



California Public Employees' Retirement System

Parallel Valuation and Certification Report

CalPERS State and Schools Valuations (Task #2)

Annual Valuation

Reports as of: June 30, 2021

December 2022



December 30, 2022

Board of Administration
California Public Employees' Retirement System (CalPERS)
P.O. Box 942701
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Members of the Board:

As provided in Contract 2021-9096, we have reviewed valuations prepared by the CalPERS professional actuarial staff in order to certify that such work satisfies applicable standards of the actuarial profession. In the following pages, we report the results of our review of the June 30, 2021, annual actuarial valuations prepared for the State and Schools plans.

We reviewed the assumptions, methods and procedures used by CalPERS staff to perform the State and Schools valuations we examined, and we confirm that they conform to applicable Actuarial Standards of Practice (ASOPs). In Section 5 of this report, we provide recommendations for enhancement of the compliance of the content of the valuation reports with applicable ASOPs.

In addition, we completed parallel actuarial valuations for the State and Schools plans using the same assumptions and census, asset and benefit provision data that were used by CalPERS staff to prepare their June 30, 2021, valuations of these plans. We compared the key results of our parallel valuations to those in the corresponding valuation reports published by CalPERS.

Each actuarial organization has its own valuation model and applies actuarial assumptions and methods in its preferred way. There is rarely a single "right" answer when it comes to actuarial calculations. For a pension actuarial valuation, we consider one actuary's calculations to reasonably match another actuary's calculations when the present values (liabilities), normal cost contributions, and total employer contributions computed by the two actuaries are within 5% of each other.

For all State and Schools plans, our key calculations matched those prepared by CalPERS staff within 5%, which was the target tolerance level specified by CalPERS. We view the differences as not material.

Although not required under Contract 2021-9096, we also compared key valuation results for each individual participant (active members, transferred and terminated members, and retired members and beneficiaries) in the State and Schools plans. This enhanced reconciliation process provides a deeper review of the calculations and may highlight differences in the handling of individual participants in the valuation process whose effects may offset each other when results are aggregated at the level of the entire plan.

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Future actuarial measurements may differ significantly from current measurements due to plan experience differing from that anticipated by the economic and demographic assumptions, changes expected as part of the natural operation of the methodology used for these measurements, and changes in plan provisions, applicable law, or regulations. An analysis of the potential range of such future differences is beyond the scope of this study.

This report was prepared for the Board and professional staff of CalPERS for their use in evaluating the preparation of actuarial valuations by the System. Use of this report for any other purpose or by other parties may not be appropriate and may result in mistaken conclusions because of failure to understand applicable assumptions, methods, or inapplicability of the report for other purposes. Because of the risk of misinterpretation of actuarial results, Buck recommends requesting its advance review of any statement, document, or filing to be based on information contained in this report. Buck will accept no liability for any such statement, document or filing made without its prior review.

Actuarial Standard of Practice No. 56 (ASOP 56) provides guidance to actuaries when performing actuarial services with respect to designing, developing, selecting, modifying, using, reviewing, or evaluating models. Buck uses third-party software in the performance of annual actuarial valuations and projections. The model is intended to calculate the liabilities associated with the provisions of each plan using data and assumptions as of the measurement date under the funding methods specified in this report. The output from the third-party vendor software is used as input to internally developed models that apply applicable funding methods and policies to the derived liabilities and other inputs, such as plan assets and contributions, to generate many of the exhibits found in this report. Buck has an extensive review process in which the results of the liability calculations are checked using detailed sample life output, changes from year to year are summarized by source, and significant deviations from expectations are investigated. Other funding outputs and the internal models are similarly reviewed in detail and at a higher level for accuracy, reasonability, and consistency with prior results. Buck also reviews the third-party model when significant changes are made to the software. This review is performed by experts within Buck who are familiar with applicable funding methods, as well as the manner in which the model generates its output. If significant changes are made to the internal models, extra checking and review are completed. Significant changes to the internal models that are applicable to multiple clients are generally developed, checked, and reviewed by multiple experts within Buck who are familiar with the details of the required changes.

The undersigned are Fellows of the Society of Actuaries, Members of the American Academy of Actuaries and Enrolled Actuaries. We each meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained in this report. This report has been prepared in accordance with all applicable Actuarial Standards of Practice, and we are available to answer questions about it.

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Section I - Introduction

Under the California Constitution, the Board of Administration has plenary authority and fiduciary responsibility to provide for actuarial services. The CalPERS Chief Actuary advises the Board and directs the activities of the CalPERS professional actuarial staff. The Board also retains the services of an outside actuarial firm to review the work of the CalPERS professional actuarial staff and to certify that such work satisfies actuarial professional standards.

Buck was contracted to provide parallel valuation and certification services to the Board.

This report summarizes our review of the State and Schools plans' actuarial valuation results as of June 30, 2021, under Task #2 of our contract.

We first reviewed the actuarial assumptions and methods used for the June 30, 2021, State and Schools valuations. Our review is based on Actuarial Standards of Practice (ASOP) applicable to the selection of economic assumptions (ASOP 27) and the selection of demographic assumptions (ASOP 35). The results of our review are discussed in Section II.

Next, we completed parallel actuarial valuations for the State and Schools plans in order to compare our key valuation results with those published in the valuation reports prepared for the plans. CalPERS requested that we reconcile any differences of more than 5% between the two sets of valuation results. Section III contains a summary of our parallel valuation methodology. The results of our analysis are summarized in Section IV.

We also reviewed the contents of the valuation reports prepared for the State and Schools plans and have formulated some recommendations for changes in these reports. These are presented in Section V.

We did not audit or review the final valuation data provided to us by CalPERS for this parallel valuation, as review of the data is explicitly excluded from the scope of this assignment.

Section II - Review of Actuarial Assumptions and Methods

We have reviewed the actuarial assumptions and methods used in the State and Schools valuations. The key valuation assumptions include the following:

Assumption	Detail	Basis and Rationale	Commentary
Expected rate of return on investments, net of investment and administrative expenses	6.80%	Reviewed as part of the Asset Liability Management process	We have reviewed the assumed long-term annual rate of return on plan assets using our own economic modeling tool and determined that it is reasonable.
Discount Rate	6.80%	Set equal to the expected rate of return on investments, net of investment and administrative expenses	Reasonable, as stated above.
Price Inflation	2.30%	Documented in 2021 experience study report	We have reviewed the assumed price inflation using our own economic modeling tool and determined that it is reasonable.
Productivity Increases	0.50%	Documented in 2021 experience study report	We agree with the documented basis and rationale for the assumption.
Payroll Growth/Wage Inflation	2.80%	Documented in 2021 experience study report	We agree with the documented basis and rationale for the assumption.
Salary/Merit Increases	Varies by entry age, service, and type of employee	Documented in 2021 experience study report	We agree with the documented basis and rationale for the assumption.
Decrement assumptions including mortality, rates of termination, and retirement	The mortality assumption is comprised of customized base rates projected from 2017 using 80% of Scale MP-2020. Other demographic assumptions may vary by gender, age, or service.	Documented in 2021 experience study report	We agree with the documented basis and rationale for the assumptions. Please note our recommendation in Section V regarding the disclosure of the mortality assumption in the valuation reports.

Section II - Review of Actuarial Assumptions and Methods (continued)

Actuarial Standard of Practice (ASOP) 27 discusses the selection of economic assumptions for the measurement of pension liabilities. Similarly, ASOP 35 discusses the selection of demographic assumptions for the measurement of pension liabilities. In our opinion, the assumptions used in the State and Schools valuations are reasonable and the methodology used to select these assumptions is appropriate and consistent with the guidance provided in ASOP 27 and ASOP 35. We do recommend improvements in the disclosure of assumptions used in the valuations in accordance with ASOP 27 and 35 sections 4.1.1 – please refer to our comments in Section V.

Notes on the actuarial methods employed in the State and Schools valuations are as follows:

Concept	Method Employed	Commentary
Actuarial Cost Method	The State and Schools valuations use the entry age actuarial cost method, in which projected benefits are determined for all members and the associated liabilities are spread in a manner that produces level annual cost as a percentage of pay in each year from the member's entry age to their assumed retirement age on the valuation date.	Described as a "Model Practice" in the Conference of Consulting Actuaries' 2014 report titled "Actuarial Funding Policies and Practices for Public Pension Plans", commonly referred to as the "White Paper." The guidance offered in the White Paper is not binding but provides a sense of the actuarial profession's beliefs about the relative merits of different approaches to funding public retirement systems.
Asset Valuation Method	Market value of assets plus accounts receivable.	This is an acceptable method.
Amortization of Unfunded Actuarial Accrued Liability (UAL)	Layered: UAL bases are amortized over fixed periods (varying by source of the base and the amortization policy in effect when established), calculated as a percentage of payroll (for bases established prior to June 30, 2019) or as a level dollar amount (for bases established on or after June 30, 2019); a ramp-up and/or ramp-down feature is incorporated in the amortization of certain bases.	Under the current policy, the amortization periods for all sources of UAL bases are within the Model Practice criteria in the White Paper with the possible exception of benefit changes. The current policy is set at 20 years, which is a longer period than recommended by the White Paper. Level-dollar amortization, as in effect under the current policy, is described as an "Acceptable Practice" in the White Paper.

Section III – Parallel Actuarial Valuation Methodology

The steps followed in our parallel actuarial valuation are described below.

The State and Schools plans consist of the following separate plans:

- State Plans¹
 - State Miscellaneous Tier 1
 - State Miscellaneous Tier 2
 - State Industrial
 - State Safety
 - State Peace Officers & Firefighters
 - California Highway Patrol
- Schools Pool

We requested and received copies of the final June 30, 2021, valuation reports for the State and Schools plans.

For each of the seven plans we completed the following steps:

1. For each plan, we requested:
 - a) The complete decrement tables used by CalPERS to prepare the valuation
 - b) The final participant data used in generating the valuation report
 - c) The key actuarial results presented in each valuation report (normal cost, actuarial accrued liability, present value of benefits, present value future salary, etc.) both in the aggregate and *on a per participant basis*.
2. Using the information provided in the two valuation reports and in 1(a) and 1(b) above, we produced valuations for each plan using ProVal®, a commercially available valuation system used worldwide by actuaries and investment professionals. We generated the key actuarial results for comparison to results published in the actuarial valuation reports.
3. In the reconciliation process, using the data provided in 1(b) above and the output from ProVal®, we compared the key results both on an aggregate basis and an individual basis. Reconciling results for individual participants as well as by plan may uncover multiple discrepancies that could offset each other, producing aggregate results that fall within 5% tolerance level. Valuation results that differ by less than 5% in total may camouflage systematic errors with respect to particular types of participants. Comparing results by participant helps us to identify the reasons if aggregate results differ by more than the 5% tolerance, and to identify hidden material discrepancies for results that are within the tolerance as well. As part of this enhanced reconciliation process, we provide in Schedule C a frequency distribution of the percentage difference in key actuarial results by participant.
4. We have communicated preliminary results to CalPERS.
5. In our Summary of Findings in the next section, we provide the following:
 - Recap of issues found in each actuarial review
 - Discussion of how issues were resolved
 - Description of any outstanding issues

¹ The results for State Miscellaneous Tier 1 and Tier 2 are combined in the June 30, 2021, CalPERS report. The results for these two groups were presented to Buck separately, so the analysis contained in this report considers them separately.

Section IV - Summary of Findings

In our parallel valuations and review, we compared total present values of future benefits, actuarial accrued liabilities, and total normal costs. We then used these key valuation results to compute and compare the total employer contribution rates. We are pleased to report that for all plans all of our calculations for these key results differed by less than 5% from the corresponding results reported by CalPERS.

The table in Schedule B summarizes the results for each of the State and Schools plans. This schedule indicates that we were able to closely replicate the present value of future benefits, in most cases within 0.5% of CalPERS' results. The attribution of this liability under the entry age method gave rise to a slightly greater variance, particularly in the normal cost. As part of this process, we observed several items that contributed to this variance. These items can be categorized in one of two ways:

1. Differences in valuation system. No two valuation systems will produce identical results due to differing approaches to age- and service-rounding, adjustments for mid-year timing, consideration of monthly-vs.- annual payments, etc. These differences generally will not produce materially different results.
2. Areas for which refinement of calculation would be advisable.

Differences in valuation system

The following observations relate to evident differences between valuation systems. These are not errors; they are simply differences of approach. These items do not have a material effect on overall liabilities but can give rise to some significant percentage differences on an individual basis.

- The present value of a participant's future benefits is based on his or her actual credited service amount as of the valuation date. However, the accrued liability and normal cost are determined using a theoretical service amount built by assumption from entry age. Generally, the theoretical service is at least as much as the actual service, which tends to produce a lower accrued liability and a higher normal cost than if actual service were used.

Consider the following relatively extreme example: A member in the State Safety plan with birth date in October 1974, "Normal Cost Start Date" in December 2002, and credited service equal to 8.755 years. The following table compares the resulting liabilities under the two methods—to be clear, the "actual service" approach refers to valuing the entry age liabilities by projecting the actual service as of the valuation date back to entry age, rather than building a theoretical service amount:

	Buck Calculation Using the CalPERS Approach	Buck Calculation Using the Actual Service Approach
Present value of future benefits	353,209	353,209
Entry age normal accrued liability	217,382	259,778
Entry age normal cost	15,290	10,518

This issue affects a relatively small portion of the plan population; thus, its overall impact is minor. For example, for the State Safety plan, we estimate that using the "actual service" approach would increase active accrued liability by 1.0% and reduce normal cost by about 1.6%. For the plan overall (including all statuses), the accrued liability would increase by approximately 0.4%.

- Similar to the treatment of service noted above, the liability for the refund-of-contributions benefit is valued by calculating the present value of a participant's future benefits based on his or her actual accumulated balance as of the valuation date, while the accrued liability and normal cost are determined using a theoretical accumulated balance built by assumption from entry age. If CalPERS were to apply the attribution method by projecting the current account balance as of the valuation date back to entry age and forward to future decrement ages (as opposed to creating the theoretical balance starting at entry age), we expect that the active accrued liability would increase and the normal cost would decrease, both to an immaterial degree. For example, applying this approach to the Safety plan, the accrued liability would increase by 0.2% and the normal cost would decrease by 0.3%.

Section IV - Summary of Findings (continued)

Areas for refinement

- The valuation reports indicate that when a member is eligible to retire, the probability of termination with a vested benefit is set to zero. It appears that this is not actually done in some of the State valuations, and that this is intentional. We suggest that the description of the decrement that appears in the valuation reports be changed to make it consistent with the actual application of the decrement, and CalPERS staff have indicated that they agree this change should be made.
- The application of pay caps should be examined, at least in the case of one sample we reviewed from the Miscellaneous First Tier Plan. The 2021 PEPR cap (for employees who participate in Social Security) is \$128,059. From the sample life results, we can see that the pay cap projected for the valuation year ending June 30, 2022, is \$131,004, which is equal to the 2021 PEPR cap increased by price inflation. Thus, the pay cap is slightly overstated. CalPERS staff have indicated that this issue has already been resolved.

Section V – Additional Comments and Recommendations

Our review has indicated that the actuarial process followed by CalPERS is thorough, complete, and generally complies with applicable Actuarial Standards of Practice. In the prior section, we identified some technical aspects of the calculation of results that may be considered for further refinement. In this section, we provide some additional comments and recommendations.

Recommendations

1. Improve disclosure of mortality assumption in accordance with ASOP 27 and 35 Sections 4.1.1
 - We suggest that the reports provide a description of the pre-retirement mortality assumption, including the mortality improvement scale, as opposed to or in addition to a table of sample rates.
 - The Non-Industrial Death rates displayed for Miscellaneous Tier 1 and Tier 2 appear to be switched for males and females.
 - We suggest that the reports provide a description of the post-retirement mortality assumption, as opposed to or in addition to a table of sample rates.
 - The statement under the post-retirement table sample rate table on Page A-7 of the State valuation report is erroneous. We understand the sample rates to be base rates as of 2017.
 - Neither the State nor Schools Pool valuation reports reference the mortality improvement assumption used in the valuations, which was 80% of MP-2020 (as shown in the 2021 experience study report).
2. The reports indicate that the demographic assumptions are based on an experience study dated November 17, 2021. However, some of the rates disclosed in the reports do not match the rates published in the 2021 experience study report, the most notable being the non-industrial death rates listed on page 14 of the State report. All of the listed male rates and most of the listed female rates differ. We do note that the rates provided to us for this audit do match the valuation report. We suggest disclosing the source of the rates used for the valuation reports that differ from the experience study.
3. The State valuation report contains an exhibit displaying the “Key Results” (including participant information, funded status information, and employer contribution requirements) of each group within the plan. We recommend that a similar exhibit be provided in the Schools Pool valuation report.
4. Within the “Key Results” exhibit in the State valuation report, the display of the Contribution Required information implies that the Total is the sum of the components listed above it, but that is not true. We suggest reorganizing the information to make it clearer which line items sum to equal the Total.
5. Regarding ASOP 51, the Schools Pool report shares all maturity measures from 2017-2021. However, the State report only provides information for the current year (and previous year, in certain cases). ASOP 51 indicates that for some measures, “a table of historical values will be more useful than only showing one or two years of recent values.” It is left to the discretion of the actuary whether including additional historical detail on the plan maturity measures would be useful.
6. Regarding ASOP 56, page A-1 of the State valuation reports includes a description of the valuation model. This description appears to be missing from the Schools Pool valuation report. A section disclosing and describing the actuarial model should be added to the Schools Pool report to satisfy ASOP 56.

Schedule A – Comparison of Active Member Data

Plan		Number of Actives	Average Age	Average Service ¹	Average Pay
State Miscellaneous Tier 1	CalPERS	176,618	46.4	10.6	\$76,666
	Buck	176,618	46.4	10.4	\$76,666
State Miscellaneous Tier 2	CalPERS	2,337	54.8	22.9	\$76,149
	Buck	2,337	54.8	22.9	\$76,149
State Industrial	CalPERS	11,525	44.9	9.0	\$66,254
	Buck	11,525	44.9	9.0	\$66,254
State Safety	CalPERS	28,451	46.5	8.3	\$84,552
	Buck	28,451	46.5	8.3	\$84,548
State Peace Officers & Firefighters	CalPERS	41,242	40.9	11.2	\$89,949
	Buck	41,242	40.9	11.3	\$89,949
California Highway Patrol	CalPERS	6,662	41.5	14.2	\$133,171
	Buck	6,662	41.5	14.2	\$133,171
Schools Pool	CalPERS	316,847	46.5	9.1	\$45,337
	Buck	316,847	46.5	9.1	\$45,337

¹ This table is intended to be a comparison of the data summarized in the State and Schools valuation reports to the participant data provided by CalPERS for this analysis. However, average service is not included in the valuation reports, but was included in the supplementary material provided by CalPERS.

Schedule B – Comparison of Key Valuation Results

Plan		Present Value of Benefits	Accrued Liability	Projected Normal Cost (ER+EE) [@]	FY23 Employer Contribution Rate
State Miscellaneous	CalPERS	152,647,723,471	130,697,372,927	2,362,544,027	30.71%
	Buck	152,281,799,574	128,828,369,732	2,432,346,829	29.93%
	Difference	-0.24%	-1.43%	2.95%	-2.54%
State Industrial	CalPERS	6,886,845,838	5,550,468,220	142,224,770	19.51%
	Buck	6,943,373,202	5,545,041,190	147,781,376	20.22%
	Difference	0.82%	-0.10%	3.91%	3.64%
State Safety	CalPERS	21,037,827,749	16,397,024,160	551,850,106	21.13%
	Buck	21,038,861,910	16,347,856,644	553,874,589	20.87%
	Difference	0.00%	-0.30%	0.37%	-1.23%
State Peace Officers & Firefighters	CalPERS	67,950,091,223	57,507,446,617	1,146,805,933	47.21%
	Buck	68,197,046,485	57,306,282,485	1,106,564,077	45.29%
	Difference	0.36%	-0.35%	-3.51%	-4.07%
California Highway Patrol	CalPERS	18,454,375,105	15,822,003,794	288,550,693	63.89%
	Buck	18,310,894,062	15,673,094,410	285,505,300	61.91%
	Difference	-0.78%	-0.94%	-1.06%	-3.10%
Schools Pool	CalPERS	131,025,681,158	110,507,282,219	2,396,293,794	25.37%
	Buck	130,842,477,940	109,668,092,699	2,465,754,002	25.43%
	Difference	-0.14%	-0.76%	2.90%	0.24%

[@] Normal cost as of the valuation date

Schedule C – Comparison of Individual Participant Results

Present Value of Future Benefit Differences

All Members for all 7 Plans Combined

