



California Public Employees' Retirement System

Parallel Valuation and Certification Report
CalPERS Public Agency Valuations

As of June 30, 2017

April 2019



April 19, 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 produced 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, 2017 annual actuarial valuations prepared for 20 sample Public Agency plans. The process by which the 20 plans reviewed in this report were selected is set forth in Section III of this report.

We reviewed the assumptions, methods and procedures used by CalPERS staff to perform the Public Agency valuations we examined, and we confirm that they conform to applicable Actuarial Standards of Practice.

In addition, we completed parallel actuarial valuations for the 20 sample Public Agency plans using the same assumptions and census, asset and benefit provision data that were used by CalPERS staff to prepare their June 30, 2017 valuations of these plans. We compared the key results of our parallel valuations with the results published in the 20 sample Public Agency plan valuation reports.

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 16 Public Agency 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. For four Public Agency Plans, our calculations produced results that differed by more than 5% from the corresponding results produced by CalPERS. We have documented causes of the differences in results in Section IV.

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 20 Public Agency plans whose valuations we reviewed. 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.

Board of Administration
California Public Employees' Retirement System
April 19, 2019
Page 2

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 letter. 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 (Buck)


David L. Driscoll, FSA, EA, MAAA
Principal, Consulting Actuary
david.driscoll@buck.com
617.306.2011


Aaron Shapiro, FSA, EA, MAAA
Principal, Consulting Actuary
aaron.shapiro@buck.com
201.902.2706

DLD/AS/jac

Contents

Section

I	Introduction.....	1
II	Review of Actuarial Assumptions and Methods.....	2
III	Parallel Actuarial Valuation Methodology.....	2
IV	Summary of Findings.....	5
V	Additional Comments and Recommendations.....	8

Schedules

A	Comparison of Active Member Data.....	9
B	Comparison of Individual Public Agency Plan Key Results.....	11
C	Comparison of Individual Participant Key Results.....	13

Appendix

	Previous Parallel Valuation and Certification Report Recommendations.....	14
--	---	----

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 sample Public Agency plans' actuarial valuation results as of June 30, 2017.

We first reviewed the actuarial assumptions and methods used for the June 30, 2017 Public Agency valuations. Many of the assumptions and methods were revised for the June 30, 2017 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 20 of the Public Agency plans in order to compare our key valuation results with those published in the valuation reports prepared for the 20 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 reports for the sample Public Agency plans based on the requirements of ASOP 4, the standard of practice for measuring pension obligations and determining pension plan costs or contributions. The results of our review are shown 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, and our comments related to CalPERS' follow-up.

Section II - Review of Actuarial Assumptions and Methods

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

- Expected rate of return on investments, net of expenses: 7.25% (a 7.00% assumption is scheduled to be used for the June 30, 2018 valuations)
- Payroll growth: 2.875% (a 2.75% assumption is scheduled to be used for the June 30, 2018 valuations). This is used for projecting payroll in developing amortization payment schedules
- Salary scale: varies by entry age, service, and type of employee.
- Inflation: 2.625% (a 2.50% assumption is scheduled to be used for the June 30, 2018 valuations)
- Decremental 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 Public Agency 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 have reviewed the assumed annual rate of return on plan assets of 7.25% and the scheduled 7.00% assumption, using our own economic modeling tool, and determined that 7.00% 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 this 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 comments in Section V.

Section III – Parallel Actuarial Valuation Methodology

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

CalPERS provided a list of the 10 largest Public Agency plans and asked that these plans be included in the sample. In addition, we were directed to select 10 or more additional Public Agency plans using a random sampling technique.

In order to select an additional 10 Public Agency plans randomly for review, we first identified categories of Public Agency plans for which different methods or assumptions had been implemented and then randomly selected plans from each of those categories.

The selection categories for random sampling were based on the type of Public Agency, specifically 1) City or Town, 2) County, and 3) Other. Within each of these, there exist Miscellaneous and/or Safety rate plans, resulting in six distinct categories to select from:

1. City or Town – Miscellaneous
2. City or Town – Safety
3. County – Miscellaneous
4. County – Safety
5. Other – Miscellaneous
6. Other – Safety

The 10 randomly selected Public Agencies were chosen so that each of these six categories was sampled. The complete list of plans selected for review is shown below:

Selected Employer	Type of Public Agency	Type of Plan
10 Largest Plans		
Santa Clara	County	Miscellaneous
San Francisco Bay Area Rapid Transit	Other	Miscellaneous
Long Beach	City	Miscellaneous
Monterey	County	Miscellaneous
Oakland	City	Miscellaneous
Riverside	County	Miscellaneous
Riverside	County	Safety
Sacramento	City	Miscellaneous
Solano	County	Miscellaneous
Public Transportation Services Corporation	Other	Miscellaneous
10 Randomly Selected Plans		
Brooktrails Township ¹	Town	Miscellaneous
Fortuna ¹	City	PEPRA Misc
Galt ¹	City	Safety
Oakdale ¹	City	Miscellaneous 2 nd Tier
Alpine ¹	County	PEPRA Misc
Butte	County	Safety
Glenn ¹	County	PEPRA Safety
Mariposa	County	Miscellaneous
Mokelumne Rural Fire District ¹	Other	Safety
Port San Luis Harbor District ¹	Other	PEPRA Safety

¹ Plan is valued in a CalPERS risk pool.

For each of the 20 plans we completed the following steps:

1. For each valuation report to be validated, we requested:
 - a) A copy of the final June 30, 2017 actuarial valuation report
 - b) The complete decrement tables used by CalPERS to prepare the valuation
 - c) The final participant data used in generating the valuation report
 - d) 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 1(a), 1(b), and 1(c) 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. We note that, for plans in a risk pool, normal cost is based on the average normal cost of all public agencies in that pool. Because replicating the normal cost of the pool is beyond the scope of this engagement, we compared our results to these plans' present values of benefits and accrued liabilities only, which are calculated outside of the risk pool by CalPERS on a stand-alone basis.
3. In the reconciliation process, using the data provided in 1(d) above and the output data from ProVal[®], we compared the key results on both on an aggregate basis and an individual basis. Reconciling results for individual participants as well as by rate plans 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 per person.
4. We have communicated preliminary results to CalPERS.
5. In the 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

Section IV - Summary of Findings

In our parallel valuations and review, we compared total present values of future benefits, actuarial accrued liabilities, normal costs, and total employer contribution rates. For the 10 largest public agency plans we reviewed, we are happy to report that all of our calculations for these key results differed by less than 5% from the corresponding results reported by CalPERS.

For the 10 random public agency plans that we reviewed, our calculations of the present value of future benefits and normal cost were within the 5% threshold. However, for four of these plans there were discrepancies of more than 5% between our calculation and CalPERS' calculation of the accrued liabilities.

The table in Schedule B summarizes the results for each of the 20 Public Agency plans whose valuations we reviewed. 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.

- 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 is to say their normal cost is nonzero, which would result in a difference of 100%. However, the dollar amounts involved are inconsequential.
- For active participants, CalPERS uses rounded mid-year age to assign age-based decrement probabilities. For retirees, CalPERS uses rounded beginning-of-year age to assign the age-based decrement probabilities. This issue has an immaterial impact.
- For actives, CalPERS calculates the present value of future benefits based on a data field representing benefit service earned as of the valuation date with the agency plan being valued. It then attributes this liability, using the entry age cost method, based on a data field that is representative of a full career with the CalPERS system. For most participants, these two data fields are consistent, i.e., the service they measure is substantially the same. There are individuals for which these two fields measure two different service periods, e.g., transfers and part-time employees. CalPERS determines the entry age normal cost rate using the full-career field, and then uses this rate to attribute the liability derived using the current-agency benefit service field.

We believe the theoretical basis for this approach can be illustrated by example: consider two identical plans A and B. CalPERS' method would result in identical normal cost and actuarial accrued liability values regardless of whether an individual stays in plan A or transfers to B (in which case there is also a benefit being valued in plan A). This theoretical approach weakens if A and B are not identical. If B provides greater benefits than A, then there is the potential for "over-accruing" liability and vice versa if B provides lesser benefits than A. Assuming there is not significant transfer activity, it is unlikely that any resulting over/under-accrual would have a material effect on overall liabilities.

We can emulate this approach with multiple runs of the ProVal valuation system with accompanying manual calculations; however, we prefer to compute entry-age liabilities and normal cost using the benefit

service field representing service with the current agency plan. This approach generally will produce a lower normal cost than the CalPERS method for those individuals with significant differences between the current agency-only service field and the full career service field.

We chose the Long Beach Miscellaneous valuation to investigate this. Below are the replication results under the CalPERS method:

	CalPERS	Buck	Pct. Difference
Present Value of Future Benefits	1,134,344,349	1,133,471,901	-0.1%
Actuarial Accrued Liability	808,825,635	806,274,082	-0.3%
Normal Cost	41,498,316	41,587,809	0.2%

Below are the results using ProVal's approach; i.e., attributing the benefit derived by the current agency-only benefit service field.

	CalPERS	Buck	Pct. Difference
Present Value of Future Benefits	1,134,344,349	1,133,471,901	-0.1%
Actuarial Accrued Liability	808,825,635	809,200,958	0.0%
Normal Cost	41,498,316	39,729,270	-4.3%

Based on this example, the result of the replacement of CalPERS' method with ProVal's method would be a relatively minor shift from the normal cost to the accrued liability.

Areas for refinement

There are some areas where refinement of the calculation would be advisable.

- There is an apparent inconsistency in the valuation of the refund of contributions benefit. The present value of a participant's future benefits is based on his or her actual accumulated balance as of the valuation date. However, the accrued liability and normal cost are determined using a theoretical accumulated balance built by assumption from entry age. Generally, the theoretical balance is greater than the actual, which produces some unusual results. For example, for contract package 101723 in Santa Clara, the present value of future benefits is \$38,305,221, normal cost is \$11,715,744, and accrued liability is -\$51,823,567. This is generally a small percentage of the overall liability, so resulting differences tend to be inconsequential, but it does show up more noticeably in some of the smaller PEPRA plans (which cover only those with short service).
- For retirees with a child beneficiary under the continuance portion of the Post Retirement Survivor Allowance, the CalPERS valuation does not appear to be stopping the continuance when the beneficiary attains age 18. This issue does not cause the present value of future benefits calculated in ProVal to be outside of the 5% threshold for any plan under examination.

In the aggregate, as shown in the chart in Schedule C in which we compare our calculations of individual participants' present values of benefits to those developed by CalPERS (in our enhanced reconciliation process), our results matched within the 5% tolerance for the majority of participants belonging to the 20 public agencies.

In considering the cases in which the match between our results and those developed by CalPERS were not within 5% of each other, focusing solely on the 5% threshold as a reasonableness test can be misleading for small plans. In general, due to otherwise inconsequential differences in age- and service-rounding conventions between CalPERS' valuation system and Buck's, significant percentage differences can occur for new hires even though the dollar amount differences are negligible. For example, Port San Luis Harbor District has two participants, both new entrants. The minor differences in age and/or service rounding produce a 46% difference in accrued liability, but this only represents \$3,200 of liability. Thus, results for this public agency fall outside the 5% threshold but should not have a material effect on the contribution calculation.

All differences greater than 5% identified were for small pooled public agencies, specifically those that predominantly cover newer, short-service employees. This is primarily a result of the aforementioned age- and service rounding differences between the two valuation systems. A very rough gauge of the effect of this rounding can be characterized as the ratio of service at the valuation plus one-half year to the service, e.g., for a person with 10 years of service, the accrued liability might be inflated by a factor of something less than $10.5 \div 10$, or 5%, a person with 20 years of service might be inflated by less than $20.5 \div 20$, or 2.5%, etc. For most plans, this effect is negligible, but if a plan consists entirely of new entrants, then this difference can be more noticeable; e.g., a person with one year of service might be off by less than $1.5 \div 1$, or 50%. However, in such cases the dollar amount would be very small, and since the contribution rate would be driven by normal cost, the overall effect of the rounding is inconsequential.

The following table shows the average years of service for the active participants in the four agencies with accrued liability outside the 5% threshold. In each case, the dollar difference, especially when amortized, is significantly less than the normal cost associated with these groups, thus the impact on the contribution is immaterial.

Agency	Average Service	% Difference in Actuarial Accrued Liability	\$ Difference in Actuarial Accrued Liability
City of Fortuna	1.744	-25.23%	63,938
County of Alpine	1.956	-21.76%	143,597
County of Glenn	1.222	-36.55%	19,335
Port San Luis Harbor District	0.086	-46.36%	3,214

For these four entities, we were able to bring the differences between Buck's calculated values for the present value of future benefits and the present value of future normal costs and CalPERS's calculations of these amounts to within one percent of each other by forcing ProVal to mimic CalPERS's conventions with respect to the rounding of ages and half-years of accruals. A difference in excess of 5% of calculated accrued liabilities is still possible in such cases simply because other approaches to handling accruals and rounding ages produce values of \$0 for new entrants. We reiterate that we regard these differences to be transitory and insignificant.

Section V – Additional Comments and Recommendations

First, we would like to note that 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 did note some technical aspects of the calculation of results that may be considered for further refinement. In this section, we will provide some additional comments and recommendations.

Recommendations

- 1. 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.**

As noted in Section II, the economic assumptions (expected rate of investment return, payroll growth rate, and inflation rate) were changed for the June 30, 2017 valuations. In addition, they are scheduled to be changed again for the June 30, 2018 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.

- 2. Consider including additional demographic data in pooled public agency valuation reports.**

While not required by actuarial standards, it may be beneficial for completeness and transparency to include additional demographic data such as average age, average service, and average pay in the pooled public agency valuation reports. This information is incorporated for the entire risk pool by reference in Section 2 of each public agency valuation report, but not separately for each public agency on a stand-alone basis.

Schedule A – Comparison of Active Member Data

10 Largest Public Agency Plans

Selected Employer	Plan		Number of Actives	Average Age	Average Service	Average Pay
County of Santa Clara	Miscellaneous	CalPERS	15,221	46.30	11.34	\$96,202
		Buck	15,221	46.30	11.34	\$96,203
San Francisco Bay Area Rapid Transit	Miscellaneous	CalPERS	3,387	49.47	12.82	\$88,405
		Buck	3,387	49.47	12.82	\$88,405
City of Long Beach	Miscellaneous	CalPERS	3,413	44.66	10.93	\$69,072
		Buck	3,413	44.66	10.93	\$69,073
City of Oakland	Miscellaneous	CalPERS	2,646	48.61	11.95	\$83,184
		Buck	2,646	48.61	11.95	\$83,184
City of Sacramento	Miscellaneous	CalPERS	2,563	45.36	11.55	\$68,856
		Buck	2,563	45.36	11.55	\$68,841
Public Transportation Services Corporation	Miscellaneous	CalPERS	2,218	48.99	9.34	\$91,854
		Buck	2,218	48.99	9.34	\$91,855
County of Monterey	Miscellaneous	CalPERS	4,620	44.21	9.96	\$72,127
		Buck	4,620	44.21	9.96	\$72,128
County of Riverside	Miscellaneous	CalPERS	17,083	44.07	9.77	\$66,054
		Buck	17,083	44.06	9.77	\$66,906
County of Riverside	Safety	CalPERS	3,527	39.81	11.26	\$93,110
		Buck	3,527	39.81	11.26	\$93,111
County of Solano	Miscellaneous	CalPERS	2,481	46.27	10.14	\$73,198
		Buck	2,481	46.27	10.14	\$73,198

Schedule A – Comparison of Active Member Data (continued)

10 Randomly Selected Public Agency Plans

Selected Employer	Plan		Number of Actives	Average Age	Average Service	Average Pay
Town of Brooktrails Township	Miscellaneous	CalPERS	5	Not in Rpt	Not in Rpt	\$63,279
		Buck	5	50.42	14.37	\$63,279
City of Fortuna	PEPRA Misc	CalPERS	20	Not in Rpt	Not in Rpt	\$37,393
		Buck	20	38.45	1.69	\$37,393
City of Galt	Safety	CalPERS	18	Not in Rpt	Not in Rpt	\$99,089
		Buck	18	46.20	13.26	\$99,089
City of Oakdale	Miscellaneous 2 nd Tier	CalPERS	11	Not in Rpt	Not in Rpt	\$64,285
		Buck	11	46.24	3.65	\$64,286
County of Alpine	PEPRA Misc	CalPERS	33	Not in Rpt	Not in Rpt	\$48,781
		Buck	33	48.07	1.91	\$48,781
County of Butte	Safety	CalPERS	306	40.35	11.25	\$67,903
		Buck	306	40.35	11.24	\$67,903
County of Glenn	PEPRA Safety	CalPERS	3	Not in Rpt	Not in Rpt	\$52,104
		Buck	3	27.93	1.22	\$52,105
County of Mariposa	Miscellaneous	CalPERS	320	47.55	7.44	\$54,256
		Buck	320	47.55	7.44	\$54,257
Mokelumne Rural Fire District	Safety	CalPERS	5	Not in Rpt	Not in Rpt	\$63,454
		Buck	5	45.06	12.75	\$63,454
Port San Luis Harbor District	PEPRA Safety	CalPERS	2	Not in Rpt	Not in Rpt	\$46,757
		Buck	2	30.88	0.10	\$46,758

Schedule B – Comparison of Individual Public Agency Plan Key Results

10 Largest Public Agency Plans

Selected Employer	Plan		Present Value of Benefits	Accrued Liability	Total Normal Cost (ER+EE)	Employer Contr. Rate
County of Santa Clara	Miscellaneous	CalPERS	12,222,623,736	10,310,532,855	246,245,618	23.517%
		Buck	12,179,916,578	10,251,918,039	236,739,147	22.794%
		Differ.	-0.35%	-0.57%	-3.86%	-3.074%
San Francisco Bay Area Rapid Transit	Miscellaneous	CalPERS	2,639,860,915	2,305,983,270	46,416,539	21.891%
		Buck	2,642,931,783	2,311,007,241	44,256,715	21.213%
		Differ.	0.12%	0.22%	-4.65%	-3.099%
City of Long Beach	Miscellaneous	CalPERS	2,853,132,271	2,527,613,557	41,498,316	28.446%
		Buck	2,850,391,990	2,526,121,047	39,729,270	27.898%
		Differ.	-0.10%	-0.06%	-4.26%	-1.927%
City of Oakland	Miscellaneous	CalPERS	2,911,227,952	2,616,012,657	42,008,377	42.226%
		Buck	2,912,379,724	2,616,715,160	40,246,914	41.684%
		Differ.	0.04%	0.03%	-4.19%	-1.283%
County of Sacramento	Miscellaneous	CalPERS	1,465,648,951	1,244,577,324	27,486,299	21.078%
		Buck	1,462,935,620	1,239,400,069	26,835,070	20.930%
		Differ.	-0.19%	-0.42%	-2.37%	-0.704%
Public Transportation Services Corporation	Miscellaneous	CalPERS	963,178,184	745,732,415	30,465,264	12.694%
		Buck	985,218,684	762,481,508	29,931,907	12.817%
		Differ.	2.29%	2.25%	-1.75%	0.968%
County of Monterey	Miscellaneous	CalPERS	2,190,417,833	1,778,548,785	50,358,320	16.539%
		Buck	2,185,301,775	1,764,214,969	49,291,342	15.585%
		Differ.	-0.23%	-0.81%	-2.12%	-2.146%
County of Riverside	Miscellaneous	CalPERS	9,101,025,982	7,441,270,302	208,286,685	21.572%
		Buck	9,119,585,297	7,456,649,126	201,057,569	21.209%
		Differ.	0.20%	0.21%	-3.47%	-1.682%
County of Riverside	Safety	CalPERS	4,254,972,861	3,361,565,098	97,795,420	37.439%
		Buck	4,238,518,503	3,342,586,096	94,475,978	37.437%
		Differ.	-0.39%	-0.56%	-3.39%	-0.005%
County of Solano	Miscellaneous	CalPERS	1,759,136,824	1,518,417,973	32,497,683	25.271%
		Buck	1,761,674,624	1,518,679,325	31,463,193	24.822%
		Differ.	0.14%	0.02%	-3.18%	-1.778%

Schedule B – Comparison of Individual Public Agency Plan Key Results (continued)

10 Randomly Selected Public Agency Plans

Selected Employer	Plan		Present Value of Benefits	Accrued Liability	Total Normal Cost (ER+EE)	Employer Contr. Rate
Town of Brooktrails Township	Miscellaneous	CalPERS	6,473,414	6,108,695	Pooled*	Pooled*
		Buck	6,470,896	6,096,892		
		Differ.	-0.04%	-0.19%		
City of Fortuna	PEPRA Misc	CalPERS	1,283,300	253,435	Pooled*	Pooled*
		Buck	1,285,986	189,497		
		Differ.	0.21%	-25.23%		
City of Galt	Safety	CalPERS	33,560,270	29,454,263	Pooled*	Pooled*
		Buck	34,111,981	29,957,598		
		Differ.	1.64%	1.71%		
City of Oakdale	Miscellaneous 2 nd Tier	CalPERS	1,847,585	641,525	Pooled*	Pooled*
		Buck	1,838,269	632,990		
		Differ.	-0.50%	-1.33%		
County of Alpine	PEPRA Misc	CalPERS	3,109,375	659,995	Pooled*	Pooled*
		Buck	3,093,222	516,398		
		Differ.	-0.52%	-21.76%		
County of Butte	Safety	CalPERS	248,786,838	196,896,767	5,752,483	34.774%
		Buck	249,512,837	197,664,767	5,567,228	35.209%
		Differ.	0.29%	0.39%	-3.22%	1.251%
County of Glenn	PEPRA Safety	CalPERS	607,992	52,893	Pooled*	Pooled*
		Buck	586,907	33,558		
		Differ.	-3.47%	-36.55%		
County of Mariposa	Miscellaneous	CalPERS	145,979,233	122,510,700	3,220,292	26.449%
		Buck	146,164,075	122,407,908	3,143,131	26.466%
		Differ.	0.13%	-0.08%	-2.40%	0.065%
Mokelumne Rural Fire District	Safety	CalPERS	3,186,543	2,520,310	Pooled*	Pooled*
		Buck	3,227,294	2,536,580		
		Differ.	1.28%	0.65%		
Port San Luis Harbor District	PEPRA Safety	CalPERS	376,108	6,933	Pooled*	Pooled*
		Buck	390,249	3,719		
		Differ.	3.76%	-46.36%		

* Replication of the pooled normal cost and related employer contribution rate requires a valuation of the entire risk pool and is beyond the scope of this engagement.

Schedule C – Comparison of Individual Participant Key Results

Present Value of Future Benefit Differences

All Members for all 20 Public Agency Plans Combined

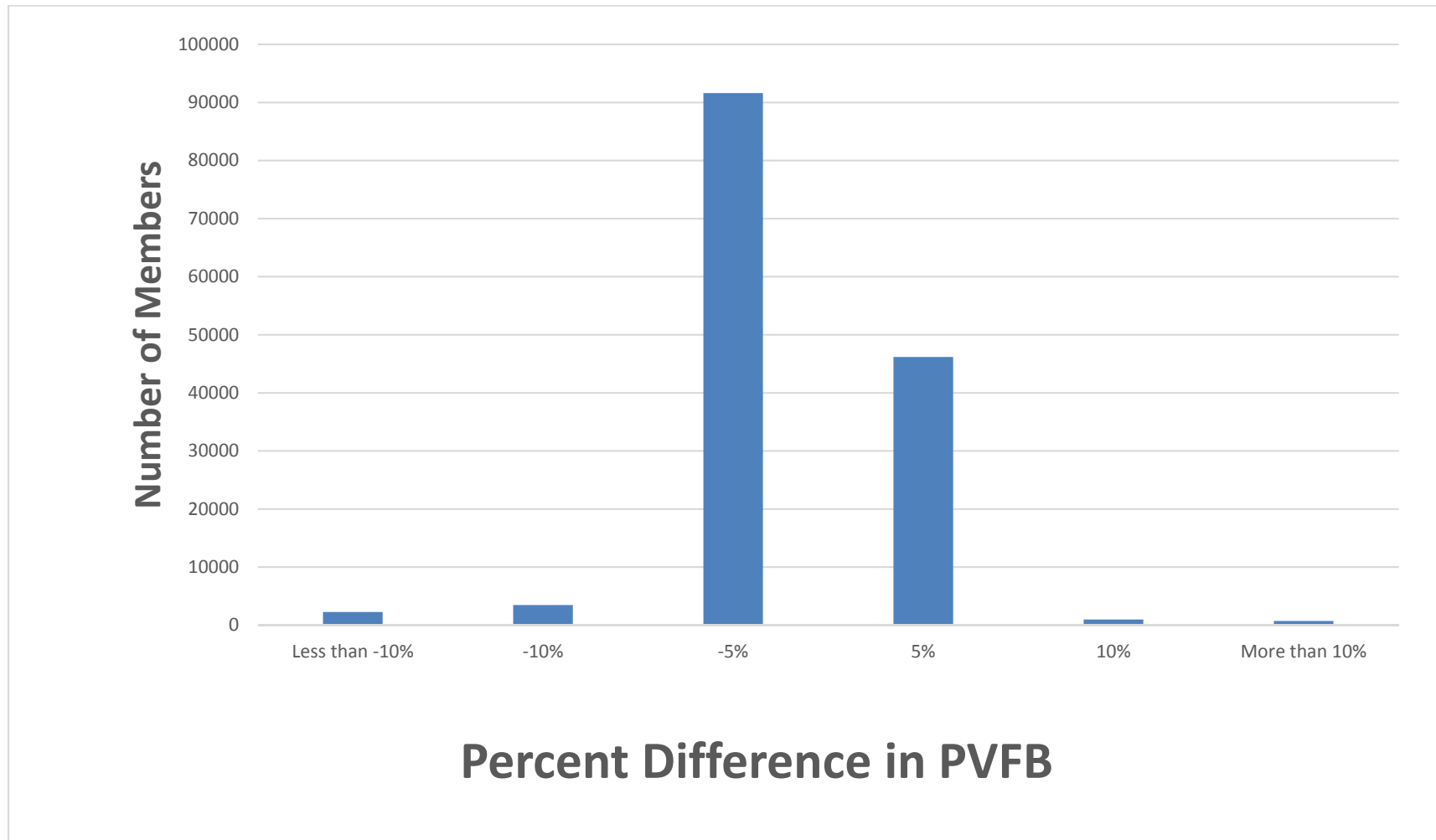


Chart Tabulation Method and Notation: The chart above reflects percent differences between Buck and CalPERS results, rounded to the nearest hundredth of a percent, where -5% reflects Buck results that were within the range from 0.00% to -4.99% compared to CalPERS results, where -10% reflects Buck results within -5.00% to -9.99% of CalPERS results, etc.

Appendix – 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. While the valuations we reviewed were made as of June 30, 2014, we have noted the following items that may be considered for inclusion in future reports in order to meet the requirements of the current version of ASOP 4:

- a) Enhanced description of the contribution allocation procedure, including a more detailed description of what the five-year ramp up and ramp-down in amortizations entails. (4.1(k) of ASOP 4) [**Comment:** The June 30, 2017 valuation reports have addressed this recommendation.]
- b) A statement regarding the impact of the funding policy on future contributions. In other words, explain 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, 2017 valuation reports have addressed this recommendation.]
- c) Provide 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, 2017 valuation reports include these items.]
- 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), include 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 to fully satisfy this requirement of ASOP 4. [**Comment:** The June 30, 2017 valuation reports include these items.]
- e) In accordance with 4.1(s), it may be advisable to provide more detail on the rationale for changes in assumptions than was present in the reports we reviewed. [**Comment:** The June 30, 2017 valuation reports adequately refer to the 2017 Experience Study.]

2. Consider revising either the termination decrement tables or the process the valuation system uses to draw the probabilities.

- f) The current use of two termination decrement tables, one for refunds and one for vesting, is a long-time CalPERS practice but is not a universal approach to reflecting multiple possible outcomes of termination before meeting retirement eligibility requirements. The more common approach is to use a single withdrawal table that reflects the total probability of termination at each age. A second forfeiture table can be incorporated to value a refund of contributions instead of a deferred vested benefit. Such a table does not affect the total termination probability at any age and thus does not lead to the inconsistency we have identified in the application of the two termination tables presently used by CalPERS. This issue may be addressed in the next experience study. Until the termination decrement tables are restructured, a short-term fix should be considered within the valuation system to eliminate the occurrence of the problem. [**Comment:** The issue with the “vesting” decrement was resolved for the June 30, 2017 valuation, though CalPERS continues to use the dual termination decrement approach.]

3. Consider including additional demographic data in pooled public agency valuation reports.

- g) While not required by actuarial standards, it may be beneficial for completeness and transparency to include additional demographic data such as average age and average service in the pooled public agency valuation reports. This information is incorporated for the entire risk pool by reference in Section 2 of each public agency valuation report, but not separately for each public agency on a stand-alone basis. [**Comment:** We reiterate this recommendation in Section V of this report.]