1301 Fifth Avenue
Suite 3800
Seattle, WA 98101-2605
USA

Tel +1 206 624 7940
Fax +1 206 623 3485

milliman.com

April 9, 2018

Teachers' Retirement Board
California State Teachers' Retirement System

Re: **Defined Benefit Program Actuarial Valuation as of June 30, 2017**

Dear Members of the Board:

At your request, we have performed an actuarial valuation of the Defined Benefit (DB) Program of the State Teachers' Retirement Plan as of June 30, 2017. The major findings of the actuarial valuation are contained in the following report, which reflects the benefit provisions and contribution rates in effect as of the valuation date. This report satisfies all basic disclosure requirements under the Model Disclosure Elements for Actuarial Valuation Reports recommended by the California Actuarial Advisory Panel.

Actuarial Certification

To the best of our knowledge and belief, this report is complete and accurate and contains sufficient information to fairly disclose the funded condition of the DB Program as of June 30, 2017.

CalSTRS funding is based on complex legislation. This valuation contains analysis based on our understanding of the relevant law based on our experience working with CalSTRS and other large public retirement systems and has been augmented by consultation with CalSTRS staff.

In preparing this report, we relied, without audit, on information (some oral and some in writing) supplied by CalSTRS staff. This information includes, but is not limited to, statutory provisions, employee data, and financial information. In our examination of these data, we have found them to be reasonably consistent and comparable with data used for other purposes. The valuation results depend on the integrity of this information. If any of this information is inaccurate or incomplete our results may be different and our calculations may need to be revised.

All costs, liabilities, rates of interest, and other factors for CalSTRS have been determined on the basis of actuarial assumptions and methods which are individually reasonable (taking into account the experience of CalSTRS and reasonable expectations) and which, in combination, offer a reasonable estimate of anticipated experience affecting CalSTRS. Further, in our opinion, each actuarial assumption used is reasonably related to the experience of CalSTRS and to reasonable expectations which, in combination, represent a reasonable estimate of anticipated experience.

Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period or additional cost or contribution requirements based on the Plan's funded status); and changes in plan provisions or applicable law. Due to the limited scope of our assignment, we did not perform an

analysis of the potential range of future measurements. The Teachers' Retirement Board has sole authority to determine the actuarial assumptions and methods used for the valuation of the DB Program. The board adopted the actuarial methods and assumptions used in the 2017 valuation.

Actuarial computations presented in this report are for purposes of assessing the funding levels of CalSTRS and calculating contribution rates under CalSTRS valuation policy. The calculations in the enclosed report have been made on a basis consistent with our understanding of CalSTRS funding structure. Determinations for other purposes, such as for financial reporting in accordance with GASB standards, may be significantly different from the results contained in this report. Accordingly, additional determinations may be needed for other purposes.

This valuation report is only an estimate of the System's financial condition as of a single date. It can neither predict the System's future condition nor guarantee future financial soundness. Actuarial valuations do not affect the ultimate cost of System benefits, only the timing of System contributions. While the valuation is based on an array of individually reasonable assumptions, other assumption sets may also be reasonable and valuation results based on those assumptions would be different. No one set of assumptions is uniquely correct. Determining results using alternative assumptions is outside the scope of our engagement.

Milliman's work is prepared solely for the internal business use of CalSTRS. To the extent that Milliman's work is not subject to disclosure under applicable public records laws, Milliman's work may not be provided to third parties without Milliman's prior written consent. Milliman does not intend to benefit or create a legal duty to any third party recipient of its work product. Milliman's consent to release its work product to any third party may be conditioned on the third party signing a Release, subject to the following exceptions:

(a) CalSTRS may provide a copy of Milliman's work, in its entirety, to CalSTRS professional service advisors who are subject to a duty of confidentiality and who agree to not use Milliman's work for any purpose other than to benefit CalSTRS.

(b) CalSTRS may provide a copy of Milliman's work, in its entirety, to other governmental entities, as required by law.

No third party recipient of Milliman's work product should rely upon Milliman's work product. Such recipients should engage qualified professionals for advice appropriate to their own specific needs.

The consultants who worked on this assignment are pension actuaries. Milliman's advice is not intended to be a substitute for qualified legal or accounting counsel.

The signing actuaries are independent of the plan sponsor. We are not aware of any relationship that would impair the objectivity of our work.

On the basis of the foregoing, we hereby certify that, to the best of our knowledge and belief, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices, including the relevant Actuarial Standards of Practice. We are members of the American Academy of Actuaries and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

We would like to express our appreciation to the CalSTRS staff who gave substantial assistance in supplying the data on which this report is based.

We respectfully submit the following report and we look forward to discussing it with you.

Sincerely,

Nick J. Collier, ASA, EA, MAAA
Consulting Actuary

Mark C. Olleman, FSA, EA, MAAA
Consulting Actuary

Julie D. Smith, FSA, EA, MAAA
Consulting Actuary

NJC/MCO/JDS/nlo

Table of Contents

Page

Letter of Transmittal
Section 1 Summary of the Findings 1
Section 2 Scope of the Report 11
Section 3 Actuarial Obligation 13
Table 1 Normal Cost 16
Table 2 Actuarial Obligation 17
Section 4 Valuation Assets 19
Table 3 Statement of Program Assets 20
Table 4 Statement of Changes in Program Assets 21
Table 5 Actuarial Value of Assets 22
Table 6 History of Actuarial Value of Assets 23
Section 5 Funded Status 25
Table 7 Funded Status 32
Table 8 Actuarial Gains and Losses 33
Section 6 State Supplemental Contribution Rate 35
Table 9 Asset Adjustment for 1990 Benefit Structure 39
Table 10 Funded Status and Supplemental Contribution Rate for 1990 Benefit Structure 40
Section 7 Employer Supplemental Contribution Rate 41
Table 11 Total Assets Allocated for Pre-2014 Service[(1)] 43
Table 12 1990 Assets Allocated for Pre-2014 Service[(1)] 44
Table 13 Funded Status and Employer Supplemental Contribution Rate for Pre-2014 Service 45
Section 8 Projected Amortization and Cash Flows 47
Table 14 Amortization of Unfunded Actuarial Obligation[(1)] 48
Table 15 Projected Cash Flow 49
Appendix A Provisions of Governing Law 51
Appendix B Actuarial Methods and Assumptions 57
Table B.1 List of Major Valuation Assumptions 59
Table B.2 Mortality as of June 30, 2017 60
Table B.3 Service Retirement 61
Table B.4 Disability Retirement 62
Table B.5 Withdrawal 63
Table B.6 Probability of Refund 64
Table B.7 Merit Salary Increases[(1)] 65
Table B.8 Supplemental Assumptions 66
Table B.9 Custom Mortality Table Key 68
Appendix C Valuation Data 69
Table C.1 Summary of Statistical Information 70
Table C.2 Age and Service Distribution – Active Male Members 72
Table C.3 Age and Service Distribution – Active Female Members 73
Table C.4 Age and Service Distribution – All Active Members 74
Table C.5 Inactive Members 75
Table C.6 Members Retired for Service 76
Appendix D Glossary 77

Section 1 Summary of the Findings

The primary purpose of the actuarial valuation is to calculate the contribution rates for members, employers, and the state and analyze the sufficiency of these future contributions to meet the current and future obligations of the DB Program. By using the actuarial methods and assumptions adopted by the Teachers' Retirement Board, this actuarial valuation provides a reasonable estimate of the long-term financing of the DB Program.

Under the board's valuation policy, an increase to the state supplemental contribution rate beginning July 2018 has been calculated. For the employer contribution rate, adjustments will be effective with the 2020 valuation for the fiscal year beginning July 2021. Note that the contribution rates calculated in this valuation are based on the relevant provisions of the Education Code and the board's valuation policy and are not necessarily our opinion of what the funding level should be; however, we note that CalSTRS is projected to make progress, albeit slow progress in the short term, toward paying off the Unfunded Actuarial Obligation (UAO).

Based on this valuation and the relevant sections of the Education Code, contribution rates for 2% at 62 members should be increased effective July 2018. There is no change for 2% at 60 members.

The key findings of this actuarial valuation are:

- The **Funded Ratio** decreased from 63.7% to 62.6% primarily due to the inclusion of a lower investment return assumption (7.00%, decreased from 7.25% in the prior year). However, our projections show the System's Funded Ratio improving over the longer term assuming all actuarial assumptions are met.
- An increase in the **state supplemental contribution rate** of 0.500% of payroll to 5.311% of payroll has been calculated for the fiscal year beginning July 1, 2018 pursuant to the valuation policy. This increase is the maximum increment allowed under the Education Code. Current projections show increases in the state supplemental contribution rate will be needed for approximately five additional years, assuming all actuarial assumptions are met.
- The **employer supplemental contribution rate** for the fiscal year beginning July 1, 2018 increases to 8.03% of payroll (currently 6.18%) as required by the Education Code, which specifies a fixed schedule of contribution increases until 2021.
- Based on this 2017 valuation, an increase in the **member contribution rates** of 1.0% of creditable compensation for CalSTRS 2% at 62 members is required for the fiscal year beginning July 1, 2018. The member contribution rate for 2% at 60 members is fixed in the Education Code, so no change is required for this group. Effective July 1, 2018, 2% at 60 members continue to contribute at a 10.250% rate, and 2% at 62 members will now contribute at a 10.205% rate.

Contribution Rates

The 2014 legislation added three subsections to the Education Code which address contribution rates. EC §22955.1 specifies graded increases in the supplemental state contribution rates. Effective with the 2016 valuation, the board has the authority to annually adjust the state contribution rate for years through June 30, 2046, so that the rate is sufficient to amortize the UAO attributable to the 1990 contribution and benefit structure. However, the maximum increase in a given year is limited to 0.5% of payroll.

EC §22950.5 specifies graded increases in the employer supplemental contribution rate. Effective July 1, 2021, the employer supplemental contribution rate will be adjusted annually based on the contribution rate necessary to amortize the UAO attributable to service prior to July 1, 2014 that is not funded by the state as part of the 1990 Benefit Structure.

Graded increases were also implemented for member contribution rates under EC §22901.7. The 2% at 60 member rates are fixed now that they have reached the ultimate rate of 10.25% and are not dependent on the DB Program's funded status. The scheduled increases specified in the law for 2% at 62 members has also fully phased in, but the rates can still vary depending on the calculated Normal Cost Rate as discussed later in this section.

State Supplemental Contribution Rate

For the 2017 valuation, an increase in the state supplemental contribution rate under EC §22955.1 has been calculated. The following table shows a numerical breakdown of each of the factors that caused the increase in the unconstrained (i.e., prior to the application of the minimum supplemental rate and the maximum increase) state supplemental contribution rate. The actual calculation is limited to a 0.5% increase over the prior year and cannot be less than 4.311% until the 1990 UAO has been fully paid off.

Sources of Change	Theoretical Unconstrained State Supplemental Rate
June 30, 2016 Actuarial Valuation	**5.97%**
Expected Year-to-Year Change	0.06%
Recognized Asset (Gain) / Loss	
• From Prior Years	0.38%
• From Current Year	-0.78%
Salary / Payroll Variation	
• Salary Increase < Assumed	-0.13%
• Payroll Increase > Assumed	-0.06%
Assumption Changes	2.79%
All Other Sources	-0.02%
Total Change	**2.24%**
June 30, 2017 Actuarial Valuation	**8.21%** (1)

1. Calculated rate is 5.311% due to application of maximum increase.

State Supplemental Contribution Rate (continued)

An **increase to the state supplemental contribution rate to 5.311%** effective July 1, 2018 has been calculated based on the board's valuation policy. For the current fiscal year, the state contribution rate is 4.811%, so the calculated rate for the next fiscal year represents the maximum increase allowed of 0.5% of payroll. We have shown details of the calculation of the state supplemental contribution rate in Section 6 of this report. These calculations are based on the smoothed actuarial value of assets. As shown later in this section (see "Looking Ahead"), when the deferred asset gain as of June 30, 2017 and other factors are reflected in the projected contribution rates, the state supplemental contribution rate is projected to increase to about 10.0%, which is approximately equal to the base state rate of 2.017% plus the calculated unconstrained supplemental contribution rate of 8.21%.

Employer Supplemental Contribution Rate

Consistent with the Education Code, the 2017 valuation does not calculate changes in the employer supplemental contribution rate. Increases in this rate are fixed for the next few years. Effective with the 2020 valuation, we will calculate the change in the employer supplemental contribution rate starting July 1, 2021. For illustrative purposes, we have shown details of how this calculation will look in Section 7 of this report.

UAO for New Benefits, Post-2014 Service

The funding legislation included actuarial funding (within certain constraints) for most of the benefits provided by CalSTRS. The one exception is that there is no provision for the state, employers, or members to fund any UAO arising for New Benefits (i.e., those not included in the 1990 Benefit Structure) attributable to service after June 30, 2014. We will refer to this as the "Unallocated UAO". Under the valuation policy, a portion of each year's total contributions, equal to the Normal Cost of the New Benefits, is allocated to fund these benefits. Since the contribution is equal to the Normal Cost, there are no remaining contributions to pay down the Unallocated UAO. Therefore, the Unallocated UAO will increase or decrease based on future experience.

The following table shows how the Unallocated UAO (based on assets at market value) has evolved over time. The primary cause of the increase has been the actuarial assumptions adopted, based on the recent experience analysis which increased the UAO in the last two valuations. This was somewhat offset this valuation by the investment return which exceeded the assumption. As of June 30, 2017, the Unallocated UAO is small relative to the total UAO, as it only reflects service accrued for three years. However, as members continue to accrue benefits for service after June 30, 2014, there is the potential for the Unallocated UAO to increase significantly if actual experience differs materially from that assumed or if further changes in assumptions occur.

($ Millions)	Unallocated UAO[(1)]	Unallocated UAO as % of Payroll
2014 Valuation	$ 0	0.0%
2015 Valuation	213	0.7%
2016 Valuation	639	2.0%
2017 Valuation	369	1.1%

1. The Unallocated UAO is calculated using the market value of assets. It is currently $523 million based on the actuarial value of assets.

UAO for New Benefits, Post-2014 Service (continued)

As previously discussed, there is currently no dedicated funding to pay off the Unallocated UAO. If the Unallocated UAO were to be funded on an actuarial basis with a June 30, 2046 target date, an additional 0.09% of payroll would be required effective July 1, 2018.

Normal Cost Rate for CalSTRS 2% at 62 Members

As part of the annual valuation process, the Normal Cost Rate is calculated for CalSTRS 2% at 62 members, generally those first hired on or after January 1, 2013. The Normal Cost Rate is used as the basis for setting the base member contribution rate for this group for the following fiscal year, the fiscal year beginning July 1, 2018, for this valuation. Generally, the base member contribution rate is one-half of the Normal Cost Rate, within certain parameters.

EC §22901(b)(1) requires the board to adopt the Normal Cost Rate that is used to determine the 2% at 62 member contribution rate. As of June 30, 2017, the Normal Cost Rate for the CalSTRS 2% at 62 members is 17.893%. We recommend the board adopt this rate.

EC §22901(b)(1) specifies that the CalSTRS 2% at 62 base member contribution rate does not change if the increase or decrease in the Normal Cost Rate for members is less than 1% of creditable compensation since the last adjustment. This year, the cumulative change is an increase in the Normal Cost Rate of 1.993%, from 15.900% (the time of the last adjustment) to 17.893% for this group. Therefore, the current base member contribution rate should be increased from 8.00% to 9.00% for 2% at 62 members based on the relevant section of the Education Code.

Note that increases of 1.205% under EC §22901.7(b) are added to the base member rate. Therefore, **effective July 1, 2018, the total member contribution rate for 2% at 62 members should be increased to 10.205%** (9.00% plus the 1.205% additional contribution rate).

Funding Progress

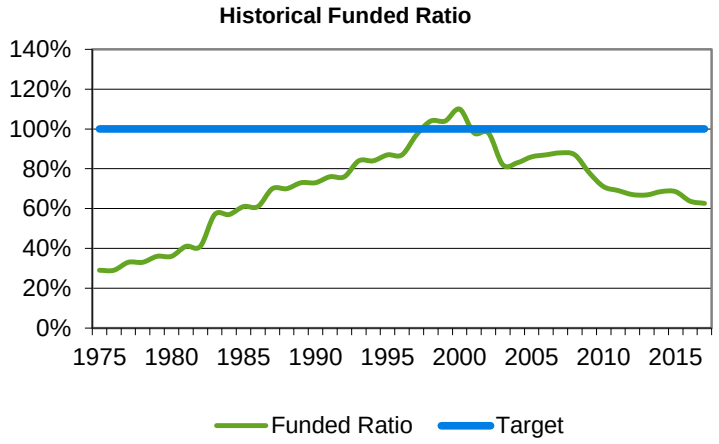
The UAO of a retirement plan is equal to the difference between its Actuarial Value of Assets and its Actuarial Obligation. The Funded Ratio is equal to the Actuarial Value of Assets divided by the Actuarial Obligation.

($ Millions)	2017 Valuation (7.00%)	2016 Valuation (7.25%)
Actuarial Obligation	$ 286,950	$ 266,704
Actuarial Value of Assets	179,689	169,976
Unfunded Actuarial Obligation	$ 107,261	$ 96,728
Funded Ratio	62.6%	63.7%

The $107.3 billion UAO compares to a projected June 30, 2017 value of $101.3 billion based on the prior valuation. The primary reason for the increase in the UAO and the decrease in the funded ratio is the adoption of the 7.00% investment assumption which was first reflected in this valuation. Additional discussion of the contributing factors in this change can be found in Section 5 under Actuarial Gains and Losses.

Funding Progress (continued)

The following graph shows a historical perspective of the Funded Ratio for CalSTRS.



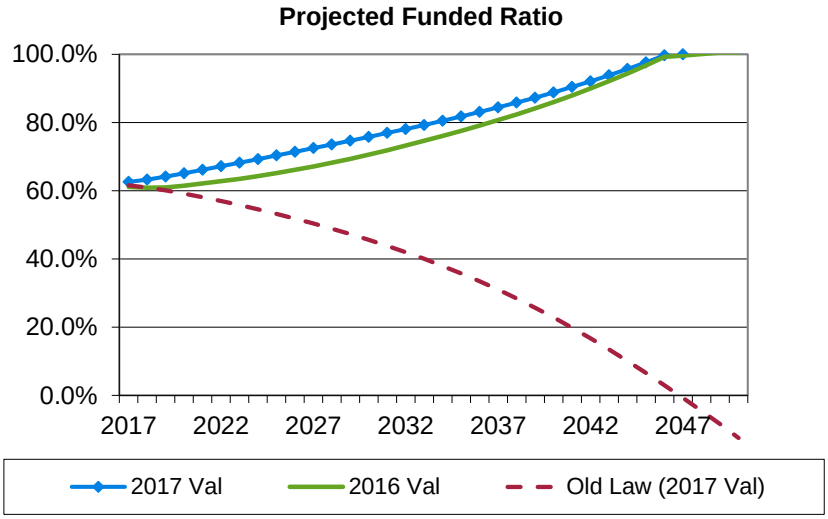
The table below shows the factors that affected the DB Program's Funded Ratio since the last valuation. The increase in the actuarial obligation due to the lower investment return assumption was the most significant factor causing the decrease in the Funded Ratio.

Sources of Change	Funded Ratio
June 30, 2016 Actuarial Valuation	**63.7%**
Expected Year-to-Year Change	0.1%
Recognized Asset Gain/(Loss)	
• From Prior Years	-0.6%
• From Current Year	1.4%
Salary Variation	0.2%
Assumption Change	-2.0%
All Other Sources	-0.2%
Total Change	**-1.1%**
June 30, 2017 Actuarial Valuation	**62.6%**

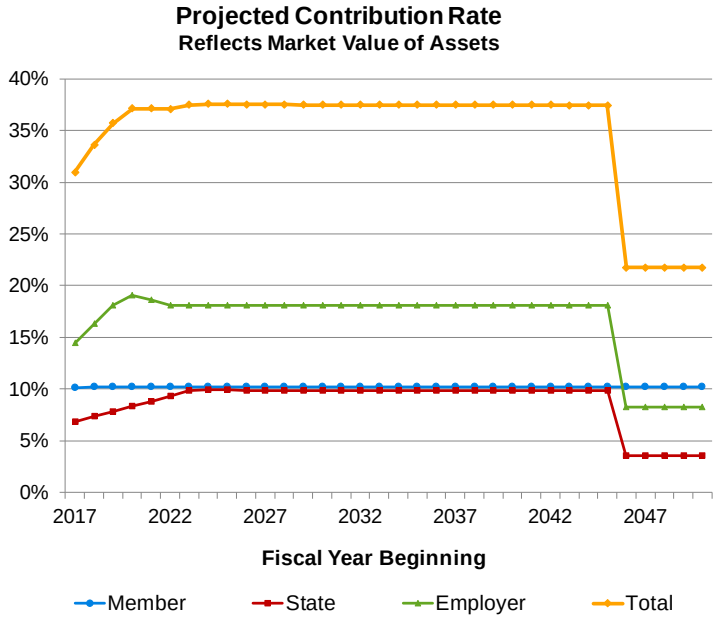
1. The contributions paid in the prior year were not enough to improve the funded ratio. Future projected contribution increases are expected to increase the funded ratio as shown in the graph in the "Looking Ahead" section.

Looking Ahead

The following projection shows the Funded Ratio if the DB Program earns 7.00% in each future year and all other assumptions are met. As shown in the graph, the DB Program is projected to reach approximately 100% funding by 2046 based on the 2017 valuation (blue line). The funded ratio is higher than projected in the 2016 valuation (green line), primarily due to the actual return for the prior year which was greater than assumed. Note that we have also shown a hypothetical projection of the funded status based on the 2017 valuation but without the 2014 funding legislation (red line). See the end of this subsection for a summary of the assumptions on which these projections are based.



The following graph shows the projected contribution rates for each of the stakeholder groups and in total. Note that the actual contribution rates paid in the future will vary based on experience after the valuation date. The contribution rates shown include both the base and supplemental contribution rates, but do not reflect the state contribution to the Supplemental Benefit Maintenance Account (SBMA).



Looking Ahead (continued)

Asset gains and losses will generally have the largest year-to-year impact on the total contribution rates needed, although assumption changes can cause a significant change in years when they occur. Under the legislation, as reflected in the valuation policy, the impact of asset gains and losses will tend to have a much more significant impact on the state contribution rate than the employer contribution rate. Therefore, the state contribution rate will tend to be more volatile than the employer rate, as shown in the following section ("Projections Under Alternate Return Scenarios").

The above projection calculations are based on the following assumptions:

- All experience subsequent to the valuation date is consistent with the valuation assumptions, as described in Appendix B.
- Future changes in the state and employer supplemental contribution rates will be consistent with the board's valuation policy. In particular, the state rate is based on funding the UAO by 2046, a year which is not defined in statute.
- Current deferred asset gains and losses (currently a net deferred gain) are reflected as they are expected to be recognized in the asset smoothing method.
- The projection assumes new members will have the same Normal Cost Rate as the current 2% at 62 members. The emerging Normal Cost Rate for the total plan will gradually decrease over time due to the lower benefits provided for 2% at 62 members.

Projections Under Alternate Return Scenarios

Actuarial valuations are based on a certain set of assumptions. The reality is that these assumptions will not be exactly met and that this will affect future valuation results. Investment returns will likely have the biggest impact on the future funding of CalSTRS. In the following graphs, we show some simple examples of the future variation that may occur on key funding metrics. This is not intended to be a comprehensive analysis of the potential risks to CalSTRS funding, but it will give the board some idea of the sensitivity of funding levels and contribution rates caused by returns that are above or below the assumption.

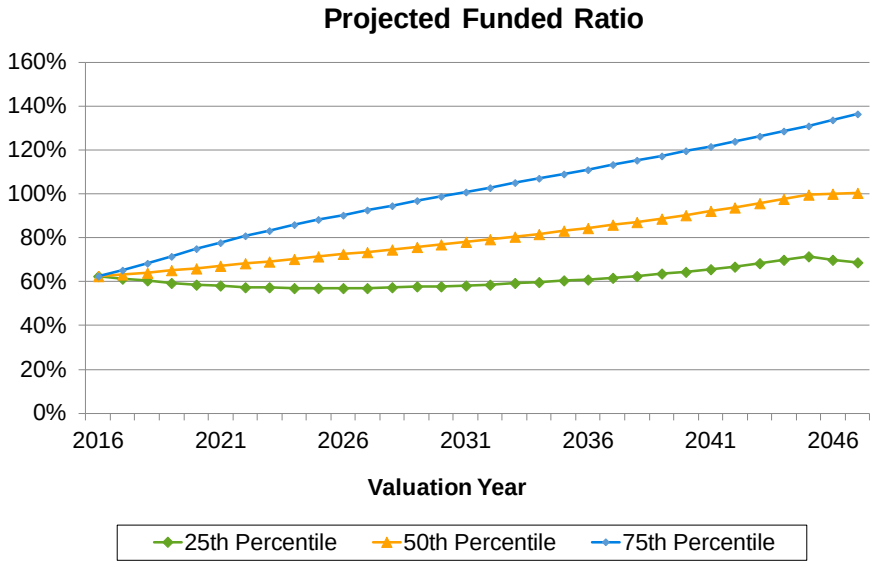
Last fall, CalSTRS internal actuarial staff completed a fairly comprehensive analysis of potential risks ("2017 Review of Funding Level and Risks"). Our understanding is that this analysis will be performed annually, with an update for the 2017 valuation to be presented at the November 2018 board meeting.

To show potential variability of future returns, we have assumed CalSTRS earns the 25th, 50th, and 75th percentile returns over the next 30 years. This assumes a median (50th percentile) geometric return of 7.0% and a standard deviation of 13.0%. The average 30-year returns shown for the 30-year period are approximately 5.5% for the 25th percentile and 8.5% for the 75th percentile.

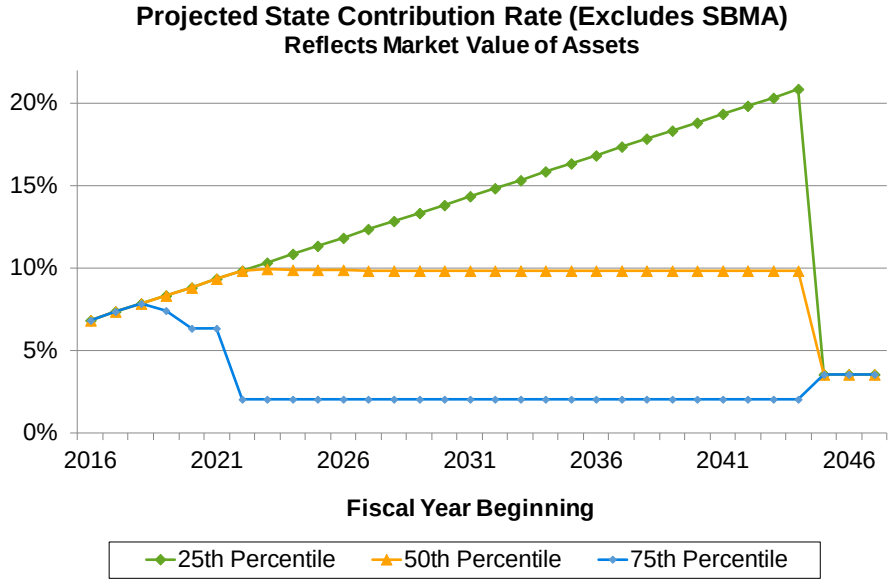
Note that the 25th percentile indicates there is a 25% probability of earning a return lower than 5.5%. This may be different than the way investment professionals use percentiles, but we have used this approach for consistency with the way CalSTRS actuarial staff reports percentiles in their risk report.

Projections Under Alternate Return Scenarios (continued)

The following graph shows the potential impact of alternate returns on CalSTRS funded ratio. The green line (below average returns) illustrates how the caps on contribution rate increases restrict CalSTRS ability to make significant progress toward its funding goal when the funded ratio is low.

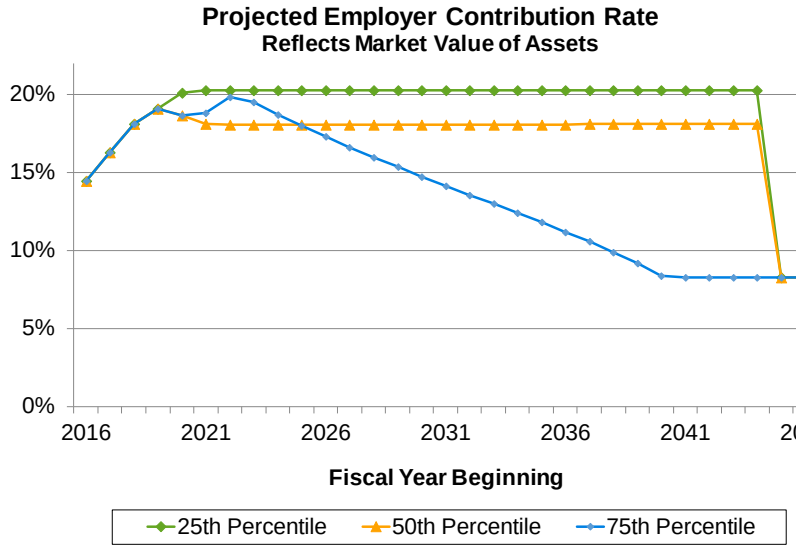


The following graph shows the potential impact of alternate returns on the state contribution rate (excluding contributions to the SBMA). The state's contribution rate is quite sensitive to future returns, although the 0.5% cap on increases prevents large year-over-year increases. It should be noted that minimizing the year-over-year increases defers these costs and ultimately results in a higher ultimate contribution level than if the full increase needed was immediate.



Projections Under Alternate Return Scenarios (continued)

The following graph shows the potential impact of varying returns on the employer contribution rate. The employer contribution rate is not as sensitive to future returns as the state contribution rate, although returns can still have a significant impact. Note that the green line reflects the employers' 12.00% cap on their supplemental contribution rate (20.25% total).



Member rates are not affected by future returns; however, the 2% at 62 member contributions may be affected by changes in the investment return assumption or other assumption changes.

Further Information

Details of our findings are included in later sections of this report. The appendices include supporting documentation on the benefit and eligibility provisions used to project future benefits, the actuarial methods and assumptions used to value the projected benefits, and the underlying census data provided by CalSTRS for this valuation.

Summary of Key Valuation Results

	2017 Valuation (7.00%)	2016 Valuation (7.25%)	Percent Change
1. Total Membership			
A. Active Members	445,935	438,537	1.7 %
B. Inactive Members	192,601	187,722	2.6 %
C. Retired Members and Beneficiaries	294,874	288,195	2.3 %
D. Total Membership	933,410	914,454	2.1 %
2. Payroll as of Valuation Date (All Members)			
A. Annual Total *($Millions)*	$ 31,136	$ 29,826	4.4 %
B. Annual Average Earned Salary per Active Member	$ 69,822	$ 68,013	2.7 %
3. Average Annual Allowance Payable			
A. Service Retirement	$ 47,820	$ 46,608	2.6 %
4. Actuarial Obligation *($Millions)*			
A. Active Members	$ 126,326	$ 116,273	8.6 %
B. Inactive Members	6,006	5,323	12.8 %
C. Retired Members and Beneficiaries	154,304	144,793	6.6 %
D. Existing MPPP Unfunded Obligation	314	315	(0.3) %
E. Total	$ 286,950	$ 266,704	7.6 %
5. Value of System Assets *($Millions)*			
A. Fair Market Value	$ 197,718	$ 177,914	11.1 %
B. Deferred Investment (Gains) or Losses	(3,793)	4,858	
C. Actuarial Value	$ 193,925	$ 182,772	6.1 %
D. Ratio of Actuarial Value to Fair Value	98%	103%	
E. Less SBMA Reserve	(14,236)	(12,796)	11.3 %
F. Net Actuarial Value	$ 179,689	$ 169,976	5.7 %
6. Funded Status -- Actuarial Value Basis			
A. Unfunded Actuarial Obligation *($Millions)*	$ 107,261	$ 96,728	10.9 %
B. Funded Ratio *(5F ÷ 4E)*	62.6%	63.7%	
7. Normal Cost Rates *(percent of salaries)*			
A. CalSTRS 2% at 60 Members	20.566%	19.297%	6.6 %
B. CalSTRS 2% at 62 Members	17.893%	16.723%	7.0 %
C. All Members	20.275%	19.100%	6.2 %
8. Next Fiscal Year Contribution Rates (percent of salaries)			
A. 2% at 60 Members	10.250%	10.250%	- %
B. 2% at 62 Members	10.205%	9.205%	10.9 %
C. State Supplemental Rate	5.311%	4.811%	10.4 %
D. Employer Supplemental Rate	8.030%	6.180%	29.9 %
9. Funded Status -- Market Value Basis			
A. Unfunded Actuarial Obligation *($Millions) [4E - (5A + 5E)]*	$ 103,468	$ 101,586	1.9 %
B. Alternate Funded Ratio (Based on Market Value of Assets)	63.9%	61.9%	

Section 2 Scope of the Report

This report presents the actuarial valuation of the DB Program of the State Teachers' Retirement Plan as of June 30, 2017. A summary of the key results of this valuation is presented in the previous section. The remainder of this report is arranged as follows:

Section 3 describes the benefit obligations of CalSTRS, including the development of the Normal Cost and the Actuarial Obligation.

Section 4 outlines the Fair Market Value of Assets of the DB Program and the determination of the Actuarial Value of Assets as of June 30, 2017. All of the assets of the Program are available to finance future DB Program benefits and expenses, except those allocated for the Supplemental Benefit Maintenance Account (SBMA).

Section 5 shows the relationship between the Actuarial Value of Assets and the Actuarial Obligation, also called the Funded Ratio.

Section 6 discusses the calculations used to determine the state supplemental contribution rate in accordance with EC §22955.1(b). The key elements of this calculation pertain to an evaluation of the assets and obligations associated with the benefits in effect in 1990. An adjustment to the state supplemental rate is calculated based on this valuation and effective with the fiscal year beginning July 1, 2018.

Section 7 discusses the calculations used to determine the employer supplemental contribution rate in accordance with EC §22950.5. The key elements of this calculation are parallel to the funding valuation, except the assets and obligations are those associated with the benefits earned prior to July 1, 2014. Note that the employer supplemental rate is currently based on a fixed schedule of increases. No adjustments to the scheduled rates will be calculated until the 2020 valuation.

Section 8 shows the projected UAO payment schedule and a comparison of the projected contributions and benefit payments for the DB Program.

Scope of the Report (continued)

This report includes several appendices:

Appendix A — A summary of the current benefit structure, as determined by the provisions of governing law on June 30, 2017.

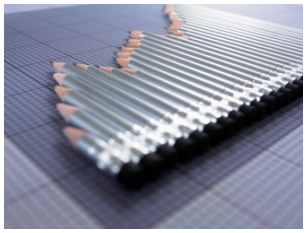
Appendix B — A summary of the actuarial methods and assumptions used to estimate actuarial obligations and the funding sufficiency.

In our opinion, the assumptions used in the valuation are reasonably related to the past experience of the DB Program, are internally consistent, and represent a reasonable estimate of future conditions affecting the DB Program. Nevertheless, the emerging costs of the DB Program will vary from those presented in this report to the extent that actual experience differs from that projected by the actuarial assumptions.

Appendix C — Schedules of valuation data classified by various categories of plan members. We relied upon the membership and beneficiary data supplied by CalSTRS. We compared the data for this and the prior valuation and tested for reasonableness. Based on these tests, we believe the data to be sufficient for the purposes of our calculations.

Appendix D — A glossary of actuarial terms used in this report.

Section 3 Actuarial Obligation



In this section, the discussion will focus on the commitments of CalSTRS for retirement benefits, which are referred to as its actuarial obligation. The actuarial obligation, or liabilities, are compared with the actuarial value of assets. If there is a deficiency, it has to be provided by future contributions, net actuarial gains due to experience more favorable than assumed or, to some extent, net growth in the number of active members. An actuarial valuation method sets out a schedule of future contributions and determines whether they will amortize any deficiency in an orderly fashion.

Normal Cost

The **Normal Cost** represents the cost assigned to an average member for a given year such that it would meet the continuing costs of a particular benefit if contributed each year starting with the date of membership. The Entry Age Actuarial Cost Method is designed to produce a Normal Cost that remains a level percentage of payroll (payroll is calculated as the sum of the expected creditable compensation for the active members), so it is best expressed as a rate. Normal Cost contributions are assumed to be contributed uniformly throughout the year.

The following table shows that the total DB Program Normal Cost Rate has increased from 19.100% to 20.275% since the last valuation. This rate represents a blended average of the Normal Cost Rates for the 2% at 60 and 2% at 62 members. **Table 1** provides more details on the calculation of the Normal Cost and Normal Cost Rate.

($ Millions)	Projected Payroll	Normal Cost	Normal Cost Rate
FYB July 1, 2016	$31,303	$5,979	19.100%
FYB July 1, 2017	$32,670	$6,624	20.275%

In general, the Normal Cost Rate is expected to remain fairly stable as a percentage of payroll as long as the benefit provisions are not amended, the assumptions are not changed, membership experience emerges as assumed, and the demographic characteristics of the membership remain reasonably consistent. CalSTRS can expect modest decreases in the Normal Cost Rate over time due to the change in benefit levels for most members hired in 2013 or later. The reduction in the investment return assumption from 7.25% to 7.00% increased the Normal Cost Rate by 1.277% resulting in the increase between the 2016 and 2017 actuarial valuations.

Primarily because of the different benefit formulas, the CalSTRS 2% at 60 members have different Normal Cost Rates compared to the 2% at 62 members, as illustrated in the following table for the fiscal year beginning July 1, 2017.

($ Millions)	2% at 60 Members	2% at 62 Members	Proportion 2% at 62
Projected Payroll	$28,630	$4,040	12.4%
Normal Cost $	5,901	723	10.9%
Normal Cost Rate	20.566%	17.893%	NA

Normal Cost Rate for CalSTRS 2% at 62 Members

As part of the annual valuation process, we determine the Normal Cost Rate for CalSTRS 2% at 62 members, generally those first hired on or after January 1, 2013. The Normal Cost Rate is used as the basis for setting the base member contribution rate for this group for the following fiscal year, the fiscal year beginning July 1, 2018, for this valuation. Generally, the base member contribution rate is one-half of the Normal Cost Rate within certain parameters.

EC §22901(b)(1) requires the board to adopt the Normal Cost Rate that is used to determine the 2% at 62 member contribution rate. As of June 30, 2017, the Normal Cost Rate for the CalSTRS 2% at 62 members is 17.893%. We recommend the board adopt this rate.

EC §22901(b)(1) specifies that the CalSTRS 2% at 62 base member contribution rate does not change if the increase or decrease in the Normal Cost Rate for members is less than 1% of creditable compensation since the last adjustment. This year, the cumulative change is an increase in the Normal Cost Rate of 1.993%, from 15.900% (the time of the last adjustment) to 17.893% for this group. Therefore, the current base member contribution rate should increase to 9.00% for 2% at 62 members based on the relevant section of the Education Code.

Note that increases under EC §22901.7(b) are added to the base member rate. Therefore, effective July 1, 2018, the total member contribution rate for 2% at 62 members should increase to 10.205% (9.00% plus the 1.205% additional contribution rate rate).

Actuarial Obligation

The next step in the actuarial valuation process is to project all future DB Program benefit payments for current members and retirees. The level of benefits currently being paid is known, but assumptions are needed to estimate how long they will be paid, and the amount and timing of the payment of future benefits for active and inactive members who are not currently receiving payments. The summation of the discounted values of all of the projected benefit payments for all current members at the assumed rate of return is called the **Actuarial Present Value of Projected Benefits**.

Details are shown in **Table 2** and summarized below.

($ Millions)	2017 Valuation (7.00%)	2016 Valuation (7.25%)
Benefits Being Paid	$ 154,304	$ 144,793
Inactive Deferred Benefits	6,006	5,323
Active Member Benefits	201,730	182,901
Existing MPPP Unfunded Obligation	314	315
Present Value of Projected Benefits	$ 362,354	$ 333,332
Present Value of Future Normal Costs	75,404	66,628
Actuarial Obligation	$ 286,950	$ 266,704

Actuarial Obligation (continued)

The **Actuarial Present Value of Future Normal Costs** is the value of all remaining Normal Costs expected to be received over the future working lifetime of current active members. The **Actuarial Obligation** is the difference between the Actuarial Present Value of Projected Benefits and the Actuarial Present Value of Future Normal Costs. The Actuarial Obligation is equal to the assets that would exist if the current Normal Cost Rate had been paid for all members since entry into the Program, and if all experience had emerged as assumed.

Over time, 2% at 62 members will account for a larger portion of the actuarial obligation; however, as of this valuation, only 1.1% of the actuarial obligation for active members is for the 2% at 62 members.

($ Millions)	2% at 60 Members	2% at 62 Members	Proportion 2% at 62
Active PVB	$188,816	$12,914	6.4%
Active PVFNC	63,916	11,488	15.2%
Active AO	$124,900	$1,426	1.1%

Table 1
Normal Cost

($Millions)	2017 (7.00%)	2016 (7.25%)
Estimated Annual Earned Salaries [1]	$31,502	$30,189
Present Value of Future Normal Costs for Current Active Members	$75,404	$66,628
Present Value of Future Earned Salaries for Current Active Members	$377,098	$352,348
Normal Cost		
Retirement	$5,915	$5,326
Disability	263	241
Death	49	46
Refund	160	153
Total Normal Cost	$6,387	$5,766
Normal Cost Rate Percent of Payroll		
Retirement	18.776 %	17.643 %
Disability	0.835	0.798
Death	0.156	0.152
Refund	0.508	0.507
Total Normal Cost	**20.275** %	**19.100** %

1. Annual rate of payroll for active members on the valuation date, excluding active members over age 75 on the valuation date who are assumed to retire immediately and therefore do not generate a Normal Cost. Creditable compensation for new entrants who have only worked a partial year have been annualized.

Table 2
Actuarial Obligation

($ Millions)	2017 (7.00%)	2016 (7.25%)
Present Value of Projected Benefits to All Current Members		
Benefits Currently Being Paid		
Service Retirement	$ 143,042	$ 134,249
Disability	3,803	3,617
Survivors	7,459	6,927
Total	$ 154,304	$ 144,793
Benefits to Inactive Members	6,006	5,323
Benefits to Active Members		
Retirement	$ 194,404	$ 176,300
Disability	5,347	4,801
Death	1,119	1,036
Refund	860	764
Total	$ 201,730	$ 182,901
Existing MPPP Unfunded Obligation	314	315
Total Present Value of Projected Benefits	$ 362,354	$ 333,332
Present Value of Future Normal Costs	75,404	66,628
Actuarial Obligation	**$ 286,950**	**$ 266,704**

This page intentionally left blank.

Section 4 Valuation Assets

In many respects, an actuarial valuation can be thought of as an inventory process. The inventory is taken as of the actuarial valuation date which, for this valuation, is June 30, 2017. On that date, the assets available for the payment of retirement benefits are appraised.

The next step in the valuation process is to calculate the **Actuarial Value of Assets** that will be used to determine the funding status of the Program. As shown in **Table 3**, the Fair Market Value of assets was reported as $197,718 million as of June 30, 2017, up from $177,914 million as of June 30, 2016. **Table 4** shows the asset changes for the period.

Valuation Assets

Because the underlying calculations in the actuarial valuation are long term in nature, it may be advantageous to use an asset smoothing method to lessen the impact of short-term fluctuations in the value of assets. This is particularly true given that the supplemental state and employer contribution rates are determined based on the applicable funded status.

The asset smoothing method utilized in the valuation uses a projection of the expected Actuarial Value of Assets from the Actuarial Value of Assets as of the previous year based on the assumed rate of investment return. The projection then recognizes one-third of the difference between the expected value and the Fair Market Value to arrive at the Actuarial Value of Assets. The calculation of the Actuarial Value of Assets is shown in **Table 5** and the result is shown below.

($ Millions)	2017 Valuation	2016 Valuation
Fair Market Value	$ 197,718	$ 177,914
Actuarial Value of Assets	193,925	182,772
Deferred Investment Gains or (Losses)	$ 3,793	$ (4,858)
Ratio of AVA to FMV	98%	103%

Due to the asset smoothing method, there are investment gains of $3,793 million that have not yet been recognized (the difference between the Actuarial and Fair Market Value of Assets). Absent investment returns in future years less than the assumed rate to offset the deferred investment gains, the current deferred gains will gradually be reflected in the Actuarial Value of Assets.

If the future returns on the Fair Market Value of Assets are 7.00% each year, then as the current deferred gains flow through the smoothing method and are recognized, future valuations will show an actuarial gain. The result will be a gradual increase in the DB Program's funded status, ultimately decreasing the UAO by the $3,793 million of currently deferred investment gains.

Table 6 shows a history of the Actuarial Value of Assets compared to the Fair Market Value of Assets.

Table 3
Statement of Program Assets

($ Millions)	June 30, 2017	June 30, 2016
Invested Assets		
Cash	$ 688	$ 384
Debt Securities	38,856	37,487
Equity Securities	106,402	93,805
Alternative Investments	52,830	47,177
Derivative Instruments	-	1
Total Investments	$ 198,776	$ 178,854
Receivables	5,928	4,101
Liabilities Net of Securities Lending Collateral	(7,057)	(5,049)
Net Deferred (Inflows) and Outflows	71	8
Fair Market Value of Net Assets	**$ 197,718**	**$ 177,914**

Table 4
Statement of Changes in Program Assets

($ Millions)	June 30, 2017	June 30, 2016
Contributions		
Members	$ 3,300	$ 2,824
Employers	4,021	3,248
State of California	2,478	1,940
Total Contributions	9,799	8,012
Benefits and Expenses		
Retirement, Death and Survivors	(13,226)	(12,546)
Refunds of Member Contributions	(88)	(62)
Purchasing Power Benefits	(161)	(172)
Administrative & Other Expenses	(180)	(183)
Total Benefits and Expenses	(13,655)	(12,963)
Net Cash Flow	**$ (3,856)**	**$ (4,951)**
Investment Income		
Realized Income	$ 4,951	$ 4,649
Net Appreciation	18,912	(2,253)
Net Securities Lending Income	98	89
Investment Expenses	(373)	(294)
Other (Expense) Income	72	41
Net Investment Return	23,660	2,232
Net Increase (Decrease)	**$ 19,804**	**$ (2,719)**
Fair Market Value of Net Assets		
Beginning of Year	177,914	180,633
End of Year	**$ 197,718**	**$ 177,914**
Estimated Net Rate of Return [1]	13.4%	1.3%

1. Estimated return on a Fair-Market-Value basis, net of all investment expenses, gross of administrative expenses, and assuming uniform cash flow throughout the year. This number may differ from the money-weighted return reported by CalSTRS.

Table 5
Actuarial Value of Assets

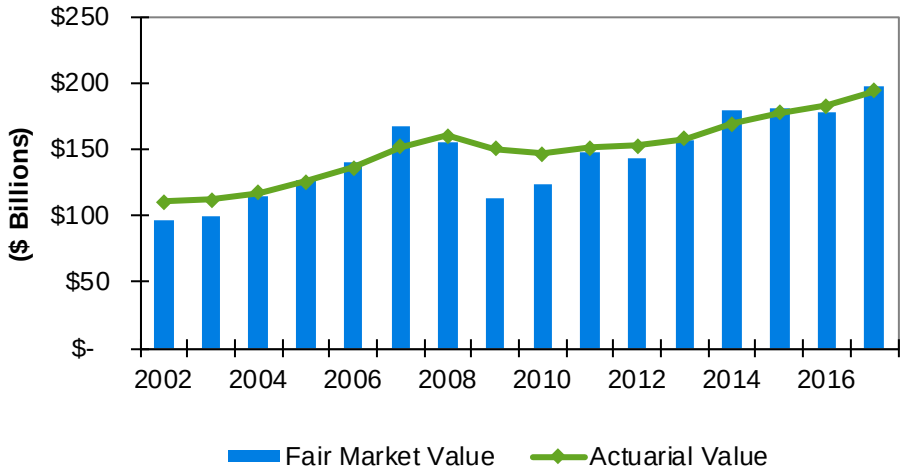
($ Millions)	June 30, 2017	June 30, 2016
Actuarial Value at Beginning of Year	$ 182,772	$ 177,059
Contributions	9,799	8,012
Benefits and Expenses	(13,655)	(12,963)
Expected Return at 7.25% / 7.50%	13,112	13,093
Expected Actuarial Value End of of Year	$ 192,028	$ 185,201
Fair Market Value	197,718	177,914
Difference between Fair Market Value and Expected Actuarial Value	$ 5,690	$ (7,287)
Recognition Factor	One-third	One-third
Recognized Gain or Loss	$ 1,897	$ (2,429)
Actuarial Value at End of of Year	**$ 193,925**	**$ 182,772**
Deferred Investment Gains or (Losses)	$ 3,793	$ (4,858)
Ratio of Actuarial Value of Assets to Fair Market Value of Assets	98.082%	102.731%
Estimated Net Rate of Return [(1)]	8.3%	6.1%

1. Estimated return on an Actuarial-Value basis, net of all investment expenses, gross of administrative expenses, and assuming uniform cash flow throughout the year.

Table 6
History of Actuarial Value of Assets

($ Millions) June 30	Fair Market Value	Estimated Return [1]	Actuarial Value	Ratio of Actuarial to Market
2001	$ 102,915	(9.1) %	$ 108,571	105%
2002	96,028	(6.1)	109,755	114
2003	99,031	3.8	111,604	113
2004	113,815	16.6	117,206	103
2005	126,447	12.3	125,665	99
2006	140,192	12.5	135,832	97
2007	166,903	20.9	151,827	91
2008	155,763	(5.5)	159,785	103
2009	113,192	(25.4)	150,445	133
2010	123,242	12.9	146,404	119
2011	147,140	23.6	151,030	103
2012	143,118	0.6	152,515	107
2013	157,176	13.9	157,883	100
2014	179,479	18.6	168,838	94
2015	180,633	3.9	177,059	98
2016	177,914	1.3	182,772	103
2017	197,718	13.4	193,925	98

1. Estimated return on a Fair-Market-Value basis, net of all investment expenses, gross of administrative expenses, and assuming uniform cash flow throughout the year, reported on a dollar-weighted basis.



This page intentionally left blank.

Section 5 Funded Status

The **Unfunded Actuarial Obligation** (UAO) is the excess of the Actuarial Obligation over the Actuarial Value of Assets, which represents a liability that must be funded over time. Contributions in excess of the Normal Cost are used to amortize the UAO. An **Actuarial Surplus** exists if the Actuarial Value of Assets exceeds the Actuarial Obligation.

The **Funded Ratio** is equal to the Actuarial Value of Assets divided by the Actuarial Obligation. A Funded Ratio of 100% means the Value of Assets equals the Actuarial Obligation, and the DB Program could be financed by contributions equal to the Normal Cost, if all future experience emerged as assumed. The Funded Ratio is shown below and in **Table 7**.

($ Millions)	2017 Valuation (7.00%)	2016 Valuation (7.25%)
Actuarial Obligation	$ 286,950	$ 266,704
Actuarial Value of Assets (AVA)		
From Table 5	$ 193,925	$ 182,772
Less SBMA Reserve	(14,236)	(12,796)
Net for Funding	179,689	169,976
Unfunded Actuarial Obligation	$ 107,261	$ 96,728
Funded Ratio (on AVA)	**62.6%**	**63.7%**
Alternate Funded Ratio (based on Fair Market Value)	*63.9%*	*61.9%*

The Funded Ratio decreased by 1.1% during the past year and has decreased by approximately 25% over the past 10 years. Increases in the Actuarial Obligation due to the investment return assumption change was the primary cause of the decrease in the funded ratio from last year. The longer-term decrease has been primarily due to a combination of returns over the last 10 years that have been less than the actuarial assumption and changes in the actuarial assumptions that have increased the actuarial obligation. The Alternate Funded Ratio using the Fair Market Value of assets has increased since the last valuation. This increase is due to the greater than expected return on assets during the 2016-2017 year.

Future benefits provided through the Supplemental Benefits Maintenance Account (SBMA) are not part of the projected benefits included in this valuation. Therefore, the SBMA Reserve is subtracted from the DB Program assets to arrive at the value available to support the benefits included in this valuation.

In addition, the Teachers' Retirement Board has established a policy of allocating funds for future costs associated with the Teachers' Health Benefits Fund (THBF). This policy was revised in April of 2009 to make a one-time credit to the THBF and "true up" the future MPPP obligations (payable from the THBF) in the funding of the DB Program. As of June 30, 2017, only a relatively small amount of less than $0.1 million resides in the THBF, while the remaining unfunded amount of $314 million is added to the DB Program obligation.

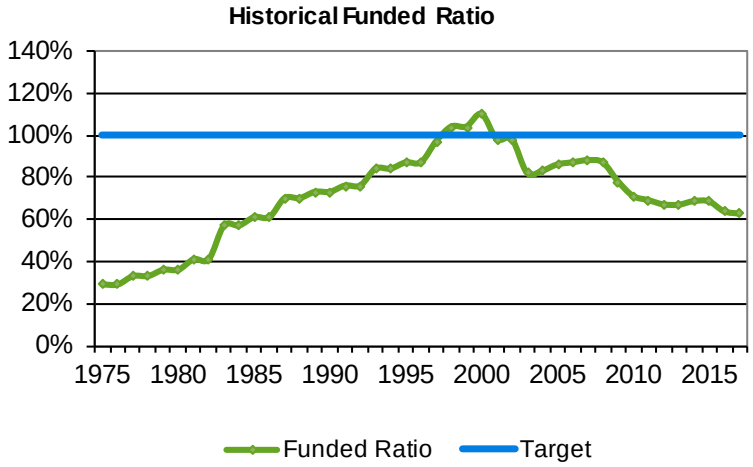
Funded Status (continued)

The following table shows a history of the Funded Status of the DB Program.

($ Millions) Year	Actuarial Obligation	Actuarial Value of Assets	Unfunded Actuarial Obligation	Funded Ratio
1975	**$ 12,834**	**$ 3,775**	**$ 9,059**	**29%**
1977	15,203	5,019	10,184	33%
1979	17,971	6,488	11,483	36%
1981	22,545	9,345	13,200	41%
1983	26,553	15,023	11,530	57%
1985	**28,401**	**17,457**	**10,944**	**61%**
1987	34,637	24,401	10,236	70%
1989	40,266	29,327	10,939	73%
1991	47,100	36,001	11,099	76%
1993	53,581	45,212	8,369	84%
1995	**63,391**	**55,207**	**8,184**	**87%**
1997	69,852	67,980	1,872	97%
1998	74,234	77,290	(3,056)	104%
1999	86,349	90,001	(3,652)	104%
2000	93,124	102,225	(9,101)	110%
2001	109,881	107,654	2,227	98%
2003	131,777	108,667	23,110	82%
2004	138,254	114,094	24,160	83%
2005	**142,193**	**121,882**	**20,311**	**86%**
2006	150,872	131,237	19,635	87%
2007	167,129	146,419	20,710	88%
2008	177,734	155,215	22,519	87%
2009	185,683	145,142	40,541	78%
2010	196,315	140,291	56,024	71%
2011	208,405	143,930	64,475	69%
2012	215,189	144,232	70,957	67%
2013	222,281	148,614	73,667	67%
2014	231,213	158,495	72,718	69%
2015	**241,753**	**165,553**	**76,200**	**69%**
2016	266,704	169,976	96,728	64%
2017	286,950	179,689	107,261	63%

Funded Status (continued)

The historical Funded Ratios are shown on the following graph. In years in which a valuation was not performed, the Funded Ratio from the previous year is used.



Actuarial Gains and Losses

Comparing the UAO as of two valuation dates does not provide enough information to determine whether there were actuarial gains or losses. The correct comparison is between the UAO on the valuation date and the Expected UAO projected from the prior valuation date using the actuarial assumptions in effect since the previous valuation.

The actuarial gains and losses since the last report are summarized in the following tables and shown in **Table 8**.

($ Millions)	Expected Results	Actual Results	(Gain) or Loss
Actuarial Obligation	$ 279,021	$ 286,950	$ 7,929
Act. Value of Assets	177,767	179,689	(1,922)
Unfunded Act. Oblig.	$ 101,254	$ 107,261	$ 6,007
Actuarial (Gains) or Losses by Source			
Change in actuarial assumptions			$ 8,706
Salaries increased less than assumed			(872)
All other non-investment sources			95
Loss on the Actuarial Obligation			$ 7,929
Investment Return on Actuarial Value of Assets			(1,709)
Contributions (in excess of) or less than assumed			(213)
(Gain) on the Actuarial Value of Assets			$ (1,922)
Total Actuarial Loss			$ 6,007

Actuarial Gains and Losses (continued)

($ Millions) Actuarial (Gains) or Losses on the Actuarial Obligation	(Gain) or Loss	Percent of Actuarial Obligation
Change in actuarial assumptions	$ 8,706	3.0%
Salaries increased less than assumed	(872)	(0.3)
All other non-investment sources	95	0.0
(Gain) or Loss on the Actuarial Obligation	$ 7,929	2.7%

Actuarial (Gains) or Losses on the Actuarial Value of Assets	(Gain) or Loss	Percent of AVA
Return on Actuarial Value of Assets	$ (1,709)	(1.0)%
Contributions (greater)/less than assumed	(213)	(0.1)
(Gain) or Loss on the Actuarial Value of Assets	$ (1,922)	(1.1)%

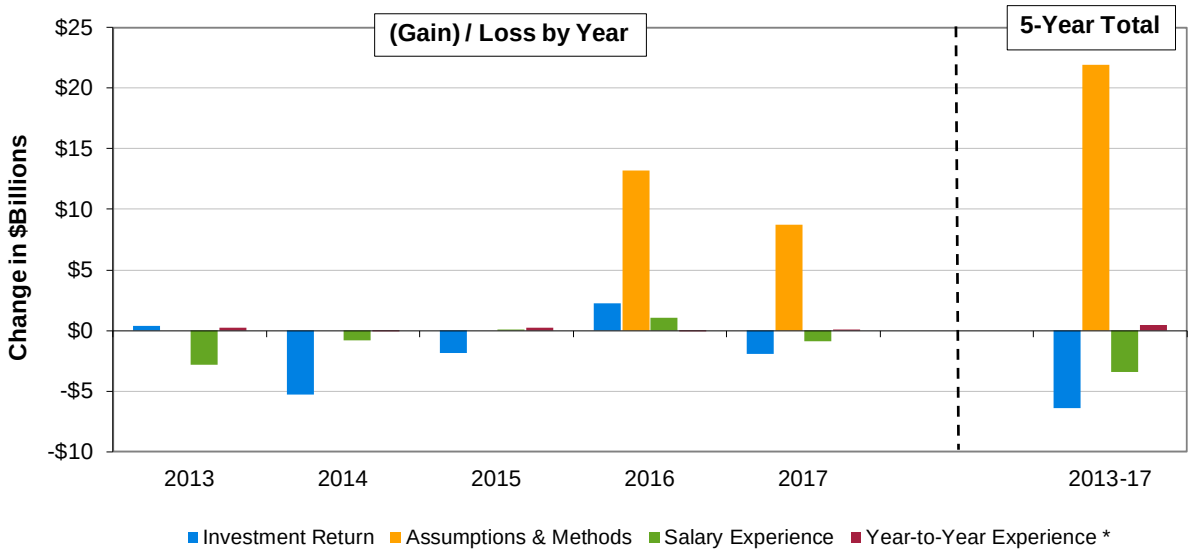
These net gains and losses are within a reasonable range for variances in a single year given the newly adopted investment return assumption.

Based on the 2016 Actuarial Valuation, the UAO was expected to increase to $101,254 million. The actual UAO of $107,261 million represents a net actuarial loss of $6,007 million.

- The change in investment return assumption from 7.25% to 7.00% caused the Actuarial Obligation to increase by $8,706 million.
- Salaries increased less than projected by the current actuarial assumptions, causing the Actuarial Obligation to decrease by $872 million from the expected amount. We expect to continue to see salary increase fluctuations from year to year.
- All other non-investment experience represents only a relatively small portion of the expected Actuarial Obligation. These relatively minor net gains and losses indicate that the census is reasonably consistent from the prior period, and the actual experience tracked closely overall with the actuarial assumptions (exclusive of the asset return and the salary increase).
- On the asset side, there was an asset gain based on both the actuarial value of assets and the Market Value of Assets, as the investment return on the Fair Market Value of Assets was greater than the prior valuation's 7.25% assumption. The return on market value was estimated at 13.4%, while the return on the Actuarial Value of Assets was less (estimated at 8.3%) due to the smoothing of the current year gain and the recognition of a portion of prior deferred investment losses.

Actuarial Gain and Loss History

To get an idea of the overall trend of gains and losses, we have analyzed actuarial gains and losses since 2013. The following graph shows how actuarial losses and changes in assumptions have increased the UAO over the last five years. It also shows the actuarial gains that have reduced the UAO.



** Year-to-Year Experience includes changes due to Termination, Retirement, Mortality and Other Experience.*

Over the last five years, assumptions changes have increased the UAO by over $20 billion. During that period, investment returns that have generally exceeded the assumed return and salary increases that have generally been less than assumed have caused decreases in the UAO, partially offsetting the increase due to assumptions. All other experience has had a relatively small impact.

Note that the UAO has increased by approximately $35 billion over the last 5 years. This compares to the actuarial gains and losses described above which account for approximately $15 billion of the increase in UAO. The remaining $20 billion increase is due to contributions received by CalSTRS under the prior law. These contributions were insufficient to cover the interest on the UAO resulting in an increase in the UAO. Under the new funding law, the contributions are projected to eventually cover the interest on the UAO and reduce the principal, but it will still take a number of years due to the graded increases in the state and employer contribution rates. Based on the baseline projections included in this report, the UAO is projected to start declining in 2027 and be lower than the current value by the year 2034.

Volatility Ratios

As a retirement system becomes more mature (i.e., a greater percentage of the obligation is attributable to benefits already earned), it tends to be subject to increased volatility in the contributions needed. Specifically, for CalSTRS, there may be significant fluctuations in the state contribution rates (and to a lesser extent the employer contribution rates) from year to year due to the actual investment return.

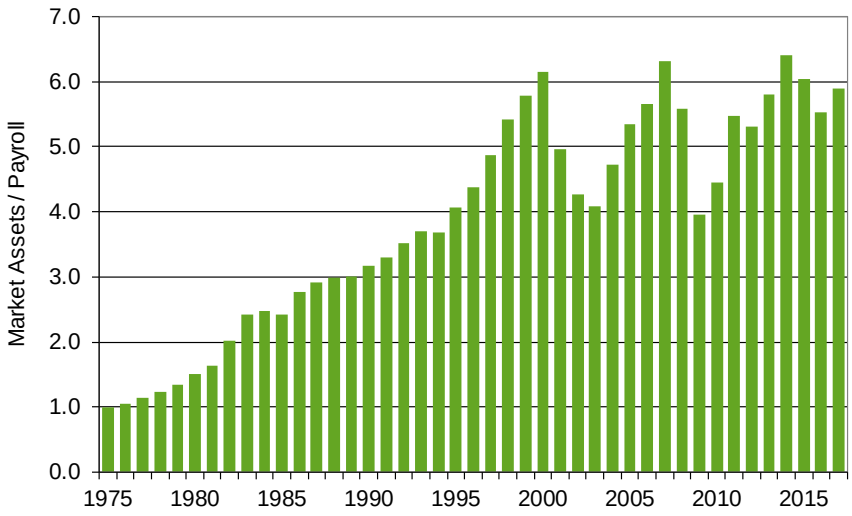
Volatility Ratios (continued)

One indicator of this potential volatility is the Asset Volatility Ratio (AVR), which is equal to the Fair Market Value of Assets divided by total payroll. Plans with a high Asset Volatility Ratio will be subject to a greater level of contribution volatility. The AVR is a current measure since it is based on the current level of assets and will vary from year to year.

For CalSTRS, the current AVR is equal to 5.9, which is typical for a mature system. This means that for each 1% asset loss (in relation to the assumed investment return), there will need to be an increase in contributions equivalent to 5.9% of one-year's payroll. Since CalSTRS is currently targeting a funding period of 28 years (the years from the next valuation date to June 30, 2046), the increase (or decrease) in the state and employer contribution rates will be spread out over 28 years, resulting in approximately a 0.32% of payroll increase (or decrease) in the total contribution rate needed for each 1% asset loss (gain). An asset loss (or gain) will primarily cause a contribution rate increase (or decrease) for the state and have a much smaller impact on the employer contribution rate.

The following graph shows how the System matured during the last 25 years of the 20th Century, as represented by the increasing AVR. Over the last decade and a half, increases in the AVR have somewhat leveled off although there continues to be year-to-year variance.

Historical Asset Volatility Ratio



Another measure of a system's maturity is the Liability Volatility Ratio (LVR), which is equal to the Actuarial Obligation divided by the total payroll. This ratio provides an indication of the longer-term potential for contribution volatility for any given level of investment volatility. In addition, this ratio provides an indication of the potential contribution volatility due to liability experience (gains and losses) and liability re-measurements (assumption changes). For CalSTRS, the current LVR is 9.2%. Ultimately, the LVR and AVR should be equal if CalSTRS achieves 100% funding in the future.

Volatility Ratios (continued)

The following graph shows the historical LVR. It is a similar pattern to the Asset Volatility Ratio except the increase is more gradual and the year-to-year variance is significantly less.

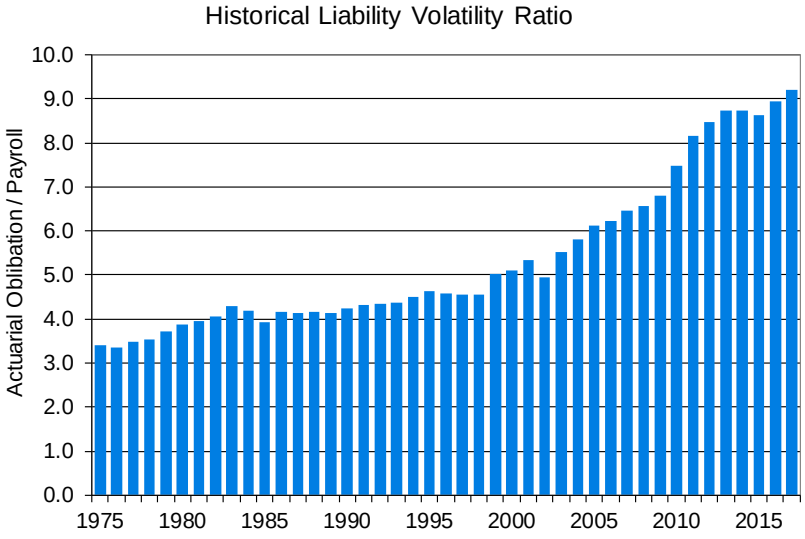


Table 7
Funded Status

($ Millions)	2017 (7.00%)	2016 (7.25%)
Actuarial Obligation *(Table 2)*	$286,950	$266,704
Actuarial Value of Assets		
Calculated *(Table 5)*	$ 193,925	$ 182,772
Less SBMA Reserve	(14,236)	(12,796)
Program Assets	$ 179,689	$ 169,976
Unfunded Actuarial Obligation	**$ 107,261**	**$ 96,728**
Funded Ratio	**62.6%**	**63.7%**

Table 8
Actuarial Gains and Losses

($ Millions)	Expected	Actual	(Gain) / Loss
Actuarial Obligation			
Actuarial Obligation June 30, 2016	$266,704		
Normal Cost for 2016-2017	6,312		
Benefits Paid (Excludes Purchasing Power)	(13,314)		
Expected Interest at 7.25%	19,319		
Actuarial Obligation June 30, 2017	**$279,021**	**$286,950**	**$ 7,929**
By Source:			
Change in actuarial assumptions			*8,706*
Retiree Mortality			*(246)*
Active Member Mortality			*(14)*
Service Retirements			*(9)*
Disability Retirement			*63*
Other Terminations of Employment			*271*
Salary increases more / (less) than assumed			*(872)*
All Other Non-investment Sources			*30*
Total (Gain) Loss on the Actuarial Obligation			*$ 7,929*
Actuarial Value of Assets			
Actuarial Value of Assets June 30, 2016	$169,976		
Expected Contributions for 2016-2017	8,940		
Benefits Paid (Excludes Purchasing Power)	(13,314)		
Expected Interest at 7.25% on AVA	12,165		
Actuarial Value of Assets June 30, 2017	**$177,767**	**$179,689**	**$ (1,922)**
By Source: Investment Return on Actuarial Value of Assets (including the recognition of prior deferred investment gains and losses)			*$ (1,709)*
Contributions (in excess of) or less than assumed (including service purchases)			*(213)*
Total (Gain) Loss on the Actuarial Value of Assets			*$ (1,922)*
Unfunded Actuarial Obligation	**$101,254**	**$107,261**	**$ 6,007**

This page intentionally left blank.

Section 6 State Supplemental Contribution Rate

Under EC §22955.1(b), scheduled increases in the state contribution rate were required through June 30, 2017, with subsequent adjustments to the contribution rate based on actuarial funding. We will refer to this contribution as the state supplemental contribution. Note that for the state, the payroll is the second prior fiscal year payroll, so contributions made in fiscal year 2018-2019 will be based on the covered member compensation for fiscal year 2016-2017. The state supplemental rate is in addition to the base state contribution under EC §22955.1(a) of 2.017% of payroll and contributions to fund the SBMA under EC §22954.

Effective July 1, 2017, the board shall increase or decrease the state supplemental contribution rate (within certain parameters) to reflect the contribution required to eliminate the remaining UAO associated with the 1990 benefit and contribution rate structure. This will be referred to as the 1990 UAO. State supplemental contributions are included as part of the 1990 UAO. Although not specified in the law, the board's valuation policy calls for the state supplemental contribution rate to be calculated to amortize the UAO by June 30, 2046.

Changes in the state supplemental contribution are determined annually beginning with the 2016 valuation and subject to the following conditions:

- The state supplemental contribution rate cannot increase by more than 0.5% of payroll over the prior year supplemental rate. There is no limit on decreases, except for the 4.311% floor discussed below.
- In any year when there is no UAO for the 1990 Benefit Structure, the supplemental contribution shall be reduced to zero.
- The state supplemental contribution rate shall not be reduced below 4.311% if a UAO for the 1990 Benefit Structure exists.

The state is contributing at 4.811% of pay for the current fiscal year ending June 30, 2018. We are recommending this be increased to 5.311% for the next fiscal year as discussed in this section.

1990 Unfunded Actuarial Obligation

The 1990 Actuarial Obligation for the DB Program is calculated using the benefit provisions in place during 1990. CalSTRS provides us with supplementary information on the census data for this determination. The process has limitations since we do not know, for example, whether members would have retired earlier or later if the post-1990 benefit enhancements had not been enacted. However, we believe it is a reasonable process to estimate what the Actuarial Obligation would be if only the 1990 benefits were currently in place.

There were no benefit improvements enacted between 1990 and 1998 that had a material cost. All benefit enhancements enacted with effective dates from July 1, 1990 to December 31, 1998 have been presumed to be cost-neutral. Due to the enhanced retirement benefits enacted since 1990, a separate set of retirement probabilities is used to evaluate the 1990 Benefit Structure.

1990 Unfunded Actuarial Obligation (continued)

The Actuarial Obligation related to the 1990 Benefit Structure is $234.6 billion. This compares to the Actuarial Obligation for the DB Program of $286.9 billion.

($ Millions)	2017 Valuation (7.00%)	2016 Valuation (7.25%)
Actuarial Obligation -- 1990 Benefit Structure		
Value of Projected Benefits	$ 300,895	$ 276,120
Value of Future Normal Costs	66,249	58,082
Actuarial Obligation	$ 234,646	$ 218,038

To estimate the portion of the Actuarial Value of Assets associated with the 1990 Actuarial Obligation, the current Actuarial Value of Assets for the DB Program are adjusted for 1) contributions started after September 30, 1998 (excluding the state supplemental contributions under 22955.1(b)) as detailed below, and 2) additional benefits that have been paid over time due to the post-1990 benefit increases. Limitations exist with this approach since precise data regarding the portion or the timing of benefit payments that would be attributable to only the 1990 benefit structure is unknown.

The most significant adjustments to the assets are:

- Eliminating contributions in excess of 16.00% (except for the state supplemental contributions),
- Adding back the member contributions that were directed to the DBS Program,
- Adding back the post-1990 benefit enhancements that have been paid, and
- Adjusting for actual investment return.

See **Table 9** for the details of the asset adjustment.

($ Millions)	2017 Valuation (7.00%)	2016 Valuation (7.25%)
Asset Adjustment -- 1990 Benefit Structure		
Actuarial Value for DB Program	$ 179,689	$ 169,976
Adjustments per Table 9	19,616	18,730
Actuarial Value of Assets	$ 199,305	$ 188,706

For purposes of testing the funding sufficiency of the 1990 Benefit Structure, note that we did not reserve the board's allocation of assets for future THBF costs because it was established subsequent to 1990.

1990 Unfunded Actuarial Obligation (continued)

The following table summarizes the Funded Status of the 1990 Benefit Structure as detailed in **Table 10**. The 1990 Benefit Structure has an actuarial deficit equal to the UAO of $35.3 billion.

($ Millions)	2017 Valuation (7.00%)	2016 Valuation (7.25%)
Funded Status -- 1990 Benefit Structure		
Actuarial Obligation	$ 234,646	$ 218,038
Actuarial Value of Assets	199,305	188,706
Unfunded Actuarial Obligation	$ 35,341	$ 29,332
Funded Ratio	84.9%	86.5%

State Supplemental Contributions

The statute calls for an adjustment to the state supplemental contribution to amortize the 1990 UAO effective with the 2016 and later actuarial valuations. An increase in the state supplemental contribution rate is needed effective July 1, 2018.

As shown in **Table 10**, a supplemental contribution rate of 8.213% of payroll is needed to amortize the 1990 UAO by June 30, 2046 based on the board's current valuation policy. This is based on an unconstrained increase of about 3.4% of payroll from the current supplemental rate of 4.811%. However, increases in the state contribution rate are limited to 0.5%. Therefore, the state supplemental contribution rate for the fiscal year beginning July 1, 2018 should be 5.311% under EC §22955.1(b). Note that the 8.213% is based on the Actuarial Value of Assets, so it does not reflect the future recognition of currently deferred asset gains and losses, and therefore differs from the projection shown in the "Looking Ahead" subsection of Section 1.

The funded status of the 1990 Benefit Structure in future years is difficult to forecast because the Actuarial Value of Assets for the 1990 Benefit Structure includes adjustments for contributions and benefits paid in excess of those that were in place in 1990. The benefits paid may also vary considerably depending on demographic experience.

Actuarial Gains and Losses

Similar to the total DB Program, we perform a comparison for the 1990 Benefit Structure between the UAO on the valuation date and the Expected UAO projected from the prior valuation date using the actuarial assumptions in effect since the previous valuation.

The actuarial gains and losses since the last report for the 1990 Benefit Structure are summarized in the following table. Note that projected payroll used in the 1990 Actuarial Obligation is fractionally different than in the calculation of the total Actuarial Obligation because the retirement assumption used in the calculations differ.

($ Millions)	Expected Results	Actual Results	(Gain) or Loss
Actuarial Obligation	$ 227,986	$ 234,646	$ 6,660
Act. Value of Assets	197,292	199,305	(2,013)
Unfunded Act. Oblig.	$ 30,694	$ 35,341	$ 4,647
Actuarial (Gains) or Losses by Source			
Change in actuarial assumptions			$ 7,146
Salaries increased less than assumed			(692)
All other non-investment sources			206
Loss on the Actuarial Obligation			$ 6,660
Investment Return on Actuarial Value of Assets			(1,999)
Contributions (in excess of) or less than assumed			(14)
(Gain) on the Actuarial Value of Assets			$ (2,013)
Total Actuarial Loss			$ 4,647

Table 9
Asset Adjustment for 1990 Benefit Structure

($ Millions)	2017	2016
Assets Adjustment due for 1990 Structure Changes		
Allocated Market Value at Beginning of Year	$18,232	$17,663
Contributions During the Year		
EC §22901.7 at 2.250% (or 1.205%) / 1.20% (or 0.560%) of Earned Salaries	(684)	(348)
EC §22950.5 at 4.330% / 2.480% of Earned Salaries	(1,384)	(748)
EC §22951 at 0.250% of Earned Salaries	(80)	(75)
EC §22955 at 2.017% of second preceding fiscal year Earned Salaries	(581)	(548)
THBF costs reallocated to DB Program	29	30
Total Adjustment to Contributions[1]	(2,700)	(1,689)
Benefits Paid During the Year		
Post-1990 Benefits Paid During the Year	2,077	2,046
Post-1990 Refunds of supplemental member contributions	3	1
Prior 2% DBS redirection contributions refunded	(10)	(11)
Total Adjustment to Benefits Paid [1]	2,070	2,036
Estimated Investment Earnings for the Year [2]	2,398	222
Total Allocated Market Value at End of Year	**$20,000**	**$18,232**
Ratio of Actuarial Value to Market Value [3]	98.082%	102.731%
Asset Adjustment (Actuarial Value of Assets)	**$19,616**	**$18,730**

1. May not add exactly, due to rounding.

2. Based on Fair Market Value and uniform cash flow for contributions, benefits and expenses. The rates of return used in these calculations were 1.25% for 2015-2016 and 13.44% for 2016-2017.

3. Developed from Table 5.

Table 10
Funded Status and Supplemental Contribution Rate for 1990 Benefit Structure

($ Millions)	2017	2016
Actuarial Obligation		
Present Value of Projected Benefits		
Benefits Currently Being Paid	$ 128,651	$ 120,901
Benefits to Inactive Members	5,808	5,152
Benefits to Active Members	166,436	150,067
Total	$ 300,895	$ 276,120
Present Value of Future Normal Costs	(66,249)	(58,082)
Actuarial Obligation	$ 234,646	$ 218,038
Actuarial Value of Assets		
Actuarial Value of Assets *(Table 7)*	$ 179,689	$ 169,976
Plus, 1990 Asset Adjustment (Table 9)	19,616	18,730
Theoretical AVA for 1990 Benefits	$199,305	$188,706
Funded Status		
Actuarial Obligation	$ 234,646	$ 218,038
Actuarial Value of Assets	199,305	188,706
Unfunded Actuarial Obligation (Surplus)	$35,341	$29,332
Funded Ratio	84.9%	86.5%
Amortization Sufficiency Under Current Contribution Schedule		
Revenue for 1990 Benefits	16.000%	16.000%
Normal Cost Rate for 1990 Benefits	(17.615)	(16.303)
Equivalent Normal Cost Surplus / (Deficit) Express as Percent of Employer Payroll	(1.615%)	(0.303%)
Equivalent Normal Cost Surplus / (Deficit) Express as Percent of State Payroll	(1.726%)	(0.325%)
Level Equivalent Additional Revenue Under EC 22955.1(b)	4.811	4.311
Revenue Available for Amortization	3.085%	3.986%
Revenue Needed for Amortization	6.487	5.645
Revenue Surplus / (Deficit)	(3.402%)	(1.659%)
Amortization Status under current contribution rate	Contribution Intreases Needed	Contribution Intreases Needed
Contribution Rate for Amortization of 1990 UAO without Statutory Limits		
Current EC 22955.1(b) Contribution Rate	4.811%	4.311%
Increase / (Decrease) in State Contribution Rate for Next Fiscal Year	3.402	1.659
Unconstrained Contribution Rate for Next FY	8.213%	5.970%
Contribution Rate for Amortization of 1990 UAO with Statutory Limits		
Current EC 22955.1(b) Contribution Rate	4.811%	4.311%
Increase / (Decrease) in State Contribution Rate for Next Fiscal Year (Increase capped at 0.5%)	0.500	0.500
EC 22955.1(b) Contribution Rate for Next FY	**5.311%**	**4.811%**

Section 7 Employer Supplemental Contribution Rate

Under EC §22950.5, increases in the employer contribution rate are required, reaching an ultimate increase of 10.85% of payroll as of July 1, 2020. We will refer to this contribution as the employer supplemental contribution. The employer supplemental rate is in addition to the base employer contribution under EC §22950 and 22951 of 8.25% of payroll.

Effective July 1, 2021, the board shall increase or decrease the employer supplemental contribution rate (within certain parameters) to reflect the contribution required to eliminate the remaining UAO associated with service earned prior to July 1, 2014. This will be referred to as the pre-2014 UAO.

There is an additional complexity in that the pre-2014 UAO that the employer is responsible for funding overlaps with the 1990 UAO that the state is responsible for funding. Under the board's valuation policy, the pre-2014 UAO is split into two separate pieces: 1) the pre-2014 UAO for the 1990 Benefit Structure; and 2) the pre-2014 UAO for "new" benefits (i.e., those adopted after 1990). The employers are responsible for funding the New Benefit UAO. However, the employer supplemental contribution rate must, at a minimum, be sufficient to pay down the total Pre-2014 UAO when combined with the base employer rate and the state and member contribution rates. This is referred to as the "minimum rate."

Changes in the employer supplemental contribution are determined annually beginning with the 2020 valuation and are subject to the following conditions:

- The employer supplemental contribution rate cannot increase or decrease by more than 1.0% of payroll over the prior year supplemental rate.
- The employer supplemental contribution rate cannot exceed 12.00%.

To determine the pre-2014 UAO for New Benefits, we must determine the total UAO for pre-2014 service and subtract the 1990 UAO for pre-2014 service.

Pre-2014 Unfunded Actuarial Obligation

The pre-2014 Actuarial Obligation for the DB Program is calculated using service through June 30, 2014 and projected salaries. Since there are no future service accruals for this portion of the Actuarial Obligation, the Projected Unit Credit actuarial cost method is used, per the board's valuation policy.

To determine the pre-2014 assets to be used in the 2017 valuation, a theoretical pre-2014 asset value is maintained based on the prior year value adjusted as follows:

- Add total contributions (excluding SBMA),
- Subtract total Normal Costs for prior year,
- Subtract benefit payments attributable to pre-2014 service, and
- Adjust for actual investment return.

See **Table 11** for the details of the asset adjustment.

Pre-2014 Unfunded Actuarial Obligation for 1990 Benefit Structure

A second calculation is done to isolate the portion of the pre-2014 UAO that is allocated to the 1990 Benefit Structure and therefore is subject to state funding. The Actuarial Obligation for this portion is calculated using the 1990 Benefit Structure, service through June 30, 2014 and projected salaries. Since there are no future service accruals, the Projected Unit Credit actuarial cost method is used.

To determine the pre-2014 assets allocated to the 1990 Structure that are to be used in the 2017 valuation, a theoretical pre-2014 asset value for the 1990 Structure is maintained based on the prior year value adjusted as follows:

- Add contributions equal to 16.00% of prior year payroll,
- Add state supplemental contributions under EC §22955.1(b),
- Subtract total Normal Costs for prior year attributable to 1990 Benefit Structure,
- Subtract benefit payments attributable to pre-2014 service and the 1990 Benefit Structure, and
- Adjust for actual investment return.

See **Table 12** for the details of the asset adjustment.

Pre-2014 Unfunded Actuarial Obligation for New Benefits

The following table shows the calculation of the UAO for Pre-2014 Service attributable to New Benefits.

($ Millions)	Pre-2014 Service		
	Total	1990 Benefits	New Benefits
Funded Status -- Pre-2014 Service			
Actuarial Obligation	$ 252,226	$ 208,341	$ 43,885
Actuarial Value of Assets	148,646	176,158	(27,512)
Unfunded Actuarial Obligation	$ 103,580	$ 32,183	**$ 71,397**

Employer Supplemental Contributions

The statute calls for an adjustment to the employer supplemental contribution rate to amortize the pre-2014 UAO effective with the 2020 actuarial valuation. Therefore, no adjustment to the scheduled employer supplemental contribution is required effective July 1, 2018.

For illustrative purposes, we have shown the adjustment to the employer supplemental contribution rate that would have been calculated if this were the 2020 valuation. As shown in **Table 13**, no increase in the employer supplemental contribution rate, above the ultimate rate of 10.85%, would be needed to amortize the pre-2014 UAO for New Benefits by June 30, 2046. However, under the minimum contribution rate requirement for the total Pre-2014 UAO, an increase would apply. Note that this is a hypothetical calculation as the employer contribution rate is still being determined under a fixed graded schedule through June 30, 2021. As shown in the projection in the "Looking Ahead" subsection of Section 1, a small decrease is projected after the ultimate supplemental contribution rate of 10.85% (19.10% total) is reached.

Table 11
Total Assets Allocated for Pre-2014 Service[1]

($ Millions)	2017	2016
Asset Value for Pre-2014 Service (excludes SBMA)		
Allocated Market Value at Beginning of Year	$142,731	$152,849
Contributions During the Year		
Total Contributions (excluding SBMA)	9,146	7,400
Less Normal Costs for Year with Expenses	(6,105)	(5,463)
Total Adjusted Contributions	$ 3,041	$ 1,937
Benefits and Expenses Paid for Pre-2014 Service	(13,382)	(12,742)
Re-Allocation to Assets for Post-2014 Service[2]	0	(527)
Estimated Investment Earnings for the Year [3]	19,163	687
Total Allocated Market Value at End of Year	**$151,553**	**$142,731**
Ratio of Actuarial Value to Market Value [4]	98.082%	102.731%
Actuarial Value of Assets for Pre-2014 Service	**$148,646**	**$146,629**

1. May not add exactly, due to rounding.

2. In the 2016 valuation, a revision was made that reduced the 1990 Actuarial Obligation for Post-2014 service. A corresponding revision needs to be made to the allocation of assets between Pre- and Post-2014 Service which would have been reflected in the original allocation of Pre-2014 assets made with the 2014 valuation, if the correction had been reflected at the time.

3. Based on Fair Market Value excluding SBMA and uniform cash flow for contributions, benefits, and expenses. The rates of return used in these calculations were 0.82% for 2015-2016 and 13.93% for 2016-2017.

4. Developed from Table 5.

Table 12
1990 Assets Allocated for Pre-2014 Service[1]

($ Millions)	2017	2016
1990 Asset Value for Pre-2014 Service (excludes SBMA)		
Allocated Market Value at Beginning of Year	$167,166	$175,392
Contributions During the Year for 1990 Structure		
Total Contributions (excluding SBMA)	6,445	5,711
Less 1990 Normal Costs for Year with Expenses	(5,211)	(4,612)
Total Adjusted Contributions	$ 1,234	$ 1,099
Benefits and Expenses Paid for Pre-2014 Service	(11,378)	(10,729)
Estimated Investment Earnings for the Year [2]	22,581	1,404
Total 1990 Allocated Market Value at End of Year	**$179,603**	**$167,166**
Ratio of Actuarial Value to Market Value [3]	98.082%	102.731%
1990 Actuarial Value of Assets for Pre-2014 Service	**$176,158**	**$171,731**

1. May not add exactly, due to rounding.

2. Based on Fair Market Value excluding SBMA and uniform cash flow for contributions, benefits, and expenses. The rates of return used in these calculations were 0.82% for 2015-2016 and 13.93% for 2016-2017.

3. Developed from Table 5.

Table 13
Funded Status and Employer Supplemental Contribution Rate for Pre-2014 Service

($ Millions)	2017	2016
Funded Status		
Total Unfunded Actuarial Obligation (Pre-2014 Service)		
Total Actuarial Obligation for Pre-2014 Service	$252,226	$241,246
Total AVA for Pre-2014 Service	148,646	146,629
Total UAO (pre-2014 Service)	$103,580	$94,617
1990 Unfunded Actuarial Obligation (Pre-2014 Service)		
1990 Actuarial Obligation for Pre-2014 Service	$208,341	$199,422
1990 AVA for Pre-2014 Service	176,158	171,731
1990 UAO (pre-2014 Service)	$32,183	$27,691
Post-1990 UAO (Pre-2014 Service)	$71,397	$66,926
Amortization Sufficiency for Post-1990, Pre-2014 UAO Under Current Contribution Schedule		
Revenue from Member Contributions[(1)]	10.222%	9.774%
Revenue from Employer Contributions (22950 & 22951)[(1)]	8.250	8.250
Revenue from State Contributions EC 22955(a)[(1)]	1.888	1.882
Equivalent Normal Cost Rate for Total Benefits	(19.544)	(18.124)
Post-1990 Normal Cost Rate (Surplus)/Deficit	2.474	0.303
Additional Revenue Under EC 22950.5[(1)]	10.411	10.074
Revenue Available for Amortization	13.701%	12.159%
Revenue Needed for Amortization	12.194	12.171
Revenue Surplus / (Deficit)	1.507%	(0.012%)
Minimum Contribution Required for Total Pre-2014 UAO		
Total Preliminary Pre-2014 UAO Contribution Rate	16.424%	Not
Total Pre-2014 UAO Contribution Rate Needed	17.705	Calculated
Revenue Surplus / (Deficit)	(1.280%)	na
Amortization Status under current contribution rate schedule and no changes in ultimate employer rate	Contribution Increase Needed	Contribution Increase Needed
Contribution Rate for Amortization of UAO for pre-2014 Service and New Benefits [Illustrative Purposes Only. Not Applicable for 2017 Valuation]		
Current EC 22950.5 Contribution Rate	10.850%	10.850%
Adjustment in Employer Contribution Rate for Next Fiscal Year[(2)]	1.000	0.012
EC 22955.1(b) Contribution Rate for FYB 2021[(2)]	**11.850%**	**10.862%**

1. Equivalent level contribution rate payable through June 30, 2046.
2. Hypothetical value based on the Actuarial Value of Assets. Current projections indicate a decrease in the ultimate employer contribution rate when reflecting the future recognition of currently deferred asset gains and losses and the scheduled reduction in the investment return assumption. See "Looking Ahead" subsection of Section 1.

This page intentionally left blank.

Section 8 Projected Amortization and Cash Flows

We have previously shown graphical projections of contribution rates, the funded ratio, and the UAO. In this section, we show the numerical details behind those projections.

Table 14 shows the amortization of the UAO for the total DB Program on a year-by-year basis, based on 7.00% future returns, additional contribution rate increases, and the future recognition of the currently deferred asset gains. Assuming all other future experience emerges as assumed and no changes in the scheduled contribution rates, the UAO will not be amortized by June 30, 2046. However, the CalSTRS board has rate-setting authority (within certain parameters) to adjust the state and employer contribution rates to pay down the UAO. Assuming the contribution rates are adjusted in the future, the UAO is projected to be fully paid off, except for a small portion of the UAO attributable to New Benefits and Post-2014 service (the Unallocated UAO) that is not actuarially funded. It is our understanding the board does not have authority to adjust contribution rates to fund this portion of the UAO. In total, the funded ratio is projected to be 99.6% under the assumptions described in the "Looking Ahead" subsection of Section 1.

In Table 14, we show the contributions projected to be paid into the DB Program to fund on-going benefits and amortize the UAO. **Table 15** shows a comparison of these inflows into DB Program with the outflows from the DB Program, which consist of benefit payments and expenses. The difference between these two values is the net cash flow. A negative value indicates CalSTRS is paying out more than it is receiving. Note that this projection does not account for cash received internally, such as interest and dividends on investments.

The net cash flow is currently negative and this is projected to remain at approximately the current level over the next 10 years. In future years, the cash flow is expected to become increasingly negative. This is a typical pattern for a mature retirement system where it is expected that contributions will be less than benefits and that the system will begin drawing on the fund that has been built up over prior years.

Table 14
Amortization of Unfunded Actuarial Obligation[1]
(Reflecting Projected Contribution Increases)[2]

($Millions)		Beginning	Amortization Payment						Interest	Ending	Ending
		Unfunded	Contriubtions				Normal	Available	Charge	Unfunded	Funded
Year	FYE	Act. Oblig.	Member	Employer	State	Total	Cost	Amtzn.	at 7.00%	Act. Oblig.	Ratio
1	2018	$107,261	$3,306	$4,714	$2,096	$10,116	$6,611	$3,505	$7,388	$109,791	63.3%
2	2019	109,791	3,464	5,505	2,404	11,373	6,826	4,547	7,529	111,807	64.1%
3	2020	111,807	3,584	6,345	2,558	12,487	7,048	5,439	7,639	113,319	65.1%
4	2021	113,319	3,709	6,918	2,817	13,444	7,276	6,168	7,720	114,380	66.2%
5	2022	114,380	3,839	6,990	3,089	13,918	7,511	6,407	7,786	115,409	67.2%
6	2023	115,409	3,973	7,029	3,378	14,380	7,752	6,628	7,851	116,382	68.2%
7	2024	116,382	4,111	7,252	3,684	15,047	8,001	7,046	7,904	117,062	69.3%
8	2025	117,062	4,254	7,508	3,855	15,617	8,257	7,360	7,941	117,515	70.3%
9	2026	117,515	4,403	7,773	3,975	16,151	8,521	7,630	7,964	117,758	71.4%
10	2027	117,758	4,556	8,046	4,105	16,707	8,792	7,915	7,971	117,750	72.5%
11	2028	117,750	4,715	8,329	4,240	17,284	9,070	8,214	7,960	117,450	73.6%
12	2029	117,450	4,879	8,621	4,383	17,883	9,356	8,527	7,928	116,818	74.7%
13	2030	116,818	5,049	8,923	4,533	18,505	9,649	8,856	7,873	115,812	75.8%
14	2031	115,812	5,225	9,236	4,688	19,149	9,950	9,199	7,790	114,387	76.9%
15	2032	114,387	5,407	9,560	4,849	19,816	10,258	9,558	7,678	112,496	78.1%
16	2033	112,496	5,596	9,894	5,017	20,507	10,576	9,931	7,533	110,089	79.2%
17	2034	110,089	5,790	10,241	5,192	21,223	10,905	10,318	7,351	107,116	80.5%
18	2035	107,116	5,992	10,600	5,372	21,964	11,244	10,720	7,129	103,522	81.7%
19	2036	103,522	6,201	10,971	5,559	22,731	11,596	11,135	6,863	99,247	83.0%
20	2037	99,247	6,417	11,355	5,753	23,525	11,959	11,566	6,549	94,228	84.4%
21	2038	94,228	6,641	11,752	5,954	24,347	12,336	12,011	6,183	88,398	85.8%
22	2039	88,398	6,872	12,163	6,163	25,198	12,726	12,472	5,759	81,684	87.2%
23	2040	81,684	7,112	12,589	6,378	26,079	13,132	12,947	5,272	74,009	88.8%
24	2041	74,009	7,360	13,030	6,600	26,990	13,555	13,435	4,718	65,292	90.4%
25	2042	65,292	7,617	13,486	6,831	27,934	13,996	13,938	4,091	55,444	92.0%
26	2043	55,444	7,883	13,958	7,070	28,911	14,455	14,456	3,384	44,372	93.8%
27	2044	44,372	8,158	14,447	7,317	29,922	14,933	14,989	2,590	31,973	95.7%
28	2045	31,973	8,443	14,952	7,573	30,968	15,433	15,535	1,704	18,142	97.6%
29	2046	18,142	8,737	15,476	7,838	32,051	15,956	16,095	716	2,762	99.6%

1. Based on the actuarial value of assets with projected recognition of known deferred asset gains and losses.

2. Contribution rates include projected increases and decreases allowed under Education Code.

Table 15
Projected Cash Flow
(Reflecting Projected Contribution Increases)[1]

($Millions)

		Contributions[1]						Cash Flow as a Percentage of		Ending
Year	FYE	Member	Employer	State	Total	Benefit Payments[2]	Net Program Cash Flow	Payroll	Market Value of Assets	Funded Ratio
1	2018	$3,306	$4,714	$2,096	$10,116	$14,551	($4,435)	(13.6%)	(2.4%)	63.3%
2	2019	3,464	5,505	2,404	11,373	15,103	(3,730)	(11.0%)	(1.9%)	64.1%
3	2020	3,584	6,345	2,558	12,487	15,790	(3,303)	(9.4%)	(1.6%)	65.1%
4	2021	3,709	6,918	2,817	13,444	16,497	(3,053)	(8.4%)	(1.4%)	66.2%
5	2022	3,839	6,990	3,089	13,918	17,234	(3,316)	(8.8%)	(1.4%)	67.2%
6	2023	3,973	7,029	3,378	14,380	18,005	(3,625)	(9.3%)	(1.5%)	68.2%
7	2024	4,111	7,252	3,684	15,047	18,808	(3,761)	(9.4%)	(1.5%)	69.3%
8	2025	4,254	7,508	3,855	15,617	19,639	(4,022)	(9.7%)	(1.5%)	70.3%
9	2026	4,403	7,773	3,975	16,151	20,500	(4,349)	(10.1%)	(1.5%)	71.4%
10	2027	4,556	8,046	4,105	16,707	21,447	(4,740)	(10.6%)	(1.6%)	72.5%
11	2028	4,715	8,329	4,240	17,284	22,453	(5,169)	(11.2%)	(1.6%)	73.6%
12	2029	4,879	8,621	4,383	17,883	23,525	(5,642)	(11.8%)	(1.7%)	74.7%
13	2030	5,049	8,923	4,533	18,505	24,677	(6,172)	(12.5%)	(1.7%)	75.8%
14	2031	5,225	9,236	4,688	19,149	25,915	(6,766)	(13.2%)	(1.8%)	76.9%
15	2032	5,407	9,560	4,849	19,816	27,226	(7,410)	(14.0%)	(1.9%)	78.1%
16	2033	5,596	9,894	5,017	20,507	28,587	(8,080)	(14.8%)	(2.0%)	79.2%
17	2034	5,790	10,241	5,192	21,223	29,974	(8,751)	(15.4%)	(2.0%)	80.5%
18	2035	5,992	10,600	5,372	21,964	31,379	(9,415)	(16.1%)	(2.1%)	81.7%
19	2036	6,201	10,971	5,559	22,731	32,806	(10,075)	(16.6%)	(2.1%)	83.0%
20	2037	6,417	11,355	5,753	23,525	34,311	(10,786)	(17.2%)	(2.2%)	84.4%
21	2038	6,641	11,752	5,954	24,347	35,822	(11,475)	(17.7%)	(2.2%)	85.8%
22	2039	6,872	12,163	6,163	25,198	37,321	(12,123)	(18.0%)	(2.2%)	87.2%
23	2040	7,112	12,589	6,378	26,079	38,789	(12,710)	(18.3%)	(2.2%)	88.8%
24	2041	7,360	13,030	6,600	26,990	40,216	(13,226)	(18.4%)	(2.2%)	90.4%
25	2042	7,617	13,486	6,831	27,934	41,632	(13,698)	(18.4%)	(2.2%)	92.0%
26	2043	7,883	13,958	7,070	28,911	43,004	(14,093)	(18.3%)	(2.1%)	93.8%
27	2044	8,158	14,447	7,317	29,922	44,317	(14,395)	(18.0%)	(2.1%)	95.7%
28	2045	8,443	14,952	7,573	30,968	45,549	(14,581)	(17.6%)	(2.0%)	97.6%
29	2046	8,737	15,476	7,838	32,051	46,683	(14,632)	(17.1%)	(1.9%)	99.6%

1. *Contribution rates include projected increases and decreases allowed under Education Code.*
2. *Projected benefit payments include estimated administrative expenses.*

This page intentionally left blank.

Appendix A Provisions of Governing Law

The actuarial calculations contained in this report are based upon our understanding of the CalSTRS DB Program as contained in Part 13 of the California Education Code and augmented by consultation with CalSTRS staff. The provisions used in this valuation are summarized below for reference purposes.

Member Contributions

Base Contribution Rate:

2% at 60 Members: 8.0% of creditable compensation. 25% of this contribution was redirected to the member's Defined Benefit Supplement account from January 1, 2001 through December 31, 2010.

The redirection of member contributions does not apply to the 1990 Benefit Structure.

2% at 62 Members: Equal to one-half of the Normal Cost Rate determined in the valuation rounded to the nearest quarter percent. Member rates only change when the Normal Cost Rate changes by 1.0% of payroll as compared to the initial Normal Cost Rate (or at the time of the last adjustment). Currently, the base member contribution rate is equal to 8.0% of creditable compensation. This will increase to 9.0% of creditable compensation beginning July 1, 2018

Supplemental Contribution Rates:

In addition to the base contribution rates, members make additional contributions for fiscal years beginning July 1, 2016 and later:

2% at 60 Members: 2.250% of creditable compensation

2% at 62 Members: 1.205% of creditable compensation

Interest Rate:

Interest is credited at the end of each fiscal year based on rates adopted by the Teachers' Retirement Board. Currently, rates are approximately equal to two-year Treasury notes.

Normal Retirement

Eligibility Requirement:

2% at 60 Members: Age 60 with five years of credited service.

2% at 62 Members: Age 62 with five years of credited service.

Allowance:

Two percent of final compensation for each year of credited service.

Final Compensation:

2% at 60 Members: Average salary earnable for the highest three consecutive years of credited service for one position. For members with 25 years of service, the calculation is based on the highest average compensation earnable in a consecutive 12-month period.

Twelve-month highest average compensation does not apply to the 1990 Benefit Structure.

2% at 62 Members: Final compensation is based on the highest three consecutive years of salary earnable. Compensation is limited to 120% of the Social Security Wage Base. The limit effective July 1, 2017 is $143,082 (after applying the 120% factor) and is adjusted annually based on changes to the Consumer Price Index for All Urban Consumers. The 2% at 62 members are not eligible for the one-year final compensation benefit enhancement.

Normal Retirement (continued)

Credited Service	For each year of membership, credited service is granted based on the ratio of salary earned to full-time salary earnable for one position.
Sick Leave Service Credit:	Credited service is granted for unused sick leave at the time of retirement. Sick Leave Service Credit up to 0.2 years of Credited Service may be used for eligibility for One-Year Final Compensation or to attain the Career Factor or the Longevity Bonus. Unused sick leave service credit does not apply to the 1990 Benefit Structure.
Career Factor:	If a member has 30 years of credited service, the age factor is increased by 0.2%. However, the maximum age factor is 2.4%. Career factor does not apply to 2% at 62 members or the 1990 Benefit Structure.
Longevity Bonus:	For members attaining 30 years of service by January 1, 2011, a longevity bonus of $200 per month is added to the unmodified allowance. The bonus is increased to $300 per month with 31 years of service, and $400 per month with 32 or more years of service. Longevity Bonus does not apply to 2% at 62 members or the 1990 Benefit Structure.
IRC Section 415:	Benefits are subject to limits imposed under Internal Revenue Code (IRC) Section 415. However, no limits are imposed in the valuation of the DB Program until they actually occur, in order to address the potential pay-as-you-go funding needs of the Teachers' Replacement Benefits Program Fund.
IRC Section 401(a)(17):	Compensation is limited under IRC Section 401(a)(17) and assumed to increase at the rate of inflation for valuation purposes. Current 401(a)(17) limits do not apply to members hired before July 1, 1996.

Early Retirement

Eligibility Requirement:	2% at 60 Members: Age 55 with five years of credited service, or age 50 with 30 years of credited service. 2% at 62 Members: Age 55 with five years of credited service.
Benefit Reduction:	2% at 60 Members: A half-percent reduction in the normal retirement allowance for each full month or partial month the member is younger than age 60, plus a reduction of a quarter percent for each full month or partial month the member is younger than age 55. 2% at 62 Members: A half-percent reduction in the normal retirement allowance for each full month or partial month the member is younger than age 62

Late Retirement

Allowance:	2% at 60 Members: Members continue to earn additional service credit after age 60. The 2% age factor increases by 0.033% for each quarter year of age that the member is over age 60, up to a maximum of 2.4%. 2% at 62 Members: Members continue to earn additional service credit after age 62. The 2% age factor increases by 0.033% for each quarter year of age that the member is over age 62, up to a maximum of 2.4%. The late retirement adjustment does not apply to the 1990 Benefit Structure.

Deferred Retirement

Allowance:	Any time after satisfying the minimum service requirement, a member may cease active service, leave the accumulated contributions on deposit, and later retire upon attaining the minimum age requirement.

Post-Retirement Benefit Adjustment

Benefit Improvement:	2% simple increase on September 1 following the first anniversary of the effective date of the allowance, applied to all continuing allowances.

Disability Allowance - Coverage A

Eligibility Requirement:	Member has five years of credited California service and has not attained age 60.
Allowance:*	50% of final compensation or 5% of final compensation for each year of service credit if over age 45 with less than 10 years of service credit.
Children's Benefit:	10% for each eligible dependent child, up to a maximum of 40% of final compensation. The increment for each eligible child continues until the child marries or attains age 22.
Offsets:	Allowance, including children's increment, is reduced by disability benefits payable under Social Security, Workers' Compensation and employer-paid income protection plan.

** Note that, for valuation purposes, the greater of the service retirement allowance and the disability allowance is valued if the member is eligible for service retirement.*

Disability Allowance - Coverage B (including 2% at 62 members)

Eligibility Requirement:	Member has five years of credited California service.
Allowance:*	50% of final compensation, regardless of age and service credit.
Children's Benefit:	10% for each eligible child up to four children, for a maximum of 40% of final compensation. The increment for each child continues until the child attains age 21, regardless of student, marital, or employment status.
Offsets:	The member's allowance is reduced by disability benefits payable under Workers' Compensation.

** Note that, for valuation purposes, the greater of the service retirement allowance and the disability allowance is valued if the member is eligible for service retirement.*

Death Before Retirement - Coverage A

Eligibility Requirement:	One or more years of service credit for active members or members receiving a disability allowance.
Lump Sum Payment:	$6,163 lump sum to the designated beneficiary. If there is no surviving spouse, domestic partner, or eligible children, the contributions and interest are paid to the designated beneficiary.
Allowance:	The surviving spouse or domestic partner with eligible children will receive a family benefit of 40% of final compensation for as long as there is at least one eligible child. An additional 10% of final compensation is payable for each eligible child up to a maximum benefit of 90%. If there is no surviving spouse or domestic partner, an allowance of 10% of final compensation is payable to eligible children up to a maximum benefit of 50%. When there are no eligible children, the spouse or domestic partner may elect to receive one-half of a 50% joint and survivor allowance projected to age 60, or take a lump sum payment of the remaining contributions and interest.

Death Before Retirement - Coverage B (including 2% at 62 members)

Eligibility:	One or more years of service credit for active members.
Lump Sum Payment:	$24,652 lump sum to the designated beneficiary. If there is no surviving spouse or domestic partner, the contributions and interest are paid to the designated beneficiary.
Allowance:	A lump sum payment of the contributions and interest. or One-half of a 50% joint and survivor allowance, beginning on the member's 60th birthday, or immediately with a reduction based on the member's and spouse's (or domestic partner's) ages at the time the benefit begins. If the surviving spouse or domestic partner elects a monthly allowance, each eligible child would receive 10% of the member's final compensation, with a maximum benefit of 50%.

Death After Retirement

Lump Sum Payment:	$6,163 lump sum to the designated beneficiary.
Annuity Form:	If the retiree had elected one of the joint and survivor options, the retirement allowance would be modified in accordance with the option selected. If no annuity option had been elected, payment of the unpaid contributions and interest, if any, remaining in the retiree's account will be made.

Termination from the Program

Refund:	Refund of contributions with interest as credited to the member's account to date of withdrawal. A refund terminates membership and all rights to future benefits from the System.
Re-entry After Refund:	Former members who re-enter the System may redeposit all amounts previously refunded plus regular interest. The member must earn one year of credited service after re-entry before becoming eligible for System benefits.

This page intentionally left blank.

Appendix B Actuarial Methods and Assumptions

This section of the report discloses the actuarial methods and assumptions used in this Actuarial Valuation. These methods and assumptions have been chosen on the basis of recent experience of the DB Program and on current expectations as to future economic conditions. The assumptions were reviewed and changed for the June 30, 2016 actuarial valuation as a result of the 2015 Experience Analysis. Please refer to that Experience Analysis report dated December 30, 2016 for the data and rationale used in the recommendation of each assumption.

The assumptions are intended to estimate the future experience of the members of the DB Program and of the DB Program itself in areas that affect the projected benefit flow and anticipated investment earnings. Any variations in future experience from that expected from these assumptions will result in corresponding changes in estimated costs of the DB Program's benefits.

Actuarial Cost Method

The accruing costs of all benefits with future accruals are measured by the Entry Age Normal Actuarial Cost Method. For measurements where no future service is earned (i.e., those with service fixed as of June 30, 2014), the actuarial obligation uses the Projected Unit Credit Actuarial Cost Method.

The projected revenue in excess of the Normal Cost is tested for sufficiency to amortize the Unfunded Actuarial Obligation created by this method. Amortization is calculated on a level percentage of payroll including general wage inflation but no increase or decrease in the number of active members.

Entry Age Normal Cost Method:

The actuarial present value of projected benefits for each individual member included in the valuation is allocated on a level basis over the earnings of the individual between entry age and assumed exit ages. The portion of this actuarial present value allocated to a valuation year is called the Normal Cost. For 2% at 60 members, the Normal Cost is based on Coverage B benefit structure. For 2% at 62 members, the Normal Cost is based on their benefit structure. The portion of this actuarial present value not provided for at a valuation date by the actuarial present value of future Normal Costs is called the Actuarial Obligation. The excess of the Actuarial Obligation over the Actuarial Value of Assets is called the Unfunded Actuarial Obligation. If the Actuarial Value of Assets exceeds the Actuarial Obligation, the difference is called the Actuarial Surplus.

Entry Age:

The ages at entry of future active members are assumed to average the same as the entry ages of the present active members they replace. If the number of active members should increase (or decrease), it is further assumed that the average entry age of the larger (or smaller) group will be the same, from an actuarial standpoint, as that of the present active group. Under these assumptions, the Normal Cost Rate will not vary significantly due to the termination of the present active membership, or with an expansion or contraction of the active membership.

Projected Unit Cost Method:

The actuarial present value of projected benefits for each individual member included in the valuation is determined based on the current service and salary projected to the age the member leaves active employment. The Normal Cost is $0 since no benefits are being earned.

Asset Valuation Method

The assets are valued using a method that delays recognition of investment gains or losses. The expected actuarial value is the prior year's actuarial value increased with net cash flow of funds, and all increased with interest during the past year at the expected investment return assumption. One-third of the difference between the expected actuarial value of assets and the Fair Market Value of assets is added to the expected actuarial value of assets to arrive at the Actuarial Value of Assets. The smoothing is applied on the total DB Program assets and then the SBMA is deducted to determine the net actuarial value for funding purposes.

The asset smoothing method was adopted for the 1999 Actuarial Valuation and is effective for the investment experience beginning in July of 1993.

Actuarial Assumptions

The Actuarial Standards Board has adopted Actuarial Standard of Practice No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations*. This Standard provides guidance on selecting economic assumptions under defined benefit retirement programs such as the System. In our opinion, the economic assumptions have been developed in accordance with the Standard.

The Actuarial Standards Board has adopted Actuarial Standard of Practice No. 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*. This Standard provides guidance on selecting demographic assumptions under defined benefit retirement programs such as the System. In our opinion, the demographic assumptions have been developed in accordance with the Standard.

The assumptions are intended to estimate the future experience of the members of the DB Program and of the System itself in areas that affect the projected benefit flow and anticipated investment earnings. Any variations in future experience from that expected from these assumptions will result in corresponding changes in estimated costs of the Program's benefits.

The demographic assumptions are listed in **Table B.1** and illustrated at selected ages and duration combinations in **Tables B.2** – **B.7**.

Payroll Growth Assumption

The wage growth assumption is equal to 3.50%, and the active population is assumed to be stable. Thus, the DB Program payroll is assumed to increase at a rate of 3.50% each year.

Table B.1
List of Major Valuation Assumptions

I. Economic Assumptions

A.	Investment Return (net of investment and administrative expenses)	7.00%
B.	Interest on Member Accounts	3.00%
C.	Wage Growth	3.50%
D.	Inflation	2.75%

II. Demographic Assumptions

A. Mortality[1]

Active	- Male	RP-2014 White Collar Employee Male set back 2 years	Table B.2
	- Female	RP-2014 White Collar Employee Female set back 2 years	Table B.2
Retired & Beneficiary	- Male	2016 CalSTRS Retired Male	Table B.2
	- Female	2016 CalSTRS Retired Female	Table B.2
Disabled	- Male	RP-2014 Disabled Retiree Male set back 2 years	Table B.2
	- Female	RP-2014 Disabled Retiree Female set back 2 years (select rates in first three years for both Males and Females)	Table B.2

1. All mortality tables use 110% of the MP-2016 Ultimate Projection Scale. The combined base tables and projection scale specified contain a margin for expected future mortality improvement. See Table B.9 of this report for a key to the custom mortality tables used for CalSTRS.

B.	Service Retirement	Experience Tables	Table B.3
C.	Disability Retirement	Experience Tables	Table B.4
D.	Withdrawal	Experience Tables	Table B.5
E.	Probability of Refund	Experience Tables	Table B.6
F.	Merit Salary Increases	Experience Tables	Table B.7
G.	Supplemental Assumptions		Table B.8

Table B.2
Mortality as of June 30, 2017

Active Members[1]

Age	Male	Female
25	0.035%	0.014%
30	0.030	0.016
35	0.033	0.021
40	0.039	0.028
45	0.054	0.043
50	0.092	0.074
55	0.155	0.117
60	0.256	0.171
65	0.446	0.254

	Retired Members and Beneficiaries[1]		Disabled Members (After Year 3) [1]	
Age	**Male**	**Female**	**Male**	**Female**
50	0.240%	0.133%	1.848%	1.043%
55	0.354	0.211	2.149	1.305
60	0.474	0.280	2.437	1.541
65	0.674	0.422	2.836	1.841
70	1.079	0.696	3.517	2.390
75	1.936	1.280	4.637	3.400
80	3.553	2.455	6.420	5.036
85	6.831	4.896	9.326	7.483
90	13.161	9.948	14.127	11.045
95	22.456	18.616	21.090	16.322

Select rates for disability:		
First year of disability	4.0%	3.0%
Second year of disability	3.5	2.5
Third year of disability	3.0	2.0

1. *Projected improvement based on 110% of the MP-2016 Ultimate Projection Scale. Projection scale does not apply to select minimum rates.*

Table B.3
Service Retirement

			DB Program – 2% at 60 Members				DB Program – 2% at 62 Members	
	Only for the 1990 Benefit Structure		Under 30 Years[1]		30 or More Years		All Years	
Age	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
50	0.0%	0.0%	0.0%	0.0%	5.0%	5.0%	0.0%	0.0%
51	0.0	0.0	0.0	0.0	3.0	3.0	0.0	0.0
52	0.0	0.0	0.0	0.0	3.0	3.0	0.0	0.0
53	0.0	0.0	0.0	0.0	3.0	3.0	0.0	0.0
54	1.5	1.5	0.0	0.0	3.0	3.0	0.0	0.0
55	5.8	7.0	2.7	3.5	6.0	8.0	3.0	4.0
56	3.9	4.5	1.8	2.5	6.0	8.0	2.0	3.0
57	4.9	4.5	1.8	2.5	8.0	10.0	3.0	3.5
58	6.8	7.0	2.7	3.5	12.0	15.0	4.0	4.0
59	17.5	14.0	4.5	5.0	16.0	18.0	6.0	6.0
60	25.0	22.0	6.3	7.0	25.0	29.0	9.0	9.0
61	16.5	15.0	7.0	9.0	50.0	50.0	15.0	15.0
62	16.5	15.0	11.0	12.5	45.0	45.0	15.0	17.0
63	15.0	15.0	12.0	16.0	35.0	40.0	15.0	18.0
64	17.5	18.0	13.0	14.0	30.0	35.0	15.0	18.0
65	20.0	18.0	14.0	17.0	32.5	37.5	30.0	30.0
66	16.0	18.0	13.0	15.0	30.0	32.0	25.0	25.0
67	16.0	18.0	13.0	15.0	27.0	32.0	25.0	25.0
68	16.0	16.0	12.0	14.0	27.0	30.0	20.0	20.0
69	16.0	16.0	12.0	14.0	25.0	30.0	20.0	20.0
70	100.0	100.0	12.0	14.0	25.0	30.0	20.0	20.0
71			11.0	13.5	25.0	30.0	20.0	20.0
72			11.0	13.5	25.0	30.0	20.0	20.0
73			11.0	13.5	25.0	30.0	20.0	20.0
74			11.0	13.5	25.0	30.0	20.0	20.0
75			100.0	100.0	100.0	100.0	100.0	100.0

1. If credited service is equal to or greater than 25 but less than 28 years, the assumed retirement rates shown above for members with less than 30 years of credited service are multiplied by 225%. For example, a 63-year old female member with 26 years of credited service would have a 36.0% probability of retirement (2.25 times the rate for service less than 30 years of 16.0%). For members with 28 but less than 30 years of credited service, the rates are equal to 125% of the assumed retirement rates shown above for members with less than 30 years of credited service.

The assumptions shown above are for retirement from active status. It is assumed that all vested terminated members retire at age 60 (2% at 60 members) or age 62 (2% at 62 members).

Table B.4
Disability Retirement

Coverage A

Age	Male	Female
25	0.018%	0.018%
30	0.027	0.027
35	0.045	0.054
40	0.072	0.081
45	0.099	0.099
50	0.144	0.198
55	0.189	0.252

Coverage B

Age	Male	Female
25	0.010%	0.020%
30	0.020	0.020
35	0.030	0.040
40	0.060	0.070
45	0.100	0.110
50	0.140	0.185
55	0.245	0.300
60	0.365	0.380
65	0.400	0.400
70	0.400	0.400

Table B.5
Withdrawal

Year[1]	Male	Female
0	16.0%	15.0%
1	11.0	9.0
2	8.5	7.0
3	6.3	5.5
4	4.0	4.0
5	3.5	3.0
10	1.8	1.8
15	1.2	1.2
20	0.9	0.9
25	0.7	0.7
30	0.6	0.6

1. Based on elapsed service since membership date.

Table B.6
Probability of Refund

Entry Ages – Male

Year[1]	Under 25	25 - 29	30 - 34	35 - 39	40 and Up
Under 5	100%	100%	100%	100%	100%
5	60	60	60	56	45
10	46	46	38	36	36
15	38	38	31	21	
20	31	31	15		
25	15	15			
30	10				

Entry Ages – Female

Year	Under 25	25 - 29	30 – 34	35 - 39	40 and Up
Under 5	100%	100%	100%	100%	100%
5	60	60	60	52	35
10	34	34	32	32	29
15	27	24	24	24	
20	19	14	14		
25	10	10			
30	10				

1. Assumption applied at time of assumed termination. Based on elapsed service since membership date. Members who terminate with less than five years of credited service are assumed to have a 100% probability of refund.

Table B.7
Merit Salary Increases[1]

	Entry Age - Annual Increase in Salaries Due to Merit					
Year[2]	**Under 25**	**25 - 29**	**30 - 34**	**35 - 39**	**40 - 44**	**45 & up**
0	6.4%	5.8%	5.3%	4.8%	4.5%	3.7%
1	6.4	5.8	5.3	4.8	4.5	3.7
2	6.0	5.5	5.0	4.5	4.3	3.5
3	5.6	5.3	4.8	4.3	4.1	3.3
4	5.4	5.0	4.5	4.1	3.9	3.0
5	5.2	4.8	4.3	3.9	3.8	2.8
10	3.7	3.4	3.0	2.7	2.5	1.8
15	1.8	1.7	1.5	1.2	1.2	0.9
20	1.3	1.2	1.2	0.8	0.8	0.6
25	1.1	1.0	0.9	0.6	0.6	
30	0.9	0.8	0.7	0.5		
35	0.8	0.7	0.6			
40	0.8	0.7				
45	0.8					

1. The total expected increase in salary includes both merit (shown above) and the general wage increase assumption of 3.50% per annum. The total result is compounded rather than additive. For example, the total assumed increase for service less than one year (Year 0 above) is 10.124% (1.064 x 1.035) for members in the entry age under 25 group.

2. Based on elapsed service since membership date.

Table B.8
Supplemental Assumptions

PEPRA Coverage

All members hired on or after the valuation date are assumed to be subject to the provisions of PEPRA.

Unused Sick Leave

Credited Service is increased by 1.8%.

Optional Forms

Active and Inactive: Based on single life annuity assumed.
Retirees and Beneficiaries: Based on optional form in data.

Probability of Marriage

Male: 85%
Female: 65%

Male spouses are assumed to be three years older than female spouses.

Number of Children

Married members under age 60 are assumed to have the following number of children:

Member's Gender	Assumed Number of Children
Male	0.65
Female	0.50

Assumed Offsets

The following offsets, expressed as a percentage of Final Compensation, are assumed to cease at age 60:

	Coverage A		Coverage B (including 2% @ 62)	
	Male	Female	Male	Female
Death	0.0%	0.0%	0.0%	0.0%
Disability	0.0%	0.0%	0.0%	0.0%

Table B.8
Supplemental Assumptions (continued)

Valuation of Inactive Members

Salary and benefit information is not available on the valuation data provided for inactive members. Therefore, we estimate the projected retirement benefits for inactive members as follows:

1) The inactive member's earnable salary information is retrieved from when they were active by matching with a database of active valuation data back to 2001 and taking the highest earnable salary for the member during the period.
2) For those members who cannot be located on the active database (because they terminated prior to 2001 or another reason), their earnable salary is estimated based on 120% of the average earnable salary for all active members in the year the member terminated.
3) The earnable salary amount from the prior steps is treated as the member's final compensation with two additional adjustments.
    a. An additional load of 5% for all inactive members is applied to their salary amount to account for potential post-termination increases in salary due to factors such as reciprocity.
    b. Final compensation is increased by an additional 4.3% if the member has 25 or more years of credited service.
4) Based on the salary data described above and the birth date and credited service from the current year's valuation data, the projected benefit amount is calculated and valued as a deferred service retirement.
5) Non-vested members who have been inactive for less than two years are assumed to take an immediate refund of their member contributions.

Table B.9
Custom Mortality Table Key

Inactives, Healthy (Service) Retirees and Beneficiaries -- Males	
Current:	RP-2014 Healthy Male White Collar -1 to age 70 smoothed to +1 at age 95
Inactives, Healthy (Service) Retirees and Beneficiaries -- Females	
Current:	RP-2014 Healthy Female White Collar -4 to age 70 smoothed to +1 at age 95
Disabled Retirees -- Males	
Current:	All Ages: RP-2014 Disabled Male -2 (select rates in first three years, regardless of age)
Disabled Retirees -- Females	
Current:	All Ages: RP-2014 Disabled Female -2 (select rates in first three years, regardless of age)
Active Members -- Males	
Current:	RP-2014 Healthy Male White Collar Employee set back 2 years
Active Members -- Females	
Current:	RP-2014 Healthy Female White Collar Employee set back 2 years

Notes:
1. *All mortality tables use 110% of the MP-2016 Ultimate Projection Scale. Projection scale does not apply to select minimum rates.*
2. *All mortality tables to be used in the June 30, 2017 actuarial valuations include three years of mortality improvement from the 2014 tables shown above.*

Appendix C Valuation Data

The membership data for this actuarial valuation was supplied by CalSTRS. Although we did not audit this data, we compared the data for this and the prior valuation and tested for reasonableness, as well as for consistency with prior periodic reports from the CalSTRS staff. Based on these tests, we believe the data to be sufficiently accurate for the purposes of this valuation. Since the valuation results are dependent on the integrity of the data supplied, the results can be expected to differ if the underlying data is incomplete or missing. It should be noted that if any data or other information is inaccurate or incomplete, our calculations may need to be revised.

Note that CalSTRS provides two files with benefit recipients. The benefit valuation file includes all service retirees, disabled retirees, and most surviving beneficiaries. The family benefit valuation file includes other survivors, including child beneficiaries and survivors deferring their benefit. Information from the family benefit valuation file is included with the survivor information shown in this section, except for average ages and benefit amounts.

Tables C.1-C.6 summarize the census data used in this valuation.

Table C.1
Summary of Statistical Information

	June 30, 2017	June 30, 2016
Number of Members		
Active Members [1]	445,935	438,537
Inactive Members [1]	192,601	187,722
Retirees and Beneficiaries		
Service Retirees	258,550	252,672
Disabled Retirees	10,023	9,940
Survivors	26,301	25,583
Total Benefit Recipients	294,874	288,195
Total Membership in Valuation	933,410	914,454
Active Member Statistics		
Earned Salaries [2]	$ 31,136 million	$ 29,826 million
Average Earned Salary	$ 69,822	$ 68,013
Average Age	45.3 years	45.4 years
Average Service	12.1 years	12.1 years

1. Some active members were reported with no Earnable Salaries, in which case their liabilities, if any, were included with inactive members.

2. Total of prior year Earned Salaries for all active members. This differs from the payroll amounts shown elsewhere in this report which reflect annualized amounts for members who were hired part way through the prior year.

Retired Member Statistics[3]	June 30, 2017	June 30, 2016
Average Age		
Service Retiree	73.5	73.3
Disabled Retiree	66.0	65.6
Survivors	77.5	77.3
All Benefit Recipients	73.5	73.3
Average Monthly Benefit		
Service Retirees	$ 3,985	$ 3,884
Disabled Retirees	2,762	2,695
Survivors	2,538	2,443
All Benefit Recipients	$ 3,831	$ 3,732

3. Average retiree ages shown here are current ages; average retiree ages shown elsewhere in this Appendix are age at retirement. Survivors from family benefit valuation file are excluded from averages.

	June 30, 2017	June 30, 2016
Inactive Member Statistics		
Average Age	49.4	49.1
Average Account Balance	$ 12,072	$ 11,953

Table C.1 (Continued)
Summary of Statistical Information

Active Member Statistics by Benefit Formula [1]	2% at 60 Members	2% at 62 Members
Number	364,232	81,703
Earned Salaries [2]	$ 27,750 million	$ 3,386 million
Average Earned Salary	$ 76,188	$ 41,443
Average Age	47.8 years	34.0 years
Average Service	14.4 years	1.6 years

Retired Member Statistics by Benefit Structure[3]	1990 Benefit	Total Benefit
Average Monthly Benefit		
Service Retirees	$ 3,304	$ 3,985
Disabled Retirees	2,732	2,762
Survivors	2,375	2,538
All Benefit Recipients	$ 3,213	$ 3,831

Pre-2014 Statistics	Pre-2014	Total
Active Member Average Service	9.6 years	12.1 years
Inactive Member Average Account Balance	$ 11,417	$ 12,072
Average Monthly Benefit for All Benefit Recipients	$ 3,795	$ 3,831

1. Some active members were reported with no Earnable Salaries, in which case their liabilities, if any, were included with inactive members.

2. Total of prior year Earned Salaries for all active members. This differs from the payroll amounts shown elsewhere in this report which reflect annualized amounts for members who were hired part way through the prior year.

Table C.2
Age and Service Distribution – Active Male Members

Male

	Years of Service					
Age	**1 & Under**	**Greater than 1 & Under 5**	**5-9**	**10-14**	**15-19**	**20-24**
Less than 25	1,226	345				
25 to 30	3,278	4,999	461			
30 to 35	2,266	5,339	3,950	777	3	
35 to 40	1,572	3,768	4,110	5,839	966	2
40 to 45	1,236	2,528	2,578	5,027	6,737	762
45 to 50	1,055	2,018	1,900	3,394	6,520	5,213
50 to 55	759	1,554	1,369	2,211	3,697	4,095
55 to 60	594	1,279	1,146	1,613	2,514	2,470
60 to 65	444	983	897	1,272	1,728	1,507
65 to 70	272	575	524	603	760	607
70 and over	141	395	328	266	239	191
Age Unknown	-	-	-	-	-	-
Total	12,843	23,783	17,263	21,002	23,164	14,847

	Years of Service					
Age	**25-29**	**30-34**	**35-39**	**40-44**	**45 & Over**	**Total**
Less than 25						1,571
25 to 30						8,738
30 to 35						12,335
35 to 40						16,257
40 to 45	7					18,875
45 to 50	332	1				20,433
50 to 55	2,725	245	1			16,656
55 to 60	2,866	1,887	195	1		14,565
60 to 65	1,458	980	495	30	1	9,795
65 to 70	433	223	138	84	8	4,227
70 and over	136	92	53	46	57	1,944
Age Unknown	-	-	-	-	-	-
Total	7,957	3,428	882	161	66	125,396

Table C.3
Age and Service Distribution – Active Female Members

Female

	Years of Service					
Age	**1 & Under**	**Greater than 1 & Under 5**	**5-9**	**10-14**	**15-19**	**20-24**
Less than 25	4,139	1,487				
25 to 30	8,455	17,524	2,118	1		
30 to 35	4,730	14,385	13,774	3,143	2	
35 to 40	3,559	8,933	11,710	18,632	3,052	1
40 to 45	2,743	6,494	7,345	13,238	17,437	1,939
45 to 50	2,279	5,517	6,028	8,773	13,636	10,984
50 to 55	1,603	3,781	4,198	6,117	8,373	7,681
55 to 60	1,087	2,801	3,232	5,032	6,802	6,075
60 to 65	641	1,840	2,047	3,038	4,656	4,135
65 to 70	278	771	846	1,124	1,630	1,373
70 and over	130	394	381	318	398	359
Age Unknown	-	-	-	-	-	-
Total	29,644	63,927	51,679	59,416	55,986	32,547

	Years of Service					
Age	**25-29**	**30-34**	**35-39**	**40-44**	**45 & Over**	**Total**
Less than 25						5,626
25 to 30						28,098
30 to 35						36,034
35 to 40						45,887
40 to 45	4					49,200
45 to 50	852	1				48,070
50 to 55	6,533	802	2			39,090
55 to 60	5,801	4,344	467	2		35,643
60 to 65	3,156	1,933	1,101	53		22,600
65 to 70	881	422	197	153	17	7,692
70 and over	249	159	96	52	63	2,599
Age Unknown	-	-	-	-	-	-
Total	17,476	7,661	1,863	260	80	320,539

Table C.4
Age and Service Distribution – All Active Members

Total

	Years of Service					
Age	**1 & Under**	**Greater than 1 & Under 5**	**5-9**	**10-14**	**15-19**	**20-24**
Less than 25	5,365	1,832				
25 to 30	11,733	22,523	2,579	1		
30 to 35	6,996	19,724	17,724	3,920	5	
35 to 40	5,131	12,701	15,820	24,471	4,018	3
40 to 45	3,979	9,022	9,923	18,265	24,174	2,701
45 to 50	3,334	7,535	7,928	12,167	20,156	16,197
50 to 55	2,362	5,335	5,567	8,328	12,070	11,776
55 to 60	1,681	4,080	4,378	6,645	9,316	8,545
60 to 65	1,085	2,823	2,944	4,310	6,384	5,642
65 to 70	550	1,346	1,370	1,727	2,390	1,980
70 and over	271	789	709	584	637	550
Age Unknown	-	-	-	-	-	-
Total	42,487	87,710	68,942	80,418	79,150	47,394

	Years of Service					
Age	**25-29**	**30-34**	**35-39**	**40-44**	**45 & Over**	**Total**
Less than 25						7,197
25 to 30						36,836
30 to 35						48,369
35 to 40						62,144
40 to 45	11					68,075
45 to 50	1,184	2				68,503
50 to 55	9,258	1,047	3			55,746
55 to 60	8,667	6,231	662	3		50,208
60 to 65	4,614	2,913	1,596	83	1	32,395
65 to 70	1,314	645	335	237	25	11,919
70 and over	385	251	149	98	120	4,543
Age Unknown	-	-	-	-	-	-
Total	25,433	11,089	2,745	421	146	445,935

Table C.5
Inactive Members

Fiscal Year Ending June 30	Number Vested	Total Number	Male % of Total	Female % of Total
2002	19,703	96,159	28.0%	72.0%
2003	20,627	104,617	28.3	71.7
2004	22,511	116,128	28.7	71.3
2005	24,113	124,394	28.8	71.2
2006	26,733	133,601	28.8	71.2
2007	28,922	141,450	28.9	71.1
2008	30,370	147,997	29.0	71.0
2009	31,661	156,207	29.0	71.0
2010	33,036	166,976	29.2	70.8
2011	33,976	173,719	29.1	70.9
2012	34,848	178,655	29.1	70.9
2013	35,883	182,576	29.1	70.9
2014	36,344	182,815	29.2	70.8
2015	36,953	184,396	29.3	70.7
2016	38,014	187,722	29.4	70.6
2017	38,955	192,601	29.5	70.5

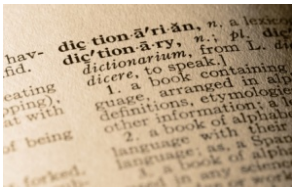
Fiscal Year Ending June 30	Average Account on Deposit	Average Age	Average Service Credit	Average Years Inactive
2002	$12,997	46.0	3.1	7.3
2003	12,691	46.0	3.0	7.4
2004	12,418	45.8	2.9	7.3
2005	12,177	45.9	2.9	7.4
2006	12,282	45.9	2.9	7.5
2007	12,440	46.0	3.0	7.7
2008	12,698	46.3	2.9	8.0
2009	12,717	46.5	2.9	8.2
2010	12,334	46.7	2.8	8.3
2011	12,035	46.8	2.8	8.6
2012	11,818	47.2	2.8	8.9
2013	11,771	47.6	2.8	9.4
2014	11,815	48.1	2.8	9.9
2015	11,825	48.7	2.9	10.4
2016	11,953	49.1	2.9	10.8
2017	12,072	49.4	2.9	11.1

Table C.6
Members Retired for Service

Fiscal Year Ending June 30	Total	Male % of Total	Female % of Total
2002	154,884	37.8%	62.2%
2003	159,172	37.6	62.4
2004	169,022	37.2	62.8
2005	176,008	36.9	63.1
2006	181,833	36.5	63.5
2007	188,659	36.1	63.9
2008	195,960	35.7	64.3
2009	203,649	35.3	64.7
2010	213,952	34.9	65.1
2011	222,222	34.4	65.6
2012	230,278	34.0	66.0
2013	236,487	33.6	66.4
2014	241,920	33.1	66.9
2015	247,353	32.7	67.3
2016	252,672	32.3	67.7
2017	258,550	31.9	68.1

Fiscal Year Ending June 30	Average Age at Retirement	Average Years of Service Credit	Final Average Compensation	Average Current Allowance Payable
2002	60.7	25.7	$3,539	$2,183
2003	60.7	25.9	3,735	2,339
2004	60.7	26.0	3,931	2,488
2005	60.8	26.1	4,103	2,617
2006	60.8	26.2	4,264	2,741
2007	60.8	26.3	4,437	2,878
2008	60.8	26.3	4,620	3,021
2009	60.8	26.4	4,798	3,164
2010	60.9	26.3	4,983	3,302
2011	61.0	26.3	5,138	3,417
2012	61.1	26.2	5,271	3,517
2013	61.1	26.1	5,385	3,609
2014	61.2	26.0	5,487	3,694
2015	61.3	25.9	5,597	3,786
2016	61.3	25.8	5,716	3,884
2017	61.4	25.7	5,846	3,985

Appendix D Glossary


dic·tion·ā′ri·ăn, n, a lexic
dic′tion·ā·ry, n.; pl. dic
dictionarium, from L. di
dicere, to speak.]
1. a book containing
guage, arranged in alp
definitions, etymologie
other information; a l
2. a book of alphab
language with their
language; as, a Spa
3. a book of alph
in any scien

The following definitions are largely excerpts from a list adopted by the major actuarial organizations in the United States. In some cases, the definitions have been modified for specific applicability to the CalSTRS DB Program. Defined terms are capitalized throughout this Appendix.

Actuarial Assumptions — Assumptions as to the occurrence of future events affecting pension costs, such as mortality, withdrawal, disablement and retirement, changes in compensation, rates of investment earnings and asset appreciation or depreciation, and procedures used to determine other relevant items.

Actuarial Cost Method — A procedure for determining the Actuarial Present Value of pension plan benefits and expenses and for developing an actuarially equivalent allocation of such value to time periods, usually in the form of a Normal Cost and an Actuarial Obligation.

Actuarial Equivalent — Of equal Actuarial Present Value, determined as of a given date with each value based on the same set of Actuarial Assumptions.

Actuarial Gain or Loss — A measure of the difference between actual experience and that expected based upon a set of Actuarial Assumptions during the period between two actuarial valuation dates, as determined in accordance with a particular Actuarial Cost Method.

Actuarial Obligation — That portion, as determined by a particular Actuarial Cost Method, of the Actuarial Present Value of pension plan benefits and expenses which is not provided for by future Normal Costs.

Actuarial Present Value — The value of an amount or series of amounts payable or receivable at various times, determined as of a given date by the application of a particular set of Actuarial Assumptions.

Actuarial Surplus — The excess, if any, of the Actuarial Value of Assets over the Actuarial Obligation.

Actuarial Valuation — The determination, as of a Valuation Date, of the Normal Cost, Actuarial Obligation, Actuarial Value of Assets and related Actuarial Present Values for a pension plan.

Actuarial Value of Assets — The value of cash, investments and other property belonging to a pension plan, as used by the actuary for the purpose of an actuarial valuation.

Entry Age Cost Method	An Actuarial Cost Method under which the Actuarial Present Value of Projected Benefits of each individual included in the actuarial valuation is allocated on a level basis over the earnings of the individual between entry age and assumed exit ages. The portion of this Actuarial Present Value allocated to a valuation year is called the Normal Cost. The portion of this Actuarial Present Value not provided for at a Valuation Date by the Actuarial Present Value of future Normal Costs is called the Actuarial Obligation.
Normal Cost	The portion of the Actuarial Present Value of Projected Benefits which is allocated to a valuation year by the Actuarial Cost Method.
Projected Unit Credit Cost Method	An Actuarial Cost Method under which the Actuarial Obligation is equal to the portion of the Actuarial Present Value of Projected Benefits of each individual included in the actuarial valuation is attributable to service credit that has been earned to date (past service). Since this cost method is only used in this valuation for cases where the service is fixed as of June 30, 2014, the Actuarial Obligation is equal to the portion of the Actuarial Present Value of Projected Benefits for the DB Program, and there is no Normal Cost.
Unfunded Actuarial Obligation	The excess, if any, of the Actuarial Obligation over the Actuarial Value of Assets.
Valuation Date	June 30, 2017.