the valuation assumption for inflation were reflected in the sensitivities above. The statute also requires that the actuarial valuation report show the results using a market value of assets basis. The "funded ratio" and "unfunded accrued liability" in Table F-1 are based upon the market value of assets. In order to alleviate volatility, future employer contributions are determined based on the actuarial value of assets, which smooths market value returns.

None of the liability amounts shown are intended to imply the amount that might represent the cost of any settlement of the plan's obligations. The various caveats, constraints, and discussions presented earlier in the report apply to these results as well.

# Appendix G: Data for Section 2 Graphs

The tables below provide the numbers associated with the graphs in Section 2 of this report.

**Graph 1: Active Members**

| | Active Member Count | Reported Compensation |
|---|---|---|
| 2013 | 310,370 | $ 12,834,121,020 |
| 2014 | 307,313 | 12,932,045,817 |
| 2015 | 305,291 | 13,145,602,154 |
| 2016 | 305,013 | 13,497,815,754 |
| 2017 | 304,554 | 13,914,085,325 |

**Graph 2: Retired Members and Survivors of Deceased Members**

| | Retired and Survivors of Deceased Member Count | Retirement Allowance |
|---|---|---|
| 2013 | 187,448 | $ 3,870,867,895 |
| 2014 | 194,607 | 4,057,596,822 |
| 2015 | 201,522 | 4,202,371,724 |
| 2016 | 208,443 | 4,343,259,132 |
| 2017 | 215,008 | 4,521,393,822 |

**Graph 3: Market Value of Assets and Asset Returns**

| | Market Value of Assets | Asset Return |
|---|---|---|
| 2013 | $ 62,789,451,194 | 12.21% |
| 2014 | 64,587,417,979 | 6.21% |
| 2015 | 62,669,341,716 | 0.36% |
| 2016 | 64,246,523,614 | 6.22% |
| 2017 | 70,607,887,248 | 13.49% |

# Appendix G: Data for Section 2 Graphs (continued)

**Graph 5: Cost-of-Living Increase and CPI-U History**

| | Total Allowance Increase | National CPI-U |
|---|---|---|
| 1987 | 4.80% | 4.40% |
| 1988 | 5.40% | 4.40% |
| 1989 | 6.70% | 4.60% |
| 1990 | 0.00% | 6.10% |
| 1991 | 5.20% | 3.10% |
| 1992 | 2.20% | 2.90% |
| 1993 | 4.70% | 2.70% |
| 1994 | 3.20% | 2.70% |
| 1995 | 4.40% | 2.50% |
| 1996 | 6.20% | 3.30% |
| 1997 | 2.50% | 1.70% |
| 1998 | 2.30% | 1.60% |
| 1999 | 4.20% | 2.70% |
| 2000 | 2.00% | 3.40% |
| 2001 | 2.00% | 2.60% |
| 2002 | 1.30% | 2.40% |
| 2003 | 1.70% | 1.90% |
| 2004 | 2.00% | 3.30% |
| 2005 | 3.00% | 3.40% |
| 2006 | 2.20% | 2.50% |
| 2007 | 2.20% | 4.10% |
| 2008 | 0.00% | 0.10% |
| 2009 | 0.00% | 2.70% |
| 2010 | 0.00% | 1.50% |
| 2011 | 1.00% | 3.00% |
| 2012 | 0.00% | 1.70% |
| 2013 | 1.00% | 1.50% |
| 2014 | 0.00% | 0.80% |
| 2015 | 0.00% | 0.70% |
| 2016 | 1.00% | 2.10% |
| 2017 | 0.00% | 2.10% |

* Allowance increases are effective at July 1 the following year.

# Appendix G: Data for Section 2 Graphs (continued)

**Graph 6: Actuarial Value and Market Value of Assets**

| | Actuarial Value of Assets | Market Value of Assets |
|---|---|---|
| 2013 | $ 62,363,807,168 | $ 62,789,451,194 |
| 2014 | 64,734,119,837 | 64,587,417,979 |
| 2015 | 66,169,352,203 | 62,669,341,716 |
| 2016 | 67,376,892,466 | 64,246,523,614 |
| 2017 | 69,568,450,606 | 70,607,887,248 |

**Graph 7: Asset Returns**

| | Actuarial Value Value of Assets | Market Value Asset Return |
|---|---|---|
| 2013 | 7.43% | 12.21% |
| 2014 | 7.19% | 6.21% |
| 2015 | 5.87% | 0.36% |
| 2016 | 5.32% | 6.22% |
| 2017 | 6.56% | 13.49% |

**Graph 8: Actuarial Accrued Liability**

| Fiscal Year Ending | Active | Deferred | Retired | Total |
|---|---|---|---|---|
| 2013 | $ 27,623,752,029 | $ 2,890,559,796 | $ 35,291,243,666 | $ 65,805,555,491 |
| 2014 | 27,948,998,177 | 3,188,560,504 | 36,577,507,863 | 67,715,066,544 |
| 2015 | 27,630,686,237 | 3,482,641,054 | 40,408,588,106 | 71,521,915,397 |
| 2016 | 28,548,308,913 | 3,764,216,305 | 42,235,329,807 | 74,547,855,025 |
| 2017 | 30,943,761,739 | 4,053,311,655 | 44,212,274,274 | 79,209,347,668 |

# Appendix G: Data for Section 2 Graphs (continued)

**Graph 9: Actuarial Accrued Liability and Actuarial Value of Assets**

| | Actuarial Accrued Liability | Actuarial Value of Assets |
|---|---|---|
| 2013 | $ 65,805,555,491 | $ 62,363,807,168 |
| 2014 | 67,715,066,544 | 64,734,119,837 |
| 2015 | 71,521,915,397 | 66,169,352,203 |
| 2016 | 74,547,855,025 | 67,376,892,466 |
| 2017 | 79,209,347,668 | 69,568,450,606 |

**Graph 10: Funded Ratios**

| | Funded Ratio (Actuarial Basis) | Funded Ratio (Market Value Basis) |
|---|---|---|
| 2013 | 94.8% | 95.4% |
| 2014 | 95.6% | 95.4% |
| 2015 | 92.5% | 87.6% |
| 2016 | 90.4% | 86.2% |
| 2017 | 87.8% | 89.1% |

**Graph 11: Actuarially Determined Employer Contribution Rates Before Applying Funding Policy Minimums**

| Fiscal Year Ending | Normal Rate | Accrued Liability Rate | Total ADEC |
|---|---|---|---|
| 2016 | 5.19% | 3.50% | 8.69% |
| 2017** | 4.23% | 5.73% | 9.96% |
| 2018 | 4.31% | 6.22% | 10.53% |
| 2019 | 4.48% | 7.80% | 12.28% |
| 2020* | 4.87% | 8.10% | 12.97% |

* Subject to the impact of future legislative changes during that fiscal year
** Includes impact of the experience study

# Appendix G: Data for Section 2 Graphs (continued)

**Graph 12: Projected Actuarially Determined Employer Contribution Rates**

| | Alternate #1 (0.0% 2018 Return) | Baseline Projection | Alternate #2 (14.0% 2018 Return) |
|---|---|---|---|
| 2018 | 10.78% | 10.78% | 10.78% |
| 2019 | 11.98% | 11.98% | 11.98% |
| 2020 | 12.97% | 12.97% | 12.97% |
| 2021 | 14.19% | 13.39% | 13.32% |
| 2022 | 15.80% | 14.03% | 13.67% |
| 2023 | 16.11% | 13.42% | 10.73% |
| 2024 | 14.50% | 10.87% | 7.25% |
| 2025 | 14.85% | 10.56% | 6.18% |
| 2026 | 13.96% | 9.79% | 6.00% |
| 2027 | 13.69% | 9.64% | 6.00% |
| 2028 | 13.55% | 9.62% | 6.00% |
| 2029 | 13.46% | 9.65% | 6.00% |
| 2030 | 11.61% | 7.91% | 6.00% |
| 2031 | 10.22% | 6.64% | 6.00% |
| 2032 | 8.58% | 6.00% | 6.00% |
| 2033 | 7.79% | 6.00% | 6.00% |
| 2034 | 6.86% | 6.00% | 6.00% |
| 2035 | 6.44% | 6.00% | 6.00% |

**Graph 13: Projected Funded Ratio**

| | Alternate #1 (0.0% 2018 Return) | Baseline Projection | Alternate #2 (14.0% 2018 Return) |
|---|---|---|---|
| 2017 | 87.83% | 87.83% | 87.83% |
| 2018 | 87.11% | 88.30% | 89.49% |
| 2019 | 86.27% | 88.99% | 91.70% |
| 2020 | 86.67% | 90.85% | 95.03% |
| 2021 | 87.43% | 93.01% | 98.59% |
| 2022 | 87.87% | 94.37% | 101.00% |
| 2023 | 89.33% | 95.46% | 101.74% |
| 2024 | 90.71% | 96.32% | 102.08% |
| 2025 | 92.08% | 97.10% | 102.30% |
| 2026 | 93.38% | 97.82% | 102.51% |
| 2027 | 94.70% | 98.54% | 102.72% |
| 2028 | 96.03% | 99.29% | 102.94% |
| 2029 | 97.23% | 99.90% | 103.16% |
| 2030 | 98.16% | 100.24% | 103.39% |
| 2031 | 98.84% | 100.41% | 103.62% |
| 2032 | 99.30% | 100.52% | 103.86% |

# Appendix H: Participating Employers

| Employer | Employer Code |
|---|---|
| A Childs Garden Charter (Aka Cross Creek Charter) | 33501 |
| Academy of Moore County | 36301 |
| Administrative Office of the Courts | 10800 |
| Alamance Community College | 30105 |
| Alamance County Schools | 30100 |
| Alexander County Schools | 30200 |
| Alleghany County Schools | 30300 |
| American Renaissance Middle School | 34901 |
| Anson County Schools | 30400 |
| Appalachian State University | 20100 |
| Arapahoe Charter School | 36901 |
| Arts Based Elementary Charter | 33402 |
| Ashe County Schools | 30500 |
| Asheboro City Schools | 37610 |
| Asheville City Schools | 31110 |
| Asheville-Buncombe Technical College | 31105 |
| Avery County Schools | 30600 |
| Barber Examiners, State Board of | 18600 |
| Bear Grass Charter School | 33206 |
| Beaufort County Community College | 30705 |
| Beaufort County Schools | 30700 |
| Bertie County Schools | 30800 |
| Bethany Community Middle School | 37901 |
| Bladen Community College | 30905 |
| Bladen County Schools | 30900 |
| Blue Ridge Community College | 34505 |
| Brevard Academy Charter School | 38801 |
| Bridges Charter Schools | 38601 |
| Brunswick Community College | 31005 |
| Brunswick County Schools | 31000 |
| Buncombe County Schools | 31100 |
| Burke County Schools | 31200 |
| Cabarrus County Schools | 31300 |
| Caldwell Community College | 31405 |
| Caldwell County Schools | 31400 |
| Camden County Schools | 31500 |
| Cape Fear Community College | 36505 |
| Cape Fear Center For Inquiry | 36501 |
| Carolina International School | 31301 |
| Carteret Community College | 31605 |
| Carteret County Schools | 31600 |
| Casa Esperanza Montessori | 39209 |
| Caswell County Schools | 31700 |
| Catawba County Schools | 31800 |
| Catawba Valley Community College | 31805 |
| Central Carolina Community College | 35305 |
| Central Park School For Children | 33202 |
| Central Piedmont Community College | 36005 |
| Chapel Hill - Carboro City Schools | 36810 |
| Charlotte Secondary Charter | 36009 |
| Charlotte-Mecklenburg County Schools | 36000 |
| Chatham County Schools | 31900 |
| Cherokee County Schools | 32000 |
| Childrens Village Academy | 35401 |
| Clay County Schools | 32200 |
| Cleveland County Schools | 32300 |
| Cleveland Technical College | 32305 |
| Clinton City Schools | 38210 |
| Clover Garden Charter School | 30102 |
| Coastal Carolina Community College | 36705 |
| College of the Albemarle | 37005 |
| Columbus County Schools | 32400 |
| Community Charter School | 36001 |
| Community Colleges Administration | 19005 |
| Community School of Davidson | 36003 |
| Cornerstone Academy | 33027 |
| Corvian Community School | 36004 |
| Craven Community College | 32505 |
| Cumberland County Schools | 32600 |
| Currituck County Schools | 32700 |
| Dare County Schools | 32800 |
| Davidson County Community College | 32905 |
| Davidson County Schools | 32900 |
| Davie County Schools | 33000 |
| Department of Administration | 10900 |
| Department of Agriculture | 18400 |
| Department of Commerce | 12510 |
| Department of Cultural Resources | 10700 |
| Department of Justice | 10400 |
| Department of Public Instruction | 22000 |

# Appendix H: Participating Employers

| Employer | Employer Code |
|---|---|
| Department of Public Safety | 19100 |
| Duplin County Schools | 33100 |
| Durham Public Schools | 33200 |
| Durham Technical Institute | 33205 |
| East Carolina University | 20300 |
| East Wake Academy | 39208 |
| Edenton-Chowan County Schools | 32100 |
| Edgecombe County Schools | 33300 |
| Edgecombe Technical College | 33305 |
| Elizabeth City and Pasquotank County Schools | 37000 |
| Elizabeth City State University | 20400 |
| Elkin City Schools | 38620 |
| Endeavor Charter School | 39201 |
| Environment and Natural Resources | 11300 |
| Evergreen Community Charter School | 31102 |
| F Delany New School For Children | 31101 |
| Fayetteville State University | 20600 |
| Fayetteville Technical Community College | 32605 |
| Fernleaf Community Charter | 36310 |
| Forsyth Technical Institute | 33405 |
| Franklin County Schools | 33500 |
| Gaston College | 33605 |
| Gaston College Preparatory Charter | 36601 |
| Gaston County Schools | 33600 |
| Gates County Schools | 33700 |
| General Assembly | 12160 |
| Governor's Office | 12100 |
| Graham County Schools | 33800 |
| Grandfather Academy | 30601 |
| Granville County Schools and Oxford Orphanage | 33900 |
| Gray Stone Day School | 38402 |
| Greene County Schools | 34000 |
| Guilford County Schools | 34100 |
| Guilford Technical Community College | 34105 |
| Halifax Community College | 34205 |
| Halifax County Schools | 34200 |
| Haliwa-Saponi Tribal Charter | 39301 |
| Harnett County Schools | 34300 |
| Haywood County Schools | 34400 |
| Haywood Technical College | 34405 |
| Health & Human Svcs | 12220 |
| Healthy Start Academy | 33203 |
| Henderson Collegiate Charter School | 39401 |
| Henderson County Schools | 34500 |
| Hertford County Schools | 34600 |
| Hickory City Schools | 31810 |
| Highway - Administrative | 51000 |
| Hoke County Schools | 34700 |
| Hyde County Schools | 34800 |
| Information Technology Services | 10930 |
| Insurance Department | 12600 |
| Invest Collegiate Charter (Buncombe) | 33207 |
| Invest Collegiate Charter School | 32901 |
| Iredell County Schools | 34900 |
| Isothermal Community College | 38105 |
| Jackson County Schools | 35000 |
| James Sprunt Technical College | 33105 |
| Johnston County Schools | 35100 |
| Johnston Technical College | 35105 |
| Jones County Schools | 35200 |
| Kannapolis City Schools | 31320 |
| Kipp Charlotte Charter | 36102 |
| Labor Department | 12700 |
| Lake Norman Charter School | 36006 |
| Lenoir County Community College | 35405 |
| Lenoir County Schools | 35400 |
| Lexington City Schools | 32910 |
| Lincoln County Schools | 35500 |
| Lt Governor's Office | 12150 |
| Macon County Schools | 35600 |
| Madison County Schools | 35700 |
| Martin Community College | 35805 |
| Martin County Schools | 35800 |
| Mayland Technical College | 36105 |
| Mcdowell County Schools | 35900 |
| Mcdowell Technical College | 35905 |
| Millennium Charter Academy | 38602 |
| Mitchell Community College | 34905 |
| Mitchell County Schools | 36100 |
| Montgomery Community College | 36205 |

# Appendix H: Participating Employers

| Employer | Employer Code |
|---|---|
| Montgomery County Schools | 36200 |
| Moore County Schools | 36300 |
| Mooresville City Schools | 34910 |
| Mount Airy City Schools | 38610 |
| Mountain Community School | 34501 |
| Mtn Discovery Charter | 38701 |
| NC Auctioneers Licensing Board | 18740 |
| NC Central University | 20800 |
| NC School of Science & Mathematics | 10950 |
| NC School of the Arts | 20200 |
| NC State Board of Examiners of Practicing Psychol | 18780 |
| NC State University | 21300 |
| N.E. Academy of Aerospace & Adv.Tech | 37001 |
| N.E. Regional School For Biotechnology | 33001 |
| N.E. Academy of Aerospace & Adv.Tech | 37001 |
| Nash-Rocky Mount Schools | 36400 |
| NC A&T University | 20700 |
| NC Housing Finance Agency | 11310 |
| Neuse Charter School | 35106 |
| New Bern/Craven County Board of Education | 32500 |
| New Hanover County Schools | 36500 |
| Newton-Conover City Schools | 31820 |
| North Carolina Education Lottery | 10200 |
| Northampton County Schools | 36600 |
| Office of Administrative Hearing | 10850 |
| Office of State Budget & Management | 10910 |
| Office of State Controller | 10940 |
| Onslow County Schools | 36700 |
| Orange Charter School | 36802 |
| Orange County Schools | 36800 |
| Pamlico Community College | 36905 |
| Pamlico County Schools | 36900 |
| Pender County Schools | 37100 |
| Perquimans County Schools | 37200 |
| Person County Schools | 37300 |
| Piedmont Community College | 37305 |
| Pine Lake Prep Charter | 36008 |
| Pinnacle Classical Academy | 39703 |
| Pioneer Springs Community Charter | 33209 |
| Pitt Community College | 37405 |

| Employer | Employer Code |
|---|---|
| Pitt County Schools | 37400 |
| Polk County Schools | 37500 |
| Randolph Community College | 37605 |
| Randolph County Schools | 37600 |
| Revenue Department | 13500 |
| Richmond County Schools | 37700 |
| Richmond Technical College | 37705 |
| River Mill Academy Charter | 30103 |
| Roanoke Rapids City Schools | 34220 |
| Roanoke-Chowan Community College | 34605 |
| Robeson Community College | 37805 |
| Robeson County Schools | 37800 |
| Rockingham Community College | 37905 |
| Rockingham County Schools | 37900 |
| Rowan-Cabarrus Community College | 38005 |
| Rowan-Salisbury School System | 38000 |
| Roxboro Community School | 37301 |
| Rutherford County Schools | 38100 |
| Sampson Community College | 38205 |
| Sampson County Schools | 38200 |
| Sandhills Community College | 36305 |
| Sanford-Lee County Board of Education | 35300 |
| Scotland County Schools | 38300 |
| Secretary of State | 13700 |
| Socrates Academy | 36007 |
| South Piedmont Community College | 30405 |
| Southeastern Academy Charter School | 37801 |
| Southeastern Community College | 32405 |
| Southern Wake Academy | 39204 |
| Southwestern Community College | 35005 |
| Stanly Community College | 38405 |
| Stanly County Schools | 38400 |
| Stars Charter School | 36302 |
| State Auditor | 10500 |
| State Board of Elections | 11900 |
| State Division of Health Services | 12200 |
| State Treasurer | 14300 |
| Stokes County Schools | 38500 |
| Success Institute | 34903 |
| Surry Community College | 38605 |

# Appendix H: Participating Employers

| Employer | Employer Code |
|---|---|
| Surry County Schools | 38600 |
| Swain County Schools | 38700 |
| The Hawbridge School | 30104 |
| Thomasville City Schools | 32920 |
| Transylvania County Schools | 38800 |
| Tri-County Community College | 32005 |
| Two Rivers Comm School | 39501 |
| Tyrrell County Schools | 38900 |
| UNC - Pembroke | 21200 |
| UNC Health Care System | 21550 |
| UNC-Ch Cb 1260 | 21520 |
| UNC-General Administration | 21525 |
| Union County Schools | 39000 |
| University of North Carolina at Asheville | 23000 |
| University of North Carolina at Charlotte | 23100 |
| University of North Carolina at Greensboro | 20900 |
| University of North Carolina at Wilmington | 23200 |
| University of North Carolina Press | 21570 |
| Uwharrie Charter Academy | 37601 |
| Vance Charter School | 39101 |
| Vance County Schools | 39100 |
| Vance-Granville Community College | 39105 |
| Voyager Academy | 33204 |
| Wake County Schools | 39200 |
| Wake Technical College | 39205 |

| Employer | Employer Code |
|---|---|
| Warren County Schools | 39300 |
| Washington County Schools | 39400 |
| Watauga County Schools | 39500 |
| Wayne Community College | 39605 |
| Wayne County Schools | 39600 |
| Weldon City Schools | 34230 |
| Western Carolina University | 21800 |
| Western Piedmont Community College | 31205 |
| Whiteville City Schools | 32410 |
| Wildlife Resources Commission | 11600 |
| Wilkes Community College | 39705 |
| Wilkes County Schools | 39700 |
| Wilmington Prep Academy | 36502 |
| Wilson Community College | 39805 |
| Wilson County Schools | 39800 |
| Winston-Salem State University | 21900 |
| Winston-Salem-Forsyth County Schools | 33400 |
| Yadkin County Schools | 39900 |
| Yancey County Schools | 30000 |
| Zeca School of the Arts and Technology | 36701 |