BUCK

California Public Employees' Retirement System

Parallel Valuation and Certification Report
CalPERS State and Schools Valuations

Actuarial Valuation Reports as of June 30, 2018

December 2019

December 1, 2019

Board of Administration
California Public Employees' Retirement System (CalPERS)
P.O. Box 942701
Sacramento, CA 94229-2701

Members of the Board:

As provided in Contract 2015-8123, 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, 2018 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.

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, 2018 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 2015-8123, 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 offset each other when results are aggregated at the level of the entire plan.

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The Table of Contents, which immediately follows, outlines the material contained in the report.

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.

The undersigned are Fellows of the Society of Actuaries, Members of the American Academy of Actuaries and Enrolled Actuaries. They 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.

Respectfully submitted,

Buck Global, LLC

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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, 2018.

We first reviewed the actuarial assumptions and methods used for the June 30, 2018 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.

The Appendix lists the recommendations contained in our previous parallel valuation and certification report for the State and Schools plans, as well as our observations related to CalPERS's action on these recommendations.

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:

- Expected rate of return on investments, net of expenses: State: 7.00%; Schools: 7.25%
- Payroll growth: State: 2.75%; Schools: 2.875%. This is used for projecting payroll in developing amortization payment schedules.
- Salary scale: varies by entry age, service, and type of employee
- Inflation: State: 2.50%; Schools: 2.625%
- Decrement assumptions including mortality, rates of termination and retirement: based on a 2017 experience study

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.

The Schools plan's 7.25% assumed annual rate of return is scheduled to decrease to 7.00% in the June 30, 2019 actuarial valuation. For both State and Schools, we have reviewed the assumed long-term annual rate of return on plan assets of 7.00%, using our own economic modeling tool and determined that it is a reasonable assumed long-term expected rate of return for the plans covered by this report. We note that the use of a 7.25% rate for the determination of contributions in the Schools valuation constitutes a form of "direct-rate smoothing" of the impact of adoption of a 7.00% assumed rate of return. Please refer to our further comments in Section V.

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 Plans[1]

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

Schools Pool

We requested copies of the final June 30, 2018 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(c) 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 why 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, 2018 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 happy 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 in valuation system. 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 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, 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 = 5.755 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	272,638	272,638
Entry age normal accrued liability	143,467	182,675
Entry age normal cost	12,783	8,903

  This issue affects a relatively small portion of the plan population; thus, the 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 1.3% and reduce normal cost by about 2.2%. On the plan overall (including all statuses), the liability would increase by approximately 0.5%.

- Similar to the treatment of service noted above, the refund of contributions 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, but 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 0.4%.

Section IV - Summary of Findings (continued)

- For new entrants, ProVal® uses rounded funding ages, so that in the year of hire, the accrued liability is $0. CalPERS imputes a half-year of accrual; i.e., the accrued liability is nonzero, which would result in a difference of 100%. However, the dollar amounts involved are immaterial.

  Some of the large individual percentage changes on normal cost come from those past maximum assumed retirement age. ProVal® will compute a normal cost of $0, whereas CalPERS always imputes a half-year of accrual, which causes their normal costs to be nonzero and results in a percentage difference of 100%. However, the dollar amounts involved are inconsequential.

Areas for refinement

- The valuation reports indicate that when a member is eligible to retire, the termination with vested benefit decrement ceases to apply. It appears that this is not happening in some of the State valuations. Allowing the decrement to apply after retirement eligibility tends to produce lower liabilities than arise if the decrement is eliminated as described. Discussions with the CalPERS actuarial staff have revealed that the continued application of the decrement after attainment of retirement eligibility was intentional. We suggest that the description of the decrement provided in the reports be modified to state this clearly.

  The following table shows the estimated effect by plan on the present value of future benefits and actuarial accrued liability for active participants if the termination decrement were to be zeroed out as described in the report.

Effect on Active Liabilities Only	Present Value of Future Benefits	Actuarial Accrued Liability
State Misc 1st Tier	1.1%	0.3%
State Misc 2nd Tier	0.0%	0.0%
State Industrial	0.6%	0.3%
State Safety	1.1%	-0.2%
State Peace Officers - Fire Fighters	0.4%	0.1%
State Cal Highway Patrol	0.1%	0.0%
Schools Miscellaneous	2.7%	0.9%

Section V – Additional Comments and Recommendations

Our review has indicated that the actuarial process followed by CalPERS is thorough, complete, and 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. **Clarify valuation methodology for group term life insurance benefit within report.**

   The report describes a group term life insurance benefit, but we observe that no explicit liability for that benefit is included in plan liabilities. Rather, there appears to be segregated assets and a separate funding mechanism. We suggest that a description of the method used to value and fund this benefit be included in the report**.**

2. **Distinguish (where appropriate) between phasing in the impacts of economic assumption changes and phasing in of assumption changes themselves and identify margins for adverse deviations.**

   The economic assumptions (expected rate of investment return, payroll growth rate, and inflation rate) were changed effective with the June 30, 2018 valuations. In addition, For the Schools valuation, they are scheduled to be changed again in the June 30, 2019 valuations.

   Our understanding is that the gradual phase-in is reflected only in the determination of contributions and thus constitutes a form of "direct contribution rate smoothing". Such smoothing for the impact of assumption changes is an Acceptable Practice in the 2015 paper of the California Actuarial Advisory Panel, "Actuarial Funding Policies and Practices for Public Pension and OPEB Plans – and Level Cost Allocation Model". We suggest that it be made clear that the phase-in of the change in the assumed rate of return is made solely for the purpose of determining contributions. Further, if the revised assumption incorporates any margin for adverse deviations, we recommend that such margins be quantified in accordance with the requirements of the applicable Actuarial Standards of Practice.

Schedule A – Comparison of Active Member Data

Plan		Number of Actives	Average Age	Average Service[1]	Average Pay
State Miscellaneous Tier 1	CalPERS	170,997	47.0	11.0	$70,295
	Buck	170,995	47.0	11.0	$70,309
State Miscellaneous Tier 2	CalPERS	3,405	54.1	21.8	$67,942
	Buck	3,405	54.1	21.8	$67,939
State Industrial	CalPERS	11,811	45.2	8.3	$59,204
	Buck	11,811	45.2	8.3	$59,157
State Safety	CalPERS	28,335	46.7	7.8	$81,741
	Buck	28,335	46.7	7.8	$81,496
State Peace Officers & Firefighters	CalPERS	41,289	41.7	11.5	$85,317
	Buck	41,289	41.7	11.5	$85,286
California Highway Patrol	CalPERS	7,311	40.6	13.4	$119,258
	Buck	7,311	40.6	13.4	$119,253
Schools Pool	CalPERS	323,707	46.4	7.7	$41,550
	Buck	323,707	46.4	7.7	$40,625

[1] This table is intended to be a comparison of the data summarized in the State and Schools reports to the participant data provided by CalPERS for this analysis. However, average service is not included in the report, 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)@	Employer Contribution Rate#
State Miscellaneous	CalPERS	132,446,673,597	115,469,058,970	1,989,049,647	30.977%
	Buck	132,151,330,027	115,285,172,317	2,021,682,834	30.896%
	Difference	-0.22%	-0.16%	1.64%	-0.26%
State Industrial	CalPERS	5,746,905,539	4,670,036,601	124,372,729	20.823%
	Buck	5,731,312,251	4,626,313,315	127,487,047	20.739%
	Difference	-0.27%	-0.94%	2.50%	-0.40%
State Safety	CalPERS	17,751,712,839	13,590,778,296	517,271,960	21.526%
	Buck	17,765,395,487	13,561,392,451	519,901,240	21.428%
	Difference	0.08%	-0.22%	0.51%	-0.46%
State Peace Officers & Firefighters	CalPERS	57,779,361,435	48,792,433,542	1,034,537,954	47.198%
	Buck	58,066,243,662	48,883,246,506	1,060,917,075	47.474%
	Difference	0.50%	0.19%	2.55%	0.58%
California Highway Patrol	CalPERS	15,894,543,442	13,383,782,393	257,395,396	57.805%
	Buck	15,869,761,917	13,366,316,338	259,111,025	57.607%
	Difference	-0.16%	-0.13%	0.67%	-0.34%
Schools Pool	CalPERS	108,834,435,399	92,070,935,513	2,073,020,307	20.733%
	Buck	108,850,360,488	91,812,369,218	2,126,542,673	21.342%
	Difference	0.01%	-0.28%	2.58%	2.94%

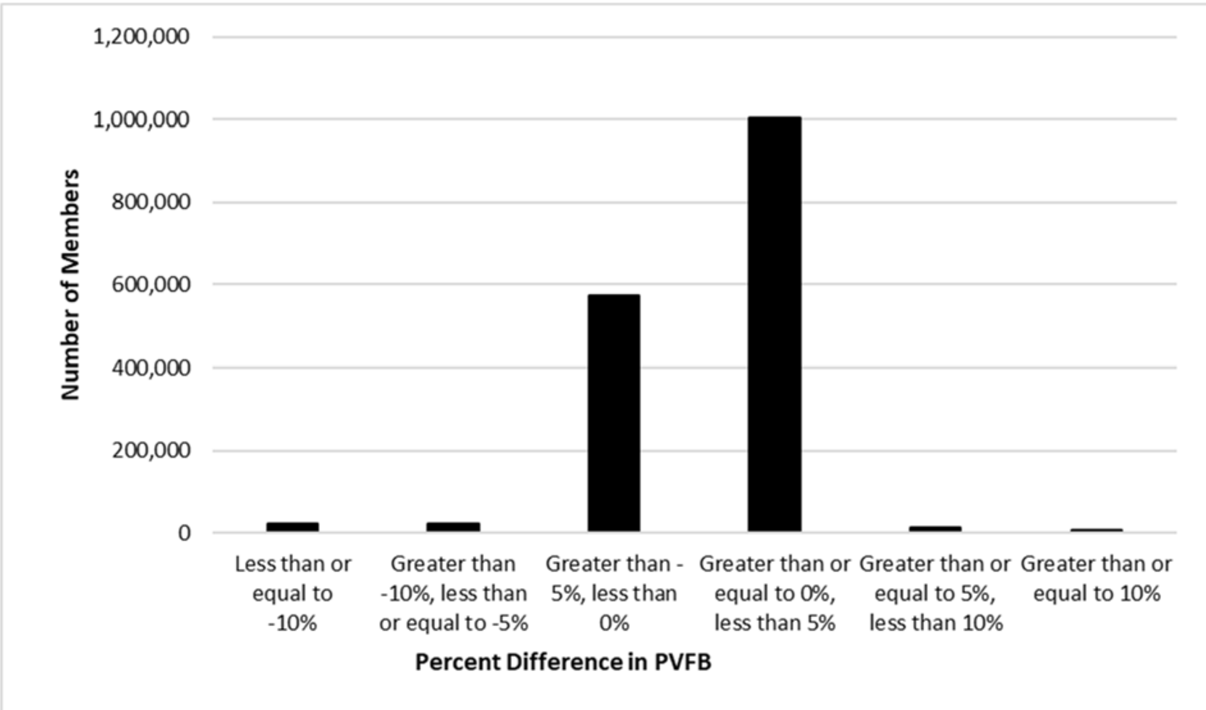
@ Normal cost projected to fiscal year 2019-20.

Pension only contribution rates are shown. Rates for Group Term Life Benefits are not reflected.

Schedule C – Comparison of Individual Participant Results

Present Value of Future Benefit Differences

All Members for all 7 Plans Combined



Schedule D – Previous Parallel Valuation and Certification Report Recommendations

1. Add information to the reports to meet new ASOP 4 requirements.

Actuarial Standard of Practice 4 (ASOP 4), which provides guidance for measuring pension obligations and determining pension plan costs or contributions, was significantly revised in 2013 for measurements made as of dates on or after December 31, 2014. We have noted the following items that may be considered for inclusion in future reports in order to more completely fulfill the requirements of the current version of ASOP 4:

a) An enhanced description of the contribution allocation procedure, including a more detailed description of what the five-year ramp up and ramp-down in amortizations entail. (4.1(k) of ASOP 4)

Comment: The June 30, 2018 valuation reports have addressed this recommendation.

b) A statement regarding the impact of the funding policy on future contributions; i.e., an explanation that the impact on funding associated with a current-year gain or loss will be increasing over the next five years before leveling out. This observation is similar to item (a) above but slightly different, as this is specifically addressed to the impact on future contributions. (4.1(m) of ASOP 4)

Comment: The June 30, 2018 valuation reports have addressed this recommendation.

c) Some additional comments about the appropriateness of reported measures of the funded status of the plan for various purposes. (4.1(q) of ASOP 4)

Comment: The June 30, 2018 valuation reports have addressed this recommendation.

d) In accordance with 4.1(r) (or 4.1(l) in the version of ASOP 4 that was in effect on June 30, 2014), a statement about future measurements and the fact that they may differ from current measurements. While some analysis was included in the reports we reviewed regarding the impact of potential variations in future investment returns, a more general statement about the potential effect of experience differing from assumptions may be needed in light of this requirement of ASOP 4.

Comment: The June 30, 2018 valuation reports have addressed this recommendation.

e) In accordance with 4.1(s), more detail on the rationale for changes in assumptions than was present in the reports we reviewed.

Comment: The June 30, 2018 valuation reports have addressed this recommendation.

f) While not specifically mandated by ASOP 4, a statement of the asset and liability transfers that are made between the State Safety and State Peace Officers & Firefighters plans. This transfer is described at the bottom of page C-1 of the State report, but we believe it would be helpful if the actual transfers were also disclosed in the body of the valuation report.

Comment: This is not an issue for the June 30, 2018 State valuation report.

2. Consider revising the calculation of projected accumulated employee contributions for Tier 2 participants.

As described previously, there were three issues found with the calculation of projected accumulated employee contributions for Tier 2 participants. We recommend changes be made to address the first two of these issues. Specifically:

a) By starting with a zero balance for special employee contribution amounts for certain separated employees and not reflecting their prior special employee contributions, the total special employee contributions are being understated, resulting in an overstatement of the liability. If the data on the prior special employee contribution amounts is available, this should be reflected in future valuations.

Comment: This issue appears to have been fixed for a limited number of participants. Only 26% of Tier 2 separated participant have a non-zero conversion account balance in the data.

Schedule D – Previous Parallel Valuation and Certification Report Recommendations (continued)

b) The accumulation of additional special employee contributions for purchase of Tier 1 level benefits by participants who have separated from active employment results in the overstatement of employee contributions and an understatement of the net liability for this group. The calculation of the special accumulated employee contributions should be adjusted to accumulate balances with interest only for participants who have separated from active employment.

Comment: The June 30, 2018 valuation reports appear to have addressed this recommendation.

c) The third discrepancy identified was related to the normal cost methodology for Tier 2 members. While the difference between our approach and that taken by CalPERS in the treatment of special employee contributions in the development of entry age normal costs led to differences between our respective valuation results for active Tier 2 members, the methodology used by CalPERS is not unreasonable and no change is proposed.

Comment: This discrepancy remains due to a difference in valuation systems.

3. Consider reflecting pre-retirement mortality for all separated participants.

As described in our findings, the valuation results can be refined by reflecting the pre-retirement mortality assumption for all separated participants. This will provide a more precise projection of expected possible outcomes in the future and, as a result, a more precise statement of the current liability of the plans. We recognize that this refinement would not be expected to have a material impact on the valuations' results.

Comment: The June 30, 2018 valuation reports have addressed this recommendation.