

# Schools Pool Actuarial Valuation

*As of June 30, 2018*



**Required Contributions for Fiscal Year**  
July 1, 2019 through June 30, 2020





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# Actuarial Certification



October 2019

To the best of our knowledge, this report is complete and accurate and contains sufficient information to fully and fairly disclose the actuarial funded condition of the Schools Pool. This valuation is based on the member and financial data as of June 30, 2018 provided by the various CalPERS databases and the benefits under this plan with CalPERS as of the date this report was produced. In our opinion, this valuation has been performed in accordance with generally accepted actuarial principles and in accordance with standards of practice prescribed by the Actuarial Standards Board. The assumptions and methods are internally consistent and reasonable for this plan, as prescribed by the CalPERS Board of Administration according to provisions set forth in the California Public Employees' Retirement Law.

The undersigned are actuaries for CalPERS, who are members of the American Academy of Actuaries and the Society of Actuaries and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

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# Highlights and Executive Summary

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## Introduction

This is the actuarial valuation report as of June 30, 2018 for the Schools Pool. This actuarial valuation determines the funded status as of June 30, 2018 and sets forth the Schools Pool employer and employee contribution rates for fiscal year July 1, 2019 through June 30, 2020.

The Schools Pool provides retirement benefits to members employed by school districts and community college districts in California. It generally does not cover non-classified members as they are covered by a separate retirement system - the California State Teachers' Retirement System, also known as CalSTRS.

## Purpose of Report

This actuarial valuation was performed by the CalPERS Actuarial Office using data as of June 30, 2018. The purpose of the report is to:

- Set forth the assets and accrued liabilities of the Schools Pool as of June 30, 2018.
- Determine the required employer contribution rate for fiscal year July 1, 2019 through June 30, 2020.
- Determine the required employee contribution rate for fiscal year July 1, 2019 through June 30, 2020 for school employees subject to the Public Employees' Pension Reform Act of 2013 (PEPRA).
- Provide actuarial information as of June 30, 2018 to the CalPERS Board of Administration (Board) and other interested parties.

The pension funding information presented in this report should not be used in financial reports subject to Governmental Accounting Standards Board (GASB) Statement Number 68 for a Cost-Sharing Multiple-Employer Defined Benefit Pension Plan.

The use of this report for any other purposes may be inappropriate.

Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; changes in actuarial policies; and changes in plan provisions or applicable law.

## California Actuarial Advisory Panel Recommendations

This report includes all the basic disclosure elements as described in the Model Disclosure Elements for Actuarial Valuation Reports recommended in 2011 by the California Actuarial Advisory Panel (CAAP), with the exception of including the original base amounts of the various components of the unfunded liability in the "Schedule of Amortization Bases."

Additionally, this report includes the following "Enhanced Risk Disclosures" also recommended by the CAAP in the Model Disclosure Elements document:

- A "Deterministic Stress Test," projecting future results under different investment income scenarios
- A "Sensitivity Analysis," showing the impact on current valuation results using alternative discount rates of 6.0 percent and 8.0 percent.

# Highlights and Executive Summary

## Required Contribution Rates

### Required Employer Contribution Rates

The actuarially required employer contribution rate for fiscal year July 1, 2019 through June 30, 2020 is shown in the table below. For comparison purposes, the corresponding contribution rate for fiscal year July 1, 2018 through June 30, 2019 is also provided. The expected contribution amounts are also shown in the table.

	Fiscal Year 2018-19	Fiscal Year 2019-20
1) Contribution as a Percentage of Payroll		
a) Total Normal Cost	15.739%	15.992%
b) Employee Contribution <sup>1</sup>	7.000%	7.000%
c) Employer Normal Cost [(1a) – (1b)]	8.739%	8.992%
d) Unfunded Liability Contribution Rate	9.323%	11.741%
e) Actuarially Determined Contribution Rate [(1c) + (1d)]	18.062%	20.733%
f) State Contribution (Section 20825.2)	0.000%	(1.012%)
<b>g) Required Employer Rate [(1e) + (1f)]</b>	<b>18.062%</b>	<b>19.721%</b>
Projected Annual Payroll for Contribution Year	\$13,683,435,270	\$14,234,498,153
2) Contribution in Projected Dollars		
a) Total Normal Cost	\$2,153,635,877	\$2,276,380,945
b) Employee Contribution <sup>1</sup>	957,840,469	996,414,871
c) Employer Normal Cost [(2a) – (2b)]	1,195,795,408	1,279,966,074
d) Unfunded Liability Contribution	1,275,750,831	1,671,277,588
e) Actuarially Determined Contribution [(2c) + (2d)]	\$2,471,546,239	\$2,951,243,662
f) State Contribution (Section 20825.2)	0	(144,000,000)
<b>g) Required Employer Contribution [(2e) + (2f)]</b>	<b>\$2,471,546,239</b>	<b>\$2,807,243,662</b>

(1) For classic members, this is the percentage specified in the Public Employees Retirement Law, net of any reduction from the use of a modified formula or other factors. For PEPRA members the member contribution rate is based on 50 percent of the total normal cost. A development of PEPRA member contribution rates can be found in Appendix D.

Note that the payroll used to calculate the expected dollar contributions is the payroll used in the valuation incorporating two years of payroll growth using the payroll growth assumption of 2.875 percent. To the extent that payroll in the contribution year is different than the projected payroll, the actual contribution amounts will be different than the expected contributions shown in the table above.

The supporting exhibit in this report entitled “Reconciliation of Employer Contributions” provides explanations of the changes in required contribution rates and expected contribution amounts from fiscal year 2018-19 to fiscal year 2019-20.

### Reasons for Change in Employer Contributions for the Schools Pool

Overall, the required contributions for the Schools Pool are expected to increase by \$479.7 million between fiscal year 2018-19 and fiscal year 2019-20. The increase is driven by a number of factors as discussed below.

CalPERS currently employs an amortization and smoothing policy that spreads rate increases or decreases over a 5-year period and amortizes all experience gains and losses over a fixed 30-year period. This means that only one-fifth of the total anticipated rate change caused by each gain or loss is realized in the first year, culminating in the full increase in the fifth year. As a result, the progression of these gain or loss amortization bases will affect contribution levels in increasing measure throughout the ramp period. A complete description of the actuarial methods used in the June 30, 2018 valuation is provided in Appendix A. In this valuation, the impact of the assumption changes adopted in 2014 and implemented in the 2015 annual valuation and the impact of previous investment experience are still being phased into the contribution requirement. The 2014 assumption change will continue to increase contribution requirements for another year.

On December 21, 2016, the CalPERS Board of Administration lowered the discount rate from 7.50 percent to 7.00 percent using a three-year phase-in beginning with the June 30, 2017 actuarial valuation for the Schools Pool. The employer contributions for fiscal year 2019-20 were calculated using a discount rate of 7.25 percent, down from 7.375 percent the prior year.

## Highlights and Executive Summary

In addition, on December 20, 2017, the Board adopted new actuarial assumptions based on an experience study of CalPERS membership performed every four years. As the result of the study, updates were made to various assumptions including mortality, retirement rates and inflation. The reduction of the inflation assumption was implemented in two steps in conjunction with the decreases in the discount rate. For the June 30, 2018 valuation, an inflation rate of 2.625 percent was used, down from 2.75 percent the prior year. The impact on required contributions of these assumption changes is approximately \$111.2 million, which accounts for the increase in normal cost and year one of the five-year phase-in of the increase in unfunded liability, to be paid over 20 years

CalPERS has implemented a new actuarial valuation software system for the June 30, 2018 valuation. With this new system we have refined and improved some of our calculation methodology. The impact on required contributions of this method change is approximately \$20.3 million, which accounts for the change in normal cost and year one of the five-year phase-in of the increase in unfunded liability, to be paid over 20 years.

The table below highlights all major contributors to the change in required contributions.

Reason for Change	(Millions)	Percent of Payroll
Prior Year Contributions		
Employer Normal Cost	\$ 1,195.8	8.74%
Unfunded Liability Contribution	1,275.7	9.32%
<b>Total Required Contributions</b>	<b>\$ 2,471.5</b>	<b>18.06%</b>
Change in Employer Normal Cost		
Assumption Changes 6/30/2018	\$ 68.6	0.48%
Method Change 6/30/2018	(4.6)	(0.03%)
Experience	(28.0)	(0.20%)
Payroll Growth	48.2	0.00%
Total	\$ 84.2	0.25%
Change in Unfunded Liability Contribution		
Phase-in from Prior Years (5-year ramps)		
Experience Loss 6/30/2014 (5 <sup>th</sup> year)	\$ 56.6	0.41%
Experience Loss 6/30/2015 (4 <sup>th</sup> year)	54.9	0.40%
Experience Loss 6/30/2016 (3 <sup>rd</sup> year)	67.5	0.49%
Experience Loss 6/30/2017 (2 <sup>nd</sup> year)	(5.1)	(0.04%)
Assumption Change 6/30/2015 (4 <sup>th</sup> year)	89.1	0.65%
Assumption Change 6/30/2017 (2 <sup>nd</sup> year)	27.1	0.20%
3% Increase on Prior Year Bases	47.0	(0.10%)
Re-amortization of Prior Year Bases (7.25%/2.875%)	(2.2)	(0.02%)
New Amortization Bases		
Assumption Change 6/30/2018 (5-year ramp)	42.6	0.30%
Method Change 6/30/2018 (5-year ramp)	24.9	0.18%
Experience Gain 6/30/2018 (5-year ramp)	(6.9)	(0.05%)
Total	\$ 395.5	2.42%
Current Year Contributions		
Employer Normal Cost	\$ 1,280.0	8.99%
Unfunded Liability Contribution	1,671.2	11.74%
<b>Total Required Contributions</b>	<b>\$ 2,951.2</b>	<b>20.73%</b>

### PEPRA Member Contribution Rates

With the enactment of PEPRA, new members hired on or after January 1, 2013 are subject to PEPRA and are required to contribute 50 percent of the total annual normal cost of their pension benefit as determined by the actuary. PEPRA school members currently contribute 7.00 percent of salary. The contribution rate for the school members not subject to PEPRA, i.e. classic members, is set by statute and is currently 7.00 percent of salary.

## Highlights and Executive Summary

Current law contains a provision that requires a change in the PEPRA member contribution rate when the total normal cost changes by more than 1 percent of payroll. When a change is triggered, the member contribution rate is adjusted to half the normal cost, rounded to the nearest quarter of one percent. The current PEPRA member contribution rate of 7.00 percent is based on a total normal cost of 14.07 percent of payroll. The change of discount rate and plan demographics have increased the total normal cost for PEPRA members from 14.07 percent to 14.28 percent of payroll this year. The total normal cost for PEPRA members has not changed by more than one percent since the last time the member contribution rate was established. As a result, no adjustment to the PEPRA member contribution rate is necessary. The member contribution rate for the PEPRA members will remain at 7.00 percent effective July 1, 2019.

Note that as of June 30, 2018, there are 126,256 active PEPRA members in the Schools Pool, which represents 39 percent of the total active population of the Schools Pool. The total payroll for active PEPRA members is \$4,149 million which accounts for 31 percent of the total Schools Pool's payroll.

The table below shows the determination of the member contribution rate based on 50 percent of the Total Normal Cost on June 30, 2018.

Plan	Basis for Current Rate		Rates Effective July 1, 2019			
	Total Normal Cost <sup>1</sup>	Member Rate	Total Normal Cost <sup>2</sup>	Change	Change Needed	Member Rate
Schools	14.072%	7.00%	14.284%	0.212%	No	7.00%

(1) As of June 30, 2017, valuation date

(2) As of June 30, 2018, valuation date

## Projected Future Contribution Rates

The table below shows the required and projected employer contribution rates for the next six fiscal years. Projected results reflect a 6.7 percent investment return reduced by estimated administrative expenses for fiscal year 2018-19 and the anticipated decrease in normal cost due to new hires entering lower benefit formulas under PEPRA. Projected rates also reflect the additional \$904 million contributed by the State in July 2019 pursuant to Senate Bill 90 (SB 90). For more information, please see "Changes Since the Prior Year's Valuation". It is assumed that all other actuarial assumptions will be realized and that no further changes to assumptions, contributions, benefits, or funding will occur during the projection period.

In addition to increases in the Schools Pool employer contribution rate, active PEPRA members may also see their contribution rate rise in the future if the lowering of the discount rate results in another change in normal cost of more than 1 percent. At this time, it is estimated the normal cost will most likely not increase by more than 1 percent when the discount rate is lowered to 7.0 percent. The PEPRA member contribution rate is expected to stay at 7.0 percent when the June 30, 2019 annual valuation is completed. This is only an estimate based on the current demographics of the active members. The PEPRA normal cost will be reassessed each year in the future to determine whether a change is required.

The following table also shows the classic member employee contribution rate and the estimated PEPRA members employee contribution rate for the future.

Valuation Date	Fiscal Year Impact	Projected Employer Contribution Rate Without SB 90 (As Percentage of Payroll)	Effect of SB 90	Projected Employer Contribution Rate (As Percentage of Payroll)	Classic Member Contribution Rate	Estimated PEPRA Member Contribution Rate
6/30/2019	2020-21	23.7%	(0.9%)	22.8%	7.00%	7.00%
6/30/2020	2021-22	25.2%	(0.3%)	24.9%	7.00%	7.00%
6/30/2021	2022-23	26.2%	(0.3%)	25.9%	7.00%	7.00%
6/30/2022	2023-24	26.9%	(0.3%)	26.6%	7.00%	7.00%
6/30/2023	2024-25	27.3%	(0.3%)	27.0%	7.00%	7.00%
6/30/2024	2025-26	27.1%	(0.3%)	26.8%	7.00%	7.00%
6/30/2025	2026-27	27.0%	(0.3%)	26.7%	7.00%	7.00%

# Highlights and Executive Summary

Under the amortization policy in effect for this valuation, changes in the Unfunded Accrued Liability (UAL) due to actuarial gains or losses or changes in actuarial assumptions or methods are amortized using a five-year ramp up. For more information, please see “Amortization of Unfunded Actuarial Accrued Liability” under “Actuarial Methods” in Appendix A. This method attempts to mitigate employer cost volatility from year to year by phasing in the impact of unanticipated changes in UAL over a five-year period. As a result of this methodology, dramatic changes in required employer contributions in any one year are less likely. However, required contributions can change gradually and significantly over the next five years. In years where there is a large increase in UAL the relatively small amortization payments during the ramp-up period could result in a funded ratio that is projected to decrease initially while the contribution impact of the increase in the UAL is phased in.

For projected contributions under alternate investment return scenarios, please see the “Future Investment Return Scenarios” in the “Risk Analysis” section.

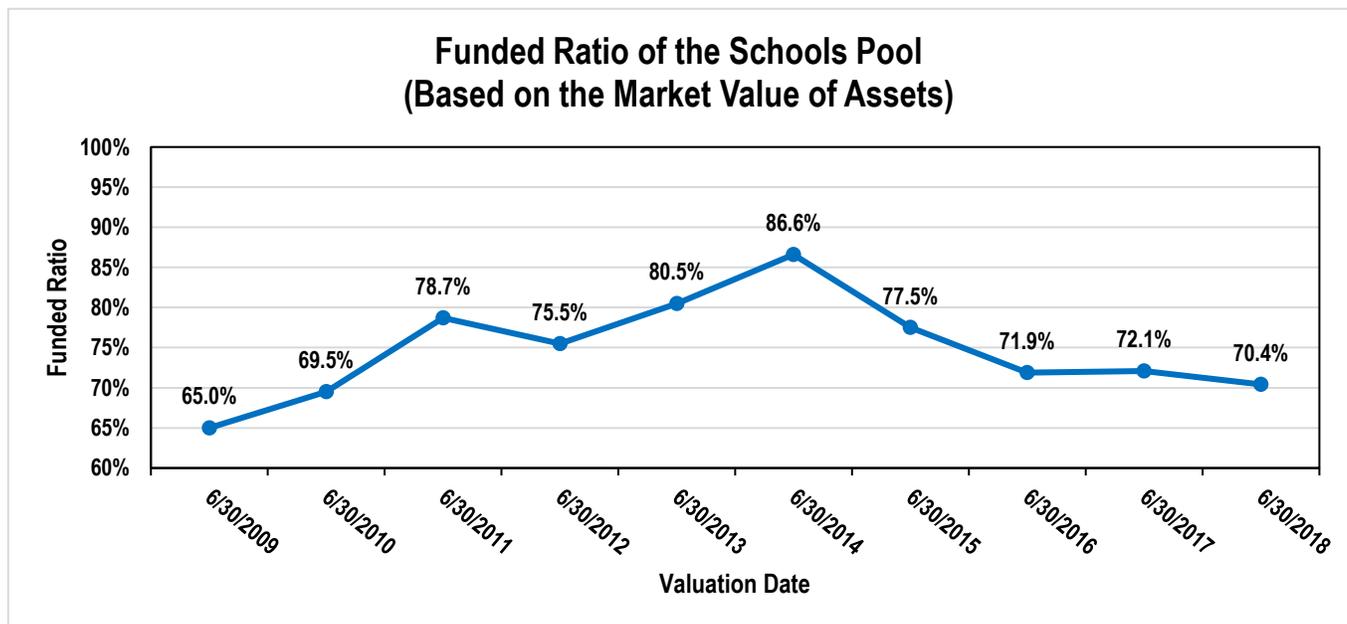
## Plan’s Funded Status

The funded status of a pension plan is defined as the ratio of assets to accrued liabilities. Plans with a lower funded ratio, all other things being equal, are more costly to maintain and more at risk of not being able to meet their future benefit obligations. From June 30, 2017 to June 30, 2018 the funded status for the Schools Pool decreased by 1.7 percent. This was primarily due to increases in liability resulting from the decrease in the discount rate assumption from 7.375 percent to 7.25 percent, and the new actuarial valuation system, partially offset by the investment return in 2017-18 being greater than expected.

The table below shows the development of the funded status of the plan using the market value of assets on June 30, 2018.

	June 30, 2017	June 30, 2018
1) Present Value of Projected Benefits	\$99,598,215,938	\$108,834,435,399
2) Entry Age Normal Accrued Liability	84,416,060,617	92,070,935,513
3) Market Value of Assets (MVA)	60,865,459,800	64,846,338,847
4) Unfunded Liability [(2) - (3)]	\$23,550,600,817	\$27,224,596,666
5) Funded Ratio [(3) / (2)]	72.1%	70.4%

The graph below shows the funded status of the Schools Pool for the past ten years based on the market value of assets.



# Highlights and Executive Summary

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## Changes Since the Prior Year's Valuation

### Additional State Contributions to the Schools Pool

On June 27, 2019, the Governor approved Senate Bill 90, which added Section 20825.2 to the Government Code. This statute appropriated \$904 million from the General Fund for payments relating to school employers' contributions and unfunded liabilities. The funds were received by CalPERS on July 29, 2019. In accordance with the statute, \$144 million pays part of the 2019-20 required contribution on behalf of school employers, \$100 million pays part of the 2020-21 required employer contribution, and \$660 million is applied to the UAL for school employers. These additional payments are reflected in this valuation report.

### Actuarial Methods and Assumptions

Two assumption changes were recognized in this valuation. On December 21, 2016, the Board lowered the discount rate from 7.50 percent to 7.00 percent using a three-year phase-in beginning with the June 30, 2017 actuarial valuations. The employer contributions for fiscal year 2019-20 were calculated using a discount rate of 7.25 percent, down from 7.375 percent the prior year. In addition, on December 20, 2017 the Board adopted a reduction in the inflation assumption to be implemented in two steps in conjunction with the decreases in the discount rate. An inflation rate of 2.625 percent was used for the June 30, 2018 valuation, down from 2.75 percent the prior year. For the June 30, 2019 valuation report, we will use a 7.0 percent discount rate and a 2.50 percent inflation rate assumption.

The changes adopted on December 20, 2017 by the Board were based on an experience study of CalPERS membership performed every four years. As a result of the study, besides reducing the inflation rate, updates were made to other assumptions including mortality and retirement rates.

CalPERS has implemented a new actuarial valuation software system for the June 30, 2018 valuation. With this new system we have refined and improved some of our calculation methodology. Any difference in liability between the legacy and current system is captured as a method change line item.

A complete description of the actuarial methods and assumptions used in the June 30, 2018 valuation can be found in Appendix A of this report.

### Plan Provisions

No changes were made since the prior valuation. Please refer to Appendix B for a summary of the plan provisions used in this valuation.

### Risk Mitigation

The CalPERS Board of Administration adopted a Funding Risk Mitigation Policy which is designed to reduce funding risk over time. This policy establishes a mechanism whereby CalPERS investment performance that significantly outperforms the discount rate triggers adjustments to strategic asset allocation targets, the expected investment return and the discount rate. A minimum excess investment return of 2 percent above the existing discount rate is necessary to cause a funding risk mitigation event. However, this policy is temporarily suspended until fiscal year 2020-21 as part of the reduction in discount rate from 7.5 percent to 7.0 percent. More details on the Risk Mitigation Policy can be found on our website.

## Subsequent Events

On February 14, 2018, the Board adopted a new amortization policy effective with the June 30, 2019 actuarial valuation, first affecting the school employer contributions for fiscal year 2020-21. The new policy will generally accelerate the recognition of new sources of Unfunded Accrued Liability. Since this change is not effective until a future valuation and will not affect any amortization bases already in existence upon implementation, it has no effect on the June 30, 2018 valuation results or fiscal year of 2019-20 required contributions. There is one exception to these rules for the Schools Pool valuation – the impact of the discount rate change from 7.25% to 7.0% in the June 30, 2019 valuation will be amortized under the prior policy. The new amortization policy is incorporated in the projected contribution rates shown in the "Future Investment Return Scenarios" section of this report.

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## Assets

### Reconciliation of Market Value of Assets

1) Market Value of Assets as of June 30, 2017 Including Receivables	\$60,865,459,800
2) Receivables for Service Buybacks as of June 30, 2017	95,503,089
3) Market Value of Assets as of June 30, 2017 [(1) - (2)]	\$60,769,956,711
4) Employer Contributions	2,070,831,846
5) Employee Contributions	914,852,502
6) Benefit Payments to Retirees and Beneficiaries	(3,952,122,750)
7) Refunds	(100,996,006)
8) Administrative Expense	(73,902,919)
9) Transfers and Miscellaneous Adjustments	29,791,414
10) Investment Return	5,084,088,016
11) Market Value of Assets as of June 30, 2018 Excluding Receivables [(3) + (4) + (5) + (6) + (7) + (8) + (9) + (10)]	\$64,742,498,814
12) Receivables for Service Buybacks as of June 30, 2018	103,840,033
13) Market Value of Assets as of June 30, 2018 Including Receivables [(11) + (12)]	<b>\$64,846,338,847</b>

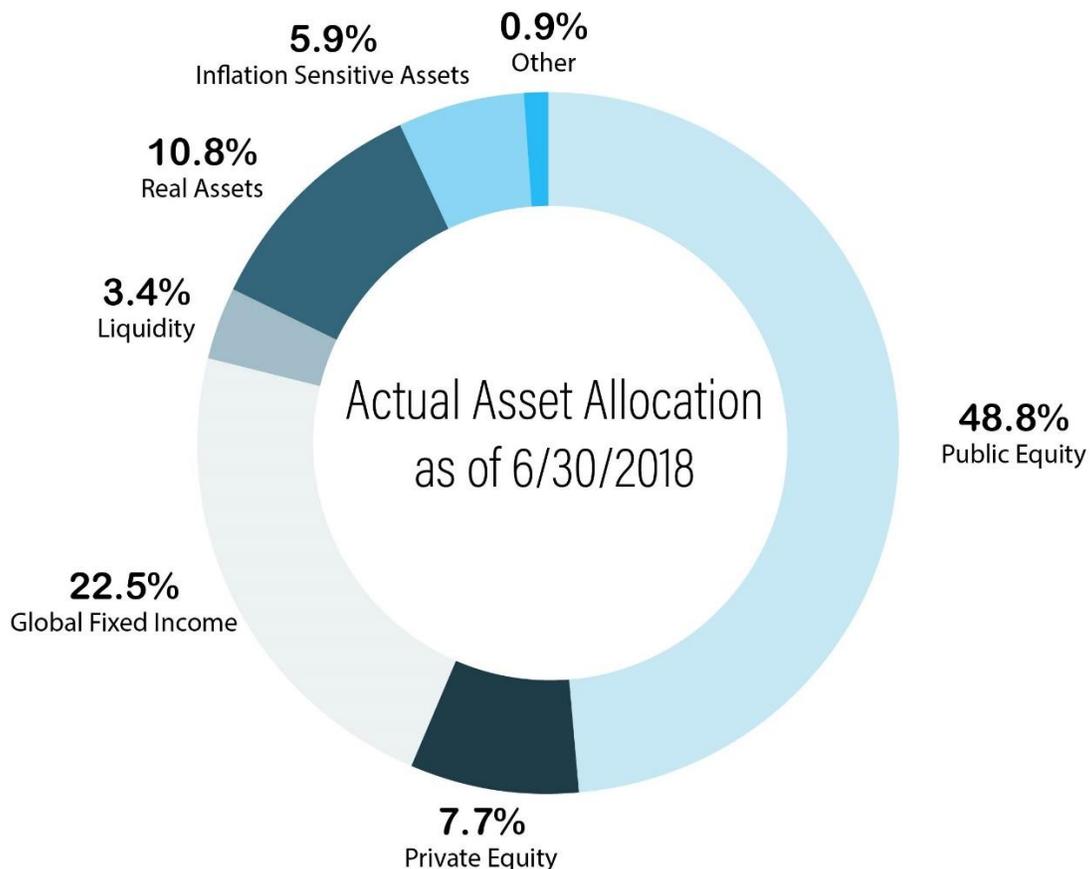
# Assets

## Asset Allocation

CalPERS adheres to an Asset Allocation Strategy which establishes asset class allocation policy targets and ranges and manages those asset class allocations within their policy ranges. CalPERS Investment Beliefs No. 6 recognizes that strategic asset allocation is the dominant determinant of portfolio risk and return. On December 19, 2017, the Board adopted changes to the asset allocation as shown in the Policy Target Allocation as of June 30, 2018, below expressed as a percentage of total assets

The asset allocation and market value of assets shown below reflect the values of the Public Employees Retirement Fund (PERF) in its entirety as of June 30, 2018. The assets of the Schools Pool are part of the Public Employees Retirement Fund (PERF) and are invested accordingly.

Asset Class	Market Value (Dollars in Billions)	Actual Allocation June 30, 2018	Policy Target Allocation June 30, 2018
Public Equity	\$171.8	48.8%	49.0%
Private Equity	27.2	7.7%	8.0%
Global Fixed Income	79.1	22.5%	22.0%
Liquidity	11.8	3.4%	3.0%
Real Assets	38.1	10.8%	12.0%
Inflation Sensitive Assets	20.8	5.9%	6.0%
Other	3.1	0.9%	0.0%
<b>Total Fund</b>	<b>\$351.9</b>	<b>100.0%</b>	<b>100.0%</b>

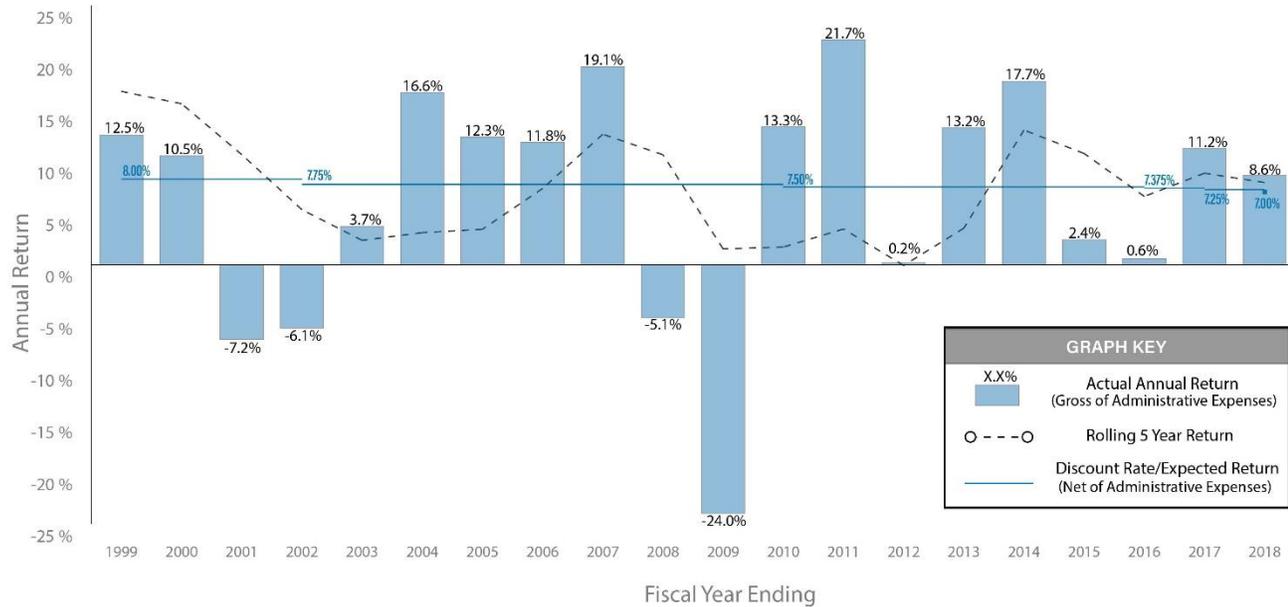


# Assets

## CalPERS History of Investment Returns

Following is a chart with the 20-year historical annual returns of the PERF for each fiscal year ending on June 30. Beginning in 2002, the figures are reported as gross of fees.

### History of Investment Returns (1999 - 2018)



The table below shows historical compound annual returns of the PERF for various time periods ending on June 30, 2018, (figures are reported as gross of fees). The compound annual return is the average rate per period compounded over multiple periods. It should be recognized that in any given year the rate of return is volatile. The portfolio has an expected “volatility” of 11.4 percent per year based on the most recent Asset Liability Modeling study. The volatility is a measure of the risk of the portfolio expressed in the standard deviation of the fund’s total return distribution, expressed as a percentage. Consequently, when looking at investment returns it is more informative to look at returns over longer time horizons.

### History of CalPERS Rates of Return and Volatilities

	1 Year	5 Year	10 Year	20 Year	30 Year
Compound Annual Return	8.6%	7.9%	5.7%	6.0%	8.3%
Volatility	—	6.9%	12.9%	11.1%	10.1%

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# Liabilities and Employer Contributions

## Accrued and Unfunded Liabilities

	June 30, 2017	June 30, 2018
Members Included in the Valuation <sup>1</sup>		
Active Members	317,860	323,707
Transfers from Schools	19,070	19,666
Vested Terminations <sup>2</sup>	197,558	183,033
Receiving Payments	225,490	233,733
<b>Total</b>	<b>759,978</b>	<b>760,139</b>
Average Entry Age of Active Members	36.1	36.0
Average Age of Active Members	46.6	46.4
Average Age of Retired Members	72.6	71.6
Average Pay	\$40,577	\$41,550
Covered Payroll in Fiscal Year	\$12,897,950,108	\$13,450,005,563
Projected Payroll for Contribution Rate	\$13,683,435,270	\$14,234,498,153
1) Present Value of Projected Benefits		
a) Active Members	\$48,367,592,189	\$52,838,094,303
b) Transferred Members	7,022,715,849	6,597,320,327
c) Terminated Members	2,035,933,722	2,665,235,600
d) Members and Beneficiaries Receiving Payments	42,171,974,178	46,733,785,169
<b>e) Total</b>	<b>\$99,598,215,938</b>	<b>\$108,834,435,399</b>
2) Present Value of Future Employer Normal Costs	\$8,110,382,505	\$9,034,315,973
3) Present Value of Future Employee Normal Costs	\$7,071,772,816	\$7,729,183,913
4) Entry Age Normal Accrued Liability		
a) Active Members [(1a) – (2) – (3)]	\$33,185,436,868	\$36,074,594,417
b) Transferred Members (1b)	7,022,715,849	6,597,320,327
c) Terminated Members (1c)	2,035,933,722	2,665,235,600
d) Members and Beneficiaries Receiving Payments (1d)	42,171,974,178	46,733,785,169
<b>e) Total</b>	<b>\$84,416,060,617</b>	<b>\$92,070,935,513</b>
5) Market Value of Assets (MVA)	\$60,865,459,800	\$64,846,338,847
6) Unfunded Liability/(Surplus) [(4e) – (5)]	\$23,550,600,817	\$27,224,596,666
<b>7) Funded Status [(5) / (4e)]</b>	<b>72.1%</b>	<b>70.4%</b>

Counts are of unique members included in the valuation. Multiple records may exist for members with service in more than one benefit group. This does not result in double counting liabilities.

(1) Includes non-vested terminated participants with employee contributions remaining in the plan.

# Liabilities and Employer Contributions

## Schedule of Amortization Bases

The schedule on the next page shows the development of the payment on the amortization bases used to determine the employer contribution rate. Each row of the schedule gives a brief description of a base (or portion of the Unfunded Actuarial Liability), the date the base was established, the balance of the base on the valuation date, and the number of years remaining in the amortization period. The schedule also shows the expected payment for the year immediately following the valuation date, the balance on the date a year after the valuation date, and the scheduled payment for fiscal year 2019-20. Please refer to Appendix A for an explanation of how amortization periods are determined.

There is a one-year lag between the valuation date and the start of the contribution fiscal year.

- The assets, liabilities, and funded status of the plan are measured as of the valuation date: June 30, 2018.
- The required employer contributions determined by the valuation are for the fiscal year beginning one year after the valuation date: fiscal year 2019-20.

This one-year lag is necessary due to the amount of time needed to extract and test the membership and financial data, and the need to provide employers with their required employer contribution well in advance of the start of the fiscal year.

The Unfunded Accrued Liability (UAL) is used to determine the employer contribution and therefore must be rolled forward one year from the valuation date to the first day of the fiscal year for which the contribution is being determined. The UAL is rolled forward each year by subtracting the expected payment on the UAL for the fiscal year and adjusting for interest. The expected payment on the UAL for a fiscal year is equal to the Expected Employer Contribution for the fiscal year, plus any additional discretionary payments made during the year, minus the Expected Normal Cost for the year. The Employer Contribution for the first fiscal year is determined by the actuarial valuation one year ago. The Normal Cost Rate for the fiscal year is assumed to be the same as the rate determined by the current valuation. Expected dollar amounts are determined by multiplying the rate by the expected payroll for the applicable fiscal year, based on payroll as of the valuation date.

Reason for Base	Date Established	Remaining Amortization Period	Balance on 6/30/2018	Expected Payment in 2018-19	Amount Remaining on 6/30/2019	Scheduled Payment for Fiscal Year 2019-20	Payment as Percentage of Payroll
Fresh Start (Gain/Loss)	6/30/2004	16	\$2,757,180,891	\$229,622,682	\$2,719,275,637	\$236,163,872	1.659%
Assumption Change	6/30/2009	11	941,016,754	101,102,521	904,537,104	103,970,400	0.730%
Gain)/Loss	6/30/2009	21	861,021,198	60,633,887	860,651,826	62,367,448	0.438%
Gain)/Loss	6/30/2010	22	420,046,250	28,796,358	420,677,640	29,620,220	0.208%
Assumption Change	6/30/2011	13	1,285,241,066	122,927,212	1,251,115,685	126,420,426	0.888%
Gain)/Loss	6/30/2011	23	(921,645,481)	(61,617,651)	(924,652,567)	(63,381,691)	(0.445%)
Gain)/Loss	various	25	(334,427,976)	(21,363,453)	(336,549,672)	(21,975,843)	(0.153%)
Gain)/Loss	6/30/2014	26	4,274,284,266	226,368,332	4,349,739,263	291,068,869	2.045%
Assumption Change	6/30/2015	17	4,867,104,152	267,443,180	4,943,000,830	366,751,166	2.576%
Gain)/Loss	6/30/2015	27	4,137,027,907	164,721,848	4,266,373,888	225,929,760	1.587%
Gain)/Loss	6/30/2016	28	5,012,599,961	135,099,889	5,236,101,883	208,470,932	1.465%
Assumption Change	6/30/2017	19	1,438,363,705	27,111,289	1,514,568,195	55,772,406	0.392%
Gain)/Loss	6/30/2017	29	(367,609,783)	(5,095,263)	(388,984,757)	(10,483,691)	(0.074%)
Method Change	6/30/2018	20	1,236,652,437	4,427,742	1,321,724,299	24,908,810	0.175%
Assumption Change	6/30/2018	20	2,042,603,228	(66,692,861)	2,259,760,140	42,586,745	0.299%
(Gain)/Loss	6/30/2018	30	(424,861,909)	41,547,019	(498,691,144)	(6,912,241)	(0.049%)
<b>Total</b>			<b>\$27,224,596,666</b>	<b>\$1,255,032,731</b>	<b>\$27,898,648,250</b>	<b>\$1,671,277,588</b>	<b>11.741%</b>

## Liabilities and Employer Contributions

### (Gain)/Loss Analysis

To calculate the cost requirements of the plan, assumptions are made about future events that affect the amount and timing of benefits to be paid and assets to be accumulated. Each year, actual experience is compared to the expected experience based on the actuarial assumptions. Deviations between expected and actual experience result in actuarial gains or losses, as shown below.

<b>1) Total (Gain)/Loss for the Year</b>	
a) Unfunded Accrued Liability (UAL) as of June 30, 2017	\$23,550,600,817
b) Expected Payment on the UAL during 2017-18	885,193,805
c) Interest through June 30, 2018 $[.07375 \times (1a) - ((1.07375)^{1/2} - 1) \times (1b)]$	1,704,795,898
d) Expected UAL before Other Changes $[(1a) - (1b) + (1c)]$	\$24,370,202,910
e) Change Due to Plan Changes	-
f) Change Due to Assumptions Changes	2,042,603,228
g) Change Due to Method Changes	1,236,652,437
h) Expected UAL After All Other Changes $[(1d) + (1e) + (1f) + (1g)]$	\$27,649,458,575
i) Actual Unfunded Accrued Liability as of June 30, 2018	27,224,596,666
<b>j) Total (Gain)/Loss for 2017-18 [(1i) - (1h)]</b>	<b>(\$424,861,909)</b>
<b>2) Contribution (Gain)/Loss for the Year</b>	
a) Expected Contribution (Employer and Employee)	\$2,993,239,930
b) Actual Contributions	2,985,684,348
<b>c) Contribution (Gain)/Loss for 2017-18 [(2a) - (2b)]</b>	<b>\$7,555,582</b>
<b>3) Asset (Gain)/Loss for the Year</b>	
a) Market Value of Assets as of June 30, 2017	\$60,865,459,800
b) Prior Fiscal Year Receivables	(95,503,089)
c) Current Fiscal Year Receivables	103,840,033
d) Contributions Received	2,985,684,348
e) Benefits and Refunds Paid	(4,053,118,756)
f) Transfers and Miscellaneous Adjustments	29,791,414
g) Expected Interest $[0.07375 \times (3a + 3b) + ((1.07375)^{1/2} - 1) \times ((3d) + (3e) + (3f))]$	4,444,201,824
h) Expected Assets as of June 30, 2018 $[(3a) + (3b) + (3c) + (3d) + (3e) + (3f) + (3g)]$	64,280,355,574
i) Market Value of Assets as of June 30, 2018	64,846,338,847
<b>j) Asset (Gain)/Loss for 2017-18 [(3h) - (3i)]</b>	<b>(\$565,983,273)</b>
<b>4) Liability (Gain)/Loss for the Year</b>	
a) Total (Gain)/Loss (1j)	(\$424,861,909)
b) Contribution (Gain)/Loss (2c)	7,555,582
c) Asset (Gain)/Loss (3j)	(565,983,273)
<b>d) Liability (Gain)/Loss for 2017-18 [(4a) - (4b) - (4c)]</b>	<b>\$133,565,782</b>

### Reconciliation of Employer Contributions

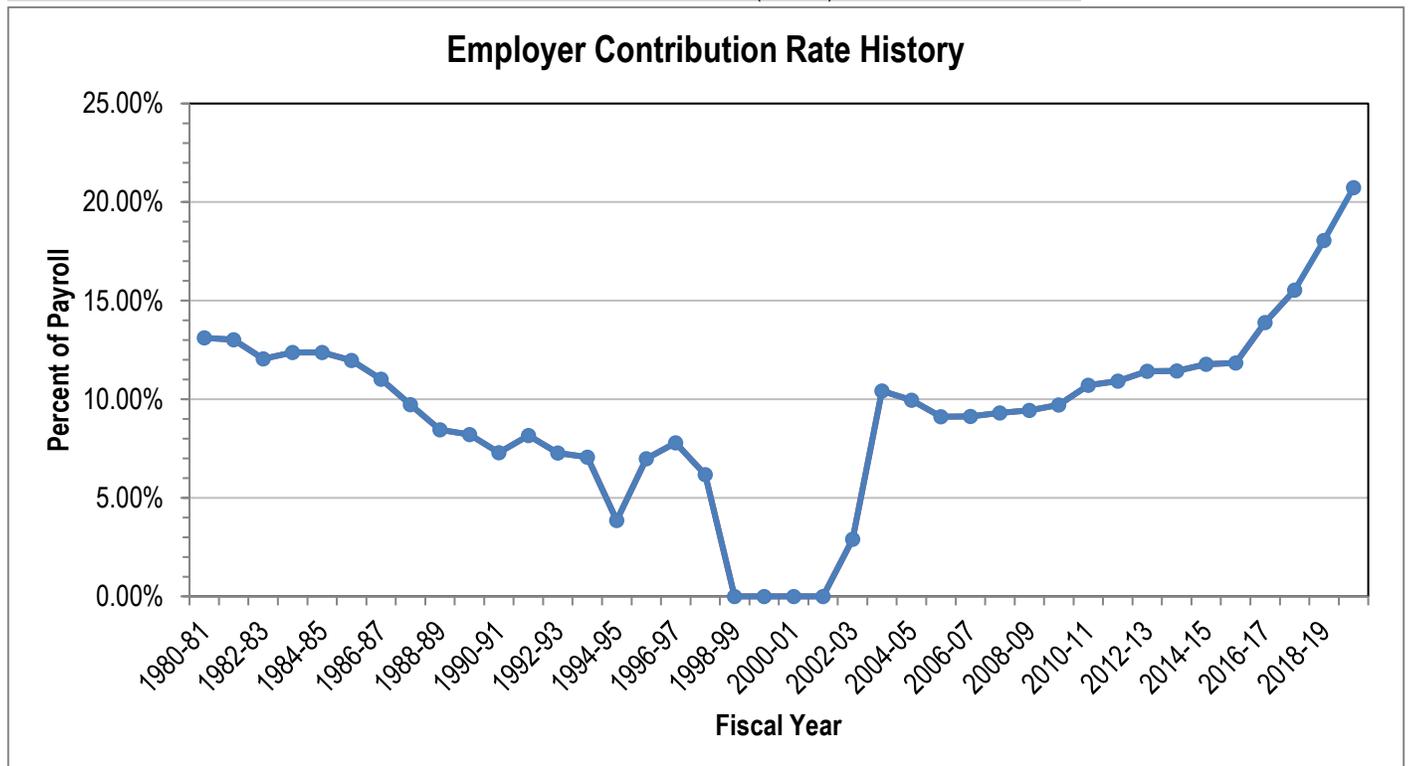
	Percentage of Projected Payroll	Estimated \$ Based on Projected Payroll
1) Contribution for 7/1/17-6/30/18	18.062%	\$2,471,546,239
2) Effect of changes since the prior year annual valuation		
a) Effect of unexpected changes in demographics and financial results	(0.246%)	(34,954,202)
b) Effect of plan changes	0.000%	0
c) Effect of changes in assumptions	0.781%	111,197,027
d) Effect of changes in method	0.143%	20,353,771
e) Effect of progression of amortization bases and change in payroll	1.993%	383,100,827
f) Net effect of the changes above [sum of a through e]	2.671%	479,697,423
<b>3) Contribution for 7/1/19 - 6/30/20 [(1) +(2f)]</b>	<b>20.733%</b>	<b>\$2,951,243,662</b>

# Liabilities and Employer Contributions

## History of Employer Contribution Rates

The table below provides a 25-year history of contribution rates for the Schools Pool. In cases where the contribution rate changed during the course of a fiscal year, the entry shown is the weighted average of the rates effective during the fiscal year.

Fiscal Year	Valuation Date	Employer Normal Cost	Unfunded Liability Contribution/(Credit)	Total Employer Contribution
2019 - 2020	6/30/2018	8.992%	11.741%	20.733%
2018 - 2019	6/30/2017	8.739%	9.323%	18.062%
2017 - 2018	6/30/2016	8.103%	7.428%	15.531%
2016 - 2017	6/30/2015	8.242%	5.646%	13.888%
2015 - 2016	6/30/2014	7.621%	4.226%	11.847%
2014 - 2015	6/30/2013	7.814%	3.957%	11.771%
2013 - 2014	6/30/2012	7.313%	4.129%	11.442%
2012 - 2013	6/30/2011	7.415%	4.002%	11.417%
2011 - 2012	6/30/2010	7.132%	3.791%	10.923%
2010 - 2011	6/30/2009	7.173%	3.534%	10.707%
2009 - 2010	6/30/2008	7.410%	2.299%	9.709%
2008 - 2009	6/30/2007	7.414%	2.014%	9.428%
2007 - 2008	6/30/2006	7.421%	1.885%	9.306%
2006 - 2007	6/30/2005	7.398%	1.726%	9.124%
2005 - 2006	6/30/2004	7.399%	1.717%	9.116%
2004 - 2005	6/30/2003	7.393%	2.559%	9.952%
2003 - 2004	6/30/2002	9.396%	1.024%	10.420%
2002 - 2003	6/30/2001	9.329%	(6.435%)	2.894%
2001 - 2002	6/30/2000	9.082%	(9.082%)	0.000%
2000 - 2001	6/30/1999	6.914%	(6.914%)	0.000%
1999 - 2000	6/30/1998	6.867%	(6.867%)	0.000%
1998 - 1997	6/30/1997	6.829%	(6.829%)	0.000%
1997 - 1998	6/30/1996	7.582%	(1.410%)	6.172%
1996 - 1997	6/30/1995	7.576%	0.211%	7.787%
1995 - 1996	6/30/1994	7.556%	(0.578%)	6.979%



## Liabilities and Employer Contributions

### History of Funded Status and Funding Progress (dollars in millions)

Shown below is a 30-year history of funding status for the Schools Pool. One could view the trend in the ratio of the unfunded liability to covered payroll as a measure of the ability of the employer to address the unfunded liability.

Valuation Date	Actuarial Accrued Liabilities	Market Value of Assets	Unfunded Liabilities/(Surplus)	Funded Ratio	Projected Payroll for Contribution	Unfunded/(Surplus) as a % of Payroll
6/30/2018	\$92,071	\$64,846	\$27,225	70.4%	\$14,234	191.3%
6/30/2017	84,416	60,865	23,551	72.1%	13,683	172.1%
6/30/2016	77,544	55,785	21,759	71.9%	13,022	167.1%
6/30/2015	73,325	56,814	16,511	77.5%	12,098	136.5%
6/30/2014	65,600	56,838	8,761	86.6%	11,294	77.6%
6/30/2013	61,487	49,482	12,005	80.5%	10,424	115.2%
6/30/2012	59,439	44,854	14,585	75.5%	10,242	142.4%
6/30/2011	58,358	45,901	12,457	78.7%	10,540	118.2%
6/30/2010	55,307	38,435	16,872	69.5%	11,283	149.5%
6/30/2009	52,493	34,146	18,347	65.0%	11,110	165.1%
6/30/2008	48,538	45,548	2,990	93.8%	11,138	26.8%
6/30/2007	44,810	48,293	(3,483)	107.8%	10,250	(34.0%)
6/30/2006	41,409	40,852	556	98.7%	9,881	5.6%
6/30/2005	38,368	36,898	1,469	96.2%	9,223	15.9%
6/30/2004	35,933	32,828	3,104	91.4%	9,069	34.2%
6/30/2003	33,793	28,182	5,611	83.4%	9,079	61.8%
6/30/2002	31,271	27,690	3,581	88.5%	8,344	42.9%
6/30/2001	27,946	30,308	(2,361)	108.4%	7,912	(29.8%)
6/30/2000	25,474	33,295	(7,821)	130.7%	7,053	(110.9%)
6/30/1999	21,216	30,918	(9,702)	145.7%	5,961	(162.8%)
6/30/1998	19,499	27,874	(8,374)	142.9%	5,445	(153.8%)
6/30/1997	17,583	23,499	(5,916)	133.6%	4,907	(120.5%)
6/30/1996	17,572	19,706	(2,135)	112.1%	5,146	(41.5%)
6/30/1995	16,422	17,314	(892)	105.4%	5,351	(16.7%)
6/30/1994	15,136	15,373	(238)	101.6%	5,140	(4.6%)
6/30/1993	13,575	14,956	(1,381)	110.2%	4,853	(28.4%)
6/30/1992	12,856	13,816	(960)	107.5%	4,883	(19.7%)
6/30/1991	12,022	13,301	(1,298)	110.8%	4,850	(26.8%)
6/30/1990	11,249	9,298	1,951	82.7%	4,393	44.4%
6/30/1989	9,941	9,926	16	99.8%	4,054	0.4%
6/30/1988	9,395	8,341	1,054	88.8%	3,769	28.0%
6/30/1987	8,583	8,174	409	95.2%	3,605	11.3%

# Risk Analysis

- 20 Future Investment Return Scenarios
- 21 Discount Rate Sensitivity
- 21 Mortality Rate Sensitivity
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- 22 Maturity Measures
- 23 Volatility Ratios

# Risk Analysis

## Future Investment Return Scenarios

Analysis was performed to determine the effects of various future investment returns on required employer contributions. Starting with the baseline projections and underlying inputs/assumptions described in "Projected Future Contribution Rates", the projections below provide a range of results based on five hypothetical investment return scenarios over the three following fiscal years (2019-20, 2020-21, and 2021-22). Each scenario assumes an alternate fixed annual return during each of these fiscal years.

The alternate investment returns were chosen based on stochastic analysis of possible future investment returns over a four-year period. Using the expected return and volatility of each asset class in which the funds are invested, 10,000 stochastic outcomes were generated for this period. Annual returns were then selected that approximate the 5th, 25th, 50th, 75th, and 95th percentiles of these outcomes. The corresponding annual returns are 1.0 percent, 4.0 percent, 7.0 percent, 9.0 percent and 12.0 percent. For example, of all the four-year outcomes generated in the stochastic analysis, approximately 25 percent had an average annual return of 4.0 percent or less.

On February 14, 2018, the Board adopted a new amortization policy effective with the June 30, 2019 actuarial valuation, first affecting the Schools Pool employer contributions for fiscal year 2020-21. The new policy will generally accelerate the recognition of new sources of UAL. Existing UAL bases will not be affected. The new policy is reflected in the projected contribution rates shown in the following section.

Required contributions outside of this range are also possible. In particular; while it is unlikely that investment returns will average less than 1.0 percent or greater than 12.0 percent over this period, the possibility of a single investment return less than 1.0 percent or greater than 12.0 percent in any given year is much greater.

The table below shows the projected contribution rates for 2020-21 through 2023-24 for the Schools Pool. These projections reflect a 6.7 percent investment return reduced for estimated administrative expenses for 2018-19 and the five different scenarios from 2019-20 through 2021-22.

Assumed Annual Return From 2019-20 through 2021-22	Projected Employer Contributions			
	2020-21	2021-22	2022-23	2023-24
1.0%	22.8%	26.2%	29.6%	33.9%
4.0%	22.8%	25.5%	27.7%	30.3%
Assumed 7.0%	22.8%	24.9%	25.9%	26.6%
9.0%	22.8%	24.5%	24.6%	24.1%
12.0%	22.8%	23.8%	22.6%	20.1%

The projections above do not reflect any potential impact of CalPERS' Funding Risk Mitigation Policy.

The projected normal cost percentages do reflect that the normal cost will decline over time as new employees are hired into PEPRA or other lower cost benefit tiers.

## Risk Analysis

### Discount Rate Sensitivity

The discount rate reflects expectations of what the markets will deliver in the future. It is calculated based on two components: expected price inflation and real rate of return. A change in either component over the long term would necessitate further evaluation of the discount rate.

This section includes an analysis of discount rate sensitivity on employer contribution rates under two different discount rate scenarios. This type of analysis conveys a sense of the long-term risk to the employer contribution rates and changes to the funded status on a Market Value of Assets basis.

This section shows the impact on employer contribution rates using the ultimate discount rate of 7.0 percent as well as alternate discount rates of 6.0 percent and 8.0 percent. The rates of 6.0 percent and 8.0 percent were selected since they illustrate the impact of a 1.0 percent increase or decrease to the ultimate rate. This analysis shows the potential plan impacts if the PERF were to realize investment returns of 6.0 percent or 8.0 percent over the long term.

As of June 30, 2018	Discount Rate Sensitivity Analysis					
	Employer Normal Cost	Unfunded Liability Rate	Total Employer Rate	Accrued Liability	Unfunded Accrued Liability	Funded Status
7.25% (current discount rate)	8.992%	11.741%	20.733%	\$92,070,935,513	\$27,224,596,666	70.4%
6.0%	14.0%	18.6%	32.6%	\$107,189,100,440	\$42,342,761,593	60.5%
7.0%	9.7%	13.0%	22.7%	\$94,554,832,484	\$29,708,493,637	68.6%
8.0%	6.4%	7.6%	14.0%	\$84,084,601,207	\$19,238,262,360	77.1%

- The change in accrued liability due to the change in ultimate discount rate of +/-1.0% was amortized over 20 years as a level percentage of pay.
- In the case of a surplus, rates were calculated to equal the employer normal cost rate. This is based on a provision in the Public Employees' Pension Reform Act of 2013 (PEPRA) that requires a minimum employer contribution rate in combination with employee contributions shall not be less than the normal cost rate.
- Numbers may not add due to rounding.

### Mortality Rate Sensitivity

The following table shows how June 30, 2018 valuation results would differ under two alternate longevity scenarios, namely assuming rates of mortality are 10 percent lower or 10 percent higher than our current mortality assumptions. This type of analysis highlights the impact on the plan of improving or worsening mortality over the long-term.

As of June 30, 2018	Mortality Rate Analysis			
	Accrued Liability	Market Value of Assets	Unfunded Accrued Liability	Funded Status
Current Mortality	\$92,070,935,513	\$64,846,338,847	\$27,224,596,666	70.4%
10% Lower Mortality Rates	\$94,022,131,976	\$64,846,338,847	\$29,175,793,129	69.0%
10% Higher Mortality Rates	\$90,275,805,533	\$64,846,338,847	\$25,429,466,686	71.8%

## Risk Analysis

### Inflation Rate Sensitivity

The following table show how June 30, 2018 valuation results would differ under two alternate inflation rate scenarios, namely assuming the inflation rate is 1 percent lower or 1 percent higher than the current valuation inflation rate assumption of 2.625 percent, while holding the discount rate fixed at 7.25 percent. This type of analysis highlights the impact on the plan of higher or lower inflation of over the long-term.

As of June 30, 2018	Inflation Rate Analysis			
	Accrued Liability	Market Value of Assets	Unfunded Accrued Liability	Funded Status
Current Inflation Rate	\$92,070,935,513	\$64,846,338,847	\$27,224,596,666	70.4%
-1% Inflation Rate	\$85,546,529,717	\$64,846,338,847	\$20,700,190,870	75.8%
+1% Inflation Rate	\$95,256,820,888	\$64,846,338,847	\$30,410,482,041	68.1%

### Maturity Measures

As pension plans mature they become more sensitive to risks. To understand plan maturity and how it affects the ability of a pension plan sponsor to tolerate risk, it is important to understand how a plan is impacted by investment return volatility, other economic variables and changes in longevity or other demographic assumptions.

One measure of a plan's maturity is the ratio of retiree liability to total liability. A pension plan in its infancy will have a very low ratio of retiree liability to total liability. As the plan matures, the ratio increases. A mature plan will often have a ratio above 60-65 percent. For both CalPERS and many other retirement systems in the United States, these ratios have been steadily increasing in recent years.

#### Ratio of Retiree Accrued Liability to Total Accrued Liability

	June 30, 2017			June 30, 2018		
	Retiree Accrued Liability	Total Accrued Liability	Ratio	Retiree Accrued Liability	Total Accrued Liability	Ratio
Schools Pool	42,171,974,178	84,416,060,617	50.0%	46,733,785,169	92,070,935,513	50.8%

Another measure of maturity is the ratio of actives to retirees, also called the Support Ratio. A pension plan in its infancy will have a very high ratio of active to retired members. As the plan matures, and members retire, the ratio declines. A mature plan will often have a ratio near or below one.

#### Support Ratio

Plan	June 30, 2017			June 30, 2018		
	Number of Actives	Number of Retirees	Support Ratio	Number of Actives	Number of Retirees	Support Ratio
Schools Pool	317,860	225,490	1.41	323,707	233,733	1.38

Volatility ratios, presented in the following section, are another measure for assessing plan maturity.

## Risk Analysis

### Volatility Ratios

The actuarial calculations supplied in this communication are based on number of assumptions about long-term demographic and economic behavior. Unless these assumptions (e.g. terminations, deaths, disabilities, retirements, salary growth, and investment return) are exactly realized each year, there will be differences on a year-to-year basis. The year-to-year differences between actual experience and the assumptions are called actuarial gains and losses and serve to lower or raise the employer's rates from one year to the next. Therefore, the rates will inevitably fluctuate, especially due to fluctuations in investment returns.

#### Asset Volatility Ratio (AVR)

Plans that have higher asset-to-payroll ratios produce more volatile employer rates due to investment return. For example, a plan with an asset-to-payroll ratio of 8 may experience twice the contribution volatility due to investment return volatility than a plan with an asset-to-payroll ratio of 4. Shown below is the asset volatility ratio, a measure of the plan's current rate volatility. It should be noted that this ratio is a current measure. It increases over time but generally tends to stabilize as the plan matures.

#### Liability Volatility Ratio (LVR)

Plans that have higher liability-to-payroll ratios experience more volatile employer rates due to investment return and changes in liability. For example, a plan with a liability-to-payroll ratio of 12 is expected to have twice the contribution volatility of a plan with a liability-to-payroll ratio of 6. The liability volatility ratio is also included in the table below. It should be noted that this ratio indicates a longer-term potential for contribution volatility. The asset volatility ratio, described above, will tend to move closer to the liability volatility ratio as the plan matures.

#### Contribution Volatility

Market Value of Assets without Receivables	Payroll	Asset Volatility Ratio	Accrued Liability 7.25% discount rate	Liability Volatility Ratio	Accrued Liability 7.00% discount rate	Projected Liability Volatility Ratio
(1)	(2)	(1)/(2)	(3)	(3)/(2)	(4)	(4)/(2)
\$64,742,498,814	\$13,450,005,563	4.8	\$92,070,935,513	6.8	\$94,554,832,484	7.0

# Appendices

A-1 Appendix A – Statement of Actuarial Methods and Assumptions

B-1 Appendix B – Principal Plan Provisions

C-1 Appendix C – Participant Data

D-1 Appendix D – Normal Cost Information

E-1 Appendix E – Glossary of Actuarial Terms

# Appendix A – Statement of Actuarial Methods and Assumptions

## Actuarial Data

As stated in the Actuarial Certification, the data which serves as the basis for this valuation has been obtained from the various CalPERS databases. We have reviewed the valuation data and believe that it is reasonable and appropriate in aggregate. We are unaware of any potential data issues that would have a material effect on the results of this valuation, except that data does not always contain the latest salary information for former members now in reciprocal systems and does not recognize the potential for unusually large salary deviation in certain cases such as elected officials. Therefore, salary information in these cases may not be accurate. These situations are relatively infrequent, however, and when they do occur, they generally do not have a material impact on the employer contribution rates.

## Actuarial Methods

### Actuarial Cost Method

The actuarial cost method used is the Entry Age Normal Cost Method. Under this method, projected benefits are determined for all members and the associated liabilities are spread in a manner that produces level annual cost as a percent of pay in each year from the member's age of hire (entry age) to their assumed retirement age on the valuation date. The cost allocated to the current fiscal year is called the normal cost.

The actuarial accrued liability for active members is then calculated as the portion of the total cost of the plan allocated to prior years. The actuarial accrued liability for members currently receiving benefits and for members entitled to deferred benefits is equal to the present value of the benefits expected to be paid. Normal costs are not applicable for these members.

### Amortization of Unfunded Actuarial Accrued Liability

The excess of the total accrued liability over the market value of plan assets is called the unfunded accrued liability (UAL). Funding requirements are determined by adding the normal cost and an amortization payment toward the UAL. The UAL is amortized as a "level percentage of pay" wherein the amortization payment increases each year at an escalation rate equal to the assumed payroll growth rate. All new gains or losses are tracked and amortized over a fixed 30-year period with a 5-year ramp up at the beginning and a 5-year ramp down at the end of the amortization period. All changes in liability due to plan amendments (other than golden handshakes) are amortized over a 20-year period with no ramp. Changes in actuarial assumptions, or changes in actuarial methodology are amortized separately over a 20-year period with a 5-year ramp up at the beginning and a 5-year ramp down at the end of the amortization period. Changes in UAL due to a golden handshake are amortized over a period of 5 years. A summary of the current policy is provided in the table below:

Driver	Source				
	(Gain)/Loss		Assumption or Method Change	Benefit Change	Golden Handshake
	Investment	Non-Investment			
Amortization Period	30 Years	30 Years	20 Years	20 Years	5 Years
Escalation Rate - Active Plans - Inactive Plans	2.75% 0%	2.75% 0%	2.75% 0%	2.75% 0%	2.75% 0%
Ramp Up	5	5	5	0	0
Ramp Down	5	5	5	0	0

# Appendix A - Statement of Actuarial Methods and Assumptions

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## Actuarial Methods (continued)

The 5-year ramp up means that the payments in the first four years of the amortization period are 20 percent, 40 percent, 60 percent and 80 percent of the “full” payment which begins in year five. The 5-year ramp down means that the reverse is true in the final four years of the amortization period.

On February 14, 2018, the Board adopted a new amortization policy effective with the June 30, 2019 actuarial valuation, first affecting Schools Pool employer contributions for fiscal year 2020-21. The new policy will generally accelerate the recognition of new sources of UAL. Since this change is not effective until a future valuation and will not affect any amortization bases already in existence upon implementation, it has no effect on the June 30, 2018 valuation results or fiscal year 2019-20 required contributions. The new amortization policy is incorporated in the projected contribution rates shown in the “Future Investment Return Scenarios” section of this report.

### Exceptions for Inconsistencies

An exception to the amortization rules above is used whenever their application results in inconsistencies. In these cases, a “fresh start” approach is used. This means that the current unfunded actuarial liability is projected and amortized over a set number of years. For example, a fresh start is needed in the following situations:

- 1) When a positive payment would be required on a negative unfunded actuarial liability (or conversely a negative payment on a positive unfunded actuarial liability); or
- 2) When there are excess assets, rather than an unfunded liability. In this situation, a 30-year fresh start is used.

It should be noted that the actuary may determine that a fresh start is necessary under other circumstances. In all cases of fresh start, the period is set by the actuary at what is deemed appropriate; however, the period will not be greater than 30 years.

### Asset Valuation Method

The Actuarial Value of Assets is set equal to the Market Value of Assets. The direct rate smoothing technique described under “Amortization of Unfunded Actuarial Accrued Liability” is used to determine employer contribution rates.

### Accounts Receivable

In preparing valuations and setting employer contribution rates, asset values include accounts receivable. The CalPERS Actuarial Office assumes that all assets are accruing interest at the actuarially assumed rate. Therefore, the rates depicted assume that all payments have been made and are accruing interest.

### PEPRA Normal Cost Rate Methodology

The Public Employees’ Pension Reform Act of 2013 (PEPRA) mandated new benefit formulas and new member contributions for members hired on or after January 1, 2013, as defined by PEPRA. Different assumptions for PEPRA members are disclosed below.

# Appendix A - Statement of Actuarial Methods and Assumptions

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## Actuarial Methods (continued)

### **Purchasing Power Protection Act (PPPA) Method**

PPPA benefits are cost-of-living adjustments intended to maintain the individual's current retirement benefit at 75 percent of the original benefit at retirement adjusted for inflation since retirement. The PPPA benefit is paid, if necessary, in addition to any other cost-of-living adjustment provided under the terms of the plan. Prior to January 1, 2001, there was a single PPPA pool covering all CalPERS employers. However, commencing January 1, 2001, separate PPPA pools were established. A pool was set up for all State plans and a separate pool for school employers. The public agencies were removed entirely from PPPA pooling resulting in each public agency plan paying for its own PPPA benefits. The creation of separate pools effectively eliminates the cross subsidization between the State, Schools and public agencies.

For the Schools Pool, the total annual outlay for PPPA benefits is limited by State statute to earnings of up to 1.1 percent of accumulated member contributions. If this annual outlay is insufficient to provide the PPPA benefits in a given fiscal year, the 75 percent maintenance target would be proportionately reduced. Since the inception of the PPPA benefit program, 1.1 percent has proved more than sufficient to provide the 75 percent maintenance. Under the inflation assumption of 2.75 percent compounded annually, the 1.1 percent appears to remain more than sufficient in the foreseeable future.

### **Internal Revenue Code Section 415**

The valuation reflects the limitations on benefits imposed by Internal Revenue Code Section 415. The current valuation is based on the IRC 415(b) dollar limit for 2018 of \$220,000, up from the 2017 limit of \$215,000 used in the prior valuation.

### **Internal Revenue Code Section 401(a)(17)**

The valuation reflects the limitations on pensionable compensation imposed by Internal Revenue Code Section 401(a)(17). The current valuation is based on the IRC 401(a)(17) limit for 2018 of \$275,000, up from the 2017 limit of \$270,000 used in the prior valuation.

# Appendix A - Statement of Actuarial Methods and Assumptions

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## Actuarial Assumptions

In 2017, CalPERS completed its most recent asset liability management study incorporating actuarial assumptions and strategic asset allocation. In December 2017, the CalPERS Board of Administration adopted relatively modest changes to the asset allocation that reduced the expected volatility of returns. The adopted asset allocation was expected to have a long-term blended return that continued to support a discount rate assumption of 7.00 percent. The Board also approved several changes to the demographic assumptions that more closely aligned with actual experience. These new actuarial assumptions were first used in the June 30, 2018 valuation to set the fiscal year 2019-20 contribution for the state plans.

On December 21, 2016, the CalPERS Board of Administration lowered the discount rate from 7.50 percent to 7.00 percent using a three-year phase-in beginning with the June 30, 2017 actuarial valuations for the Schools Pool. The minimum employer contributions for fiscal year 2019-20 determined in the June 30, 2018 valuation were calculated using a discount rate of 7.25 percent. The projected employer contributions are calculated assuming that the discount rate will be lowered to 7.00 percent the following year as adopted by the Board. The decision to reduce the discount rate was primarily based on reduced capital market assumptions provided by external investment consultants and CalPERS investment staff. The specific decision adopted by the Board reflected recommendations from CalPERS staff and additional input from employer and employee stakeholder groups. Based on the investment allocation adopted by the Board and capital market assumptions, the reduced discount rate schedule provides a more realistic assumption for the long-term investment return of the fund.

Notwithstanding the Board's decision to phase into a 7.0 percent discount rate, subsequent analysis of the expected investment return of CalPERS assets or changes to the investment allocation may result in a further change to the discount rate.

For more details and additional rationale for the selection of the actuarial assumptions, please refer to the CalPERS Experience Study and Review of Actuarial Assumptions report from December 2017 that can be found on the CalPERS website under: "Forms and Publications". Click on "View All" and search for Experience Study.

All actuarial assumptions used in this report represent estimates of future experience rather than observations of estimates inherent in market data.

# Appendix A - Statement of Actuarial Methods and Assumptions

## Economic Assumptions

### Discount Rate

The discount rate is 7.25 percent compounded annually (net of expenses) as of June 30, 2018, (reduced from 7.375 percent in the prior valuation). The discount rate will be further reduced to 7.00 percent compounded annually (net of expenses) as of June 30, 2019.

### Salary Growth

Annual increases vary by entry age and duration of service. A sample of assumed increases is shown below. Wage inflation assumption in the valuation year (2.875 percent for 2018, reduced from 3.0 percent for 2017) is added to these factors for total salary growth.

Duration of Service	Entry Age		
	20	30	40
0	4.28%	4.19%	3.80%
3	3.54%	3.32%	2.80%
5	2.62%	2.34%	1.80%
10	1.71%	1.54%	1.13%
15	1.52%	1.34%	0.98%
20	1.35%	1.17%	0.86%
25	1.20%	1.03%	0.76%
30	0.87%	0.71%	0.48%

### Overall Payroll Growth

2.875 percent compounded annually (used in projecting the payroll over which unfunded accrued liability is amortized). The payroll growth rate will be further reduced to 2.75 percent as of June 30, 2019.

### Inflation

2.625 percent compounded annually. The inflation rate will be further reduced to 2.5 percent as of June 30, 2019.

## Demographic Assumptions

### Post-Retirement Mortality

Rates vary by age, type of retirement, and gender. See sample rates in table below.

Age	Healthy Recipients		Non-Industrial Disabled (Not Job-Related)		Industrial Disabled (Job-Related)	
	Male	Female	Male	Female	Male	Female
50	0.00372	0.00346	0.01183	0.01083	0.00372	0.00346
55	0.00437	0.00410	0.01613	0.01178	0.00437	0.00410
60	0.00671	0.00476	0.02166	0.01404	0.00671	0.00476
65	0.00928	0.00637	0.02733	0.01757	0.01113	0.00765
70	0.01339	0.00926	0.03358	0.02184	0.01607	0.01112
75	0.02316	0.01635	0.04277	0.02969	0.02779	0.01962
80	0.03977	0.03007	0.06272	0.04641	0.04773	0.03609
85	0.07122	0.05418	0.09793	0.07847	0.08547	0.06501
90	0.13044	0.10089	0.14616	0.13220	0.14348	0.11098
95	0.21658	0.17698	0.21658	0.21015	0.21658	0.17698
100	0.32222	0.28151	0.32222	0.32226	0.32222	0.28151

# Appendix A - Statement of Actuarial Methods and Assumptions

## Demographic Assumptions (continued)

### Marital Status

For active members 85 percent are assumed to be married upon retirement.

### Age of Spouse

It is assumed that female spouses are 3 years younger than male spouses.

### Terminated Members

Terminated members who are non-vested are assumed to refund immediately. Terminated members who are vested are assumed to retire at age 59 for Schools Pool members.

### Termination with Refund

Rates vary by entry age and service. See sample rates in the table below.

Duration of Service	Entry Age				
	20	25	30	35	40
5	0.0808	0.0808	0.0634	0.0461	0.0409
6	0.0618	0.0618	0.0482	0.0345	0.0305
7	0.0462	0.0462	0.0359	0.0255	0.0223
8	0.0343	0.0343	0.0266	0.0189	0.0161
9	0.0258	0.0258	0.0200	0.0143	0.0117
10	0.0202	0.0202	0.0157	0.0112	0.0087
14	0.0117	0.0117	0.0087	0.0056	0.0040
15	0.0107	0.0107	0.0077	0.0048	0.0034
19	0.0065	0.0065	0.0043	0.0021	0.0019
20	0.0056	0.0056	0.0037	0.0017	0.0016
24	0.0030	0.0030	0.0020	0.0009	0.0012
25	0.0026	0.0026	0.0018	0.0009	0.0012
29	0.0015	0.0015	0.0012	0.0009	0.0012
30	0.0013	0.0013	0.0011	0.0009	0.0012

# Appendix A - Statement of Actuarial Methods and Assumptions

## Demographic Assumptions (continued)

### Termination with Vested Deferred Benefits

Rates vary by entry age and service. See sample rates in the table below.

Duration of Service	Entry Age				
	20	25	30	35	40
5	0.0405	0.0405	0.0346	0.0288	0.0264
6	0.0404	0.0404	0.0343	0.0281	0.0261
7	0.0395	0.0395	0.0333	0.0272	0.0253
8	0.0377	0.0377	0.0319	0.0261	0.0241
9	0.0353	0.0353	0.0301	0.0249	0.0227
10	0.0324	0.0324	0.0280	0.0235	0.0211
14	0.0219	0.0219	0.0196	0.0172	0.0141
15	0.0202	0.0202	0.0179	0.0155	0.0126
19	0.0154	0.0154	0.0125	0.0095	0.0057
20	0.0144	0.0144	0.0114	0.0083	0.0042
24	0.0102	0.0102	0.0059	0.0017	0.0008
25	0.0091	0.0091	0.0046	—	—
29	0.0029	0.0029	0.0015	—	—
30	0.0015	0.0015	0.0007	—	—

- When a member is eligible to retire, the termination with vested benefits probability is set to zero.
- After termination with vested benefits, a miscellaneous member is assumed to retire at age 59 and a safety member at age 54.

### Non-Industrial (Not Job-Related) Death and Disability

Rates vary by age and gender. See sample rates in the table below.

Attained Age	Non-Industrial Death (Not Job-Related)		Non-Industrial Disability (Not Job-Related)	
	Male	Female	Male	Female
20	0.00022	0.00007	0.00010	0.00011
25	0.00029	0.00011	0.00010	0.00011
30	0.00038	0.00016	0.00011	0.00016
35	0.00049	0.00027	0.00053	0.00043
40	0.00064	0.00037	0.00119	0.00081
45	0.00080	0.00054	0.00195	0.00168
50	0.00116	0.00079	0.00261	0.00224
55	0.00172	0.00120	0.00246	0.00180
60	0.00255	0.00166	0.00221	0.00109

# Appendix A - Statement of Actuarial Methods and Assumptions

## Demographic Assumptions (continued)

### Service Retirement - Classic Members

Rates vary by age and service. See sample rates in the table below.

Attained Age	Years of Service						
	5	10	15	20	25	30	35
50	0.0040	0.0070	0.0110	0.0120	0.0130	0.0150	0.0180
52	0.0050	0.0100	0.0140	0.0160	0.0180	0.0210	0.0240
54	0.0080	0.0170	0.0230	0.0270	0.0310	0.0340	0.0400
56	0.0190	0.0370	0.0530	0.0620	0.0690	0.0780	0.0910
58	0.0220	0.0450	0.0620	0.0740	0.0820	0.0920	0.1080
60	0.0330	0.0660	0.0920	0.1090	0.1210	0.1350	0.1580
62	0.0660	0.1310	0.1840	0.2180	0.2420	0.2710	0.3180
65	0.0800	0.1580	0.2210	0.2610	0.2910	0.3260	0.3830
70	0.0710	0.1400	0.1960	0.2310	0.2580	0.2890	0.3380
75	0.0670	0.1320	0.1840	0.2180	0.2430	0.2720	0.3200

### Service Retirement - PEPRA Members

Rates vary by age and service. See sample rates in the table below.

Attained Age	Years of Service						
	5	10	15	20	25	30	35
50	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
52	0.0040	0.0070	0.0100	0.0110	0.0130	0.0150	0.0170
54	0.0050	0.0110	0.0150	0.0180	0.0200	0.0220	0.0260
56	0.0130	0.0260	0.0370	0.0430	0.0480	0.0550	0.0640
58	0.0170	0.0340	0.0470	0.0560	0.0620	0.0690	0.0810
60	0.0260	0.0530	0.0740	0.0870	0.0970	0.1080	0.1260
62	0.0530	0.1050	0.1470	0.1740	0.1940	0.2170	0.2540
65	0.0720	0.1420	0.1990	0.2350	0.2620	0.2930	0.3450
70	0.0710	0.1400	0.1960	0.2310	0.2580	0.2890	0.3380
75	0.0670	0.1320	0.1840	0.2180	0.2430	0.2720	0.3200

## Miscellaneous Loading Factors

### Credit for Unused Sick Leave

Total years of service is increased by 1 percent for plans with the Credit for Unused Sick Leave provision.

### Norris Decision (Best Factors)

Projected benefit amounts for employees hired prior to July 1, 1982 increased to reflect the use of "Best Factors" in the calculation of optional benefit forms. This is due to a 1983 Supreme Court decision, known as the Norris Decision, which required males and females to be treated equally in the determination of benefit amounts. Consequently, anyone already employed at that time is given the best possible conversion factor when optional benefits are determined. No loading is necessary for employees hired after July 1, 1982.

# Appendix B – Principal Plan Provisions

The following is a description of the principal plan provisions used in calculating costs and liabilities. Many of the statements in this summary are general in nature but are intended to provide an easy to understand summary of the Public Employees' Retirement Law. The law itself governs in all situations.

## Service Retirement

### Eligibility

A classic CalPERS school member becomes eligible for Service Retirement upon attainment of age 50 with at least 5 years of credited service (total service across all CalPERS employers, and with certain other Retirement Systems with which CalPERS has reciprocity agreements). PEPRA school members become eligible for Service Retirement upon attainment of age 52 with at least 5 years of service.

### Benefit

The Service Retirement benefit is a monthly allowance equal to the product of the benefit factor, years of service, and final compensation.

- The benefit factor for classic members comes from the **2% at 55** benefit factor table. New PEPRA members hired on or after January 1, 2013 are subject to the **2% at 62** benefit factor table. The factor depends on the member's age at retirement. Listed below are the factors for retirement at whole year ages:

Retirement Age	2% @ 55 Factor	2% @ 62 Factor
50	1.100%	N/A
51	1.280%	N/A
52	1.460%	1.000%
53	1.640%	1.100%
54	1.820%	1.200%
55	2.000%	1.300%
59	2.064%	1.400%
57	2.126%	1.500%
58	2.188%	1.600%
59	2.250%	1.700%
60	2.314%	1.800%
61	2.376%	1.900%
62	2.438%	2.000%
63	2.500%	2.100%
64	2.500%	2.200%
65	2.500%	2.300%
66	2.500%	2.400%
67 & Up	2.500%	2.500%

- The *years of service* is the amount credited by CalPERS to a member while he or she is employed in this group (or for other periods that are recognized under the employer's contract with CalPERS). For a member who has earned service with multiple CalPERS employers, the benefit from each employer is calculated separately according to each employer's contract, and then added together for the total allowance. Any unused sick leave accumulated at the time of retirement will be converted to credited service at the rate of 0.004 years of service for each day of sick leave.

## Appendix B – Principal Plan Provisions

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### Service Retirement (continued)

- The *final compensation* is the monthly average of the member's highest 12 consecutive months' full-time equivalent monthly pay (no matter which CalPERS employer paid this compensation). For new PEPRA members hired after January 1, 2013 final compensation is based on the monthly average of the member's highest 36 consecutive months' full-time equivalent monthly pay. PEPRA members have a cap on the annual salary that can be used to calculate final compensation for all new members based on the Social Security Contribution and Benefit Base. For employees that participate in Social Security this cap is \$121,388 for 2018 and for those employees that do not participate in social security the cap for 2018 is \$145,666, the equivalent of 120 percent of the 2018 Contribution and Benefit Base. Adjustments to the caps are permitted annually based on changes to the CPI for All Urban Consumers.
- The employees in this plan may or may not be covered by Social Security. For employees with service prior to January 1, 2001 covered by Social Security, the final compensation is offset by \$133.33 (or by one-third if, the final compensation is less than \$400). For PEPRA members, the final compensation is not offset.
- The Service Retirement benefit is not capped.

### Vested Deferred Retirement

#### Eligibility for Deferred Status

A CalPERS member becomes eligible for a deferred vested retirement benefit when he or she leaves employment, keeps his or her contribution account balance on deposit with CalPERS, and has earned at least 5 years of credited service (total service across all CalPERS employers, and with certain other Retirement Systems with which CalPERS has reciprocity agreements).

#### Eligibility to Start Receiving Benefits

The CalPERS classic member becomes eligible to receive the deferred retirement benefit upon satisfying the eligibility requirements for Deferred Status and upon attainment of age 50. PEPRA school members become eligible to receive the deferred retirement benefit upon satisfying the eligibility requirements for Deferred Status and upon attainment of age 52.

#### Benefit

The vested deferred retirement benefit is the same as the Service Retirement benefit, where the benefit factor is based on the member's age at allowance commencement. For members who have earned service with multiple CalPERS employers, the benefit from each employer is calculated separately according to each employer's contract, and then added together for the total allowance.

### Non-Industrial (Non-Job Related) Disability Retirement

#### Eligibility

A CalPERS member is eligible for Non-Industrial Disability Retirement if he or she becomes disabled and has at least 5 years of credited service (total service across all PERS employers, and with certain other Retirement Systems with which PERS has reciprocity agreements). There is no special age requirement. Disabled means the member is unable to perform his or her job because of an illness or injury which is expected to be permanent or to last indefinitely. The illness or injury does not have to be job related. A CalPERS member must be actively working with any CalPERS employer at the time of disability in order to be eligible for this benefit.

#### Benefit

The Non-Industrial Disability Retirement benefit is a monthly allowance equal to 1.8 percent of final compensation, multiplied by *service*, which is determined as follows:

- *service* is CalPERS credited service, for members with less than 10 years of service or greater than 18.518 years of service; or
- *service* is CalPERS credited service plus the additional number of years that the member would have worked until age 60, for members with at least 10 years but not more than 18.518 years of service. The maximum benefit in this case is 33 1/3 percent of Final Compensation.

## Appendix B – Principal Plan Provisions

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### Non-Industrial (Non-Job Related) Disability Retirement (continued)

Members who are eligible for a larger service retirement benefit may choose to receive that benefit in lieu of a disability benefit. Members eligible to retire, and who have attained the normal retirement age determined by their service retirement benefit formula, will receive the same dollar amount for disability retirement as that payable for service retirement. For members who have earned service with multiple CalPERS employers, the benefit attributed to each employer is the total disability allowance multiplied by the ratio of service with a particular employer to the total CalPERS service.

### Post-Retirement Death Benefit

#### Lump Sum Payment

Upon the death of a retiree, a one-time lump sum payment of \$2,000 will be made to the retiree's designated survivor(s), or to the retiree's estate.

#### Form of Payment for Retirement Allowance

Generally, the retirement allowance is paid to the retiree in the form of an annuity for as long as he or she is alive. The retiree may choose to provide for a portion of his or her allowance to be paid to any designated beneficiary after the retiree's death. CalPERS provides for a variety of such benefit options, which the retiree pays for by taking a reduction in his or her retirement allowance. Such reduction takes into account the amount to be provided to the beneficiary and the probable duration of payments (based on the ages of the member and beneficiary) made subsequent to the member's death.

For retirement allowances with respect to service earned by employment in this group, 25 percent of the retirement allowance will automatically be continued to certain statutory beneficiaries upon the death of the retiree, *without* a reduction in the retiree's allowance (50 percent for service not covered by Social Security). This additional benefit is often referred to as post retirement survivor allowance (PRSA) or simply as *survivor continuance*.

In other words, 25 percent of the allowance (or 50 percent for service not covered by Social Security), the *continuance portion*, is paid to the retiree for as long as he or she is alive, and that same amount is continued to the retiree's spouse (or if no eligible spouse, to unmarried children until they attain age 18; or, if no eligible children, to a qualifying dependent parent) for the rest of his or her lifetime. This benefit will not be discontinued in the event the spouse remarries.

The remaining 75 percent of the retirement allowance (or 50 percent for service not covered by Social Security), which may be referred to as the *option portion* of the benefit, is paid to the retiree as an annuity for as long as he or she is alive. Or, the retiree may choose to provide for some of this *option portion* to be paid to any designated beneficiary after the retiree's death. Benefit options applicable to the *option portion* are the same as those offered with the standard form. The reduction is calculated in the same manner but is applied only to the *option portion*.

### Pre-Retirement Death Benefits

#### Basic Death Benefit

##### Eligibility

An employee's beneficiary (or estate) may receive the Basic Death benefit if the member dies while actively employed. A CalPERS member who is no longer actively employed with any CalPERS employer is not eligible for this benefit. A member's survivor who is eligible for any other pre-retirement death benefit described below may choose to receive that death benefit instead of this Basic Death benefit.

##### Benefit

The Basic Death Benefit is a lump sum in the amount of the member's accumulated contributions, where interest is currently credited at 7.25 percent per year. In addition, a lump sum in the amount of six months' salary is paid. For purposes of this benefit, one month's salary is defined as the member's average monthly full-time rate of compensation during the 12 months preceding death.

## Appendix B – Principal Plan Provisions

### Pre-Retirement Death Benefits (continued)

#### 1957 Survivor Benefit

##### Eligibility

An employee's eligible survivor(s) may receive the 1957 Survivor benefit if the member dies while actively employed, has attained at least age 50 for classic members and age 52 for PEPRA school members, and has at least five years of credited service (total service across all CalPERS employers and with certain other Retirement Systems with which CalPERS has reciprocity agreements). A CalPERS member who is no longer actively employed with any CalPERS employer is not eligible for this benefit. An eligible survivor means the surviving spouse to whom the member was married at least one year before death or, if there is no eligible spouse, to the member's unmarried children under age 18. A member's survivor may choose this benefit in lieu of the Basic Death benefit or the Special Death benefit.

##### Benefit

The 1957 Survivor benefit is a monthly allowance equal to one-half of the unmodified Service Retirement benefit that the member would have been entitled to receive if the member had retired on the date of his or her death. If the benefit is payable to the spouse, the benefit is discontinued upon the death of the spouse. If the benefit is payable to a dependent child, the benefit will be discontinued upon death or attainment of age 18, unless the child is disabled. There is a guarantee that the total amount paid will at least equal the Basic Death benefit.

#### Cost-of-Living Adjustments

Retirement and survivor allowances are adjusted each year in May for cost of living, beginning the second calendar year after the year of retirement. The standard cost-of-living adjustment (COLA) is 2 percent. Annual adjustments are calculated by first determining the lesser of 1) 2 percent compounded from the end of the year of retirement or 2) actual rate of inflation. The resulting increase is divided by the total increase provided in prior years. For any particular year, the COLA adjustment may be less than 2 percent (when the rate of inflation is low), may be greater than the rate of inflation (when the rate of inflation is low after several years of high inflation) or may even be greater than 2 percent (when inflation is high after several years of low inflation).

#### Purchasing Power Protection Allowance (PPPA)

Retirement and survivor allowances are protected against inflation by PPPA. PPPA benefits are cost-of-living adjustments that are intended to maintain an individual's allowance at 75 percent of the initial allowance at retirement adjusted for inflation since retirement. The PPPA benefit will be coordinated with other cost-of-living adjustments provided under the plan. The total annual outlay for PPPA is limited to 1.1 percent of accumulated member contributions. If this amount of member contributions were insufficient to provide for PPPA payments, the 75 percent target would be proportionately reduced.

#### Employee Contributions

Each employee contributes toward his or her retirement based upon one of the following schedules. The employer may choose to "pick-up" these contributions for the employees.

The contribution schedule is as follows:

The percent contributed below the monthly compensation breakpoint is 0 percent. The monthly compensation breakpoint is \$0. The percent contributed above the monthly compensation breakpoint is 7 percent for both classic and PEPRA members.

#### Refund of Employee Contributions

If the member's service with the employer ends, and if the member does not satisfy the eligibility conditions for any of the retirement benefits above, the member may elect to receive a refund of his or her employee contributions, which are credited annually with 6 percent interest.

#### 1959 Survivor Benefits Program

For these benefits, please refer to the 1959 Survivor Report.

# Appendix C – Participant Data

## Source of the Participant Data

The data was extracted from various databases within CalPERS and placed in a data warehouse by a series of extract programs. Included in this data is:

- Individual member and beneficiary information,
- Employment and payroll information,
- Accumulated contributions with interest,
- Service information,
- Benefit payment information,
- Information about the various organizations which contract with CalPERS, and
- Detailed information about the plan provisions applicable to each group of members.

## Data Validation Test and Adjustments

Once the information is extracted from the various computer systems into the data warehouse, update queries are then run against this data to correct for flaws found in the data. This part of the process is intended to validate the participant data for all CalPERS plans. It is not specific to the Schools Pool.

Checks on the data included:

- A reconciliation of the membership of the plans,
- Comparisons of various member statistics (average attained age, average entry age, average salary, etc.) for the plan with those from the prior valuation,
- Pension amounts for each retiree and beneficiary receiving payments were compared with the pension amounts from the prior valuation,
- Checks for invalid ages and dates, and
- Reasonableness checks on various key data elements such as service and salary.

As the result of the tests on the data, number of adjustments were determined to be necessary. These included:

- Dates of hire and dates of entry were adjusted where necessary to be consistent with the service fields, the date of birth and each other, and
- The annual earnings rate for most school members were overwritten with the annualized earnings based on their yearly contributions.

## Data Statement

The data does not contain information about reciprocal systems and hence salary information for terminated participants covered by reciprocal systems may not be up to date. This situation is not expected to have a material impact on the employer contribution rates since the total present value for all terminated participants represents less than 2.5 percent of the present value of benefits for all members.

We are unaware of any other data issues that would have a material effect on the results of this valuation. It is our opinion that, after the adjustments noted above, the participant data was sufficient and reliable for the purposes of the valuation

## Appendix C - Participant Data

### Reconciliation of Participants

	Active	Transfer	Terminated	Receiving	Total
<b>As of June 30, 2017</b>	<b>317,860</b>	<b>19,070</b>	<b>197,558</b>	<b>225,490</b>	<b>759,978</b>
Retirements	(10,749)	(971)	(1,562)	13,253	(29)
Industrial Disabilities	(1)	(31)	(1)	39	6
Ordinary Disabilities	(116)	(18)	(51)	208	23
Deaths <sup>1</sup>	(494)	(33)	(577)	(7,551)	(8,655)
New Survivors	-	-	-	1,936	1,936
Non-Vested Terminations <sup>2</sup>	(13,838)	(276)	14,114	0	0
Vested Terminations	(3,815)	(266)	4,084	(3)	0
Refunds of Contributions	(1,964)	(109)	(4,122)	0	(6,195)
Transfers	(1,165)	2,230	(1,040)	(25)	0
Redeposits/Rehires	3,960	(252)	(3,685)	(23)	0
First Year in Status	33,373	107	2,226	0	35,706
Data Corrections <sup>3</sup>	656	215	(23,911)	409	(22,631)
<b>As of June 30, 2018</b>	<b>323,707</b>	<b>19,666</b>	<b>183,033</b>	<b>233,733</b>	<b>760,139</b>

- (1) Includes both deaths without survivors and deaths with survivors receiving a benefit  
(2) Includes non-vested terminated participants with employee contributions left in the plan.  
(3) May include the combining of data records into a single record.

## Appendix C - Participant Data

### Active Members

#### Distribution of Active Members by Age and Service

Attained Age	Years of Service at Valuation Date						Total	Payroll
	0 - 4	5 - 9	10 - 14	15 - 19	20-24	25+		
15 - 24	12,010	28	-	-	-	-	12,038	\$312,796,858
25 - 29	26,756	1,824	53	-	-	-	28,633	893,548,837
30 - 34	22,314	6,769	2,146	44	-	-	31,273	1,179,932,800
35 - 39	18,779	7,410	6,218	1,912	55	2	34,376	1,443,944,244
40 - 44	16,171	7,044	6,643	4,753	1,244	25	35,880	1,567,093,708
45 - 49	16,052	8,317	7,310	5,841	2,949	881	41,350	1,810,034,400
50 - 54	13,539	9,265	8,859	6,922	3,942	3,397	45,924	2,053,240,436
55 - 59	10,569	8,543	9,711	8,278	4,745	5,163	47,009	2,141,504,677
60 - 64	5,751	5,682	6,914	6,230	3,903	3,887	32,367	1,445,881,829
65 and over	2,812	2,846	3,176	2,643	1,678	1,702	14,857	602,027,774
<b>Total</b>	<b>144,753</b>	<b>57,728</b>	<b>51,030</b>	<b>36,623</b>	<b>18,516</b>	<b>15,057</b>	<b>323,707</b>	<b>\$13,450,005,563</b>

Counts are of unique members included in the valuation. Multiple records may exist for members with service in more than one benefit group. This does not result in double counting liabilities.

#### Distribution of Average Annual Salaries by Age and Service

Attained Age	Years of Service at Valuation Date						Average Salary
	0 - 4	5 - 9	10 - 14	15 - 19	20 - 24	25+	
15 - 24	\$25,946	\$42,296	\$0	\$0	\$0	\$0	\$25,984
25 - 29	30,398	42,443	52,910	0	0	0	31,207
30 - 34	34,290	43,775	53,942	61,907	0	0	37,730
35 - 39	35,050	44,109	54,156	61,675	74,494	61,445	42,004
40 - 44	33,730	42,222	52,905	60,666	66,321	77,382	43,676
45 - 49	32,518	40,201	50,038	57,884	64,251	68,509	43,774
50 - 54	31,738	37,292	46,427	55,608	62,842	68,914	44,710
55 - 59	31,334	35,431	44,283	53,463	60,025	67,834	45,555
60 - 64	30,133	34,162	42,261	50,829	56,487	64,099	44,671
65 and over	25,345	30,055	40,566	48,401	52,852	58,621	40,521
<b>Average</b>	<b>\$31,924</b>	<b>\$39,173</b>	<b>\$47,715</b>	<b>\$55,134</b>	<b>\$60,368</b>	<b>\$66,127</b>	<b>\$41,550</b>

## Appendix C - Participant Data

### Transferred and Terminated Participants

#### Distribution by Age and Service – Transfers to Other CalPERS Plans

Attained Age	Years of Service at Valuation Date						Total	Average Salary
	0 - 4	5 - 9	10 - 14	15 - 19	20-24	25+		
15 - 24	135	-	-	-	-	-	135	\$39,902
25 - 29	978	27	-	-	-	-	1,005	49,806
30 - 34	1,685	145	18	1	-	-	1,849	60,245
35 - 39	2,232	305	70	8	-	-	2,615	73,169
40 - 44	2,196	378	113	30	2	-	2,719	85,515
45 - 49	2,161	455	159	42	12	1	2,830	89,686
50 - 54	2,042	483	186	76	22	6	2,815	89,565
55 - 59	2,018	502	198	74	31	12	2,835	85,084
60 - 64	1,383	347	129	46	8	4	1,917	77,904
65 and over	698	165	61	17	4	1	946	69,620
<b>Total</b>	<b>15,528</b>	<b>2,807</b>	<b>934</b>	<b>294</b>	<b>79</b>	<b>24</b>	<b>19,666</b>	<b>\$78,971</b>

Counts are of unique members included in the valuation. Multiple records may exist for members with service in more than one benefit group. This does not result in double counting liabilities.

#### Distribution by Age and Service – Terminated Participants with Funds on Deposit

Attained Age	Years of Service at Valuation Date						Total	Average Salary
	0 - 4	5 - 9	10 - 14	15 - 19	20-24	25+		
15 - 24	3,775	1	0	0	0	0	3,776	\$29,694
25 - 29	15,491	126	0	0	0	0	15,617	31,090
30 - 34	21,968	1,316	71	0	0	0	23,355	32,602
35 - 39	23,957	2,344	417	48	0	0	26,766	34,721
40 - 44	19,947	2,339	736	158	14	0	23,194	38,638
45 - 49	18,174	2,472	845	310	69	11	21,880	39,339
50 - 54	16,345	2,730	1,030	408	134	60	20,702	39,750
55 - 59	16,094	2,699	992	315	99	54	20,246	38,610
60 - 64	13,173	2,059	618	225	85	34	16,190	37,864
65 and over	9,863	1,000	274	99	42	29	11,307	34,892
<b>Total</b>	<b>158,787</b>	<b>17,086</b>	<b>4,983</b>	<b>1,563</b>	<b>443</b>	<b>188</b>	<b>183,033</b>	<b>\$36,373</b>

Counts are of unique members included in the valuation. Multiple records may exist for members with service in more than one benefit group. This does not result in double counting liabilities.

## Appendix C - Participant Data

### Retired Members and Beneficiaries

#### Number of Retirees and Beneficiaries - by Age and Retirement Type

Attained Age	Service Retirement	Non-Industrial Disability	Industrial Disability	Non-Industrial Death	Industrial Death	Death After Retirement	Total
Under 30	-	-	-	-	-	222	222
30 - 34	1	7	5	-	-	142	155
35 - 39	-	35	16	1	-	196	248
40 - 44	-	95	46	2	-	234	377
45 - 49	-	275	53	11	-	332	671
50 - 54	1,269	735	79	40	1	541	2,665
55 - 59	9,844	1,462	148	105	3	968	12,530
60 - 64	29,070	2,008	167	164	2	1,578	32,989
65 - 74	46,791	2,037	192	200	-	2,457	51,677
70 - 74	41,799	1,802	140	155	3	3,213	47,112
75 - 79	27,802	1,462	66	104	2	3,615	33,051
80 - 84	18,902	850	16	61	5	3,887	23,721
85 and over	20,519	763	15	47	-	6,971	28,315
<b>Total</b>	<b>195,997</b>	<b>11,531</b>	<b>943</b>	<b>890</b>	<b>16</b>	<b>24,356</b>	<b>233,733</b>

Counts are of unique members included in the valuation. Multiple records may exist for members with service in more than one benefit group. This does not result in double counting liabilities.

#### Annual Allowance Amounts for Retirees and Beneficiaries - by Age and Retirement Type

##### Annual Amounts Including PPPA Payments

Attained Age	Service Retirement	Non-Industrial Disability	Industrial Disability	Non-Industrial Death	Industrial Death	Death After Retirement	Total
Under 30	\$0	\$0	\$0	\$0	\$0	\$1,174,881	\$1,174,881
30 - 34	13,575	43,183	2,414	0	0	815,432	874,604
35 - 39	0	386,625	4,400	3,966	0	1,347,462	1,742,454
40 - 44	0	964,613	29,327	28,919	0	1,952,379	2,975,238
45 - 49	0	3,246,145	46,305	69,244	0	2,963,815	6,325,509
50 - 54	11,729,148	8,884,747	105,758	346,791	570	4,939,517	26,006,531
55 - 59	183,219,997	17,969,873	349,930	1,027,284	1,624	9,961,619	212,530,327
60 - 64	618,903,416	25,551,131	324,243	1,770,749	3,394	19,096,469	665,649,402
65 - 69	971,043,112	25,050,901	508,003	1,610,452	0	30,501,013	1,028,713,480
70 - 74	828,460,462	22,060,624	435,387	1,372,567	4,884	39,436,129	891,770,053
75 - 79	505,074,336	16,588,605	241,021	842,661	709	42,918,097	565,665,430
80 - 84	297,247,741	8,655,033	23,935	455,851	4,527	42,729,039	349,116,126
85 and over	265,205,220	6,746,740	134,813	372,670	0	66,684,430	339,143,872
<b>Total</b>	<b>\$3,680,897,006</b>	<b>\$136,148,220</b>	<b>\$2,205,535</b>	<b>\$7,901,156</b>	<b>\$15,708</b>	<b>\$264,520,282</b>	<b>\$4,091,687,906</b>

## Appendix C - Participant Data

### Retired Members and Beneficiaries (continued)

#### Number of Retirees and Beneficiaries - by Years Retired and Retirement Type

Years Retired	Service Retirement	Non-Industrial Disability	Industrial Disability	Non-Industrial Death	Industrial Death	Death After Retirement	Total
Under 5 Years	55,511	1,311	182	246	-	8,613	65,863
5 – 9	47,266	1,716	172	243	1	6,139	55,537
10 – 14	36,310	1,837	172	192	2	4,199	42,712
15 – 19	24,834	2,382	166	114	-	2,615	30,111
20 – 24	15,451	2,099	99	41	2	1,469	19,161
25 – 29	9,665	1,231	71	35	3	816	11,821
30 and over	6,960	955	81	19	8	505	8,528
<b>Total</b>	<b>195,997</b>	<b>11,531</b>	<b>943</b>	<b>890</b>	<b>16</b>	<b>24,356</b>	<b>233,733</b>

Counts of members do not include alternate payees receiving benefits while the member is still working. Multiple records may exist for members with service in more than one benefit group. This does not result in double counting liabilities.

#### Annual Allowance Amounts for Retirees and Beneficiaries - by Years Retired and Retirement Type

##### Annual Amounts Including PPPA Payments

Years Retired	Service Retirement	Non-Industrial Disability	Industrial Disability	Non-Industrial Death	Industrial Death	Death After Retirement	Total
Under 5 Years	\$1,208,483,157	\$17,011,947	\$449,232	\$2,435,199	\$0	\$102,895,581	\$1,331,275,115
5 – 9	963,765,874	22,247,010	592,732	2,269,783	859	68,330,783	1,057,207,042
10 – 14	691,987,156	23,921,314	458,692	1,633,546	873	44,974,123	762,975,705
15 – 19	443,751,869	29,745,724	423,757	858,761	0	25,130,166	499,910,276
20 – 24	201,252,015	22,934,637	68,884	266,494	6,169	13,045,015	237,573,215
25 – 29	117,663,108	12,967,431	184,185	284,984	4,922	6,657,975	137,762,604
30 and over	53,993,827	7,320,157	28,052	152,388	2,885	3,486,639	64,983,948
<b>Total</b>	<b>\$3,680,897,006</b>	<b>\$136,148,220</b>	<b>\$2,205,535</b>	<b>\$7,901,156</b>	<b>\$15,708</b>	<b>\$264,520,282</b>	<b>\$4,091,687,906</b>

## Appendix C - Participant Data

### Retired Members and Beneficiaries (continued)

#### Number Counts and Benefits - by Year of Retirement

Year Retired	Total Retirements	Total Benefits	Average Benefits
2018*	7,138	\$142,481,153	\$19,961
2017	15,022	329,153,385	21,911
2016	13,015	265,351,582	20,388
2015	12,909	253,684,962	19,652
2014	11,938	226,029,483	18,934
2013	11,449	206,133,336	18,004
2012	11,467	210,126,482	18,324
2011	11,076	205,678,741	18,570
2010	11,675	229,333,733	19,643
2009	10,575	210,575,534	19,913
2008	8,719	166,115,382	19,052
2007	8,351	153,976,345	18,438
2006	8,492	148,113,125	17,441
2005	8,473	146,339,085	17,271
2004	8,640	152,391,431	17,638
2003	8,759	164,449,472	18,775
2002	6,767	124,255,279	18,362
2001	5,926	106,468,758	17,966
2000	7,037	120,968,761	17,190
1999	4,041	50,567,409	12,514
1998	4,725	61,116,301	12,935
1997	4,169	51,202,029	12,282
1996	3,918	48,435,867	12,362
1995	3,835	47,532,863	12,394
1994	3,391	42,121,662	12,422
1993	3,202	41,333,229	12,909
1992	2,934	37,438,443	12,760
1991	2,561	31,318,743	12,229
1990	2,098	23,150,567	11,035
1989 and earlier	11,431	95,844,764	8,385
<b>Total</b>	<b>233,733</b>	<b>\$4,091,687,906</b>	<b>\$17,506</b>

\* The numbers for 2018 are for the first 6 months of the calendar year only

Counts of members do not include alternate payees receiving benefits while the member is still working. Multiple records may exist for members with service in more than one benefit group. This does not result in double counting liabilities.

# Appendix D – Normal Cost Information

## Normal Cost Chart

The normal cost is determined using the Entry Age Cost method. Some important features of this method are that the costs are dependent upon a member's entry age in the plan and benefit level of the plan. In general, the lower the entry age the lower the total normal cost. Note that future costs may vary as the entry age of the members change. FAC means Final Average Compensation.

Schools	Total Normal Cost	Employee Contribution <sup>1</sup>	Range of Breakpoints	Average Effective Member Rate	Employer Normal Cost
Schools 2% @ 62 – 3 Year FAC	14.284%	7.0%	--	7.0%	7.284%
Schools 2% @ 55 – 1 Year FAC	16.759%	7.0%	--	7.0%	9.759%

(1) Employee contribution rates are based on rates in effect at the valuation date.

## Development of PEPRA Member Contribution Rates

The table below shows the determination of the Member contribution rate based on 50 percent of the Total Normal Cost on June 30, 2018.

Assembly Bill (AB) 340 created PEPRA that implemented new benefit formulas and a final compensation period as well as new contribution requirements for new employees. In accordance with Section Code 7522.30(b), "new members ... shall have an initial contribution rate of at least 50 percent of the normal cost rate." The normal cost for the plan is dependent on the benefit levels, actuarial assumptions and demographics of the plan particularly the entry age into the plan. Should the total normal cost of the plan change by one percent or more from the base total normal cost established for the plan, the new member rate shall be 50 percent of the new normal cost rounded to the nearest quarter percent.

Plan	Basis for Current Rate		Effective July 1, 2019			
	Total Normal Cost <sup>1</sup>	Member Rate	Total Normal Cost <sup>2</sup>	Change	Change Needed	Member Rate
Schools	14.07%	7.0%	14.28%	0.21%	No	7.0%

(1) As of June 30, 2017, valuation date

(2) As of June 30, 2018, valuation date

# Appendix E – Glossary of Actuarial Terms

**Accrued Liability:** (also called Actuarial Accrued Liability or Entry Age Normal Accrued Liability) The total dollars needed as of the valuation date to fund all benefits earned in the past for *current* members.

**Actuarial Assumptions:** Assumptions made about certain events that will affect pension costs. Assumptions generally can be broken down into two categories: demographic and economic. Demographic assumptions include such things as mortality, disability and retirement rates. Economic assumptions include discount rate, salary growth and inflation.

**Actuarial Methods:** Procedures employed by actuaries to achieve certain funding goals of a pension plan. Actuarial methods include funding method, setting the length of time to fund the Accrued Liability and determining the Value of Assets.

**Actuarial Valuation:** The determination, as of a valuation date of the Normal Cost, Accrued liability, and related actuarial present values for a pension plan. These valuations are performed annually or when an employer is contemplating a change to their plan provisions.

**Amortization Bases:** Separate payment schedules for different portions of the Unfunded Liability. The total Unfunded Liability of a plan can be segregated by "cause," creating "bases" and each such base will be separately amortized and paid for over a specific period of time. However, all bases are amortized using investment and payroll assumptions from the current valuation. This can be likened to a home having a first mortgage of 24 years remaining payments and a second mortgage that has 10 years remaining payments. Each base or each mortgage note has its own terms (payment period, principal, etc.)

Generally, in an actuarial valuation, the separate bases consist of changes in unfunded liability due to contract amendments, actuarial assumption changes, actuarial methodology changes, and/or gains and losses. Amortization methodology is determined by Board policy.

**Amortization Period:** The number of years required to pay off an Amortization Base.

**Classic Member (under PEPR):** A classic member is a member who joined CalPERS prior to January 1, 2013 and who is not defined as a new member under PEPR. (See definition of new member below)

**Discount Rate Assumption:** The actuarial assumption that was called "investment return" in earlier CalPERS reports or "actuarial interest rate" in Section 20014 of the California Public Employees' Retirement Law (PERL).

**Entry Age:** The earliest age at which a plan member begins to accrue benefits under a defined benefit pension Plan or risk pool. In most cases, this is the same as the date of hire.

## Appendix E – Glossary of Actuarial Terms

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**Entry Age Normal Cost Method:** An actuarial cost method designed to fund a member's total plan benefit over the course of his or her career. This method is designed to yield a rate expressed as a level percentage of payroll.

(The assumed retirement age less the entry age is the amount of time required to fund a member's total benefit. Generally, the older a member on the date of hire, the greater the entry age normal cost. This is mainly because there is less time to earn investment income to fund the future benefits.)

**Fresh Start:** A Fresh Start is when multiple amortization bases are collapsed to one base and amortized together over a new funding period.

**Funded Status:** A measure of how well funded, or how "on track" a plan or risk pool is with respect to assets versus accrued liabilities. A ratio greater than 100% means the plan or risk pool has more assets than liabilities and a ratio less than 100% means liabilities are greater than assets.

**GASB 68:** Statement No. 68 of the Governmental Accounting Standards Board. The accounting standard governing a state or local governmental employer's accounting and financial reporting for pensions. GASB 68 replaces GASB 27 effective the first fiscal year beginning after June 15, 2014.

**New Member (under PEPR):** A new member includes an individual who becomes a member of a public retirement system for the first time on or after January 1, 2013, and who was not a member of another public retirement system prior to that date, and who is not subject to reciprocity with another public retirement system.

**Normal Cost:** The annual cost of service accrual for the upcoming fiscal year for active employees. The normal cost should be viewed as the long-term contribution rate.

**Pension Actuary:** A business professional that is authorized by the Society of Actuaries, and the American Academy of Actuaries to perform the calculations necessary to properly fund a pension plan.

**PEPRA:** The California Public Employees' Pension Reform Act of 2013

**Present Value of Benefits (PVB):** The total dollars needed as of the valuation date to fund all benefits earned in the past or expected to be earned in the future for *current* members.

**Unfunded Liability (UAL):** When a plan or pool's Value of Assets is less than its Accrued Liability, the difference is the plan or pool's Unfunded Liability. If the Unfunded Liability is positive, the plan or pool will have to pay contributions exceeding the Normal Cost.



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