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May 17, 2018

Teachers’ Retirement Board
California State Teachers’ Retirement System

Re: Cash Balance Benefit Program
Actuarial Valuation as of June 30, 2017

Dear Members of the Board:

At your request, we have performed an actuarial valuation of the Cash Balance Benefit (CBB) Program of the State Teachers' Retirement Plan as of June 30, 2017. Details about the actuarial valuation are contained in the following report. The major findings of the 2017 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 CBB Program as of June 30, 2017.

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 2017 valuation.

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.

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:

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

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

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

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

We would like to express our appreciation to the CalSTRS staff who gave substantial assistance in supplying the data on which this report is based. We respectfully submit the following report and we look forward to discussing it with you.

Sincerely,

Nick Collier

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

Mark C Olleman

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Section 1 Summary of the Findings

As of June 30, 2017, the Actuarial Value of Assets of the Cash Balance Benefit (CBB) Program exceeds the Actuarial Obligation by $50,324,000. This number is the negative Unfunded Actuarial Obligation (UAO), sometimes referred to as an Actuarial Surplus. Consistent with its policy, the board granted an Additional Earnings Credits of $8,859,000 as of June 30, 2017, as discussed in this report.

($ Thousands)		June 30, 2017		June 30, 2016
Actuarial Balance Sheet				
Actuarial Obligation (before Add'l Credits)	$	252,124	$	235,838
Actuarial Value of Assets		302,448		256,675
Unfunded Actuarial Obligation /				
(Actuarial Surplus)	$	(50,324)	$	(20,837)
Additional Earnings Credit		8,859		-
Additional Annuity Credit		-		-
Final Unfunded Actuarial Obligation /				
(Actuarial Surplus)	$	(41,465)	$	(20,837)
Funded Ratio (Assets ÷ Actuarial Obligation)				
Before Additional Credits		**119.96%**		**108.84%**
After Additional Credits		**115.89%**		**108.84%**

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 15.5% net of investment and administrative expenses.

($ Thousands)		Year Ended June 30, 2017		Year Ended June 30, 2016
Additions				
Contributions	$	18,066	$	16,021
Earnings		40,568		(727)
Total Additions	$	58,634	$	15,294
Deductions				
Benefits	$	12,502	$	7,045
Expenses		359		273
Total Deductions		12,861		7,318
Net Increase (Decrease)	$	45,773	$	7,976
Net Assets				
Beginning of Year	$	256,675	$	248,699
Net Increase (Decrease)		45,773		7,976
End of Year	$	302,448	$	256,675
Estimated Net Rate of Return		15.5%		-0.4%

Summary of the Findings (continued)

If the experience had emerged as assumed, the Actuarial Surplus would have increased from $20,837,000 to $22,243,000. The difference between the actual and expected UAO is the actuarial gain or loss for the year.

- There was an actuarial gain of $22,696,000 due to the actual investment return being greater than last year's assumed long-term return of 6.75%.
- There was an actuarial gain of $5,385,000 on the actuarial obligation. This consisted of a gain of $5,505,000 primarily due to the current year's interest credits being less than 6.75% during the year, which was partially offset by a loss of $120,000 due to the change in the investment return assumption from 6.75% to 6.50%. The Minimum Interest Rate for 2016-2017, was 2.88%.
- The net actuarial gain was $28,081,000, which increased the Funded Ratio to 119.96%.
- The Actuarial Obligation increased by $8,859,000 due to Additional Credits adopted effective June 30, 2017.

A summary of the actuarial (gains) and losses for the last two years is shown in the following table.

($ Thousands)	June 30, 2017	June 30, 2016
Actuarial (Gain) or Loss		
Investment Return on Assets	$ (22,696)	$ 18,723
Assumption Changes	120	207
Interest Credits on Accounts	(5,505)	(8,732)
Total Actuarial (Gain) or Loss	$ (28,081)	$ 10,198
Expected UAO at End of Year	(22,243)	(31,035)
Total Unfunded Actuarial Obligation / (Actuarial Surplus) Before Add'l Credits	$ (50,324)	$ (20,837)

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.

At the May 2018 meeting, the board granted an Additional Earnings Credits of $8,859,000, pursuant to the board policy.

Summary of the Findings (continued)

The following table shows a history of prior board actions.

($ Thousands) Valuation Date	Funded Ratio	Available Reserves and Unallocated Gains (Losses)	Additional Credits Adopted	Final Gain and Loss Reserve
June 30, 2007	116.6%	$ 16,879	$ 3,579	$ 13,300
June 30, 2008	100.9%	861	0	861
June 30, 2009	80.0%	(22,887)	0	(22,887)
June 30, 2010	88.3%	(15,156)	0	(15,156)
June 30, 2011	104.7%	6,786	0	6,786
June 30, 2012	100.0%	34	0	34
June 30, 2013	107.1%	17,972	5,544	12,428
June 30, 2014	117.1%	41,310	7,492	33,818
June 30, 2015	113.2%	34,557	5,552	29,005
June 30, 2016	108.8%	20,837	0	20,837
June 30, 2017	115.9%	50,324	8,859	41,465

Future Funding

As of June 30, 2017, 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.

There is currently no provision in the Education Code to increase contributions to make up for any future shortfalls, if they were to occur. However, the assumed return on investments exceeds the current 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.

Conclusion

The CBB Program is currently in a surplus funding position; that is, the assets exceed the value of the actuarial obligation based on the actuarial assumptions. Given the current funded position, it is consistent with their policy for the board to grant Additional Credits. However, it should be noted that future experience will not exactly conform to the assumptions. To the extent future experience is worse than assumed, it is possible that a UAO could develop in the future.

The board granted an Additional Earnings Credit of 3.62% to active and inactive member accounts, consistent with its policy. The estimated value of the Additional Earnings Credits is $8,859,000.

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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 2016-2017 was calculated to be 15.5% 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 (UAO). 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 2.88%. Since the assumed total earnings rate last year was 6.75% 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 $5,385,000, which also reflects a relatively small increase in the actuarial obligation due to the reduction in the investment return assumption..

Last year, the assumed earnings rate on the invested assets was 6.75% per year. The actual return for the year was about 15.5% (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 gain of $22,696,000.

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

The total actuarial gain due to all causes was $28,081,000 as shown in **Table 4**.

Contributions and Normal Costs

Table 4 shows that the Normal Costs of the CBB 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 $18,066,000 were made up of $9,364,000 in member contributions and $8,702,000 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, an Additional Earnings Credit of $8,859,000 was granted as of June 30, 2017.

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 Expected Net Investment Return	6.50%
Minimum Interest Rate (year prior to valuation)	2.88
Maximum Available in First Allocation (1)	3.62%
Actuarial Surplus	19.96%
First Threshold (1x Portfolio Std. Deviation)	13.00
Maximum credit such that resulting Funded Ratio is not less than 100% + Std. Deviation (2)	6.35%*
First Allocation [lesser of (1) and (2)]	**3.62%**

** The result is not a simple subtraction of the Actuarial Surplus and the First Threshold, because the maximum credit is determined based on a division of the Actuarial Value of Assets and the Actuarial Obligation with the First Allocation.*

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.

Second Allocation

Remaining Actuarial Surplus (3)	15.89%
Second Threshold (2x Portfolio Std. Deviation) (4)	26.00
Target Second Threshold Surplus [Average of (3) and (4), but not less than Second Threshold]	26.00%
Available for Second Allocation	**0.00%**

The total available is the sum of the two steps, or 3.62% of the Actuarial Obligation for active and inactive member accounts as of June 30, 2017.

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

($ Thousands)	June 30, 2017	June 30, 2016
Invested Assets		
Cash	$ 868	$ 892
Debt Securities	71,192	76,166
Equity Securities	226,789	192,987
Alternative Investments	33,075	12,890
Derivative Instruments	6	121
Total Investments	$ 331,930	$ 283,056
Receivables	(24,857)	(25,019)
Liabilities	(4,625)	(1,362)
Fair Market Value of Net Assets	$ 302,448	$ 256,675

Table 2
Statement of Change in Program Assets

($ Thousands)

	Year Ended June 30, 2017	Year Ended June 30, 2016
Additions		
Contributions		
Participants	$ 9,364	$ 8,022
Employers	8,702	7,999
Total Contributions	18,066	16,021
Net Earnings	40,568	(727)
Total Additions	$ 58,634	$ 15,294
Deductions		
Benefit Payments		
Retirement, Death and Survivor	$ 6,007	$ 4,669
Refunds of Participant Contributions	6,495	2,376
Total Benefits	12,502	7,045
Expenses	359	273
Total Deductions	$ 12,861	$ 7,318
Net Increase (Decrease)	$ 45,773	$ 7,976
Fair Market Value of Net Assets		
Beginning of Year	$ 256,675	$ 248,699
Accounting Adjustments (GASB 68)	0	0
Net Increase (Decrease)	45,773	7,976
End of Year	$ 302,448	$ 256,675
Estimated Net Rate of Return	15.5%	(0.4)%

- Assuming uniform cash flow through the year
- Net of investment and administrative expenses

Table 3
Actuarial Balance Sheet

($ Thousands)

	June 30, 2017		June 30, 2016
	Without Additional Credits	**With Additional Credits Adopted**	
Total Requirements			
Actuarial Obligation			
Retirees and Beneficiaries	$ 7,411	$ 7,411	$ 4,974
Inactive Members	107,812	111,715	96,459
Active Members	136,901	141,857	134,405
Total Requirements	$ 252,124	$ 260,983	$ 235,838
Total Resources			
Actuarial Value of Assets	$ 302,448	$ 302,448	$ 256,675
Unfunded Actuarial Obligation or (Actuarial Surplus)	(50,324)	(41,465)	(20,837)
Total Resources	$ 252,124	$ 260,983	$ 235,838
Funded Ratio	119.96%	115.89%	108.84%

Table 4
Actuarial Gains and Losses*

($ Thousands)

	Actuarial Obligation	Actuarial Value of Assets	Unfunded Actuarial Obligation (Surplus)
Balance at June 30, 2016	$ 235,838	$ 256,675	$ (20,837)
Expected Changes			
Actual Contributions	18,066	18,066	0
Actual Benefits Paid	(12,502)	(12,502)	0
Expected Earnings / Credits	16,107	17,513	(1,406)
Expected Balance at June 30, 2017	$ 257,509	$ 279,752	$ (22,243)
Actuarial Gains or Losses			
(Gain)/Loss on Actuarial Obligation	(5,385)**		
Gain/(Loss) on Assets		22,696	
Net (Gain) or Loss			(28,081)
Actual Balance at June 30, 2017	$ 252,124	$ 302,448	$ (50,324)

** Prior to Additional Credits.*
*** Includes impact of change in assumptions.*

Table 5
Gain and Loss Reserve

($ Thousands)	**June 30, 2017**		**June 30, 2016**
	Without Additional Credits	With Additional Credits Adopted	
Unfunded Actuarial Obligation or (Actuarial Surplus) (prior to any additional earnings credits)	$ (50,324)	$ (50,324)	$ (20,837)
Additional Earnings Credit	0	8,859	0
Unfunded Actuarial Obligation or (Actuarial Surplus)	(50,324)	(41,465)	(20,837)
Gain and Loss Reserve			
Beginning of Year	$ 20,837	$ 20,837	$ 29,005
Allocated to Funding	29,487	20,628	(8,168)
End of Year Gain and Loss Reserve	50,324	41,465	20,837
Unallocated Gains and (Losses)	$ 0	$ 0	$ 0

($ Thousands) **Valuation Date**	**Available Reserves and Unallocated Gains (Losses)**	**Additional Credits Adopted**	**Final Gain and Loss Reserve**
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
June 30, 2017	50,324	8,859	41,465

Table 6
Additional Credits Based on Board Policy

	June 30, 2017	June 30, 2016
Funded Ratio before Additional Credits	119.96%	108.84%
Actuarial Surplus	19.96%	8.84%
First Threshold	13.00%	13.00%
Second Threshold	26.00%	26.00%
First Allocation		
Long-term Net Investment Return	6.50%	6.75%
Minimum Interest Rate (MIR) (year prior to valuation)	2.88	3.15
Maximum Available in First Allocation (1)	3.62%	3.60%
Actuarial Surplus	19.96%	8.84%
First Threshold (1 x Std. Deviation of Portfolio Return)	13.00	13.00
Maximum credit such that resulting Funded Ratio is not less than 100% + Std. Deviation (2)	6.35%*	0.00%
First Allocation [lesser of (1) and (2)]	**3.62%**	**0.00%**

** The result is not a simple subtraction of the Actuarial Surplus and the First Threshold, because the maximum credit is determined based on a division of the Actuarial Value of Assets and the Actuarial Obligation with the First Allocation.*

	June 30, 2017	June 30, 2016
Second Allocation		
Remaining Actuarial Surplus after First Allocation	$41,465	$20,387
Total Actuarial Obligation after First Allocation	$260,983	$235,838
Remaining Actuarial Surplus % (3)	15.89%	8.84%
Second Threshold (2 x Std. Deviation of Portfolio Return) (4)	26.00%	26.00%
Target Second Threshold Surplus [Average of (3) and (4), but not less than Second Threshold]	26.00%	26.00%
Maximum Credit to meet Target Surplus	$0	$0
Non-Retired Actuarial Obligation	$244,713	$230,864
Available for Second Allocation	**0.00%**	**0.00%**
Additional Earnings Credit based on Board Policy		
As a percentage of Actuarial Obligation (actives and inactives only) as of the valuation date	3.62%	0.00%
As a dollar amount ($ Thousands)	**$ 8,859**	**$ 0**

Table 7
History of Cash Flow

($ Thousands)

		Expenditures During the Year					Fair Market
Year End	**Contributions for the Year**	**Benefit Payments**	**Contribution Refunds**	**Expenses**	**Total**	**External Cash Flow**	**Value of Assets**
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
2017	18,066	6,007	6,495	359	12,861	5,205	302,448

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)%
2017*	302,448	260,983	(41,465)	116%	217,721	(19)%

** Results include Additional Earnings Credits adopted at the May 2018 Teachers' Retirement Board meeting.*

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)
2017**	(20,837)	(1,406)	(5,385)*	(22,696)	8,859	(41,465)

** Includes impact of changes in assumptions.*
*** Results include Additional Earnings Credits adopted at the May 2018 Teachers' Retirement Board meeting.*

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%
2017	2.75%	3.50%	6.50%

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%
2017*	100%	138.9%	119.9%

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.

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)	6.50%
B.	Interest on Member Accounts	6.50%
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 the member's account balance.

Table B.2
Mortality as of June 30, 2017

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

Select rates for disability:	Male	Female
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.

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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.

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

Table C.1
Summary of Statistical Information

	June 30, 2017	June 30, 2016
Number of Members		
Active Members[1]	10,480	10,676
Inactive Members[1]	25,115	24,017
Retirees and Beneficiaries	310	252
Total Number of Members	35,905	34,945
Active Members Statistics		
Annualized Salaries ($ millions)	$ 217.7	$ 209.2
Average Salary	$ 20,775	$ 19,595
Average Age	48.5 years	48.8 years
Average Service in CBB Program	6.3 years	6.3 years

1. Member counts as shown in CalSTRS Overview.

Table C.2
Age and Service Distribution
All Active Members

Age Group		Years	
Under 25	74	Under 1	2,045
25 – 29	632	1 – 2	1,337
30 – 34	1,260	2 – 3	1,079
35 – 39	1,337	3 – 4	869
40 – 44	1,249	4 – 5	495
45 – 49	1,271	5 – 9	1,876
50 – 54	1,181	10 and Over	2,779
55 – 59	1,112	Total	10,480
60 – 64	1,029		
65 and Over	1,335		
Total	10,480		

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
2017	25,115	107,811,000

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
2017	310	8,777,000

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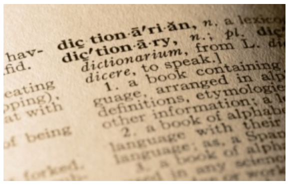
Appendix D Glossary



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, 2017.