October 26, 2017

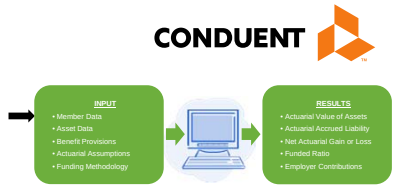
Consolidated Judicial Retirement System
Principal Results of Actuarial Valuation
as of December 31, 2016

Board of Trustees Meeting
David Driscoll and Mike Ribble

Conduent Human Resource Services

Valuation Input

Membership Data



Number as of	12/31/2016	12/31/2015
Active members	560	561
Terminated members and survivors of deceased members entitled to benefits but not yet receiving benefits	42	45
Retired members and survivors of deceased members currently receiving benefits	654	647
Total	1,256	1,253

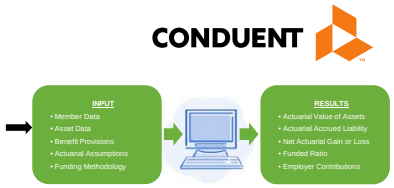
The number of active members has decreased by 0.2% from the previous valuation date. A decrease in active members results in less benefits accruing but also fewer contributions supporting the system.

The number of retired members and survivors of deceased members currently receiving benefits increased by 1.1% 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 of the actuarial report.

Valuation Input

Asset Data: Market Value of Assets



Asset Data as of	12/31/2016	12/31/2015
Beginning of Year Market Value of Assets	$ 520,979,678	$ 534,452,795
Contributions	27,123,101	24,978,524
Benefit Payments	(41,293,727)	(40,305,705)
Investment Income	31,957,498	1,854,064
Net Increase/(Decrease)	17,786,872	(13,473,117)
End of Year Market Value of Assets	$ 538,766,550	$ 520,979,678
Estimated Net Investment Return on Market Value	6.22%	0.35%

The Market Value of Assets is $538.8 million as of December 31, 2016 and was $521.0 million as of December 31, 2015. The investment return for the market value of assets for calendar year 2016 was 6.22%.

The market value of assets is provided in Section 4 of the actuarial report.

Valuation Results

Net Actuarial Gain or Loss: Reconciliation of Unfunded Actuarial Accrued Liability

(in millions)		
Unfunded Actuarial Accrued Liability (UAAL) as of 12/31/2015	$	65.5
Normal Cost during 2016		15.2
Reduction due to Actual Contributions during 2016		(27.1)
Interest on UAAL, Normal Cost, and Contributions		4.9
Asset (Gain)/Loss		10.4
Actuarial Accrued Liability (Gain)/Loss		1.6
Impact of Assumption Changes		3.0
Impact of Legislative Changes		4.2
Unfunded Actuarial Accrued Liability (UAAL) as of 12/31/2016	$	77.7

During 2016, the UAAL increased faster than expected primarily due to asset losses.

The asset loss of $10.4 million means that the asset valuation method resulted in a recognition of $10.4 million of asset losses from 2015 and 2016.

The change in discount rate from 7.25% to 7.20% from the prior valuation increased the unfunded actuarial accrued liability (UAAL), or pension debt, by $3.0 million.

Changes in plan provisions increased the UAAL by $4.2 million.

The accrued liability loss of $1.6 million means that the actuarial accrued liability was $1.6 million higher than expected based on the current assumptions.

The net actuarial gain/(loss) is provided in Section 5 of the actuarial report.

Valuation Results

Actuarially Determined Employer Contribution (ADEC) Rates

Valuation Date	Fiscal Year Ending	Normal Rate*	Accrued Liability Rate	Change due to Legislation**	Final ADEC	Appropriated Rate
12/31/2016	6/30/2019	15.83%	16.52%	N/A	N/A	N/A
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%
12/31/2012	6/30/2015	17.91%	8.64%	0.66%	27.21%	27.21%

* Includes Death Benefit Rate.

** The change due to legislation for the contribution for fiscal year ending 6/30/2017 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 appropriated rate for fiscal year ending 2018 is 31.05% of payroll. The preliminary ADEC for fiscal year ending 2019 is 32.35% of payroll.

Each 1% COLA is equivalent to 0.80% of payroll.

The actuarially determined employer contribution rates are provided in Section 6 of the actuarial report.

Valuation Results

Reconciliation of the Change in Actuarially Determined Employer Contribution

Fiscal year ending June 30, 2018 Preliminary ADEC (based on December 31, 2015 valuation)	30.23%
Impact of Legislative Changes	0.82%
Fiscal year ending June 30, 2018 Final ADEC	31.05%
Change Due to Demographic (Gain)/Loss	(1.35%)
Change Due to Investment (Gain)/Loss	1.95%
Change Due to Contributions Less (Greater) than ADEC	(0.05%)
Impact of Assumption Changes	0.75%
Fiscal year ending June 30, 2019 Preliminary ADEC (based on December 31, 2016 valuation)	32.35%

Demographic gain primarily due to lower reported compensation than assumed.

Investment loss is a recognition of asset losses from 2015 and 2016.

*The change due to legislative changes includes a 0.82% increase in the ADEC due to the 1% COLA effective July 1, 2017

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

Key Takeaways

Key results of the December 31, 2016 valuation were:

- Market value returns of 6.22% compared to 7.25% assumed
- Increase in covered payroll of 2.7% compared to approximately 3% expected
- Recent legislation signed into law since the prior valuation
  - 1.0% cost-of-living adjustment effective July 1, 2017 for retired members and survivors of deceased members receiving benefits as of July 1, 2016 (and a prorated increase for those who retired after July 1, 2016 but before June 30, 2017)
- Change in discount rate from 7.25% to 7.20% as of December 31, 2016

Key Takeaways (continued)

When compared to the December 31, 2015 valuation, the above resulted in:

- A lower funded ratio as of December 31, 2016 (87.9% in the December 31, 2016 valuation compared to 89.4% in the prior valuation)
- Higher actuarially determined employer contribution rate (32.35% for fiscal year ending June 30, 2019 compared to the preliminary contribution of 30.23% calculated in the December 31, 2015 valuation for fiscal year ending June 30, 2018)
- Lower projected benefit amounts being accrued by active members

Certification

The assumptions, methods, and plan provisions used in the results presented in this presentation were provided in October 2017 in the "Report on Actuarial Valuation of the Consolidated Judicial Retirement System of North Carolina of prepared as of December 31, 2016."

The results were prepared under the direction of Michael Ribble and David Driscoll who meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. These results have been prepared in accordance with all applicable Actuarial Standards of Practice, and we are available to answer questions about them.

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.

Michael A. Ribble, FSA, EA, MAAA
Principal, Consulting Actuary

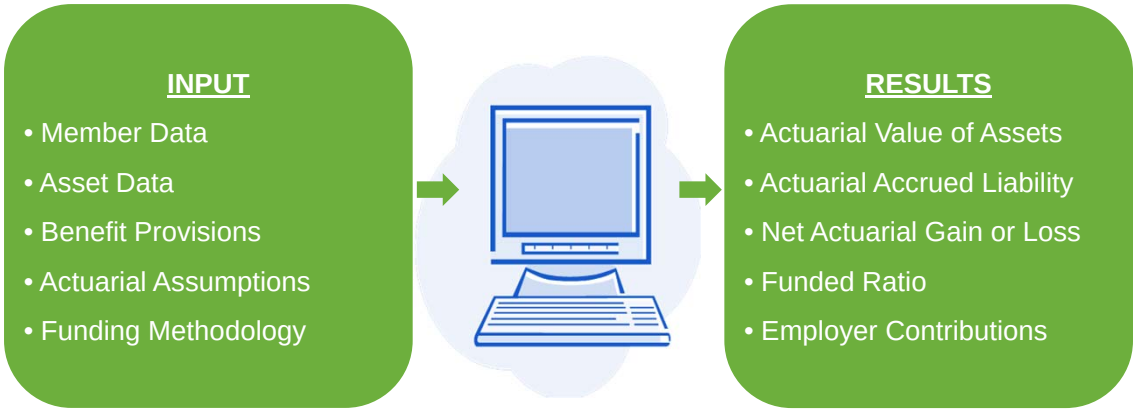
David Driscoll, FSA, EA, MAAA, FCA
Principal, Consulting Actuary

Appendix: Purpose of the Annual Actuarial Valuation

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

Appendix: The Valuation Process

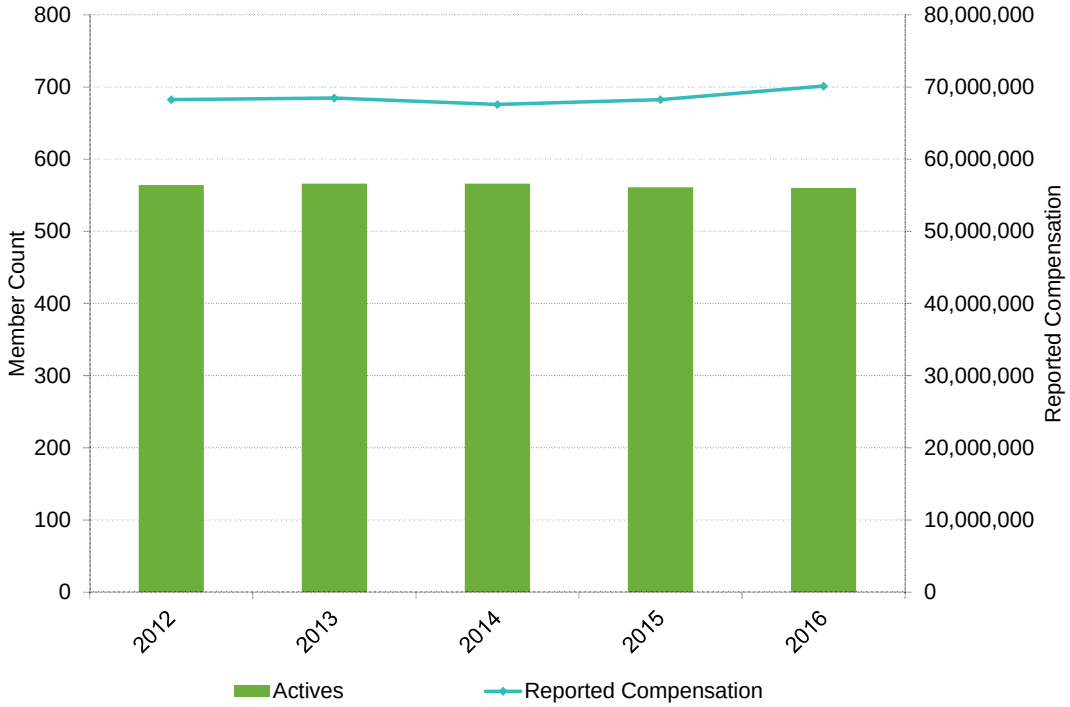
The following diagram summarizes the inputs and results of the actuarial valuation process.

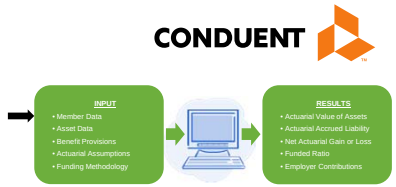


A detailed summary of the valuation process and a glossary of actuarial terms are provided in Appendix A of the actuarial report.

Appendix: Valuation Input

Membership Data: Active Members





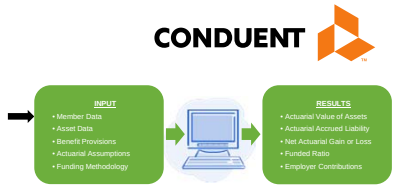
Reported compensation has increased by 2.7% and has remained relatively stable over the past five years. Covered payroll is expected to increase by approximately 3% annually in the future.

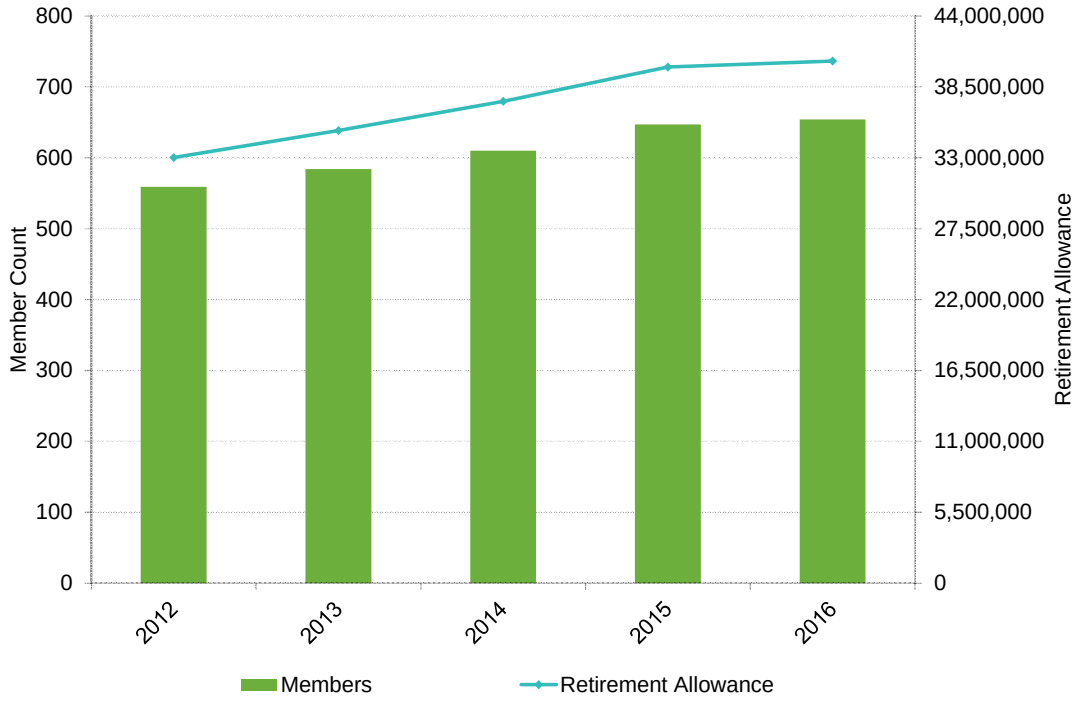
Payroll that is not increasing as fast as assumed results in less benefits accruing but also fewer contributions supporting the system.

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

Appendix: Valuation Input

Membership Data: Retired Members and Survivors of Deceased Members



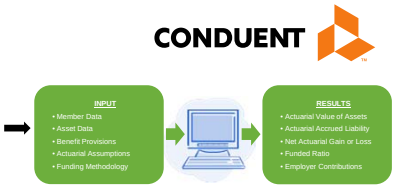


The number of retired members and survivors of deceased members and the benefits paid to these members has been increasing steadily, as expected based on plan assumptions.

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

Appendix: Valuation Input

Asset Data: Market Value of Assets and Asset Returns

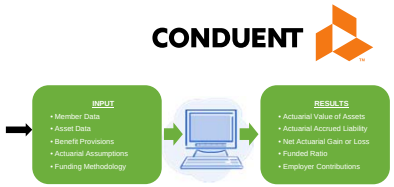


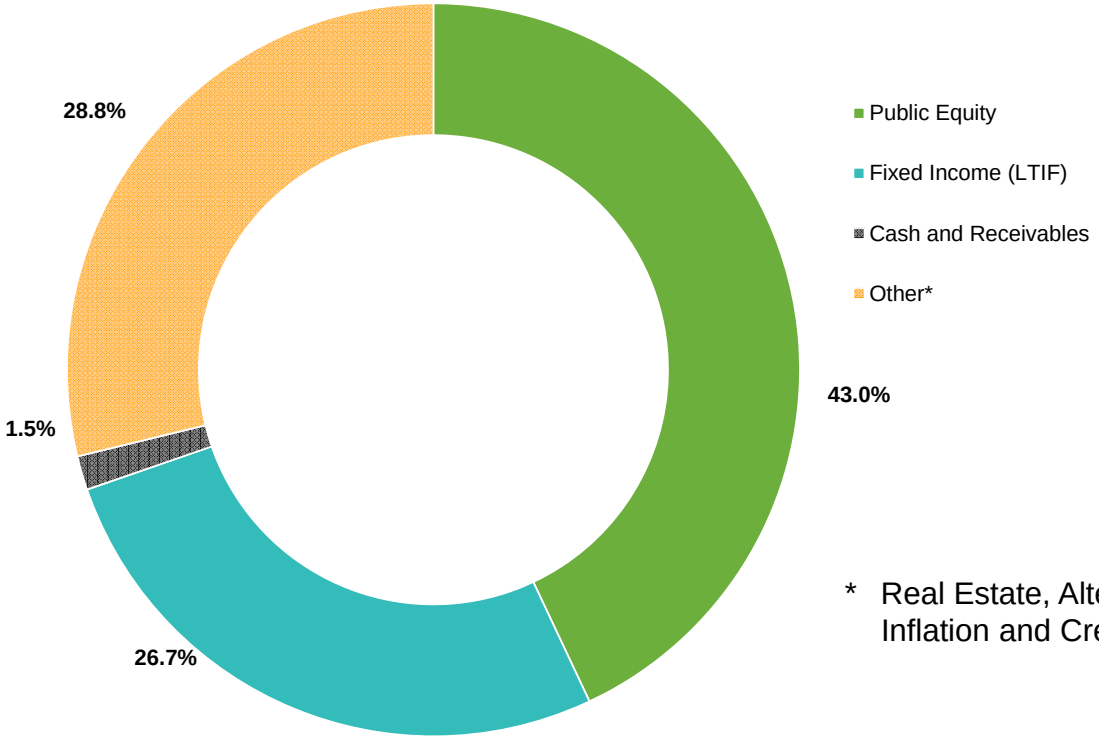
Returns were less than the 7.25% assumed rate of return, resulting in a higher actuarially determined employer contribution than anticipated as of the December 31, 2016 baseline projections presented in the December 31, 2015 actuarial report.

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

Appendix: Valuation Input

Asset Data: Allocation of Investments by Category





* Real Estate, Alternatives, Inflation and Credit

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 7.20% 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 the actuarial report.

Appendix: Valuation Input

Benefit Provisions

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

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

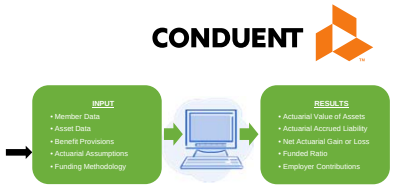
- 1.0% cost-of-living adjustment effective July 1, 2017 for retired members and survivors of deceased members receiving benefits as of July 1, 2016 (and a prorated increase for those who retired after July 1, 2016 but before June 30, 2017)

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 needed 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, the system should review likely impacts of the shift and consider corresponding changes to actuarial assumptions, funding policy and/or benefit levels.

Appendix: Valuation Input

Actuarial Assumptions



- Demographic (future events that relate to people)
  - Retirement
  - Termination
  - Disability
  - Death
- Economic (future events that relate to money)
  - Interest rate – 7.20% per year
  - Salary increase (individual, varies by service)
  - Inflation – 3.00%
  - Real wage growth – 0.50%
- The interest rate was decreased from 7.25% to 7.20% as adopted by the Board of Trustees on April 20, 2017

The assumptions used for the December 31, 2016 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, and a discount rate of 7.20% as adopted by the Board of Trustees on April 20, 2017.

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

Appendix: Valuation Input

Funding Methodology

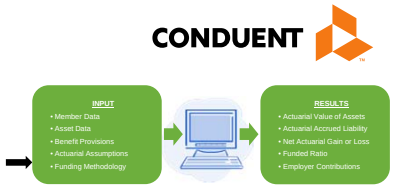
The Funding Methodology is the payment plan for CJRS and is composed of the following three components:

- 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

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

Appendix: Valuation Input

Funding Methodology (continued)



- Amortization Methods determine the payment schedule for unfunded actuarial accrued liability (i.e. the difference between the actuarial accrued liability and actuarial value of assets)
  - Payment level: the payment is determined as a level dollar amount, similar to a mortgage payment
  - Payment period: a 12-year closed amortization period was adopted for fiscal year ending 2012. A new amortization base is created each year based on the prior years' experience.

When compared to other Public Sector Retirement Systems in the United States, the funding policy for TSERS is quite aggressive in that the policy pays down the pension debt over a much shorter period of time (12 years) compared to the national average of around 24 years. 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 the actuarial report.

Appendix: Valuation Results

Actuarial Value of Assets

Asset Data as of	12/31/2016
(a) Beginning of Year Market Value of Assets	$ 520,979,678
(b) Contributions	27,123,101
(c) Benefit Payments	(41,293,727)
(d) Net Cash Flow	(14,170,626)
(e) Expected Investment Return	37,257,341
(f) Expected End of Year Market Value of Assets	544,066,393
(g) End of Year Market Value of Assets	538,766,550
(h) Excess of Market Value over Expected Market Value of Assets	(5,299,843)
(i) 80% of 2016 Asset Gain/(Loss)	(4,239,874)
(j) 60% of 2015 Asset Gain/(Loss)	(21,802,892)
(k) 40% of 2014 Asset Gain/(Loss)	N/A
(l) 20% of 2013 Asset Gain/(Loss)	N/A
(m) Total Deferred Asset Gain/(Loss)	(26,042,766)
(n) Preliminary End of Year Actuarial Value of Assets	564,809,316
(o) Final End of Year Actuarial Value of Assets (not less than 80% and not greater than 120% of Market Value)	564,809,316
(p) Estimated Net Investment Return on Actuarial Value	5.33%

The actuarial value of assets is provided in Section 4 of the actuarial report.

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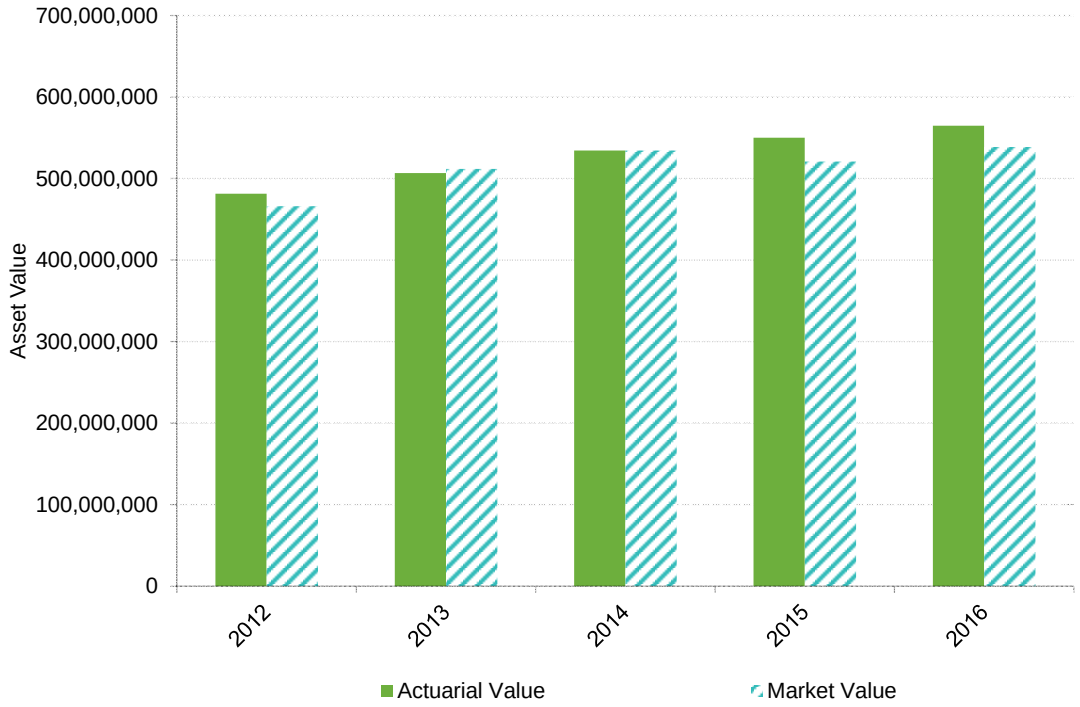
The actuarial value of assets smooths investment gains/losses, resulting in less volatility in the employer contribution.

Lower than expected market returns in 2015 and 2016 resulted in an actuarial value of asset return for calendar year 2016 of 5.33% and a recognized actuarial asset loss of $10.4 million during 2016.

Appendix: Valuation Results

Actuarial Value of Assets: Compared to Market Value



The market value of assets is lower than the actuarial value of assets, which is used to determine employer contributions. This indicates that there are unrecognized asset losses to be recognized in future valuations.

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

Appendix: Valuation Results

Historical Asset Returns

Calendar Year	Actuarial Value of Asset Return	Market Value of Asset Return
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%
Average	6.33%	5.52%
Range	6.16%	34.22%

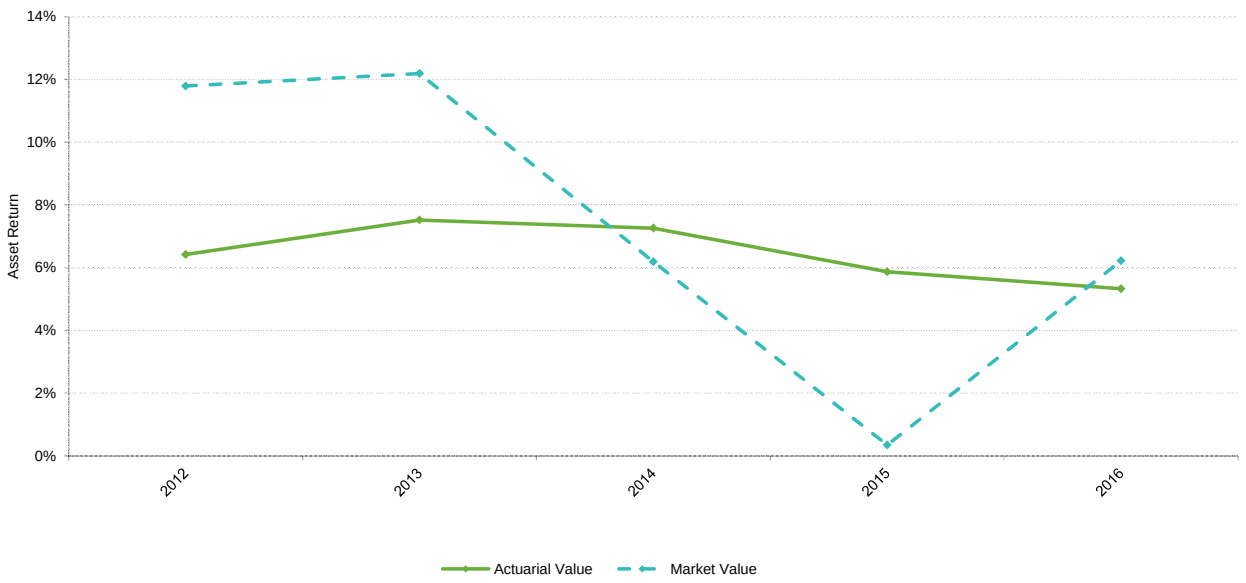
The average investment return recognized for purposes of determining the annual change in contribution each year is the actuarial value of assets return.

Currently, the average actuarial return of 6.33% tracks average market return of 5.52% rather well. But the range of returns is markedly less – 6.16% versus 34.22%. 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.

The valuation assumes that the funds will earn a 7.20% asset return. This table provides a history of the actuarial value and market value of asset returns.

Appendix: Valuation Results

Asset Returns: Actuarial Value and Market Value

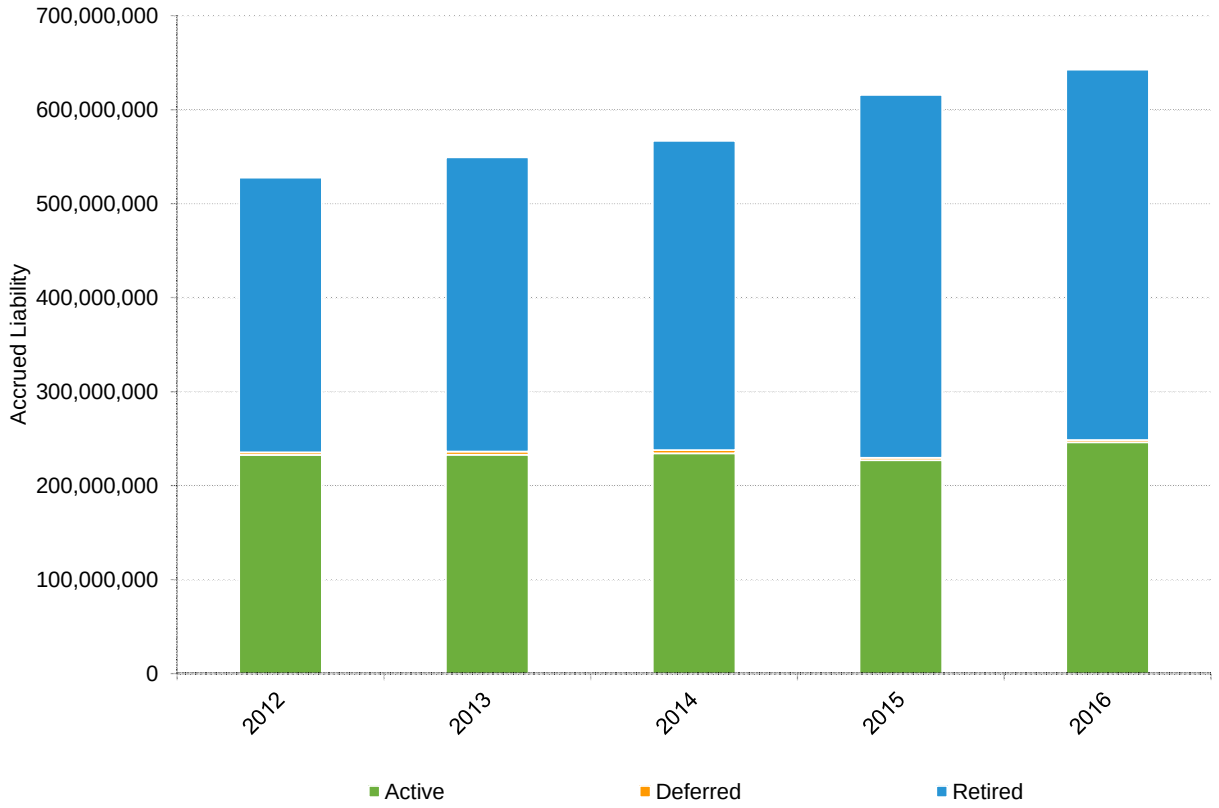


The actuarial value of assets smooths investment gains/losses, resulting in less volatility in the employer contribution.

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

Appendix: Valuation Results

Actuarial Accrued Liability (AAL)



The AAL increased from $616 million to $643 million during 2016. 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.

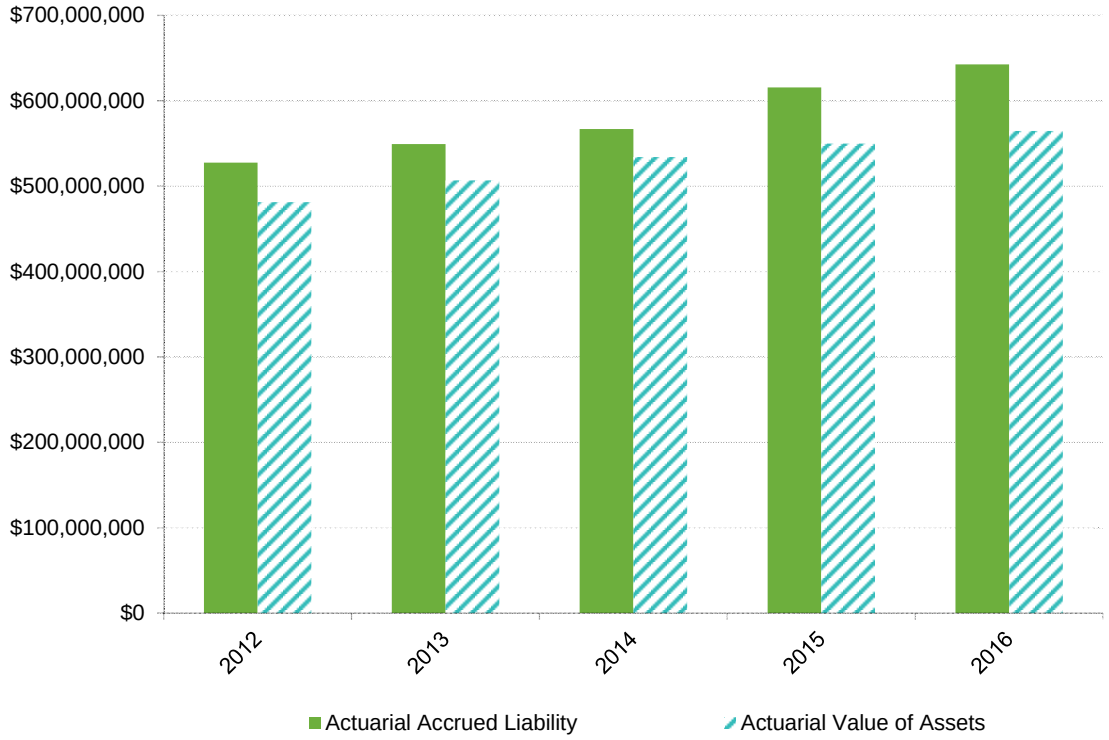
The AAL prior to assumption and legislative changes was $1.6 million higher than expected, which resulted in a demographic loss of $1.6 million during 2016.

Assumption changes increased the AAL by $3.0 million. Legislative changes increased the AAL by $4.2 million.

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

Appendix: Valuation Results

Actuarial Accrued Liability (AAL) and Actuarial Value of Assets (AVA)



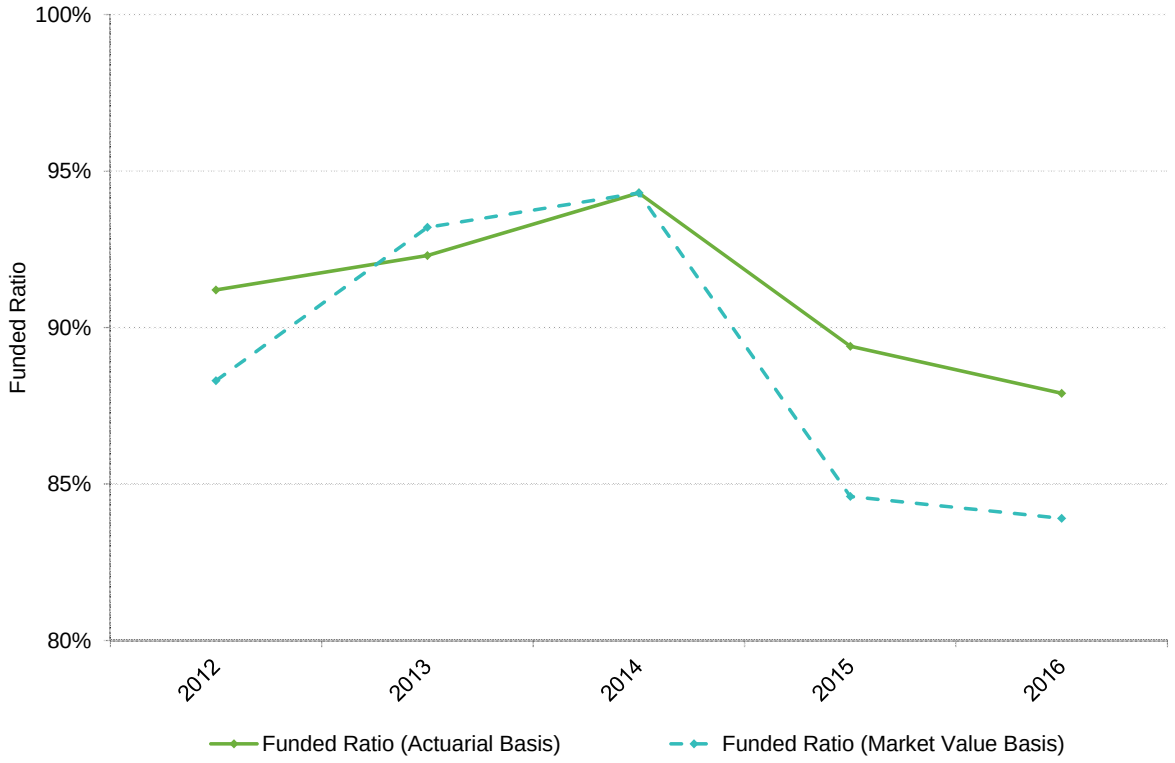
The AVA basis is used for computing contributions to alleviate contribution volatility.

The difference in the AAL and the AVA is the amount of pension debt to be paid off in 12 years.

A detailed summary of the AVA is provided in Section 4 of the actuarial report, and a detailed summary of the AAL is provided in Section 5 of the actuarial report.

Appendix: Valuation Results

Funded Ratio: AAL Divided by AVA

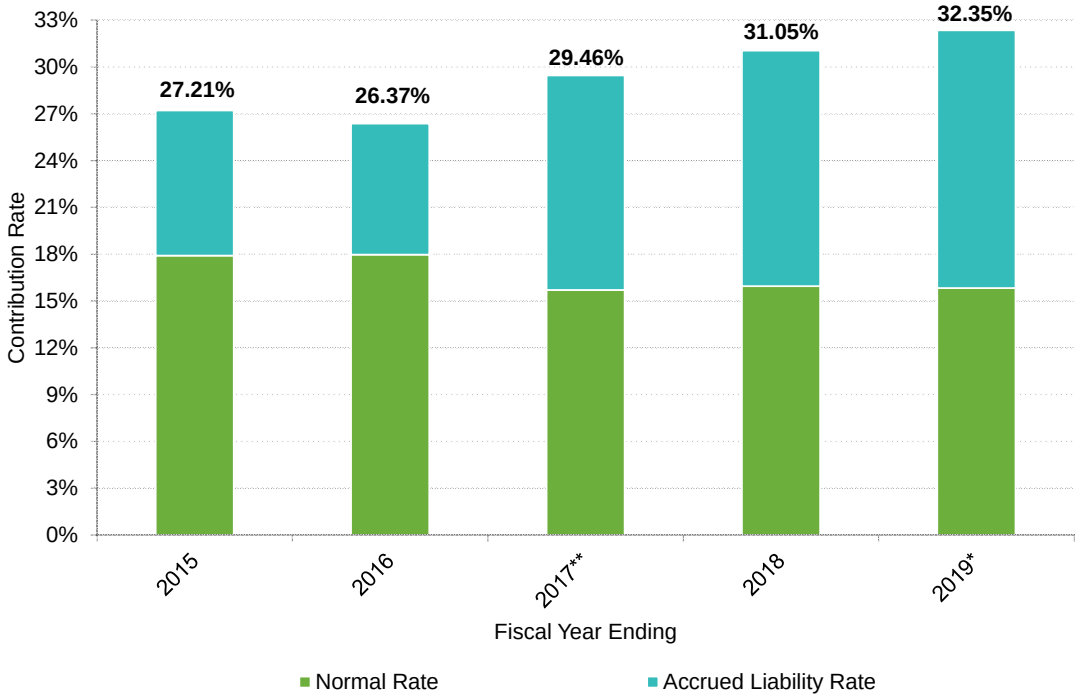


The ratio of assets to liabilities shows the health of the plan on an accrued basis.

The funded ratio on an actuarial basis decreased from 89.4% at December 31, 2015 to 87.9% at December 31, 2016.

Appendix: Valuation Results

Actuarially Determined Employer Contributions



The actuarially determined employer contribution rate is the amount needed to pay for the cost of the benefits accruing and to pay off the pension debt over 12 years, offset for the 6% of pay contribution the members make.

The 12-year period is a short period for Public Sector Retirement Systems in the United States, with most Systems using a period of 25 years or more to pay off the pension debt. The shorter period results in higher contributions and more benefit security.

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

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

Conduent Human Resource Service
Retirement Services

CONDUENT

Consolidated Judicial Retirement System of North Carolina

Report on the Actuarial Valuation Prepared as of December 31, 2016

October 2017

Document Version: 1.0 (November 2016).

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P: 972.366.2011

October 12, 2017

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 actuarial valuation of the Consolidated Judicial Retirement System of North Carolina (referred to as "CJRS" or the "Judicial Plan") prepared as of December 31, 2016. The report has been prepared in accordance with North Carolina General Statute 135-50 through 135-75.

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 Systems Division and Department of State Treasurer Staff may not be appropriate and may result in mistaken conclusions because of failure to understand applicable assumptions, methods, or inapplicability of the report for that purpose. The attached pages should not be provided without a copy of this cover letter. Because of the risk of misinterpretation of actuarial results, you should ask Conduent to review any statement you wish to make on the results contained in this report. Conduent 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 Conduent and we cannot certify as to the accuracy and completeness of the data supplied. 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, 2016 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, and a discount rate of 7.20% as adopted by the Board of Trustees on April 20, 2017. 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 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, Conduent performed no analysis of the potential range of such future differences, except for some limited analysis in financial projections or required disclosure information.

I 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 I am available to answer questions about it.

Respectfully submitted,

Michael A. Ribble, FSA, EA, MAAA

Principal, 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, 2016, the RSD defined benefit plans cover over one million current and prior public servants in the state of North Carolina. During the fiscal year ending June 30, 2017, RSD paid nearly $6.0 billion in pensions to more than 290,000 retirees. And as of June 30, 2017, RSD's assets were valued at almost $94 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 $539 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, 2016, 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, 2016 valuation were:

- Market value returns of 6.22% compared to 7.25% assumed at the beginning of the year
- Increase in covered payroll of 2.7% compared to approximately 3% expected
- Recent legislation signed into law since the prior valuation
  - 1.0% cost-of-living adjustment at July 1, 2017
- Change in discount rate from 7.25% to 7.20% as of December 31, 2016

When compared to the December 31, 2015 valuation, the above resulted in:

- Lower funded ratio (87.9% in the December 31, 2016 valuation compared to 89.4% in the December 31, 2015 valuation)
- Higher actuarially determined employer contribution rate (32.35% for fiscal year ending June 30, 2019 compared to the preliminary contribution of 30.23% calculated in the December 31, 2015 valuation for fiscal year ending June 30, 2018)
- Lower projected benefit amounts being accrued by active members

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 over a 12-year period
- 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, 2016, 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	12/31/2016	12/31/2015
Active Members		
Number	560	561
Reported Compensation	$ 70,112,652	$ 68,245,416
Valuation Compensation*	$ 72,276,199	$ 70,467,331
Retired Members and Survivors of Deceased Members Currently Receiving Benefits		
Number	654	647
Annual Allowances	$ 40,501,250	$ 40,036,451
Assets		
Actuarial Value (AVA)	$ 564,809,316	$ 550,050,200
Market Value	$ 538,766,550	$ 520,979,678
Actuarial Accrued Liability (AAL)	$ 642,527,945	$ 615,599,280
Unfunded Accrued Liability (AAL-AVA)	$ 77,718,629	$ 65,549,080
Funded Ratio (AVA/AAL)**	87.9%	89.4%
Results for Fiscal Year Ending	**6/30/2019**	**6/30/2018**
Actuarially Determined Employer Contribution (ADEC), as a percentage of payroll		
Normal Cost	15.46%	15.58%
Death Benefit	0.37%	0.37%
Accrued Liability	16.52%	14.28%
Total	32.35%	30.23%
Impact of Legislative Changes	N/A	0.82%
Final ADEC	N/A	31.05%
Appropriations Act for Fiscal Year Ending	**6/30/2018**	**6/30/2017**
Employer Contribution Rate as a percentage of payroll		
Normal Cost	15.46%	15.58%
Death Benefit	0.37%	0.37%
Accrued Liability	15.22%	13.51%
Total	31.05%	29.46%
Preliminary Reserve for Undistributed Gains/(Losses)	(1.30)%	(0.77)%

* Reported compensation adjusted to reflect the assumed rate of pay increase prior to the valuation date.

** The Funded Ratio on a Market Value of Assets basis is 83.9% at December 31, 2016.

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)

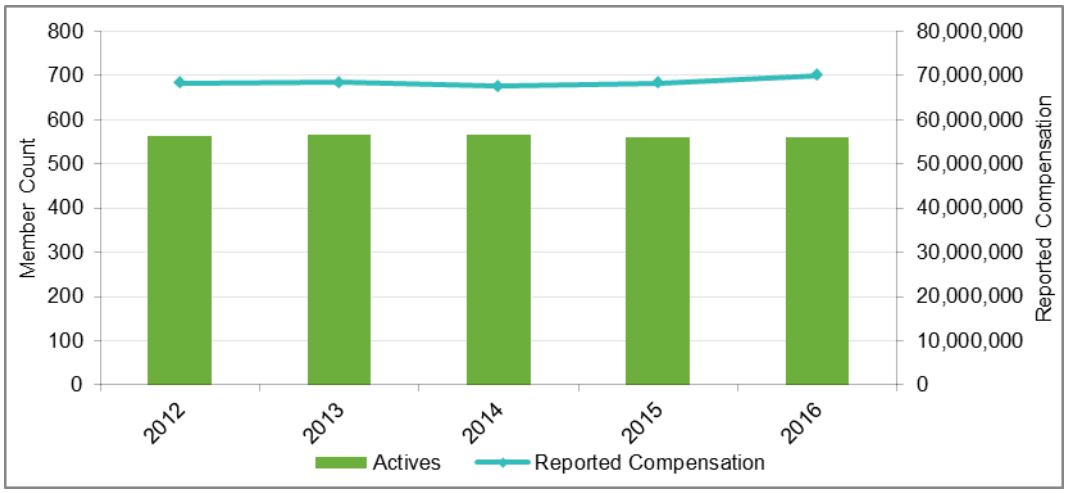
The table below provides a summary of the membership data used in this valuation compared to the prior valuation.

Number as of	12/31/2016	12/31/2015
Active members	560	561
Terminated members and survivors of deceased members entitled to benefits but not yet receiving benefits	42	45
Retired members and survivors of deceased members currently receiving benefits	654	647
Total	1,256	1,253

Commentary: The number of active members has decreased by 0.2% from the previous valuation date. A decrease in active members results in less benefits accruing but also fewer contributions supporting the system. The number of retired members and survivors of deceased members currently receiving benefits increased by 1.1% 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.



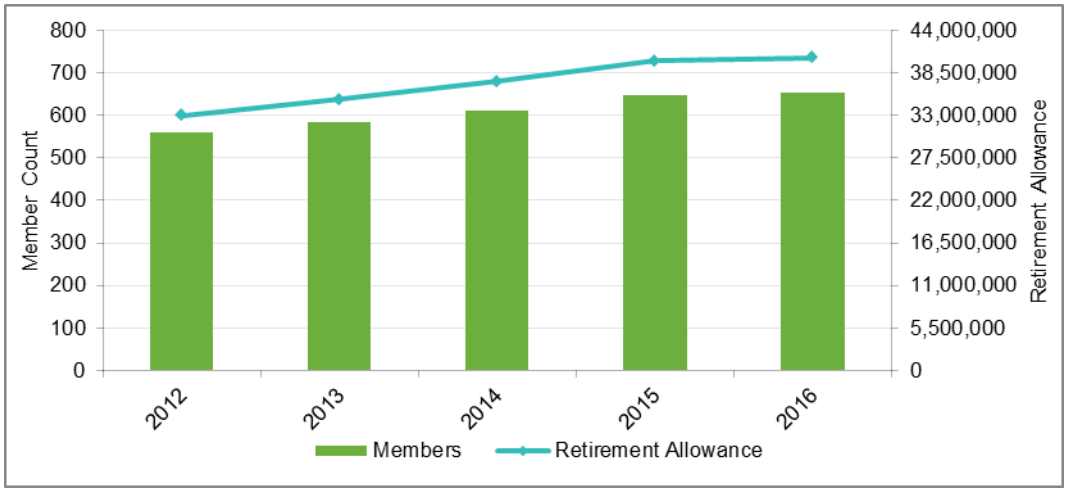
Commentary: Reported compensation has increased by 2.7% and has remained relatively stable over the past five years. Covered payroll is expected to increase by approximately 3% annually in the future. Payroll that is not increasing as fast as assumed results in less benefits accruing but also fewer contributions 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.

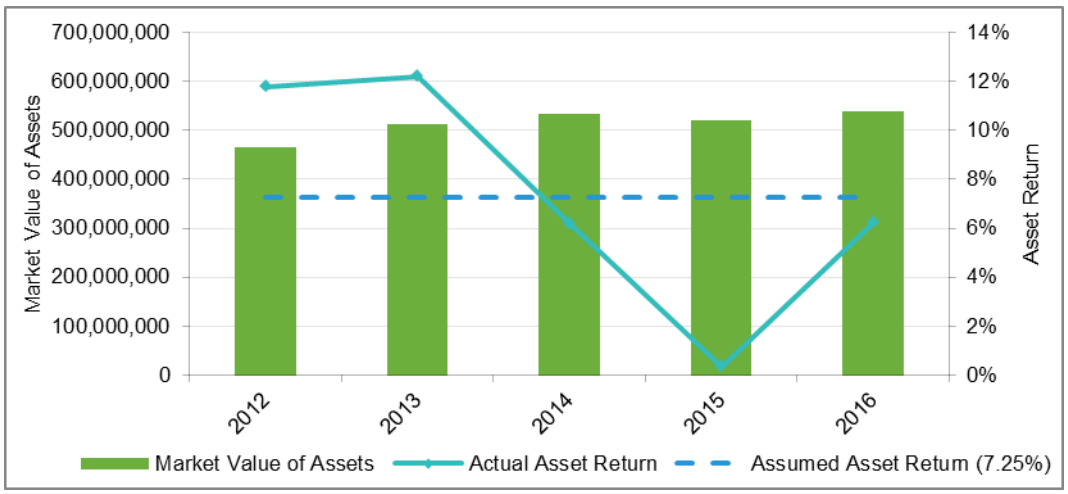
Section 2: The Valuation Process

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 $539 million as of December 31, 2016 and $521 million as of December 31, 2015. The investment return for the market value of assets for calendar year 2016 was 6.22%.

Graph 3: Market Value of Assets and Asset Returns

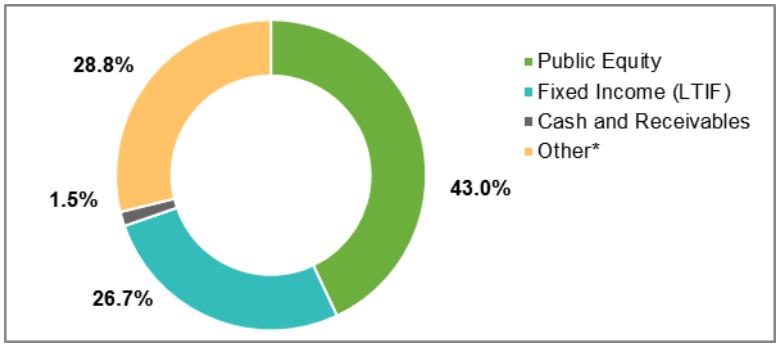
The graph below provides a history of the market value of assets and asset returns over the past five years.



Commentary: Returns were less than the 7.25% assumed rate of return, resulting in higher contributions and lower funded ratio than anticipated, all else being equal.

Graph 4: Allocation of Investments by Category

The graph below provides the breakdown of the market value of assets at December 31, 2016 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 7.20% 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 Statues, Chapter 135.

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

- 1.0% cost-of-living adjustment at July 1, 2017.

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 needed 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, 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.

The assumptions used for the December 31, 2016 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 7.20% as adopted by the Board of Trustees on April 20, 2017.

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 the national average of around 24 years. As such it is a best practice in the industry.

Section 2: The Valuation Process

Valuation Input: Funding Methodology (continued)

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

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 $564.8 million as of December 31, 2016 and $550.1 million as of December 31, 2015.

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.

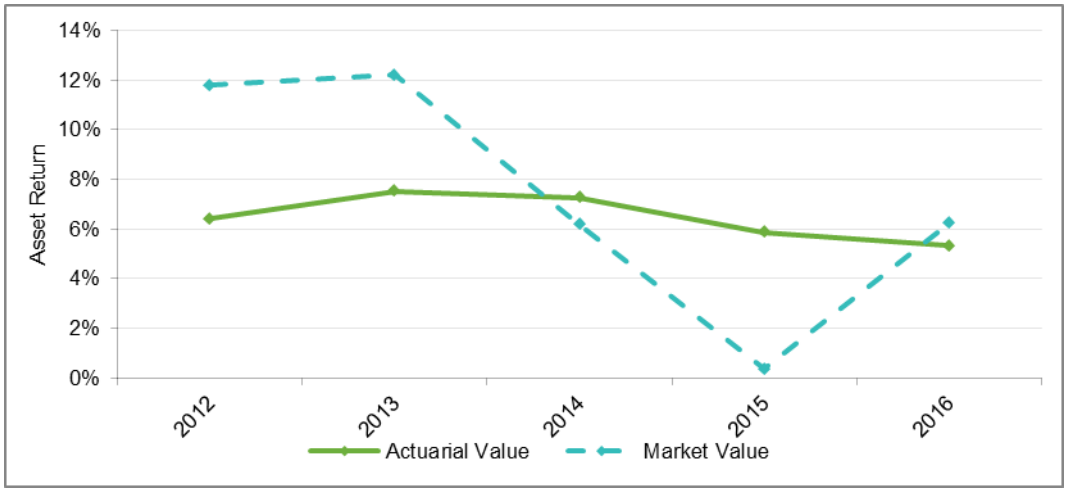
Commentary: The market value of assets is lower than the actuarial value of assets, which is used to determine employer contributions. This indicates that there are unrecognized asset losses to be recognized in future valuations.

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 2016 was 6.22%. The actuarial value of assets smooths investment gains and losses. Lower than expected market returns in 2016 resulted in an actuarial value of asset return for calendar year 2016 of 5.33% and an asset loss of $10.4 million during 2016.

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

Section 2: The Valuation Process

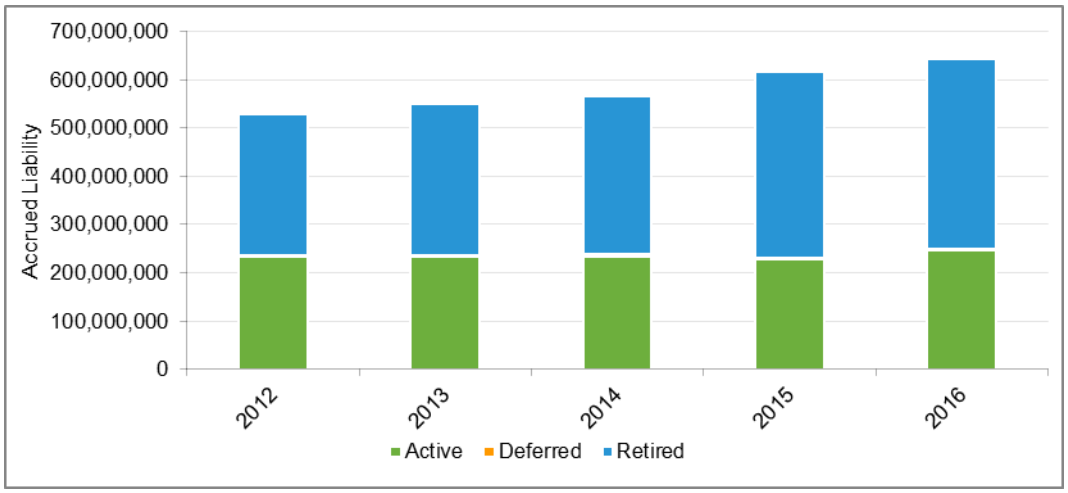
Valuation Results: Actuarial Accrued Liability

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 $616 million to $643 million during 2016. 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. In addition to the expected increase in liabilities, actuarial losses increased the AAL by $1.6 million, assumption changes increased the AAL by $3.0 million, and legislation increased the AAL by $4.2 million.

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

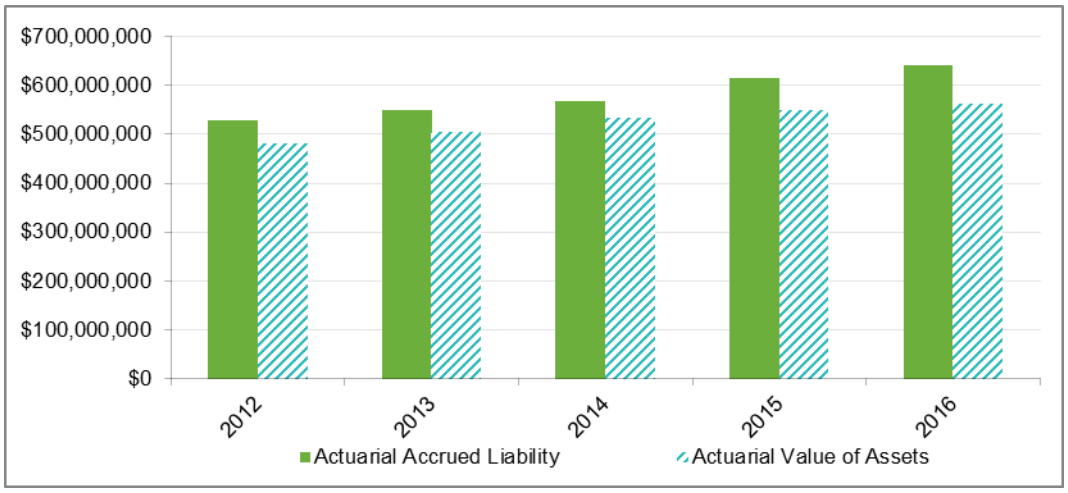
Section 2: The Valuation Process

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.



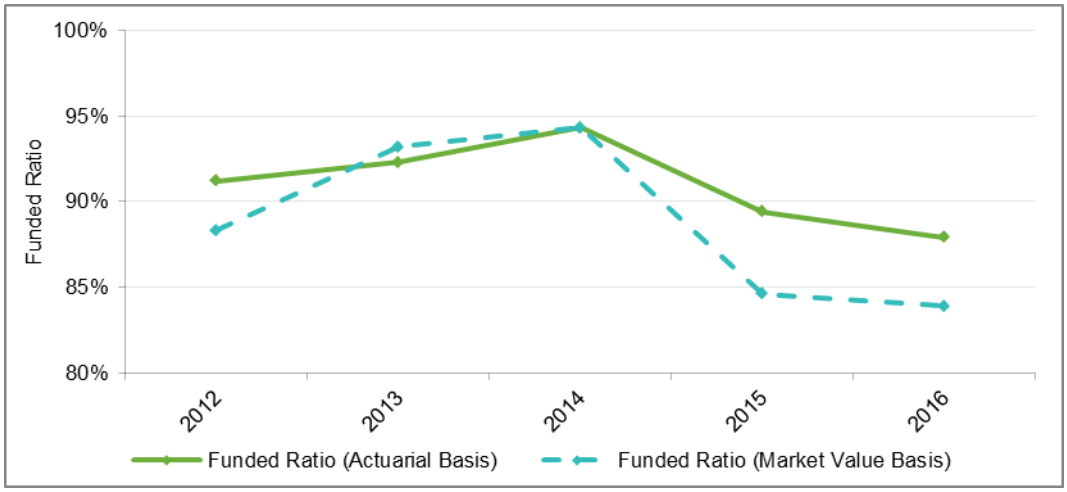
Commentary: The actuarial value of assets basis is used for computing contributions to alleviate contribution volatility. The difference in the actuarial accrued liability and the actuarial value of assets is the amount of pension debt to be paid off in 12 years.

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 89.4% at December 31, 2015 to 87.9% at December 31, 2016.

Section 2: The Valuation Process

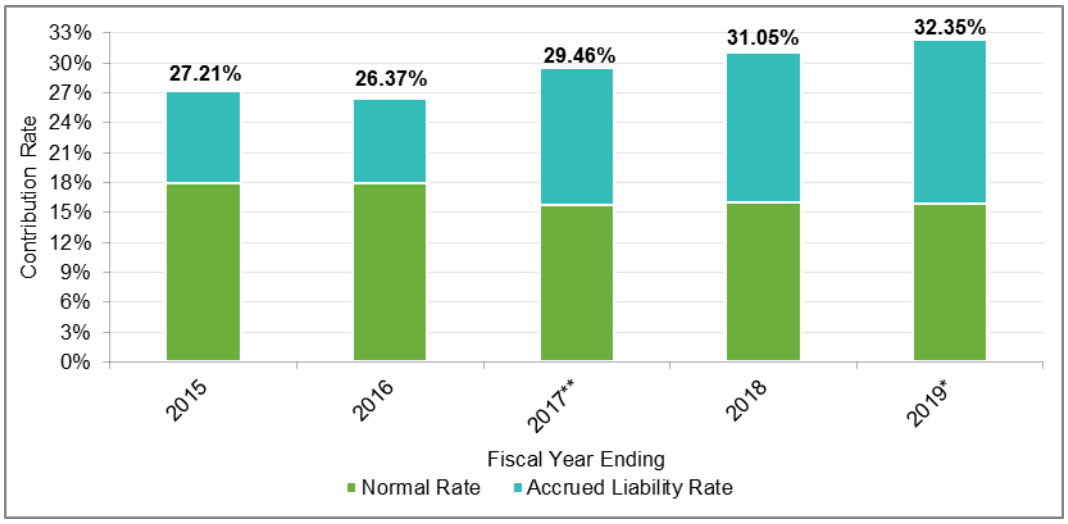
Valuation Results: Employer Contributions

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, 2015 valuation suggested that the preliminary total employer contribution rate be set at 30.23% of payroll for the fiscal year ending June 30, 2018. Subsequently, the 2017 Appropriations Act (Session Laws 2017-57) set contributions at 31.05% of payroll effective for the fiscal year ending June 30, 2018, in order to account for recent legislation passed into law. As a result of this December 31, 2016 valuation, the preliminary actuarially determined employer contribution rate is 32.35% of payroll for the fiscal year ending June 30, 2019, 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 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 most Systems using a period of 25 years or more to pay off the pension debt. 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, 2017, is $82,727,000 (compared to $95,402,000 for fiscal year ending June 30, 2016). 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
Justices of Supreme Court and Judges of Court of Appeals	23	58.85	12.31	$ 3,515,779
Judges of the Superior Court and Administrative Officers of the Court	105	59.01	15.77	15,055,069
Judges of the District Court, District Attorneys, Clerks of the Superior Court, and Public Defenders	432	54.05	13.15	51,541,804
Total	560	55.18	13.61	$ 70,112,652

The table above includes members not in receipt of benefits who had reported compensation in 2016.

Section 3: Membership Data

Table 3: Terminated Vested Member Data

	Member Count	Average Age	Average Service	Accumulated Contributions	Final Reported Compensation
Justices of Supreme Court and Judges of Court of Appeals	1	60.08	1.75	$ 17,888	$ 129,771
Judges of the Superior Superior Court and Administrative Officers of the Court	3	47.45	4.69	136,744	366,559
Judges of the District Court, District Attorneys, Clerks of the Superior Court, and Public Defenders	38	54.15	4.03	1,377,516	3,212,520
Total	42	53.81	4.02	$ 1,532,148	$ 3,708,850

The table above includes members not in receipt of benefits who did not have reported compensation in 2016.

Section 3: Membership Data

Table 4: Data for Members Currently Receiving Benefits

	Member Count	Average Age	Annual Retirement Allowances
Retired Members (Healthy at Retirement)			
Male	369	72.15	$ 26,962,357
Female	137	69.50	8,045,536
Total	506	71.43	$ 35,007,893
Retired Members (Disabled at Retirement)*			
Male	1	59.75	$ 69,006
Female	2	72.46	83,437
Total	3	68.22	$ 152,443
Survivors of Deceased Members			
Male	13	75.24	$ 405,436
Female	132	76.85	4,935,478
Total	145	76.71	$ 5,340,914
Grand Total	654	72.59	$ 40,501,250

* 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	12/31/2016	12/31/2015
Beginning of Year Market Value of Assets	$ 520,979,678	$ 534,452,795
Contributions	27,123,101	24,978,524
Benefit Payments	(41,293,727)	(40,305,705)
Investment Income	31,957,498	1,854,064
Net Increase/(Decrease)	17,786,872	(13,473,117)
End of Year Market Value of Assets	$ 538,766,550	$ 520,979,678
Estimated Net Investment Return on Market Value	6.22%	0.35%

Table 6: Allocation of Investments by Category of the Market Value of Assets

Asset Data as of	12/31/2016	12/31/2015
Allocation by Dollar Amount		
Public Equity	$ 231,721,761	$ 221,173,042
Fixed Income (LTIF)	144,112,590	146,531,256
Cash and Receivables	7,817,953	10,729,615
Other*	155,114,246	142,545,765
Total Market Value of Assets	$ 538,766,550	$ 520,979,678
Allocation by Percentage of Asset Value		
Public Equity	43.0%	42.5%
Fixed Income (LTIF)	26.7%	28.1%
Cash and Receivables	1.5%	2.1%
Other*	28.8%	27.3%
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	12/31/2016
(a) Beginning of Year Market Value of Assets	$ 520,979,678
(b) Contributions	27,123,101
(c) Benefit Payments	(41,293,727)
(d) Net Cash Flow	(14,170,626)
(e) Expected Investment Return	37,257,341
(f) Expected End of Year Market Value of Assets	544,066,393
(g) End of Year Market Value of Assets	538,766,550
(h) Excess of Market Value over Expected Market Value of Assets	(5,299,843)
(i) 80% of 2016 Asset Gain/(Loss)	(4,239,874)
(j) 60% of 2015 Asset Gain/(Loss)	(21,802,892)
(k) 40% of 2014 Asset Gain/(Loss)	N/A
(l) 20% of 2013 Asset Gain/(Loss)	N/A
(m) Total Deferred Asset Gain/(Loss)	(26,042,766)
(n) Preliminary End of Year Actuarial Value of Assets	564,809,316
(o) Final End of Year Actuarial Value of Assets (not less than 80% and not greater than 120% of Market Value)	564,809,316
(p) Estimated Net Investment Return on Actuarial Value	5.33%

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 resulted in an actuarial value of asset return for calendar year 2016 of 5.33% and a recognized actuarial asset loss of $10.4 million during 2016.

Section 4: Asset Data

The valuation assumes that the funds will earn a 7.20% 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
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%
Average	6.33%	5.52%
Range	6.16%	34.22%

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 6.33% tracks average market return of 5.52% relatively well. But the range of returns is markedly less – 6.16% versus 34.22%. 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	12/31/2016	12/31/2015
(a) Present Value of Future Benefits		
(1) Active Members	$ 382,399,050	$ 364,256,139
(2) Terminated Members	2,404,005	2,403,740
(3) Members Currently Receiving Benefits	393,976,711	386,097,159
(4) Total	$ 778,779,766	$ 752,757,038
(b) Present Value of Future Normal Costs	$ 136,251,821	$ 137,157,758
(c) Actuarial Accrued Liability: (a4) - (b)	$ 642,527,945	$ 615,599,280
(d) Actuarial Value of Assets	$ 564,809,316	$ 550,050,200
(e) Unfunded Accrued Liability: (c) - (d)	$ 77,718,629	$ 65,549,080

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 12/31/2015	$ 65.5
Normal Cost during 2016	15.2
Reduction due to Actual Contributions during 2016	(27.1)
Interest on UAAL, Normal Cost, and Contributions	4.9
Asset (Gain)/Loss	10.4
Actuarial Accrued Liability (Gain)/Loss	1.6
Impact of Assumption Changes	3.0
Impact of Legislative Changes	4.2
Unfunded Actuarial Accrued Liability (UAAL) as of 12/31/2016	$ 77.7

Commentary: During 2016, the unfunded actuarial accrued liability (UAAL), or pension debt, increased more than expected. Actuarial losses increased the UAAL by $12.0 million. The change in assumptions reflects the change in interest rate from 7.25% to 7.20% and increased the UAAL by $3.0 million. Changes in plan provisions increased the UAAL by $4.2 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 death benefit normal rate is the rate necessary to provide the one year's compensation upon death in active service. This rate is calculated to provide the death benefit on a one-year term basis and is payable to the Death Benefit Fund. 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 ADEC for Fiscal Year Ending	12/31/2016 6/30/2019	12/31/2015 6/30/2018
Normal Cost Rate Calculation		
(a) Normal Cost*	$ 15,507,768	$ 15,205,707
(b) Valuation Compenation	72,276,199	70,467,331
(c) Normal Cost Rate: (a) / (b)	21.46%	21.58%
(d) Employee Contribution Rate	6.00%	6.00%
(e) Total Normal Cost Rate: (c) - (d)	15.46%	15.58%
Death Benefit Rate Calculation		
(f) Death Benefit Normal Cost	$ 266,574	$ 257,894
(g) Valuation Compenation	72,276,199	70,467,331
(h) Death Benefit Rate: (f) / (g)	0.37%	0.37%
Accrued Liability Rate Calculation		
(i) Total Annual Amortization Payments**	$ 11,936,737	$ 10,064,594
(j) Valuation Compensation	72,276,199	70,467,331
(k) Accrued Liability Rate: (i) / (j)	16.52%	14.28%
Total ADEC (e) + (h) + (k)	32.35%	30.23%
Impact of Legislative Changes	N/A	0.82%
Final ADEC	N/A	31.05%

* Includes assumed administrative expenses.
** See Table 14 for more detail.

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, 2018 Preliminary ADEC (based on December 31, 2015 valuation)	30.23%
Impact of Legislative Changes	0.82%
Fiscal year ending June 30, 2018 Final ADEC	31.05%
Change Due to Demographic (Gain)/Loss	(1.35%)
Change Due to Investment (Gain)/Loss	1.95%
Change Due to Contributions Less (Greater) than ADEC	(0.05%)
Impact of Assumption Changes	0.75%
Fiscal year ending June 30, 2019 Preliminary ADEC (based on December 31, 2016 valuation)	32.35%

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	12/31/2016	12/31/2015
(a) Unfunded Actuarial Accrued Liability*	$ 77,718,629	$ 64,895,030
(b) Prior Years' Outstanding Balances	$ 63,849,747	$ 28,623,826
(c) New Amortization Base: (a) - (b)	$ 13,868,882	$ 36,271,204
(d) New Amortization Payment	$ 1,891,817	$ 4,963,089

* The unfunded actuarial accrued liability at December 31, 2015 does not reflect the cost of the one-time pension supplement to be paid on or before October 31, 2016, as the entire cost of this supplement was funded in the appropriated contribution for fiscal year ending June 30, 2017.

Table 14: Amortization Schedule for Unfunded Accrued Liability

Date Established	Original Balance	12/31/2016 Outstanding Balance	Annual Payment
December 31, 2009	$ 34,962,037	$ 24,978,328	$ 4,777,240
December 31, 2010	3,913,729	3,124,225	534,671
December 31, 2011	10,017,079	8,779,341	1,368,213
December 31, 2012	(4,239,030)	(4,024,188)	(578,894)
December 31, 2013	(892,665)	(908,082)	(121,883)
December 31, 2014	(6,478,378)	(7,000,743)	(884,392)
December 31, 2015	36,271,204	38,900,866	4,949,965
December 31, 2016	13,868,882	13,868,882	1,891,817
Total		$ 77,718,629	$ 11,936,737

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**	Final ADEC	Appropriated Rate
12/31/2016	6/30/2019	15.83%	16.52%	N/A	N/A	N/A
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%
12/31/2012	6/30/2015	17.91%	8.64%	0.66%	27.21%	27.21%

* Includes Death Benefit rate

** The change due to legislation for the contribution for fiscal year ending 6/30/2017 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.

Table 16: Cost of Benefit Enhancements

Calculation as of	12/31/2016	12/31/2015
Increase in ADEC for a 1% COLA*	0.80%	0.82%

* The 1% COLA calculated at the December 31, 2016 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	12/31/2016	12/31/2015
Assets		
Current Actuarial Value of Assets		
Annuity Savings Fund	$ 63,578,490	$ 59,036,814
Pension Accumulation Fund	501,230,826	491,013,386
Total	$ 564,809,316	$ 550,050,200
Future Member Contributions to the Annuity Savings Fund	$ 36,791,245	$ 37,344,879
Prospective Contributions to the Pension Accumulation Fund		
Normal Contributions	$ 99,460,576	$ 100,466,929
Unfunded Accrued Liability Contributions	77,718,629	64,895,030
Undistributed Gain Contributions	(6,096,134)	(3,510,580)
Total	$ 171,083,071	$ 161,851,379
Total Assets	$ 772,683,632	$ 749,246,458
Liabilities		
Annuity Savings Fund		
Past Member Contributions	$ 63,578,490	$ 59,036,814
Future Member Contributions	36,791,245	37,344,879
Total Contributions	$ 100,369,735	$ 96,381,693
Pension Accumulation Fund		
Benefits Currently in Payment	$ 389,775,797	$ 385,443,109
Benefits to be Paid to Current Active Members	284,433,320	270,278,186
Reserve for Increases in Retirement Allowances effective July 1, 2017 (July 1, 2016 for December 31, 2015)	4,200,914	654,050
Reserve for Undistributed Gains/(Losses)	(6,096,134)	(3,510,580)
Total Benefits Payable	$ 672,313,897	$ 652,864,765
Total Liabilities	$ 772,683,632	$ 749,246,458

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, 2017 based on a valuation date of December 31, 2016.

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

The June 30, 2017 total pension liability presented in this section was determined by an actuarial valuation as of December 31, 2016, 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, 2016

Group	Number
Retired members and survivors of deceased members currently receiving benefits	654
Terminated members and survivors of deceased members entitled to benefits but not yet receiving benefits	42
Active members	560
Total	1,256

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)

Calculation as of	June 30, 2017
Total Pension Liability	
Service Cost	$ 15,630,000
Interest	44,837,000
Changes of Benefit Terms	4,349,000
Difference between Expected and Actual Experience	2,193,000
Change of Assumptions	3,032,000
Benefit Payments, including Refund of Member Contributions	(42,053,000)
Net Change in Total Pension Liability	$ 27,988,000
Total Pension Liability - Beginning of Year	$ 623,842,000
Total Pension Liability - End of Year	$ 651,830,000
Plan Fiduciary Net Position	
Employer Contributions	$ 19,592,000
Member Contributions	7,399,000
Net Investment Income	55,762,000
Benefit Payments, including Refund of Member Contributions	(42,053,000)
Administrative Expenses	(37,000)
Other	0
Net Change in Fiduciary Net Position	$ 40,663,000
Plan Fiduciary Net Position - Beginning of Year	$ 528,440,000
Plan Fiduciary Net Position - End of Year	$ 569,103,000

Table 20: Net Pension Liability (Asset)

Calculation as of	June 30, 2017	June 30, 2016
Total Pension Liability	$ 651,830,000	$ 623,842,000
Plan Fiduciary Net Position	569,103,000	528,440,000
Net Pension Liability (Asset)	$ 82,727,000	$ 95,402,000
Plan Fiduciary Net Position as a Percentage of the Total Pension Liability	87.31%	84.71%

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, 2017 to Changes in the Discount Rate

	1% Decrease	Current	1% Increase
Discount Rate	6.20%	7.20%	8.20%
Net Pension Liability (Asset)	149,016,000	82,727,000	25,987,000

The discount rate used to measure the total pension liability was 7.20%. The projection of cash flows used to determine the discount rate assumed that System contributions will continue to follow the current funding policy. 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	12/31/2016
Actuarial Cost Method	Entry Age
Amortization Method	Level dollar closed
Amortization Period	12 years
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*	7.20%
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 (the "State Plan") 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 further "the normal rate of contribution shall be determined by the actuary after each valuation."

The Actuarial Valuation Process

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

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

Appendix A: Valuation Process and Glossary of Actuarial Terms

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

Appendix A: Valuation Process and Glossary of Actuarial Terms

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 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.

Appendix A: Valuation Process and Glossary of Actuarial Terms

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 of UAAL results in North Carolina being home to many of the best funded Public Retirement Systems in the United States.

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. For the aggressive North Carolina contribution policy to be effective, the amounts that Conduent calculates need to be contributed. With very limited exception, North Carolina has contributed the amounts that Conduent has calculated, which has resulted in the North Carolina Retirements Systems being 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 7.20% 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

Appendix A: Valuation Process and Glossary of Actuarial Terms

changing the funding policy to occur. Contribution surprises are a primary contributor to employers considering pension reform. It is important to keep the employer apprised of future contribution requirements. A projection of funded ratio can serve the Trustees by illustrating the trend of the funded ratio over time. The funded ratio, under a prudent funding policy, should trend to 100% over a period of less than 30 years. (It is worthwhile to note that while 30 years has served as an industry standard for the longest period over which 100% funding should be achieved, that period is coming under scrutiny by the actuarial community and will likely be shortened.) If a projection of funded ratio does not trend to 100% over time, consideration should be given to fixing the funding policy to achieve this goal. For the North Carolina Retirement Systems, projections are generally performed for the January Board meetings. While the projection period has tended to be limited to five years, a longer projection would show the funded ratio trend to 100% much faster than other Public Retirement Systems.

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

Finally, the valuation report and/or presentation should contain sufficient information in an understandable fashion to allow the Board to take action and adopt the contribution rate for the upcoming year. It should also allow stakeholders to understand key observations over the past year that resulted in contributions increasing (or decreasing) and where contributions are headed. The actuary is always open to making the results understandable. Conduent works with the North Carolina Retirement 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.*

Appendix A: Valuation Process and Glossary of Actuarial Terms

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 – Amortization Period Length – Generally amortization periods of up to 15 to 20 years (and certainly not longer than 25) 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 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.

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. Note that in practice, this number is rarely discussed.*

Appendix A: Valuation Process and Glossary of Actuarial Terms

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, 2016

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	5	0	0	0	0	0	0	0	0	6
	6,189	114,197	0	0	0	0	0	0	0	0	96,196
35 to 39	0	12	5	0	0	0	0	0	0	0	17
	0	118,759	119,681	0	0	0	0	0	0	0	119,030
40 to 44	1	15	15	5	0	0	0	0	0	0	36
	8,842	108,849	122,244	124,184	0	0	0	0	0	0	113,782
45 to 49	1	34	19	29	8	7	3	0	0	0	101
	7,533	115,405	117,678	123,925	134,750	130,828	91,921	0	0	0	119,115
50 to 54	1	22	23	12	22	12	10	2	0	0	104
	8,055	120,224	125,369	123,065	134,586	137,324	128,143	101,041	0	0	126,015
55 to 59	0	24	12	19	10	16	9	8	2	0	100
	0	108,945	120,918	124,694	124,339	137,919	144,383	115,114	98,715	0	123,028
60 to 64	0	17	15	10	15	20	11	3	10	3	104
	0	113,946	129,153	135,499	132,396	137,100	140,894	150,308	125,340	101,585	129,964
65 to 69	0	2	9	18	7	16	2	8	4	3	69
	0	125,312	124,904	127,080	138,200	153,842	155,821	144,013	133,846	101,477	136,154
70 & Up	0	1	5	4	5	2	0	0	2	4	23
	0	129,730	121,092	125,307	144,229	138,238	0	0	165,450	125,296	133,310
Total	4	132	103	97	67	73	35	21	18	10	560
	7,655	114,619	123,003	125,818	133,683	140,416	134,803	129,811	128,729	111,037	125,201

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, 2016

	Men		Women	
Age	Number	Compensation	Number	Compensation
30	1	$ 6,189		
32	1	114,197	1	114,197
33	1	114,197		
34	1	114,197	1	114,197
35	1	130,452		
36	3	342,591		
37	2	239,362		
38	3	353,559	2	250,625
39	3	358,846	3	348,075
40	4	382,256	2	228,394
41	3	320,167	4	497,539
42	5	592,525	2	200,486
43			4	493,063
44	7	783,315	5	598,405
45	14	1,633,733	4	510,758
46	12	1,373,397	11	1,307,487
47	9	1,123,751	8	948,114
48	12	1,425,101	12	1,432,255
49	12	1,440,164	7	835,794
50	11	1,489,972	9	1,164,687
51	16	2,103,528	11	1,288,437
52	9	1,151,722	10	1,166,219
53	6	749,039	9	1,045,013
54	12	1,624,280	11	1,322,633
55	9	1,148,494	11	1,377,285
56	13	1,661,663	9	1,111,051
57	14	1,777,990	9	992,424
58	10	1,229,460	7	735,489
59	13	1,722,662	5	546,248
60	16	2,258,844	9	972,904
61	14	1,785,936	6	782,414
62	16	2,144,545	5	627,981
63	11	1,458,932	4	466,362
64	19	2,562,453	4	455,855
65	13	1,711,871	2	318,277

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, 2016 (continued)

	Men		Women	
Age	Number	Compensation	Number	Compensation
66	11	$ 1,537,013	1	$ 149,735
67	13	1,710,738	3	394,492
68	11	1,570,682	4	518,015
69	9	1,192,163	2	291,632
70	8	1,113,349		
71	7	1,008,248	1	107,001
72	5	640,090		
78	1	90,435		
86			1	107,001
Total	361	$ 46,292,108	199	$ 23,820,544

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, 2016

	Men		Women	
Service	Number	Compensation	Number	Compensation
0	3	$ 22,564	1	$ 8,055
1	13	1,390,221	2	$ 186,089
2	40	4,732,887	20	2,248,345
3	14	1,663,935	5	531,741
4	20	2,373,924	18	2,002,488
5	3	389,230	3	346,492
6	22	2,779,171	16	1,903,030
7	7	917,535	5	593,186
8	15	1,915,958	15	1,763,586
9	11	1,339,707	6	721,441
10	25	3,061,653	9	1,075,611
11	10	1,321,915	2	274,894
12	17	2,172,150	9	1,204,311
13	2	214,256	2	219,734
14	12	1,586,293	9	1,073,543
15	4	574,613	3	368,393
16	17	2,293,412	9	1,230,737
17	8	1,084,934	1	134,876
18	11	1,414,554	4	540,069
19	5	672,924	5	642,253
20	10	1,345,441	7	913,335
21	4	550,287	5	697,744
22	21	2,932,292	2	322,446
23	9	1,375,148	5	607,182
24	6	902,210	4	604,243
25	1	142,397	3	339,443
26	9	1,378,462	2	259,641
27	5	582,828	2	255,802
28	9	1,319,754	4	439,778
30	5	647,705	1	119,681
31	2	257,331	2	221,396
32	4	618,703	4	406,532
33	1	165,450		
34	1	154,350	1	134,876
35	2	201,576	3	367,286

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, 2016 (continued)

	Men		Women	
Service	Number	Compensation	Number	Compensation
36	2	$ 319,800	2	$ 226,682
37	5	746,822	2	206,023
38			1	94,575
39	1	154,350		
40	1	102,855		
41	1	90,753	3	321,003
42	1	154,350		
44	2	227,408		
45			1	107,001
48			1	107,001
Total	361	$ 46,292,108	199	$ 23,820,544

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, 2016

	Men		Women	
Age	Number	Contributions	Number	Contributions
34	1	$ 3,175		
40			1	$ 10,616
42			1	4,365
45	2	112,886		
46	3	25,671		
47	1	44,380	1	45,898
48			1	54,109
49	3	154,986		
50	1	6,587	2	83,543
51	1	5,560	1	4,699
52	1	32,658	1	46,131
53	1	14,035	1	5,034
54	1	34,674		
55			1	87,945
56	2	93,600		
57	1	39,680		
59	2	108,393	2	250,512
60	1	17,888		
63	1	30,393	1	1,398
64	2	115,408		
66	2	22,965	1	42,077
69	1	17,549		
70	1	15,333		
Total	28	$ 895,821	14	$ 636,327

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, 2016

	Men		Women	
Age	Number	Allowances	Number	Allowances
50			3	$ 102,290
52			4	103,586
53	2	$ 80,813		
54	3	243,358	2	36,923
55	2	123,812	2	88,212
56	1	21,257	2	98,318
57	3	229,873		
58	1	6,235	3	206,588
59			3	157,963
60	6	467,610	11	650,706
61	2	123,574	8	518,954
62	13	974,306	10	547,428
63	12	764,958	10	483,211
64	9	625,076	7	331,771
65	20	1,351,705	11	589,860
66	12	872,393	13	873,505
67	26	1,856,460	11	694,070
68	21	1,461,684	7	459,857
69	19	1,349,912	5	340,891
70	27	2,081,138	7	353,821
71	24	1,674,532	16	885,133
72	15	1,090,606	6	300,903
73	19	1,396,881	5	206,189
74	21	1,441,341	7	533,126
75	12	935,133	12	473,239
76	10	864,235	2	14,885
77	12	1,115,557	8	489,969
78	8	684,672	8	329,370
79	9	625,308	7	225,802
80	11	857,836	7	358,433
81	10	547,834	6	247,225
82	4	201,853	7	274,383
83	7	510,668	3	90,918
84	4	361,408	8	338,246
85	4	325,188	5	351,601

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, 2016 (continued)

	Men		Women	
Age	Number	Allowances	Number	Allowances
86	6	$ 442,432	3	$ 117,482
87	6	332,433	5	200,073
88	6	418,684	6	99,716
89	1	10,865	8	207,852
90	2	80,575	4	157,095
91	4	278,119	3	92,468
92	1	103,985	2	36,286
93	1	99,760	3	45,738
94	3	202,094	2	37,754
95	1	35,909		
96	1	24,038	2	30,213
97	1	71,683	1	52,525
98			2	96,329
99			1	49,260
100			1	847
Total	382	$ 27,367,793	269	$ 12,981,014

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, 2016

	Men		Women	
Annuity Type	Number	Allowances	Number	Allowances
Maximum	220	$ 16,478,758	111	$ 6,539,160
Option 1	4	329,866		
Option 2	35	1,689,183	4	218,531
Option 3	42	3,652,618	2	109,278
Option 4	3	247,284	8	389,958
Option 5-2				
Option 5-3				
Option 6-2	15	742,169	1	90,360
Option 6-3	47	3,742,957	10	645,724
Other	3	79,522	1	52,525
Survivors of Deceased Members	13	405,436	132	4,935,478
Total	382	$ 27,367,793	269	$ 12,981,014

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, 2016

	Men		Women	
Age	Number	Allowances	Number	Allowances
60	1	$ 69,006		
68			1	$ 52,490
77			1	$ 30,947
Total	1	$ 69,006	2	$ 83,437

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, 2016

	Men		Women	
Annuity Type	Number	Allowances	Number	Allowances
Maximum	1	$ 69,006	1	$ 30,947
Option 1				
Option 2				
Option 3			1	52,490
Option 4				
Option 5-2				
Option 5-3				
Option 6-2				
Option 6-3				
Other				
Total	1	$ 69,006	2	$ 83,437

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 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 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 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 his creditable service and compensation to the date of separation.
Spouse Benefit	
Conditions for Benefit	Upon the death of a member in active service after his attainment of age 50 and completion of five years of creditable service a death benefit is payable to his 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 he retired on the first day of the calendar month coincident with or next following his date of death reduced by 2% for each year that the member's age exceeds that of his spouse.
Lump Sum Death Benefit	Upon the death of a member in active service prior to his attainment of age 50 a lump sum payment equal to his accumulated contributions plus his final compensation is made to his designated beneficiary or estate.
Death after Retirement	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 spouse, until death or remarriage, equal to one-half the allowance which was payable to the member prior to his death reduced by 2% for each year that the member's age exceeds that of his spouse. Upon the death of a member in receipt of a disability retirement allowance prior to age 65, an allowance is paid to his spouse, until death or remarriage, equal to one-half the service retirement allowance he would have received had he remained in service up to his date of death reduced by 2% for each year that the member's age exceeds that of his spouse.
Other Death Benefits	Upon the death of a member in service, other benefits may be provided by the Death Benefit Plan.
Return of Contributions	Any member who terminates service other than by retirement or death is entitled to the return of his accumulated contributions. 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.

Appendix C: Summary of Main Benefit and Contribution Provisions

The current interest rate on member contributions is 4%.

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 his retirement date, an amount equal to his accumulated contributions at retirement, less 1/120 for each month he has received a retirement allowance payment, is paid to his estate, or to a person designated by the member, or

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

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

Option 4 - At retirement, any member may elect to receive a retirement allowance in such amount that, together with his Social Security benefit, he will receive approximately the same income per annum before and after the earliest age at which he becomes eligible to receive the Social Security benefit. A member who elects to receive his 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 life with some other benefit approved by the Board of Trustees payable after he dies, or he 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

Appendix C: Summary of Main Benefit and Contribution Provisions

	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.
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 his annual compensation.
Employer Contributions	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. 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.
Changes Since Prior Valuation	A 1.0% cost-of-living adjustment was granted effective July 1, 2017 for retired members and survivor of deceased members receiving benefits as of July 1, 2016 (and a prorated increase for those who retired after July 1, 2016 but before June 30, 2017). This change was made pursuant to Session Law 2017-57 (Appropriations Act of 2017).

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 7.20% was adopted by the Board of Trustees on April 20, 2017.

Interest Rate: 7.20% 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		
	Disability	Base Mortality*	
Age	Male & Female	Male	Female
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:

	Service					
Age	5	10	15	20	25	30
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

Service	
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)	
ge	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.

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 7.25% to 7.20%.

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
2017	$ 538,767	$ 4,337	$ 19,291	$ 42,786	$ 119	$ 38,065	$ 557,555
2018	557,555	4,201	22,211	44,528	116	39,485	578,808
2019	578,808	4,070	23,352	46,512	112	40,982	600,588
2020	600,588	3,949	24,345	48,498	109	42,512	622,787
2021	622,787	3,819	25,245	50,379	105	44,072	645,439
2022	645,439	3,696	25,592	52,057	102	45,661	668,229
2023	668,229	3,577	22,914	53,755	98	47,187	688,054
2024	688,054	3,445	19,867	55,327	94	48,409	704,354
2025	704,354	3,315	18,493	56,862	90	49,482	718,692
2026	718,692	3,175	17,713	58,270	86	50,415	731,639
2027	731,639	3,030	17,606	59,746	82	51,290	743,737
2028	743,737	2,876	17,657	61,084	77	52,105	755,214
2029	755,214	2,722	15,174	62,328	73	52,845	763,554
2030	763,554	2,572	11,472	63,430	68	53,240	767,340
2031	767,340	2,417	9,512	64,541	64	53,397	768,061
2032	768,061	2,251	7,667	65,693	59	53,337	765,564
2033	765,564	2,078	5,876	66,846	53	53,046	759,665
2034	759,665	1,896	4,704	67,790	49	52,531	750,957
2035	750,957	1,732	4,162	68,516	44	51,851	740,142
2036	740,142	1,571	3,718	69,038	39	51,035	727,389
2037	727,389	1,400	3,257	69,572	35	50,074	712,513
2038	712,513	1,237	2,769	70,046	30	48,964	695,407
2039	695,407	1,054	2,329	70,328	25	47,701	676,138
2040	676,138	882	1,920	70,328	21	46,293	654,884
2041	654,884	730	1,510	70,129	17	44,749	631,727
2042	631,727	576	1,155	69,621	13	43,083	606,907
2043	606,907	447	854	68,758	10	41,310	580,750
2044	580,750	341	671	67,322	8	39,469	553,901
2045	553,901	275	535	65,522	6	37,591	526,774
2046	526,774	219	444	63,488	5	35,705	499,649
2047	499,649	177	335	61,434	4	33,821	472,544
2048	472,544	137	248	59,276	3	31,940	445,590
2049	445,590	102	174	57,042	2	30,074	418,896
2050	418,896	72	121	54,712	1	28,232	392,608
2051	392,608	53	84	52,293	1	26,423	366,874
2052	366,874	37	67	49,803	1	24,657	341,831
2053	341,831	28	43	47,340	1	22,941	317,502
2054	317,502	18	31	44,864	0	21,274	293,961
2055	293,961	12	15	42,418	0	19,666	271,236
2056	271,236	6	8	39,973	0	18,115	249,392
2057	249,392	3	2	37,555	0	16,628	228,470
2058	228,470	1	2	35,158	0	15,206	208,521
2059	208,521	1	0	32,809	0	13,852	189,565
2060	189,565	0	0	30,505	0	12,570	171,630
2061	171,630	0	0	28,259	0	11,357	154,728
2062	154,728	0	0	26,077	0	10,218	138,869
2063	138,869	0	0	23,964	0	9,151	124,056
2064	124,056	0	0	21,925	0	8,157	110,288
2065	110,288	0	0	19,967	0	7,235	97,556
2066	97,556	0	0	18,095	0	6,384	85,845

Appendix E: GASB 67 Fiduciary Net Position Projection

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

(in thousands)

Calendar Year	Beginning Fiduciary Position	Member Contributions	Employer Contributions	Benefit Payments	Administrative Expenses	Investment Earnings	Ending Fiduciary Position
2067	$ 85,845	$ 0	$ 0	$ 16,315	$ 0	$ 5,604	$ 75,134
2068	75,134	0	0	14,630	0	4,892	65,396
2069	65,396	0	0	13,046	0	4,247	56,597
2070	56,597	0	0	11,566	0	3,666	48,697
2071	48,697	0	0	10,193	0	3,146	41,650
2072	41,650	0	0	8,929	0	2,683	35,404
2073	35,404	0	0	7,773	0	2,273	29,904
2074	29,904	0	0	6,724	0	1,915	25,095
2075	25,095	0	0	5,780	0	1,603	20,918
2076	20,918	0	0	4,935	0	1,331	17,314
2077	17,314	0	0	4,186	0	1,099	14,227
2078	14,227	0	0	3,525	0	900	11,602
2079	11,602	0	0	2,948	0	730	9,384
2080	9,384	0	0	2,448	0	589	7,525
2081	7,525	0	0	2,016	0	471	5,980
2082	5,980	0	0	1,647	0	372	4,705
2083	4,705	0	0	1,333	0	291	3,663
2084	3,663	0	0	1,069	0	226	2,820
2085	2,820	0	0	848	0	172	2,144
2086	2,144	0	0	665	0	131	1,610
2087	1,610	0	0	516	0	98	1,192
2088	1,192	0	0	394	0	71	869
2089	869	0	0	297	0	52	624
2090	624	0	0	220	0	37	441
2091	441	0	0	161	0	27	307
2092	307	0	0	115	0	18	210
2093	210	0	0	81	0	13	142
2094	142	0	0	55	0	7	94
2095	94	0	0	37	0	6	63
2096	63	0	0	25	0	4	42
2097	42	0	0	16	0	2	28
2098	28	0	0	10	0	2	20
2099	20	0	0	6	0	2	16
2100	16	0	0	4	0	1	13
2101	13	0	0	2	0	1	12
2102	12	0	0	1	0	1	12
2103	12	0	0	1	0	1	12
2104	12	0	0	0	0	0	12
2105	12	0	0	0	0	1	13
2106	13	0	0	0	0	1	14
2107	14	0	0	0	0	1	15
2108	15	0	0	0	0	1	16
2109	16	0	0	0	0	1	17
2110	17	0	0	0	0	1	18
2111	18	0	0	0	0	2	20
2112	20	0	0	0	0	1	21
2113	21	0	0	0	0	2	23
2114	23	0	0	0	0	1	24
2115	24	0	0	0	0	2	26
2116	26	0	0	0	0	2	28

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	Present Value of Benefit Payments		
					Funded Payments at 7.20%	Unfunded Payments at 3.13%	Using Single Discount Rate of 7.20%
2017	$ 538,767	$ 42,786	$ 42,786	$ 0	$ 41,324	$ 0	$ 41,324
2018	557,555	44,528	44,528	0	40,118	0	40,118
2019	578,808	46,512	46,512	0	39,091	0	39,091
2020	600,588	48,498	48,498	0	38,023	0	38,023
2021	622,787	50,379	50,379	0	36,845	0	36,845
2022	645,439	52,057	52,057	0	35,515	0	35,515
2023	668,229	53,755	53,755	0	34,210	0	34,210
2024	688,054	55,327	55,327	0	32,846	0	32,846
2025	704,354	56,862	56,862	0	31,490	0	31,490
2026	718,692	58,270	58,270	0	30,102	0	30,102
2027	731,639	59,746	59,746	0	28,791	0	28,791
2028	743,737	61,084	61,084	0	27,459	0	27,459
2029	755,214	62,328	62,328	0	26,137	0	26,137
2030	763,554	63,430	63,430	0	24,812	0	24,812
2031	767,340	64,541	64,541	0	23,551	0	23,551
2032	768,061	65,693	65,693	0	22,361	0	22,361
2033	765,564	66,846	66,846	0	21,226	0	21,226
2034	759,665	67,790	67,790	0	20,080	0	20,080
2035	750,957	68,516	68,516	0	18,932	0	18,932
2036	740,142	69,038	69,038	0	17,795	0	17,795
2037	727,389	69,572	69,572	0	16,728	0	16,728
2038	712,513	70,046	70,046	0	15,711	0	15,711
2039	695,407	70,328	70,328	0	14,715	0	14,715
2040	676,138	70,328	70,328	0	13,726	0	13,726
2041	654,884	70,129	70,129	0	12,768	0	12,768
2042	631,727	69,621	69,621	0	11,824	0	11,824
2043	606,907	68,758	68,758	0	10,893	0	10,893
2044	580,750	67,322	67,322	0	9,949	0	9,949
2045	553,901	65,522	65,522	0	9,033	0	9,033
2046	526,774	63,488	63,488	0	8,165	0	8,165
2047	499,649	61,434	61,434	0	7,370	0	7,370
2048	472,544	59,276	59,276	0	6,634	0	6,634
2049	445,590	57,042	57,042	0	5,955	0	5,955
2050	418,896	54,712	54,712	0	5,328	0	5,328
2051	392,608	52,293	52,293	0	4,750	0	4,750
2052	366,874	49,803	49,803	0	4,220	0	4,220
2053	341,831	47,340	47,340	0	3,742	0	3,742
2054	317,502	44,864	44,864	0	3,308	0	3,308
2055	293,961	42,418	42,418	0	2,918	0	2,918
2056	271,236	39,973	39,973	0	2,565	0	2,565
2057	249,392	37,555	37,555	0	2,248	0	2,248
2058	228,470	35,158	35,158	0	1,963	0	1,963
2059	208,521	32,809	32,809	0	1,709	0	1,709
2060	189,565	30,505	30,505	0	1,482	0	1,482
2061	171,630	28,259	28,259	0	1,281	0	1,281
2062	154,728	26,077	26,077	0	1,103	0	1,103
2063	138,869	23,964	23,964	0	945	0	945
2064	124,056	21,925	21,925	0	807	0	807
2065	110,288	19,967	19,967	0	685	0	685
2066	97,556	18,095	18,095	0	579	0	579

Appendix E: GASB 67 Fiduciary Net Position Projection

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

(in thousands)

Calendar Year	Beginning Fiduciary Position	Benefit Payments	Present Value of Benefit Payments				
			Funded Benefit Payments	Unfunded Benefit Payments	Funded Payments at 7.20%	Unfunded Payments at 3.13%	Using Single Discount Rate of 7.20%
2067	$ 85,845	$ 16,315	$ 16,315	$ 0	$ 487	$ 0	$ 487
2068	75,134	14,630	14,630	0	408	0	408
2069	65,396	13,046	13,046	0	339	0	339
2070	56,597	11,566	11,566	0	280	0	280
2071	48,697	10,193	10,193	0	231	0	231
2072	41,650	8,929	8,929	0	188	0	188
2073	35,404	7,773	7,773	0	153	0	153
2074	29,904	6,724	6,724	0	123	0	123
2075	25,095	5,780	5,780	0	99	0	99
2076	20,918	4,935	4,935	0	79	0	79
2077	17,314	4,186	4,186	0	62	0	62
2078	14,227	3,525	3,525	0	49	0	49
2079	11,602	2,948	2,948	0	38	0	38
2080	9,384	2,448	2,448	0	30	0	30
2081	7,525	2,016	2,016	0	23	0	23
2082	5,980	1,647	1,647	0	17	0	17
2083	4,705	1,333	1,333	0	13	0	13
2084	3,663	1,069	1,069	0	10	0	10
2085	2,820	848	848	0	7	0	7
2086	2,144	665	665	0	5	0	5
2087	1,610	516	516	0	4	0	4
2088	1,192	394	394	0	3	0	3
2089	869	297	297	0	2	0	2
2090	624	220	220	0	1	0	1
2091	441	161	161	0	1	0	1
2092	307	115	115	0	1	0	1
2093	210	81	81	0	0	0	0
2094	142	55	55	0	0	0	0
2095	94	37	37	0	0	0	0
2096	63	25	25	0	0	0	0
2097	42	16	16	0	0	0	0
2098	28	10	10	0	0	0	0
2099	20	6	6	0	0	0	0
2100	16	4	4	0	0	0	0
2101	13	2	2	0	0	0	0
2102	12	1	1	0	0	0	0
2103	12	1	1	0	0	0	0
2104	12	0	0	0	0	0	0
2105	12	0	0	0	0	0	0
2106	13	0	0	0	0	0	0
2107	14	0	0	0	0	0	0
2108	15	0	0	0	0	0	0
2109	16	0	0	0	0	0	0
2110	17	0	0	0	0	0	0
2111	18	0	0	0	0	0	0
2112	20	0	0	0	0	0	0
2113	21	0	0	0	0	0	0
2114	23	0	0	0	0	0	0
2115	24	0	0	0	0	0	0
2116	26	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 19th, 2016.

Section 6(c) of Session Law 2016-108 requires that the actuarial valuation report provide the valuation results using a 30-year treasury rate as of December 31 of the year of the valuation as the discount rate. This is 3.06% at December 31, 2016 and has been used as the lower bound of the sensitivity analysis presented. The range between the current discount rate (7.20%) and the 30-year treasury rate (3.06%) was used to establish an upper bound for sensitivity analysis (11.34%). 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 3.06% falls below the 5th percentile of estimated future 30-year returns while the upper bound of 11.34% falls between the 75th and 95th percentiles of estimated future 30-year returns.

Table F-1: Sensitivity of Valuation Results as of December 31, 2016

Discount Rate	3.06%	5.13%	7.20%	9.27%	11.34%
Market Value of Assets	$ 538,766,550	$ 538,766,550	$ 538,766,550	$ 538,766,550	$ 538,766,550
Actuarial Accrued Liability	$ 997,435,218	$ 786,285,217	$ 642,527,945	$ 531,265,978	$ 451,592,218
Unfunded Accrued Liability (UAL)	$ 458,668,668	$ 247,518,667	$ 103,761,395	$ (7,500,572)	$ (87,174,332)
Funded Ratio	54.0%	68.5%	83.9%	101.4%	119.3%
20-Year Amortization of UAL	$ 31,949,599	$ 21,111,123	$ 10,663,208	N/A	N/A
(as % of general state revenue)	0.11%	0.07%	0.04%	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
1996	10.19%	9.32%	2003	8.44%	18.33%	2010	6.01%	11.49%
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%

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
2012	564	$ 68,237,144
2013	566	68,456,637
2014	566	67,562,225
2015	561	68,245,416
2016	560	70,112,652

Graph 2: Retired Members and Survivors of Deceased Members

	Retired and Survivors of Deceased Member Count	Retirement Allowance
2012	559	$ 33,015,346
2013	584	35,111,390
2014	610	37,376,920
2015	647	40,036,451
2016	654	40,501,250

Graph 3: Market Value of Assets and Asset Returns

	Market Value of Assets	Asset Return
2012	$ 466,099,097	11.79%
2013	511,969,020	12.19%
2014	534,452,795	6.19%
2015	520,979,678	0.35%
2016	538,766,550	6.22%

Appendix G: Data for Section 2 Graphs

Graph 5: Actuarial Value and Market Value of Assets

	Actuarial Value of Assets	Market Value of Assets
2012	$ 481,285,608	$ 466,099,097
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

Graph 6: Asset Returns

	Actuarial Value	Market Value
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%

Graph 7: Actuarial Accrued Liability

	Liability for Active Members	Liability for Deferred Members	Liability for Retired Members	Total Liability
2012	$ 232,560,316	$ 2,743,231	$ 292,281,547	$ 527,585,094
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

Appendix G: Data for Section 2 Graphs

Graph 8: Actuarial Accrued Liability and Actuarial Value of Assets

	Actuarial Accrued Liability	Actuarial Value of Assets
2012	$ 527,585,094	$ 481,285,608
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

Graph 9: Funded Ratios

	Funded Ratio (Actuarial Basis)	Funded Ratio (Market Value Basis)
2012	91.2%	88.3%
2013	92.3%	93.2%
2014	94.3%	94.3%
2015	89.4%	84.6%
2016	87.9%	83.9%

Graph 10: Actuarially Determined Employer Contribution Rates

Fiscal Year Ending	Normal Rate	Accrued Liability Rate	Total Rate
2015	17.91%	9.30%	27.21%
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%

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

** Includes impact of the experience study