

City of Phoenix Employees' Retirement System

ACTUARIAL VALUATION REPORT AS OF

June 30, 2020





October 9, 2020

Mr. Scott Steventon
Retirement Program Administrator
City of Phoenix Employees' Retirement System
200 W. Washington Street, 10th Floor
Phoenix, Arizona 85003

Re: Actuarial Valuation of the City of Phoenix Employees' Retirement System as of June 30, 2020

Dear Scott:

The results of the June 30, 2020 Annual Actuarial Valuation of the City of Phoenix Employees' Retirement System ("COPERS") are presented in this report.

This report was prepared at the request of the Board and is intended for use by COPERS and those designated or approved by the Board. This report may be provided to parties other than COPERS only in its entirety and only with the permission of the Board. GRS is not responsible for unauthorized use of this report.

The purposes of the valuation are to measure the COPERS's funding progress, to determine the employer contribution rate, and analyze changes in this rate. In addition, the report provides various summaries of the data. This report should not be relied on for any purpose other than the purposes described herein. Determinations of financial results, associated with the benefits described in this report, for purposes other than those identified above may be significantly different. Accounting information for purposes of complying with Governmental Accounting Standards Board (GASB) Statements No. 67 and No. 68 for the is provided in a separate report.

The contribution rate in this report is determined using the actuarial assumptions and methods disclosed in Section G of this report. This report includes risk metrics in Section H, but does not include a more robust assessment of the risks of future experience not meeting the actuarial assumptions. Additional assessment of risks was outside the scope of this assignment.

This valuation assumed the continuing ability of the plan sponsor to make the contributions necessary to fund this plan. A determination regarding whether or not the plan sponsor is actually able to do so is outside our scope of expertise and was not performed.

This report was prepared using assumptions adopted by the Board. All actuarial assumptions used in this report are reasonable for the purposes of this valuation. All actuarial assumptions and methods used in the valuation follow the guidance in the applicable Actuarial Standards of Practice.

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This report was prepared using our proprietary valuation model which in our professional judgment has the capability to provide results that are consistent with the purposes of the valuation. We performed tests to ensure that the model reasonably represents that which is intended to be modeled.

We certify that the information contained in this report is accurate and fairly presents the actuarial position of COPERS as of the valuation date.

Financing Objectives

The Actuarially Determined Contribution (ADC) is determined by taking the sum of the normal cost, a component to amortize the unfunded liability and a component to cover administrative expenses. The Board's current funding policy is to contribute an amount each year based on the most recently calculated Actuarially Determined Contribution.

The unfunded accrued liability is comprised of experience gains and losses, assumption changes and benefit changes. A base is established in each year for changes in the unfunded accrued liability arising from these sources. In September 2013, the Board adopted amortization payment methods that amortize the pre-assumption changes of July 1, 2013 over a closed 25-year period as a level percentage of payroll; amortizes the assumption change liability as of July 1, 2013 over a closed 25-year period as a level percentage of payroll with a four-year phase in, and amortizes future gains and losses over a closed 20 year period. Future gains cannot be amortized over a period shorter than the period remaining on the 25-year amortization schedule. The actuarially determined contribution has decreased from 38.62% of pay to 37.60% of pay. The decrease is primarily due to assumption changes.

Assuming all actuarial assumptions are met, this method of payment of the unfunded liability will result in full funding in 19 years. Actual results can and almost certainly will differ, as actual experience deviates from the assumptions. A schedule of each year's initial base and remaining outstanding balance is illustrated in Exhibit B.6.

Progress Toward Realization of Financing Objectives

The unfunded actuarial accrued liability and the funded ratio (ratio of the actuarial value of assets to the actuarial accrued liability) illustrate the progress toward the realization of certain financing objectives.

Based on the actuarial valuation as of June 30, 2020, COPERS has an unfunded liability of \$1,603 million and a funded ratio of 63.69%.

Although there were losses on the actuarial value of assets, the funded ratio on an actuarial value of assets basis increased from 60.80% to 63.69%. The funded ratio on a market value of assets basis increased from 60.4% to 60.7%. This increase was due primarily to liability gains and assumption changes. A funded ratio less than 100% indicates an actuarially determined contribution that will require a normal cost and an amortization payment. If the contributions equal the ADC, and if all assumptions are met, the funded ratio should improve over time.



Benefit Provisions

All of the benefit provisions reflected in this valuation are those which were in effect on June 30, 2020. The benefit provisions are summarized in Section E of this Report.

Assumptions and Methods

The Board accepted GRS's recommendations on both the economic and demographic assumptions based on the most recent experience study that analyzed data from July 1, 2014 through June 30, 2019. The new assumptions were adopted in July 2020. The assumptions regarding sick leave, vacation time, and compensation time were adopted in August 2020. These assumptions and methods are detailed in Section G of this Report. The Board has sole authority to determine the actuarial assumptions used for COPERS. In our opinion, the actuarial assumptions used are reasonable.

Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period or additional cost or contribution requirements based on COPERS's funded status); and changes in plan provisions or applicable law. The actuarial calculations presented in this report are intended to provide information for rational decision making.

Data

The findings in this report are based on data and other information through June 30, 2020. The valuation was based upon information furnished by the City of Phoenix Employees' Retirement System staff, concerning Retirement System benefits, financial transactions, plan provisions and active members, terminated members, retirees and beneficiaries. We checked for internal reasonability and year-to-year consistency, but did not audit the data. We are not responsible for the accuracy or completeness of the information provided by City of Phoenix Employees' Retirement System staff.

Certification

This report has been prepared by actuaries who have substantial experience valuing public employee retirement systems. To the best of our knowledge the information contained in this report is accurate and fairly presents the actuarial position of the City of Phoenix Employees' Retirement System as of the valuation date. All calculations have been made in conformity with generally accepted actuarial principles and practices, and with the Actuarial Standards of Practice issued by the Actuarial Standards Board.

Paul Wood and Bill Detweiler are members of the American Academy of Actuaries. These actuaries meet the Academy's Qualification Standards to render the actuarial opinions contained herein. The signing actuaries are independent of the plan sponsor.



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Gabriel, Roeder, Smith & Company will be pleased to review this valuation and Report with the Board of Trustees and to answer any questions pertaining to the valuation.

Respectfully submitted,

Gabriel, Roeder, Smith & Company

A handwritten signature in black ink that reads "Paul Wood". The signature is fluid and cursive, with a long horizontal stroke at the end.

Paul Wood, ASA, FCA, MAAA
Consultant

A handwritten signature in black ink that reads "Bill Detweiler". The signature is cursive and somewhat stylized, with a prominent horizontal line across the middle.

Bill Detweiler, ASA, FCA, MAAA
Senior Analyst

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SECTION A

EXECUTIVE SUMMARY

Actuarial Valuation

Valuations are prepared annually, as of June 30 of each year. The primary purposes of the valuation report are to measure the plan's liabilities, to determine the contribution rate and to analyze changes in the City of Phoenix Employees' Retirement System actuarial position.

In addition, the report provides summaries of the member data, financial data, plan provisions, and actuarial assumptions and methods.

Financing Objectives

The employer contributions are intended to be sufficient to pay the normal cost and administrative expenses and to amortize the Unfunded Actuarial Accrued Liability (UAAL) as described on page B-6 of this report.

The contribution rate shown on pages B-4 and B-5 may be considered as a minimum contribution rate that complies with the Board's funding policy. Users of this report should be aware that contributions made at that rate do not guarantee benefit security. Given the importance of benefit security to any retirement system, we suggest that contributions to COPERS in excess of those presented in this report be considered.

The contribution rate in this report is determined using the actuarial assumptions and methods disclosed in Section G of this report. This report does not include a more robust assessment of the risks of future experience not meeting the actuarial assumptions. Assessment of risks was outside the scope of this assignment. We encourage a review and assessment of investment and other significant risks that may have a material effect on the plan's financial condition.

Assumption Changes

The assumptions have been selected by the Board based upon the actuary's analysis and recommendations. New assumptions were adopted by the Board in July 2020 and August 2020 to first be effective as of June 30, 2020. The assumptions were adopted based on the most recent experience study that analyzed data from July 1, 2014 through June 30, 2019.

Below is a summary of the changes in assumptions from the prior valuation:

- The discount rate/assumed rate of return was reduced from 7.25% to 7.00%. The underlying price inflation was reduced from 2.50% to 2.30%.
- The COLA assumption for the Pension Equalization Reserve was reduced from 1.25% in all years to 0.50% through 2024, 1.00% from 2025-2029 and then 1.25%, thereafter.
- The assumption for unused sick leave, vacation time, and compensation time was updated to be valued explicitly with a 1.50% load included for adverse experience.
- Wage inflation was reduced from 3.00% to 2.80% and individual merit/promotion increase were changed to be service based rates ranging from 4.20% to 0.00%.



- The total payroll growth rate was reduced from 3.00% to 2.50%.
- Post-retirement, active life and disabled life mortality was updated to be based on the Pub-2010 tables with multipliers for healthy annuitant mortality and projected with the ultimate rates from the MP projection scales.
- Rates of disability, retirement, and termination were updated to reflect recent experience.

These assumption changes decreased the accrued liability by \$62.4 million and decreased the actuarially determined contribution by 1.1% of compensation.

These assumptions are detailed in Section G of this Report.

Experience During the Year

The plan experienced a contribution gain of \$2.2 million and a liability gain of \$77.7 million during fiscal year 2020. Details on the liability loss can be found on page B-8.

The plan experienced an asset loss of \$29.9 million during fiscal year 2020. As of June 30, 2020, the amount of outstanding assets losses not yet recognized in the actuarial value of assets was \$130.0 million. If the Plan does not earn investment earnings in excess of the assumed 7.00% per year, these losses will need to be recognized in future valuations. This will put downward pressure on the funded ratio and upward pressure on the Actuarially Determined Contribution.

Benefit Provision Changes

There were no changes to benefit provisions since the prior valuation. The benefit provisions are summarized in Section E of the report.

Financial Position and Summary of Results

The funded ratio on an actuarial value of assets basis increased from June 30, 2019 to June 30, 2020. On a market value of assets basis, the funded ratio increased from June 30, 2019 to June 30, 2020.

Exhibit A.1		
City of Phoenix Employees' Retirement System		
Executive Summary		
	June 30, 2020	June 30, 2019
1. Total Actuarially Determined Contribution		
a. Dollar Amount	\$ 218,934,349	\$ 223,534,984
b. As a % of Payroll	37.60%	38.62%
2. Funded Status		
a. Actuarial Accrued Liability	\$ 4,414,114,179	\$ 4,401,825,358
b. Actuarial Value of Assets (AVA)	2,811,162,852	2,677,352,751
c. Unfunded Liability (AVA-basis)	1,602,951,327	1,724,472,607
d. Funded Ratio (AVA-basis)	63.69%	60.82%
e. Market Value of Assets (MVA)	\$ 2,681,172,998	\$ 2,660,133,356
f. Unfunded Liability (MVA-basis)	1,732,941,181	1,741,692,002
g. Funded Ratio (MVA-basis)	60.74%	60.43%
3. Summary of Census Data		
a. Actives		
i.(a) Tier 1 Count	4,855	5,197
i.(b) Tier 2 Count	626	657
i.(c) Tier 3 Count	2,546	2,087
i.(d) Total Active Count	8,027	7,941
ii. Total Annual Compensation	\$ 568,646,484	\$ 562,988,925
iii. Average Projected Compensation	70,842	70,896
iv. Average Age	46.8	46.6
v. Average Service	12.1	12.2
b. Deferred Vested Member Counts	1,033	1,008
c. Retiree Counts	6,109	6,013
d. Beneficiary and Alternate Payee Counts	1,160	1,110
e. Disability Counts	233	245
f. Total Members Included in Valuation	16,562	16,317

The funded ratio may not be appropriate for assessing the need for future contributions. The funded ratio is not appropriate for assessing the sufficiency of plan assets to cover the estimated cost of settling the plan's benefit obligations.



SECTION B

VALUATION RESULTS

Exhibit B.1
City of Phoenix Employees' Retirement System
Actuarial Valuation Results
Actuarial Accrued Liability

	June 30, 2020				June 30, 2019
	Tier 1	Tier 2	Tier 3	Total	Total
1. Active Members					
a. Retirement Benefits	\$ 1,441,969,524	\$ 37,142,850	\$ 38,971,262	\$ 1,518,083,636	\$ 1,536,663,961
b. Withdrawal Benefits	14,502,021	1,293,188	2,469,751	18,264,960	28,747,193
c. Disability Benefits	5,387,240	268,499	259,647	5,915,386	16,013,617
d. Death Benefits	13,286,053	661,144	648,841	14,596,038	15,625,419
e. Total	<u>\$ 1,475,144,838</u>	<u>\$ 39,365,681</u>	<u>\$ 42,349,501</u>	<u>\$ 1,556,860,020</u>	<u>\$ 1,597,050,190</u>
2. Members with Deferred Benefits				\$ 88,340,438	\$ 80,242,160
3. Members Receiving Benefits				\$ 2,768,913,721	\$ 2,724,533,008
4. Total				\$ 4,414,114,179	\$ 4,401,825,358
5. Actuarial Value of Assets				<u>\$ 2,811,162,852</u>	<u>\$ 2,677,352,751</u>
6. Unfunded Actuarial Accrued Liability				\$ 1,602,951,327	\$ 1,724,472,607

Tier 1: Hired before July 1, 2013

Tier 2: Hired between July 1, 2013 and December 31, 2015

Tier 3: Hired on or after January 1, 2016



Exhibit B.2
City of Phoenix Employees' Retirement System
Actuarial Valuation Results
Normal Cost for Fiscal Year Ending June 30, 2022

	Tier 1	Tier 2	Tier 3	Total	Prior Year
1. Dollar Normal Cost					
a. Retirement Benefits	\$ 44,556,219	\$ 5,796,130	\$ 15,409,032	\$ 65,761,381	\$ 66,779,186
b. Withdrawal Benefits	6,694,559	992,385	3,179,039	10,865,983	10,861,831
c. Disability Benefits	474,291	57,823	159,501	691,615	2,029,985
d. Death Benefits	849,928	126,878	347,331	1,324,137	1,448,169
e. Total	\$ 52,574,997	\$ 6,973,216	\$ 19,094,903	\$ 78,643,116	\$ 81,119,171
2. Normal Cost as a Percentage of Pay	13.81%	16.62%	13.12%	13.84%	14.44%
3. Projected Payroll for FYE June 30, 2022	\$ 390,098,517	\$ 43,002,955	\$ 149,190,129	\$ 582,291,601	\$ 578,796,076
4. Dollar Normal Cost for FYE June 30, 2022	\$ 53,889,372	\$ 7,147,546	\$ 19,572,276	\$ 80,609,194	\$ 83,552,746

Tier 1: Hired before July 1, 2013

Tier 2: Hired between July 1, 2013 and December 31, 2015

Tier 3: Hired on or after January 1, 2016



Exhibit B.3
City of Phoenix Employees' Retirement System
Actuarial Valuation Results
Present Value of Projected Benefits

	June 30, 2020				June 30, 2019
	Tier 1	Tier 2	Tier 3	Total	Total
1. Active Members					
a. Retirement Benefits	\$ 1,705,462,968	\$ 94,328,995	\$ 198,500,085	\$ 1,998,292,048	\$ 2,020,565,843
b. Withdrawal Benefits	56,162,914	12,909,478	39,298,743	108,371,135	118,077,718
c. Disability Benefits	8,266,522	927,441	2,082,651	11,276,614	31,622,815
d. Death Benefits	<u>18,228,252</u>	<u>1,965,071</u>	<u>4,323,999</u>	<u>24,517,322</u>	<u>26,201,722</u>
e. Total	\$ 1,788,120,656	\$ 110,130,985	\$ 244,205,478	\$ 2,142,457,119	\$ 2,196,468,098
2. Members with Deferred Benefits				\$ 88,340,438	\$ 80,242,160
3. Members Receiving Benefits					
a. Healthy Retirees				\$ 2,510,904,553	\$ 2,481,348,289
b. Disabled Retirees				44,369,620	45,880,108
c. Beneficiaries				<u>213,639,548</u>	<u>197,304,611</u>
d. Total				\$ 2,768,913,721	\$ 2,724,533,008
4. Total				\$ 4,999,711,278	\$ 5,001,243,266

Tier 1: Hired before July 1, 2013

Tier 2: Hired between July 1, 2013 and December 31, 2015

Tier 3: Hired on or after January 1, 2016



Exhibit B.4
City of Phoenix Employees' Retirement System
Development of the Actuarially Determined Contribution

	June 30, 2020	June 30, 2019
1. Present Value of Projected Benefits		
a. Retirees and Beneficiaries	\$ 2,768,913,721	\$ 2,724,533,008
b. Deferred vested members	88,340,438	80,242,160
c. Active members	<u>2,142,457,119</u>	<u>2,196,468,098</u>
d. Total [(a) + (b) + (c)]	\$ 4,999,711,278	\$ 5,001,243,266
2. Present Value of Future Normal Costs	\$ 585,597,099	\$ 599,417,908
3. Entry Age Normal Accrued Liability [(1) - (2)]	\$ 4,414,114,179	\$ 4,401,825,358
4. Actuarial Value of Assets	<u>2,811,162,852</u>	<u>2,677,352,751</u>
5. Unfunded Actuarial Accrued Liability [(3) - (4)]	\$ 1,602,951,327	\$ 1,724,472,607
Development of the Actuarially Determined Contribution		
Fiscal Year Ending	June 30, 2022	June 30, 2021
6. Entry Age Normal Cost	\$ 80,609,194	\$ 83,552,746
7. Administrative Expenses	2,635,815	841,094
8. Amortization of UAAL	<u>135,689,340</u>	<u>139,141,144</u>
9. Actuarially Determined Contribution [(6) + (7) + (8)]	\$ 218,934,349	\$ 223,534,984
10. Projected Payroll	\$ 582,291,601	\$ 578,796,076
11. Actuarially Determined Contribution as a Percent of Compensation	37.599%	38.621%

Exhibit B.5
City of Phoenix Employees' Retirement System
Actuarial Valuation Results
Summary of Contribution Rates and Estimated Amounts

Fiscal Year Ending	June 30, 2022	June 30, 2021
1. Total Contribution Rate		
a. Total Normal Cost Rate	13.84%	14.44%
b. Administrative Expense Rate	0.45%	0.15%
c. Total UAL Contribution Rate	23.30%	24.04%
d. Total Projected Rate	37.60%	38.62%
2. Member Contribution Rates		
a. Tier 1	5.00%	5.00%
b. Tier 2	11.00%	11.00%
c. Tier 3	11.00%	11.00%
3. City Contribution Rates		
a. Tier 1	32.60%	33.62%
b. Tier 2	26.60%	27.62%
c. Tier 3	26.60%	27.62%
4. Projected Payroll		
a. Tier 1	\$ 390,098,517	\$ 415,669,317
b. Tier 2	43,002,955	42,457,893
c. Tier 3	149,190,129	120,668,866
d. Total	\$ 582,291,601	\$ 578,796,076
5. Estimated Contribution Amounts		
a. Memebrs	\$ 40,646,165	\$ 38,727,409
b. City	178,288,184	184,807,575
c. Total	\$ 218,934,349	\$ 223,534,984

Development of Actuarially Determined Contribution (Continued)

The Actuarially Determined Contribution (ADC) is calculated in accordance with the Funding Policy adopted by the Board. The unfunded accrued liability is amortized according to the following schedule. Please see Section G of this report for a full description of the funding policy.

Exhibit B.6					
City of Phoenix Employees' Retirement System					
Amortization of Unfunded Actuarial Liability as of June 30, 2020					
Base Year	Remaining Base as of June 30, 2020	Years Remaining as of June 30, 2020	Remaining Base as of June 30, 2021	Years Remaining as of June 30, 2021	Amortization Payment For FYE June 30, 2022
2013 UAL	\$ 1,110,744,192	18	\$ 1,095,685,617	17	\$ 91,966,547
2013 Assumption Changes	473,626,488	18	467,205,442	17	39,214,963
2014 Experience Gain	(58,604,883)	18	(57,810,365)	17	(4,852,322)
2015 Experience Gain	(2,995,173)	18	(2,954,567)	17	(247,992)
2015 Assumption Changes	290,574,060	15	283,390,237	14	27,273,674
2016 Experience Gain	(33,185,930)	18	(32,736,022)	17	(2,747,703)
2016 Plan Changes	(3,427,462)	18	(3,380,995)	17	(283,784)
2016 Assumption Changes	(73,683,975)	18	(72,685,026)	17	(6,100,829)
2017 Experience Loss	10,173,836	17	10,002,678	16	875,291
2017 Assumption Changes	2,552,696	17	2,509,751	16	219,617
2018 Experience Gain	(75,423,968)	18	(74,401,431)	17	(6,244,896)
2019 Experience Loss	75,020,592	19	74,221,551	18	5,995,453
2020 Assumption Changes	(62,385,553)	20	(66,752,542)	19	(5,204,577)
2020 Experience Gain	(50,033,593)	20	(53,535,945)	19	(4,174,102)
Total	\$ 1,602,951,327		\$ 1,568,758,383		\$ 135,689,340

The payment of the 2015 assumption changes was phased-in over four years. The first year payment was one-fourth of the regularly calculated amortization payment, increasing each year until the end of the phase-in period. The outstanding balance at the end of the phase-in period is then amortized such that the full amount is paid off by the end of the remaining period.



Exhibit B.7
City of Phoenix Employees' Retirement System
Plan Experience for Fiscal Year 2020

Liabilities

1. Actuarial Accrued Liability at June 30, 2019	\$ 4,401,825,358
2. Normal Cost during Fiscal Year 2020	81,119,171
3. Benefit Payments during Fiscal Year 2020	242,143,292
4. Interest on Items 1-3 to End of Year	313,397,342
5. Change in Actuarial Accrued Liability Due to Assumption Changes	(62,385,553)
6. Change in Actuarial Accrued Liability Due to Provision Changes	0
7. Expected Actuarial Accrued Liability at June 30, 2020	4,491,813,026
8. Actual Actuarial Accrued Liability at June 30, 2020	4,414,114,179
9. Liability (Gain)/Loss	(77,698,847)

Assets

10. Actuarial Value of Assets at June 30, 2019	\$ 2,677,352,751
11. Benefit Payments and Administrative Expenses during Fiscal Year 2020	244,652,099
12. Expected Contributions during Fiscal Year 2020	213,141,648
13. Interest on Items 10-12 to End of Year	192,985,806
14. Expected Actuarial Value of Assets at June 30, 2020	2,838,828,106
15. Actual Actuarial Value of Assets at June 30, 2020	2,811,162,852
16. Total Asset and Contribution (Gain)/Loss	27,665,254
16.(a) Asset (Gain)/Loss	29,904,010
16.(b) Contribution (Gain)/Loss	(2,238,756)

Total

17. Total (Gain)/Loss [9. + 16.]	\$ (50,033,593)
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Exhibit B.8
City of Phoenix Employees' Retirement System
Plan Experience for Fiscal Year 2020
(Gain)/Loss by Source

1. Liability (Gain)/Loss		
a. Salary (Gain)/Loss		(32,984,202)
b. New Members and Rehire (Gain)/Loss		1,367,815
c. Withdrawal (Gain)/Loss		3,522,492
d. Retirement (Gain)/Loss		(15,943,134)
e. Annuitant Mortality (Gain)/Loss		(4,889,295)
f. Difference Between Expected and Actual COLA		(27,835,147)
h. Other Demographic (Gain)/Loss		(937,376)
i. Total		<u>(77,698,847)</u>
2. Asset (Gain)/Loss	\$	29,904,010
3. Contribution (Gain)/Loss	\$	(2,238,756)
4. Total (Gain)/Loss	\$	(50,033,593)

Exhibit B.9
City of Phoenix Employees' Retirement System
Schedule of Funding Progress

Actuarial Valuation Date	Actuarial Value of Assets	Actuarial Accrued Liability (AAL)	Unfunded AAL (UAAL)	Funded Ratio	Covered Payroll	UAAL as a Percentage of Covered Payroll
(1)	(2)	(3)	(4)=(3)-(2)	(5)=(2)/(3)	(6)	(7)=(4)/(6)
6/30/2008	\$ 1,908,414	\$ 2,413,365	\$ 504,951	79.1%	\$ 566,512	89.1%
6/30/2009	1,895,148	2,518,094	622,946	75.3%	539,468	115.5%
6/30/2010	1,868,093	2,697,288	829,195	69.3%	550,175	150.7%
6/30/2011	1,834,620	2,752,909	918,289	66.7%	513,322	178.9%
6/30/2012	1,827,528	2,939,374	1,111,845	62.2%	506,017	219.7%
6/30/2013	1,961,939	3,055,606	1,093,668	64.2%	508,032	215.3%
6/30/2014	2,120,700	3,614,784	1,494,084	58.7%	509,267	293.4%
6/30/2015	2,202,923	3,975,908	1,772,985	55.4%	484,853	365.7%
6/30/2016	2,283,216	3,984,137	1,700,921	57.3%	496,333	342.7%
6/30/2017	2,402,707	4,129,452	1,726,745	58.2%	521,709	331.0%
6/30/2018	2,562,847	4,226,046	1,663,199	60.6%	527,161	315.5%
6/30/2019	2,677,353	4,401,825	1,724,473	60.8%	562,989	306.3%
6/30/2020	2,811,163	4,414,114	1,602,951	63.7%	568,646	281.9%

Amounts in thousands



Exhibit B.10
City of Phoenix Employees' Retirement System
Solvency Test

Valuation Date	Aggregated Accrued Liabilities for				Actuarial Value of Assets	Portion of Accrued Liabilities Covered by Reported Assets		
	Active Members Contributions	Retirees Beneficiaries and Vested Terminations	Members (Employer Financed Portion)	[(5)-(2)-(3)]/ (4)		(5)/(2)	[(5)-(2)]/(3)	(4)
	(2)	(3)	(4)					
June 30, 2008	\$ 433,742	\$ 1,066,886	\$ 912,737	\$ 1,908,414	100.0%	100.0%	44.7%	
June 30, 2009	446,039	1,193,391	878,664	1,895,148	100.0%	100.0%	29.1%	
June 30, 2010	445,141	1,311,929	940,217	1,868,093	100.0%	100.0%	11.8%	
June 30, 2011	446,456	1,431,877	874,576	1,834,620	100.0%	96.9%	0.0%	
June 30, 2012	443,964	1,525,152	970,258	1,827,528	100.0%	90.7%	0.0%	
June 30, 2013	396,583	1,881,123	1,201,741	1,962,533	100.0%	83.2%	0.0%	
June 30, 2014	393,754	2,099,274	1,121,756	2,120,700	100.0%	82.3%	0.0%	
June 30, 2015	383,029	2,465,862	1,127,017	2,202,923	100.0%	73.8%	0.0%	
June 30, 2016	393,626	2,522,989	1,067,522	2,283,216	100.0%	74.9%	0.0%	
June 30, 2017	406,651	2,638,084	1,084,717	2,402,707	100.0%	75.7%	0.0%	
June 30, 2018	417,314	2,704,971	1,103,761	2,562,847	100.0%	79.3%	0.0%	
June 30, 2019	420,431	2,804,775	1,176,619	2,677,353	100.0%	80.5%	0.0%	
June 30, 2020	437,719	2,857,254	1,119,141	2,811,163	100.0%	83.1%	0.0%	

Amounts in thousands



Exhibit B.11
City of Phoenix Employees' Retirement System
Analysis of Financial Experience
Dollar Amounts in Thousands

Fiscal Year	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011
1. UAAL at Start of Year	\$ 1,724,473	1,663,199	1,726,745	1,700,921	1,772,985	1,494,084	1,516,915	1,111,845	918,289	829,195
2. Normal Cost for Year*	83,628	74,048	73,449	73,256	80,757	75,310	78,331	71,828	77,366	80,099
3. Expected Contributions	(213,142)	(198,860)	(187,324)	(183,023)	(178,288)	(157,314)	(153,885)	(143,502)	(133,822)	(119,613)
4. Assumed Investment Income Accrual on (1), (2) and (3)	<u>120,412</u>	<u>116,137</u>	<u>121,133</u>	<u>123,527</u>	<u>129,383</u>	<u>109,037</u>	<u>110,987</u>	<u>86,136</u>	<u>71,248</u>	<u>64,652</u>
5. Expected UAAL Before Changes	\$ 1,715,371	1,654,524	1,734,003	1,714,681	1,804,836	1,521,117	1,552,347	1,126,307	933,081	854,333
6. Effect of Assumption/Method Changes	(62,386)	0	0	2,420	(69,420)	254,870	0	423,247	0	0
7. Effect of Benefit Changes	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>(3,229)</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
8. Expected UAAL After Changes	\$ 1,652,985	1,654,524	1,734,003	1,717,101	1,732,187	1,775,987	1,552,347	1,549,554	933,081	854,333
9. Actual UAAL	<u>1,602,951</u>	<u>1,724,473</u>	<u>1,663,199</u>	<u>1,726,745</u>	<u>1,700,921</u>	<u>1,772,985</u>	<u>1,494,084</u>	<u>1,516,915</u>	<u>1,111,845</u>	<u>918,289</u>
10. Gain / (Loss) [8. - 9.]	\$ 50,034	(69,949)	70,804	(9,644)	31,266	3,002	58,263	32,639	(178,764)	(63,956)
11. As % of AAL at Start of Year	1.14%	-1.66%	1.71%	-0.24%	0.80%	0.10%	1.70%	1.10%	-6.50%	-2.40%

* Includes administrative expenses beginning in 2017



SECTION C

PLAN ASSETS

Exhibit C.1
City of Phoenix Employees' Retirement System
Statement of Plan Net Assets

	June 30, 2020
Assets	
Cash and Cash Equivalents	\$ 68,296,064
Investments, at fair value:	
Fixed income	500,218,393
Equity securities	913,348,063
Hedge funds	108,911,558
Real estate investments	347,119,418
International equities	759,904,460
Total investments	\$ 2,629,501,892
Receivables:	
Employer contributions	7,545,364
Employee contributions	1,660,513
Dividends and Interest	3,581,960
Unsettled transactions	4,678,445
Other	1,752,497
Total receivables	\$ 19,218,779
Total assets	\$ 2,717,016,735
Accounts Payable	
Accrued investment expenses	3,100,646
Unsettled transactions	10,691,620
Other	22,051,471
Total payables	\$ 35,843,737
Net assets held in trust for pension benefits	\$ 2,681,172,998



Exhibit C.2
City of Phoenix Employees' Retirement System
Statement of Changes in Plan Net Assets

	<u>Year Ended June 30, 2020</u>	<u>Year Ended June 30, 2019</u>
Additions to Net Assets Attributed to:		
Contributions		
Employer contributions	\$ 175,947,312	\$ 165,796,485
Plan members contributions	39,356,099	35,042,394
Retirement office administration	2,134,000	1,986,000
Inter-system transfers	0	374,972
Total	<u>\$ 217,437,411</u>	<u>\$ 203,199,851</u>
Net Investment Income		
Net appreciation in fair value of investments	29,104,643	113,264,706
Interest and dividends	37,197,216	39,577,284
Net income from security lending activities	208,076	289,573
Other	3,899,161	5,106,080
	<u>70,409,096</u>	<u>158,237,643</u>
Less Investment expense	<u>(20,020,766)</u>	<u>(15,275,344)</u>
Net investment income	<u>\$ 50,388,330</u>	<u>\$ 142,962,299</u>
Total additions	<u>\$ 267,825,741</u>	<u>\$ 346,162,150</u>
Deductions to Net Assets Attributed to:		
Benefit payments	239,406,948	234,301,348
Refunds	2,525,765	3,011,713
Retirement office administration	2,134,000	1,986,000
Inter-system transfers	210,579	450,630
Administrative expenses	2,508,807	792,812
Total deductions	<u>\$ 246,786,099</u>	<u>\$ 240,542,503</u>
Change in net assets	21,039,642	105,619,647
Net assets held in trust for benefits:		
Beginning of year	2,660,133,356	2,554,513,709
End of year	<u>\$ 2,681,172,998</u>	<u>\$ 2,660,133,356</u>



Exhibit C.3
City of Phoenix Employees' Retirement System
Development of the Actuarial Value of Assets

Item	Year Ending June 30, 2020
1. Actuarial Value of Assets, Beginning of Year	\$ 2,677,352,751
2. Net Cash Flow	\$ (29,348,688)
3. Expected return	\$ 193,062,799
4. Actual Return	\$ 50,388,330
5. Excess return [(4) - (3)]	\$ (142,674,469)
6. Gains/(Losses)	
a. Current Year	(142,674,469)
b. Prior Year	(41,514,122)
c. 2nd Prior Year	(8,907,765)
d. 3rd Prior Year	73,480,315
e. Total	(119,616,041)
7. Phase-In Amount [25% of 6.e.]	\$ (29,904,010)
8. Actuarial Value of Assets, End of Year [(1) + (2) + (3) + (7)]	\$ 2,811,162,852
9. Estimated Rate of Return	6.13%
10. Ratio of Actuarial to Market Value of Assets	104.8%

SECTION D

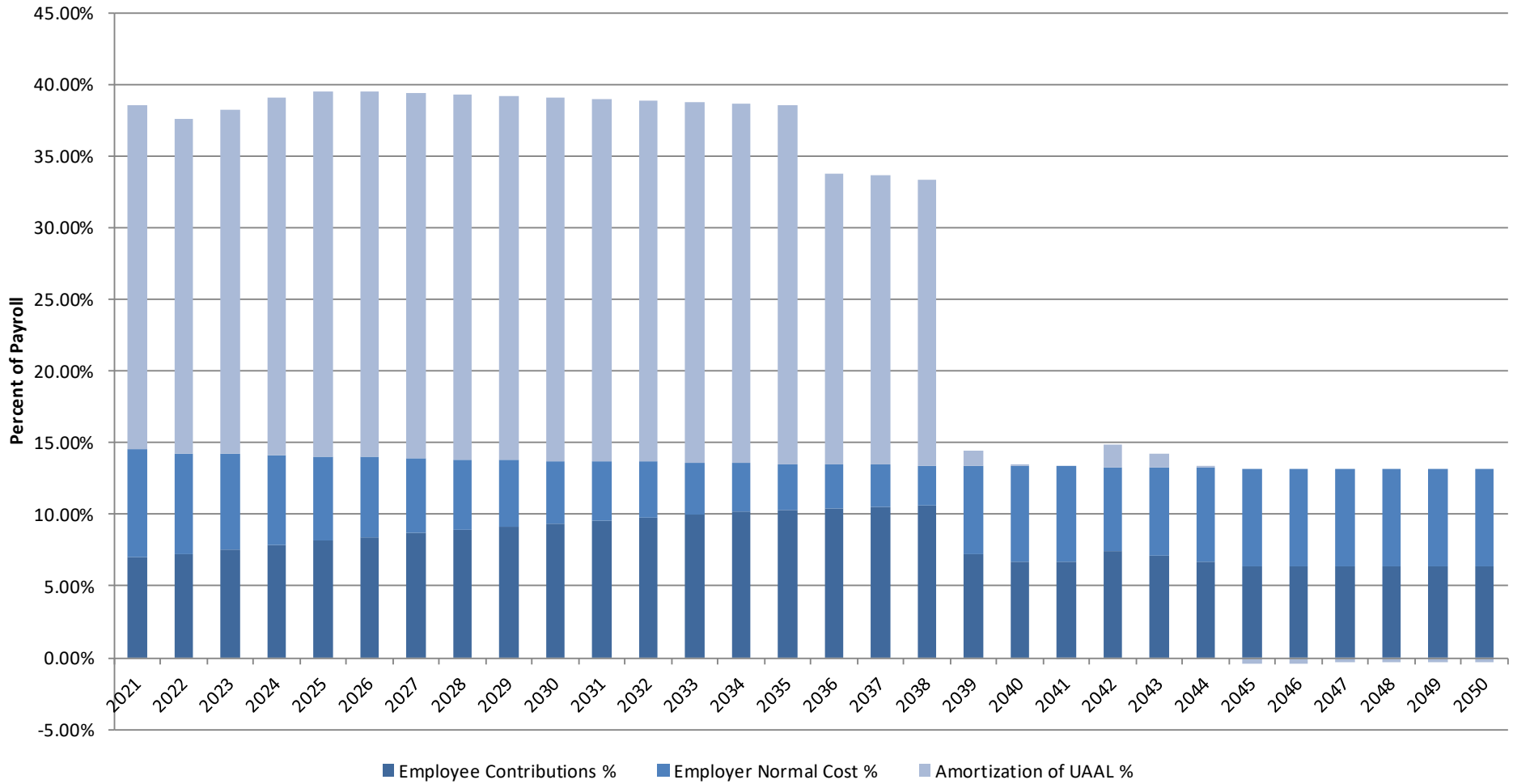
PROJECTIONS

**City of Phoenix Employees Retirement System
Projection Results Based on June 30, 2020 Actuarial Valuation**

Valuation as of June 30,	Contribution for Fiscal Year End June 30,	Market Return for FY Beginning on Valuation Date	Payroll (in Millions)	Employee Contribution (% of Payroll)	Employer Normal Cost (% of Payroll)	Employer Amortization Payment (% of Payroll)	Total Employer Contribution (6)+(7) (% of Payroll)	Total Contribution (5)+(8) (% of Payroll)	Employee Contribution (4)*(5) (in Millions)	Employer Contribution (4)*(8) (in Millions)	Total Contribution (10)+(11) (in Millions)	Actuarial Accrued Liability (AAL, in Millions)	Actuarial Value of Assets (AVA, in Millions)	Unfunded Actuarial Accrued Liability (UAAL, in Millions)	Funded Ratio	Projected Benefit Payments in FY Following Val Date (in Millions)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
2020	2021	7.00%	\$568	7.02%	7.57%	24.04%	31.60%	38.62%	\$40	\$180	\$219	\$4,414	\$2,811	\$1,603	63.7%	\$252
2021	2022	7.00%	582	7.26%	7.04%	23.30%	30.34%	37.60%	42	177	219	4,542	2,921	1,621	64.3%	264
2022	2023	7.00%	594	7.57%	6.64%	24.08%	30.72%	38.29%	45	182	227	4,668	3,027	1,641	64.8%	275
2023	2024	7.00%	607	7.86%	6.28%	24.94%	31.22%	39.08%	48	190	237	4,792	3,146	1,646	65.7%	287
2024	2025	7.00%	622	8.15%	5.92%	25.47%	31.39%	39.54%	51	195	246	4,914	3,308	1,607	67.3%	299
2025	2026	7.00%	636	8.42%	5.58%	25.50%	31.08%	39.50%	54	198	251	5,034	3,479	1,555	69.1%	312
2026	2027	7.00%	652	8.68%	5.25%	25.47%	30.72%	39.40%	57	200	257	5,151	3,655	1,495	71.0%	325
2027	2028	7.00%	668	8.93%	4.94%	25.45%	30.39%	39.33%	60	203	263	5,264	3,838	1,426	72.9%	338
2028	2029	7.00%	684	9.17%	4.64%	25.44%	30.08%	39.25%	63	206	269	5,373	4,025	1,348	74.9%	351
2029	2030	7.00%	702	9.40%	4.36%	25.40%	29.75%	39.16%	66	209	275	5,479	4,219	1,260	77.0%	363
2030	2031	7.00%	720	9.62%	4.09%	25.34%	29.43%	39.05%	69	212	281	5,581	4,420	1,161	79.2%	376
2031	2032	7.00%	740	9.82%	3.84%	25.28%	29.12%	38.94%	73	215	288	5,679	4,628	1,052	81.5%	389
2032	2033	7.00%	760	10.00%	3.62%	25.21%	28.82%	38.83%	76	219	295	5,774	4,844	930	83.9%	400
2033	2034	7.00%	780	10.16%	3.41%	25.13%	28.54%	38.71%	79	223	302	5,865	5,070	795	86.4%	412
2034	2035	7.00%	802	10.31%	3.23%	25.04%	28.27%	38.58%	83	227	309	5,954	5,308	646	89.2%	422
2035	2036	7.00%	824	10.44%	3.07%	20.28%	23.34%	33.78%	86	192	278	6,040	5,559	481	92.0%	432
2036	2037	7.00%	847	10.55%	2.92%	20.20%	23.12%	33.67%	89	196	285	6,126	5,785	340	94.4%	441
2037	2038	7.00%	871	10.65%	2.79%	19.93%	22.72%	33.37%	93	198	291	6,210	6,025	185	97.0%	450
2038	2039	7.00%	896	7.23%	6.18%	1.05%	7.23%	14.46%	65	65	130	6,295	6,278	17	99.7%	457
2039	2040	7.00%	922	6.70%	6.68%	0.02%	6.70%	13.39%	62	62	123	6,381	6,374	6	99.9%	463
2040	2041	7.00%	948	6.67%	6.67%	0.00%	6.67%	13.35%	63	63	127	6,469	6,465	5	99.9%	469
2041	2042	7.00%	975	7.42%	5.90%	1.52%	7.42%	14.84%	72	72	145	6,562	6,559	3	100.0%	474
2042	2043	7.00%	1,003	7.10%	6.19%	0.91%	7.10%	14.20%	71	71	142	6,658	6,672	(14)	100.2%	479
2043	2044	7.00%	1,032	6.69%	6.57%	0.12%	6.69%	13.38%	69	69	138	6,760	6,787	(26)	100.4%	484
2044	2045	7.00%	1,061	6.43%	6.80%	-0.37%	6.43%	12.86%	68	68	136	6,868	6,900	(31)	100.5%	488
2045	2046	7.00%	1,090	6.41%	6.80%	-0.39%	6.41%	12.82%	70	70	140	6,982	7,014	(32)	100.5%	493
2046	2047	7.00%	1,120	6.41%	6.77%	-0.36%	6.41%	12.82%	72	72	144	7,102	7,134	(32)	100.4%	500
2047	2048	7.00%	1,150	6.40%	6.76%	-0.36%	6.40%	12.80%	74	74	147	7,228	7,260	(32)	100.4%	506
2048	2049	7.00%	1,181	6.40%	6.75%	-0.35%	6.40%	12.79%	76	76	151	7,359	7,391	(33)	100.4%	514
2049	2050	7.00%	1,213	6.40%	6.74%	-0.34%	6.40%	12.79%	78	78	155	7,495	7,528	(33)	100.4%	522
2050	2051	7.00%	1,245	6.40%	6.73%	-0.34%	6.40%	12.79%	80	80	159	7,636	7,670	(34)	100.4%	530



Projected Contribution Rate for FYE June 30,



SECTION E

SUMMARY OF BENEFIT PROVISIONS

SUMMARY OF BENEFIT PROVISIONS

Membership

Full-time employees of the City of Phoenix other than police officers, firefighters, or elected officials who are covered by another retirement system to which the City contributes.

Members who were hired before July 1, 2013, as well as members who join the City after July 1, 2013 who were members of ASRS prior to July 1, 2011 and did not withdraw their contributions are Tier 1 members.

Members hired into employment with the City between July 1, 2013 and December 31, 2015 who are not Tier 1 members are Tier 2 members.

Members hired into employment with the City on or after January 1, 2016 who are not Tier 1 members or Tier 2 members are Tier 3 members.

Final Average Compensation (FAC)

Tier 1/Tier 2

The average of annual compensation for the period of 3 consecutive years producing the highest average contained within the last 10 years immediately preceding retirement.

Tier 3

The average of annual compensation for the period of 5 consecutive years producing the highest average contained within the last 10 years immediately preceding retirement. Annual compensation will be limited to the first \$125,000 of compensation, indexed to inflation (Phoenix Area CPI-U) each January 1, commencing on January 1, 2017.

Credited Service

Credited service is determined based on Section 14 of Chapter XXIV of the Phoenix City Charter as well as COPERS administrative policy number 43. In no case is more than a year of service credited to any member for all service rendered in any calendar year. The amount of service credited to members varies by Tier, as detailed below.

Tier 1

A member is credited with a month of service for each calendar month in which the member performs at least 10 days of City service. A member is credited with a year of service for any calendar year in which the member has at least 10 months of credited service. If a member has less than 10 months of credited service for any calendar year, they are credited for the actual number of months.



Tier 2/Tier 3

A member is credited with a month of service for each calendar month in which the member performs at least 20 days of City service. A member is credited with a year of service for any calendar year in which the member has at least 12 months of credited service. If a member has less than 12 months of credited service for any calendar year, they are credited for the actual number of months.

Voluntary Retirement (no reduction for age)

Tier 1

Eligibility:

Sum of age and credited service equals 80 or more, age 60 with 10 or more years of credited service or age 62 with 5 or more years of credited service.

Annual Benefit:

Unused sick leave service multiplied by 2% of FAC plus 2% of FAC times credited service up to 32.5 years plus 1% of FAC times service in excess of 32.5 years plus 0.5% of FAC times service in excess of 35.5 years. Minimum monthly pension is \$250 (\$500 if member has 15 or more years of service).

Tier 2/Tier3

Eligibility:

Sum of age and credited service equals 87 or more, age 60 with 10 or more years of credited service or age 62 with 5 or more years of credited service.

Annual Benefit:

Unused sick leave service multiplied by 2% of FAC for Tier 2 members only plus FAC times credited service times the corresponding accrual rate:

Tier 2		Tier 3	
Years of Service	Accrual Rate	Years of Service	Accrual Rate
0<Service≤20	2.10%	0<Service≤10	1.85%
20<Service≤25	2.15%	10<Service≤20	1.90%
25<Service≤30	2.20%	20<Service≤30	2.00%
Service>30	2.30%	Service>30	2.10%

Note that for Tier 2 and Tier 3, the same accrual rate will apply for each year of service based on the total years of service.



Deferred Vested Retirement

Eligibility:

Termination of City employment prior to age 62 with 5 or more years of credited service.

Annual Benefit:

Accrued regular retirement amount based on credited service, unused sick leave service, and FAC at time of termination, payable beginning at age 62.

Duty Disability Retirement

Eligibility:

Total and permanent disability incurred in line of duty with the City.

Annual Benefit:

Computed in the same manner as the regular retirement amount base on FAC and credited service at time of disability retirement. Minimum is 15% of FAC for Tier 1 members and 15.75% for Tier 2 and Tier 3 members. Maximum during worker's compensation period is difference between final compensation and annualized workers compensation. At expiration of worker's compensation period, amount is recomputed to include years during which worker's compensation was paid.

Non-Duty Disability Retirement

Eligibility:

Total and permanent disability after 10 or more years of credited service.

Annual Benefit:

Computed in the same manner as the regular retirement amount base on FAC and credited service at time of disability retirement.

Pre-Retirement Duty Death Benefit

Eligibility:

Death in line of duty with the City and compensable under worker's compensation.

Annual Benefit:

To the spouse: Joint and 100% survivor actuarial equivalent of accrued regular retirement amount based on FAC and credited service and unused sick leave service at time of death. Minimum of 10 years of service is credited. To the children of a deceased member with 10 or more years of credited service: each child shall receive a monthly pension of \$200 until adoption, marriage, death or attainment of age 18.



Pre-Retirement Non-Duty Death Benefit

Eligibility:

10 or more years of credited service.

Annual Benefit:

Same as Pre-Retirement Duty Death Benefit.

Refund of Contributions

Eligibility:

Termination of covered service employment prior to eligibility for any other benefits.

Annual Benefit:

Accumulated member contribution with interest at no more than 3.75% annually after July 1, 2016.

Pension Equalization Reserve (PER)

The PER is credited with Excess Earnings, if any, each calendar year. Excess Earnings are defined as the excess over 8.0% of the annual average of the time-weighted rates of return for the immediately preceding five calendar years. The amounts credited to the PER are either used to fund percentage increases to pension amounts or one-time post retirement distribution benefits (13th checks).

On July 1 of each year, persons in receipt of a pension for at least 36 months receive a percentage increase based on the lesser of:

- i. Phoenix area Consumer Price Index (CPI) and
- ii. The amount the balance in the PER can fully fund

The increase, subject to the availability of funds in the PER, is payable beginning with the April 1 payment each year, retroactive to January 1 of the same year.

Also, after each plan year's return is known, all pensioners (excluding minors) as of the end of the plan year are eligible to receive a one-time post retirement distribution (13th check). The 13th check is a percentage of the pensioner's annual benefits based on the lesser of:

- i. One half of the Phoenix area Consumer Price Index (CPI) and
- ii. The excess of the rate of return over the assumed interest rate

The percentage cannot be more than three percent, but must be at least one percent and is subject to the availability of funds in the PER. The 13th check is payable on December 1.

The PER is only applicable for Tiers 1 and 2.



Projected Percentage

Actuarially determined normal cost rate plus an amortization rate on the unfunded actuarial liability and a rate for administrative expenses, stated as a percentage of projected member compensation.

Member Contribution Rates

Tier 1: 5% of pay
Tier 2/Tier 3: 50% of the Projected Percentage not to exceed 11% of pay on or after January 1, 2016

City Contribution Rates

Total Projected Percentage less Member Contribution Rates for each Tier.

Note: The summary of plan provisions is designed to outline principal plan benefits. If COPERS should find the plan summary not in accordance with the actual plan provisions, the actuary should immediately be alerted so the proper provisions are valued.



SECTION F

SUMMARY OF PARTICIPANT DATA

Exhibit F.1
City of Phoenix Employees' Retirement System
Summary of Census Data

	June 30, 2020	June 30, 2019
1. Active Members		
a. Counts	8,027	7,941
b. Annual Compensation	\$ 568,646,484	\$ 562,988,925
c. Average Annual Compensation	\$ 70,842	\$ 70,896
d. Average Age	46.8	46.6
e. Average Service	12.1	12.2
2. Deferred Vested Members		
a. Counts	1,033	1,008
b. Annual Deferred Benefits	\$ 14,115,513	\$ 13,619,208
c. Average Benefit	\$ 13,665	\$ 13,511
3. Retired Members		
a. Counts	6,109	6,013
b. Annual Benefits	\$ 214,952,799	\$ 210,707,173
c. Average Benefit	\$ 35,186	\$ 35,042
4. Disability		
a. Counts	233	245
b. Annual Deferred Benefits	\$ 3,830,503	\$ 3,963,226
c. Average Benefit	\$ 16,440	\$ 16,176
5. Beneficiaries and QDROs		
a. Counts	1,160	1,110
b. Annual Benefits	\$ 23,551,335	\$ 22,007,859
c. Average Benefit	\$ 20,303	\$ 19,827
6. Total Members Included in Valuation	16,562	16,317



Exhibit F.2
Summary of Changes in Participant Status
During Fiscal Year 2020

	Active Participants	With Deferred Benefits	Retirees	Disability	QDROs	Beneficiaries	Total
A. Number as of June 30, 2019	7,941	1,008	6,013	245	173	937	16,317
1. Age Retirements	(246)	(38)	284				0
2. Disability		(4)		4			0
3. Deceased	(8)	(2)	(188)	(16)	(10)	(45)	(269)
4. New Beneficiary					16	89	105
5. Terminated - Vested	(100)	100					0
6. Terminated - Nonvested	(243)						(243)
7. Cashouts	(6)	(17)					(23)
8. Benefits Expired			(1)			(1)	(2)
9. Rehired as Active	14	(14)					0
10. New Members	675						675
11. Data Corrections			1		1		2
B. Number as of June 30, 2020	8,027	1,033	6,109	233	180	980	16,562

Exhibit F.3
Active Member Counts by Age and Service
as of June 30, 2020

Age	Service							Total
	0-4	5-9	10-14	15-19	20-24	25-29	Over 30	
Under 20	2							2
20-24	148							148
25-29	432	32						464
30-34	423	121	84	4				632
35-39	435	131	214	100	5			885
40-44	369	142	226	252	105	4		1,098
45-49	315	134	223	266	277	67	6	1,288
50-54	256	104	214	270	263	172	41	1,320
55-59	219	111	172	241	243	125	93	1,204
60-64	129	81	124	155	106	66	58	719
Over 65	36	18	50	46	56	26	35	267
Total	2,764	874	1,307	1,334	1,055	460	233	8,027

Exhibit F.4
Active Member Average Salary by Age and Service
as of June 30, 2020

Age	Service							Total
	0-4	5-9	10-14	15-19	20-24	25-29	Over 30	
Under 20	*							\$42,041
20-24	\$42,390							\$42,390
25-29	\$50,940	\$59,464						\$49,650
30-34	\$53,922	\$69,393	\$63,377	*				\$58,161
35-39	\$59,462	\$72,031	\$71,637	\$75,450	\$71,037			\$65,280
40-44	\$64,712	\$75,317	\$74,579	\$80,570	\$80,669	*		\$72,265
45-49	\$62,793	\$70,768	\$75,390	\$80,269	\$86,181	\$94,554	\$95,061	\$75,786
50-54	\$64,631	\$71,405	\$72,248	\$77,745	\$85,296	\$89,276	\$93,421	\$77,089
55-59	\$65,312	\$75,862	\$68,002	\$76,169	\$78,901	\$84,943	\$87,159	\$75,123
60-64	\$71,240	\$79,348	\$70,991	\$74,205	\$78,124	\$88,863	\$83,593	\$76,319
Over 65	\$71,992	\$98,975	\$77,245	\$73,055	\$75,347	\$79,496	\$80,124	\$77,463
Over 70								
Total	\$59,838	\$73,191	\$72,030	\$77,690	\$82,279	\$88,179	\$86,520	\$70,842

*Average salary not shown for fields with less than four active members.

Exhibit F.5 Summary of Inactive Vested Members		
Age	Number of Members	Monthly Benefit
<30	3	\$1,205
30-34	50	\$34,747
35-39	109	\$93,209
40-44	152	\$177,509
45-49	201	\$238,156
50-54	226	\$271,231
55-59	201	\$269,181
60-64	86	\$86,654
65& Up	5	\$4,402

**Exhibit F.6
Summary of Members in Pay Status**

Age	Service Retirees		Disabled Retirees		Beneficiaries/QDROs	
	Number of Members	Annual Benefit	Number of Members	Annual Benefit	Number of Members	Annual Benefit
<55	139	\$7,094,900	32	\$618,173	87	\$1,252,304
55-59	570	\$26,466,182	36	\$617,667	72	\$1,472,756
60-64	1178	\$46,664,714	53	\$875,481	117	\$2,490,208
65-69	1476	\$52,062,182	47	\$803,735	153	\$3,026,204
70-74	1328	\$43,453,376	30	\$412,548	184	\$4,179,359
75-79	714	\$21,098,703	16	\$200,461	174	\$4,145,431
80-84	409	\$10,925,889	8	\$121,771	159	\$3,020,601
85-89	191	\$4,799,395	10	\$159,234	128	\$2,482,455
90 & Up	104	\$2,387,459	1	\$21,434	86	\$1,482,016

Exhibit F.7
Schedule of Retired Members Added to and Removed from Rolls
as of June 30, 2020

Year Ended	Added to Rolls		Removed		Total		Average Annual Pensions	% Increase in Pensions
	Count	Annual Pensions	Count	Annual Pensions	Count	Annual Pensions		
6/30/2010	432	15,259	170	3,206	4,931	138,273	28,042	9.5%
6/30/2011	444	15,251	184	3,574	5,191	149,950	28,887	8.4
6/30/2012	448	14,488	161	4,174	5,478	160,264	29,256	6.9
6/30/2013	426	12,574	201	3,996	5,703	168,843	29,606	5.4
6/30/2014	597	21,948	145	3,232	6,155	187,559	30,473	11.1
6/30/2015	578	22,483	192	4,225	6,541	205,816	31,466	9.7
6/30/2016	375	11,573	182	4,329	6,734	213,061	31,640	3.5
6/30/2017	321	9,317	233	4,395	6,822	218,364	32,009	2.5
6/30/2018	370	11,314	218	4,825	6,974	225,644	32,355	3.3
6/30/2019	417	13,109	196	4,398	7,195	234,341	32,570	3.9
6/30/2020	378	12,025	251	6,530	7,322	239,836	32,756	2.3

Note: The dollar amounts of the pensions added to and removed from the rolls for years prior to June 30, 2017 were determined by prior actuaries. The amounts added to the rolls includes additions and deletions due to PER increases, in addition to the annual pensions for new retirees.

Exhibit F.8
Schedule of Retired Members by Type
as of June 30, 2020

Monthly Benefit	# of Retirees	Type of Retirement						
		Deferred	Normal or Voluntary	Duty Disability	Non-Duty Disability	Survivor Payment	Death Benefit	Alternate Payee
Deferred	1,033	1,033						
\$1 - \$300	93		46	1	0	15	19	12
\$301 - \$400	129		85	4	1	25	3	11
\$401 - \$500	141		92	6	1	31	1	10
\$501 - \$600	146		99	4	6	26	3	8
\$601 - \$700	159		82	3	7	49	5	13
\$701 - \$800	181		104	1	11	41	8	16
\$801 - \$900	187		110	5	21	34	8	9
\$901 - \$1,000	188		106	1	12	49	5	15
\$1,001 - \$1,100	210		123	4	10	49	10	14
\$1,101 - \$1,200	207		138	1	13	36	5	14
\$1,201 - \$1,300	169		122	1	14	22	3	7
\$1,301 - \$1,400	182		119	0	16	31	8	8
\$1,401 - \$1,500	179		131	3	5	28	9	3
\$1,501 - \$2,000	859		666	14	35	93	32	19
\$2,001 - \$2,500	907		774	1	12	98	13	9
\$2,501 - \$3,000	823		734	0	10	60	13	6
\$3,001 - \$4,000	1,251		1,159	0	8	69	13	2
\$4,001 - \$5,000	737		702	0	2	25	6	2
\$5,001 +	754		717	0	0	32	3	2
Total	8,535	1,033	6,109	49	184	813	167	180



SECTION G

ACTUARIAL COST METHODS AND ASSUMPTIONS

SUMMARY OF ACTUARIAL COST METHODS AND ASSUMPTIONS

I. Valuation Date

The valuation date is June 30th of each plan year. This is the date as of which the actuarial present value of future benefits and the actuarial value of assets are determined.

II. Actuarial Cost Method

The actuarial valuation uses the Entry Age Normal actuarial cost method. Under this method, the employer contribution rate is the sum of (i) the employer normal cost rate including administrative expenses, and (ii) a rate that will amortize the unfunded actuarial liability.

1. The valuation is prepared on the projected benefit basis. The present value of each participant's expected benefit payable at retirement or termination is determined, based on age, service, sex, compensation, and the interest rate assumed to be earned in the future (7.00%). The calculations take into account the probability of a participant's death or termination of employment prior to becoming eligible for a benefit, as well as the possibility of his terminating with a service benefit. Future salary increases are also anticipated. The present value of the expected benefits payable on account of the active participants is added to the present value of the expected future payments to retired participants and beneficiaries to obtain the present value of all expected benefits payable from the Plan on account of the present group of participants and beneficiaries.
2. The employer contributions required to support the benefits of the Plan are determined following a level percent of pay funding approach, and consist of a normal cost contribution and an unfunded accrued liability contribution, plus a component to cover administrative expenses.
3. The normal cost and the allocation of benefit values between service rendered before and after the valuation date were determined using the individual entry age actuarial cost method having the following characteristics of (i) the annual normal costs for each active member, payable from the date of entry into the system to the date of retirement, are sufficient to accumulate the value of the member's benefit at the time of retirement, and (ii) each annual normal cost is constant percentage of the member's year-by-year projected covered pay.
4. The unfunded accrued liability contributions are determined by subtracting the actuarial value of assets from the actuarial accrued liability. Amortization bases are established each year and amortized over periods in accordance with the following amortization methods.
 - a. The UAL as of June 30, 2013, developed prior to implementing the September 2013 assumption changes, is amortized over a closed 25-year period as a level percentage of payroll.



- b. The impact of the September 2013 assumption changes on the UAL is amortized over a closed 25-year period as a level percentage of payroll with a four-year phase-in to the full amortization rate. The phase-in is calculated by multiplying the first year amortization payment by 25 percent. For the second year, the amortization schedule is recalculated reflecting the 25 percent payment in the first year and the remaining 24-year period and the calculated amortization payment is then multiplied by 50 percent. The process is repeated until the full amortization payment is made beginning in the fourth year of the 25-year period.
- c. The impact of the August 2015 assumption changes on the UAL is amortized over a closed 20-year period as a level percentage of payroll with a four-year phase-in to the full amortization rate. The phase-in is calculated by multiplying the first year amortization payment by 25 percent. For the second year, the amortization schedule is recalculated reflecting the 25 percent payment in the first year and the remaining 19-year period and the calculated amortization payment is then multiplied by 50 percent. The process is repeated until the full amortization payment is made beginning in the fourth year of the 20-year period.
- d. Future gains and losses are amortized over closed 20-year periods as a level percentage of payroll from the valuation date in which they are first recognized. However, gains will not be amortized over a shorter period than the remaining period on the amortization of the 2013 UAL.

III. Actuarial Value of Assets

The actuarial value of assets is determined by recognizing market value gains and losses over a four-year period. Gain and loss bases to be spread over the four-year period are determined by comparing expected returns based on the market value of assets and cash flows during the year to actual investment returns. The actuarial value of assets must be between 80 and 120% of market value.

IV. Actuarial Assumptions

A. Economic Assumptions

1. Investment return: 7.00% per annum, compounded annually. Inflation is assumed to be 2.30%.
2. Salary increase rate: Individual salary increases are composed of a price inflation component, a real wage growth component, and a merit or longevity component that varies by age. The table below combines the various components of salary increases for sample ages. Growth in the total payroll is assumed to be 2.50%.

Sample Attained Service	Percentage Increase in Salary			
	Price Inflation	Real Wage Growth	Merit or Longevity	Total
1-7	2.30 %	0.50 %	4.20 %	7.00 %
8-14	2.30	0.50	1.30	4.10
15+	2.30	0.50	0.00	2.80

3. COLA Due to Pension Equalization Reserve (PER): The PER only applies to Tier 1 and Tier 2 benefits. Future benefits payable through the PER are valued as an annual compound cost-of-living adjustment (COLA) equal to 0.50% through 2024, 1.00% from 2025-2029, and then 1.25% thereafter.
4. Administrative expenses are assumed to be equal to the prior year's amount, increased by 2.50%.

B. Demographic Assumptions

1. Rates of Mortality for Healthy and Disabled Lives: Mortality rates are based on the sex-distinct employee and annuitant mortality tables described below, including adjustment factors applied to the published tables for each group. Half of active member deaths are assumed to be duty related. Future mortality improvements are reflected by applying the ultimate rates of the MP projection scales on a generational basis to the adjusted base tables from the base year shown below.

i) Non-Annuitant – Pub-2010, Amount-Weighted, General, Employee mortality table

Gender	Adjustment Factor	Base Year
<i>Male</i>	1.000	2010
<i>Female</i>	1.000	2010

(i) Healthy Annuitant – Pub-2010, Amount-Weighted, General, Healthy Retiree mortality table

Gender	Adjustment Factor	Base Year
<i>Male</i>	1.090	2010
<i>Female</i>	1.040	2010

(ii) Disabled Annuitant – Pub-2010, Amount-Weighted, General, Disabled Retiree mortality tables

Gender	Adjustment Factor	Base Year
<i>Male</i>	1.000	2010
<i>Female</i>	1.000	2010

Sample rates, including projections to 2020, are shown below (not including adjustment factors).

Sample Attained Ages	Probability of Death Pre-Retirement		Sample Attained Ages	Probability of Death Post-Retirement		Sample Attained Ages	Probability of Death Post-Disability	
	Men	Women		Men	Women		Men	Women
20	0.033 %	0.012 %	20	0.036 %	0.012 %	20	0.373 %	0.211 %
25	0.025	0.008	25	0.028	0.008	25	0.251	0.148
30	0.033	0.014	30	0.035	0.014	30	0.320	0.232
35	0.043	0.021	35	0.046	0.022	35	0.414	0.363
40	0.060	0.033	40	0.065	0.034	40	0.583	0.569
45	0.089	0.051	45	0.108	0.061	45	0.911	0.891
50	0.135	0.075	50	0.294	0.209	50	1.452	1.341
55	0.198	0.111	55	0.425	0.269	55	1.912	1.575
60	0.288	0.168	60	0.606	0.361	60	2.264	1.769
65	0.423	0.268	65	0.900	0.577	65	2.753	2.040
70	0.636	0.442	70	1.504	1.000	70	3.528	2.588
75	0.991	0.731	75	2.633	1.771	75	4.696	3.620
80	1.565	1.203	80	4.706	3.160	80	6.645	5.433
85	6.532	4.823	85	8.469	5.836	85	9.781	8.439
90	13.363	10.462	90	14.566	10.881	90	14.803	12.446

2. Disability rates. The disability incidence rates are 20% of the Arizona State Retirement System disability table. Half of disabilities are assumed to be duty related. Sample disability rates of active members are provided in the table below. These rates apply to both male and female COPERS member.

Sample Attained Ages	Probability of Disablement
25	0.0100 %
30	0.0121
35	0.0185
40	0.0294
45	0.0454
50	0.0677
55	0.0794
60	0.0863

3. Termination rates (for causes other than death, disability or retirement): Termination rates are based on age and service. Termination rates are not applied after a member becomes eligible for a retirement benefit. Rates at selected ages are shown:

Probability of Termination						
Age	Years of Service					
	0	1	2	3	4	5+
20	19.00 %	17.00 %	11.00 %	10.00 %	8.25 %	8.00 %
25	19.00	17.00	11.00	10.00	8.25	8.00
30	17.00	13.25	10.00	8.75	7.25	5.00
35	17.00	10.75	9.00	7.50	6.50	4.00
40	17.00	9.50	8.25	6.50	6.00	3.10
45	17.00	8.50	7.50	6.50	6.00	2.10
50	14.00	9.00	5.00	5.00	4.50	1.50
55	14.00	9.00	5.00	5.00	4.50	1.50
60	14.00	9.00	5.00	5.00	4.50	1.50

4. Retirement rates.

Probability of Retirement				
Age	Years of Service			
	<15	15-24	25-31	>31
50-51	0.00 %	0.00 %	40.00 %	42.50 %
52	0.00	0.00	40.00	35.00
53	0.00	0.00	40.00	27.50
54	0.00	0.00	30.00	27.50
55	0.00	0.00	30.00	27.50
56	0.00	37.50	25.00	27.50
57	0.00	37.50	22.50	22.50
58	0.00	25.00	22.50	22.50
59	0.00	22.50	20.00	22.50
60	10.00	22.50	20.00	22.50
61	10.00	20.00	20.00	22.50
62	13.00	20.00	25.00	32.50
63	13.00	20.00	25.00	37.50
64	10.00	17.50	15.00	25.00
65	20.00	27.50	25.00	35.00
66	25.00	32.50	40.00	37.50
67	25.00	35.00	40.00	37.50
68	25.00	35.00	40.00	37.50
69	25.00	35.00	40.00	47.50
70	100.00	100.00	100.00	100.00

C. Other Assumptions

1. Percent married: 90% of employees are assumed to be married.
2. Age difference: Male members are assumed to be three years older than their spouses, and female members are assumed to be three years younger than their spouses.
3. Unused Vacation and Compensatory Time: For Tier 1 and Tier 2 members, compensatory service credits and lump sum payments for unused vacation and compensatory time are explicitly valued. An additional load of 1.5% is also included as margin for adverse deviation.
4. Member Contribution Crediting Rate: Member contributions are credited with interest at 3.75% per annum.

SECTION H

RISKS ASSOCIATED WITH MEASURING THE ACCRUED LIABILITY

Risks Associated With Measuring the Accrued Liability and Actuarially Determined Contribution

The determination of the accrued liability and the actuarially determined contribution requires the use of assumptions regarding future economic and demographic experience. Risk measures, as illustrated in this report, are intended to aid in the understanding of the effects of future experience differing from the assumptions used in the course of the actuarial valuation. Risk measures may also help with illustrating the potential volatility in the accrued liability and the actuarially determined contribution that result from the differences between actual experience and the actuarial assumptions.

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 due to changing conditions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period, or additional cost or contribution requirements based on the plan's funded status); and changes in plan provisions or applicable law. The scope of an actuarial valuation does not include an analysis of the potential range of such future measurements.

Examples of risk that may reasonably be anticipated to significantly affect the plan's future financial condition include:

1. Investment risk – actual investment returns may differ from the expected returns;
2. Asset/Liability mismatch – changes in asset values may not match changes in liabilities, thereby altering the gap between the accrued liability and assets and consequently altering the funded status and contribution requirements;
3. Contribution risk – actual contributions may differ from expected future contributions. For example, actual contributions may not be made in accordance with the plan's funding policy or material changes may occur in the anticipated number of covered employees, covered payroll, or other relevant contribution base;
4. Salary and Payroll risk – actual salaries and total payroll may differ from expected, resulting in actual future accrued liability and contributions differing from expected;
5. Longevity risk – members may live longer or shorter than expected and receive pensions for a period of time other than assumed;
6. Other demographic risks – members may terminate, retire or become disabled at times or with benefits other than assumed resulting in actual future accrued liability and contributions differing from expected.

The effects of certain trends in experience can generally be anticipated. For example if the investment return since the most recent actuarial valuation is less (or more) than the assumed rate, the cost of the plan can be expected to increase (or decrease). Likewise if longevity is improving (or worsening), increases (or decreases) in cost can be anticipated.



The computed contribution rate shown on Exhibit B.5 may be considered as a minimum contribution rate that complies with the Board’s funding policy. The timely receipt of the actuarially determined contributions is critical to support the financial health of the plan. Users of this report should be aware that contributions made at the actuarially determined rate do not necessarily guarantee benefit security.

Plan Maturity Measures

Risks facing a pension plan evolve over time. A young plan with virtually no investments and paying few benefits may experience little investment risk. An older plan with a large number of members in pay status and a significant trust may be much more exposed to investment risk. Generally accepted plan maturity measures include the following:

	<u>June 30, 2020</u>	<u>June 30, 2019</u>
Ratio of the market value of assets to total payroll	4.6	4.6
Ratio of actuarial accrued liability to payroll	7.6	7.6
Ratio of actives to retirees and beneficiaries	1.1	1.1
Ratio of net cash flows to market value of assets	-1%	-1%
Duration of the actuarial accrued liability	12.3	12.1

Ratio of Market Value of Assets to Payroll

The relationship between assets and payroll is a useful indicator of the potential volatility of contributions. For example, if the market value of assets is 4.0 times the payroll, a return on assets 5% different than assumed would equal 20% of payroll. A higher (lower) or increasing (decreasing) level of this maturity measure generally indicates a higher (lower) or increasing (decreasing) volatility in plan sponsor contributions as a percentage of payroll.

Ratio of Actuarial Accrued Liability to Payroll

The relationship between actuarial accrued liability and payroll is a useful indicator of the potential volatility of contributions for a fully funded plan. A funding policy that targets a funded ratio of 100% is expected to result in the ratio of assets to payroll and the ratio of liability to payroll converging over time.

The ratio of liability to payroll may also be used as a measure of sensitivity of the liability itself. For example, if the actuarial accrued liability is 5.5 times the payroll, a change in liability 2% other than assumed would equal 11% of payroll. A higher (lower) or increasing (decreasing) level of this maturity measure generally indicates a higher (lower) or increasing (decreasing) volatility in liability (and also plan sponsor contributions) as a percentage of payroll.

Ratio of Actives to Retirees and Beneficiaries

A young plan with many active members and few retirees will have a high ratio of active to retirees. A mature open plan may have close to the same number of actives to retirees resulting in a ratio near 1.0. A super-mature or closed plan may have significantly more retirees than actives resulting in a ratio below 1.0.



Ratio of Net Cash Flow to Market Value of Assets

A positive net cash flow means contributions exceed benefits and expenses. A negative cash flow means existing funds are being used to make payments. A certain amount of negative net cash flow is generally expected to occur when benefits are prefunded through a qualified trust. Large negative net cash flows as a percent of assets may indicate a super-mature plan or a need for additional contributions.

Duration of Actuarial Accrued Liability

The duration of the actuarial accrued liability may be used to approximate the sensitivity to a 1% change in the assumed rate of return. For example, duration of 10 indicates that the liability would increase approximately 10% if the assumed rate of return were lowered 1%.

Additional Risk Assessment

Additional risk assessment is outside the scope of the annual actuarial valuation. Additional assessment may include scenario tests, sensitivity tests, stochastic modeling, stress tests, and a comparison of the present value of accrued benefits at low-risk discount rates with the actuarial accrued liability