



# Defined Benefit Program of the California State Teachers' Retirement System

June 30, 2019 Actuarial Valuation

Prepared by:

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

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

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

Milliman, Inc.  
1301 Fifth Avenue, Suite 3800  
Seattle, WA 98101-2605  
Tel +1 206 624 7940  
milliman.com



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

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

milliman.com

April 15, 2020

Teachers' Retirement Board  
California State Teachers' Retirement System

Re: **Defined Benefit Program Actuarial Valuation as of June 30, 2019**

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, 2019. 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, 2019.

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

This work product was prepared solely for CalSTRS for the purposes described herein and may not be appropriate to use for other purposes.  
Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work.  
Milliman recommends that third parties be aided by their own actuary or other qualified professional when reviewing the Milliman work product.

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 2019 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 retirement 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.

This work product was prepared solely for CalSTRS for the purposes described herein and may not be appropriate to use for other purposes.  
Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work.  
Milliman recommends that third parties be aided by their own actuary or other qualified professional when reviewing the Milliman work product.

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

Sincerely,

A handwritten signature in black ink that reads "Nick Collier".

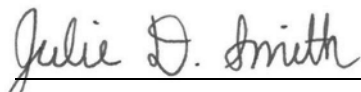
---

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

A handwritten signature in black ink that reads "Mark C. Olleman".

---

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

A handwritten signature in black ink that reads "Julie D. Smith".

---

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

---

## Table of Contents

<b>1. Summary of the Findings</b> .....	<b>1</b>
<b>2. Scope of the Report</b> .....	<b>12</b>
<b>3. Actuarial Obligation</b> .....	<b>13</b>
Table 1 Normal Cost .....	16
Table 2 Actuarial Obligation .....	17
<b>4. Valuation Assets</b> .....	<b>18</b>
Table 3 Statement of Program Assets .....	19
Table 4 Statement of Changes in Program Assets .....	20
Table 5 Actuarial Value of Assets .....	21
Table 6 History of Actuarial Value of Assets .....	22
<b>5. Funded Status</b> .....	<b>23</b>
Table 7 Funded Status .....	29
Table 8 Actuarial Gains and Losses .....	30
<b>6. State Supplemental Contribution Rate</b> .....	<b>31</b>
Table 9 Asset Adjustment for 1990 Benefit Structure .....	35
Table 10 Funded Status and Supplemental Contribution Rate for 1990 Benefit Structure .....	36
<b>7. Employer Supplemental Contribution Rate</b> .....	<b>37</b>
Table 11 Total Assets Allocated for Pre-2014 Service .....	39
Table 12 1990 Assets Allocated for Pre-2014 Service .....	40
Table 13 Funded Status and Employer Supplemental Contribution Rate for Pre-2014 Service .....	41
<b>8. Projected Amortization and Cash Flows</b> .....	<b>42</b>
Table 14 Amortization of Unfunded Actuarial Obligation .....	43
Table 15 Projected Cash Flow .....	44
<b>9. Risk Disclosures</b> .....	<b>45</b>

---

<b>Appendix A Provisions of Governing Law .....</b>	<b>49</b>
<b>Appendix B Actuarial Methods and Assumptions .....</b>	<b>54</b>
Table B.1 List of Major Valuation Assumptions .....	56
Table B.2 Mortality as of June 30, 2019 .....	57
Table B.3a Service Retirement – 2% at 60 Males .....	58
Table B.3b Service Retirement – 2% at 60 Females.....	59
Table B.3c Service Retirement – 2% at 62 Males .....	60
Table B.3d Service Retirement – 2% at 62 Females.....	61
Table B.3e Service Retirement – 1990 Benefit Structure Males .....	62
Table B.3f Service Retirement – 1990 Benefit Structure Females .....	63
Table B.4 Disability Retirement.....	64
Table B.5 Other Terminations of Employment (Withdrawal) .....	65
Table B.6 Probability of Refund .....	66
Table B.7 Merit Salary Increases.....	67
Table B.8 Supplemental Assumptions .....	68
<b>Appendix C Valuation Data.....</b>	<b>69</b>
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
<b>Appendix D Glossary.....</b>	<b>77</b>

## 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 (TRB), this actuarial valuation provides a reasonable estimate of the long-term financing of the DB Program. The assumptions and methods were adopted at the January 2020 TRB meeting and have been updated since the last valuation.

Under the board's valuation policy, an increase to the state supplemental contribution rate beginning July 2020 has been calculated. For the employer contribution rate, actuarially calculated 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).

The key findings of this actuarial valuation are:

- The **Funded Ratio** increased from 64.0% to 66.0% primarily due to additional contributions by the State, as well as the reflection of a portion of prior investment gains in the asset smoothing calculation.
- An increase in the **state supplemental contribution rate** of 0.500% of payroll to 6.311% of payroll has been calculated for the fiscal year beginning July 1, 2020 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 two additional years, assuming all actuarial assumptions are met.
- The **employer supplemental contribution rate** for the fiscal year beginning July 1, 2020 increases to 10.15% of payroll (currently 8.85%) as required by the Education Code, which specifies a fixed schedule of contribution increases until 2021. SB 90 reduced the employer supplemental contribution rate for the fiscal year beginning July 1, 2019 by 1.03% from 9.88% to 8.85% and for the fiscal year beginning July 1, 2020 by 0.70% from 10.85% to 10.15%, reflecting an additional state contribution of \$2.246 billion paid by the state on behalf of the employers in June 2019.
- Based on this 2019 valuation, no change in the CalSTRS 2% at 62 **member contribution rate** is required for the fiscal year beginning July 1, 2020. The member contribution rate for 2% at 60 members is fixed in the Education Code, so no change is required for this group, either.

Note that the state's 2019-20 budget includes additional contributions for CalSTRS and some reductions in the employer contributions as previously noted. For purposes of the 2019 valuation, we have only reflected the additional contribution of \$2.246 billion that the state made in June of 2019 and the corresponding 2-year reduction in the fixed employer contribution rate schedule. The state also made a contribution of \$1.117 billion toward its funding in July of 2019 which is not reflected in the valuation results, but we have included it in the projections shown in the Executive Summary.

### Post-Valuation Investment Market Activity

This valuation represents a snapshot of the DB Program as of June 30, 2019. Significant declines in investment markets have occurred in the first half of the 2020 calendar year which will almost certainly have an adverse impact on future DB Program funding. This impact is not directly reflected in this valuation report. All other things being equal, it is expected that the 2020 DB Program valuation will show a greater increase in the projected state contribution rate (and possibly the employer rate) and a possible decline in the Funded Ratio. In the section of this

report titled "Projections Under Alternate Return Scenarios," we show the potential impact of investment returns materially less than the assumed return (see 25<sup>th</sup> percentile).

A significantly negative return has the potential to stress the CalSTRS funding plan due to the constraints on contribution rate increases. The board should monitor this situation in consultation with Milliman and its internal actuarial and investment staff.

### 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, which were reduced under SB 90. 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. However, the maximum increase or decrease in a given year is limited to 1.0% of payroll and the total employer contribution rate cannot exceed 20.25% of payroll.

The 2% at 60 member rate is fixed at 10.250% of pay. The 2% at 62 member rate, currently 10.205% of pay, can vary depending on the calculated Normal Cost Rate as discussed later in this section.

The following table shows a summary of the contribution rates currently being paid (2019-20 fiscal year) and those to be paid next year (2020-21 fiscal year) under the valuation policy.

Source of Revenue	2019 Valuation FY 20-21 Rate	2018 Valuation FY 19-20 Rate
Employers – Base Rate	8.000 %	8.000 %
Employers – Sick Leave	0.250	0.250
Employers – Supplemental Rate <sup>(1)</sup>	10.150	8.850
<b>Employers – Total Rate</b>	<b>18.400</b>	<b>17.100</b>
State – Base Rate	2.017 %	2.017 %
State – Supplemental Rate <sup>(2)</sup>	6.311	5.811
<b>State – Total DB Program</b>	<b>8.328</b>	<b>7.828</b>
State – SBMA Rate <sup>(2)</sup>	2.500	2.500
<b>State – Total Contribution to CalSTRS</b>	<b>10.828</b>	<b>10.328</b>
Members – 2% at 60	10.250 %	10.250 %
Members – 2% at 62	10.205	10.205

1. Reflects provisions of SB 90.

2. Calculated based on valuation policy and subject to board adoption.

3. The state contribution to fund the Supplemental Benefit Maintenance Account (SBMA) is reduced by \$72 million each fiscal year.



### State Supplemental Contribution Rate

For the 2019 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 or decrease 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
<b>June 30, 2018 Actuarial Valuation</b>	<b>7.81%</b>
Expected Year-to-Year Change	0.11%
Recognized Asset (Gain) / Loss	
• From Prior Years	-0.36%
• From Current Year	0.06%
Salary / Payroll Variation	
• Salary Increase < Assumed	-0.14%
• Payroll Increase < Assumed	0.02%
Assumption Changes	0.36%
All Other Sources	0.04%
<b>Total Change</b>	<b>0.09%</b>
<b>June 30, 2019 Actuarial Valuation</b>	<b>7.90%</b> <sup>(1)</sup>

1. Calculated rate is 6.311% due to application of maximum increase.  
 Unconstrained total does not include July 2019 additional contribution.

An **increase to the state supplemental contribution rate to 6.311%** effective July 1, 2020 has been calculated based on the board's valuation policy. For the current fiscal year, the state contribution rate is 5.811%, 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 actuarial value of assets, which recognizes investment gains and losses over multiple valuations. As shown later in this section (see "Looking Ahead"), when the deferred asset gain as of June 30, 2019 and other factors, including the additional state contribution made July 2019, are reflected in the projected contribution rates, the total state DB Program contribution rate is projected to increase to about 9.3% (2.017% base contribution rate plus an approximate 7.3% supplemental contribution rate). In addition, the state contributes approximately 2.5% of payroll to the Supplemental Benefits Maintenance Account (SBMA).

### Employer Supplemental Contribution Rate

Consistent with the Education Code, the 2019 valuation does not calculate changes in the employer supplemental contribution rate. Note that the fixed employer supplemental contribution rates for the fiscal years beginning July 1, 2019 and July 1, 2020 were reduced to 8.85% and 10.15%, respectively, to reflect additional contributions made by the state on behalf of employers. Effective with the 2020 valuation, the employer supplemental contribution rate starting July 1, 2021 will be actuarially determined. 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. For June 30, 2019, there was a small increase in the Unallocated UAO. As of June 30, 2019, the Unallocated UAO is small relative to the total UAO, as it only reflects service accrued for five years. However, as members continue to accrue benefits for service after June 30, 2014, there is the potential for the Unallocated UAO to increase (or decrease) significantly if actual experience differs materially from that assumed or if further changes in assumptions occur.

(\$ Millions)	Unallocated UAO <sup>(1)</sup>	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%
2018 Valuation	65	0.2%
2019 Valuation	109	0.3%

1. The Unallocated UAO is calculated using the market value of assets. It is currently \$245 million based on the actuarial value of assets.

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 0.04% of payroll would be required effective July 1, 2020.

**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, 2020, 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, 2019, the Normal Cost Rate for the CalSTRS 2% at 62 members is 18.133%. We recommend the board adopt this rate.

EC §22901(b)(2) 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 0.240%,

from 17.893% (the time of the last adjustment) to 18.133% for this group. Therefore, the current base member contribution rate should remain at 9.00% for 2% at 62 members based on the relevant section of the Education Code.

Note that under EC §22901.7(b) 1.205% of pay is added to the base member rate. Therefore, **as of July 1, 2020, the total member contribution rate for 2% at 62 members continues to be 10.205%** (9.00% plus the 1.205% additional contribution rate).

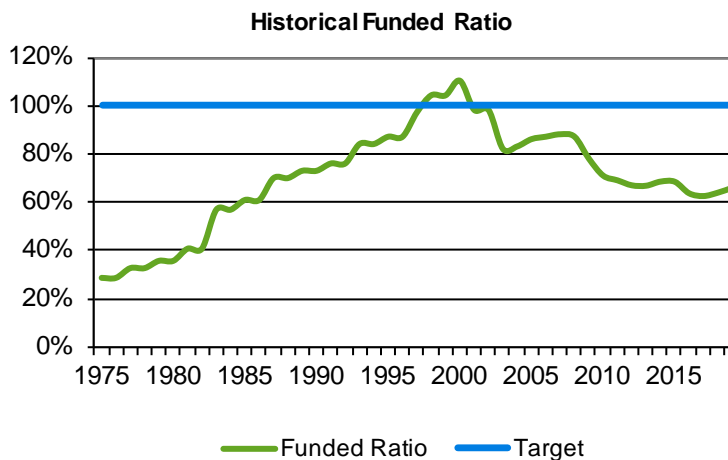
### Funding Progress

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)	2019 Valuation	2018 Valuation
<b>Actuarial Obligation</b>	\$ 310,719	\$ 297,603
<b>Actuarial Value of Assets</b>	205,016	190,451
<b>Unfunded Actuarial Obligation</b>	\$ 105,703	\$ 107,152
<b>Funded Ratio</b>	66.0%	64.0%

The \$105.7 billion UAO compares to a projected June 30, 2019 value of \$110.0 billion based on the prior valuation. The primary reasons for the decrease in the UAO and the increase in the Funded Ratio are salary increases less than assumed, additional state contributions, and actuarial asset gains recognized from prior years. Additional discussion of the contributing factors in this change can be found in Section 5 under Actuarial Gains and Losses.

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

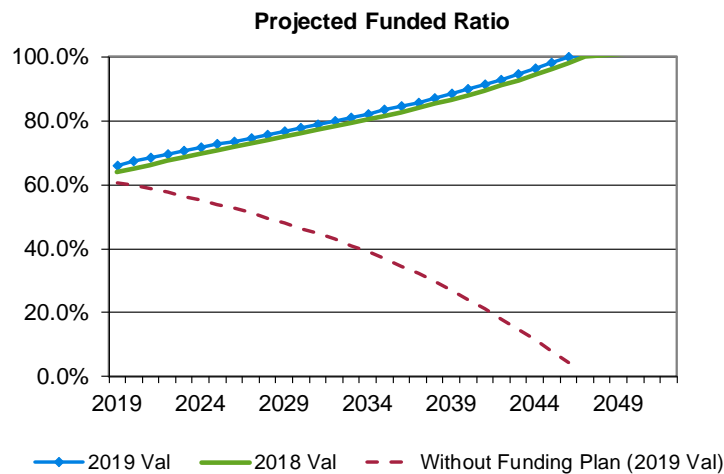


The table below shows the factors that affected the DB Program's Funded Ratio since the last valuation. As previously discussed, the primary reasons for the increase in the Funded Ratio are salary increases less than assumed, additional state contributions, and actuarial asset gains recognized from prior years.

Sources of Change	Funded Ratio
<b>June 30, 2018 Actuarial Valuation</b>	<b>64.0%</b>
Expected Year-to-Year Change	0.5%
Recognized Asset Gain/(Loss)	
• From Prior Years	0.6%
• From Current Year	-0.1%
Additional State Contributions made in FY2018-19	0.7%
Salary Variation	0.2%
Assumption and Method Changes	0.0%
All Other Sources	0.1%
<b>Total Change</b>	<b>2.0%</b>
<b>June 30, 2019 Actuarial Valuation</b>	<b>66.0%</b>

**Looking Ahead**

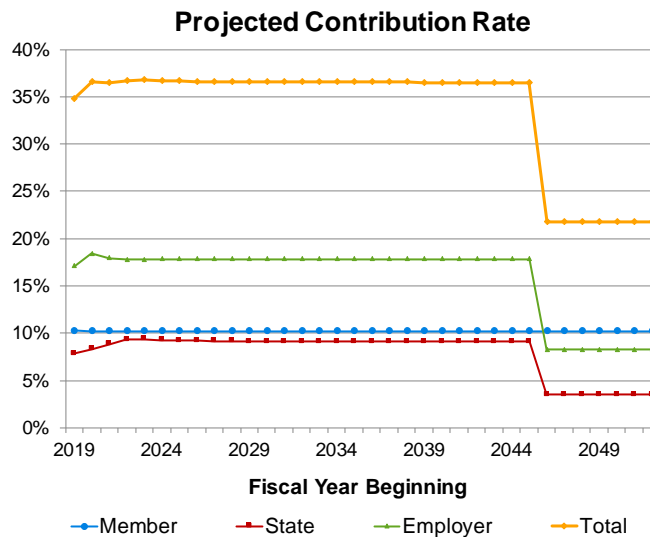
The following projection shows the Funded Ratio if the DB Program earns 7.00% in each future year and all other assumptions are met. As shown in the graph, the DB Program is projected to reach approximately 100% funding by 2046 based on the 2019 valuation (blue line). The Funded Ratio is slightly higher than projected in the 2018 valuation (green line), primarily due to the additional state contributions during fiscal year 2018-2019. Note that we have also shown a hypothetical projection of the funded status based on the 2019 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.



As previously discussed, significant declines in investment markets have occurred in the first half of the 2020 calendar year, which will almost certainly have an adverse impact on future DB Program funding. This impact is not directly reflected in these projections. If market conditions do not improve significantly prior to June 30, 2020, it is expected that the 2020 DB Program valuation will show a greater increase in the projected state contribution rate (and possibly the employer rate) and a possible decline in the Funded Ratio, as compared to the projections shown in this report.

An example of the potential impact of investment returns materially less than the assumed return is represented by the 25th percentile in the Projections Under Alternate Return Scenarios discussion. It should be noted that the 25th percentile projection represents long-term underperformance, not just one year.

The following graph shows the projected contribution rates for each of the stakeholder groups and in total assuming all valuation assumptions are met in the future. 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).



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 statute, 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
- The state made a contribution of approximately \$1.1 billion in July 2019 to help pay down its UAO, which is not reflected in the 2019 valuation results, but is reflected in the projections.

### Projections Under Alternate Return Scenarios

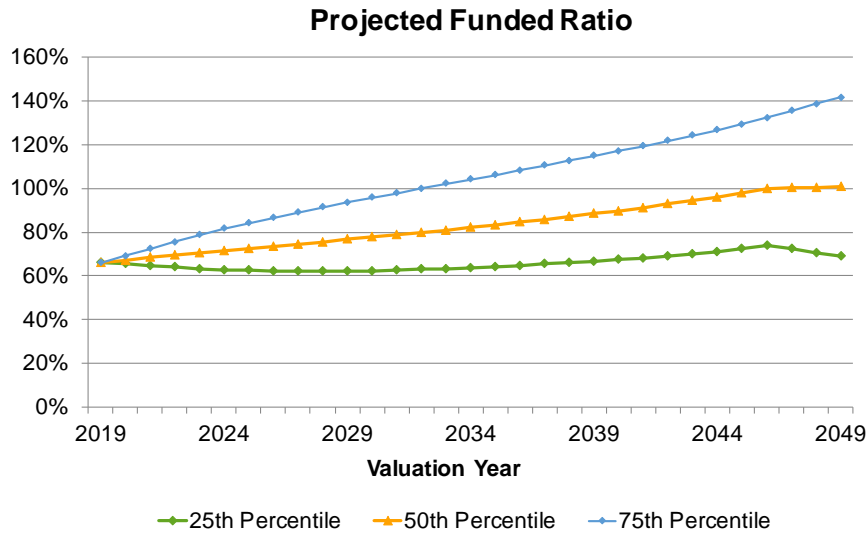
Actuarial valuations are based on a certain set of assumptions. The reality is that these assumptions will not be exactly met and that this will affect future valuation results. Investment returns will likely have the biggest impact on the future funding of CalSTRS. In the following graphs, we show some 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 provide the board a general sense of the sensitivity of funding levels and contribution rates caused by returns that are above or below the assumption over a long period.

Each fall, CalSTRS internal actuarial staff completes a rather comprehensive analysis of potential risks to future DB Program funding levels ("Review of Funding Level and Risks"). The update for the 2019 valuation is scheduled to be presented at the November 2020 board meeting.

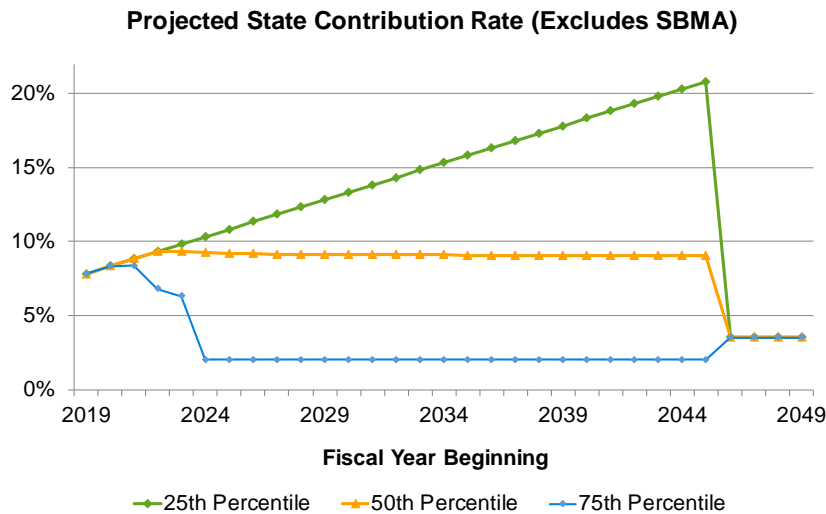
To show potential variability of future returns, we have assumed CalSTRS earns the 25<sup>th</sup>, 50<sup>th</sup>, and 75<sup>th</sup> percentile returns over the next 30 years. This assumes a median (50<sup>th</sup> percentile) geometric return of 7.0% and a standard deviation of 11.6% (before adjusting for the impact of guaranteed SBMA crediting). The average 30-year returns shown for the 30-year period are approximately 5.5% for the 25<sup>th</sup> percentile and 8.5% for the 75<sup>th</sup> percentile.

Note that the 25<sup>th</sup> 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.

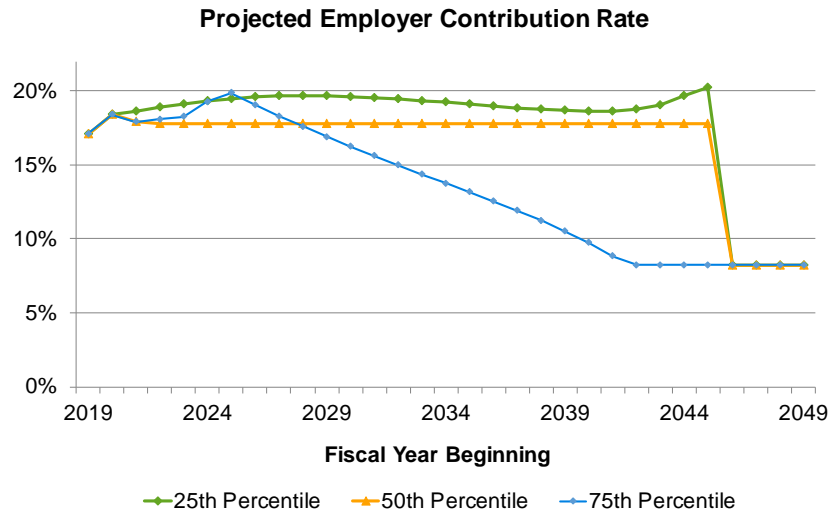
The following graph shows the potential impact of alternate returns on CalSTRS Funded Ratio. The green line (below-average returns) illustrates how the caps on contribution rate increases restrict CalSTRS ability to make significant progress toward its funding goal following sustained below-average returns.



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 implemented in the following fiscal year.



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.



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

	2019 Valuation	2018 Valuation	Percent Change
<b>1. Total Membership</b>			
A. Active Members	451,429	449,595	0.4 %
B. Inactive Members	204,593	198,058	3.3 %
C. Retired Members and Beneficiaries	308,639	301,859	2.2 %
D. Total Membership	964,661	949,512	1.6 %
<b>2. Payroll as of Valuation Date (All Members)</b>			
A. Annual Total (\$Millions)	\$ 32,897	\$ 31,884	3.2 %
B. Annual Average Earned Salary per Active Member	\$ 72,872	\$ 70,918	2.8 %
<b>3. Average Annual Allowance Payable</b>			
A. Service Retirement	\$ 50,208	\$ 49,032	2.4 %
<b>4. Actuarial Obligation (\$Millions)</b>			
A. Active Members	\$ 136,225	\$ 130,051	4.7 %
B. Inactive Members	6,778	6,333	7.0 %
C. Retired Members and Beneficiaries	167,428	160,932	4.0 %
D. Existing MPPP Unfunded Obligation	288	287	0.3 %
E. Total	\$ 310,719	\$ 297,603	4.4 %
<b>5. Value of System Assets (\$Millions)</b>			
A. Fair Market Value	\$ 225,466	\$ 211,367	6.7 %
B. Deferred Investment (Gains) or Losses	(3,067)	(5,160)	
C. Actuarial Value	\$ 222,399	\$ 206,207	7.9 %
D. Ratio of Actuarial Value to Fair Value	99%	98%	
E. Less SBMA Reserve	(17,383)	(15,756)	10.3 %
F. Net Actuarial Value	\$ 205,016	\$ 190,451	7.6 %
<b>6. Funded Status -- Actuarial Value Basis</b>			
A. Unfunded Actuarial Obligation (\$Millions)	\$ 105,703	\$ 107,152	(1.4) %
B. Funded Ratio ( 5F ÷ 4E )	66.0%	64.0%	
<b>7. Normal Cost Rates (percent of salaries)</b>			
A. CalSTRS 2% at 60 Members	20.867%	20.557%	1.5 %
B. CalSTRS 2% at 62 Members	18.133%	17.863%	1.5 %
C. All Members	20.403%	20.181%	1.1 %
<b>8. Next Fiscal Year Contribution Rates (percent of salaries)</b>			
A. 2% at 60 Members	10.250%	10.250%	- %
B. 2% at 62 Members	10.205%	10.205%	- %
C. State Supplemental Rate	6.311%	5.811%	8.6 %
D. Employer Supplemental Rate	10.150%	8.850%	14.7 %
<b>9. Funded Status -- Market Value Basis</b>			
A. Unfunded Actuarial Obligation (\$Millions) [4E - (5A + 5E)]	\$ 102,636	\$ 101,992	0.6 %
B. Alternate Funded Ratio (Based on Market Value of Assets)	67.0%	65.7%	

## **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, 2019. 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, 2019. 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, 2020.

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. The fixed employer supplemental contribution rates for the fiscal years beginning July 1, 2019 and July 1, 2020 were reduced to reflect additional contributions made by the state on behalf of the employer. No other 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.

Section 9 provides a general discussion of the potential risks to CalSTRS funding.

This report includes several appendices:

Appendix A is a summary of the current benefit structure, as determined by the provisions of governing law on June 30, 2019.

Appendix B is 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 includes 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 is a glossary of actuarial terms used in this report.

### 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.

#### 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 Normal 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) and is expressed as a rate of compensation. 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 20.181% to 20.403% 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, 2018	\$33,387	\$6,738	20.181%
FYB July 1, 2019	\$34,502	\$7,004	20.300%

*Note: Normal Cost rate for FYB July 1, 2019 is for the full fiscal year and differs from the Normal Cost rate of 20.403% shown elsewhere which is the rate as of June 30, 2019.*

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 as current members leave active employment and are replaced by new members with lower benefit levels. The Normal Cost Rate increased since last year due to the adoption of new actuarial assumptions based on the 2020 Experience Analysis. This increase was slightly offset by increasing membership of CalSTRS 2% at 62 members who have a lower overall Normal Cost Rate than the 2% at 60 members. We expect small decreases in the overall Normal Cost Rate in future years when assumptions are unchanged.

Primarily because of different benefit formulas, the CalSTRS 2% at 60 members have higher Normal Cost Rates compared to the 2% at 62 members, as shown in the following table for the fiscal year beginning July 1, 2019.

(\$ Millions)	2% at 60 Members	2% at 62 Members	Proportion 2% at 62
Projected Payroll	\$27,344	\$7,158	20.7%
Normal Cost \$	5,706	1,298	18.5%
Normal Cost Rate	20.867%	18.133%	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, 2020, 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, 2019, the Normal Cost Rate for the CalSTRS 2% at 62 members is 18.133%. We recommend the board adopt this rate.

EC §22901(b)(2) 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 0.240%, from 17.893% (the time of the last adjustment) to 18.133% for this group. Therefore, the current base member contribution rate should remain at 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, 2020, the total member contribution rate for 2% at 62 members continues to be 10.205% (9.00% plus the 1.205% additional contribution 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)	2019 Valuation	2018 Valuation
Benefits Being Paid	\$ 167,428	\$ 160,932
Inactive Deferred Benefits	6,778	6,333
Active Member Benefits	217,733	206,841
Existing MPPP Unfunded Obligation	288	287
Present Value of Projected Benefits	\$ 392,227	\$ 374,393
Present Value of Future Normal Costs	81,508	76,790
Actuarial Obligation	\$ 310,719	\$ 297,603

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 2.3% 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	\$194,672	\$23,061	10.6%
Active PVFNC	61,549	19,959	24.5%
Active AO	\$133,123	\$3,102	2.3%

**Table 1**  
**Normal Cost**

<i>(\$Millions)</i>	<b>2019</b>	<b>2018</b>
Estimated Annual Earned Salaries <sup>(1)</sup>	\$32,936	\$31,871
Present Value of Future Normal Costs for Current Active Members	\$81,508	\$76,790
Present Value of Future Earned Salaries for Current Active Members	\$409,368	\$387,081
<b>Normal Cost</b>		
Service Retirement	\$6,091	\$5,711
Deferred Retirement & Refund	335	406
Death	43	47
Disability	251	268
Total Normal Cost	<u>\$6,720</u>	<u>\$6,432</u>
<b>Normal Cost Rate</b>		
<b>Percent of Payroll</b>		
Service Retirement	18.493 %	17.919 %
Deferred Retirement & Refund	1.017	1.274
Death	0.131	0.147
Disability	0.762	0.841
<b>Total Normal Cost</b>	<b><u>20.403 %</u></b>	<b><u>20.181 %</u></b>

1. Annual 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.

**Table 2**  
**Actuarial Obligation**

(\$ Millions)	2019	2018
Present Value of Projected Benefits to All Current Members		
Benefits Currently Being Paid		
Service Retirement	\$ 155,206	\$ 149,184
Disability	4,004	3,905
Survivors	8,218	7,843
Total	<u>\$ 167,428</u>	<u>\$ 160,932</u>
Benefits to Inactive Members	6,778	6,333
Benefits to Active Members		
Retirement	\$ 207,225	\$ 195,185
Disability	5,576	5,621
Death	934	1,148
Deferred Retirement & Refund	3,998	4,887
Total	<u>\$ 217,733</u>	<u>\$ 206,841</u>
Existing MPPP Unfunded Obligation	<u>288</u>	<u>287</u>
Total Present Value of Projected Benefits	\$ 392,227	\$ 374,393
Present Value of Future Normal Costs	<u>81,508</u>	<u>76,790</u>
<b>Actuarial Obligation</b>	<b>\$ 310,719</b>	<b>\$ 297,603</b>

#### 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, 2019. 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 (adjusted from the accounting value to account for pre-recognized GASB expenses) was reported as \$225,466 million as of June 30, 2019, up from \$211,367 million as of June 30, 2018. **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 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 and the net cash flow during the year. The projection then recognizes one-third of the difference between the expected value and the Fair Market Value as of the valuation date 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)	2019 Valuation	2018 Valuation
<b>Fair Market Value</b>	\$ 225,466	\$ 211,367
<b>Actuarial Value of Assets</b>	222,399	206,207
<b>Deferred Investment Gains or (Losses)</b>	\$ 3,067	\$ 5,160
Ratio of AVA to FMV	98.6%	97.6%

Due to the asset smoothing method, there are investment gains of \$3,067 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 \$3,067 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**

<i>(\$ Millions)</i>	June 30, 2019	June 30, 2018
<b>Invested Assets</b>		
Cash	\$ 599	\$ 404
Debt Securities	44,191	41,288
Equity Securities	107,701	108,286
Alternative Investments	72,097	62,046
Derivative Instruments	181	29
Total Investments	<u>\$ 224,769</u>	<u>\$ 212,053</u>
<b>Receivables</b>	10,180	6,235
<b>Liabilities Net of Securities Lending Collateral</b>	(10,242)	(6,979)
<b>Net Deferred (Inflows) and Outflows</b>	(46)	58
<b>Exclude Net Pension and OPEB Obligation</b>	805	-
<b>Fair Market Value of Net Assets</b>	<u>\$ 225,466</u>	<u>\$ 211,367</u>

**Table 4**  
**Statement of Changes in Program Assets**

(\$ Millions)	June 30, 2019	June 30, 2018
<b>Contributions</b>		
Members	\$ 3,496	\$ 3,345
Employers	5,482	4,705
State of California	5,335	2,797
Total Contributions	<u>14,313</u>	<u>10,847</u>
<b>Benefits and GASB Adjustments</b>		
Retirement, Death and Survivors	(14,528)	(13,855)
Refunds of Member Contributions	(75)	(75)
Purchasing Power Benefits	(194)	(162)
Change in GASB Adjustments	805	-
Total Benefits and GASB Adjustments	<u>(13,992)</u>	<u>(14,092)</u>
<b>Net Cash Flow</b>	<b>\$ 321</b>	<b>\$ (3,245)</b>
<b>Investment Income</b>		
Realized Income	\$ 5,167	\$ 5,350
Net Appreciation	9,152	12,549
Net Securities Lending Income	41	49
Investment Expenses	(466)	(473)
Administrative & Other Expenses	(244)	(204)
Other (Expense) Income	128	103
Net Investment Return	<u>13,778</u>	<u>17,374</u>
<b>Net Increase (Decrease)</b>	<b>\$ 14,099</b>	<b>\$ 14,129</b>
<b>Fair Market Value of Net Assets</b>		
Beginning of Year	<u>211,367</u>	<u>197,718</u>
Accounting Adjustments (GASB 75)	-	(480)
<b>End of Year</b>	<b>\$ 225,466</b>	<b>\$ 211,367</b>
Estimated Net Rate of Return <sup>(1)</sup>	6.6%	9.0%

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**

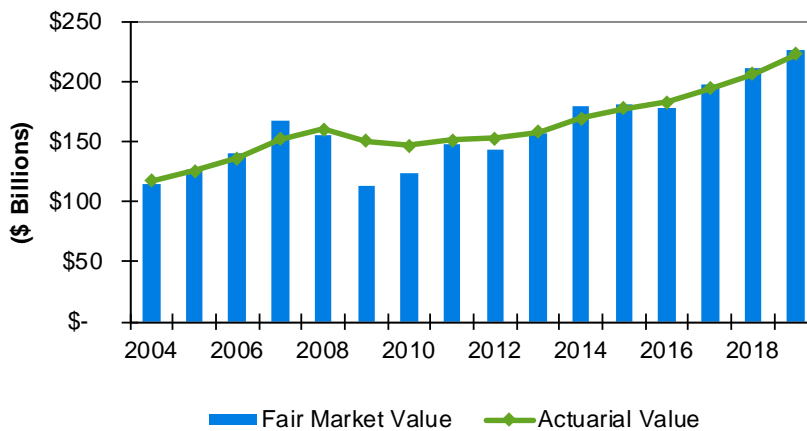
(\$ Millions)	June 30, 2019	June 30, 2018
<b>Actuarial Value at Beginning of Year</b>	\$ 206,207	\$ 193,445
Contributions	14,313	10,847
Benefits	(14,798)	(14,092)
Change in GASB Adjustments	805	-
Expected Return	14,339	13,427
<b>Expected Actuarial Value End of of Year</b>	<u>\$ 220,866</u>	<u>\$ 203,627</u>
<b>Fair Market Value</b>	225,466	211,367
<b>Difference between Fair Market Value and Expected Actuarial Value</b>	\$ 4,600	\$ 7,740
Recognition Factor	One-third	One-third
Recognized Gain or Loss	\$ 1,533	\$ 2,580
<b>Actuarial Value at End of of Year</b>	<b>\$ 222,399</b>	<b>\$ 206,207</b>
<b>Deferred Investment Gains or (Losses)</b>	\$ 3,067	\$ 5,160
Ratio of Actuarial Value of Assets to Fair Market Value of Assets	98.640%	97.559%
Estimated Net Rate of Return <sup>(1)</sup>	7.7%	8.3%

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)				Ratio of
June 30	Fair Market Value	Estimated Return <sup>(1)</sup>	Actuarial Value	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
2018	211,367	9.0	206,207	98
2019	225,466	6.6	222,399	99

1. Estimated return on a Fair-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.



## 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)	2019 Valuation	2018 Valuation
Actuarial Obligation	\$ 310,719	\$ 297,603
Actuarial Value of Assets (AVA)		
From Table 5	\$ 222,399	\$ 206,207
Less SBMA Reserve	(17,383)	(15,756)
Net for Funding	205,016	190,451
Unfunded Actuarial Obligation	\$ 105,703	\$ 107,152
<b>Funded Ratio (on AVA)</b>	<b>66.0%</b>	<b>64.0%</b>
<i>Alternate Funded Ratio (based on Fair Market Value)</i>	<i>67.0%</i>	<i>65.7%</i>

The Funded Ratio increased by 2.0% during the past year and has decreased by approximately 12% over the past 10 years. The additional state contribution and the return on the Actuarial Value of Assets (7.7%) that exceeded the assumed return (7.0%) were the primary causes of the increase in the Funded Ratio from last year. The longer-term decrease has been primarily due to a combination of returns since 2008 that have, on a smoothed basis, been less than the actuarial assumption, contributions less than the actuarially calculated amount, 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 was primarily due to the additional state contributions made during the 2018-2019 fiscal year.

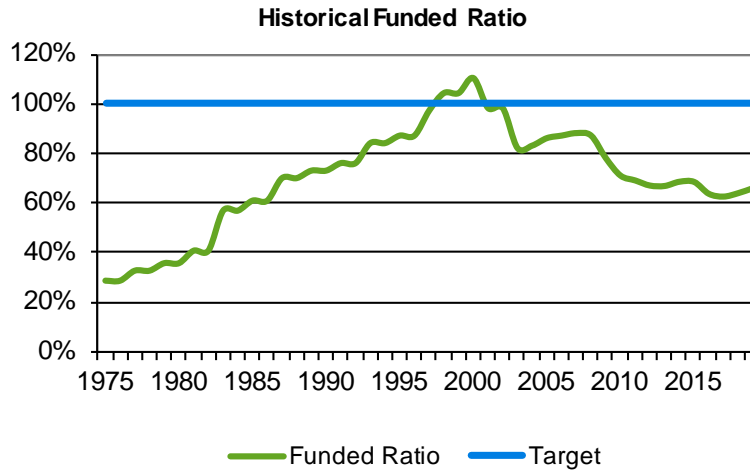
Future benefits provided through the Supplemental Benefits Maintenance Account (SBMA) are not part of the projected benefits included in this valuation. Therefore, the SBMA Reserve is subtracted from the DB Program assets to arrive at the value available to support the benefits included in this valuation.

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, 2019, only a relatively small amount to cover monthly payments resides in the THBF, while the remaining unfunded amount of \$288 million is added to the DB Program obligation.

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

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	<b>28,401</b>	<b>17,457</b>	<b>10,944</b>	<b>61%</b>
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	<b>63,391</b>	<b>55,207</b>	<b>8,184</b>	<b>87%</b>
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	<b>142,193</b>	<b>121,882</b>	<b>20,311</b>	<b>86%</b>
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	<b>241,753</b>	<b>165,553</b>	<b>76,200</b>	<b>69%</b>
2016	266,704	169,976	96,728	64%
2017	286,950	179,689	107,261	63%
2018	297,603	190,451	107,152	64%
2019	310,719	205,016	105,703	66%

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	\$ 310,263	\$ 310,719	\$ 456
Act. Value of Assets	<u>200,268</u>	<u>205,016</u>	<u>(4,748)</u>
Unfunded Act. Oblig.	\$ 109,995	\$ 105,703	\$ (4,292)
<b>Actuarial (Gains) or Losses by Source</b>			
Changes in assumptions & methods (Actuarial Obligation)			\$ 814
Salaries increased less than assumed			(979)
All other non-investment sources			<u>621</u>
Loss on the Actuarial Obligation			\$ 456
Investment Return on Actuarial Value of Assets			(1,492)
Changes in assumptions & methods (Actuarial Assets)			(805)
Contributions (in excess of) or less than assumed			<u>(2,451)</u>
(Gain) on the Actuarial Value of Assets			\$ (4,748)
Total Actuarial (Gain)			\$ (4,292)

(\$ Millions)			
Actuarial (Gains) or Losses on the Actuarial Obligation	(Gain) or Loss	Percent of Actuarial Obligation	
Change in actuarial assumptions	\$ 814	0.3%	
Salaries increased less than assumed	(979)	(0.3)	
All other non-investment sources	<u>621</u>	<u>0.2</u>	
(Gain) or Loss on the Actuarial Obligation	\$ 456	0.1%	
Actuarial (Gains) or Losses on the Actuarial Value of Assets	(Gain) or Loss	Percent of AVA	
Return on Actuarial Value of Assets	\$ (1,492)	(0.7)%	
Change in actuarial methods	(805)	(0.4)	
Contributions (greater)/less than assumed	<u>(2,451)</u>	<u>(1.2)</u>	
(Gain) or Loss on the Actuarial Value of Assets	\$ (4,748)	(2.3)%	

These net gains and losses are within a reasonable range for variances in a single year.

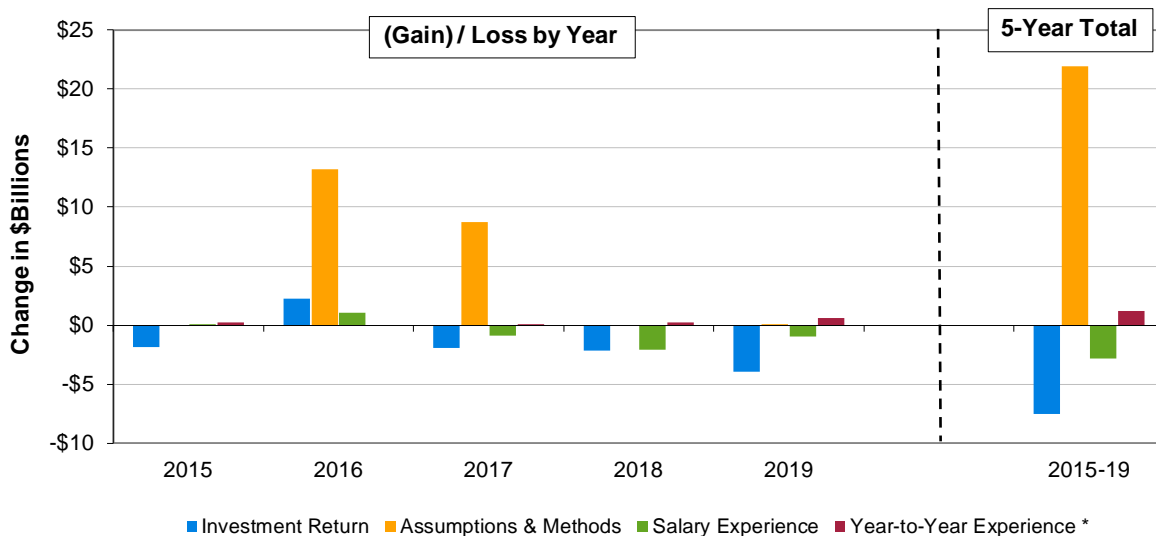


Based on the 2018 Actuarial Valuation, the UAO was expected to increase to \$109,995 million. The actual UAO of \$105,703 million represents a net actuarial gain of \$4,292 million.

- The change in the actuarial valuation assumptions based on the most recent Experience Analysis caused the Actuarial Obligation to increase by \$814 million.
- Salaries increased less than projected by the current actuarial assumptions, causing the Actuarial Obligation to decrease by \$979 million from the expected amount. We expect to continue to see salary increase fluctuations from year to year.
- All other non-investment experience caused the Actuarial Obligation to increase by \$621 million.
- On the asset side, there was an actuarial asset gain based on the actuarial value of assets and an actuarial asset loss on the Market Value of Assets. The return on market value was estimated at 6.6%, less than the assumed 7.0% return from the prior valuation, while the return on the Actuarial Value of Assets was more (estimated at 7.7%) due to recognizing prior year actuarial investment gains. Also, a change in the actuarial asset valuation method (treatment of pre-recognized GASB expenses) increased the actuarial value of assets by \$805 million.

### 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 2015.



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

Over the last five years, assumption and method changes have increased the UAO by about \$22 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 \$33 billion over the last 5 years. This compares to the net effect of actuarial gains and losses (including assumption changes) described above which account for approximately \$13 billion of the increase in UAO. The remaining \$20 billion increase is due to contributions received by CalSTRS that 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 this is not projected to occur for a few more years due to the graded increases in the state and employer contribution rates. Under 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 2032.

**Table 7**  
**Funded Status**

<i>(\$ Millions)</i>	<b>2019</b>	<b>2018</b>
<b>Actuarial Obligation</b> <i>(Table 2)</i>	\$310,719	\$297,603
<b>Actuarial Value of Assets</b>		
Calculated <i>(Table 5)</i>	\$ 222,399	\$ 206,207
Less SBMA Reserve	<u>(17,383)</u>	<u>(15,756)</u>
Program Assets	\$ 205,016	\$ 190,451
<b>Unfunded Actuarial Obligation</b>	<b>\$ 105,703</b>	<b>\$ 107,152</b>
<b>Funded Ratio</b>	<b>66.0%</b>	<b>64.0%</b>

**Table 8**  
**Actuarial Gains and Losses**

(\$ Millions)	Expected	Actual	(Gain) / Loss
<b>Actuarial Obligation</b>			
Actuarial Obligation June 30, 2018	\$297,603		
Normal Cost for 2018-2019	6,703		
Benefits Paid (Excludes Purchasing Power)	(14,603)		
Expected Interest at 7.00%	<u>20,560</u>		
<b>Actuarial Obligation June 30, 2019</b>	<b>\$310,263</b>	<b>\$310,719</b>	<b>\$ 456</b>
<i>By Source:</i>			
<i>Change in actuarial assumptions</i>			814
<i>Retiree Mortality</i>			21
<i>Active Member Mortality</i>			79
<i>Service Retirements</i>			202
<i>Disability Retirement</i>			(4)
<i>Other Terminations of Employment</i>			136
<i>Salary increases more / (less) than assumed</i>			(979)
<i>All Other Non-investment Sources</i>			<u>187</u>
<i>Total (Gain) Loss on the Actuarial Obligation</i>			\$ 456
<b>Actuarial Value of Assets</b>			
Actuarial Value of Assets June 30, 2018	\$190,451		
Expected Contributions for 2018-2019	11,207		
Benefits Paid (Excludes Purchasing Power)	(14,603)		
Expected Interest at 7.00% on AVA	<u>13,213</u>		
<b>Actuarial Value of Assets June 30, 2019</b>	<b>\$200,268</b>	<b>\$205,016</b>	<b>\$ (4,748)</b>
<i>By Source:</i>			
<i>Investment Return on Actuarial Value of Assets (including the recognition of prior deferred investment gains and losses)</i>			\$ (1,492)
<i>Change in actuarial asset method</i>			\$ (805)
<i>Contributions (in excess of) or less than assumed (including service purchases)</i>			<u>(2,451)</u>
<i>Total (Gain) Loss on the Actuarial Value of Assets</i>			\$ (4,748)
<b>Unfunded Actuarial Obligation</b>	<b>\$109,995</b>	<b>\$105,703</b>	<b>\$(4,292)</b>

## 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 2020-2021 will be based on the covered member compensation for fiscal year 2018-2019. 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 5.811% of pay for the current fiscal year ending June 30, 2020. In accordance with the valuation policy, this rate is increased to 6.311% 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.

The Actuarial Obligation related to the 1990 Benefit Structure is \$256.5 billion. This compares to the Actuarial Obligation for the DB Program of \$310.7 billion.

(\$ Millions)	2019 Valuation	2018 Valuation
<b>Actuarial Obligation -- 1990 Benefit Structure</b>		
Value of Projected Benefits	\$ 327,837	\$ 311,968
Value of Future Normal Costs	<u>71,304</u>	<u>68,092</u>
Actuarial Obligation	\$ 256,533	\$ 243,876

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,
- Adjusting for the increase in the actuarial obligation due to the change in the service retirement rate assumption for the 1990 Benefit Structure adopted in the 2020 Experience Analysis, so there is no change in the 1990 UAO, and
- Adjusting for actual investment return.

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

(\$ Millions)	2019 Valuation	2018 Valuation
<b>Asset Adjustment -- 1990 Benefit Structure</b>		
Actuarial Value for DB Program	\$ 205,016	\$ 190,451
Adjustments per Table 9	<u>18,453</u>	<u>20,039</u>
Actuarial Value of Assets	\$ 223,469	\$ 210,490

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.

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 \$33.1 billion.

(\$ Millions)	2019 Valuation	2018 Valuation
<b>Funded Status -- 1990 Benefit Structure</b>		
Actuarial Obligation	\$ 256,533	\$ 243,876
Actuarial Value of Assets	223,469	210,490
Unfunded Actuarial Obligation	\$ 33,064	\$ 33,386
Funded Ratio	87.1%	86.3%

### 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, 2020.

As shown in **Table 10**, a supplemental contribution rate of 7.901% 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 2.1% of payroll from the current supplemental rate of 5.811%. 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, 2020 should be 6.311% under EC §22955.1(b). Note that the 7.901% is based on the Actuarial Value of Assets, so it does not reflect the future recognition of currently deferred asset gains and losses or the additional state contribution made July 2019, 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	\$ 254,216	\$ 256,533	\$ 2,317
Act. Value of Assets	219,877	223,469	(3,592)
Unfunded Act. Oblig.	\$ 34,339	\$ 33,064	\$ (1,275)
<b>Actuarial (Gains) or Losses by Source</b>			
Changes in assumptions & methods (Actuarial Obligation)			\$ 2,291
Salaries increased less than assumed			(780)
All other non-investment sources			806
Loss on the Actuarial Obligation			\$ 2,317
Investment Return on Actuarial Value of Assets			(1,791)
Changes in assumptions & methods (Actuarial Assets)			(1,782)
Contributions (in excess of) or less than assumed			(19)
(Gain) on the Actuarial Value of Assets			\$ (3,592)
Total Actuarial (Gain)			\$ (1,275)



**Table 9**  
**Asset Adjustment for 1990 Benefit Structure**

(\$ Millions)	2019	2018
<b>Assets Adjustment due for 1990 Structure Changes</b>		
Allocated Market Value at Beginning of Year	\$20,540	\$20,000
Contributions During the Year		
EC §22901.7 at 2.250% (or 1.205%) of Earned Salaries	(755)	(688)
EC §22950.5 at 8.030% / 6.180% of Earned Salaries	(2,704)	(2,015)
EC §22951 at 0.250% of Earned Salaries	(84)	(82)
EC §22955 at 2.017% of second preceding fiscal year Earned Salaries	(647)	(618)
THBF costs reallocated to DB Program	28	28
Total Adjustment to Contributions <sup>(1)</sup>	(4,162)	(3,375)
Benefits Paid During the Year		
Post-1990 Benefits Paid During the Year	2,322	2,205
Post-1990 Refunds of supplemental member contributions	4	3
Prior 2% DBS redirection contributions refunded	(8)	(10)
Total Adjustment to Benefits Paid <sup>(1)</sup>	2,318	2,198
Estimated Investment Earnings for the Year <sup>(2)</sup>	(966)	1,717
Allocated 1990 Assets due to Assumption Changes	977	-
<b>Total Allocated Market Value at End of Year</b>	<b>\$18,707</b>	<b>\$20,540</b>
Ratio of Actuarial Value to Market Value <sup>(3)</sup>	98.640%	97.559%
<b>Asset Adjustment (Actuarial Value of Assets)</b>	<b>\$18,453</b>	<b>\$20,039</b>

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 8.88% for 2017-2018 and 6.56% for 2018-2019.

3. Developed from Table 5.

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

(\$ Millions)	2019	2018
<b>Actuarial Obligation</b>		
Present Value of Projected Benefits		
Benefits Currently Being Paid	\$ 139,538	\$ 134,102
Benefits to Inactive Members	6,543	6,116
Benefits to Active Members	181,756	171,750
Total	<u>\$ 327,837</u>	<u>\$ 311,968</u>
Present Value of Future Normal Costs	(71,304)	(68,092)
Actuarial Obligation	<u>\$ 256,533</u>	<u>\$ 243,876</u>
<b>Actuarial Value of Assets</b>		
Actuarial Value of Assets (Table 7)	\$ 205,016	\$ 190,451
Plus, 1990 Asset Adjustment (Table 9)	<u>18,453</u>	<u>20,038</u>
Theoretical AVA for 1990 Benefits	<u>\$ 223,469</u>	<u>\$ 210,489</u>
<b>Funded Status</b>		
Actuarial Obligation	\$ 256,533	\$ 243,876
Actuarial Value of Assets	<u>223,469</u>	<u>210,489</u>
Unfunded Actuarial Obligation (Surplus)	<u>\$ 33,064</u>	<u>\$ 33,387</u>
Funded Ratio	87.1%	86.3%
<b>Amortization Sufficiency Under Current Contribution Schedule</b>		
Revenue for 1990 Benefits	16.000%	16.000%
Normal Cost Rate for 1990 Benefits	<u>(17.822)</u>	<u>(17.613)</u>
Equivalent Normal Cost Surplus / (Deficit)		
Express as Percent of Employer Payroll	(1.822%)	(1.613%)
Equivalent Normal Cost Surplus / (Deficit)		
Express as Percent of State Payroll	(1.950%)	(1.726%)
Level Equivalent Additional Revenue Under EC 22955.1(b)	<u>5.811</u>	<u>5.311</u>
Revenue Available for Amortization	3.861%	3.585%
Revenue Needed for Amortization	<u>5.951</u>	<u>6.089</u>
Revenue Surplus / (Deficit)	<u>(2.090%)</u>	<u>(2.504%)</u>
Amortization Status under current contribution rate	Contribution Increases Needed	Contribution Increases Needed
<b>Contribution Rate for Amortization of 1990 UAO without Statutory Limits</b>		
Current EC 22955.1(b) Contribution Rate	5.811%	5.311%
Increase / (Decrease) in State Contribution Rate for Next Fiscal Year	<u>2.090</u>	<u>2.504</u>
Unconstrained Contribution Rate for Next FY	<u>7.901%</u>	<u>7.815%</u>
<b>Contribution Rate for Amortization of 1990 UAO with Statutory Limits</b>		
Current EC 22955.1(b) Contribution Rate	5.811%	5.311%
Increase / (Decrease) in State Contribution Rate for Next Fiscal Year (Increase capped at 0.5%)	<u>0.500</u>	<u>0.500</u>
<b>EC 22955.1(b) Contribution Rate for Next FY</b>	<b><u>6.311%</u></b>	<b><u>5.811%</u></b>

## 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 rate. Pursuant to SB 90, additional contributions made by the state on behalf of the employers in fiscal year 2018-19 decreased the ultimate rate to 10.15%. 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 2019 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 2019 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
<b>Funded Status -- Pre-2014 Service</b>			
Actuarial Obligation	\$ 257,003	\$ 212,812	\$ 44,191
Actuarial Value of Assets	154,663	182,866	(28,203)
Unfunded Actuarial Obligation	\$ 102,340	\$ 29,946	\$ <b>72,394</b>

**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, 2020.

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 10.15%, 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 10.15% (18.40% total) is reached.

**Table 11**  
**Total Assets Allocated for Pre-2014 Service<sup>(1)</sup>**

<i>(\$ Millions)</i>	<b>2019</b>	<b>2018</b>
<b>Asset Value for Pre-2014 Service (excludes SBMA)</b>		
Allocated Market Value at Beginning of Year	\$154,118	\$151,553
Pre-2014 Allocation of GASB Expense Adjustment	432	(396)
Contributions During the Year		
Total Contributions (excluding SBMA)	13,576	10,146
Less Normal Costs for Year with Expenses	<u>(6,797)</u>	<u>(6,612)</u>
Total Adjusted Contributions	\$ 6,779	\$ 3,534
Benefits and Expenses Paid for Pre-2014 Service	(14,313)	(13,761)
Estimated Investment Earnings for the Year <sup>(2)</sup>	<u>9,779</u>	<u>13,188</u>
<b>Total Allocated Market Value at End of Year</b>	<b>\$156,795</b>	<b>\$154,118</b>
Ratio of Actuarial Value to Market Value <sup>(3)</sup>	98.640%	97.559%
<b>Actuarial Value of Assets for Pre-2014 Service</b>	<b>\$154,663</b>	<b>\$150,356</b>

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 8.75% for 2017-2018 and 6.53% for 2018-2019.

3. Developed from Table 5.

**Table 12**  
**1990 Assets Allocated for Pre-2014 Service<sup>(1)</sup>**

<i>(\$ Millions)</i>	<b>2019</b>	<b>2018</b>
<b>1990 Asset Value for Pre-2014 Service (excludes SBMA)</b>		
Allocated Market Value at Beginning of Year	\$184,240	\$179,603
Pre-2014 Allocation of GASB Expense Adjustment	432	(396)
Contributions During the Year for 1990 Structure		
Total Contributions (excluding SBMA)	7,166	6,770
Less 1990 Normal Costs for Year with Expenses	<u>(5,932)</u>	<u>(5,745)</u>
Total Adjusted Contributions	\$ 1,234	\$ 1,025
Benefits and Expenses Paid for Pre-2014 Service	(12,227)	(11,695)
Estimated Investment Earnings for the Year <sup>(2)</sup>	<u>11,709</u>	<u>15,703</u>
<b>Total 1990 Allocated Market Value at End of Year</b>	<b>\$185,388</b>	<b>\$184,240</b>
Ratio of Actuarial Value to Market Value <sup>(3)</sup>	98.640%	97.559%
<b>1990 Actuarial Value of Assets for Pre-2014 Service</b>	<b>\$182,866</b>	<b>\$179,743</b>

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 8.75% for 2017-2018 and 6.53% for 2018-2019.

3. Developed from Table 5.

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

(\$ Millions)	2019	2018
<b>Funded Status</b>		
Total Unfunded Actuarial Obligation (Pre-2014 Service)		
Total Actuarial Obligation for Pre-2014 Service	\$257,003	\$254,062
Total AVA for Pre-2014 Service	<u>154,663</u>	<u>150,356</u>
Total UAO (pre-2014 Service)	\$102,340	\$103,706
1990 Unfunded Actuarial Obligation (Pre-2014 Service)		
1990 Actuarial Obligation for Pre-2014 Service	\$212,812	\$209,981
1990 AVA for Pre-2014 Service	<u>182,866</u>	<u>179,742</u>
1990 UAO (pre-2014 Service)	\$29,946	\$30,239
Post-1990 UAO (Pre-2014 Service)	\$72,394	\$73,467
<b>Amortization Sufficiency for Post-1990, Pre-2014 UAO Under Current Contribution Schedule</b>		
Post-1990 Normal Cost Rate (Surplus)/Deficit	2.522%	2.582%
Additional Revenue Under EC 22950.5 <sup>(1)</sup>	<u>10.150</u>	<u>10.647</u>
Revenue Available for Amortization	12.672%	13.229%
Revenue Needed for Amortization	<u>12.065</u>	<u>12.433</u>
Revenue Surplus / (Deficit)	0.607%	0.796%
<b>Minimum Contribution Required for Total Pre-2014 UAO</b>		
Total Preliminary Pre-2014 UAO Contribution Rate	16.829%	17.136%
Total Pre-2014 UAO Contribution Rate Needed	<u>17.079</u>	<u>17.566</u>
Revenue Surplus / (Deficit)	(0.250%)	(0.430%)
Amortization Status under current contribution rate schedule and no changes in ultimate employer rate	Contribution Increase Needed	Contribution Increase Needed
<b>Contribution Rate for Amortization of UAO for pre-2014 Service and New Benefits</b>		
<b>[Illustrative Purposes Only. Not Applicable for 2019 Valuation]</b>		
Current EC 22950.5 Contribution Rate	10.150%	10.850%
Adjustment in Employer Contribution Rate for Next Fiscal Year <sup>(2)</sup>	<u>0.250</u>	<u>0.430</u>
<b>EC 22955.1(b) Contribution Rate for FYB 2021<sup>(2)</sup></b>	<b>10.400%</b>	<b>11.280%</b>

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. See the "Looking Ahead" subsection of Section 1.

## 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 99.9% under the assumptions described in the "Looking Ahead" subsection of Section 1. Note that this projection (and Table 15) includes the \$1.117 billion additional state contribution made in July of 2019, but does not include any additional contribution scheduled to be made in future fiscal years or any negative investment experience that has occurred since June 30, 2019.

In **Table 14**, we show the contributions projected to be paid into the DB Program to fund ongoing 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<sup>(1)</sup>**  
**(Reflecting Projected Contribution Increases)<sup>(2)</sup>**

(\$Millions)		Beginning Unfunded Act. Oblig.	Amortization Payment				Normal Cost	Available Amtzn.	Interest Charge at 7.00%	Ending Unfunded Act. Oblig.	Ending Funded Ratio
Year	FYE		Contributions								
			Member	Employer	State	Total					
1	2020	\$105,703	\$3,533	\$5,900	\$3,690	\$13,123	\$7,004	\$6,119	\$7,189	\$105,638	67.3%
2	2021	105,638	3,656	6,571	2,818	13,045	7,233	5,812	7,195	106,241	68.4%
3	2022	106,241	3,784	6,633	3,046	13,463	7,471	5,992	7,231	106,923	69.5%
4	2023	106,923	3,916	6,803	3,331	14,050	7,715	6,335	7,267	107,458	70.5%
5	2024	107,458	4,053	7,046	3,459	14,558	7,966	6,592	7,295	107,878	71.6%
6	2025	107,878	4,194	7,296	3,551	15,041	8,225	6,816	7,317	108,177	72.6%
7	2026	108,177	4,340	7,554	3,653	15,547	8,491	7,056	7,330	108,307	73.6%
8	2027	108,307	4,492	7,820	3,764	16,076	8,765	7,311	7,330	108,224	74.6%
9	2028	108,224	4,648	8,095	3,885	16,628	9,047	7,581	7,315	107,884	75.6%
10	2029	107,884	4,810	8,380	4,011	17,201	9,336	7,865	7,281	107,248	76.7%
11	2030	107,248	4,978	8,674	4,145	17,797	9,632	8,165	7,226	106,273	77.7%
12	2031	106,273	5,151	8,978	4,285	18,414	9,936	8,478	7,147	104,915	78.8%
13	2032	104,915	5,331	9,293	4,431	19,055	10,248	8,807	7,041	103,130	79.9%
14	2033	103,130	5,517	9,618	4,583	19,718	10,568	9,150	6,904	100,870	81.0%
15	2034	100,870	5,709	9,955	4,742	20,406	10,898	9,508	6,734	98,086	82.1%
16	2035	98,086	5,908	10,304	4,906	21,118	11,239	9,879	6,526	94,727	83.3%
17	2036	94,727	6,114	10,664	5,077	21,855	11,591	10,264	6,278	90,736	84.5%
18	2037	90,736	6,327	11,038	5,253	22,618	11,955	10,663	5,985	86,054	85.8%
19	2038	86,054	6,547	11,424	5,437	23,408	12,331	11,077	5,643	80,617	87.1%
20	2039	80,617	6,776	11,824	5,626	24,226	12,721	11,505	5,247	74,357	88.4%
21	2040	74,357	7,012	12,238	5,822	25,072	13,126	11,946	4,794	67,204	89.8%
22	2041	67,204	7,256	12,666	6,027	25,949	13,548	12,401	4,278	59,079	91.3%
23	2042	59,079	7,510	13,110	6,236	26,856	13,986	12,870	3,693	49,901	92.9%
24	2043	49,901	7,772	13,569	6,454	27,795	14,441	13,354	3,034	39,581	94.5%
25	2044	39,581	8,043	14,044	6,679	28,766	14,916	13,850	2,294	28,024	96.2%
26	2045	28,024	8,324	14,535	6,913	29,772	15,411	14,361	1,468	15,130	98.0%
27	2046	15,130	8,614	15,044	7,155	30,813	15,929	14,884	547	792	99.9%

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

2. Contribution rates include projected changes allowed under Education Code. Includes \$1.117 billion additional state contribution made in July 2019.

**Table 15**  
**Projected Cash Flow**  
 (Reflecting Projected Contribution Increases)<sup>(1)</sup>

(\$Millions)		Contributions <sup>(1)</sup>				Benefit	Net Program	Cash Flow as a Percentage of		Ending
Year	FYE	Member	Employer	State	Total	Payments <sup>(2)</sup>	Cash Flow	Payroll	Market Value of Assets	Funded Ratio
1	2020	\$3,533	\$5,900	\$3,690	\$13,123	\$15,979	(\$2,856)	(8.3%)	(1.3%)	67.0%
2	2021	3,656	6,571	2,818	13,045	16,497	(3,452)	(9.7%)	(1.5%)	68.1%
3	2022	3,784	6,633	3,046	13,463	17,212	(3,749)	(10.1%)	(1.6%)	69.1%
4	2023	3,916	6,803	3,331	14,050	17,951	(3,901)	(10.2%)	(1.6%)	70.1%
5	2024	4,053	7,046	3,459	14,558	18,718	(4,160)	(10.5%)	(1.6%)	71.2%
6	2025	4,194	7,296	3,551	15,041	19,513	(4,472)	(10.9%)	(1.6%)	72.2%
7	2026	4,340	7,554	3,653	15,547	20,348	(4,801)	(11.3%)	(1.6%)	73.3%
8	2027	4,492	7,820	3,764	16,076	21,226	(5,150)	(11.7%)	(1.7%)	74.3%
9	2028	4,648	8,095	3,885	16,628	22,202	(5,574)	(12.3%)	(1.7%)	75.3%
10	2029	4,810	8,380	4,011	17,201	23,244	(6,043)	(12.9%)	(1.8%)	76.4%
11	2030	4,978	8,674	4,145	17,797	24,364	(6,567)	(13.5%)	(1.8%)	77.4%
12	2031	5,151	8,978	4,285	18,414	25,574	(7,160)	(14.2%)	(1.9%)	78.5%
13	2032	5,331	9,293	4,431	19,055	26,863	(7,808)	(15.0%)	(2.0%)	79.6%
14	2033	5,517	9,618	4,583	19,718	28,214	(8,496)	(15.7%)	(2.0%)	80.7%
15	2034	5,709	9,955	4,742	20,406	29,601	(9,195)	(16.5%)	(2.1%)	81.9%
16	2035	5,908	10,304	4,906	21,118	31,021	(9,903)	(17.1%)	(2.2%)	83.1%
17	2036	6,114	10,664	5,077	21,855	32,480	(10,625)	(17.8%)	(2.2%)	84.3%
18	2037	6,327	11,038	5,253	22,618	33,965	(11,347)	(18.3%)	(2.2%)	85.6%
19	2038	6,547	11,424	5,437	23,408	35,525	(12,117)	(18.9%)	(2.3%)	86.9%
20	2039	6,776	11,824	5,626	24,226	37,083	(12,857)	(19.4%)	(2.3%)	88.3%
21	2040	7,012	12,238	5,822	25,072	38,629	(13,557)	(19.7%)	(2.3%)	89.7%
22	2041	7,256	12,666	6,027	25,949	40,156	(14,207)	(20.0%)	(2.3%)	91.2%
23	2042	7,510	13,110	6,236	26,856	41,665	(14,809)	(20.1%)	(2.3%)	92.8%
24	2043	7,772	13,569	6,454	27,795	43,189	(15,394)	(20.2%)	(2.3%)	94.4%
25	2044	8,043	14,044	6,679	28,766	44,674	(15,908)	(20.2%)	(2.3%)	96.2%
26	2045	8,324	14,535	6,913	29,772	46,096	(16,324)	(20.0%)	(2.2%)	98.0%
27	2046	8,614	15,044	7,155	30,813	47,438	(16,625)	(19.7%)	(2.2%)	99.9%

1. Contribution rates include projected changes allowed under Education Code. Includes \$1.117 billion additional state contribution made in July 2019.

2. Projected benefit payments include estimated administrative expenses.

## 9. Risk Disclosures

The results of any actuarial valuation are based on a set of assumptions. Although we believe the current DB Program assumptions provide a reasonable estimate of future expectations, it is almost certain that future experience will differ from the assumptions to some extent.

The following is a general discussion of the potential risks to CalSTRS funding. Additional analysis on the potential impact of future investment returns on the Funded Ratio and supplemental contribution rates is included in Section 1 (subsection "Projections Under Alternate Return Scenarios"). A more comprehensive analysis of potential risks ("Review of Funding Level and Risks") is completed each fall by CalSTRS internal actuarial staff.

### Factors Affecting Future Results

There are a number of factors that affect future valuation results. To the extent actual experience for these factors varies from the assumptions, this will likely cause either increases or decreases in the plan's future funding level and calculated supplemental contribution rates. Examples of factors that can have a significant impact on valuation results are:

- Investment return
- Payroll variation
- Salary variation
- Mortality (how long retirees live)
- Service retirement
- Termination (members leaving active employment for reasons other than death, disability or service retirement)
- Contribution limitations. The board has limited rate-setting authority. If significant contribution increases are needed in the future, CalSTRS may receive insufficient funding due to the limitations on the board's ability to increase contribution rates under the current law. Projections based on the valuation assumptions indicate this is not currently an issue.

Of these factors, we believe the factor with the greatest potential risk is future investment returns. Payroll variation could also have a significant impact if there was a significant decline in the active teacher population, which, for example could occur if there was a large increase in the proportion of charter schools.

As an example of these risks, if actual investment returns fall short of the current assumption of 7% per year, this will cause an increase in the total supplemental contribution rate and a decrease in the Funded Ratio for the DB Program, all other things being equal. Conversely, if returns exceed 7%, this will decrease the total supplemental contribution rate and increase the Funded Ratio.

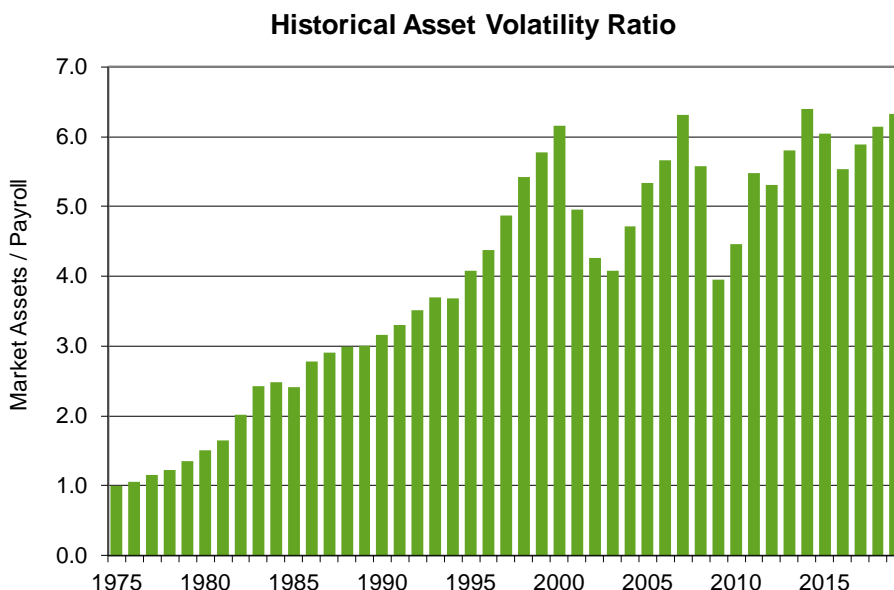
### Maturity Risk

The magnitude of any contribution rate increase or decrease is affected by the Program's maturity level. As the DB Program becomes more mature (i.e., the number of retirees grows compared to the number of actives, and the accumulated assets grow compared to payroll), it tends to be subject to increased volatility in the contributions needed. Specifically, for CalSTRS there may be significant fluctuations in the state supplemental contribution rates (and to a lesser extent the employer contribution rates) from year to year due to the actual investment return. One way to measure maturity risk is volatility ratios.

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 rate volatility. The AVR is a current measure since it is based on the current level of assets and will vary from year to year.

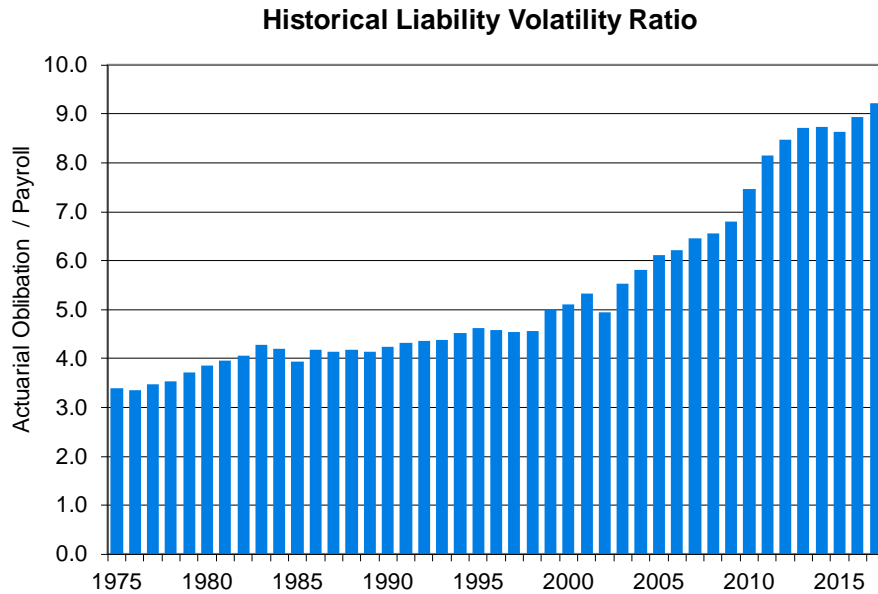
For CalSTRS, the current AVR is equal to 6.3, which is typical for a mature system. This means that for each 1% asset loss (in relation to the assumed investment return), there will need to be an increase in contributions equivalent to 6.3% of one-year's payroll. Since CalSTRS is currently targeting a funding period of 26 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 26 years, resulting in approximately a 0.34% 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 20<sup>th</sup> 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.



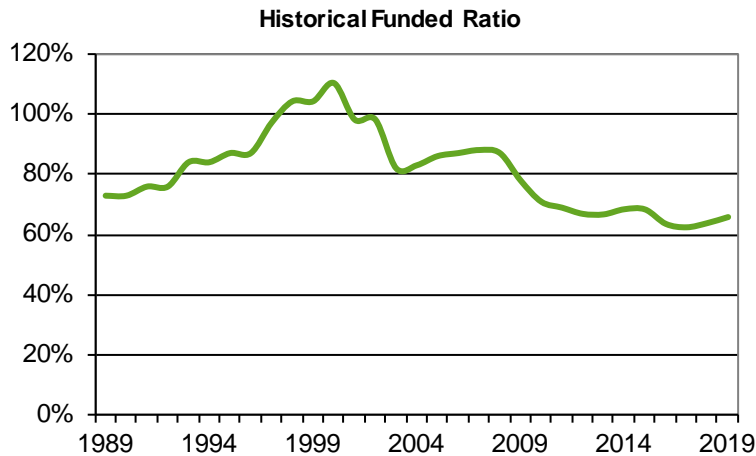
Another measure of a system's maturity is the Liability Volatility Ratio (LVR), which is equal to the Actuarial Obligation divided by the total payroll. This ratio provides an indication of the longer-term potential for contribution rate volatility if CalSTRS becomes fully funded. In addition, this ratio provides an indication of the potential contribution rate volatility due to liability experience (gains and losses) and liability re-measurements (assumption changes). For CalSTRS, the current LVR is 9.4. Ultimately, the LVR and AVR should be equal if CalSTRS achieves 100% funding in the future.

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, although there have been larger changes in years where assumptions changes have occurred.

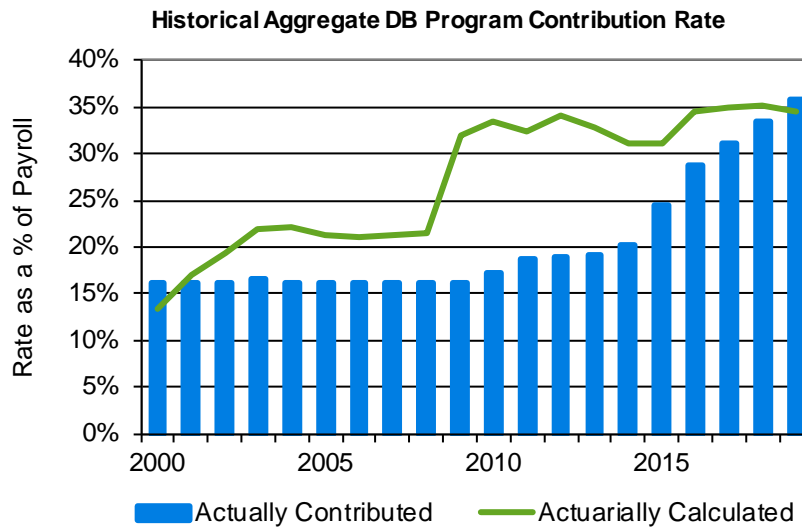


### Historical Measures

One way to assess future risks is to look at historical measurements. The following graph shows how the DB Program Funded Ratio has varied over the last 30 years. In particular, it reflects the significant impact that investment returns can have. The strong returns of the 1990's caused a large increase in the Funded Ratio. Since 2000, actual returns have lagged the assumption and expectations of future returns have decreased. Additionally, the actual contribution rate lagged the actuarially determined rate during most of the period, as discussed in the next paragraph. This combination has been the primary cause of the decline in the Funded Ratio since then.



The graph below shows the history of the actual contributions made (blue bar) as a percentage of payroll. The green line shows the actuarially calculated contribution rate based on amortizing the UAO by June 30, 2046 (for years before 2014, a 30-year amortization was used). There has been variance in both rates. As previously noted, as the DB Program continues to mature, year-to-year variance is projected to increase. Year-to-year changes in the actual contribution rate will likely be less than for the actuarially calculated rate due to the restrictions on changes in the state and employer supplemental contribution rates.



## 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 9.0% of creditable compensation.

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, 2018 is \$146,230 (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.

**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 for members hired after June 30, 1980.

**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 Allowance:\*

Member has five years of credited California service and has not attained age 60.

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.

*\*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.*

Offsets:

Allowance, including children's increment, is reduced by disability benefits payable under Social Security, Workers' Compensation and employer-paid income protection plan.

**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. Ineligible members may receive a lump sum payment of their contributions with interest.

Lump Sum Payment:

\$6,372 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. Ineligible members may receive a lump sum payment of their contributions with interest.

#### Lump Sum Payment:

\$25,488 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:

\$6,372 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.

## 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, 2019 actuarial valuation as a result of the 2020 Experience Analysis. Please refer to that Experience Analysis report dated January 14, 2020 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

Entry Age Normal Cost Method:

The accruing costs of all benefits with future accruals are measured by the Entry Age Normal 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 Cost Method.

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

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. The Normal Cost is based on the respective benefit structures. For projection purposes, the Normal Cost rate is assumed to increase by a relative 0.12% per year to reflect an assumed gradual increase in life expectancies due to generational mortality. 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.

Entry age is determined as the age at membership date.

Projected Unit Credit (PUC) Cost Method:

This cost method is used for calculations of the actuarial obligation where there are no future service accruals. Under the PUC 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 Fair Market Value excludes the liability for "Net Pension and OPEB Obligation," which are pre-recognized administrative expenses, from the Fiduciary Net Position reported for accounting purposes.

### 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**

**Economic Assumptions**

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

**Demographic Assumptions**

Mortality <sup>(1)</sup>		
Active - Male	2019 CalSTRS Active Member Male	Table B-2
Active - Female	2019 CalSTRS Active Member Female	Table B-2
Retired & Beneficiary - Male	2019 CalSTRS Service Retired Male	Table B-2
Retired & Beneficiary - Female	2019 CalSTRS Service Retired Female	Table B-2
Disabled - Male	2019 CalSTRS Disabled Retiree Male	Table B-2
Disabled - Female	2019 CalSTRS Disabled Retiree Female (select rates in first three years for both Males and Females)	Table B-2
Service Retirement		Table B-3
Disability Retirement		Table B-4
Withdrawal		Table B-5
Probability of Refund		Table B-6
Merit Salary Increases		Table B-7
Supplemental Assumptions		Table B-8

*1. The mortality assumption uses a generational mortality approach with a base year of 2019. Projected improvement is based on 110% of the MP-2019 Ultimate Projection Scale. The combined base tables and projection scale specified contain a margin for expected future mortality improvement.*

**Table B.2**  
**Mortality as of June 30, 2019**

Age	Active Members <sup>(1)</sup>	
	Male	Female
25	0.012%	0.007%
30	0.017	0.011
35	0.023	0.015
40	0.032	0.024
45	0.052	0.037
50	0.085	0.056
55	0.132	0.082
60	0.203	0.124
65	0.335	0.208

Age	Retired Members and Beneficiaries <sup>(1)</sup>		Disabled Members (After Year 3) <sup>(1)</sup>	
	Male	Female	Male	Female
50	0.235%	0.131%	1.807%	1.021%
55	0.346	0.206	2.102	1.277
60	0.464	0.274	2.383	1.507
65	0.659	0.413	2.774	1.800
70	1.056	0.681	3.440	2.337
75	1.894	1.252	4.536	3.326
80	3.475	2.401	6.279	4.926
85	6.682	4.788	9.122	7.319
90	12.893	9.746	13.840	10.820
95	22.038	18.269	20.697	16.019

**Select minimum 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. The mortality assumption uses a generational mortality approach with a base year of 2019 for the mortality rates. Projected improvement is based on 110% of the MP-2019 Ultimate Projection Scale. The rates shown reflect mortality improvement through June 30, 2019. The projection scale does not apply to the select minimum rates.

**Table B.3a**  
**Service Retirement – 2% at 60 Males**

DB Program - 2% at 60 Members - Males								
Age	Years of Credited Service							
	5-9 years	10-14 years	15-19 years	20-24 years	25 years	26-29 years	30 years	31 or More Years
50	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.0%	4.5%
51	0.0	0.0	0.0	0.0	0.0	0.0	3.5	2.5
52	0.0	0.0	0.0	0.0	0.0	0.0	3.5	2.5
53	0.0	0.0	0.0	0.0	0.0	0.0	3.5	2.5
54	0.0	0.0	0.0	0.0	0.0	0.0	3.5	2.5
55	2.0	2.5	3.0	4.0	6.0	5.0	7.5	5.5
56	1.5	1.5	2.0	2.5	4.0	3.5	7.5	5.5
57	1.5	1.5	2.0	2.5	4.0	3.5	10.0	7.5
58	2.0	2.0	2.5	3.5	6.0	5.0	12.5	9.0
59	3.0	3.0	4.0	5.0	8.5	7.0	18.5	13.5
60	4.0	5.0	6.5	8.0	11.5	9.5	28.0	20.5
61	5.0	5.5	7.5	9.0	16.0	13.5	50.0	50.0
62	7.0	8.0	10.5	13.0	25.5	21.0	45.0	45.0
63	8.5	9.5	12.5	15.5	34.5	29.0	35.0	35.0
64	9.0	10.5	13.5	17.0	27.5	23.0	30.0	30.0
65	11.0	13.0	17.0	21.0	32.0	27.0	32.5	32.5
66	11.0	13.0	17.0	21.0	27.5	23.0	30.0	30.0
67	11.0	13.0	17.0	21.0	27.5	23.0	27.0	27.0
68	10.0	11.0	14.5	18.0	27.5	23.0	27.0	27.0
69	10.0	11.0	14.5	18.0	27.5	23.0	25.0	25.0
70	10.0	11.0	14.5	18.0	27.5	23.0	25.0	25.0
71	9.0	10.0	13.0	16.5	27.5	23.0	25.0	25.0
72	9.0	10.0	13.0	16.5	27.5	23.0	25.0	25.0
73	9.0	10.0	13.0	16.5	27.5	23.0	25.0	25.0
74	9.0	10.0	13.0	16.5	27.5	23.0	25.0	25.0
75+	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

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



**Table B.3b**  
**Service Retirement – 2% at 60 Females**

DB Program - 2% at 60 Members - Females								
Age	Years of Credited Service							
	5-9 years	10-14 years	15-19 years	20-24 years	25 years	26-29 years	30 years	31 or More Years
50	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.0%	4.5%
51	0.0	0.0	0.0	0.0	0.0	0.0	3.5	3.0
52	0.0	0.0	0.0	0.0	0.0	0.0	3.5	3.0
53	0.0	0.0	0.0	0.0	0.0	0.0	3.5	3.0
54	0.0	0.0	0.0	0.0	0.0	0.0	3.5	3.0
55	2.0	3.0	3.5	4.5	6.0	5.0	8.5	6.5
56	1.5	2.0	2.5	3.5	5.0	4.0	8.5	6.5
57	1.5	2.0	2.5	3.5	6.0	5.0	9.5	7.5
58	2.0	3.0	3.5	4.5	7.0	5.5	14.5	11.0
59	3.0	4.0	5.5	7.0	10.0	8.0	18.0	14.0
60	4.0	5.5	7.5	9.5	15.5	12.5	30.5	23.0
61	5.0	7.0	9.5	12.0	21.5	17.0	50.0	50.0
62	7.0	10.0	13.0	17.0	33.0	26.0	48.0	48.0
63	9.0	13.0	17.0	21.5	42.0	33.5	38.0	38.0
64	7.5	11.0	14.5	19.0	36.0	28.5	36.0	36.0
65	10.0	14.5	19.0	24.5	39.0	31.0	38.0	38.0
66	10.0	14.5	19.0	24.5	36.0	28.5	32.0	32.0
67	9.0	13.0	17.0	21.5	36.0	28.5	32.0	32.0
68	9.0	13.0	17.0	21.5	36.0	28.5	30.0	30.0
69	9.0	13.0	17.0	21.5	36.0	28.5	30.0	30.0
70	9.0	13.0	17.0	21.5	36.0	28.5	30.0	30.0
71	8.5	12.0	16.0	20.5	36.0	28.5	30.0	30.0
72	8.5	12.0	16.0	20.5	36.0	28.5	30.0	30.0
73	8.5	12.0	16.0	20.5	36.0	28.5	30.0	30.0
74	8.5	12.0	16.0	20.5	36.0	28.5	30.0	30.0
75+	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

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

**Table B.3c**  
**Service Retirement – 2% at 62 Males**

<b>DB Program - 2% at 62 Members - Males</b>						
<b>Age</b>	<b>Years of Credited Service</b>					
	<b>5-9 years</b>	<b>10-14 years</b>	<b>15-19 years</b>	<b>20-24 years</b>	<b>25-29 years</b>	<b>30 or More Years</b>
50	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
51	0.0	0.0	0.0	0.0	0.0	0.0
52	0.0	0.0	0.0	0.0	0.0	0.0
53	0.0	0.0	0.0	0.0	0.0	0.0
54	0.0	0.0	0.0	0.0	0.0	0.0
55	1.5	2.0	2.5	3.0	4.0	5.0
56	1.0	1.0	1.5	2.0	2.5	3.0
57	1.0	1.0	1.5	2.0	2.5	3.0
58	1.5	1.5	2.0	2.5	4.0	5.0
59	2.5	2.5	3.0	4.0	5.5	6.5
60	3.0	4.0	5.0	6.0	7.5	9.0
61	4.0	4.0	5.5	7.0	10.5	12.5
62	5.5	6.0	8.0	10.0	16.5	20.0
63	6.5	7.0	9.0	11.5	17.5	21.0
64	7.0	8.0	10.0	13.0	18.0	21.5
65	11.0	13.0	17.0	21.0	28.0	28.0
66	11.0	13.0	17.0	21.0	24.0	24.0
67	13.0	15.5	20.5	25.0	28.5	28.5
68	10.0	11.0	14.5	18.0	24.0	24.0
69	10.0	11.0	14.5	18.0	24.0	24.0
70	10.0	11.0	14.5	18.0	24.0	24.0
71	9.0	10.0	13.0	16.5	24.0	24.0
72	9.0	10.0	13.0	16.5	24.0	24.0
73	9.0	10.0	13.0	16.5	24.0	24.0
74	9.0	10.0	13.0	16.5	24.0	24.0
75	100.0	100.0	100.0	100.0	100.0	100.0

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

**Table B.3d**  
**Service Retirement – 2% at 62 Females**

DB Program - 2% at 62 Members - Females						
Age	Years of Credited Service					
	5-9 years	10-14 years	15-19 years	20-24 years	25-29 years	30 or More Years
50	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
51	0.0	0.0	0.0	0.0	0.0	0.0
52	0.0	0.0	0.0	0.0	0.0	0.0
53	0.0	0.0	0.0	0.0	0.0	0.0
54	0.0	0.0	0.0	0.0	0.0	0.0
55	1.5	2.5	2.5	3.5	4.0	5.0
56	1.0	1.5	2.0	2.5	3.0	3.5
57	1.0	1.5	2.0	2.5	4.0	5.0
58	1.5	2.5	2.5	3.5	4.5	5.5
59	2.5	3.0	4.0	5.5	6.5	8.0
60	3.0	4.0	5.5	7.0	10.0	12.0
61	4.0	5.5	7.0	9.0	13.5	16.0
62	5.5	7.5	10.0	13.0	20.5	24.5
63	5.5	8.0	10.5	14.0	21.5	26.0
64	5.5	8.5	11.0	14.5	22.5	27.0
65	10.0	14.5	19.0	24.5	32.5	32.5
66	10.0	14.5	19.0	24.5	30.0	30.0
67	11.0	15.5	20.5	26.0	36.0	36.0
68	9.0	13.0	17.0	21.5	30.0	30.0
69	9.0	13.0	17.0	21.5	30.0	30.0
70	9.0	13.0	17.0	21.5	30.0	30.0
71	8.5	12.0	16.0	20.5	30.0	30.0
72	8.5	12.0	16.0	20.5	30.0	30.0
73	8.5	12.0	16.0	20.5	30.0	30.0
74	8.5	12.0	16.0	20.5	30.0	30.0
75	100.0	100.0	100.0	100.0	100.0	100.0

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

**Table B.3e**  
**Service Retirement – 1990 Benefit Structure Males**

DB Program - 1990 Structure - Males						
Age	Years of Credited Service					
	5-9 years	10-14 years	15-19 years	20-24 years	25-29 years	30 or More Years
50	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
51	0.0	0.0	0.0	0.0	0.0	0.0
52	0.0	0.0	0.0	0.0	0.0	0.0
53	0.0	0.0	0.0	0.0	0.0	0.0
54	1.0	1.0	1.5	1.5	1.5	1.5
55	3.5	4.5	5.0	6.0	6.0	6.5
56	2.5	3.0	3.5	4.0	4.0	4.5
57	3.0	4.0	4.5	5.0	5.0	5.5
58	4.0	5.5	6.0	7.0	7.0	8.0
59	10.5	14.0	16.0	17.5	18.5	20.0
60	15.0	20.0	22.5	25.0	26.5	29.0
61	10.0	13.0	15.0	16.5	17.5	19.0
62	10.0	13.0	15.0	16.5	17.5	19.0
63	9.0	12.0	13.5	15.0	16.0	17.5
64	10.5	14.0	16.0	17.5	18.5	20.0
65	12.0	16.0	18.0	20.0	21.0	23.0
66	9.5	13.0	14.5	16.0	17.0	18.5
67	9.5	13.0	14.5	16.0	17.0	18.5
68	9.5	13.0	14.5	16.0	17.0	18.5
69	9.5	13.0	14.5	16.0	17.0	18.5
70+	100.0	100.0	100.0	100.0	100.0	100.0

The assumptions shown above are for retirement from active status. It is assumed that all vested terminated members retire at age 60 under the 1990 Benefit Structure.

**Table B.3f**  
**Service Retirement – 1990 Benefit Structure Females**

DB Program - 1990 Structure - Females						
Age	Years of Credited Service					
	5-9 years	10-14 years	15-19 years	20-24 years	25-29 years	30 or More Years
50	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
51	0.0	0.0	0.0	0.0	0.0	0.0
52	0.0	0.0	0.0	0.0	0.0	0.0
53	0.0	0.0	0.0	0.0	0.0	0.0
54	1.0	1.0	1.5	1.5	1.5	1.5
55	4.0	5.5	6.5	7.0	7.5	8.0
56	2.5	3.5	4.0	4.5	4.5	5.0
57	2.5	3.5	4.0	4.5	4.5	5.0
58	4.0	5.5	6.5	7.0	7.5	8.0
59	8.5	11.0	12.5	14.0	14.5	16.0
60	13.0	17.5	20.0	22.0	23.0	25.5
61	9.0	12.0	13.5	15.0	16.0	17.5
62	9.0	12.0	13.5	15.0	16.0	17.5
63	9.0	12.0	13.5	15.0	16.0	17.5
64	11.0	14.5	16.0	18.0	19.0	20.5
65	11.0	14.5	16.0	18.0	19.0	20.5
66	11.0	14.5	16.0	18.0	19.0	20.5
67	11.0	14.5	16.0	18.0	19.0	20.5
68	9.5	13.0	14.5	16.0	17.0	18.5
69	9.5	13.0	14.5	16.0	17.0	18.5
70+	100.0	100.0	100.0	100.0	100.0	100.0

The assumptions shown above are for retirement from active status. It is assumed that all vested terminated members retire at age 60 under the 1990 Benefit Structure.

**Table B.4**  
**Disability Retirement**

Coverage A		
Age	Male	Female
25	0.015%	0.015%
30	0.025	0.025
35	0.040	0.050
40	0.065	0.075
45	0.090	0.090
50	0.130	0.180
55	0.170	0.225

Coverage B		
Age	Male	Female
25	0.010%	0.015%
30	0.015	0.015
35	0.025	0.030
40	0.050	0.055
45	0.085	0.095
50	0.125	0.165
55	0.235	0.285
60	0.345	0.360
65	0.380	0.380
70	0.380	0.380

**Table B.5**  
**Other Terminations of Employment (Withdrawal)**

Year <sup>(1)</sup>	Male	Female
0	12.25%	11.25%
1	8.50	7.00
2	6.75	5.50
3	5.40	4.25
4	3.75	3.25
5	3.10	2.70
10	1.65	1.50
15	1.05	1.05
20	0.75	0.75
25	0.50	0.50
30	0.45	0.40

1. Based on elapsed service since membership date.

**Table B.6**  
**Probability of Refund**

Year <sup>(1)</sup>	Entry Ages					
	Under 25	25-29	30-34	35-39	40-44	45 and Up
Under 5	100%	100%	100%	100%	100%	100%
5	60	60	60	54	50	45
10	38	38	38	34	25	
15	30	30	28	17		
20	24	22	18			
25	14	12				
30	5					

1. Assumption applied at time of assumed termination based on credited service. 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<sup>(1)</sup>**

Year <sup>(2)</sup>	Entry Age - Annual Increase in Salaries Due to Merit					
	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% ( $1.064 \times 1.035$ ) for members in the entry age under 25 group.

2. Based on elapsed service since membership date.

**Table B.8**  
**Supplemental Assumptions**

<b>PEPRA Coverage</b>	All members hired on or after the valuation date are assumed to be subject to the provisions of PEPRA.						
<b>Unused Sick Leave</b>	Credited Service is increased by 1.7%.						
<b>Optional Forms</b>	Active and Inactive: Based on single life annuity assumed. Retirees and Beneficiaries: Based on optional form in data.						
<b>Probability of Marriage</b>	Male: 85% Female: 65%						
	Male spouses are assumed to be three years older than female spouses.						
<b>Children</b>	Married members under age 60 are assumed to have the number of children shown in the following table. Children are assumed to receive benefits until the member would have turned age 60.						
	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr style="background-color: #004a7c; color: white;"> <th>Member's Gender</th> <th>Assumed Number of Children</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Male</td> <td style="text-align: center;">0.65</td> </tr> <tr> <td style="text-align: center;">Female</td> <td style="text-align: center;">0.50</td> </tr> </tbody> </table>	Member's Gender	Assumed Number of Children	Male	0.65	Female	0.50
Member's Gender	Assumed Number of Children						
Male	0.65						
Female	0.50						
<b>Assumed Offsets</b>	No offsets to disability and survivor benefits are assumed.						

**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.

## 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, 2019	June 30, 2018
<b>Number of Members</b>		
Active Members <sup>(1)</sup>	451,429	449,595
Inactive Members <sup>(1)</sup>	204,593	198,058
Retirees and Beneficiaries		
Service Retirees	270,835	264,780
Disabled Retirees	10,152	10,089
Survivors	<u>27,652</u>	<u>26,990</u>
Total Benefit Recipients	308,639	301,859
Total Membership in Valuation	964,661	949,512
<b>Active Member Statistics</b>		
Earned Salaries <sup>(2)</sup>	\$ 32,897 million	\$ 31,884 million
Average Earned Salary	\$ 72,872	\$ 70,918
Average Age	45.2 years	45.2 years
Average Service	12.2 years	12.1 years
<p>1. Some active members were reported with no Earnable Salaries, in which case their liabilities, if any, were included with inactive members.</p> <p>2. Total of prior year Earned Salaries for all active members. This may differ from the payroll amounts shown elsewhere which may include other adjustments.</p>		
<b>Retired Member Statistics<sup>(3)</sup></b>		
Average Age		
Service Retiree	73.9	73.7
Disabled Retiree	66.5	66.2
Survivors	77.7	77.6
All Benefit Recipients	73.9	73.7
Average Monthly Benefit		
Service Retirees	\$ 4,184	\$ 4,086
Disabled Retirees	2,901	2,833
Survivors	2,714	2,624
All Benefit Recipients	\$ 4,026	\$ 3,930
<p>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.</p>		
<b>Inactive Member Statistics</b>		
Average Age		
	49.8	49.7
Average Account Balance		
	\$ 12,671	\$ 12,257

**Table C.1**  
**Summary of Statistical Information**  
**(Continued)**

<b>Active Member Statistics by Benefit Formula<sup>(1)</sup></b>	<b>2% at 60 Members</b>	<b>2% at 62 Members</b>
Number	334,407	117,022
Earned Salaries <sup>(2)</sup>	\$ 27,569 million	\$ 5,327 million
Average Earned Salary	\$ 82,442	\$ 45,525
Average Age	48.8 years	34.8 years
Average Service	15.6 years	2.4 years

<b>Retired Member Statistics by Benefit Structure<sup>(3)</sup></b>	<b>1990 Benefit</b>	<b>Total Benefit</b>
Average Monthly Benefit		
Service Retirees	\$ 3,462	\$ 4,184
Disabled Retirees	2,871	2,901
Survivors	2,547	2,714
All Benefit Recipients	\$ 3,370	\$ 4,026

	<b>Pre-2014</b>	<b>Total</b>
<b>Pre-2014 Statistics</b>		
Active Member Average Service	8.2 years	12.2 years
Inactive Member Average Account Balance	\$ 10,622	\$ 12,671
Average Monthly Benefit for All Benefit Recipients	\$ 3,956	\$ 4,026

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						
Age	Years of Service					
	Greater than 1		5-9	10-14	15-19	20-24
	1 & Under	& Under 5				
Less than 25	1,152	359	-	-	-	-
25 to 30	3,301	5,641	669	-	-	-
30 to 35	2,123	5,712	4,262	472	-	-
35 to 40	1,504	4,051	4,354	5,006	780	2
40 to 45	1,144	2,790	2,808	4,594	5,940	973
45 to 50	1,004	2,224	1,927	2,997	5,767	6,442
50 to 55	722	1,684	1,490	1,936	3,467	5,210
55 to 60	608	1,362	1,132	1,391	2,289	2,999
60 to 65	384	1,009	798	1,053	1,452	1,695
65 to 70	213	604	498	508	681	625
70 and over	152	450	321	280	290	200
<b>Total</b>	<b>12,307</b>	<b>25,886</b>	<b>18,259</b>	<b>18,237</b>	<b>20,666</b>	<b>18,146</b>

Age	Years of Service					Total
	25-29	30-34	35-39	40-44	45 & Over	
Less than 25	-	-	-	-	-	1,511
25 to 30	-	-	-	-	-	9,611
30 to 35	-	-	-	-	-	12,569
35 to 40	-	-	-	-	-	15,697
40 to 45	3	-	-	-	-	18,252
45 to 50	430	3	-	-	-	20,794
50 to 55	3,149	236	3	-	-	17,897
55 to 60	2,870	2,040	145	-	-	14,836
60 to 65	1,263	1,059	384	21	-	9,118
65 to 70	355	227	106	69	2	3,888
70 and over	145	105	61	40	44	2,088
<b>Total</b>	<b>8,215</b>	<b>3,670</b>	<b>699</b>	<b>130</b>	<b>46</b>	<b>126,261</b>

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

Female							
Age	Years of Service						
	1 & Under	Greater than 1 & Under 5		5-9	10-14	15-19	20-24
	<b>Less than 25</b>	4,247	1,647	2	-	-	-
<b>25 to 30</b>	8,309	18,793	2,916	-	-	-	
<b>30 to 35</b>	4,337	14,897	14,613	1,909	-	-	
<b>35 to 40</b>	3,318	9,810	11,979	16,916	2,705	4	
<b>40 to 45</b>	2,683	7,288	7,743	12,854	17,331	2,526	
<b>45 to 50</b>	2,120	5,681	6,081	8,218	13,252	14,206	
<b>50 to 55</b>	1,472	4,042	4,416	5,859	8,053	10,043	
<b>55 to 60</b>	1,037	2,920	3,178	4,346	6,121	6,687	
<b>60 to 65</b>	553	1,742	1,970	2,724	3,964	4,191	
<b>65 to 70</b>	306	803	888	1,003	1,366	1,420	
<b>70 and over</b>	154	456	418	359	428	415	
<b>Total</b>	28,536	68,079	54,204	54,188	53,220	39,492	

Age	Years of Service					Total
	25-29	30-34	35-39	40-44	45 & Over	
<b>Less than 25</b>	-	-	-	-	-	5,896
<b>25 to 30</b>	-	-	-	-	-	30,018
<b>30 to 35</b>	-	-	-	-	-	35,756
<b>35 to 40</b>	-	-	-	-	-	44,732
<b>40 to 45</b>	5	-	-	-	-	50,430
<b>45 to 50</b>	1,012	1	-	-	-	50,571
<b>50 to 55</b>	6,743	802	2	-	-	41,432
<b>55 to 60</b>	5,908	4,861	386	1	-	35,445
<b>60 to 65</b>	2,768	1,866	882	41	1	20,702
<b>65 to 70</b>	791	413	183	119	15	7,307
<b>70 and over</b>	249	178	81	57	84	2,879
<b>Total</b>	17,476	8,121	1,534	218	100	325,168

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

Total						
Age	Years of Service					
	Greater than 1		5-9	10-14	15-19	20-24
	1 & Under	& Under 5				
Less than 25	5,399	2,006	2	-	-	-
25 to 30	11,610	24,434	3,585	-	-	-
30 to 35	6,460	20,609	18,875	2,381	-	-
35 to 40	4,822	13,861	16,333	21,922	3,485	6
40 to 45	3,827	10,078	10,551	17,448	23,271	3,499
45 to 50	3,124	7,905	8,008	11,215	19,019	20,648
50 to 55	2,194	5,726	5,906	7,795	11,520	15,253
55 to 60	1,645	4,282	4,310	5,737	8,410	9,686
60 to 65	937	2,751	2,768	3,777	5,416	5,886
65 to 70	519	1,407	1,386	1,511	2,047	2,045
70 and over	306	906	739	639	718	615
<b>Total</b>	<b>40,843</b>	<b>93,965</b>	<b>72,463</b>	<b>72,425</b>	<b>73,886</b>	<b>57,638</b>

Age	Years of Service					Total
	25-29	30-34	35-39	40-44	45 & Over	
Less than 25	-	-	-	-	-	7,407
25 to 30	-	-	-	-	-	39,629
30 to 35	-	-	-	-	-	48,325
35 to 40	-	-	-	-	-	60,429
40 to 45	8	-	-	-	-	68,682
45 to 50	1,442	4	-	-	-	71,365
50 to 55	9,892	1,038	5	-	-	59,329
55 to 60	8,778	6,901	531	1	-	50,281
60 to 65	4,031	2,925	1,266	62	1	29,820
65 to 70	1,146	640	289	188	17	11,195
70 and over	394	283	142	97	128	4,967
<b>Total</b>	<b>25,691</b>	<b>11,791</b>	<b>2,233</b>	<b>348</b>	<b>146</b>	<b>451,429</b>



**Table C.5  
 Inactive Members**

<b>Fiscal Year Ending June 30</b>	<b>Number Vested</b>	<b>Total Number</b>	<b>Male % of Total</b>	<b>Female % of Total</b>
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
2018	39,942	198,058	29.6	70.4
2019	41,192	204,593	29.6	70.4

<b>Fiscal Year Ending June 30</b>	<b>Average Account on Deposit</b>	<b>Average Age</b>	<b>Average Service Credit</b>	<b>Average Years Inactive</b>
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
2018	12,257	49.7	2.9	11.4
2019	12,671	49.8	2.9	11.6

**Table C.6**  
**Members Retired for Service**

<b>Fiscal Year Ending June 30</b>	<b>Total</b>	<b>Male % of Total</b>	<b>Female % of Total</b>
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
2018	264,780	31.5	68.5
2019	270,835	31.1	68.9

<b>Fiscal Year Ending June 30</b>	<b>Average Age at Retirement</b>	<b>Average Years of Service Credit</b>	<b>Final Average Compensation</b>	<b>Average Current Allowance Payable</b>
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
2018	61.5	25.6	5,981	4,086
2019	61.6	25.6	6,110	4,184

## Appendix D Glossary

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, 2019.