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March 21, 2017

Teachers' Retirement Board
California State Teachers' Retirement System

**Re: Cash Balance Benefit Program
Actuarial Valuation as of June 30, 2016**

Dear Members of the Board:

At your request, we have performed an actuarial valuation of the Cash Balance Benefit (CBB) Program of the State Teachers' Retirement Plan as of June 30, 2016. Details about the actuarial valuation are contained in the following report. The major findings of the 2016 Actuarial Valuation are contained in this report. This report reflects the benefit provisions and contribution rates in effect as of the valuation date.

Actuarial Certification

To the best of our knowledge and belief, this report is complete and accurate and contains sufficient information to fully and fairly disclose the funded condition of the Cash Balance Benefit Program as of June 30, 2016.

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

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

Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period or additional cost or contribution requirements based on the Plan's funded status); and changes in plan provisions or applicable law. Due to the limited scope of our assignment, we did not perform an analysis of the potential range of future measurements. The Teachers' Retirement Board has sole authority to determine the actuarial assumptions and methods used for the valuation of the CBB Program. The board adopted the actuarial methods and assumptions used in the 2016 valuation. Note that the board adopted a 6.75% investment return assumption for the 2016 valuation, but a 6.50% assumption is scheduled to be used for the 2017 and future valuations.

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.

Actuarial computations presented in this report are for purposes of assessing the funding of the CBB Program. The calculations in the enclosed report have been made on a basis consistent with our understanding of the CBB Program funding structure. Determinations for other purposes may be significantly different from the results contained in this report. Accordingly, additional determinations may be needed for other purposes.

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

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

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



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

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

Sincerely,

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
Actuary

NJC/MCO/JDS/nlo

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Section 1 Summary of the Findings



The Cash Balance Benefit (CBB) Program was established on July 1, 1996 (as the CB Plan). The number of participants has increased over the years, as shown below.

Date of Valuation	Number of Non-Retired Participants	Accumulated Account Balances
June 30, 2009	28,461	\$ 114,338,203
June 30, 2010	29,149	129,075,283
June 30, 2011	29,798	143,705,744
June 30, 2012	30,337	156,609,547
June 30, 2013	31,004	168,698,672
June 30, 2014	32,233	187,310,217
June 30, 2015	33,500	210,312,075
June 30, 2016	34,693	230,879,059

The Actuarial Value of Assets for this valuation is the Fair Market Value as provided to us by CalSTRS. The actual return for the year, as measured using uniform cash flow throughout the year, was about -0.4% net of investment and administrative expenses.

(\$ Thousands)	Year Ended June 30, 2016	Year Ended June 30, 2015
Additions		
Contributions	\$ 16,021	\$ 15,861
Earnings	(727)	7,928
Total Additions	\$ 15,294	\$ 23,789
Deductions		
Benefits	\$ 7,045	\$ 6,333
Expenses	273	203
Total Deductions	7,318	6,536
Net Increase (Decrease)	\$ 7,976	\$ 17,253
Net Assets		
Beginning of Year	\$ 248,699	\$ 231,446 ⁽¹⁾
Net Increase (Decrease)	7,976	17,253
End of Year	\$ 256,675	\$ 248,699
Estimated Net Rate of Return	-0.4%	3.3%

1. Adjustment to prior year ending balance for application of GASB 68.

Summary of the Findings
 (continued)

As of June 30, 2016 the Actuarial Value of Assets of the CBB Program exceeds the Actuarial Obligation by \$20,837,000. This number is the negative Unfunded Actuarial Obligation (UAO), sometimes referred to as an Actuarial Surplus. If the experience had emerged as assumed, the Actuarial Surplus would have increased from \$29,005,000 to \$31,035,000. The difference between the actual and expected Unfunded Actuarial Obligation is the actuarial gain or loss for the year.

- There was an actuarial loss of \$18,723,000 due to the actual investment return being less than last year's assumed long-term return of 7.00%.
- There was an actuarial gain of \$8,525,000 due primarily to the current year's interest credits being less than 7.00% during the year. The Minimum Interest Rate for 2015-2016 was 3.15%.
- The net actuarial loss was \$10,198,000, which reduced the Funded Ratio to 108.84%.

The valuation results are based on the June 30, 2016 fair market value of assets.

(\$ Thousands)	June 30, 2016	June 30, 2015
Actuarial Balance Sheet		
Actuarial Obligation (before Add'l Credits)	\$ 235,838	\$ 214,142
Actuarial Value of Assets	<u>256,675</u>	<u>248,699</u>
Unfunded Actuarial Obligation / (Actuarial Surplus)	\$ (20,837)	\$ (34,557)
Additional Earnings Credit	-	5,552
Additional Annuity Credit	<u>-</u>	<u>-</u>
Final Unfunded Actuarial Obligation / (Actuarial Surplus)	\$ (20,837)	\$ (29,005)
Funded Ratio (Assets ÷ Actuarial Obligation)		
Before Add'l Credits	108.84%	116.14%
After Add'l Credits	108.84%	113.20%
Actuarial (Gain) or Loss		
Investment Return on Assets	\$ 18,723	\$ 9,050
Interest Credits on Accounts	<u>(8,525)</u>	<u>(7,422)</u>
Total Actuarial (Gain) or Loss	\$ 10,198	\$ 1,628
Expected UAO at End of Year	<u>(31,035)</u>	<u>(36,185)</u>
Total Unfunded Actuarial Obligation / (Actuarial Surplus) Before Add'l Credits	\$ (20,837)	\$ (34,557)

**Summary of the Findings
 (continued)**

The board established a policy (“Additional Credit Policy”) on June 9, 2006 that was effective for the Additional Earnings Credit and Additional Annuity Credit decisions beginning in 2006. The board’s Additional Credit Policy calls for a two-step determination of the allocation as shown in detail in this report. This policy was updated at the board’s April 2015 meeting to increase the thresholds needed to be met to grant Additional Earnings Credits and to remove the Additional Annuity Credit.

Based on the board’s policy, no Additional Earnings Credits should be granted as of June 30, 2016.

The following chart shows a history of prior board actions.

Valuation Date	(\$ Thousands)		
	Available Reserves and Unallocated Gains (Losses)	Additional Credits Adopted	Final Gain and Loss Reserve
June 30, 2007	\$ 16,879	\$ 3,579	\$ 13,300
June 30, 2008	861	0	861
June 30, 2009	(22,887)	0	(22,887)
June 30, 2010	(15,156)	0	(15,156)
June 30, 2011	6,786	0	6,786
June 30, 2012	34	0	34
June 30, 2013	17,972	5,544	12,428
June 30, 2014	41,310	7,492	33,818
June 30, 2015	34,557	5,552	29,005
June 30, 2016	20,837	0	20,837

Future Funding

As of June 30, 2016, the CBB Program has an Actuarial Surplus (negative UAO), since the value of assets is greater than the current value of the Actuarial Obligation. If all assumptions are met, the funding surplus will slowly grow in the future. If future experience is worse than assumed, a UAO may develop. For example, if the CBB Program earned 0.0% in FYE2017, we project the funded ratio to be 106% as of June 30, 2017, but if the return is -10%, then the projected funded ratio is 95%. As of the date of this report, the return is positive, so it is likely the June 30, 2017 valuation will show a funded ratio greater than 100%.

There is currently no provision in the Education Code to increase contributions to make up the hypothetical shortfall described above, if it were to occur. However, the assumed return on investments exceeds the Minimum Interest Rate. To the extent that the assets earn more than the accounts are credited in the future, this may be sufficient to make up any potential shortfall.

The actuarially determined contribution in accordance with the funding policy is equal to the actual contributions that will be required to be made to the CBB Program according to the California Education Code.

**Impact of 6.50%
Investment Return
Assumption on 2016
Valuation Results**

The 2016 valuation calculates results as of June 30, 2016 based on a 6.75% investment return assumption. A 6.50% investment return assumption is scheduled to be used in the 2017 valuation. If the 6.50% investment return assumption had been reflected in the 2016 valuation, it would have increased the Actuarial Obligation and reduced the funded ratio, but the impact on the funded ratio would have been less than a 1% decrease.

Conclusion

The CBB Program currently has a funded ratio greater than 100% but less than the first threshold for considering granting Additional Earnings Credits. Given the current funded position, the board should not grant Additional Earnings Credits this year under its policy.

Section 2 Findings of the Actuarial Valuation



An actuarial valuation is performed as of June 30 of each year, the last day of the Program's plan year. The primary purpose of the valuation is to determine the financial condition of the CBB Program through the measurement of the Gain and Loss Reserve. We also describe recent changes in the Program's financial condition and provide additional disclosure information.

The findings have been determined according to actuarial assumptions that were adopted on the basis of recent experience and current expectations of future experience. In our opinion, the assumptions used in the valuation are reasonably related to the past experience of the CBB Program and represent a reasonable estimate of future conditions affecting the Program. Nevertheless, the emerging costs of the Program will vary from those presented in this report to the extent that actual experience differs from that projected by the actuarial assumptions.

Actuarial Value of Assets

The Actuarial Value of Assets for this valuation is the Fair Market Value as reported by CalSTRS. A Statement of Program Assets for the last two plan years is shown in **Table 1**, and the Statement of Change in Program Assets is shown in **Table 2**.

The investment return for 2015-2016 was calculated to be -0.4% net of all investment and administrative expenses and assuming uniform cash flow throughout the year. This is an estimate only for the purpose of comparing investment experience from one year to the next and will likely differ from information provided by your investment advisors.

Actuarial Balance Sheet

Under the Traditional Unit Credit Actuarial Cost Method, when the assumed investment return is equal to the assumed interest crediting rate, then the Normal Cost is equal to the contributions made during the year and the Actuarial Obligation is equivalent to the current sum of the Participants' Account Balances plus a reserve for the present value of the current annuity payments.

Table 3 shows the Actuarial Obligation for this and the prior valuation.

For the purpose of this valuation, the account information was provided to us by CalSTRS, including Additional Earnings Credits granted for 2006, 2007, 2013, 2014, and 2015. No adjustments were needed to these account balances to reflect the Additional Earnings Credits. We checked the information for reasonableness by reviewing the individual participant records supplied to us. We independently calculated the value of the annuitized benefits.

Actuarial Balance Sheet
(continued)

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.

If all experience emerged as assumed every year, the CBB Program would have an Actuarial Surplus at the end of each year before any Additional Earnings Credit. This is because the Minimum Interest Rate is less than the assumed earnings rate. In order to retain an Actuarial Surplus, the investment returns over a long period of time must exceed the combination of the Minimum Interest Rates and the Additional Earnings Credits.

Although we expect this to be the case, investment performance for several prior years was below the long-term assumption.

Actuarial Gains and Losses

The Minimum Interest Rate for the year ending on the valuation date was 3.15%. Since the assumed total earnings rate last year was 7.00% per year, the increase in the Actuarial Obligation was less than expected. The total actuarial gain on the Actuarial Obligation due to interest credits being less than expected was \$8,525,000.

Last year, the assumed earnings rate on the invested assets was 7.00% per year. The actual return for the year was about -0.4% (net of investment and administrative expenses and assuming uniform cash flow through the year, which is slightly different than how interest is actually posted), which produced an investment loss of \$18,723,000.

The assumed earnings rate is 6.75% for the upcoming year and 6.50% in all future years, as adopted by the board in February 2017.

The total actuarial loss due to all causes was \$10,198,000 as shown in **Table 4**.

Contributions and Normal Costs

Table 4 shows that the Normal Costs of the Cash Balance Benefit Program are equal to the actual contributions. They are shown as the actual dollar amount of contributions. The timing in **Table 4** is therefore consistent with the fact that contributions are spread over the entire year and correspond to payroll timing. The total contributions of \$16,021,000 were made up of \$8,022,000 in employee contributions and \$7,999,000 in employer contributions.

Gain and Loss Reserve

Table 5 shows the derivation of the Gain and Loss Reserve. After each actuarial valuation, the Teachers' Retirement Board decides on the adjustment to the prior year's Gain and Loss Reserve and the Additional Earnings Credit, if any.

This report assumes the Teachers' Retirement Board will allocate any unallocated gain or loss to funding after any Additional Earnings Credits are adopted.

**Additional Credits
 Based on Board Policy**

Based on the board's Policy, no Additional Earnings Credit should be granted as of June 30, 2016.

The board's Policy calls for a two-step determination of the allocation.

The first step in the process allocates the excess of the Actuarial Surplus over 1 times the Standard Deviation of the Expected Long-Term Rate of Return on the investment portfolio, but limited by the long-term assumed rate of earnings.

First Allocation

Long-term Net Investment Return	6.75%
Minimum Interest Rate (year prior to valuation)	<u>3.15</u>
Maximum Available in First Allocation (1)	3.60%
Actuarial Surplus	8.84%
First Threshold (1x Portfolio Std. Deviation)	<u>13.00</u>
Actuarial Surplus in excess of First Threshold (2)	0.00%
Maximum credit such that resulting Funded Ratio is not less than 100% + Std. Deviation (3)	0.00%
First Allocation [lesser of (1), (2), and (3)]	0.00%

The second step in the process allocates 50% of the remaining Actuarial Surplus over 2 times the Standard Deviation of the Expected Long-Term Rate of Return on the investment portfolio.

The second step is not necessary this year.

Details of the calculation are shown in **Table 6**.

Historical Information

A history of the CBB Program's cash flow and funded status are shown in **Tables 7 and 8**.

Supplemental Information

Supplemental information that is recommended to be disclosed by the California Actuarial Advisory Panel is shown in **Tables 9, 10, and 11**.

Table 1
Statement of Program Assets

<i>(\$ Thousands)</i>	June 30, 2016	June 30, 2015
Invested Assets		
Cash	\$ 892	\$ 1,624
Debt Securities	76,166	65,831
Equity Securities	192,987	193,771
Alternative Investments	12,890	13,537
Derivative Instruments	<u>121</u>	<u>16</u>
Total Investments	\$ 283,056	\$ 274,779
Receivables	(25,019)	(24,322)
Liabilities	<u>(1,362)</u>	<u>(1,758)</u>
Fair Market Value of Net Assets	\$ 256,675	\$ 248,699

Table 2
Statement of Change in Program Assets

(\$ Thousands)	Year Ended June 30, 2016	Year Ended June 30, 2015
Additions		
Contributions		
Participants	\$ 8,022	\$ 7,882
Employers	<u>7,999</u>	<u>7,979</u>
Total Contributions	16,021	15,861
Net Earnings	<u>(727)</u>	<u>7,928</u>
Total Additions	\$ 15,294	\$ 23,789
Deductions		
Benefit Payments		
Retirement, Death and Survivor	\$ 4,669	\$ 4,332
Refunds of Participant Contributions	<u>2,376</u>	<u>2,001</u>
Total Benefits	7,045	6,333
Expenses	<u>273</u>	<u>203</u>
Total Deductions	\$ 7,318	\$ 6,536
Net Increase (Decrease)	\$ 7,976	\$ 17,253
Fair Market Value of Net Assets		
Beginning of Year	\$ 248,699	\$ 231,671
Accounting Adjustments (GASB 68)	0	(225)
Net Increase (Decrease)	<u>7,976</u>	<u>17,253</u>
End of Year	\$ 256,675	\$ 248,699
Estimated Net Rate of Return	(0.4)%	3.3%
- Assuming uniform cash flow through the year		
- Net of investment and administrative expenses		

Table 3
Actuarial Balance Sheet

<i>(\$ Thousands)</i>	<u>June 30, 2016</u>	<u>June 30, 2015</u> (Reflects 2015 Additional Credits)
Total Requirements		
Actuarial Obligation		
Retirees and Beneficiaries	\$ 4,974	\$ 3,843
Inactive Participants	96,459	88,378
Active Participants	<u>134,405</u>	<u>127,473</u>
Total Requirements	\$ 235,838	\$ 219,694
Total Resources		
Actuarial Value of Assets	\$ 256,675	\$ 248,699
Unfunded Actuarial Obligation or (Actuarial Surplus)	<u>(20,837)</u>	<u>(29,005)</u>
Total Resources	\$ 235,838	\$ 219,694
Funded Ratio	108.84%	113.20%

Table 4
Actuarial Gains and Losses

<i>(\$ Thousands)</i>	Actuarial Obligation	Actuarial Value of Assets	Unfunded Actuarial Obligation (Surplus)
Balance at June 30, 2015	\$ 219,694	\$ 248,699	\$ (29,005)
Expected Changes			
Actual Contributions	16,021	16,021	0
Actual Benefits Paid	(7,045)	(7,045)	0
Expected Earnings / Credits	<u>15,693</u>	<u>17,723</u>	<u>(2,030)</u>
Expected Balance at June 30, 2016	\$ 244,363	\$ 275,398	\$ (31,035)
Actuarial Gains or Losses			
(Gain)/Loss on Actuarial Obligation	(8,525)		
Gain/(Loss) on Assets		(18,723)	
Net (Gain) or Loss	<u> </u>	<u> </u>	<u>10,198</u>
Actual Balance at June 30, 2016	\$ 235,838	\$ 256,675	\$ (20,837)

Table 5
Gain and Loss Reserve

<i>(\$ Thousands)</i>	<u>June 30, 2016</u>	<u>June 30, 2015</u>
Unfunded Actuarial Obligation or (Actuarial Surplus) (prior to any additional earnings credits)	\$ (20,837)	\$ (34,557)
Additional Earnings Credit	0	5,552
Additional Annuity Credit	<u>0</u>	<u>0</u>
Unfunded Actuarial Obligation or (Actuarial Surplus) (after any additional earnings credits)	(20,837)	(29,005)
Gain and Loss Reserve		
Beginning of Year	\$ 29,005	\$ 33,818
Allocated to Funding	<u>(8,168)</u>	<u>(4,813)</u>
End of Year Gain and Loss Reserve	20,837	29,005
Unallocated Gains and (Losses)	\$ 0	\$ 0

<i>(\$ Thousands)</i>	Available Reserves and Unallocated Gains (Losses)	Additional Credits Adopted	Final Gain and Loss Reserve
Valuation Date			
June 30, 2004	\$ 250	\$ 0	\$ 250
June 30, 2005	2,137	0	2,137
June 30, 2006	6,641	733	5,908
June 30, 2007	16,879	3,579	13,300
June 30, 2008	861	0	861
June 30, 2009	(22,887)	0	(22,887)
June 30, 2010	(15,156)	0	(15,156)
June 30, 2011	6,786	0	6,786
June 30, 2012	34	0	34
June 30, 2013	17,972	5,544	12,428
June 30, 2014	41,310	7,492	33,818
June 30, 2015	34,557	5,552	29,005
June 30, 2016	20,837	0	20,837

Table 6
Additional Credits Based on Board Policy

	June 30, 2016	June 30, 2015
Funded Ratio before Additional Credits	108.84%	116.14%
Actuarial Surplus	8.84%	16.14%
First Threshold	13.00%	13.20%
Second Threshold	26.00%	26.40%
First Allocation		
Long-term Net Investment Return	6.75%	7.00%
Minimum Interest Rate (MIR) (year prior to valuation)	<u>3.15</u>	<u>3.55</u>
Maximum Available in First Allocation (1)	3.60%	3.45%
Actuarial Surplus	8.84%	16.14%
First Threshold (1 x Std. Deviation of Portfolio Return)	<u>13.00</u>	<u>13.20</u>
Actuarial Surplus in excess of First Threshold (2)	0.00%	2.94%
Maximum credit such that resulting Funded Ratio is not less than 100% + Std. Deviation (3)	0.00%	2.64%
First Allocation [lesser of (1), (2), and (3)]	0.00%	2.64%
Second Allocation		
Remaining Actuarial Surplus	0.00%	13.20%
Second Threshold (2 x Std. Deviation of Portfolio Return)	<u>26.00</u>	<u>26.40</u>
Actuarial Surplus in excess of Second Threshold	0.00%	0.00%
Less 50%	<u>0.00%</u>	<u>0.00%</u>
Available for Second Allocation	0.00%	0.00%
Additional Earnings Credit based on Board Policy		
As a percentage of Actuarial Obligation (actives and inactive only) as of the valuation date	0.00%	2.64%
As a dollar amount (\$ Thousands)	\$ 0	\$ 5,552

Table 7
History of Cash Flow

(\$ Thousands)

Year End	Contributions for the Year	Expenditures During the Year				External Cash Flow	Fair Market Value of Assets
		Benefit Payments	Contribution Refunds	Expenses	Total		
1997	\$ 148	\$ 0	\$ 0	\$ 428	\$ 428	\$ (280)	\$ (393)
1998	1,544	0	0	466	466	1,078	790
1999	3,082	0	15	430	445	2,637 ⁽¹⁾	5,224
2000	4,955	0	59	4	63	4,892	10,868
2001	5,972	0	119	8	127	5,845	15,768
2002	7,121	0	195	11	206	6,915	21,748
2003	7,171	0	320	17	337	6,834	29,963
2004	7,712	580	197	28	805	6,907	42,253
2005	8,639	1,235	245	34	1,514	7,125	53,918
2006	10,605	1,330	472	34	1,836	8,769	68,797
2007	11,884	884	664	44	1,592	10,292	93,182
2008	14,418	1,053	608	52	1,713	12,705	98,892
2009	14,970	1,222	1,054	65	2,341	12,629	91,793
2010	13,199	2,019	1,091	112	3,222	9,977	114,418
2011	12,889	2,463	1,305	114	3,882	9,007	151,248
2012	11,846	3,582	1,160	133	4,875	6,971	158,020
2013	13,425	3,329	1,692	161	5,182	8,243	188,551
2014	13,831	4,200	1,987	185	6,372	7,459	231,671
2015	15,861	4,332	2,001	203	6,536	9,325	248,699
2016	16,021	4,669	2,376	273	7,318	8,703	256,675

1. Excludes write-off of loan from the DB Plan of \$1,417,000 as of January 1, 1999.

Table 8
Schedule of Funding Progress

(\$ Thousands)

Year End	Actuarial Value of Assets	Actuarial Accrued Liability	Unfunded Actuarial Accrued Liability	Funded Ratio Assets/AAL	Estimated Covered Payroll	Coverage Ratio UAAL/Pay
1997	\$ (393)	\$ 164	\$ 557	(240)%	\$ 4,504	12%
1998	790	1,728	938	46%	18,838	5%
1999	5,224	5,001	(223)	104%	50,426	(0)%
2000	10,868	10,351	(517)	105%	70,605	(1)%
2001	15,768	16,938	1,170	93%	97,921	1%
2002	21,748	25,080	3,332	87%	89,871	4%
2003	29,963	33,837	3,874	89%	81,080	5%
2004	42,253	42,003	(250)	101%	96,199	(0)%
2005	53,918	51,781	(2,137)	104%	106,951	(2)%
2006	68,797	62,889	(5,908)	109%	122,316	(5)%
2007	93,182	79,882	(13,300)	117%	144,516	(9)%
2008	98,892	98,031	(861)	101%	181,104	(0)%
2009	91,793	114,680	22,887	80%	182,030	13%
2010	114,418	129,574	15,156	88%	162,546	9%
2011	151,248	144,462	(6,786)	105%	157,871	(4)%
2012	158,020	157,986	(34)	100%	150,686	(0)%
2013	188,551	176,123	(12,428)	107%	150,678	(8)%
2014	231,671	197,853	(33,818)	117%	174,342	(19)%
2015	248,699	219,694	(29,005)	113%	192,277	(15)%
2016	256,675	235,838	(20,837)	109%	209,220	(10)%

Table 9
Reconciliation of Changes in Unfunded Actuarial Obligation

(\$ Thousands)

Year End	Beginning of Year UAO	Expected Earnings/ Credits	(G)/L on Actuarial Obligation	(G)/L on Assets	Additional Credits	End of Year UAO
2011	\$ 15,156	\$ 1,099	\$ (3,958)	\$ (19,083)	\$ 0	(6,786)
2012	(6,786)	(475)	(3,941)	11,168	0	(34)
2013	(34)	(3)	(7,164)	(10,771)	5,544	(12,428)
2014	(12,428)	(870)	(6,002)	(22,010)	7,492	(33,818)
2015	(33,818)	(2,367)	(7,422)	9,050	5,552	(29,005)
2016	(29,005)	(2,030)	(8,525)	18,723	0	(20,837)

Table 10
Changes in Economic Assumptions

Year	Price Inflation	Wage Inflation	Investment Return
2011	3.00%	3.75%	7.00%
2012	3.00%	3.75%	7.00%
2013	3.00%	3.75%	7.00%
2014	3.00%	3.75%	7.00%
2015	3.00%	3.75%	7.00%
2016	2.75%	3.50%	6.75%

Table 11
Smoothing and Volatility Ratios

Year	Asset Smoothing Ratio AVA/MVA	Asset Volatility Ratio MVA/Payroll	Liability Volatility Ratio AAL/Payroll
2001	100%	16.1%	17.3%
2002	100%	24.2%	27.9%
2003	100%	37.0%	41.7%
2004	100%	43.9%	43.7%
2005	100%	50.4%	48.4%
2006	100%	56.2%	51.4%
2007	100%	64.5%	55.3%
2008	100%	54.6%	54.1%
2009	100%	50.4%	63.0%
2010	100%	70.4%	79.7%
2011	100%	98.8%	91.5%
2012	100%	104.9%	104.8%
2013	100%	125.1%	116.9%
2014	100%	132.9%	113.5%
2015	100%	129.3%	114.3%
2016	100%	122.7%	112.7%

Appendix A Provisions of Governing Law



All of the actuarial calculations contained in this report are based upon our understanding of the Cash Balance Benefit (CBB) Program of the State Teachers' Retirement Plan as contained in Part 14 of the California Education Code. The provisions used in this valuation are summarized below for reference purposes.

Participation

- Eligibility Requirement:** Participation if employed at less than 50% of a full-time position for a California school district, or county office of education, or a temporary employee of a community college district, and the employer has elected to offer the CBB Program and the employee has elected to participate. In addition, a trustee of an employer that offers the CBB Program is eligible to participate.
- Participant:** An eligible employee or trustee with creditable service subject to coverage, who has contributions credited in the Program or is receiving an annuity from the Program.

Account Balance

- Account Balance:** Nominal employer and employee accounts established for the purpose of determining benefits payable to the Participant. Accounts are credited with Contributions, Minimum Interest Rate (MIR) and Additional Earnings Credits.
- Contributions:** Generally, Participant Contributions are 4% of salary and Employer Contributions are 4% of salary.
- Rules for Contribution rates may differ for Participants covered by a collective bargaining agreement, but the sum of the Participant and Employer contributions must equal or exceed 8% of salary, and in no event can the Employee contribution rate be less than 4% of salary.
- The board may adjust Employer Contributions for a fixed number of years, but the adjustment shall not exceed 0.25% of salaries in any plan year, up to a maximum mandatory Employer Contribution of 4.25%.
- Minimum Interest Rate:** Annual rate determined for the plan year by the board in accordance with federal laws and regulations. The MIR is equal to the average of the yields on 30-year Treasuries for the 12 months ending in February preceding the beginning of the plan year, rounded to the next highest 0.01%.
- Additional Earnings Credit:** Annual rate determined for the plan year by the board pursuant to earnings credit policy adopted at the April 2015 meeting.
- Additional Annuity Credit:** No longer applies, per the board annuity credit policy as adopted at the April 2015 meeting.

Normal Retirement

- Eligibility Requirement: Age 60, or age 62 for a Participant subject to the Public Employees' Pension Reform Act.
- Benefit: The Account Balance at the retirement date subject to limits imposed under Internal Revenue Code (IRC) Section 415.
- Form of Payment: The normal form of payment is a lump sum distribution. Annuity options are available if the sum of the employer and Participant accounts equal or exceed \$3,500.

Early Retirement

- Eligibility Requirement: Age 55.
- Benefit and Form: Same as Normal Retirement.

Late Retirement

- Benefit and Form: Same as Normal Retirement.
- Contributions and interest continue to be credited to the Account Balances until distributed.

Deferred Retirement

- Benefit: A Participant may cease active service, leave the accumulated Account Balance on deposit, and later retire upon attaining the minimum age requirement.

Disability Benefit

- Eligibility Requirement: Determination by the board that the Participant has a total and permanent disability.
- Benefit: The Account Balance at the date of disability. An annuity benefit is discontinued if the Participant is re-employed before age 60, and performs service creditable under the Program. The actuarial equivalent of the Participant's annuity as of the date creditable service is resumed is credited to the Participant's Account Balance.
- Form of Payment: Same as Normal Retirement.

Death before Retirement

- Eligibility Requirement: Deceased Participant has an Account Balance.
- Benefit: The Account Balance at the date of death payable to the designated beneficiary.
- Form of Payment: Same as Normal Retirement, except annuity options are limited to a Period Certain Annuity.

Death after Retirement

- Eligibility Requirement: The deceased Participant was receiving an annuity.
- Benefit: According to the terms of the annuity elected by the Participant.

Termination from the Program

- Eligibility Requirement: Termination of all CalSTRS-covered service. A Participant may not apply for a Termination Payment if less than five years has elapsed since the most recent termination benefit, if any, has been paid.
- Benefit: Lump-sum distribution of the Account Balance as of the date of distribution. The benefit is payable six months from the termination of credited service.

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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 CBB Program and on current expectations as to future economic conditions. The assumptions were reviewed and changed for the June 30, 2016 Actuarial Valuation as a result of the 2016 Experience Analysis. Please refer to that Experience Analysis report dated December 30, 2016 for the data and rationale used in the selection and recommendation of each assumption.

The assumptions are intended to estimate the future experience of the members of the CBB Program and of the CBB 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 CBB Program's benefits.

Actuarial Cost Method

The accruing costs of all benefits are measured by the Traditional Unit Credit Actuarial Cost Method. Under this method, the projected benefits of each individual member are allocated by a consistent formula to valuation years. The actuarial present value of future projected benefits allocated to the current year is called the Normal Cost. The actuarial present value of future projected benefits allocated to periods prior to the valuation year is called the Actuarial Obligation.

The Actuarial Obligation is equal to the accumulated account balances and the Normal Cost is equal to the total annual contribution.

Asset Valuation Method

The assets are valued at Fair Market Value.

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.

**Actuarial Assumptions
(continued)**

The assumptions are intended to estimate the future experience of the members of the CBB 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 **Table B.2**.

Table B.1
List of Major Valuation Assumptions

I. Economic Assumptions

A.	Investment Return (net of investment and administrative expenses)	6.75%
B.	Interest on Member Accounts	6.75%
C.	Wage Growth	3.50%
D.	Inflation	2.75%
E.	Standard Deviation of Portfolio	13.00%

II. Demographic Assumptions

A.	Mortality ⁽¹⁾			
	Retired & Beneficiary	- Male	2016 CalSTRS Retired Male	Table B.2
		- Female	2016 CalSTRS Retired Female	Table B.2
	Disabled	- Male	RP-2014 Disabled Retiree Male set back 2 years	Table B.2
		- Female	RP-2014 Disabled Retiree Female set back 2 years (select rates in first three years for both Males and Females)	Table B.2

1. All tables use 110% of the MP-2016 Ultimate Projection Scale. The combined base tables and projection scale specified contain a margin for expected future mortality improvement.

Note: Assumptions for active members do not apply to the CBB Program valuation, as each active and inactive member's liabilities are equal to their account balance

Table B.2
Mortality as of June 30, 2016

Age	Retired Members and Beneficiaries ⁽¹⁾		Disabled Members (After Year 3) ⁽¹⁾	
	Male	Female	Male	Female
50	0.243%	0.124%	1.868%	1.055%
55	0.358	0.213	2.172	1.320
60	0.480	0.283	2.464	1.558
65	0.682	0.427	2.867	1.861
70	1.091	0.704	3.556	2.416
75	1.958	1.294	4.689	3.438
80	3.592	2.482	6.491	5.092
85	6.907	4.950	9.430	7.566
90	13.297	10.051	14.273	11.159
95	22.668	18.791	21.289	16.477
Select rates for disability:				
	First year of disability		4.0%	3.0%
	Second year of disability		3.5	2.5
	Third year of disability		3.0	2.0

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

Appendix C Valuation Data



The participant data for this actuarial valuation was supplied by CalSTRS and accepted without audit. We have examined the data for reasonableness and consistency with prior valuations and periodic reports from the CalSTRS staff to the Teachers' Retirement Board.

In preparing this report, we relied upon the participant data furnished by CalSTRS. Although we did not audit this data, we compared the data for this valuation and the prior valuation and tested for reasonableness. 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.

Tables C.1 through **C.4** summarize the census data used in this valuation.

Table C.1
Summary of Statistical Information

	June 30, 2016	June 30, 2015
Number of Participants		
Active Participants ⁽¹⁾	10,676	10,416
Inactive Participants ⁽¹⁾	24,017	23,084
Retirees and Beneficiaries	<u>252</u>	<u>200</u>
Total Number of Participants	34,945	33,700
Active Participant Statistics		
Annualized Salaries (\$ millions)	\$ 209.2	\$ 192.3
Average Salary	\$ 19,595	\$ 18,456
Average Age	48.8 years	48.7 years
Average Service in CBB Program	6.3 years	6.2 years

1. Participant counts as shown in CalSTRS Overview.

Table C.2
Age and Service Distribution
All Active Participants

Age Group		Years	
Under 25	53	Under 1	1,961
25 – 29	616	1 – 2	1,484
30 – 34	1,264	2 – 3	1,111
35 – 39	1,378	3 – 4	602
40 – 44	1,221	4 – 5	463
45 – 49	1,344	5 – 9	2,304
50 – 54	1,204	10 and Over	<u>2,751</u>
55 – 59	1,150	Total	10,676
60 – 64	1,081		
65 and Over	<u>1,365</u>		
Total	10,676		

**Table C.3
 Inactive Members**

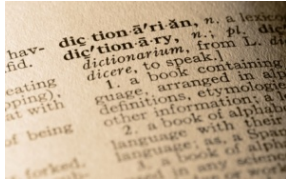
Fiscal Year Ending June 30	Number	Account Balances
2007	13,536	\$ 23,848,000
2008	15,037	28,543,000
2009	17,129	37,547,000
2010	18,771	44,154,000
2011	19,875	51,952,000
2012	21,064	60,558,000
2013	21,875	68,442,000
2014	22,278	73,363,000 ⁽¹⁾
2015	23,084	82,793,000 ⁽¹⁾
2016	24,017	96,459,000

1. From CalSTRS Overview. Does not include prior year Additional Credits.

**Table C.4
 Annuitants**

Fiscal Year Ending June 30	Number	Accounts at Retirement
2007	17	\$ 185,000
2008	24	311,000
2009	35	467,000
2010	50	599,000
2011	66	883,000
2012	102	1,626,000
2013	123	2,287,000
2014	158	3,799,000
2015	200	4,690,000
2016	252	6,020,000

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 CBB Program. Defined terms are capitalized throughout this Appendix.

Account Balance	The nominal account amount of an individual's benefit as of a specific date, determined in accordance with the terms of the Plan. The Account Balance is accumulated with contributions and interest.
Actuarial Assumptions	Assumptions as to the occurrence of future events affecting pension costs, such as mortality, withdrawal, disability and retirement, changes in compensation, rates of investment earnings and asset appreciation or depreciation, procedures used to determine the Actuarial Value of Assets and 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.

Normal Cost	The Actuarial Present Value of benefits expected to accrue in the plan year subsequent to the valuation date. The Normal Cost is equivalent to the expected Participant and Employer contributions for the next year.
Traditional Unit Credit Actuarial Cost Method	A method under which the Actuarial Obligation is equal to the actuarial present value of benefits for service accrued to the valuation date.
Unfunded Actuarial Obligation	The excess, if any, of the Actuarial Obligation over the Actuarial Value of Assets.
Valuation Date	June 30, 2016.