

CalSTRS administers retirement, disability and survivor **benefits for California’s 986,414 public school educators** (from pre-kindergarten through community college) and their beneficiaries.

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November 12, 2018

Teachers' Retirement Board
California State Teachers' Retirement System

Re: Valuation of the Defined Benefit Program

Dear Members of the Board:

The basic financial goal of the Defined Benefit Program of the California State Teachers' Retirement System (CalSTRS) is to establish contributions which fully fund the obligations and which, as a percent of payroll, remain level for each generation of active members. Annual actuarial valuations measure the progress toward this goal, as well as test the adequacy of the contribution rates.

CalSTRS measures its funding status as the Funded Ratio of the actuarial value of valuation assets over the actuarial accrued liabilities. The funding status based on the past three actuarial valuations is shown below:

Valuation Date	Funded Ratio
June 30, 2015	69%
June 30, 2016	64%
June 30, 2017	63%

Based on the June 30, 2017 actuarial valuation, the scheduled income from member, employer, and State contributions is projected to finance the DB Program on an actuarially sound basis. CalSTRS is projected to reach approximately a 100% Funded Ratio in 2046.

The June 30, 2017 valuation results are based on the membership data and the asset information provided by CalSTRS. In our examination of these data, we have found them to be reasonably consistent and comparable with data used for other purposes, although we have not audited the data at the source. 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 found to be materially inaccurate or incomplete, our calculations will need to be revised.

Milliman did not prepare the summaries or schedules shown in the Financial and Actuarial Sections. However, the actuarial information contained in the Financial Section and in this Actuarial Section was derived from our June 30, 2017 actuarial valuation report for funding and our 2018 GASB 67/68 report that communicated the actuarial results for financial reporting for June 30, 2018.

The actuarial computations presented in the valuation report are for purposes of determining the recommended funding amounts for CalSTRS consistent with our understanding of their funding requirements and goals. The liabilities are determined by using the entry age normal funding method. The actuarial assets are determined by using a one-third smoothed recognition method of the difference between the actual market value to the expected actuarial value.



The valuation is based on our understanding of the current benefit provisions of the DB Program and the actuarial assumptions adopted by the Board. The assumptions are reviewed annually for reasonableness, with a detailed experience analysis completed every four or five years. The last detailed experience analysis was completed in February of 2017 when the Board adopted the current assumptions. The assumptions are scheduled to be reviewed in detail again for use in the June 30, 2019 funding valuation and the GASB 67/68 valuation for reporting date June 30, 2020. The assumptions and methods used for financial reporting under GASB 67/68 are the same as the funding valuation assumptions with the following exceptions:

1. The discount rate of 7.10% is gross of administrative expenses; and
2. The market value of assets is used for the Fiduciary Net Position.

For financial reporting purposes, all programs within the State Teachers' Retirement Plan are reported in aggregate.

We believe the actuarial assumptions and methods are internally consistent, reasonable and meet the parameters of Governmental Accounting Standards Board Statement Numbers 67, 68 and 82 for fulfilling financial reporting requirements and meet the parameters set forth in the relevant Actuarial Standards of Practice (ASOPs). Nevertheless, the emerging costs will vary from those presented in our report to the extent that actual experience differs from that projected by the actuarial assumptions. Future actuarial measurements may differ significantly from the current measurements as presented in the valuation report due to many factors. Due to the limited scope of our assignment, we did not perform an analysis of the potential range of future measurements.

Our valuation report and this letter have been prepared exclusively for CalSTRS for a specific and limited purpose. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. It is a complex, technical analysis that assumes a high level of knowledge concerning CalSTRS operations, and uses CalSTRS data, which Milliman has not audited. 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 these assignments 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.

We certify that the June 30, 2017 valuation was performed in accordance with the Actuarial Standards Board (ASB) standards of practice and by qualified actuaries. We are members of the American Academy of Actuaries and have experience in performing valuations for public retirement systems.

Respectfully submitted,

Handwritten signature of Mark C. Olleman in black ink.

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

Handwritten signature of Nick J. Collier in black ink.

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

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DEFINED BENEFIT (DB) PROGRAM AND SCHEDULES

Actuarial Methods

CalSTRS administers the Defined Benefit (DB) Program, a cost-sharing multiple employer program. In order to value and fund the DB Program, CalSTRS has adopted actuarial methods with the objective of funding the program in a manner which minimizes year-to-year variation in cost while ensuring sufficient assets are accumulated over each member's working career. The following is a summary of the various methods used.

Actuarial Cost Method

For funding purposes, the entry age normal cost method was selected for the DB Program, which is the most common cost method among public sector pension plans. The advantage of using this method is that the cost over time tends to remain fairly level as a percentage of overall payroll. This is well-suited to most public systems, which benefit from a stable contribution rate for budgeting and planning purposes. The actuarial cost method was reviewed and re-adopted by the Teachers' Retirement Board as part of the experience study review.

Asset Smoothing Method

The asset smoothing method, as adopted by the board, projects an Expected Value of Assets using the assumed rate of investment return, then one-third of the difference between the Expected Value and the Market Value is recognized in the Actuarial Value of Assets.

Funding Method

The system receives contributions from members, employers and the state. In 2014, the California legislature and the Governor enacted the CalSTRS funding plan, a joint commitment set forth in statute with the goal of achieving full funding of the system by 2046. Actuarial gains and losses and the unfunded actuarial obligation are amortized over a closed period ending June 30, 2046.

Member Contributions: For members covered by the 2% at 60 benefit formula the contribution rate is 10.25 percent of creditable compensation. For members covered by the 2% at 62 benefit formula, the contribution rate is equal to one-half of the Normal Cost rate determined in the valuation rounded to the nearest quarter percent, plus a supplemental amount. The contribution rate for 2% at 62 members only changes when the Normal Cost rate changes by more than 1 percent of pay as compared to the initial Normal Cost rate (or at the time of the last adjustment). For fiscal year ended

June 30, 2018, the member contribution rate was equal to 9.205 percent of creditable compensation.

Employer Contributions: Employers pay a base contribution rate of 8.25 percent of creditable compensation. Additionally, employers contribute a supplemental contribution rate for the purpose of amortizing the employers' share of the unfunded actuarial obligation by the fixed date of June 30, 2046. Currently the supplemental contributions follow a fixed schedule set in statute. The total employer contribution rate is set to increase to 19.1 percent of creditable compensation by the 2020–21 fiscal year. Effective with the 2021–22 fiscal year, the board will have limited authority to adjust the contribution rate to amortize the remaining unfunded actuarial obligation by the 2046 deadline. For fiscal year ended June 30, 2018, the total employer contribution rate was equal to 14.43 percent of creditable compensation.

State Contributions: The state contributes a base contribution rate of 2.017 percent of creditable compensation. Additionally, the state contributes a supplemental contribution rate for the purpose of amortizing the state's share of the unfunded actuarial obligation by the fixed date of June 30, 2046. The board currently has limited authority to adjust the state contribution rate to amortize the unfunded actuarial obligation by the 2046 deadline. For fiscal year ended June 30, 2018, the total state contribution rate was equal to 6.828 percent of creditable compensation.

The state contributes on the creditable compensation of the fiscal year ending in the immediately preceding calendar year upon which members' contributions are based, calculated annually on October 1 and updated on or before the subsequent April 15 and paid in four equal quarterly payments.

The state contributes an additional 2.5 percent of members' creditable earnings to protect retirees' purchasing power.

Financial Reporting Method

Under GASB 67, financial reporting for the State Teachers' Retirement Plan includes the Defined Benefit, Defined Benefit Supplement, Cash Balance Benefit, Supplemental Benefit Maintenance Account and Teachers' Replacement Benefits programs. For financial reporting, the aggregate assets of all programs in the State Teachers' Retirement Plan on a market basis are used in the determination of the Net Pension Liability.

DEFINED BENEFIT (DB) PROGRAM AND SCHEDULES

Actuarial Assumptions

The actuarial valuation utilizes two different types of assumptions: economic and demographic. Economic assumptions are related to the general economy and its impact on CalSTRS. Demographic assumptions predict the future experience of the membership with respect to eligibility and benefits and are directly related to the specific experience of CalSTRS members.

CalSTRS, through its consulting actuary, performs an experience study generally every four years to determine appropriate demographic and economic assumptions. These assumptions are then applied when the consulting actuary performs an actuarial valuation to monitor the funding status of the DB Program. The most recent experience study examined data for the five year period spanning July 1, 2010, through June 30, 2015, and was adopted by the board in February 2017.

Below is a summary of the different types of assumptions used.

Economic Assumptions

The two major economic assumptions are investment return and wage growth, and each is affected by the underlying assumed rate of inflation. The assumption for investment return, also known as the discount rate, is 7.00 percent, net of investment and administrative expenses. The assumption for general wage increase is 3.50 percent, of which 2.75 percent is due to inflation and 0.75 percent is due to expected gain in productivity.

As required by GASB 67, for financial reporting the discount rate is net of investment expenses but gross of administrative expenses, equivalent to 7.10%.

Table 6 provides a summary of the economic actuarial assumptions for this program as reflected in the most recent actuarial valuation.

Demographic Assumptions

Demographic assumptions are based upon the most recent CalSTRS experience study and include assumptions for postretirement mortality; probabilities of retirement, disability or withdrawal from the system; assumptions for pay increases due to promotions; and various other assumptions needed to value the benefits.

Tables 1–5 and 7–8 provide a summary of the demographic assumption information for this program as reflected in the most recent actuarial valuation.

Changes Since Prior Valuation

Changes in Actuarial Methods

There were no changes in the actuarial methods for the Defined Benefit Program.

Changes in Actuarial Assumptions

On February 1, 2017, the board lowered the discount rate from 7.50 percent to 7.00 percent using a phased in approach. The June 30, 2016, actuarial valuation used a discount rate of 7.25 percent. For the June 30, 2017, actuarial valuation the discount rate was reduced to 7.00 percent.

Changes in Plan Provisions

There were no changes in plan provisions reflected in the June 30, 2017, actuarial valuation. Note that after the June 30, 2017, valuation was completed, the board increased the lump-sum death benefit payment by 3.4 percent. This change was deemed immaterial for financial reporting purposes and is not reflected in any of the actuarial calculations.

Valuation Results

The most recent actuarial valuation was completed as of June 30, 2017. This valuation determined there is an unfunded actuarial obligation for this program. The valuation projected the program will reach approximately 100 percent funding by 2046 as contributions increase according with the funding plan.

Tables 10–14 provide summaries of the valuation results. The data displayed in Table 10 is as of June 30 of the specified year. Other information, specifically annual payroll amounts, reported in the Financial Section of this report will generally not be consistent with this data as the financial data reflects payroll for all individuals who were active during the year, while Table 10 only includes those individuals who are active as of June 30. It does not include those individuals who were active at some point during the year but not as of June 30.

In addition, amounts provided in Table 11 represent the status of the population as of June 30 of the indicated year. The information provided in the “Removed from Rolls” and “Rolls End of Year” columns include the application of the annual postretirement 2 percent non-compounded benefit adjustment.

DEFINED BENEFIT (DB) PROGRAM AND SCHEDULES

The data provided for each year in Table 11 is a snapshot of the population taken following year-end closing for the indicated period. It is likely adjustments will be made subsequent to this closing. No attempt is made to update the data in Table 11 for these adjustments.

With one exception, actuarial valuations have been performed every year since June 30, 1997, to analyze the sufficiency of the statutory contributions to meet the current and future obligations of the program. By using the actuarial methods and assumptions adopted by the board, the actuarial valuation provides the best estimate of the program's long-term financing.

Comparing the unfunded actuarial obligation as of two valuation dates does not provide enough information to determine if there were actuarial gains or losses. The correct comparison is between the unfunded actuarial obligation on the valuation date and the expected unfunded actuarial obligation projected from the prior valuation date using the actuarial assumptions in effect for the period of comparison.

Actuarial gains reduce the unfunded actuarial obligation as of the valuation date, and actuarial losses increase the unfunded actuarial obligation. Most actuarial gains and losses are a result of short-term fluctuations in experience or changes in actuarial assumptions. Because of the long-term nature of actuarial assumptions, future patterns of emerging experience may offset these short-term fluctuations.

Independent Actuarial Review

Actuarial services for CalSTRS are provided under contract by a qualified independent actuarial firm, with additional review provided by CalSTRS actuarial staff. The current actuarial firm, Milliman, has been the program's actuarial firm since January 15, 2000.

In addition to the review performed by CalSTRS actuarial staff, all independent actuarial services are subject to a periodic independent review. The selection of the firm performing the independent review is done generally every five years through the competitive bid process.

A review of the 2016 Actuarial Experience Study of the DB Program was performed by the actuarial firm Cheiron. The result of the review was reported to the board on February 1, 2017. Cheiron found the recommendations made by Milliman

in the 2016 Actuarial Experience Study to be reasonable, and the work performed by Milliman on the experience study meets the Actuarial Standards of Practice.

A review of the 2015 Actuarial Valuation of the DB Program was performed by the actuarial firm Segal Consulting. The result of the review was reported to the board on April 6, 2017. Overall Segal found that the results of the June 30, 2015, DB Actuarial Valuation were reasonable and accurate. Segal was able to match the valuation results and the individual sample test lives within an acceptable range and found the economic assumptions and cost method used were appropriate. Segal stated that Milliman adhered to reasonable quality control procedures and the valuation was performed in accordance with the principles and practices of the California Actuarial Advisory Panel, the Public Plan Committee of the Conference of Consulting Actuaries, the Actuarial Standards Board, the American Academy of Actuaries, the Society of Actuaries and the Joint Board for the Enrollment of Actuaries.

Summary of Defined Benefit Program Provisions

The provisions used in the June 30, 2017 valuation of the DB program are summarized below.

Normal Retirement

Eligibility Requirement

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

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

Benefit

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

Benefit Factors

Credited Service—For each year of membership, credited service is granted based on the ratio of creditable compensation earned to compensation earnable. No more than one full year of service credit is allowed during any school year; however, the contributions for any service in excess of one year are deposited to the member and employer contribution accounts within the DBS Program.

DEFINED BENEFIT (DB) PROGRAM AND SCHEDULES

Contributions received for DBS compensation that are attributable to increases under AB 1469 will be returned to school district employers. School district employers return excess member contributions to their employees, and the returned pre-tax contributions will be considered taxable income in the year they are received by the employee.

Final Compensation—CalSTRS 2% at 60 Members: Highest average annual compensation earnable for 36 consecutive months of credited service. For members with 25 years of service, the calculation is based on the highest average annual compensation earnable for 12 consecutive months.

CalSTRS 2% at 62 Members: Final compensation is based on the highest average annual compensation earnable for 36 consecutive months. Compensation is limited to 120 percent of the Social Security wage base in effect January 1, 2013, adjusted each fiscal year based on the changes in the Consumer Price Index for All Urban Consumers: U.S. City Average.

IRC Section 401(a)(17)—Compensation is limited under IRC section 401(a)(17) and assumed to increase at the rate of inflation.

Sick Leave Service Credit—Credited service is granted for unused sick leave at the time of retirement. Up to 0.2 years of credited service for sick leave may be used for eligibility for one-year final compensation or to attain the career factor or the longevity bonus for eligible members.

Career Factor—If a CalSTRS 2% at 60 member has 30 years of credited service, the age factor is increased by 0.2 percent. However, the maximum age factor is 2.4 percent. The career factor does not apply to CalSTRS 2% at 62 members.

Longevity Bonus—For CalSTRS 2% at 60 members attaining 30 years of service by January 1, 2011, a longevity bonus of \$200 per month is added to the Member-Only Benefit. The bonus is increased to \$300 per month with 31 years of service and \$400 per month with 32 or more years of service. The longevity bonus does not apply to CalSTRS 2% at 62 members.

Postretirement Benefit Adjustment

Benefit Improvement Factor—Two percent simple increase on September 1 following the first anniversary of the effective date of the benefit, applied to all continuing benefits.

IRC Section 415(b)—For CalSTRS 2% at 60 members, benefits are subject to limits imposed under IRC section 415(b). However, no limits are imposed in the valuation of the DB Program in order to address the potential pay-as-you-go funding needs of the Teachers' Replacement Benefits Program Fund. CalSTRS 2% at 62 members will not receive any benefits in excess of the federal limit.

Early Retirement

Eligibility Requirement—CalSTRS 2% at 60 Members: Age 55 with five years of credited service, or age 50 with 30 years of credited service.

CalSTRS 2% at 62 Members: Age 55 with five years of credited service.

Benefit Reduction—CalSTRS 2% at 60 Members: A 0.5 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 0.25 percent for each full month or partial month the member is younger than age 55.

CalSTRS 2% at 62 Members: A 0.5 percent reduction in the normal retirement allowance for each full month or partial month the member is younger than age 62.

Late Retirement

Benefit—CalSTRS 2% at 60 Members: For members who continue to earn additional service credit after age 60. The 2 percent age factor increases by 0.033 percent for each quarter year of age that the member is over age 60, up to a maximum of 2.4 percent.

CalSTRS 2% at 62 Members: For members who continue to earn additional service credit after age 62, the 2 percent age factor increases by 0.033 percent for each quarter year of age that the member is over age 62, up to a maximum of 2.4 percent.

Deferred Retirement

Benefit—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.

DEFINED BENEFIT (DB) PROGRAM AND SCHEDULES

Disability Allowance—Coverage A

Eligibility Requirement—Member has five years of credited California service and has not attained age 60, or if a member has earned one year of creditable service and is disabled due to an unlawful act of bodily harm committed by another person while performing creditable service.

Benefit—Fifty percent of final compensation.

- or -

Five percent of final compensation for each year of service credit if over age 45 with fewer than 10 years of service credit.

Children's Benefit—Ten percent for each eligible dependent child, up to a maximum of 40 percent of final compensation. The increment for each eligible child continues until the child marries or attains age 22.

Offsets—Benefit, 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

Eligibility Requirement—Member has five years of credited California service, or if a member has earned one year of creditable service and is disabled due to an unlawful act of bodily harm committed by another person while performing creditable service.

Benefit—Fifty percent of final compensation, regardless of age and service credit.

Children's Benefit—Ten percent for each eligible child up to four children, for a maximum of 40 percent 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 benefit is reduced by disability benefits payable under workers' compensation.

Death Before Retirement—Coverage A

Eligibility Requirement—One or more years of service credit for active members or members receiving a disability benefit.

Lump-Sum Payment—The one-time death benefit recipient receives a \$6,163 lump-sum payment.

Benefit—The surviving spouse or registered domestic partner with eligible children will receive a family benefit of 40 percent of final compensation for as long as there is at least one eligible child. An additional 10 percent of final compensation is payable for each eligible child up to a maximum benefit of 90 percent.

If there is no surviving spouse or registered domestic partner, a benefit of 10 percent of final compensation is payable to eligible children up to a maximum benefit of 50 percent.

When there are no eligible children, the spouse or registered domestic partner may elect to receive one-half of a 50 percent joint and survivor benefit projected to age 60 or take a lump-sum payment of the remaining contributions and interest.

Death Before Retirement—Coverage B

Eligibility—One or more years of service credit for active members.

Lump-Sum Payment—The one-time death benefit recipient receives a \$24,652 lump-sum payment.

Benefit—A lump-sum payment of the contributions and interest.

- or -

One-half of a 50 percent joint and survivor benefit, beginning on the member's 60th birthday or immediately with a reduction based on the member's age and that of the spouse or registered domestic partner at the time the benefit begins.

If the surviving spouse or registered domestic partner elects a monthly benefit, or there is no surviving spouse, each eligible child would receive 10 percent of the member's final compensation, with a maximum benefit of 50 percent.

Death After Retirement

Lump-Sum Payment—The one-time death benefit recipient receives a \$6,163 lump-sum payment.

Members of retirement age may make a preretirement election of an option to designate a beneficiary.

Annuity Form—If the retired member had elected one of the joint and survivor options, the retirement benefit would be reduced in accordance with the option elected.

DEFINED BENEFIT (DB) PROGRAM AND SCHEDULES

If no option had been elected, payment of the unpaid contributions and interest, if any, remaining in the member's account will be made to the beneficiary, if one is named, or to the deceased member's estate.

Termination From CalSTRS

Refund—Refund of the member's 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 program.

Re-entry After Refund—Former members who re-enter the program 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 program benefits.

DEFINED BENEFIT (DB) PROGRAM AND SCHEDULES

All demographic assumptions used in the funding actuarial valuation were adopted by the board when the experience study was adopted on February 1, 2017. Following are the assumptions adopted by the board for this program.

Table 1 Postretirement Mortality for Sample Ages

Age	Male	Female
	2017 CalSTRS Retired Male	2017 CalSTRS Retired Female
50	0.240%	0.133%
55	0.354	0.211
60	0.474	0.280
65	0.674	0.422
70	1.079	0.696
75	1.936	1.280
80	3.553	2.455
85	6.831	4.896
90	13.161	9.948
95	22.456	18.616

Table 2 Probabilities of Retirement for Sample Ages¹

Age	1990 Benefits	2% at 60 Members		2% at 62 Members	
		Under 30 years	30 or More Years	All Years	All Years
Male 55	5.8%	2.7%	6.0%	3.0%	
60	25.0	6.3	25.0	9.0	
65	20.0	14.0	32.5	30.0	
70	100.0	12.0	25.0	20.0	
75	100.0	100.0	100.0	100.0	
Female 55	7.0%	3.5%	8.0%	4.0%	
60	22.0	7.0	29.0	9.0	
65	18.0	17.0	37.5	30.0	
70	100.0	14.0	30.0	20.0	
75	100.0	100.0	100.0	100.0	

¹Probabilities of retirement are adjusted for members with service between 25 and 30 years.

Table 3 Probabilities of Withdrawal from Active Service Before Age and Service Retirement for Sample Duration in Years

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

Table 4 Probabilities of Refund by Sample Duration in Years of Members and Sample Entry Ages

Duration	Entry Ages				
	Under 25	25-29	30-34	35-39	40+
Male					
Under 5	100%	100%	100%	100%	100%
5	60	60	60	56	45
10	46	46	38	36	36
15	38	38	31	21	—
20	31	31	15	—	—
25	15	15	—	—	—
Duration	Under 25	25-29	30-34	35-39	40+
Female					
Under 5	100%	100%	100%	100%	100%
5	60	60	60	52	35
10	34	34	32	32	29
15	27	24	24	24	—
20	19	14	14	—	—
25	10	10	—	—	—

DEFINED BENEFIT (DB) PROGRAM AND SCHEDULES

Table 5 Assumption for Pay Increases Due to Promotions and Longevity for Sample Ages in Years
(Exclusive of the assumed general wage increase, which includes inflation)

Duration	Entry Ages					
	Under 25	25–29	30–34	35–39	40–44	45+
1	6.4%	5.8%	5.3%	4.8%	4.5%	3.7%
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
20	1.3	1.2	1.2	0.8	0.8	0.6
30	0.9	0.8	0.7	0.5	—	—
40	0.8	0.7	—	—	—	—

Table 6 Economic Assumptions

Consumer Price Inflation	2.75%
Investment Yield (Net of Expenses)	7.00
Wage Inflation	3.50
Interest on Member Accounts	3.00

Table 7 Mortality Assumptions

Retired Members ¹	
Male	2016 CalSTRS Retired Male
Female	2016 CalSTRS Retired Female
Active Members	
Male	RP-2014 White Collar Employee Male set back 2 years
Female	RP-2014 White Collar Employee Female set back 2 years
Beneficiaries ¹	
Male	2016 CalSTRS Retired Male
Female	2016 CalSTRS Retired Female
Disabled ¹⁻²	
Male	RP-2014 Disabled Retiree Male set back 2 years
Female	RP-2014 Disabled Retiree Female set back 2 years

¹For future years, the projected improvement is based on 110% of the MP-2016 Ultimate Projection Scale.

²Select rates in first three years for both Males and Females.

DEFINED BENEFIT (DB) PROGRAM AND SCHEDULES

Table 8 Disability Rates for Sample Ages

Coverage A			Coverage B		
Male	25	0.018%	Male	25	0.010%
	30	0.027		30	0.020
	35	0.045		35	0.030
	40	0.072		40	0.060
	45	0.099		45	0.100
	50	0.144		50	0.140
Female	55	0.189	55	0.245	
	25	0.018%	60	0.365	
	30	0.027	65	0.400	
	35	0.054	70	0.400	
	40	0.081	Female	25	0.020%
	45	0.099	30	0.020	
	50	0.198	35	0.040	
	55	0.252	40	0.070	
			45	0.110	
			50	0.185	
		55	0.300		
		60	0.380		
		65	0.400		
		70	0.400		

Table 9 Supplemental Assumptions

PEPRA Coverage	All members hired on or after the valuation date are assumed to be subject to the provisions of PEPRA.	
Unused Sick Leave	Credited Service is increased by 1.8%.	
Optional Forms	Active and Inactive: Based on single life annuity assumed. Retirees and Beneficiaries: Based on optional form in data.	
Probability of Marriage	Male: 85% Male spouses are assumed to be three years older than female spouses.	Female: 65%
Number of Children	Married members under age 60 are assumed to have the following number of children:	
	Member's Gender	Assumed Number of Children
	Male	0.65
	Female	0.50
Assumed Offsets	There are no assumed offsets to death and disability benefits under Coverage A or Coverage B.	

DEFINED BENEFIT (DB) PROGRAM AND SCHEDULES

Table 10 Schedule of Active Member Valuation Data

Active Members					
Valuation Date (as of June 30) ¹	Number of Participating Employers ²	Number	Annual Payroll	Annual Average Pay	% Increase In Average Pay
2008	1,428	461,378	\$27,118,230,762	\$58,777	3.4%
2009	1,472	459,009	27,327,386,616	59,536	1.3
2010	1,514	441,544	26,274,889,981	59,507	—
2011	1,587	429,600	25,576,008,636	59,534	—
2012	1,660	421,499	25,388,209,920	60,233	1.2
2013	1,670	416,643	25,479,056,693	61,153	1.5
2014	1,690	420,887	26,469,883,008	62,891	2.8
2015	1,724	429,460	28,013,191,853	65,229	3.7
2016	1,739	438,537	29,826,149,337	68,013	4.3
2017	1,746	445,935	31,136,104,704	69,822	2.7

¹ Actuarial valuation results as of June 30, 2018, are expected to be available by May 2019.

² Number of employers is based on employers who submit the last contribution line for the active member in each respective fiscal year; however, the number of employers in the Financial Section is based on contributing employers as of the end of the respective fiscal year.

Table 11 Schedule of Retired Members and Beneficiaries Added to and Removed from Rolls¹

Date (as of June 30)	Added to Rolls		Removed from Rolls		Rolls – End of Year			
	Number	Annual Allowances ²	Number	Annual Allowances ²	Number	Annual Allowances ²	% Increase in Annual Allowances	Average Annual Allowances
2009	13,420	\$657,984	6,163	\$149,998	228,969	\$8,340,671	8.2%	\$36,427
2010	16,201	777,293	6,499	165,404	243,796	9,171,309	10.0	37,619
2011	14,559	671,868	6,938	181,927	253,041	9,802,995	6.9	38,741
2012	14,316	635,935	6,860	187,271	262,039	10,458,555	6.7	39,912
2013	12,377	555,751	7,119	205,779	269,429	11,091,944	6.1	41,168
2014	11,383	507,801	7,299	221,733	275,627	11,624,220	4.8	42,174
2015	11,952	558,655	7,759	247,766	282,100	12,197,828	4.9	43,239
2016	12,014	591,902	7,871	262,170	288,195	12,792,104	4.9	44,387
2017	12,823	649,503	8,381	289,955	294,874	13,439,239	5.1	45,576
2018	13,340	682,533	8,606	300,558	301,859	14,114,787	5.0	46,760

¹ Each year's data population is a snapshot taken following year-end closings; subsequent adjustments made to snapshots of data prior to the current period are not reflected in the table.

² Dollars in thousands.

DEFINED BENEFIT (DB) PROGRAM AND SCHEDULES

Table 12 Solvency Test
(Dollars in Millions)

Valuation Date (as of June 30) ¹	Aggregate Accrued Liabilities for				Funding of Liabilities		
	(1) Active Member Contributions on Deposit	(2) Future Benefits to Benefit Recipients	(3) Service Already Rendered by Active Members (Financed by Employer)	Actuarial Value of Assets	(1)	(2)	(3)
2008	\$26,881	\$81,984	\$68,869	\$155,215	100.0%	100.0%	67.3%
2009	27,477	88,927	69,279	145,142	100.0	100.0	41.5
2010	27,105	99,135	70,075	140,291	100.0	100.0	20.1
2011	27,038	109,984	71,383	143,930	100.0	100.0	9.7
2012	27,245	116,475	71,469	144,232	100.0	100.0	0.7
2013	27,683	121,714	72,884	148,614	100.0	99.4	—
2014	28,290	126,235	76,688	158,495	100.0	100.0	5.2
2015	28,935	131,451	81,367	165,553	100.0	100.0	6.4
2016	30,046	145,108	91,550	169,976	100.0	96.4	—
2017	31,523	154,618	100,809	179,689	100.0	95.8	—

¹ Actuarial valuation results as of June 30, 2018, are expected to be available by May 2019.

Table 13 Analysis of Financial Experience
(Gains and losses in unfunded actuarial obligation resulting from differences between assumed and actual experience)
(Dollars in Millions)

	Actuarial Valuation as of June 30 ¹	
	2017	2016
Actuarial Obligation at June 30	\$266,704	\$241,753
Normal Cost	6,312	5,463
Benefit Payments	(13,314)	(12,608)
Expected Interest	19,319	17,869
Expected Actuarial Obligation at June 30	279,021	252,477
Expected Actuarial Value of Assets at June 30	177,767	172,251
Expected Unfunded Actuarial Obligation at June 30	101,254	80,226
Actuarial (Gains) / Losses		
Change in Assumptions	8,706	13,227
Investment Return Assumptions	(1,709)	2,590
Demographic Assumptions	(777)	1,000
Net Change Other Sources	(213)	(315)
Total Actuarial (Gains) / Losses	6,007	16,502
Unfunded Actuarial Obligation at June 30	\$107,261	\$96,728
Funded Ratio	63%	64%

¹ Actuarial valuation results as of June 30, 2018, are expected to be available by May 2019.

DEFINED BENEFIT (DB) PROGRAM AND SCHEDULES

Table 14 Schedule of Funding Progress
(Dollars in Millions)

Actuarial Valuation Date as of June 30 ¹	Actuarial Value of Assets (a)	Actuarial Accrued Liability (AAL) (b)	Unfunded AAL (Funding Excess) (UAAL) (b-a)	Funded Ratio (a/b)	Covered Payroll (c)	UAAL as a % of Covered Payroll ((b-a)/c)
2008	\$155,215	\$177,734	\$22,519	87%	\$27,118	83%
2009	145,142	185,683	40,541	78	27,327	148
2010	140,291	196,315	56,024	71	26,275	213
2011	143,930	208,405	64,475	69	26,592	242
2012	144,232	215,189	70,957	67	26,404	269
2013	148,614	222,281	73,667	67	26,483	278
2014	158,495	231,213	72,718	69	26,398	275
2015	165,553	241,753	76,200	69	28,640	266
2016	169,976	266,704	96,728	64	30,324	319
2017	179,689	286,950	107,261	63	31,961	336

¹ Actuarial valuation results as of June 30, 2018, are expected to be available by May 2019.

Note: Information of actuarially determined and actual contributions for the State Teachers' Retirement Plan is provided in the Financial Section, Schedule III, Contributions of Employer and Nonemployer Contributing Entity table.

ACTUARY'S CERTIFICATION LETTER—DBS PROGRAM



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November 12, 2018

Teachers' Retirement Board
California State Teachers' Retirement System

Re: Valuation of the Defined Benefit Supplement Program

Dear Members of the Board:

The basic financial goal of the Defined Benefit Supplement (DBS) Program of the California State Teachers' Retirement System (CalSTRS) is to maintain sufficient resources to fully fund the obligations. Annual actuarial valuations measure the progress toward this goal, as well as test the adequacy of the contribution rates.

CalSTRS measures its funding status as the Funded Ratio of the actuarial value of valuation assets over the actuarial accrued liabilities. The funding status based on the past three actuarial valuations is shown below:

Valuation Date	Funded Ratio
June 30, 2015	115%
June 30, 2016	112%
June 30, 2017	118%

The actual return was greater than the assumed return for the fiscal year ended in 2017 which, combined with other factors, caused an increase in the Funded Ratio. As of June 30, 2017, the Market Value of Assets for the DBS Program exceeds the Actuarial Obligation. Additional interest credits were granted based on the Program's funded level and are reflected in the Funded Ratio shown above. Prior to the additional credits, the Funded Ratio was 122%.

The June 30, 2017 valuation results are based on the membership data and the asset information provided by CalSTRS. In our examination of these data, we have found them to be reasonably consistent and comparable with data used for other purposes, although we have not audited the data at the source. 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 found to be materially inaccurate or incomplete, our calculations will need to be revised.

Milliman did not prepare the summaries or schedules shown in the Financial and Actuarial Sections. However, the actuarial information contained in the Financial Section and in this Actuarial Section was derived from our June 30, 2017 actuarial valuation report for funding and our 2018 GASB 67/68 report that communicated the actuarial results for financial reporting for June 30, 2018.

The actuarial computations presented in the valuation report are for purposes of determining the recommended funding amounts for CalSTRS consistent with our understanding of their funding requirements and goals. The liabilities are determined by using the traditional unit credit funding method. The actuarial assets are equal to fair market value.



The funding valuation is based on our understanding of the current benefit provisions of the DBS Program and the actuarial assumptions adopted by the Board. The assumptions are reviewed annually for reasonableness, with a detailed experience analysis completed every four or five years. The last detailed experience analysis was completed in February of 2017 when the Board adopted the current assumptions. The assumptions are scheduled to be reviewed in detail again for use in the June 30, 2019 funding valuation and the GASB 67/68 valuation for reporting date June 30, 2020. The assumptions and methods used for financial reporting under GASB 67/68 are the same as the funding valuation assumptions with the following exceptions:

1. The discount rate of 7.10% is gross of administrative expenses; and
2. The individual entry age normal cost method is used.

For financial reporting purposes, all programs within the State Teachers' Retirement Plan are reported in aggregate.

We believe the actuarial assumptions and methods are internally consistent, reasonable and meet the parameters of Governmental Accounting Standards Board Statement Numbers 67, 68 and 82 for fulfilling financial accounting requirements and meet the parameters set forth in the relevant Actuarial Standards of Practice (ASOPs). Nevertheless, the emerging costs will vary from those presented in our report to the extent that actual experience differs from that projected by the actuarial assumptions. Future actuarial measurements may differ significantly from the current measurements as presented in the valuation report due to many factors. Due to the limited scope of our assignment, we did not perform an analysis of the potential range of future measurements.

Our valuation report and this letter have been prepared exclusively for CalSTRS for a specific and limited purpose. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. It is a complex, technical analysis that assumes a high level of knowledge concerning CalSTRS operations, and uses CalSTRS data, which Milliman has not audited. 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 these assignments 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.

We certify that the June 30, 2017 valuation was performed in accordance with the Actuarial Standards Board (ASB) standards of practice and by qualified actuaries. We are members of the American Academy of Actuaries and have experience in performing valuations for public retirement systems.

Respectfully submitted,

Mark Olleman, FSA, EA, MAAA
Principal and Consulting Actuary

Nick Collier, ASA, EA, MAAA
Principal and Consulting Actuary

Julie Smith, FSA, EA, MAAA
Valuation Actuary

DEFINED BENEFIT SUPPLEMENT (DBS) PROGRAM AND SCHEDULES

Actuarial Methods

The Defined Benefit Supplement (DBS) Program was established January 1, 2001. In order to value and fund the DBS Program, CalSTRS has adopted the following actuarial methods.

Actuarial Cost Method

For funding purposes, the traditional unit credit cost method was selected for the Defined Benefit Supplement Program since the projected benefits of each individual member are allocated by a consistent formula to valuation years. As a result, the actuarial obligation for non-retired members is equal to the accumulated account balances, and the normal cost is equal to the total annual contribution. The DBS Program does not provide cost-of-living adjustments for benefit recipients.

Asset Valuation Method

The Defined Benefit Supplement Program uses the fair market value of assets for actuarial valuation purposes. Asset smoothing is not used for this program.

Funding Method

Member and employer contributions are credited to the member's DBS account for service greater than one year during a single school year, and for CalSTRS 2% at 60 members, compensation for limited-term payments and retirement incentives are credited.

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 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.

Financial Reporting Method

Under GASB 67, financial reporting for the State Teachers' Retirement Plan includes the Defined Benefit, Defined Benefit Supplement, Cash Balance Benefit, Supplemental Benefit Maintenance Account and Teachers' Replacement Benefits programs. For financial reporting, the aggregate assets of all programs in the State Teachers' Retirement Plan on a market basis are used in the determination of the Net Pension Liability.

GASB 67 also specifies that, for financial reporting purposes, the entry age normal cost method should be used to calculate pension liability.

Actuarial Assumptions

The actuarial valuation utilizes two different types of assumptions: economic and demographic. Economic assumptions are related to the general economy and its impact on CalSTRS. Demographic assumptions predict the future experience of the membership with respect to eligibility and benefits and are directly related to the specific experience of CalSTRS members. The DB Program and the DBS Program share the same population, so it is reasonable to use most of the same assumptions for both programs.

The assumptions for this program will have minimal impact under the traditional unit credit cost method or only have significance when participants elect to annuitize the account balance. Under the program, a member must have at least \$3,500 in their account to elect to annuitize the account balance.

CalSTRS, through its consulting actuary, performs an experience study every four or five years to determine appropriate demographic and economic assumptions. These assumptions are then applied when the consulting actuary performs an actuarial valuation to monitor the funding status of the DBS Program. The most recent experience study examined data for the five year period spanning July 1, 2010, through June 30, 2015, and was adopted by the board in February 2017.

Below is a summary of the different types of assumptions used.

Economic Assumptions

The two major economic assumptions are investment return and wage growth, and each is affected by the underlying assumed rate of inflation. The assumption for investment return, also known as the discount rate, is 7.00 percent, net of investment and administrative expenses. The assumption for general wage increase is 3.50 percent, of which 2.75 percent is due to inflation and 0.75 percent is due to expected gain in productivity.

As required by GASB 67, for financial reporting the discount rate is net of investment expenses but gross of administrative expenses, equivalent to 7.10%.

Table 5 provides a summary of the economic actuarial assumptions for this program as reflected in the most recent actuarial valuation.

DEFINED BENEFIT SUPPLEMENT (DBS) PROGRAM AND SCHEDULES

Demographic Assumptions

Demographic assumptions are based upon the most recent CalSTRS experience study and include assumptions for postretirement mortality, probabilities of retirement, disability or withdrawal from the system, assumptions for pay increases due to promotions and various other assumptions needed to value the benefits.

Tables 1–4 and 6–7 provide a summary of the demographic assumption information for this program as reflected in the most recent actuarial valuation.

Changes Since Prior Valuation

Changes in Actuarial Methods

There were no changes in the actuarial methods for the Defined Benefit Program.

Changes in Actuarial Assumptions

On February 1, 2017, the board lowered the discount rate from 7.50 percent to 7.00 percent using a phased in approach. The June 30, 2016, actuarial valuation used a discount rate of 7.25 percent. For the June 30, 2017, actuarial valuation the discount rate was reduced to 7.00 percent.

Changes in Plan Provisions

On May 10, 2018, the board adopted a 4.12 percent additional earnings credit for the fiscal year ending June 30, 2017.

Valuation Results

The most recent actuarial valuation was completed as of June 30, 2017. This valuation determined there was an actuarial surplus of \$2,224,206,000 before the awarding of any additional earnings credit. The valuation was presented to the board on May 10, 2018, at which time the board adopted an additional earnings credit of 4.12 percent for the fiscal year ending June 30, 2017. After awarding the additional earnings credit, the actuarial surplus was reduced to \$1,867,280,000.

Tables 8–12 provide summaries of the valuation results.

Independent Actuarial Review

Actuarial services for CalSTRS are provided under contract by a qualified independent actuarial firm, with additional review provided by CalSTRS actuarial staff. The current

actuarial firm, Milliman, has been the program's actuarial firm since January 15, 2000.

In addition to the review performed by CalSTRS actuarial staff, all independent actuarial services are subject to a periodic independent review. The selection of the firm performing the independent review is done generally every five years through the competitive bid process.

A review of the 2016 Actuarial Experience Study was performed by the actuarial firm Cheiron. The result of the review was reported to the board on February 1, 2017. Cheiron found the recommendations made by Milliman in the 2016 Actuarial Experience Study to be reasonable, and the work performed by Milliman on the experience study meets the Actuarial Standards of Practice.

A review of the 2015 Actuarial Valuation of the DBS Program was also performed by Cheiron. The result of the review was reported to the board on April 6, 2017. Overall, Cheiron was able to replicate the results of the actuarial valuation with no material differences. Cheiron commented that the actuarial valuation was performed by qualified actuaries and in accordance with generally accepted actuarial principles. Cheiron further stated that appropriate methods, checking and reviewing procedures were followed in the preparation of the valuation and that the communication in the valuation report was clear and complete given the underlying plan of the benefits.

Summary of Defined Benefit Supplement Program Provisions

The following is a summary of the provisions used in the valuation of this program.

Membership

Eligibility Requirement—All members of the DB Program who perform creditable service and earn creditable compensation after December 31, 2000, have a DBS account.

Member—An eligible employee with creditable service subject to coverage who has contributions credited in the program or is receiving an annuity from the program.

DEFINED BENEFIT SUPPLEMENT (DBS) PROGRAM AND SCHEDULES

Account Balance

Account Balance—Nominal accounts are established for the purpose of determining DBS benefits payable to the member. Accounts are credited with contributions, interest at the minimum interest rate and, if applicable, additional earnings credits.

Contributions—Member and employer contributions are credited to the member's DBS account for service greater than one year during a single school year, and for CalSTRS 2% at 60 members, compensation for limited-term payments and retirement incentives are credited.

Minimum Interest Rate—Annual rate determined for the plan year by the board in accordance with federal laws and regulations. The minimum interest rate is equal to the average of the yields on 30-year Treasury Notes for the twelve months ending in February preceding the beginning of the plan year, rounded to the next highest basis point. The minimum interest rate is not less than the rate at which interest is credited under the DB Program.

Additional Earnings Credit—Annual rate determined for the plan year by the board based on the actual earnings during the plan year but only to the extent the earnings are sufficient to credit the minimum interest rate and provide any additions to the gain and loss reserve deemed warranted by the board. The board adopted an additional earnings credit of 4.12 percent for the fiscal year ending June 30, 2017.

Normal Retirement

Eligibility Requirement—Receipt of a corresponding benefit under the DB Program.

Benefit—The account balance at the benefit effective date subject to limits imposed under IRC section 415.

Form of Payment—The normal form of payment is a lump-sum distribution. Annuity options are available if the account balance is at least \$3,500.

Early Retirement

Eligibility Requirement—Same as Normal Retirement.

Benefit and Form of Payment—Same as Normal Retirement.

Late Retirement

Benefit and Form of Payment—Same as Normal Retirement.

Contributions and earnings may continue to be credited to the account balance.

Deferred Retirement

Benefit—A member must receive a DBS Program benefit when the corresponding benefit is received under the DB Program.

Disability Benefit

Eligibility Requirement—Receipt of a corresponding benefit under the DB Program.

Benefit—The account balance at the date the disability benefit becomes payable.

Form of Payment—Same as Normal Retirement. An annuity benefit is discontinued upon termination of the corresponding DB Program benefit.

Death Before Retirement

Eligibility Requirement—Deceased member has an account balance.

Benefit—The account balance at the date of death payable to the designated beneficiary.

Form of Payment—Similar to Normal Retirement.

Death After Retirement

Eligibility Requirement—The deceased member was receiving an annuity.

Benefit—According to the terms of the annuity elected by the member.

Termination from the Program

Eligibility Requirement—Termination of all CalSTRS-covered employment.

More than five years has elapsed since the most recent termination benefit, if any, has been paid.

Benefit and Form of Payment—Lump-sum distribution of the account balance as of the date of distribution.

DEFINED BENEFIT SUPPLEMENT (DBS) PROGRAM AND SCHEDULES

All of the assumptions used in the funding actuarial valuation were adopted by the board when the experience study was adopted on February 1, 2017. Following are the assumptions adopted by the board for this program. Tables 2, 3, 4 and 7 are used in the GASB 67 financial reporting valuation and not for the funding valuation.

Table 1 Postretirement Mortality for Sample Ages

Age	Male	Female
	2017	2017
50	0.240%	0.133%
55	0.354	0.211
60	0.474	0.280
65	0.674	0.422
70	1.079	0.696
75	1.936	1.280
80	3.553	2.455
85	6.831	4.896
90	13.161	9.948
95	22.456	18.616

Table 2 Probabilities of Retirement for Sample Ages¹

Age	1990 Benefits	2% at 60 Members		2% at 62 Members	
		Under 30 years	30 or More Years	All Years	All Years
Male	55	5.8%	2.7%	6.0%	3.0%
	60	25.0	6.3	25.0	9.0
	65	20.0	14.0	32.5	30.0
	70	100.0	12.0	25.0	20.0
	75	100.0	100.0	100.0	100.0
Female	55	7.0%	3.5%	8.0%	4.0%
	60	22.0	7.0	29.0	9.0
	65	18.0	17.0	37.5	30.0
	70	100.0	14.0	30.0	20.0
	75	100.0	100.0	100.0	100.0

Table 3 Probabilities of Withdrawal from Active Service Before Age and Service Retirement for Sample Duration in Years

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

¹ Probabilities of retirement are adjusted for members with service between 25 and 30 years.

DEFINED BENEFIT SUPPLEMENT (DBS) PROGRAM AND SCHEDULES

Table 4 Assumption for Pay Increases Due to Promotions and Longevity for Sample Ages in Years
(Exclusive of the assumed general wage increase, which includes inflation)

Duration	Entry Ages					
	Under 25	25–29	30–34	35–39	40–44	45+
1	6.4%	5.8%	5.3%	4.8%	4.5%	3.7%
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
20	1.3	1.2	1.2	0.8	0.8	0.6
30	0.9	0.8	0.7	0.5	—	—
40	0.8	0.7	—	—	—	—

Table 5 Economic Assumptions

Consumer Price Inflation	2.75%
Investment Yield (Net of Expenses)	7.00
Wage Inflation	3.50
Interest on Member Accounts	7.00

Table 6 Mortality Assumptions

Retired Members ¹	
Male	2016 CalSTRS Retired Male
Female	2016 CalSTRS Retired Female
Active Members	
Male	RP-2014 White Collar Employee Male set back 2 years
Female	RP-2014 White Collar Employee Female set back 2 years
Beneficiaries ¹	
Male	2016 CalSTRS Retired Male
Female	2016 CalSTRS Retired Female
Disabled ^{1,2}	
Male	RP-2014 Disabled Retiree Male set back 2 years
Female	RP-2014 Disabled Retiree Female set back 2 years

¹ For future years, the projected improvement is based on 110% of the MP-2016 Ultimate Projection Scale.

² Select rates in first three years for both Males and Females.

DEFINED BENEFIT SUPPLEMENT (DBS) PROGRAM AND SCHEDULES

Table 7 Disability Rates for Sample Ages

Coverage A			Coverage B		
Male	25	0.018%	Male	25	0.010%
	30	0.027		30	0.020
	35	0.045		35	0.030
	40	0.072		40	0.060
	45	0.099		45	0.100
	50	0.144		50	0.140
Female	55	0.189	55	0.245	
	25	0.018%	60	0.365	
	30	0.027	65	0.400	
	35	0.054	70	0.400	
	40	0.081	Female	25	0.020%
	45	0.099	30	0.020	
	50	0.198	35	0.040	
	55	0.252	40	0.070	
			45	0.110	
			50	0.185	
		55	0.300		
		60	0.380		
		65	0.400		
		70	0.400		

Table 8 Schedule of Active Member Valuation Data

Active Members					
Valuation Date (as of June 30) ¹	Number of Participating Employers ²	Number	Annual Payroll	Annual Average Pay	% Increase in Average Pay
2008	1,428	460,961	\$28,574,701,507	\$61,989	4.3%
2009	1,472	458,736	28,763,266,744	62,701	1.1
2010	1,514	441,326	27,340,840,174	61,952	(1.2)
2011	1,587	423,366	26,758,301,370	63,204	2.0
2012	1,660	403,117	26,556,820,635	65,879	4.2
2013	1,670	390,465	26,444,290,250	67,725	2.8
2014	1,690	386,766	27,582,572,209	71,316	5.3
2015	1,724	388,314	29,306,186,224	75,470	5.8
2016	1,739	391,636	31,253,254,759	79,802	5.7
2017	1,746	394,923	32,653,004,548	82,682	3.6

¹ Actuarial valuation results as of June 30, 2018, are expected to be available by May 2019.

² Number of employers is based on employers who submit the last contribution line for the active member in each respective fiscal year; however, the number of employers in the Financial Section is based on contributing employers as of the end of the respective fiscal year.

DEFINED BENEFIT SUPPLEMENT (DBS) PROGRAM AND SCHEDULES

Table 9 Schedule of Retired Members and Beneficiaries Added to and Removed from Annuity Rolls¹

Date (as of June 30)	Added to Rolls		Removed from Rolls		Rolls - End of Year			
	Number	Annual Allowances	Number	Annual Allowances	Number	Annual Allowances	% Increase in Annual Allowances	Average Annual Allowances
2009	6,668	\$22,090,439	1,582	\$4,948,230	23,010	\$55,237,098	48.1%	\$2,401
2010	8,796	31,707,577	1,816	6,612,662	30,048	80,571,112	45.9	2,681
2011	8,811	31,693,536	343	1,329,718	36,110	103,087,388	27.9	2,855
2012	8,257	32,650,936	2,386	11,666,909	42,055	124,148,784	20.4	2,952
2013	7,425	30,392,875	2,657	13,354,982	47,014	141,044,393	13.6	3,000
2014	6,753	27,678,797	3,115	16,285,428	50,963	153,375,082	8.7	3,010
2015	7,097	31,304,181	3,423	18,040,255	54,901	167,972,370	9.5	3,060
2016	7,324	35,828,397	3,335	17,497,131	59,075	187,434,597	11.6	3,173
2017	7,813	39,827,784	3,444	18,242,423	63,653	209,657,263	11.9	3,294
2018	7,873	40,794,850	3,535	19,256,485	68,194	231,963,834	10.6	3,402

¹ Each year's data population is a snapshot taken following year-end closings; subsequent adjustments made to snapshots of data prior to the current period are not reflected in the table.

Table 10 Solvency Test

Valuation Date (as of June 30) ¹	Aggregate Accrued Liabilities for				Funding of Liabilities		
	(1) Active Member Contributions on Deposit	(2) Future Benefits to Benefit Recipients	(3) Service Already Rendered by Active Members (Financed by Employer)	Actuarial Value of Assets	(1)	(2)	(3)
2008	\$5,434,171,000	\$193,173,000	\$ —	\$5,636,113,000	100.0%	100.0%	— %
2009	6,316,154,000	283,161,000	—	5,145,981,000	81.5	—	—
2010	7,012,291,000	444,151,000	—	6,412,180,000	91.4	—	—
2011	7,196,652,000	577,115,000	—	8,054,962,000	100.0	100.0	—
2012	7,280,977,000	710,586,000	—	8,042,090,000	100.0	100.0	—
2013	7,641,488,000	850,275,000	—	8,983,919,000	100.0	100.0	—
2014	8,077,762,000	942,945,000	—	10,493,062,000	100.0	100.0	—
2015	8,532,216,000	1,021,092,000	—	10,940,917,000	100.0	100.0	—
2016	8,604,042,000	1,200,485,000	—	10,943,296,000	100.0	100.0	—
2017	9,020,170,000	1,381,932,000	—	12,269,382,000	100.0	100.0	—

¹ Actuarial valuation results as of June 30, 2018, are expected to be available by May 2019.

DEFINED BENEFIT SUPPLEMENT (DBS) PROGRAM AND SCHEDULES

Table 11 Analysis of Financial Experience
(Gains and losses in unfunded actuarial obligation resulting from differences between assumed and actual experience)
(Dollars in Thousands)

Actuarial Valuation as of June 30 ¹		
	2017	2016
Actuarial Obligation at June 30	\$9,804,527	\$9,553,308
Expected Changes:		
Contributions	263,200	251,393
Benefits Paid	(404,737)	(352,606)
Expected Earnings/Credits	705,697	712,703
Expected Actuarial Obligation at June 30	10,368,687	10,164,798
Expected Actuarial Value of Assets at June 30	11,590,017	11,656,477
Expected Unfunded Actuarial Obligation (Surplus) at June 30	(1,221,330)	(1,491,679)
Actuarial (Gains) / Losses		
(Gain) on Actuarial Obligation	(323,511)	(360,271)
(Gain) / Loss on Assets	(679,365)	713,181
Total Actuarial (Gains) / Losses	(1,002,876)	352,910
Additional Earnings Credit	356,926	—
Unfunded Actuarial Obligation (Surplus) at June 30	(\$1,867,280)	(\$1,138,769)
Funded Ratio	118%	112%

¹ Actuarial valuation results as of June 30, 2018, are expected to be available by May 2019.

Table 12 Schedule of Funding Progress
(Dollars in Millions)

Actuarial Valuation Date as of June 30 ¹	Actuarial Value of Assets (a)	Actuarial Accrued Liability (AAL) (b)	Unfunded AAL (Funding Excess) (UAAL) (b-a)	Funded Ratio (a/b)	Covered Payroll ² (c)	UAAL as a % of Covered Payroll ((b-a)/c)
2008	\$5,636	\$5,627	(\$9)	100%	\$27,118	— %
2009	5,146	6,599	1,453	78	28,763	5
2010	6,412	7,456	1,044	86	27,340	4
2011	8,055	7,774	(281)	104	27,666	(1)
2012	8,042	7,992	(50)	101	27,407	—
2013	8,984	8,492	(492)	106	27,461	(2)
2014	10,493	9,021	(1,472)	116	27,396	(5)
2015	10,941	9,553	(1,388)	115	29,991	(5)
2016	10,943	9,805	(1,138)	112	31,894	(4)
2017	12,269	10,402	(1,867)	118	33,607	(6)

¹ Actuarial valuation results as of June 30, 2018, are expected to be available by May 2019.

² For the June 30, 2008 valuation, covered payroll excludes limited term incentive pay and extra service credit pay in order to present the payroll based most relevant to the funding of any unfunded actuarial accrued liabilities of the Defined Benefit Supplement Program.

Note: Information of actuarially determined and actual contributions for the State Teachers' Retirement Plan is provided in the Financial Section, Schedule III, Contributions of Employer and Nonemployer Contributing Entity table.

ACTUARY'S CERTIFICATION LETTER—CBB PROGRAM



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November 12, 2018

Teachers' Retirement Board
California State Teachers' Retirement System

Re: Valuation of the Cash Balance Benefit Program

Dear Members of the Board:

The basic financial goal of the Cash Balance Benefit (CBB) Program of the California State Teachers' Retirement System (CalSTRS) is to maintain sufficient resources to fully fund the obligations. Annual actuarial valuations measure the progress toward this goal, as well as test the adequacy of the contribution rates.

CalSTRS measures its funding status as the Funded Ratio of the actuarial value of valuation assets over the actuarial accrued liabilities. The funding status based on the past three actuarial valuations is shown below:

Valuation Date	Funded Ratio
June 30, 2015	113%
June 30, 2016	109%
June 30, 2017	116%

The actual return was greater than the assumed return for the fiscal year ended in 2017 which, combined with other factors, caused an increase in the Funded Ratio. As of June 30, 2017, the Market Value of Assets for the CBB Program exceeds the Actuarial Obligation. Additional interest credits were granted based on the Program's funded level and are reflected in the Funded Ratio shown above. Prior to the additional credits, the Funded Ratio was 120%.

The June 30, 2017 valuation results are based on the membership data and the asset information provided by CalSTRS. In our examination of these data, we have found them to be reasonably consistent and comparable with data used for other purposes, although we have not audited the data at the source. 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 found to be materially inaccurate or incomplete, our calculations will need to be revised.

Milliman did not prepare the summaries or schedules shown in the Financial and Actuarial Sections. However, the actuarial information contained in the Financial Section and in this Actuarial Section was derived from our June 30, 2017 actuarial valuation report for funding and our GASB 67/68 report which communicated the actuarial results for financial reporting for June 30, 2018.

The actuarial computations presented in the valuation report are for purposes of determining the recommended funding amounts for CalSTRS consistent with our understanding of their funding requirements and goals. The liabilities are determined by using the traditional unit credit funding method. The actuarial assets are equal to fair market value.



The funding valuation is based on our understanding of the current benefit provisions of the CBB Program and the actuarial assumptions adopted by the Board. The assumptions are reviewed annually for reasonableness, with a detailed experience analysis completed every four or five years. The last detailed experience analysis was completed in February of 2017 when the Board adopted the current assumptions. The assumptions are scheduled to be reviewed in detail again for use in the June 30, 2019 funding valuation and the GASB 67/68 valuation for reporting date June 30, 2020. The assumptions and methods used for financial reporting under GASB 67/68 are the same as the funding valuation assumptions with the following exceptions:

1. The discount rate of 7.10% is gross of administrative expenses; and
2. The individual entry age normal cost method is used.

For financial reporting purposes, all programs within the State Teachers' Retirement Plan are reported in aggregate.

We believe the actuarial assumptions and methods are internally consistent, reasonable and meet the parameters of Governmental Accounting Standards Board Statement Numbers 67, 68 and 82 for fulfilling financial accounting requirements and meet the parameters set forth in the relevant Actuarial Standards of Practice (ASOPs). Nevertheless, the emerging costs will vary from those presented in our report to the extent that actual experience differs from that projected by the actuarial assumptions. Future actuarial measurements may differ significantly from the current measurements as presented in the valuation report due to many factors. Due to the limited scope of our assignment, we did not perform an analysis of the potential range of future measurements.

Our valuation report and this letter have been prepared exclusively for CalSTRS for a specific and limited purpose. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. It is a complex, technical analysis that assumes a high level of knowledge concerning CalSTRS operations, and uses CalSTRS data, which Milliman has not audited. 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 these assignments 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.

We certify that the June 30, 2017 valuation was performed in accordance with the Actuarial Standards Board (ASB) standards of practice and by qualified actuaries. We are members of the American Academy of Actuaries and have experience in performing valuations for public retirement systems.

Respectfully submitted,

Mark Olleman, FSA, EA, MAAA
Principal and Consulting Actuary

Nick Collier, ASA, EA, MAAA
Principal and Consulting Actuary

Julie Smith, FSA, EA, MAAA
Valuation Actuary

CASH BALANCE BENEFIT (CBB) PROGRAM AND SCHEDULES

Actuarial Methods

The Cash Balance Benefit (CBB) Program was established July 1, 1996. In order to value and fund the CBB Program, CalSTRS has adopted the following actuarial methods.

Actuarial Cost Method

For funding purposes, the traditional unit credit cost method was selected for the CBB Program since the projected benefits of each individual member are allocated by a consistent formula to valuation years. As a result, the actuarial obligation is equal to the accumulated account balances, and the normal cost is equal to the total annual contribution. The CBB Program does not provide cost-of-living adjustments for benefit recipients.

Asset Valuation Method

The CBB Program uses the fair market value of assets for actuarial valuation purposes. Asset smoothing is not used for this program.

Funding Method

Generally, participant contributions are 4 percent of salary, and employer contributions are 4 percent 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 percent of salary. The employer contribution rate cannot be less than 4 percent of salary and the participant rate cannot be less than the employer rate.

The board may adjust employer contributions for a fixed number of years, but the adjustment shall not exceed 0.25 percent of salaries in any plan year.

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 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.

Financial Reporting Method

Under GASB 67, financial reporting for the State Teachers' Retirement Plan (STRP) includes the Defined Benefit, Defined Benefit Supplement, Cash Balance Benefit, Supplemental Benefit Maintenance Account and Teachers' Replacement Benefits programs. For financial reporting, the aggregate assets of all programs in the State Teachers'

Retirement Plan on a market basis are used in the determination of the Net Pension Liability.

GASB 67 also specifies that, for financial reporting purposes, the entry age normal cost method should be used to calculate pension liability.

Actuarial Assumptions

The actuarial valuation utilizes two different types of assumptions: economic and demographic. Economic assumptions are related to the general economy and its impact on CalSTRS. Demographic assumptions predict the future experience of the membership with respect to eligibility and benefits and are directly related to the specific experience of CalSTRS members.

The assumptions for this program will have minimal impact under the traditional unit credit cost method or only have significance when participants elect to annuitize the account balance. Under the program, a participant must have at least \$3,500 in their account to elect to annuitize the account balance.

CalSTRS, through its consulting actuary, performs an experience study every four or five years to determine appropriate demographic and economic assumptions. These assumptions are then applied when the consulting actuary performs an actuarial valuation to monitor the funding status of the CBB Program. The most recent experience study examined data for the five year period spanning July 1, 2010, through June 30, 2015, and was adopted by the board in February 2017.

Below is a summary of the different types of assumptions used.

Economic Assumptions

The two major economic assumptions are investment return and wage growth, and each is affected by the underlying assumed rate of inflation. The assumption for investment return, also known as the discount rate, is 6.50 percent, net of investment and administrative expenses. The assumption for general wage increase is 3.50 percent, of which 2.75 percent is due to inflation and 0.75 percent is due to expected gain in productivity.

As required by GASB 67, for financial reporting the discount rate is net of investment expenses but gross of administrative expenses, equivalent to 7.10%.

CASH BALANCE BENEFIT (CBB) PROGRAM AND SCHEDULES

Table 5 provides a summary of the economic actuarial assumptions for this program as reflected in the most recent actuarial valuation.

Demographic Assumptions

Demographic assumptions are based upon the most recent CalSTRS experience study and include assumptions for postretirement mortality, probabilities of retirement, disability or withdrawal from the system, assumptions for pay increases due to promotions and various other assumptions needed to value the benefits.

Tables 1–4 and 6–7 provide a summary of the demographic assumption information for this program as reflected in the most recent actuarial valuation.

Changes Since Prior Valuation

Changes in Actuarial Methods

There were no changes in the actuarial methods for the Cash Balance Benefit Program.

Changes in Actuarial Assumptions

On February 1, 2017, the board lowered the discount rate from 7.00 percent to 6.50 percent using a phased in approach. The June 30, 2016, actuarial valuation used a discount rate of 6.75 percent. For the June 30, 2017, actuarial valuation the discount rate was reduced to 6.50 percent.

Changes in Plan Provisions

On May 10, 2018, the board adopted a 3.62 percent additional earnings credit for the fiscal year ending June 30, 2017.

Valuation Results

The most recent actuarial valuation was completed as of June 30, 2017. This valuation determined there was an actuarial surplus of \$50,324,000 before the awarding of any additional earnings credit. The valuation was presented to the board on May 10, 2018, at which time the board adopted an additional earnings credit of 3.62 percent for the fiscal year ending June 30, 2017. After awarding the additional earnings credit, the actuarial surplus was reduced to \$41,465,000.

Tables 8–12 provide summaries of the valuation results.

Independent Actuarial Review

Actuarial services for CalSTRS are provided under contract by a qualified independent actuarial firm, with additional review provided by CalSTRS actuarial staff. The current actuarial firm, Milliman, has been the program's actuarial firm since January 15, 2000.

In addition to the review performed by CalSTRS actuarial staff, all independent actuarial services are subject to a periodic independent review. The selection of the firm performing the independent review is done generally every five years through the competitive bid process.

A review of the 2016 Actuarial Experience Study and the assumptions specific to the CBB Program was performed by the actuarial firm Cheiron. The result of the review was reported to the board on February 1, 2017. Cheiron found the recommendations made by Milliman in the 2016 Actuarial Experience Study to be reasonable, and the work performed by Milliman on the experience study meets the Actuarial Standards of Practice.

A review of the 2015 Actuarial Valuation of the CBB Program was also performed by Cheiron. The result of the review was reported to the board on April 6, 2017. Overall, Cheiron was able to replicate the results of the actuarial valuation with no material differences. Cheiron commented that the actuarial valuation was performed by qualified actuaries and in accordance with generally accepted actuarial principles. Cheiron further stated that appropriate methods, checking and reviewing procedures were followed in the preparation of the valuation and that the communication in the valuation report was clear and complete given the underlying plan of the benefits.

Summary of Cash Balance Benefit Program Provisions

The following is a summary of the provisions used in the valuation of this program.

Membership

Eligibility Requirement—Membership if employed at less than 50 percent of a full-time position for a California school district, community college district or county office of education that has elected to offer the Cash Balance Benefit Program.

CASH BALANCE BENEFIT (CBB) PROGRAM AND SCHEDULES

Extended eligibility to members hired by a community college district to perform creditable service on a part-time or temporary basis (semester to semester) or for not more than 60 percent of the hours per week considered a regular full-time assignment.

Participant—An eligible employee 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 accounts established for the purpose of determining benefits payable to the participant. Accounts are credited with contributions, minimum interest rate and additional earnings credits.

Contributions—Generally, participant contributions are 4 percent of salary, and employer contributions are 4 percent 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 percent of salary. The employer contribution rate cannot be less than 4 percent of salary and the participant rate cannot be less than the employers rate.

The board may adjust employer contributions for a fixed number of years, but the adjustment shall not exceed 0.25 percent of salaries in any plan year.

Minimum Interest Rate—Annual rate determined for the plan year by the board in accordance with federal laws and regulations. The minimum interest rate is equal to the average of the yields on 30-year Treasury Notes for the 12 months ending in February preceding the beginning of the plan year, rounded to the next highest basis point.

Additional Earnings Credit—Annual rate determined for the plan year by the board based on the actual earnings during the plan year, but only to the extent the earnings are sufficient to credit the minimum interest rate and provide any additions to the gain and loss reserve deemed warranted by the board. The board adopted an additional earnings credit of 3.62 percent for the fiscal year ending June 30, 2017.

Normal Retirement

Eligibility Requirement—Age 60.

Benefit—The account balance at the retirement date subject to limits imposed under IRC section 415. For participants hired on or after January 1, 2013, salary credited to CalSTRS from all employers is capped at \$143,082 for 2017–18 fiscal year. The limit is adjusted each fiscal year based on the changes in the Consumer Price Index for all Urban Consumers: U.S. City Average.

Form of Payment—The normal form of payment is a lump-sum distribution. Annuity options are available if the sum of the employer and employee accounts equals or exceeds \$3,500.

Early Retirement

Eligibility Requirement—Age 55.

Benefit and Form of Payment—Same as Normal Retirement.

Late Retirement

Benefit and Form of Payment—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.

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.

CASH BALANCE BENEFIT (CBB) PROGRAM AND SCHEDULES

Form of Payment—Normal distribution is a lump-sum benefit. A participant's beneficiary may elect to receive the benefit in the form of a period-certain annuity if the sum of the balance of credits to the participant's employee and employer accounts is \$3,500 or more.

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—More than five years has elapsed since the most recent termination benefit, if any, has been paid.

Benefit and Form of Payment—Lump-sum distribution of the account balance as of the date of distribution. The benefit is payable six months from the termination of creditable service.

CASH BALANCE BENEFIT (CBB) PROGRAM AND SCHEDULES

All demographic assumptions used in the actuarial valuation were adopted by the board when the experience study was adopted on February 1, 2017. The following are the assumptions adopted by the board for this program. Tables 2, 3, 4 and 7 are used in the GASB 67 financial reporting valuation and not for the the funding valuation.

Table 1 Postretirement Mortality for Sample Ages

Age	Male	Female
	2017	2017
50	0.240%	0.133%
55	0.354	0.211
60	0.474	0.280
65	0.674	0.422
70	1.079	0.696
75	1.936	1.280
80	3.553	2.455
85	6.831	4.896
90	13.161	9.948
95	22.456	18.616

Table 2 Probabilities of Retirement for Sample Ages¹

Age	2% at 60 Members		2% at 62 Members	
	1990 Benefits	Under 30 Years	30 or More Years	All Years
Male 55	5.8%	2.7%	6.0%	3.0%
60	25.0	6.3	25.0	9.0
65	20.0	14.0	32.5	30.0
70	100.0	12.0	25.0	20.0
75	100.0	100.0	100.0	100.0
Female 55	7.0%	3.5%	8.0%	4.0%
60	22.0	7.0	29.0	9.0
65	18.0	17.0	37.5	30.0
70	100.0	14.0	30.0	20.0
75	100.0	100.0	100.0	100.0

¹Probabilities of retirement are adjusted for members with service between 25 and 30 years.

Table 3 Probabilities of Withdrawal from Active Service Before Age and Service Retirement for Sample Duration in Years

Male Duration	Female Duration
0	16.0%
1	11.0
2	8.5
3	6.3
4	4.0
5	3.5
10	1.8
15	1.2
20	0.9
25	0.7

CASH BALANCE BENEFIT (CBB) PROGRAM AND SCHEDULES

Table 4 Assumption for Pay Increases Due to Promotions and Longevity for Sample Ages in Years
(Exclusive of the assumed general wage increase, which includes inflation)

Duration	Entry Ages					
	Under 25	25-29	30-34	35-39	40-44	45+
1	6.4%	5.8%	5.3%	4.8%	4.5%	3.7%
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
20	1.3	1.2	1.2	0.8	0.8	0.6
30	0.9	0.8	0.7	0.5	—	—
40	0.8	0.7	—	—	—	—

Table 5 Economic Assumptions

Consumer Price Inflation	2.75%
Investment Yield (Net of Expenses)	6.50
Wage Inflation	3.50
Interest on Member Accounts	6.50

Table 6 Mortality Assumptions

Retired Members ¹	
Male	2016 CalSTRS Retired Male
Female	2016 CalSTRS Retired Female
Active Members	
Male	RP-2014 White Collar Employee Male set back 2 years
Female	RP-2014 White Collar Employee Female set back 2 years
Beneficiaries ¹	
Male	2016 CalSTRS Retired Male
Female	2016 CalSTRS Retired Female
Disabled ^{1,2}	
Male	RP-2014 Disabled Retiree Male set back 2 years
Female	RP-2014 Disabled Retiree Female set back 2 years

¹For future years, the projected improvement is based on 110% of the MP-2016 Ultimate Projection Scale.

²Select rates in first three years for both Males and Females.

CASH BALANCE BENEFIT (CBB) PROGRAM AND SCHEDULES

Table 7 Disability Rates for Sample Ages

Coverage A			Coverage B		
Male	25	0.018%	Male	25	0.010%
	30	0.027		30	0.020
	35	0.045		35	0.030
	40	0.072		40	0.060
	45	0.099		45	0.100
	50	0.144		50	0.140
	55	0.189		55	0.245
Female	25	0.018%	60	0.365	
	30	0.027	65	0.400	
	35	0.054	70	0.400	
	40	0.081	Female	25	0.020%
	45	0.099	30	0.020	
	50	0.198	35	0.040	
	55	0.252	40	0.070	
			45	0.110	
			50	0.185	
			55	0.300	
		60	0.380		
		65	0.400		
		70	0.400		

Table 8 Schedule of Active Participant Valuation Data

Active Members					
Valuation Date (as of June 30) ¹	Number of Participating Employers ²	Number	Annual Payroll	Annual Average Pay	% Increase In Average Pay
2008	33	11,627	\$181,104,000	\$15,576	14.0%
2009	33	11,332	182,871,332	16,138	3.6
2010	33	10,378	163,248,119	15,730	(2.5)
2011	33	9,923	158,501,388	15,973	1.5
2012	33	9,273	151,284,621	16,315	2.1
2013	31	9,129	151,281,260	16,572	1.6
2014	32	9,955	175,058,251	17,585	6.1
2015	33	10,416	193,075,185	18,536	5.4
2016	30	10,676	211,259,529	19,788	6.8
2017	30	10,480	220,767,125	21,066	6.5

¹ Actuarial valuation results as of June 30, 2018, are expected to be available by May 2019.

² Number of employers is based on employers who submit the last contribution line for the active member in each respective fiscal year; however, the number of employers in the Financial Section is based on contributing employers as of the end of the respective fiscal year.

CASH BALANCE BENEFIT (CBB) PROGRAM AND SCHEDULES

Table 9 Schedule of Retired Participants and Beneficiaries Added to and Removed from Annuity Rolls¹

Date (as of June 30)	Added to Rolls		Removed from Rolls		Rolls—End of Year			
	Number	Annual Allowances	Number	Annual Allowances	Number	Annual Allowances	% Increase in Annual Allowances	Average Annual Allowances
2009	12	\$29,184	2	\$4,104	33	\$81,935	44.3%	\$2,483
2010 ²	18	55,193	5	23,079	46	114,047	39.2	2,479
2011	24	66,664	2	6,899	68	173,813	52.4	2,556
2012	42	139,297	5	18,110	105	294,000	69.1	2,800
2013	30	132,912	8	26,578	127	401,112	36.4	3,158
2014	42	212,087	10	43,746	159	568,682	41.8	3,577
2015	52	164,451	11	74,583	200	658,550	15.8	3,293
2016 ³	62	261,067	10	43,035	252	841,230	27.7	3,338
2017	80	430,331	22	87,768	310	1,223,947	45.5	3,948
2018	85	475,148	25	159,001	370	1,539,585	25.8	4,161

¹ Each year's data population is a snapshot taken following year-end closings; subsequent adjustments made to snapshots of data prior to the current period are not reflected in the table.

² Revised add count for 2010 as a result of subsequent years' end counts changed in 2015.

³ Revised add count for 2016 in 2017.

Table 10 Solvency Test

Valuation Date (as of June 30) ¹	Aggregate Accrued Liabilities for			Actuarial Value of Assets	Funding of Liabilities		
	(1) Active Member Contributions on Deposit	(2) Future Benefit to Benefit Recipients	(3) Service Already Rendered by Active Members (Financed by Employer)		(1)	(2)	(3)
2008	\$97,802,000	\$229,000	\$ —	\$98,892,000	100.0%	100.0%	— %
2009	114,338,000	354,000	—	91,793,000	80.2	—	—
2010	129,065,000	509,000	—	114,418,000	88.7	—	—
2011	143,695,000	767,000	—	151,248,000	100.0	100.0	—
2012	156,600,000	1,386,000	—	158,020,000	100.0	100.0	—
2013	174,171,000	1,952,000	—	188,551,000	100.0	100.0	—
2014	194,792,000	3,061,000	—	231,671,000	100.0	100.0	—
2015	215,851,000	3,843,000	—	248,699,000	100.0	100.0	—
2016	230,864,000	4,974,000	—	256,675,000	100.0	100.0	—
2017	253,572,000	7,411,000	—	302,448,000	100.0	100.0	—

¹ Actuarial valuation results as of June 30, 2018, are expected to be available by May 2019.

CASH BALANCE BENEFIT (CBB) PROGRAM AND SCHEDULES

Table 11 Analysis of Financial Experience
(Gains and losses in unfunded actuarial obligation resulting from differences between assumed and actual experience)
(Dollars in Thousands)

Actuarial Valuation as of June 30 ¹		
	2017	2016
Actuarial Obligation at June 30	\$235,838	\$219,694
Expected Changes:		
Contributions	18,066	16,021
Benefits Paid	(12,502)	(7,045)
Expected Earnings/Credits	16,107	15,693
Expected Actuarial Obligation at June 30	257,509	244,363
Expected Actuarial Value of Assets at June 30	279,752	275,398
Expected Unfunded Actuarial Obligaion (Surplus) at June 30	(22,243)	(31,035)
Actuarial (Gains) / Losses		
(Gain) on Actuarial Obligation	(5,385)	(8,525)
(Gain) / Loss on Assets	(22,696)	18,723
Total Actuarial (Gains) / Losses	(28,081)	10,198
Additional Earnings Credit	8,859	—
Unfunded Actuarial Obligation (Surplus) at June 30	(\$41,465)	(\$20,837)
Funded Ratio	116%	109%

¹ Actuarial valuation results as of June 30, 2018, are expected to be available by May 2019.

Table 12 Schedule of Funding Progress
(Dollars in Millions)

Actuarial Valuation Date as of June 30 ¹	Actuarial Value of Assets (a)	Actuarial Accrued Liability (AAL) (b)	Unfunded AAL (Funding Excess) (UAAL) (b-a)	Funded Ratio (a/b)	Covered Payroll (c)	UAAL as a % of Covered Payroll ((b-a)/c)
2008	\$99	\$98	(\$1)	101%	\$181	(1%)
2009	92	115	23	80	182	13
2010	114	130	16	88	163	10
2011	151	144	(7)	105	158	(4)
2012	158	158	—	100	151	—
2013	189	176	(13)	107	151	(9)
2014	232	198	(34)	117	174	(20)
2015	249	220	(29)	113	192	(15)
2016	257	236	(21)	109	209	(10)
2017	302	261	(41)	116	218	(19)

¹ Actuarial valuation results as of June 30, 2018, are expected to be available by May 2019.

Note: Information of actuarially determined and actual contributions for the State Teachers' Retirement Plan is provided in the Financial Section, Schedule III, Schedule of Pension Contributions from Employers and Nonemployer Contributing Entity.



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November 12, 2018

Teachers' Retirement Board
California State Teachers' Retirement System

Re: GASB 74 Reporting for the Medicare Premium Payment Program

Dear Members of the Board:

The basic financial goal of the Medicare Premium Payment (MPP) Program of the California State Teachers' Retirement System (CalSTRS) is to maintain sufficient resources to fully fund the obligations. Actuarial valuations are performed every year (every two years prior to 2017), and measure the progress toward this goal. The most recent valuation was as of June 30, 2017.

The MPP Program is essentially funded on a pay-as-you-go basis with a portion of contributions to the DB Program diverted to the Teachers' Health Benefit Fund to make MPP Program payments. As of June 30, 2017, \$302 million of future employer contributions to the DB Program have been allocated to pay the MPP Program benefits; however, this amount is not included as an asset for GASB 74 reporting. This gives the appearance that the MPP Program is significantly underfunded in the GASB 74 results. However, based on the commitment to transfer a portion of future contributions from the DB Program to fund the MPP Program, it is our opinion that the MPP Program continues in sound financial condition as of June 30, 2017.

The June 30, 2017 valuation results are based on the membership data and the asset information provided by CalSTRS. In our examination of these data, we have found them to be reasonably consistent and comparable with data used for other purposes, although we have not audited the data at the source. 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 found to be materially inaccurate or incomplete, our calculations will need to be revised.

Milliman did not prepare the summaries or schedules shown in the Financial and Actuarial Sections. However, the actuarial information contained in the Financial Section and in this Actuarial Section was derived from our June 30, 2017 actuarial valuation report.

The valuation is based on our understanding of the current benefit provisions of the MPP Program and the actuarial assumptions which were last reviewed and adopted by the Board at the February 2017 meeting.

We believe the actuarial assumptions and methods are internally consistent, reasonable and meet the parameters of Governmental Accounting Standards Board Statement No. 74 for fulfilling financial accounting requirements and meet the parameters set forth in the relevant Actuarial Standards of Practice (ASOPs). It should be noted that we relied on advice from Milliman's health actuaries on our recommendations of assumptions specific to health costs. Nevertheless, the emerging costs will vary from those presented in our report to the extent that actual experience differs from that projected by the actuarial assumptions. Future actuarial measurements may differ significantly from the current measurements as presented in the



Teachers' Retirement Board
November 12, 2018
Page 2

valuation report due to many factors. Due to the limited scope of our assignment, we did not perform an analysis of the potential range of future measurements.

Our valuation report and this letter have been prepared exclusively for CalSTRS for a specific and limited purpose. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. It is a complex, technical analysis that assumes a high level of knowledge concerning CalSTRS operations, and uses CalSTRS data, which Milliman has not audited. 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 these assignments 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.

In conclusion, the results presented in this report satisfy GASB 74 reporting purposes. Based on the current actuarial assumptions used for financial reporting purposes, the current assets of the MPP Program as of June 30, 2018 are less than 1% of the accrued liabilities. It should be noted that these calculations do not include the future employer contributions to the DB Program that have been allocated to pay the MPP Program benefits.

We certify that the June 30, 2017 valuation was performed in accordance with the Actuarial Standards Board (ASB) standards of practice and by qualified actuaries. We are members of the American Academy of Actuaries and have experience in performing valuations for public retirement systems.

Respectfully submitted,

Handwritten signature of Mark Olleman in black ink.

Mark Olleman, FSA, EA, MAAA
Principal and Consulting Actuary

Handwritten signature of Nick Collier in black ink.

Nick Collier, ASA, EA, MAAA
Principal and Consulting Actuary

Handwritten signature of Daniel Wade in black ink.

Daniel Wade, FSA, EA, MAAA
Principal and Consulting Actuary

MEDICARE PREMIUM PAYMENT (MPP) PROGRAM AND SCHEDULES

Actuarial Methods

The Medicare Premium Payment (MPP) Program is a cost-sharing multiple-employer other postemployment benefit plan established on January 1, 2001, pursuant to Chapter 1032, Statutes of 2000 (SB1435). CalSTRS administers the MPP Program, through the Teachers' Health Benefit Fund (THBF). In order to value and fund the MPP Program, CalSTRS has adopted the following actuarial methods.

Actuarial Cost Method

The MPP Program is funded on a pay-as-you-go basis. This method of funding the MPP Program was selected because the MPP Program was established out of the actuarial surplus of the DB Program.

Asset Valuation Method

The program assets are valued as the allocated value of DB Program Assets. This figure is equal to the actuarial obligation of the MPP Program benefits. Asset smoothing is not used for this program.

Funding Method

The MPP Program is funded on a pay-as-you go basis from a portion of monthly employer contributions. In accordance with California Education Code Section 25930 and board policy, contributions that would otherwise be credited to the Defined Benefit (DB) Program each month are instead credited to the MPP Program to fund monthly program and administrative costs. The funding method does not require an amortization method for any unfunded actuarial obligation or surplus. Actuarial gains and losses are funded as they occur through the pay-as-you go method described above. There are no retiree contributions, per capita claims costs or pay increase assumptions.

Financial Reporting Method

For financial reporting purposes, the actuarial cost method used is the Individual Entry Age Normal method as specified by GASB 74. The asset valuation method is fair market value of assets.

Actuarial Assumptions

The actuarial valuation utilizes two different types of assumptions: economic and demographic. Economic assumptions are related to the general economy and its impact on CalSTRS. Demographic assumptions predict

the future experience of the membership with respect to eligibility and benefits and are directly related to the specific experience of CalSTRS members.

CalSTRS, through its consulting actuary, performs an experience study every four or five years to determine appropriate demographic and economic assumptions. An experience study specific to the MPP Program is performed every two years to determine healthcare-related assumptions. These assumptions are then applied when the consulting actuary performs an actuarial valuation to monitor the funding status of the MPP Program. The most recent experience study for demographic, economic and healthcare-related assumptions examined data for the five-year period spanning July 1, 2010, through June 30, 2015, and was adopted by the board in February 2017.

Below is a summary of the different types of assumptions used.

Economic Assumptions

The economic assumptions used for valuation purposes are the investment return, medical inflation, and rate of inflation. The assumption for investment return, also known as the discount rate, is 7.00 percent, net of investment and administrative expenses. The assumption for premium cost trend rates vary by year; however, the increases are approximately equivalent to a 3.7 percent and 4.1 percent increase each year for Medicare Part A and Part B, respectively. The assumption for price inflation is 2.75 percent.

For financial reporting the discount rate is 3.87 percent, net of investment expenses but gross of administrative expenses. The discount rates are based on the rate for 20-year, tax exempt general obligation municipal bonds with an average rating of AA/Aa or higher as specified in GASB. The Teachers' Retirement Board has adopted The Bond Buyer's 20-Bond GO Index for these purposes.

Table 5 provides a summary of the economic actuarial assumptions for this program as reflected in the most recent actuarial valuation.

Demographic Assumptions

The MPP Program is closed to new entrants. Members who retire on or after July 1, 2012, are not eligible for coverage under the MPP Program. As such, assumptions related to active members are not applicable to this program.

MEDICARE PREMIUM PAYMENT (MPP) PROGRAM AND SCHEDULES

The primary demographic assumptions are postretirement mortality rates and program enrollment rates.

Tables 1, 6 and 9 provide a summary of the demographic assumption information for this program as reflected in the most recent actuarial valuation.

Changes Since Prior Valuation

Changes in Actuarial Methods

There were no changes in the actuarial methods for the Medicare Premium Payment Program.

Changes in Actuarial Assumptions

On February 1, 2017, the board lowered the discount rate from 7.50 percent to 7.00 percent using a phased in approach. The June 30, 2016, actuarial valuation used a discount rate of 7.25 percent. For the June 30, 2017, actuarial valuation the discount rate was reduced to 7.00 percent.

The discount rate used for 2018 financial reporting was 3.87 percent, an increase of 0.29 percent from 3.58 percent used for 2017 financial reporting.

Changes in Plan Provisions

There were no changes in the plan provisions for the MPP Program.

Valuation Results

The most recent actuarial valuation of the MPP Program was completed as of June 30, 2017. The valuation indicated that the current program assets, along with MPP-allocated funding from future employer contributions that would otherwise have been credited to the DB Program, were sufficient to finance the future MPP Program obligations of \$302.2 million for both Part A premiums and Part B penalties. Note that in prior years the MPP Program funding valuation was performed every two years. In order to meet the timing requirements of GASB 74/75 the valuation is now performed annually.

Tables 10–13 provide summaries of the valuation results.

Independent Actuarial Review

Actuarial services for CalSTRS are provided under contract by a qualified independent actuarial firm, with additional review provided by CalSTRS actuarial staff. The current actuarial firm, Milliman, has been the program's actuarial firm since January 15, 2000.

In addition to the review performed by CalSTRS actuarial staff, all independent actuarial services are subject to a periodic independent review. The selection of the firm performing the independent review is done generally every five years through the competitive bid process.

A review of the assumptions specific to the MPP Program was performed by the actuarial firm Cheiron. The result of the review was reported to the board on February 1, 2017. Cheiron found the recommendations made by Milliman for the assumptions specific to the MPP Program to be reasonable, and the work performed by Milliman meets the Actuarial Standards of Practice.

A review of the 2014 Actuarial Valuation of the MPP Program was also performed by Cheiron. The result of the review was reported to the board on April 6, 2017. Overall, Cheiron was able to replicate the results of the actuarial valuation with no material differences. Cheiron commented that the actuarial valuation was performed by qualified actuaries and in accordance with generally accepted actuarial principles. Cheiron further stated that appropriate methods, checking and reviewing procedures were followed in the preparation of the valuation and that the communication in the valuation report was clear and complete given the underlying plan of the benefits.

Summary of Medicare Premium Payment Program Plan Provisions

The following is a summary of the provisions used in the valuation of this program.

MEDICARE PREMIUM PAYMENT (MPP) PROGRAM AND SCHEDULES

Membership

Eligibility Requirement – Part A

DB Member – satisfies either:

1. Retired or disabled prior to January 1, 2001; age 65 or above; enrolled in Medicare Part A and Part B; and not eligible for Part A without premium payment

or

2. Meet all above requirements, except retired or disabled before July 1, 2012; district completed a Medicare Division election prior to retirement; and active member voted yes if they were less than 58 years of age at the time of the election

Spouse Eligibility – Spouses of members are not eligible to participate in the program.

The MPP Program is closed to new entrants as members who retire on or after July 1, 2012, are not eligible for coverage under the MPP Program.

Eligibility Requirement – Part B Late Penalty Surcharges

Only those currently enrolled are eligible.

Benefits Paid

Premium payments are made directly to the Centers for Medicare and Medicaid Services (CMS) on a monthly basis. Medicare Part A premium rates for fiscal year 2017–18 are as follows:

Medicare Part A Premium Rate¹

July 1, 2017 to December 31, 2017	\$413
January 1, 2018 to June 30, 2018	422

¹ Individuals with 30–39 quarters of Medicare covered employment pay a reduced monthly premium rate, which was \$227 and \$232 for the period of July 1, 2017, to December 31, 2017, and January 1, 2018, to June 30, 2018, respectively.

Part A and B late enrollment penalties are generally 10 percent of the respective monthly premium rates; however, the fees charged to individual participants may be higher based on certain income thresholds.

Based on the published premium rates during fiscal year 2017–18, Part A late enrollment surcharges were 41.30 and 42.20 for period of July 1, 2017, to December 31, 2017, and January 1, 2018, to June 30, 2018, respectively. Part B late enrollment surcharges were 13.40 for the period of July 1, 2017, to June 30, 2018.

MEDICARE PREMIUM PAYMENT (MPP) PROGRAM AND SCHEDULES

Demographic assumptions used in the actuarial valuation were adopted by the board when the experience study was adopted on February 1, 2017. Assumptions specific to the MPP Program were also adopted on that date. Following are assumptions adopted by the board for this program.

Table 1 Postretirement Mortality for Sample Ages

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

Select rates for disability:

First year of disablement	4.0%	3.0%
Second year of disablement	3.5	2.5
Third year of disablement	3.0	2.0

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

Table 2 Probabilities of Retirement for Sample Ages

NOT APPLICABLE

Table 3 Probabilities of Withdrawal from Active Service Before Age and Service Retirement for Sample Duration in Years

NOT APPLICABLE

MEDICARE PREMIUM PAYMENT (MPP) PROGRAM AND SCHEDULES

Table 4 Probability of Refund

NOT APPLICABLE

Table 5 Economic Assumptions

Investment Yield (Net of Expenses)	7.00%
Medical Inflation (Varies by Year—average percentage below)	
Part A Premiums	3.70%
Part B Premiums	4.10%
Price Inflation	2.75%

Table 6 Mortality Assumptions

Retired Members	
Male	2016 CalSTRS Retired Male
Female	2016 CalSTRS Retired Female
Active Members (Not applicable)	
Male	RP-2014 White Collar Employee Male set back 2 years
Female	RP-2014 White Collar Employee Female set back 2 years
Beneficiaries ¹ (Not applicable)	
Male	2016 CalSTRS Retired Male
Female	2016 CalSTRS Retired Female
Disabled ^{1,2}	
Male	RP-2014 Disabled Retiree Male set back 2 years
Female	RP-2014 Disabled Retiree Female set back 2 years

¹ For future years, the projected improvement is based on 110% of the MP-2016 Ultimate Projection Scale.

² Select rates in first three years for both Males and Females

Table 7 Service Retirement for Sample Ages

NOT APPLICABLE

Table 8 Disability Rates for Sample Ages

NOT APPLICABLE

MEDICARE PREMIUM PAYMENT (MPP) PROGRAM AND SCHEDULES

Table 9 Schedule of Medicare Part A Enrollment Rates

Assumption	Best Estimate	
	Male	Female
% of Under 65 Retirees Enrolling (Retired On or After 2001)	2.50%	2.50%
% of Under 65 Retirees Enrolling (Retired Before 2001)	3.50	3.50
% of Over 65 Retirees Enrolling (For Those Not Currently Enrolled) at Age:		
65	0.60	0.60
66	0.06	0.06
67	0.04	0.04
68	0.03	0.03
69	0.03	0.03
70–84	0.02	0.02
85 & above	—	—

Table 10 Schedule of Retired Members Added to and Removed from Medicare Part A Premium Rolls¹

Date (as of June 30)	Added to Rolls		Removed From Rolls		Rolls-End of Year			
	Number	Annual Allowances ²	Number	Annual Allowances ²	Number	Annual Allowances ²	% Increase in Annual Allowances	Average Annual Allowances
2009	399	\$1,489	208	\$604	6,431	\$35,814 ³	14.3%	\$5,569
2010	347	1,215	220	660	6,475	34,015	(5.0)	5,253
2011	537	2,202	231	695	6,709	34,677	1.9	5,169
2012	359	1,177	218	634	6,742	33,708	(2.8)	5,000
2013 ⁴	305	1,009	212	641	6,770	33,663	(0.1)	4,972
2014	235	751	259	703	6,684	32,047	(4.8)	4,795
2015	178	443	254	772	6,474	29,729	(7.2)	4,592
2016	166	404	264	768	6,324	28,345	(4.7)	4,482
2017	102	211	273	766	6,124	27,632	(2.5)	4,512
2018	119	451	281	751	5,917	26,947	(2.5)	4,554

¹ Each year's data population is a snapshot taken following year-end closings; subsequent adjustments made to snapshots of data prior to the current period are not reflected in the table.

² Dollars in thousands.

³ This does not include the \$8.04 million credit adjustments and deletions. If the credit adjustments and deletions were included, the Total Annual Allowance would be \$28.3 million; the percentage decrease in annual allowance would be 9.6% and the average annual allowance would be \$4,402.

⁴ Numbers revised in 2014.

MEDICARE PREMIUM PAYMENT (MPP) PROGRAM AND SCHEDULES

Table 11 Solvency Test
(Dollars in Millions)

Valuation Date (as of June 30) ^{1,2}	Aggregate Accrued Liabilities for			Actuarial Value of Assets ³	Funding of Liabilities		
	(1) Active Member Contributions on Deposit	(2) Future Benefit to Benefit Recipients	(3) Service Already Rendered by Active Members		(1)	(2)	(3)
2006	\$ —	\$527.6	\$ —	\$527.6	— %	100.0%	— %
2008	—	629.7	—	629.7	—	100.0	—
2010	—	601.8	—	601.8	—	100.0	—
2012	—	424.2	—	424.2	—	100.0	—
2014	—	341.7	—	341.7	—	100.0	—
2016	—	314.9	—	314.9	—	100.0	—
2017	—	302.2	—	302.2	—	100.0	—

¹ This is a 10-year schedule. However, the information in this schedule is not available for periods prior to fiscal year 2005–06. Years will be added to this schedule in future fiscal years until 10 years information is available.

² Actuarial valuation results as of June 30, 2018, are expected to be available by May 2019.

³ For funding purposes, the assets are valued as the allocated value of DB Program assets. This figure is equal to the actuarial obligation of the MPP Program benefits.

Table 12 Analysis of Financial Experience
(Gains and losses in unfunded actuarial obligation resulting from differences between assumed and actual experience)
(Dollars in Millions)

	Reporting as of June 30 ¹	
	2017	2016
Actuarial Obligation at June 30		
Expected Changes:		
Eligibility Extended	not calculated	not calculated
Benefits Paid	(\$29.0)	(\$30.0)
Interest	not calculated	not calculated
Expected Actuarial Obligation at June 30	not calculated	not calculated
Expected Actuarial Value of Assets at June 30	not calculated	not calculated
Expected Unfunded Actuarial Obligation at June 30	not calculated	not calculated
Actuarial (Gains) / Losses		
(Gain) on Medical Trend Assumption	not calculated	not calculated
(Gain) on Premium/Penalty	not calculated	not calculated
(Gain) on Part B Premium for higher earners	not calculated	not calculated
(Gain) Other Sources	not calculated	not calculated
Total Actuarial Gains / Losses	not calculated	not calculated
Unfunded Actuarial Obligation at June 30 ²	—	—
Funded Ratio ²	100.0%	100.0%

¹ Actuarial valuation results as of June 30, 2018, are expected to be available by May 2019.

² Based on the Actuarial Value of Assets. For funding purposes, the MPP Program assets are valued as the allocated value of DB Program assets, which are equal to the actuarial obligation of the MPP Program benefits.

MEDICARE PREMIUM PAYMENT (MPP) PROGRAM AND SCHEDULES

Table 13 Schedule of Funding Progress
(Dollars in Millions)

Actuarial Valuation Date as of June 30 ^{1,2}	Actuarial Value of Assets ³ (a)	Actuarial Accrued Liability (AAL) (b)	Unfunded AAL (Funding Excess) (UAAL) (b-a)	Funded Ratio (a/b)
2006	\$527.6	\$527.6	\$ —	100%
2008	629.7	629.7	—	100
2010	601.8	601.8	—	100
2012	424.2	424.2	—	100
2014	341.7	341.7	—	100
2016	314.9	314.9	—	100
2017	302.2	302.2	—	100

¹This is a 10-year schedule. However, the information in this schedule is not available for periods prior to fiscal year 2005–06. Years will be added to this schedule in future fiscal years until 10 years of information is available.

² Actuarial valuation results as of June 30, 2018, are expected to be available by May 2019.

³ For funding purposes, the assets are valued as the allocated value of DB Program assets. This figure is equal to the actuarial obligation of the MPP Program benefits.