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Consolidated Judges 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





Member Data

Inputs

Membership Data

Asset Data

Benefit Provisions

Assumptions

Funding Methodology



Results

Actuarial Value of Assets

Actuarial Accrued Liability

Net Actuarial Gain or Loss

Funded Ratio

Employer Contributions

Benefit Enhancement

Additional Disclosures

Projections

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	562	560
Terminated members and survivors of deceased members entitled to benefits but not yet receiving benefits	44	42
Retired members and survivors of deceased members currently receiving benefits	<u>682</u>	<u>654</u>
Total	1,288	1,256

The number of active members has increased by 0.4% from the previous valuation date. An increase in active members results in more benefits accruing but also more contributions supporting the system. The number of retired members and survivors of deceased members currently receiving benefits increased by 4.3% from the previous valuation date. 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.

Valuation Input

Asset Data



Inputs

Membership Data

Asset Data

Benefit Provisions

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Funding Methodology



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Actuarial Value of Assets

Actuarial Accrued Liability

Net Actuarial Gain or Loss

Funded Ratio

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Benefit Enhancement

Additional Disclosures

Projections

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	\$ 538,766,550	\$ 520,979,678
Contributions	28,011,274	27,123,101
Benefit Payments	(42,645,427)	(41,293,727)
Investment Income	<u>71,550,605</u>	<u>31,957,498</u>
Net Increase/(Decrease)	56,916,452	17,786,872
End of Year Value of Assets	\$ 595,683,002	\$ 538,766,550
Estimated Net Investment Return	13.46%	6.22%

CJRS 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.



Net Actuarial Gain or Loss

Inputs

Membership Data
Asset Data
Benefit Provisions
Assumptions
Funding Methodology



Results

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

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	\$	77.7
Increase due to Transition to New Actuary		1.1
Normal Cost and Administrative Expense during 2017		15.8
Reduction due to Actual Contributions during 2017		(28.0)
Interest on UAAL, Normal Cost, and Contributions		5.8
Asset (Gain) / Loss		3.5
Actuarial Accrued Liability (Gain) / Loss		6.1
Impact of Assumption Changes		12.7
Impact of Legislative Changes		0.4
Unfunded Actuarial Accrued Liability (UAAL) as of 12/31/2017	\$	95.1

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 \$1.1 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 \$12.7 million. The loss recognized in the actuarial value of assets during the year increased the UAAL by \$3.5 million. Additionally, changes in plan provisions increased the UAAL by \$0.4 million.

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



Employer Contributions

Inputs

Membership Data
Asset Data
Benefit Provisions
Assumptions
Funding Methodology



Results

Actuarial Value of Assets
Actuarial Accrued Liability
Net Actuarial Gain or Loss
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Employer Contributions
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Additional Disclosures
Projections

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

Fiscal year ending June 30, 2019 Preliminary ADEC (based on December 31, 2016 valuation)	32.35%
Impact of Legislative Changes	<u>0.00%</u>
Fiscal year ending June 30, 2019 ADEC for Reconciliation	32.35%
Change Due to Transition to New Actuary	(0.06%)
Change due to Anticipated Reduction in UAAL	(0.56%)
Change Due to Demographic (Gain)/Loss	1.03%
Change Due to Investment (Gain)/Loss	0.60%
Change Due to Contributions Less (Greater) than ADEC	(0.73%)
Impact of Assumption Changes	2.92%
Impact of Direct-Rate Smoothing	<u>(1.95%)</u>
Fiscal year ending June 30, 2020 Preliminary ADEC (based on December 31, 2017 valuation)	33.60%

The change in rate due to investment loss is based on the actuarial value of assets returns, which was less than the 7.20% assumed return. The impact of the asset and demographic losses was an increase of 1.63% of payroll. The impact of the assumption change, the reduction from 7.20% assumed return to 7.00% totaled 2.92%. This will be phased in over the next three years, being fully reflected for the June 30, 2022 results.

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

Valuation Results

Employer Contributions and Benefit Enhancements



Inputs

Membership Data
Asset Data
Benefit Provisions
Assumptions
Funding Methodology



Results

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

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**	Total ADEC	Appropriated Rate
12/31/2017	6/30/2020	17.28%	16.32%	N/A	N/A	N/A
12/31/2016	6/30/2019	15.83%	16.52%	1.51%	33.86%	33.86%
12/31/2015	6/30/2018	15.95%	14.28%	0.82%	31.05%	31.05%
12/31/2014	6/30/2017	17.95%	7.14%	4.37%	29.46%	29.46%
12/31/2013	6/30/2016	17.97%	8.40%	0.00%	26.37%	27.21%

* Includes Death Benefit rate

** For fiscal year ending 6/30/2017, the change due to legislation for the contribution includes a 3.44% increase in the ADEC due to the experience study and a 0.93% increase in the ADEC due to the one-time pension supplement to be paid on or before October 31, 2016. The fiscal year ending 6/30/2019 amount includes 0.60% for the one-time cost-of-living supplement to be paid in October 2018 and an additional 0.91% based on the appropriated contribution rate of 33.86% which was higher than the 32.35% preliminary ADEC calculated in the December 31, 2016 valuation for the fiscal year ending June 30, 2019.

The appropriated rate for fiscal year ending 2019 is 32.35% of payroll. The preliminary ADEC for fiscal year ending 2020 is 35.55% of payroll.

The increase in UAAL for a 1% COLA is \$4,662,000. The increase in ADEC for a 1% COLA is 0.79% of payroll.

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



Key Takeaways

- Key results of the December 31, 2017 valuation were:
 - Market value returns of 13.46% compared to 7.20% assumed
 - Recent legislation signed into law 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 valuation, the above resulted in:
 - Lower funded ratio (86.1% in the December 31, 2017 valuation compared to 87.9% in the December 31, 2016 valuation)
 - Lower actuarially determined employer contribution rate (33.60% for fiscal year ending June 30, 2020 compared to the appropriated contribution rate of 33.86% which was higher than the 32.35% preliminary ADEC calculated in the valuation for fiscal year ending June 30, 2019)

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

Consolidated Judicial Retirement System of North Carolina

Report on the Actuarial Valuation
Prepared as of December 31, 2017

October 2018





October 18, 2018

Cavanaugh Macdonald CONSULTING, LLC

The experience and dedication you deserve

Board of Trustees
Consolidated Judicial
Retirement System of North Carolina
3200 Atlantic Avenue
Raleigh, NC 27604

Members of the Board:

We submit herewith our report on the annual valuation of the Consolidated Judicial Retirement System of North Carolina (referred to as "CJRS" or the "Judicial Plan") prepared as of December 31, 2017. The report has been prepared in accordance with North Carolina General Statute 135-50 through 135-75. 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 CJRS, 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 System 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,

A handwritten signature in blue ink, appearing to read 'LL'.

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

A handwritten signature in blue ink, appearing to read 'Jonathan T. Craven'.

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 1985, the Consolidated Judicial Retirement System (referred to as "CJRS" or the "Judicial Plan") was established. CJRS provides benefits to the elected judges and justices, district attorneys, clerks of superior court of the general court of justice and public defenders. CJRS has approximately \$596 million in assets and over 1,200 members. This actuarial valuation report is our annual analysis of the financial health of CJRS. This report, prepared as of December 31, 2017, presents the results of the actuarial valuation of CJRS.

Purpose

An actuarial valuation is performed on CJRS annually as of the end of the calendar year. The actuary determines the amount of contributions to be made to CJRS 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 CJRS,
- 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

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, 2017 valuation were:

- Market value returns of 13.46% during calendar year 2017 compared to 7.20% assumed at the beginning of the year
- Recent legislation signed into law 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.

When compared to the December 31, 2017 valuation, the above resulted in:

- Lower funded ratio (86.1% in the December 31, 2017 valuation compared to 87.9% in the December 31, 2016 valuation)
- Lower actuarially determined employer contribution rate (33.60% for fiscal year ending June 30, 2020 compared to the appropriated contribution rate of 33.86% which was higher than the 32.35% preliminary ADEC calculated in the valuation for fiscal year ending June 30, 2019)

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

- Stakeholders working together to keep CJRS 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
- An ad hoc cost-of-living adjustment that supports the health of the system
- Modest changes in benefits when compared to peers

Continued focus on these measures will be needed to maintain the solid status of CJRS 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.



Section 1: Principal Results

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

Table 1: Summary of Principal Results

Valuation Results as of	12/31/2017	12/31/2016
Active Members		
Number	562	560
Reported Compensation	\$ 71,726,921	\$ 70,112,652
Valuation Compensation*	\$ 75,728,052	\$ 72,276,199
Retired Members and Survivors of Deceased Members Currently Receiving Benefits		
Number	682	654
Annual Allowances	\$ 42,920,238	\$ 40,501,250
Assets		
Actuarial Value (AVA)	\$ 586,776,499	\$ 564,809,316
Market Value (MVA)	\$ 595,683,002	\$ 538,766,550
Actuarial Accrued Liability (AAL)	\$ 681,895,087	\$ 642,527,945
Unfunded Accrued Liability (AAL - AVA)	\$ 95,118,588	\$ 77,718,629
Funded Ratio (AVA / AAL)**	86.1%	87.9%
Results for Fiscal Year Ending	6/30/2020	6/30/2019
Actuarially Determined Employer Contribution (ADEC), as a percentage of payroll		
Normal Cost	17.28%	15.46%
Death Benefit	N/A	0.37%
Accrued Liability	<u>18.27%</u>	<u>16.52%</u>
Total Preliminary ADEC	35.55%	32.35%
Total ADEC Based on Direct-Rate Smoothing	33.60%	N/A
Impact of Legislative Changes***	<u>N/A</u>	<u>1.51%</u>
Final ADEC	N/A	33.86%
Appropriation Act for Fiscal Year Ending	6/30/2019	6/30/2018
Employer Contribution Rate as a percentage of payroll		
Normal Cost	17.28%	15.46%
Death Benefit	N/A	0.37%
Accrued Liability	<u>16.58%</u>	<u>15.22%</u>
Total	33.86%	31.05%
Preliminary Reserve for Undistributed Gains/(Losses)	(1.69)%	(1.30)%

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

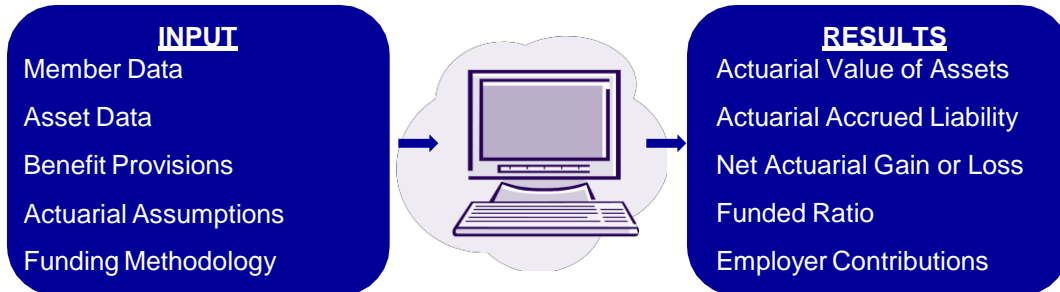
** The Funded Ratio on a Market Value of Assets basis is 87.4% at December 31, 2017.

***The impact of legislative changes includes 0.60% for the one-time cost-of-living supplement and an additional 0.91% due to appropriated contribution rate exceeding the 32.35% preliminary ADEC.



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 CJRS 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)

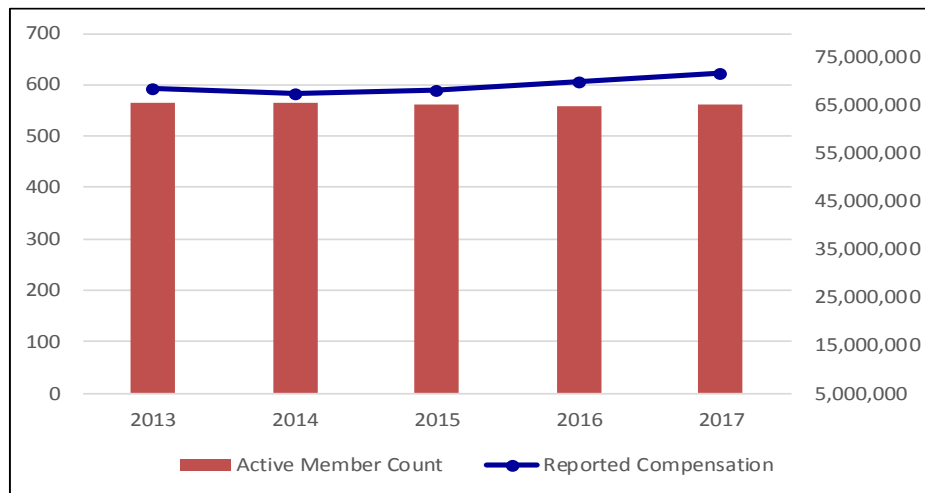
The table below provides a summary of the membership data used in this valuation compared to the prior valuation.

Number as of	12/31/2017	12/31/2016
Active Members	562	560
Terminated members and survivors of deceased members entitled to benefits but not yet receiving benefits	44	42
Retired members and survivors of deceased members currently receiving benefits	<u>682</u>	<u>654</u>
Total	1,288	1,256

Commentary: The number of active members has increased by 0.4% from the previous valuation date. An increase in active members results in more benefits accruing but also more contributions supporting the system. The number of retired members and survivors of deceased members currently receiving benefits increased by 4.3% from the previous valuation date. 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 2.3% and has remained relatively stable 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 assumed results in less benefits accruing than we anticipate, but also fewer contributions supporting the system.

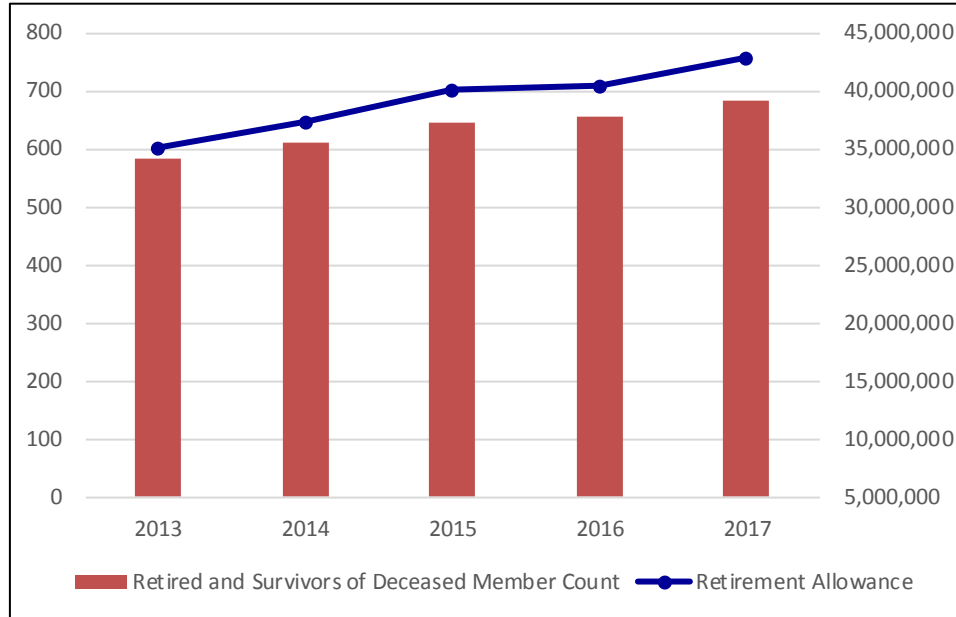


Section 2: The Valuation Process

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.



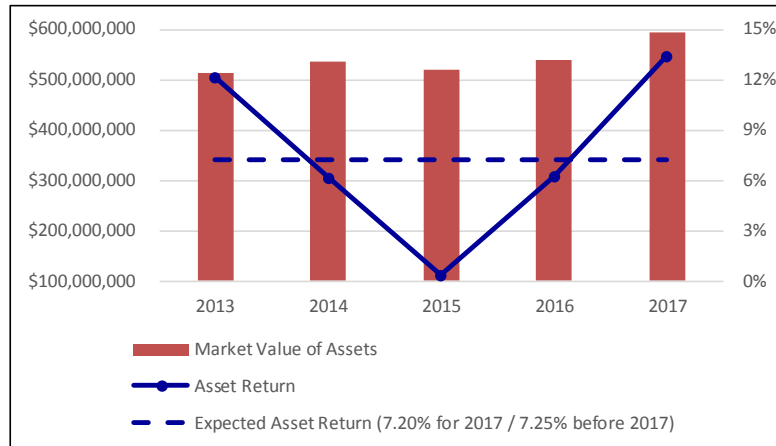
Section 2: The Valuation Process

Valuation Input: Asset Data

CJRS assets are held in trust and are invested for the exclusive benefit of plan members. The Market Value of Assets is \$596 million as of December 31, 2017 and \$539 million as of December 31, 2016. The investment return for the market value of assets for calendar year 2017 was 13.46%.

Graph 3: Market Value of Assets and Asset Returns

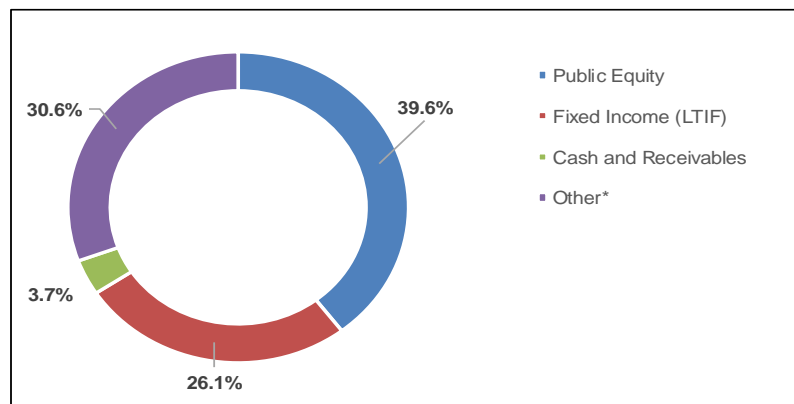
The graph below provides a history of the market value of assets and asset returns over the past five years.



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 the less than expected returns that occurred in 2015 and 2016.

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 change in benefit provisions from the prior year's valuation:

- One-time pension supplement of 1% of the annualized benefit in effect on September 1, 2018, to be paid in October 2018.

Highlights of the benefit provisions are described below.

- An unreduced retirement allowance is payable to members who retire from service:
 - after attaining age 65 and five years of creditable service; or
 - after attaining age 50 and 24 years of creditable service
- The unreduced retirement allowance is equal to:
 - 4.02% of a member's final average compensation multiplied by the number of years of creditable service rendered as a Justice of the Supreme Court or Judge of the Court of Appeals, plus
 - 3.52% of a member's final average compensation multiplied by the number of years of creditable service rendered as a Judge of the Superior Court or as Administrative Officer of the Courts, plus
 - 3.02% of a member's final average compensation multiplied by the number of years of creditable service rendered as a Judge of the District Court, District Attorney, Public Defender, or Clerk of the Superior Court
- A reduced retirement allowance is payable to members who retire from service after attaining age 50 and five years of creditable service
- Ancillary benefits are also payable upon the death or disability of a member.
- CJRS 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.

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 CJRS 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 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.

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



Section 2: The Valuation Process

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 CJRS are reviewed at least every five years. Based on this review, the actuary will make recommendations on the demographic and economic assumptions.

Demographic assumptions describe future events that relate to people such as retirement rates, termination rates, disability rates, and mortality rates. Economic assumptions describe future events that relate to the assets of CJRS such as the interest rate, salary increases, the real return, and payroll growth.

With the exception of the discount rate, 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.

Valuation Input: Funding Methodology

The Funding Methodology is the payment plan for CJRS 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 stay 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.

Commentary: When compared to other Public Sector Retirement Systems in the United States, the funding policy for CJRS is quite aggressive in that the policy pays down the pension debt over a much shorter period of time (12 years) compared to most other Public Sector Retirement 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.



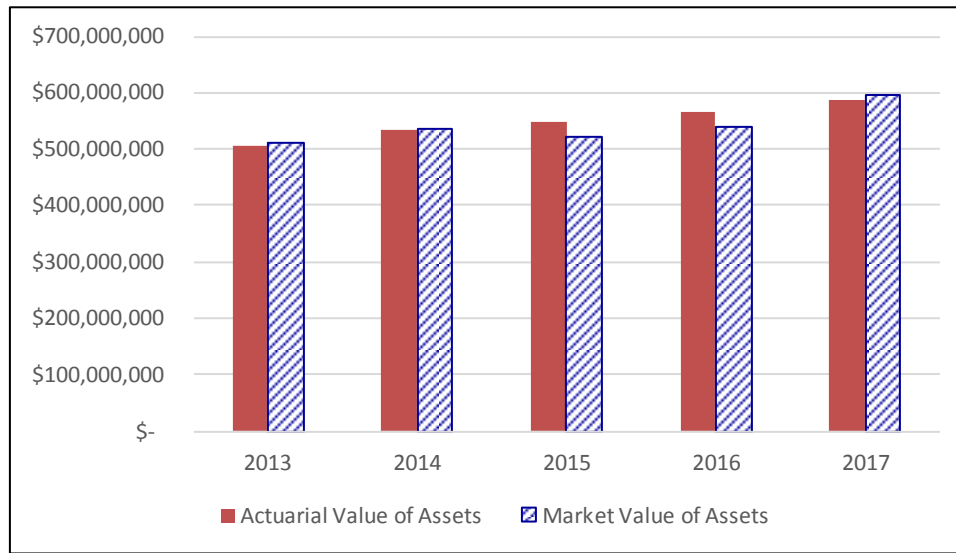
Section 2: The Valuation Process

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 CJRS, the Board adopted an asset valuation method to determine the Actuarial Value of Assets used for funding purposes. The Actuarial Value of Assets is \$586.8 million as of December 31, 2017 and \$564.8 million as of December 31, 2016.

Graph 5: 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 both the December 31, 2020 and the December 31, 2021 valuations.

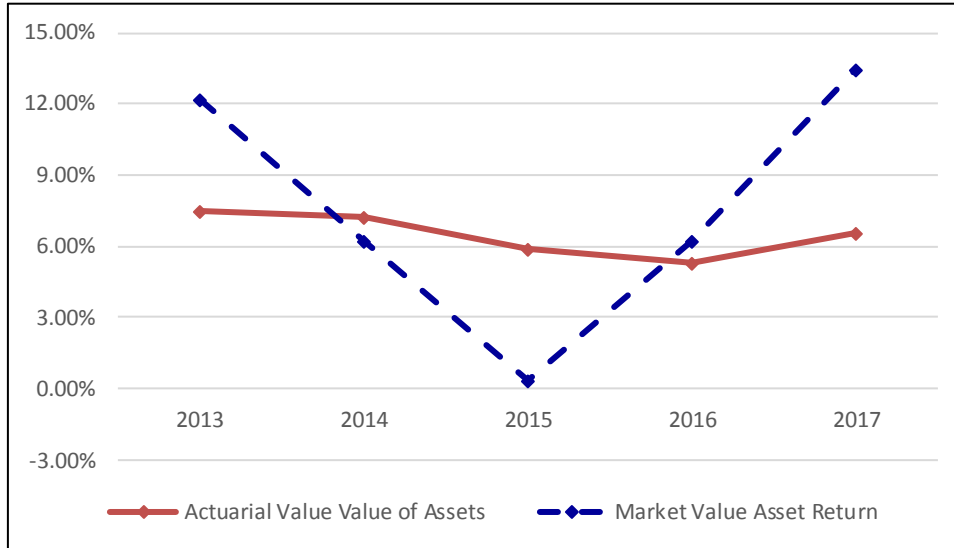


Section 2: The Valuation Process

Valuation Results: Actuarial Value of Assets (continued)

Graph 6: 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 13.46%. 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 6.57% and an asset loss of \$3.5 million during 2017.

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



Section 2: The Valuation Process

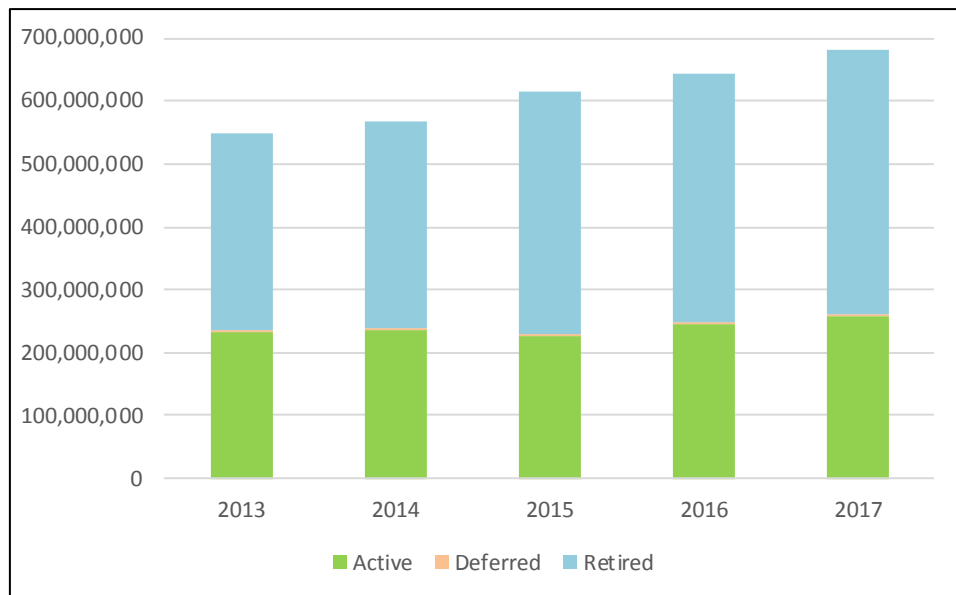
Valuation Results: Actuarial Accrued Liability

Using the provided membership data, benefit provisions, and actuarial assumptions, future benefit payments of CJRS 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 CJRS. 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 CJRS should ideally have in the trust. The NC is also referred to as the cost of benefits accruing during the year.

Graph 7: Actuarial Accrued Liability

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



Commentary: The AAL increased from \$642.5 million to \$681.9 million during 2017. CJRS 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 next as more benefits accrue and the membership approaches retirement. The AAL prior to assumption and legislative changes was \$20.2 million higher than expected, which consisted of \$12.7 million due to assumption changes, \$6.0 million resulting from demographic losses, \$1.1 million due to transition to a new actuary, and legislative changes of \$0.4 million.

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



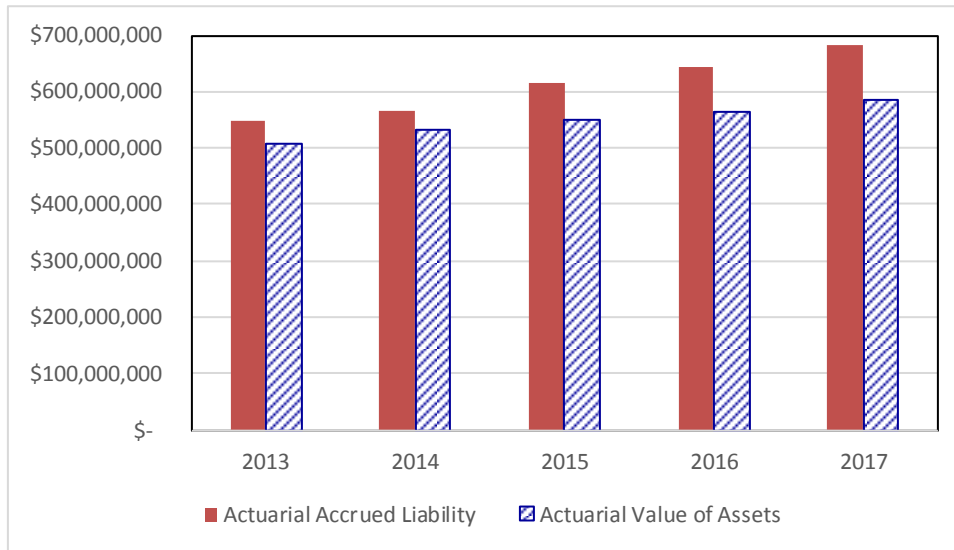
Section 2: The Valuation Process

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 CJRS actually has in the fund to the amount CJRS should have in the fund.

Graph 8: 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.

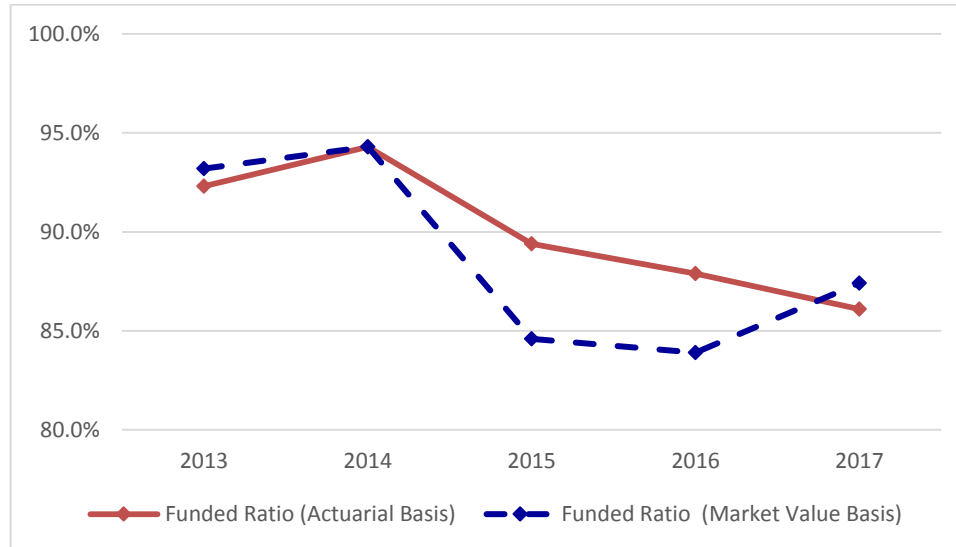


Section 2: The Valuation Process

Valuation Results: Funded Ratio (continued)

Graph 9: 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 87.9% at December 31, 2016 to 86.1% at December 31, 2017.



Section 2: The Valuation Process

Valuation Results: Employer Contributions

G.S. 135-69 of the North Carolina General Statutes provides that the state shall make a normal contribution and an unfunded accrued liability contribution.

The December 31, 2016 valuation suggested that the preliminary total employer contribution rate be set at 32.35% of payroll for the fiscal year ending June 30, 2019. Subsequently, the 2018 Appropriations Act (Session Laws 2018-5) set contributions at 33.86% of payroll effective for the fiscal year ending June 30, 2019, which included an increase to account for recent legislation passed into law. As a result of this December 31, 2017 valuation, the preliminary actuarially determined employer contribution rate is 33.60% 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 10: Actuarially Determined Employer Contribution Rates

The graph below provides a history of actuarially determined employer contribution rates over the past five fiscal 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 required 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 of most of these Systems much longer. The shorter period results in higher contributions and more benefit security.

A detailed summary of the employer required contributions rates is provided in Section 6 of this report.



Section 2: The Valuation Process

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 \$95,449,000 (compared to \$82,727,000 for fiscal year ending June 30, 2017). The required financial reporting information for CJRS 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 CJRS. 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
Judges of Supreme Court and Judges of Court of Appeals	23	57.51	12.56	\$ 3,544,208
Judges of the Superior Court and Administrative Officers of the Court	106	58.57	15.66	15,802,092
Judges of the District Court, District Attorneys, Clerks of the Superior Court, and Public Defenders	<u>433</u>	<u>57.51</u>	<u>12.56</u>	<u>52,380,621</u>
Total	562	54.76	13.47	\$ 71,726,921

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



Section 3: Membership Data

Table 3: Terminated Vested Member Data

	Member Count	Average Age	Average Service	Accumulated Contributions
Judges of Supreme Court and Judges of Court of Appeals	0	0.00	0.00	\$ -
Judges of the Superior Court and Administrative Officers of the Court	3	48.44	4.69	142,213
Judges of the District Court, District Attorneys, Clerks of the Superior Court, and Public Defenders	<u>41</u>	<u>54.69</u>	<u>4.13</u>	<u>1,508,358</u>
Total	44	54.27	4.17	\$ 1,650,571

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



Section 3: Membership Data

Table 4: Data for Members Currently Receiving Benefits

	Member Count	Average Age	Annual Retirement Allowances
<u>Retired Members (Healthy at Retirement)</u>			
Male	382	72.59	\$ 28,453,706
Female	<u>144</u>	<u>69.61</u>	<u>8,685,190</u>
Total	526	71.77	\$ 37,138,896
<u>Retired Members (Disabled at Retirement)*</u>			
Male	1	60.75	\$ 69,696
Female	<u>1</u>	<u>68.67</u>	<u>53,015</u>
Total	2	64.71	\$ 122,711
<u>Survivors of Deceased Members</u>			
Male	13	73.89	\$ 360,202
Female	<u>141</u>	<u>77.22</u>	<u>5,298,429</u>
Total	154	76.94	\$ 5,658,631
Grand Total	682	72.92	\$ 42,920,238

*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 CJRS members. The tables below provide the details of the Market Value of Assets for the current and prior years' valuations.

Table 5: Market Value of Assets

Asset Data as of	12/31/2017	12/31/2016
Beginning of Year Market Value of Assets	\$ 538,766,550	\$ 520,979,678
Contributions	28,011,274	27,123,101
Benefit Payments	(42,645,427)	(41,293,727)
Investment Income	<u>71,550,605</u>	<u>31,957,498</u>
Net Increase/(Decrease)	56,916,452	17,786,872
End of Year Value of Assets	\$ 595,683,002	\$ 538,766,550
Estimated Net Investment Return	13.46%	6.22%

Table 6: 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	\$ 235,434,181	\$ 231,721,761
Fixed Income (LTIF)	155,704,922	144,112,590
Cash and Receivables	22,088,284	7,817,953
Other*	<u>182,513,749</u>	<u>155,114,246</u>
Total Market Value of Assets	\$ 595,741,136	\$ 538,766,550
Allocation by Percentage of Asset Value		
Public Equity	39.6%	43.0%
Fixed Income (LTIF)	26.1%	26.7%
Cash and Receivables	3.7%	1.5%
Other*	<u>30.6%</u>	<u>28.8%</u>
Total Market Value of Assets	100.0%	100.0%

* Real Estate, Alternatives, Inflation and Credit



Section 4: Asset Data

In order to reduce the volatility that investment gains and losses can have on the required contributions and funded status of CJRS, 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 7: Actuarial Value of Assets

Asset Data as of	12/31/2017
Beginning of Year Market Value of Assets	\$ 538,766,550
Contributions	28,011,274
Benefit Payments and Refunds	(42,645,427)
Net Cash Flow	(14,634,153)
Expected Investment Return	38,273,518
Expected End of Year Market Value of Assets	562,405,915
End of Year Market Value of Assets	595,683,002
Excess of Market Value over Expected Market Value of Assets	33,277,087
80% of 2017 Asset Gain/(Loss)	26,621,670
60% of 2016 Asset Gain/(Loss)	(3,179,906)
40% of 2015 Asset Gain/(Loss)	(14,535,261)
20% of 2014 Asset Gain/(Loss)	<u>N/A</u>
Total Deferred Asset Gain/(Loss)	8,906,503
Preliminary End of Year Actuarial Value of Assets	586,776,499
Final End of Year Actuarial Value of Asset (not less than 80% and not greater than 120% of Market Value)	586,776,499
Estimated Net Investment Return on Actuarial Value	6.57%

Commentary: The actuarial value of assets smooths investment gains/losses, resulting in less volatility in the employer contribution. The asset valuation method recognizes asset returns in excess of or less than the expected return on the market value of assets over a five-year period.

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 2016 of 6.57% and a recognized actuarial asset loss of \$3.5 million during 2017.



Section 4: Asset Data

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 8: Historical Asset Returns

Calendar Year	Actuarial Value of Asset Return	Market Value of Asset Return
1998	9.92%	16.61%
1999	15.74%	10.03%
2000	12.37%	2.60%
2001	9.07%	-1.74%
2002	6.13%	-4.84%
2003	8.44%	18.33%
2004	8.95%	10.73%
2005	8.56%	6.94%
2006	9.17%	11.35%
2007	9.04%	8.35%
2008	3.01%	-19.39%
2009	4.88%	14.83%
2010	6.01%	11.49%
2011	5.25%	2.18%
2012	6.42%	11.79%
2013	7.52%	12.19%
2014	7.26%	6.19%
2015	5.87%	0.35%
2016	5.33%	6.22%
2017	6.57%	13.46%
Average	7.74%	6.52%
Range	12.73%	37.72%

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 of 7.74% tracks average market return of 6.52% relatively well. But the range of returns is markedly less – 12.73% versus 37.72%. This results in much lower employer contribution volatility using the actuarial value of assets versus market, while ensuring that the actuarial needs of CJRS are met.



Section 5: Liability Results

Using the provided membership data, benefit provisions, and actuarial assumptions, future benefit payments of CJRS 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 years' valuations.

Table 9: Liability Summary

Valuation Results as of	12/31/2017	12/31/2016
(a) Present Value of Future Benefits		
(1) Active Members	\$ 409,938,370	\$ 382,399,050
(2) Terminated Members	4,174,484	2,404,005
(3) Members Currently Receiving Benefits	<u>420,408,179</u>	<u>393,976,711</u>
(4) Total	\$ 834,521,033	\$ 778,779,766
(b) Present Value of Future Normal Costs	\$ 152,625,946	\$ 136,251,821
(c) Actuarial Accrued Liability: (a4) - (b3)	\$ 681,895,087	\$ 642,527,945
(d) Actuarial Value of Assets	\$ 586,776,499	\$ 564,809,316
(e) Unfunded Actuarial Accrued Liability: (c) - (d)	\$ 95,118,588	\$ 77,718,629



Section 5: Liability Results

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 10: Reconciliation of Unfunded Actuarial Accrued Liability

(in millions)	
Unfunded Actuarial Accrued Liability (UAAL) as of 12/31/2016	\$ 77.7
Increase due to Transition to New Actuary	1.1
Normal Cost and Administrative Expense during 2017	15.8
Reduction due to Actual Contributions during 2017	(28.0)
Interest on UAAL, Normal Cost, and Contributions	5.8
Asset (Gain) / Loss	3.5
Actuarial Accrued Liability (Gain) / Loss	6.1
Impact of Assumption Changes	12.7
Impact of Legislative Changes	0.4
Unfunded Actuarial Accrued Liability (UAAL) as of 12/31/2017	\$ 95.1

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 \$1.1 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 \$12.7 million. The loss recognized in the actuarial value of assets during the year increased the UAAL by \$3.5 million. Additionally, changes in plan provisions increased the UAAL by \$0.4 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.

Table 11: Calculation of the Actuarially Determined Contribution (ADEC)

Valuation Date	12/31/2017	12/31/2016
ADEC for Fiscal Year Ending	6/30/2020	6/30/2019
Normal Cost Rate Calculation		
(a) Normal Cost Rate*	23.28%	21.46%
(b) Employee Contribution Rate	<u>6.00%</u>	<u>6.00%</u>
(c) Total Normal Cost Rate: (a) - (b)	17.28%	15.46%
Death Benefit Rate Calculation**		
(d) Death Benefit Normal Cost	N/A	\$ 266,574
(e) Valuation Compensation	N/A	72,276,199
(f) Death Benefit Rate: (d) / (e)	N/A	0.37%
Accrued Liability Rate Calculation		
(g) Total Annual Amortization Payments**	\$ 14,433,684	\$ 11,936,737
(h) Valuation Compensation	79,014,246	72,276,199
(i) Accrued Liability Rate: (g) / (h)	18.27%	16.52%
Preliminary ADEC (c) + (f) + (i)	35.55%	32.35%
ADEC With Direct-Rate Smoothing	33.60%	N/A
Impact of Legislative Changes	N/A	1.51%
Final ADEC	N/A	33.86%

*Includes assumed administrative expenses.

**See Table 14 for more detail

***The method of determining the contribution rate for the death benefit has been changed from annual term cost to entry age normal, the same method that is used for other System benefits.



Section 6: Actuarially Determined Employer Contribution

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

Table 12: Reconciliation of the Change in the ADEC

Fiscal year ending June 30, 2019 Preliminary ADEC (based on December 31, 2016 valuation)	32.35%
Impact of Legislative Changes	<u>0.00%</u>
Fiscal year ending June 30, 2019 ADEC for Reconciliation	32.35%
Change Due to Transition to New Actuary	(0.06%)
Change due to Anticipated Reduction in UAAL	(0.56%)
Change Due to Demographic (Gain)/Loss	1.03%
Change Due to Investment (Gain)/Loss	0.60%
Change Due to Contributions Less (Greater) than ADEC	(0.73%)
Impact of Assumption Changes	2.92%
Impact of Direct-Rate Smoothing	<u>(1.95%)</u>
Fiscal year ending June 30, 2020 Preliminary ADEC (based on December 31, 2017 valuation)	33.60%

*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.

**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.



Section 6: Actuarially Determined Employer Contribution

Amortization methods determine the payment schedule for the unfunded actuarial accrued liability. CJRS 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 13: Calculation of the New Amortization Base

Calculation as of	12/31/2017	12/31/2016
(a) Unfunded Actuarial Accrued Liability*	\$ 94,709,956	\$ 77,718,629
(b) Prior Years' Outstanding Bases	\$ 75,520,807	\$ 63,849,747
(c) New Amortization Base: (a) - (b)	\$ 19,189,149	\$ 13,868,882
(d) New Amortization Payment	\$ 2,585,036	\$ 1,891,817

* The unfunded actuarial accrued liability at December 31, 2017 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.

Table 14: Amortization Schedule for Unfunded Accrued Liability

Date Established	Original Balance	12/31/2017 Outstanding Balance	FYE 6/30/2020 Payment
December 31, 2009	\$ 34,962,037	\$ 21,830,537	\$ 4,754,253
December 31, 2010	3,913,729	2,795,584	531,669
December 31, 2011	10,017,079	7,994,841	1,359,464
December 31, 2012	(4,239,030)	(3,714,557)	(574,752)
December 31, 2013	(892,665)	(847,271)	(120,921)
December 31, 2014	(6,478,378)	(6,589,121)	(876,777)
December 31, 2015	36,271,204	39,183,352	4,903,895
December 31, 2016	13,868,882	14,867,442	1,871,817
December 31, 2017	19,189,149	19,189,149	2,585,036
Total		\$ 94,709,956	\$ 14,433,684

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



Section 6: Actuarially Determined Employer Contribution

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

Table 15: History of Actuarially Determined Employer Contributions and Appropriated Rates

Valuation Date	Fiscal Year Ending	Normal Rate*	Accrued Liability Rate	Change due to Legislation**	Total ADEC	Appropriated Rate
12/31/2017	6/30/2020	17.28%	16.32%	N/A	N/A	N/A
12/31/2016	6/30/2019	15.83%	16.52%	1.51%	33.86%	33.86%
12/31/2015	6/30/2018	15.95%	14.28%	0.82%	31.05%	31.05%
12/31/2014	6/30/2017	17.95%	7.14%	4.37%	29.46%	29.46%
12/31/2013	6/30/2016	17.97%	8.40%	0.00%	26.37%	27.21%

* Includes Death Benefit rate

** For fiscal year ending 6/30/2017, the change due to legislation for the contribution includes a 3.44% increase in the ADEC due to the experience study and a 0.93% increase in the ADEC due to the one-time pension supplement to be paid on or before October 31, 2016. The fiscal year ending 6/30/2019 amount includes 0.60% for the one-time cost-of-living supplement to be paid in October 2018 and an additional 0.91% based on the appropriated contribution rate of 33.86% which was higher than the 32.35% preliminary ADEC calculated in the December 31, 2016 valuation for the fiscal year ending June 30, 2019.

Table 16: Cost of Benefit Enhancements

Calculation as of	12/31/2017	12/31/2016
Increase in UAAL for a 1% COLA	\$ 4,662,000	N/A
Increase in ADEC for a 1% COLA	0.79%	0.80%

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



Section 7: Valuation Balance Sheet

The valuation balance sheet shows the assets and liabilities of CJRS. 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 17: Valuation Balance Sheet

Balance Sheet as of	12/31/2017	12/31/2016
Assets		
Current Actuarial Value of Assets		
Annuity Savings Fund	\$ 64,311,122	\$ 63,578,490
Pension Accumulation Fund	<u>522,465,377</u>	<u>501,230,826</u>
Total	\$ 586,776,499	\$ 564,809,316
Future Member Contributions to the Annuity	\$ 39,016,822	\$ 36,791,245
Prospective Contributions to the Pension Accumulation Fund		
Normal Contributions	\$ 114,017,756	\$ 99,460,576
Unfunded Accrued Liability Contributions	95,118,588	77,718,629
Undistributed Gain / (Loss) Contributions	<u>(10,989,738)</u>	<u>(6,096,134)</u>
Total	\$ 198,146,606	\$ 171,083,071
Total Assets	<u>\$ 823,939,927</u>	<u>\$ 772,683,632</u>
Liabilities		
Annuity Savings Fund		
Past Member Contributions	\$ 64,311,122	\$ 63,578,490
Future Member Contributions	<u>39,016,822</u>	<u>36,791,245</u>
Total Contributions	\$ 103,327,944	\$ 100,369,735
Pension Accumulation Fund		
Benefits Currently in Payment	\$ 420,408,179	\$ 389,775,797
Benefits to be Paid to Current Active Members	310,784,910	284,433,320
Reserve for Increases in Retirement Allowances*	408,632	4,200,914
Reserve for Undistributed Gains / (Losses)	<u>(10,989,738)</u>	<u>(6,096,134)</u>
Total Benefits Payable	\$ 720,611,983	\$ 672,313,897
Total Liabilities	\$ 823,939,927	\$ 772,683,632

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

This 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 18: Number of Active and Retired Members
as of December 31, 2017**

Number of Active and Retired Participants as of December 31, 2017	
Group	Number
Retired members and survivors of deceased members currently receiving benefits	682
Terminated members and survivors of deceased members entitled to benefits but not yet receiving benefits	44
Active members	<u>562</u>
Total	1,288



Section 8: Accounting Results

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 19: Schedule of Changes in Net Pension Liability (Asset)

Schedule of Changes in Net Pension Liability as of June 30, 2018	
Plan Fiduciary Net Position	
Service Cost	\$ 17,192,000
Interest	45,397,000
Changes of Benefit Terms*	430,000
Difference between Expected and Actual Experience	7,660,000
Change of Assumptions	12,836,000
Benefit Payments, including Refund of Member Contributions	<u>(43,392,000)</u>
Net Change in Total Pension Liability	40,123,000
Total Pension Liability - Beginning of Year	\$ 651,830,000
Total Pension Liability - End of Year	\$ 691,953,000
Plan Fiduciary Net Position	
Employer Contributions	\$ 23,988,000
Member Contributions	5,706,000
Net Investment Income	41,123,000
Benefit Payments, including Refund of Member Contributions	(43,392,000)
Administrative Expenses	(24,000)
Other	<u>0</u>
Net Change in Plan Fiduciary Net Position	27,401,000
Plan Fiduciary Net Position - Beginning of Year	\$ 569,103,000
Plan Fiduciary Net Position - End of Year	\$ 596,504,000

Table 20: Net Pension Liability (Asset)

Net Pension Liability (Asset)		
	June 30, 2018	June 30, 2017
Total Pension Liability	\$ 691,953,000	\$ 651,830,000
Plan Fiduciary Net Position	<u>596,504,000</u>	<u>569,103,000</u>
Net Pension Liability (Asset)	\$ 95,449,000	\$ 82,727,000
Plan Fiduciary Net Position as a Percentage of the Total Pension Liability (Asset)	86.21%	87.31%



Section 8: Accounting Results

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

Table 21: Sensitivity of the Net Pension Liability 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)	\$166,068,000	\$95,449,000	\$35,023,000

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 System contributions will continue to follow the current funding policy, including “direct-rate smoothing” as adopted by the Board on April 26, 2018. Based on those assumptions, 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 detail.

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

Table 22: 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% - 5.50%
*Includes Inflation of	3.00%
**Includes Inflation and Productivity of	3.50%
Cost-of-living Adjustments	N/A



Appendix A: Valuation Process and Glossary of Actuarial Terms

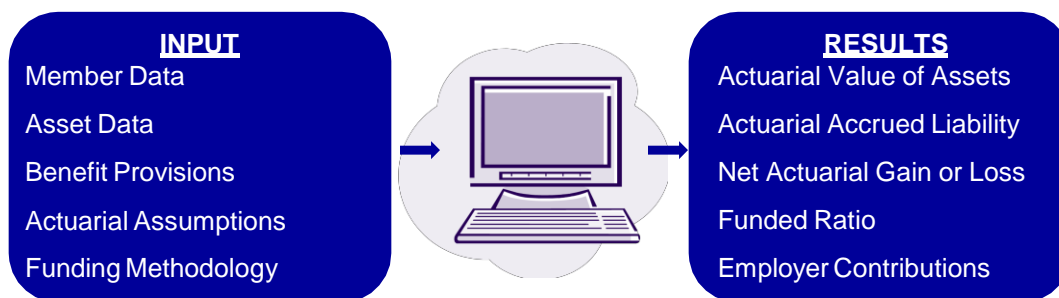
Purpose of an Actuarial Valuation

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



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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 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. 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 period 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 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



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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.



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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 funded ratio does not trend to 100% over time, consideration should be given to fixing the funding policy to 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.



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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. The actuary 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

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.*



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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 20 years (and certainly not longer than 30) are allowed. 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 CJRS 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.*



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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	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0
25 to 29	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0
30 to 34	1	10	0	0	0	0	0	0	0	0	11
	14,147	102,571	0	0	0	0	0	0	0	0	94,532
35 to 39	3	14	5	0	0	0	0	0	0	0	22
	22,521	120,126	121,721	0	0	0	0	0	0	0	107,179
40 to 44	1	20	11	3	1	0	0	0	0	0	36
	20,778	115,929	125,622	132,387	128,369	0	0	0	0	0	117,965
45 to 49	0	27	33	20	11	5	3	0	0	0	99
	0	122,819	120,557	132,141	127,252	141,056	95,788	0	0	0	124,543
50 to 54	1	13	24	12	23	13	8	2	0	0	96
	40,816	113,659	125,165	123,404	138,767	132,474	138,574	106,744	0	0	127,490
55 to 59	0	23	17	19	11	13	17	7	2	0	109
	0	122,002	120,195	129,814	127,007	136,155	145,087	120,291	101,634	0	128,392
60 to 64	0	17	11	8	14	21	11	6	6	2	96
	0	113,896	132,604	132,055	133,804	139,963	149,347	132,839	127,822	103,592	132,060
65 to 69	0	6	10	15	15	12	3	5	3	4	73
	0	121,963	127,447	129,183	137,732	156,774	158,987	146,628	150,549	117,902	137,324
70 & Over	0	1	3	4	1	5	0	1	1	4	20
	0	148,496	124,263	132,154	155,996	154,163	0	155,996	169,088	128,674	140,825
Total	6	131	114	81	76	69	42	21	12	10	562
	23,884	117,880	123,877	129,754	134,370	141,866	142,434	130,557	132,578	119,349	127,628



Appendix B: Detailed Tabulations of Member Data

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
30	0	0	1	14,147
31	1	116,710	2	233,420
32	0	0	2	195,477
33	2	181,254	1	116,710
34	1	116,710	1	65,428
35	2	128,196	1	116,710
36	2	250,557	0	0
37	6	740,516	0	0
38	3	382,865	0	0
39	5	440,117	3	298,975
40	3	371,363	4	472,444
41	5	536,979	3	350,130
42	3	327,712	6	746,473
43	5	610,058	3	326,368
44	0	0	4	505,208
45	8	978,369	5	611,570
46	15	1,911,436	4	523,545
47	13	1,647,849	11	1,348,911
48	9	1,163,976	9	1,079,182
49	12	1,472,587	13	1,592,296
50	10	1,238,358	6	737,249
51	13	1,780,995	8	1,038,710
52	14	1,893,328	11	1,336,983
53	9	1,173,434	10	1,175,084
54	6	780,443	9	1,084,486
55	13	1,821,813	12	1,471,124
56	8	1,045,206	13	1,690,945
57	13	1,740,022	9	1,148,348
58	15	1,987,496	9	1,021,211
59	8	1,059,142	9	1,009,409
60	13	1,708,868	6	639,976
61	16	2,287,131	9	994,736
62	13	1,772,840	5	663,982
63	16	2,201,438	4	535,003
64	11	1,508,574	3	365,220
65	19	2,662,061	3	371,257
66	12	1,592,513	2	325,703
67	9	1,285,159	0	0
68	13	1,726,441	3	403,792
69	8	1,127,357	4	530,346
70	5	685,513	2	310,674
71	7	1,034,789	0	0
72	2	325,084	1	109,976
73	2	240,478	0	0
87	0	0	1	109,976
Total	350	46,055,737	212	25,671,184



Appendix B: Detailed Tabulations of Member Data

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	3	46,055	3	97,249
1	19	2,185,000	22	2,338,008
2	12	1,521,547	1	116,710
3	40	4,929,805	19	2,198,613
4	13	1,608,064	5	544,546
5	18	2,181,260	16	1,809,220
6	1	121,813	2	244,628
7	20	2,565,389	16	1,960,984
8	7	945,739	5	606,766
9	14	1,875,709	15	1,810,494
10	9	1,125,426	5	618,143
11	21	2,733,993	8	1,023,871
12	10	1,357,631	1	127,918
13	14	1,841,463	9	1,231,974
14	2	224,542	2	225,126
15	13	1,702,416	9	1,101,403
16	2	299,222	3	392,120
17	17	2,369,921	9	1,261,046
18	8	1,111,879	1	119,823
19	10	1,301,269	4	553,000
20	5	693,717	3	394,946
21	8	1,133,526	6	822,834
22	5	692,052	7	996,600
23	21	2,997,945	2	329,538
24	8	1,243,220	4	484,417
25	5	765,089	5	770,790
26	1	149,410	1	92,948
27	8	1,269,614	2	265,972
28	5	600,634	2	266,682
29	8	1,204,077	5	597,012
30	0	0	1	127,334
31	5	674,223	1	122,314
32	2	264,298	2	230,730
33	4	638,902	5	514,800
34	1	169,088	0	0
35	0	0	1	137,842
36	1	97,553	2	270,124
37	0	0	1	109,976
38	4	660,663	2	217,571
39	0	0	1	97,208
40	1	158,363	0	0
41	1	105,716	0	0
42	1	97,208	2	219,952
43	1	158,363	0	0
45	2	233,933	0	0
46	0	0	1	109,976
49	0	0	1	109,976
Total	350	46,055,737	212	25,671,184



Appendix B: Detailed Tabulations of Member Data

B-4: The Number and Accumulated Contributions of Terminated Vested Members Distributed by Age as of December 31, 2017

Age	Men		Women	
	Number	Contributions	Number	Contributions
35	1	3,302	0	0
41	0	0	1	11,041
43	0	0	1	4,540
46	1	42,322	0	0
47	3	26,698	0	0
48	1	46,155	1	47,733
49	0	0	1	56,273
50	3	134,260	1	73,034
51	2	44,210	1	4,407
52	2	59,399	2	12,013
53	1	33,964	1	47,976
54	1	14,596	1	5,236
55	1	36,061	0	0
56	1	77,716	1	91,463
57	2	97,344	0	0
58	1	41,268	0	0
59	1	19,756	0	0
60	3	192,266	2	260,532
64	1	31,608	1	1,454
65	1	48,050	0	0
67	2	23,884	1	43,760
70	1	18,251	0	0
Total	29	991,110	15	659,462



Appendix B: Detailed Tabulations of Member Data

Table B-5: 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
51	0	0	5	234,738
53	0	0	5	205,301
54	2	81,621	0	0
55	3	245,792	2	37,292
56	2	125,050	2	89,095
57	1	21,469	2	99,301
58	3	232,172	0	0
59	2	81,133	3	208,654
60	0	0	5	286,699
61	7	567,858	12	739,902
62	3	228,731	9	610,653
63	13	960,208	12	641,817
64	12	772,608	11	577,972
65	10	651,814	8	394,861
66	21	1,565,416	11	588,777
67	13	999,523	15	971,700
68	26	1,866,281	11	701,011
69	24	1,824,663	7	464,455
70	23	1,694,174	5	344,300
71	28	2,167,127	8	404,771
72	29	2,002,412	16	893,984
73	17	1,199,362	6	294,679
74	20	1,425,541	5	208,251
75	21	1,455,753	7	538,460
76	12	944,485	12	464,558
77	10	872,877	2	13,994
78	12	1,126,712	8	494,868
79	9	709,730	8	332,663
80	9	631,562	11	328,938
81	9	746,975	9	378,122



Appendix B: Detailed Tabulations of Member Data

Table B-5: 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
82	8	480,549	5	198,120
83	5	229,660	7	277,127
84	7	515,775	3	91,827
85	4	365,022	9	358,152
86	4	328,440	5	355,117
87	5	374,718	3	118,657
88	6	335,757	4	202,061
89	6	422,871	6	100,713
90	1	10,973	7	170,248
91	0	0	4	158,666
92	3	227,399	2	55,637
93	1	105,024	2	36,649
94	1	100,757	2	41,234
95	2	91,633	2	38,131
97	1	24,278	2	30,516
98	0	0	1	53,050
99	0	0	2	97,292
100	0	0	1	49,753
101	0	0	1	856
Total	395	28,813,905	285	13,983,622



Appendix B: Detailed Tabulations of Member Data

Table B-6: 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
Maximum	224	17,094,829	115	6,948,377
Option 1	3	271,138	0	0
Option 2	37	1,936,670	4	220,716
Option 3	43	3,756,573	3	170,899
Option 4	3	196,984	8	352,950
Option 5-2	0	0	0	0
Option 5-3	0	0	0	0
Option 6-2	19	984,534	1	91,263
Option 6-3	50	4,132,661	12	847,935
Other	3	80,317	1	53,050
Survivors of Deceased Members	13	360,202	141	5,298,429
Total	395	28,813,908	285	13,983,619



Appendix B: Detailed Tabulations of Member Data

Table B-7: 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
60	1	69,696	0	0
68	0	0	1	53,015
Total	1	69,696	1	53,015



Appendix B: Detailed Tabulations of Member Data

B-8: 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
Maximum	1	69,696		
Option 1				
Option 2				
Option 3			1	53,015
Option 4				
Option 5-2				
Option 5-3				
Option 6-2				
Option 6-3				
Other				
	1	69,696	1	53,015



Appendix C: Summary of Main Benefit and Contribution Provisions

All justices, judges, district attorneys, and public defenders of the General Court of Justice, and clerks of the Superior Court are eligible for membership.

"Final compensation" as used in the summary means the annual rate of compensation of the member at his date of termination or death. "Average final compensation" means the average annual compensation during the 48 consecutive calendar months of membership producing the highest average. "Creditable service" includes all service rendered as a justice of the Supreme Court, judge of the Court of Appeals, judge of the Superior Court, judge of the District Court Division of the General Court of Justice, Administrative Officer of the Courts, District Attorney, Public Defender or as a Clerk of the Superior Court.

BENEFITS

Service Retirement Allowance

Conditions for Allowance

A service retirement allowance is payable to any member who retires from service and:

- (a) had attained age 50 and was in service on October 8, 1981; or
- (b) has attained age 50 and completed five or more years of creditable service; or

Retirement is compulsory at age 72 if the member is a justice or judge of the Appellate, Superior, or District Divisions of the General Court of Justice and at age 70 for each other member.

Unreduced Allowance

An unreduced annual service retirement allowance is payable to a member who:

- (a) has attained age 65 and completed five years of creditable service; or
- (b) has attained age 50 and completed 24 years of creditable service.

The Service Retirement Allowance is equal to:

- (i) 4.02% of final compensation multiplied by the number of years of creditable service rendered as a justice of the Supreme Court or judge of the Court of Appeals, plus
- (ii) 3.52% of final compensation multiplied by the number of years of creditable service rendered as a judge of the Superior Court or as Administrative Officer of the Courts, plus



Appendix C: Summary of Main Benefit and Contribution Provisions

- (iii) 3.02% of final compensation multiplied by the number of years of creditable service rendered as a judge of the District Court, District Attorney, Public Defender, or Clerk of the Superior Court, plus
- (iv) A service retirement allowance computed on average final compensation, service transferred from the Teachers' and State Employees' Retirement System or the Local Governmental Employees' Retirement System and the applicable formula accrual rate from the previous system.

Reduced Allowance

A reduced annual service retirement allowance is payable to a member who retires:

- (a) prior to the earlier of attainment of age 65 and completion of five years of creditable service;
- (b) prior to attainment of age 50 or the completion of 24 years of creditable service.

The reduced amount is an allowance as computed above reduced by 3% for each year that the member's retirement date precedes the date upon which the member would have attained age 65 or completed 24 years of service had he or she remained in service, whichever is earlier.

Maximum Amount

The maximum annual service retirement allowance (on an unreduced basis) is the amount which, when added to the member's benefit payable from the Teachers' and State Employees' Retirement System, Local Governmental Employees' Retirement System, or Legislative Retirement System (all on an unreduced basis) would total 75% of the member's final compensation.



Appendix C: Summary of Main Benefit and Contribution Provisions

Minimum Amount	In no event will a member whose creditable service commenced prior to January 1, 1974 as a justice of the Supreme Court, as a judge of the Court of Appeals, as an Administrative Officer of the courts, or as a judge of the Superior Court, receive a smaller retirement allowance than he or she would have received under Chapter 7-A of the General Statutes.
Disability Retirement Allowance	
Condition for Allowance	Any member who becomes permanently and totally disabled prior to the attainment of age 65 and who has completed at least five years of creditable service may be retired by the Board of Trustees on a disability retirement allowance. Any retired member may also apply for a disability retirement allowance within the first three years of retirement.
Amount of Allowance	The disability retirement allowance is computed as a service retirement allowance based on the number of years of creditable service the member would have had had he or she remained in service to the earliest date he could have retired on an unreduced service retirement allowance.
Deferred Allowance	Any member who separates from service prior to age 50 and completion of five years of creditable service and who leaves his total accumulated contributions in the system may receive a deferred allowance, beginning at age 50, computed in the same way as a service retirement allowance on the basis of creditable service and compensation to the date of separation.
Spouse Benefit	
Conditions for Benefit	Upon the death of a member in active service after attainment of age 50 and completion of five years of creditable service a death benefit is payable to his or her surviving spouse.



Appendix C: Summary of Main Benefit and Contribution Provisions

Amount of Benefit	The surviving spouse receives a lump sum payment equal to the member's final compensation. In addition the surviving spouse receives an annual retirement allowance, until death or remarriage, equal to 50% of the service retirement allowance to which the member would have been entitled had retirement occurred on the first day of the calendar month coincident with or next following his or her date of death reduced by 2% for each year that the member's age exceeds that of the spouse.
Lump Sum Death Benefit	Upon the death of a member in active service prior to attainment of age 50 a lump sum payment equal to the member's accumulated contributions plus his or her final compensation is made to the designated beneficiary or estate.
Death after Retirement	<p>Upon the death of a retired member while in receipt of a service retirement allowance or after age 65 if in receipt of a disability retirement allowance an allowance is paid to his or her spouse, until death or remarriage, equal to one-half the allowance which was payable to the member prior to death reduced by 2% for each year that the member's age exceeds that of the spouse.</p> <p>Upon the death of a member in receipt of a disability retirement allowance prior to age 65, an allowance is paid to his or her spouse, until death or remarriage, equal to one-half the service retirement allowance the member would have received had he or she remained in service up to the date of death reduced by 2% for each year that the member's age exceeds that of the spouse.</p>
Other Death Benefits	Upon the death of a member in service, other benefits may be provided by the Death Benefit Plan.
Return of Contributions	<p>Any member who terminates service other than by retirement or death is entitled to the return of accumulated contributions.</p> <p>If the total retirement allowance payments to a retired member, spouse and/or beneficiary under option are less than the member's accumulated contributions at retirement, the excess is paid to the designated beneficiary or legal representatives.</p> <p>The current interest rate on member contributions is 4%.</p>



Appendix C: Summary of Main Benefit and Contribution Provisions

Optional Allowances

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:

Option 1 - At the death of the member within 10 years from retirement date, an amount equal to his or her accumulated contributions at retirement, less 1/120 for each month he or she has received a retirement allowance payment, is paid to the estate, or to a person designated by the member, or

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, or

Option 4 - At retirement, any member may elect to receive a retirement allowance in such amount that, together with his or her Social Security benefit, the member 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. A member who elects to receive his or her allowance under this option is deemed to have elected Option 1 also, or

Option 5 - At retirement, the member may elect to receive a reduced retirement allowance during his or her life with some other benefit approved by the Board of Trustees payable after death, or the member 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, or

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



Appendix C: Summary of Main Benefit and Contribution Provisions

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.
Post-Retirement Increases in Allowance	Future increases in allowances may be granted at the discretion of the State.
Contributions	
Member Contributions	Each member contributes 6% of annual compensation.
Employer Contributions	<p>The State makes 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.</p> <p>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.</p>
Changes Since Prior Valuation	A one-time pension supplement was granted effective July 1, 2018 to 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).



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.

Withdrawal: No termination of employment is assumed to occur prior to retirement, other than death or disability.

Separations Before Retirement: Representative values of the assumed annual rates of separation are as follows:

Annual Rate of			
	<u>Disability</u>	<u>Base Mortality*</u>	
<u>Age</u>	<u>Male & Female</u>	<u>Male</u>	<u>Female</u>
25	.0001	.0005	.0002
30	.0001	.0005	.0002
35	.0003	.0005	.0003
40	.0007	.0006	.0004
45	.0014	.0010	.0007
50	.0023	.0017	.0011
55	.0047	.0028	.0017
60	.0077	.0047	.0024
64	.0098	.0074	.0034

* Base mortality rates as of 2014.

Service Retirement: Representative values of the assumed annual rates of service retirement are as follows:

<u>Age</u>	<u>Service</u>					
	<u>5</u>	<u>10</u>	<u>15</u>	<u>20</u>	<u>25</u>	<u>30</u>
50					.150	.150
55	.025	.025	.025	.025	.150	.150
60	.025	.025	.025	.025	.125	.125
65	.100	.100	.100	.100	.100	.100
70	.500	.500	.500	.500	.500	.500



Appendix D: Actuarial Assumptions and Methods

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

Annual Rate of Salary Increase

<u>Service</u>	
0	.0550
5	.0500
10	.0450
15	.0405
20	.0375
25	.0350
30	.0350
35	.0350
40	.0350

Deaths After Retirement: 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 (Retired Members and Survivors of Deceased Members)

Retirees (Healthy at Retirement)			Survivors of Deceased Members		Retirees (Disabled at Retirement)	
Age	Male	Female	Male	Female	Male	Female
55	.0057	.0036	.0057	.0036	.0234	.0145
60	.0078	.0052	.0078	.0052	.0266	.0170
65	.0110	.0080	.0110	.0080	.0317	.0209
70	.0168	.0129	.0168	.0129	.0403	.0282
75	.0268	.0209	.0268	.0209	.0543	.0410
80	.0447	.0348	.0447	.0348	.0766	.0610

Deaths After Retirement (Healthy Members at Retirement and Survivors of Deceased Members):

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 (Disabled Members at Retirement): Mortality rates are based on the RP-2014 Total Data Set for Disabled Annuitants Mortality Table.

Deaths Prior to Retirement: Mortality rates are based on the RP-2014 Total Data Set Employee Mortality Table.

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



Appendix D: Actuarial Assumptions and Methods

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

Liability for Inactive Members: The liability for members who terminated prior to five years of creditable service is estimated to be 100% of the member's accumulated contributions. The liability for members who terminated after completing five years of creditable service is estimated based on the member's current age and the service and reported compensation at termination of employment.

Administrative Expenses: 0.75% of normal cost.

Marriage Assumption: 90% of male members married and 50% of female members married with the 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 7. 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 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	\$ 595,683	\$ 4,544	\$ 23,931	\$ 45,549	\$ 111	\$ 41,107	\$ 619,604
2019	619,604	4,399	24,535	47,417	113	42,732	643,740
2020	643,740	4,275	24,595	49,505	115	44,348	667,338
2021	667,338	4,152	25,425	51,466	115	45,957	691,291
2022	691,291	4,038	23,030	53,250	112	47,486	712,483
2023	712,483	3,916	20,525	54,889	108	48,822	730,749
2024	730,749	3,789	19,660	56,532	104	50,011	747,572
2025	747,572	3,663	18,852	58,133	100	51,101	762,955
2026	762,955	3,527	18,826	59,606	97	52,122	777,726
2027	777,726	3,387	18,867	61,131	92	53,100	791,858
2028	791,858	3,234	16,398	62,453	88	53,954	802,902
2029	802,902	3,079	12,538	63,780	83	54,543	809,199
2030	809,199	2,930	9,863	64,928	78	54,847	811,834
2031	811,834	2,773	8,087	66,101	74	54,925	811,443
2032	811,443	2,609	7,576	67,296	69	54,834	809,097
2033	809,097	2,436	7,045	68,443	63	54,606	804,678
2034	804,678	2,254	6,555	69,390	58	54,241	798,280
2035	798,280	2,093	5,602	70,107	54	53,730	789,545
2036	789,545	1,933	4,687	70,614	49	53,065	778,567
2037	778,567	1,769	4,222	71,092	45	52,258	765,679
2038	765,679	1,607	3,752	71,514	40	51,320	750,804
2039	750,804	1,432	3,304	71,806	35	50,247	733,946
2040	733,946	1,260	2,845	71,991	31	49,039	715,068
2041	715,068	1,079	2,324	72,266	25	47,684	693,864
2042	693,864	885	1,860	72,264	20	46,178	670,503
2043	670,503	717	1,464	71,845	16	44,538	645,361
2044	645,361	576	1,204	70,779	13	42,801	619,149
2045	619,149	482	999	69,292	11	41,007	592,334
2046	592,334	399	845	67,536	9	39,182	565,215
2047	565,215	332	666	65,765	7	37,336	537,777
2048	537,777	266	523	63,840	6	35,475	510,195
2049	510,195	210	399	61,788	5	33,608	482,620
2050	482,620	161	307	59,590	3	31,749	455,244
2051	455,244	127	224	57,310	3	29,907	428,189
2052	428,189	93	177	54,912	2	28,093	401,637
2053	401,637	73	121	52,521	1	26,314	375,623
2054	375,623	52	94	50,045	1	24,577	350,300
2055	350,300	39	65	47,582	1	22,887	325,708
2056	325,708	27	44	45,116	1	21,250	301,912
2057	301,912	18	23	42,676	0	19,667	278,943
2058	278,943	9	9	40,246	0	18,142	256,857
2059	256,857	4	0	37,834	0	16,678	235,706
2060	235,706	1	0	35,428	0	15,280	215,560
2061	215,560	0	0	33,066	0	13,951	196,445
2062	196,445	0	0	30,764	0	12,693	178,374
2063	178,374	0	0	28,527	0	11,505	161,352
2064	161,352	0	0	26,359	0	10,388	145,381
2065	145,381	0	0	24,266	0	9,342	130,456
2066	130,456	0	0	22,253	0	8,366	116,569
2067	116,569	0	0	20,324	0	7,461	103,706



Appendix E: GASB 67 Fiduciary Net Position Projection

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

Calendar Year	(in thousands)						
	Beginning Fiduciary Position	Member Contributions	Employer Contributions	Benefit Payments	Administrative Expenses	Investment Earnings	Ending Fiduciary Position
2068	\$ 103,706	\$ 0	\$ 0	\$ 18,483	\$ 0	\$ 6,623	\$ 91,846
2069	91,846	0	0	16,734	0	5,853	80,965
2070	80,965	0	0	15,082	0	5,149	71,032
2071	71,032	0	0	13,529	0	4,507	62,010
2072	62,010	0	0	12,078	0	3,925	53,857
2073	53,857	0	0	10,729	0	3,401	46,530
2074	46,530	0	0	9,481	0	2,931	39,979
2075	39,979	0	0	8,334	0	2,512	34,157
2076	34,157	0	0	7,286	0	2,140	29,012
2077	29,012	0	0	6,332	0	1,813	24,492
2078	24,492	0	0	5,470	0	1,526	20,548
2079	20,548	0	0	4,695	0	1,277	17,130
2080	17,130	0	0	4,002	0	1,061	14,190
2081	14,190	0	0	3,385	0	877	11,682
2082	11,682	0	0	2,840	0	720	9,562
2083	9,562	0	0	2,361	0	588	7,788
2084	7,788	0	0	1,943	0	478	6,323
2085	6,323	0	0	1,581	0	388	5,130
2086	5,130	0	0	1,271	0	315	4,174
2087	4,174	0	0	1,007	0	258	3,424
2088	3,424	0	0	787	0	213	2,850
2089	2,850	0	0	604	0	179	2,425
2090	2,425	0	0	456	0	154	2,123
2091	2,123	0	0	337	0	137	1,923
2092	1,923	0	0	244	0	126	1,805
2093	1,805	0	0	173	0	120	1,752
2094	1,752	0	0	120	0	119	1,751
2095	1,751	0	0	81	0	120	1,790
2096	1,790	0	0	53	0	123	1,861
2097	1,861	0	0	34	0	129	1,956
2098	1,956	0	0	21	0	136	2,072
2099	2,072	0	0	12	0	145	2,204
2100	2,204	0	0	7	0	154	2,351
2101	2,351	0	0	4	0	164	2,511
2102	2,511	0	0	2	0	176	2,685
2103	2,685	0	0	1	0	188	2,872
2104	2,872	0	0	1	0	201	3,072
2105	3,072	0	0	0	0	215	3,287
2106	3,287	0	0	0	0	230	3,517
2107	3,517	0	0	0	0	246	3,763
2108	3,763	0	0	0	0	263	4,026
2109	4,026	0	0	0	0	282	4,308
2110	4,308	0	0	0	0	302	4,610
2111	4,610	0	0	0	0	323	4,932
2112	4,932	0	0	0	0	345	5,277
2113	5,277	0	0	0	0	369	5,647
2114	5,647	0	0	0	0	395	6,042
2115	6,042	0	0	0	0	423	6,465
2116	6,465	0	0	0	0	453	6,918
2117	6,918	0	0	0	0	484	7,402



Appendix E: GASB 67 Fiduciary Net Position Projection

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	Funded Payments at 7.00%	Unfunded Payments at 3.87%	Using Single Discount Rate of 7.00%
2018	\$ 595,683	\$ 45,549	\$ 45,549	\$ 0	\$ 44,034	\$ 0	\$ 44,034
2019	619,604	47,417	47,417	0	42,841	0	42,841
2020	643,740	49,505	49,505	0	41,801	0	41,801
2021	667,338	51,466	51,466	0	40,614	0	40,614
2022	691,291	53,250	53,250	0	39,273	0	39,273
2023	712,483	54,889	54,889	0	37,833	0	37,833
2024	730,749	56,532	56,532	0	36,417	0	36,417
2025	747,572	58,133	58,133	0	34,998	0	34,998
2026	762,955	59,606	59,606	0	33,537	0	33,537
2027	777,726	61,131	61,131	0	32,145	0	32,145
2028	791,858	62,453	62,453	0	30,692	0	30,692
2029	802,902	63,780	63,780	0	29,294	0	29,294
2030	809,199	64,928	64,928	0	27,870	0	27,870
2031	811,834	66,101	66,101	0	26,517	0	26,517
2032	811,443	67,296	67,296	0	25,230	0	25,230
2033	809,097	68,443	68,443	0	23,982	0	23,982
2034	804,678	69,390	69,390	0	22,723	0	22,723
2035	798,280	70,107	70,107	0	21,456	0	21,456
2036	789,545	70,614	70,614	0	20,197	0	20,197
2037	778,567	71,092	71,092	0	19,004	0	19,004
2038	765,679	71,514	71,514	0	17,866	0	17,866
2039	750,804	71,806	71,806	0	16,765	0	16,765
2040	733,946	71,991	71,991	0	15,709	0	15,709
2041	715,068	72,266	72,266	0	14,737	0	14,737
2042	693,864	72,264	72,264	0	13,773	0	13,773
2043	670,503	71,845	71,845	0	12,797	0	12,797
2044	645,361	70,779	70,779	0	11,782	0	11,782
2045	619,149	69,292	69,292	0	10,780	0	10,780
2046	592,334	67,536	67,536	0	9,820	0	9,820
2047	565,215	65,765	65,765	0	8,937	0	8,937
2048	537,777	63,840	63,840	0	8,107	0	8,107
2049	510,195	61,788	61,788	0	7,334	0	7,334
2050	482,620	59,590	59,590	0	6,610	0	6,610
2051	455,244	57,310	57,310	0	5,941	0	5,941
2052	428,189	54,912	54,912	0	5,320	0	5,320
2053	401,637	52,521	52,521	0	4,756	0	4,756
2054	375,623	50,045	50,045	0	4,235	0	4,235
2055	350,300	47,582	47,582	0	3,763	0	3,763
2056	325,708	45,116	45,116	0	3,335	0	3,335
2057	301,912	42,676	42,676	0	2,948	0	2,948
2058	278,943	40,246	40,246	0	2,598	0	2,598
2059	256,857	37,834	37,834	0	2,283	0	2,283
2060	235,706	35,428	35,428	0	1,998	0	1,998
2061	215,560	33,066	33,066	0	1,743	0	1,743
2062	196,445	30,764	30,764	0	1,515	0	1,515
2063	178,374	28,527	28,527	0	1,313	0	1,313
2064	161,352	26,359	26,359	0	1,134	0	1,134
2065	145,381	24,266	24,266	0	976	0	976
2066	130,456	22,253	22,253	0	836	0	836
2067	116,569	20,324	20,324	0	714	0	714



Appendix E: GASB 67 Fiduciary Net Position Projection

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

Calendar Year	Beginning Fiduciary Position	Benefit Payments	(in thousands)				Using Single Discount Rate of 7.00%
			Funded Benefit Payments	Unfunded Benefit Payments	Funded Payments at 7.00%	Unfunded Payments at 3.87%	
2068	\$ 103,706	\$ 18,483	\$ 18,483	\$ 0	\$ 607	\$ 0	\$ 607
2069	91,846	16,734	16,734	0	513	0	513
2070	80,965	15,082	15,082	0	432	0	432
2071	71,032	13,529	13,529	0	362	0	362
2072	62,010	12,078	12,078	0	302	0	302
2073	53,857	10,729	10,729	0	251	0	251
2074	46,530	9,481	9,481	0	207	0	207
2075	39,979	8,334	8,334	0	170	0	170
2076	34,157	7,286	7,286	0	139	0	139
2077	29,012	6,332	6,332	0	113	0	113
2078	24,492	5,470	5,470	0	91	0	91
2079	20,548	4,695	4,695	0	73	0	73
2080	17,130	4,002	4,002	0	58	0	58
2081	14,190	3,385	3,385	0	46	0	46
2082	11,682	2,840	2,840	0	36	0	36
2083	9,562	2,361	2,361	0	28	0	28
2084	7,788	1,943	1,943	0	22	0	22
2085	6,323	1,581	1,581	0	16	0	16
2086	5,130	1,271	1,271	0	12	0	12
2087	4,174	1,007	1,007	0	9	0	9
2088	3,424	787	787	0	7	0	7
2089	2,850	604	604	0	5	0	5
2090	2,425	456	456	0	3	0	3
2091	2,123	337	337	0	2	0	2
2092	1,923	244	244	0	2	0	2
2093	1,805	173	173	0	1	0	1
2094	1,752	120	120	0	1	0	1
2095	1,751	81	81	0	0	0	0
2096	1,790	53	53	0	0	0	0
2097	1,861	34	34	0	0	0	0
2098	1,956	21	21	0	0	0	0
2099	2,072	12	12	0	0	0	0
2100	2,204	7	7	0	0	0	0
2101	2,351	4	4	0	0	0	0
2102	2,511	2	2	0	0	0	0
2103	2,685	1	1	0	0	0	0
2104	2,872	1	1	0	0	0	0
2105	3,072	0	0	0	0	0	0
2106	3,287	0	0	0	0	0	0
2107	3,517	0	0	0	0	0	0
2108	3,763	0	0	0	0	0	0
2109	4,026	0	0	0	0	0	0
2110	4,308	0	0	0	0	0	0
2111	4,610	0	0	0	0	0	0
2112	4,932	0	0	0	0	0	0
2113	5,277	0	0	0	0	0	0
2114	5,647	0	0	0	0	0	0
2115	6,042	0	0	0	0	0	0
2116	6,465	0	0	0	0	0	0
2117	6,918	0	0	0	0	0	0



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 our “TSERS Asset-Liability and Investment Strategy Project” report dated April 19, 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.

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	\$ 595,683,002	\$ 595,683,002	\$ 595,683,002	\$ 595,683,002	\$ 595,683,002
Actuarial Accrued Liability	\$ 1,068,720,736	\$ 845,350,215	\$ 681,486,455	\$ 563,981,415	\$ 477,256,671
Unfunded Accrued Liability (UAL)	\$ 473,037,734	\$ 250,075,845	\$ 86,212,085	\$ (31,701,587)	\$ (118,426,331)
Funded Ratio	55.7%	70.5%	87.4%	105.6%	124.8%
20-Year Amortization of UAL (as % of general state revenue)	\$ 31,886,537 0.11%	\$ 20,812,567 0.07%	\$ 8,707,387 0.03%	N/A N/A	N/A N/A

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
1997	10.19%	18.07%	2004	8.95%	10.73%	2011	5.25%	2.18%
1998	9.92%	16.61%	2005	8.56%	6.94%	2012	6.42%	11.79%
1999	15.74%	10.03%	2006	9.17%	11.35%	2013	7.52%	12.19%
2000	12.37%	2.60%	2007	9.04%	8.35%	2014	7.26%	6.19%
2001	9.07%	-1.74%	2008	3.01%	-19.39%	2015	5.87%	0.35%
2002	6.13%	-4.84%	2009	4.88%	14.83%	2016	5.33%	6.22%
2003	8.44%	18.33%	2010	6.01%	11.49%	2017	6.57%	13.46%

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

Table F-3: Estimate of Future Asset Returns

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	566	\$ 68,456,637
2014	566	67,562,225
2015	561	68,245,416
2016	560	70,112,652
2017	562	71,726,921

Graph 2: Retired Members and Survivors of Deceased Members

	Retired and Survivors of Deceased Member Count	Retirement Allowance
2013	584	\$ 35,111,390
2014	610	37,376,920
2015	647	40,036,451
2016	654	40,501,250
2017	682	42,920,238

Graph 3: Market Value of Assets and Asset Returns

	Market Value of Assets	Asset Return
2013	\$ 511,969,020	12.19%
2014	534,452,795	6.19%
2015	520,979,678	0.35%
2016	538,766,550	6.22%
2017	595,683,002	13.46%



Appendix G: Data for Section 2 Graphs

Graph 5: Actuarial Value and Market Value of Assets

	Actuarial Value of Assets	Market Value of Assets
2013	\$ 506,787,899	\$ 511,969,020
2014	534,299,602	534,452,795
2015	550,050,200	520,979,678
2016	564,809,316	538,766,550
2017	586,776,499	595,683,002

Graph 6: Asset Returns

	Actuarial Value Value of Assets	Market Value Asset Return
2013	7.52%	12.19%
2014	7.26%	6.19%
2015	5.87%	0.35%
2016	5.33%	6.22%
2017	6.57%	13.46%

Graph 7: Actuarial Accrued Liability

	Active	Deferred	Retired	Total
2013	\$ 232,783,711	\$ 3,393,117	\$ 313,168,240	\$ 549,345,068
2014	234,280,897	3,507,279	329,042,332	566,830,508
2015	227,098,381	2,403,740	386,097,159	615,599,280
2016	246,147,229	2,404,005	393,976,711	642,527,945
2017	256,903,792	4,174,484	420,816,811	681,895,087



Appendix G: Data for Section 2 Graphs

Graph 8: Actuarial Accrued Liability and Actuarial Value of Assets

	Actuarial Accrued Liability	Actuarial Value of Assets
2013	\$ 549,345,068	\$ 506,787,899
2014	566,830,508	534,299,602
2015	615,599,280	550,050,200
2016	642,527,945	564,809,316
2017	681,895,087	586,776,499

Graph 9: Funded Ratios

	Funded Ratio (Actuarial Basis)	Funded Ratio (Market Value Basis)
2013	92.3%	93.2%
2014	94.3%	94.3%
2015	89.4%	84.6%
2016	87.9%	83.9%
2017	86.1%	87.4%

Graph 10: Actuarially Determined Employer Contribution Rates

Fiscal Year Ending	Normal Rate	Accrued Liability Rate	Total ADEC
2016	17.97%	8.40%	26.37%
2017**	15.70%	13.76%	29.46%
2018	15.95%	15.10%	31.05%
2019	15.83%	16.52%	32.35%
2020*	17.28%	16.32%	33.60%

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

** Includes impact of the experience study