ARKANSAS STATE HIGHWAY EMPLOYEES RETIREMENT SYSTEM (ASHERS)

ACTUARIAL VALUATION
AS OF JUNE 30, 2018

Osborn, Carreiro & Associates, Inc.
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November 14, 2018

Board of Trustees
Arkansas State Highway Employees
Retirement System (ASHERS)
P. O. Box 2261
Little Rock, AR 72203

RE: Actuarial Valuation as of June 30, 2018

Ladies and Gentlemen:

This report presents the results of our actuarial valuation of the assets and liabilities of the Arkansas State Highway Employees Retirement System (ASHERS) as of June 30, 2018. This valuation determines the contributions for the 2018-19 Plan Year (July 1, 2018 to June 30, 2019). The primary purposes of the valuation report are to determine the adequacy of the current employer contribution rate, to describe the current financial condition of ASHERS, and to analyze changes in the condition of the system.

This report replaces the November 1, 2018 draft of the report that was presented to the board at their regular meeting on that date. Although a few numbers were changed, there were not significant differences from the report as presented.

Actuarial Status of Plan

The funded status of the plan slipped from 86.24% to 83.51% this year. This is the ratio of the actuarial liabilities of the plan to the actuarial value (smoothed) assets. This was mostly due to the recognition of previous investment losses that were smoothed into the value this year. This is detailed in the report. There was a small loss due to the change in actuary and a small gain in liabilities during the year that wiped out most of that loss. The funding period is again infinite and we are working on the projection model to find a path of solid funding. The total contribution rate would be about 23.3% (compared to the current 18.9%) to meet the 30-year payoff of unfunded actuarial accrued liabilities.

Accounting Information

A separate report with the reporting standard of GASB Statement 67 and 68 based on the same assumptions and methods will be follow this report.

Organization of Report

Following this cover letter and a table of contents, there is an Executive Summary of the results of the valuation as well as a discussion of the highlights. The Exhibits then show the details of the calculations. The Appendices then disclose the plan provisions and assumptions used.

Statement of Qualifications

This report has been prepared by actuaries who have experience valuing public employee retirement systems, with the undersigned taking the primary responsibility. To the best of our knowledge, this report is complete and accurate and was completed in accordance with standards of practice promulgated by the Actuarial Standards Board and in conformance with applicable Arkansas law. The actuaries are Members of the American Academy of Actuaries (MAAA) and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained in this report.

The actuaries know of no significant conflicts of interest with the plan sponsor. We have previously disclosed that we also serve the Bureau of Legislative Research by preparing reports for the Joint Retirement Committee. We do not view this relationship as a significant conflict.

We look forward to discussing this report with you in detail. Please let us know if you have any questions or comments.

Sincerely,

Jody Carreiro

Jody Carreiro, FCA, ASA, EA, MAAA
Actuary

TABLE OF CONTENTS

EXECUTIVE SUMMARY

A brief summary of the more important figures developed in this valuation, with comparable results from prior reports, follows:

	6/30/2016	6/30/2017	6/30/2018
Number in Plan			
a) Active Members	3,406	3,308	3,343
b) Members in DROP	364	355	369
c) Members Receiving Benefits	3,301	3,379	3,436
d) Inactive Members	206	217	211
Market Value of Assets	$ 1,304,869,720	$ 1,354,321,200	$ 1,472,472,865
Actuarial Value of Assets	$ 1,447,342,661	$ 1,439,516,380	$ 1,424,240,080
Actuarial Accrued Liability	$ 1,689,210,622	$ 1,669,107,926	$ 1,705,400,905
Unfunded Actuarial Accrued Liability	$ 241,867,961	$ 229,591,546	$ 281,160,825
Funded Percentage (Based on Actuarial Assets)	85.68%	86.24%	83.51%
Funded Percentage (Based on Market Value of Assets)	77.25%	81.14%	86.34%
Contribution Rates			
Employee	6.00%	6.00%	6.00%
Employer	12.90%	12.90%	12.90%
Total	18.90%	18.90%	18.90%
Needed to Fund UAAL in 30 years		21.05%	23.31%
Years to Fund at Current Contribution	Infinite	77.6 years	Infinite

Discussion

Introduction

The results of the June 30, 2018 actuarial valuation of the Arkansas State Highway Employees Retirement System (ASHERS) performed by Osborn, Carreiro & Associates, Inc. are summarized in this report. The purpose of any actuarial valuation is to provide an estimate of how well the employer is meeting its emerging pension liabilities.

We have relied on the employee data and asset information provided by the staff of ASHERS. While not auditing or verifying the data at the source, we have performed such tests for consistency and reasonableness as has been deemed necessary to be satisfied with the appropriateness of the using the data supplied. There were not significant adjustments need to the data that was supplied by staff.

Executive Summary

The Executive Summary on the preceding page provides the reader with key results of this valuation report. This provides a single page with the most discussed items that are developed later in the report.

Funded Status

The Funded Status of the plan is typically first discussed in terms of the Funded Percentage. The Funded Percentage is 83.51% as of the valuation date compared with 86.24% last year. This reduction from last year is mainly due to a loss due to actuarial value of assets as discussed later. Although the goal is always to be at least 100% funded, a funded percentage over 80% is oftern considered a positive sign of health for the plan.

The Funded Status of a plan is more than just a measurement of the Funded Percentage. We also need to consider whether the contribution policy will provide funding for the long term. As you know, the funding policy of ASHERS is currently part of state law. The employees contribute 6% and the employer contributes 12.9% of pay for a total 18.9% of pay. There are also contributions that arise from Tier II DROP (6% employee, 6.9% employer) that are not explicit in state law.

Exhibit 2 of the report develops a couple of contribution levels for comparison. A 30-year amortization of unfunded accrued liabilities is an old standard that is still relevant to state law. That contribution level is 23.31% of payroll compared to the 18.9% of payroll currently contributed. This means that the plan would not be fully funded over the next 30 years at the contribution rate.

Discussion (Continued)

We also developed in Exhibit 2 the rate necessary to fund the unfunded accrued liability over 18 years. This is a number of years that has been discussed more recently. It comes from the point in which the unfunded payments will be at least large enough so the projected unfunded does not increase in the early years. This is also referred to as negative amortization. The contribution level to fund the plan over 18 years is 27.07% of payroll.

The ultimate question about contribution policy is whether or not the current policy will ever fully fund the benefits promised. Also in Exhibit 2, we calculated the years necessary to fund the unfunded accrued liability using the current contributions available. As shown there, this amount increase from 77.6 years to infinite. In other words, the plan cannot be sustained as it is with the current contribution level.

Changes in Assets during the Year

The financial information provided to us is summarized in Exhibit 3 of the report. As you will note, the estimated yield for the last fiscal year was 15.68%, well above the assumed rate of return. This compares with 10.53% for the previous year. This is using the standard mid-year average yield formula which is typically going to be a little different that a time weighted return often reported by investment advisors.

The actuarial value of assets, sometimes called smoothed value, takes the return in excess (or below) of the expected return of 8% and smooths it over 4 years. That is only 25% of that excess is recognized in the year it is earned. The rate of return on the actuarial value of assets for this fiscal year was only 5.77%. As noted in the previous valuations there was still quite a bit of below expected earnings to recognize in this year. As you will see in Exhibit 3, there is about $48 million of excess returns that will be recognized in future years.

Actuarial Gains and Losses

The difference in the market value return on assets and the return on the actuarial value of assets is the source of an unexpected result of this valuation. Although there were two better than expected market return years in a row, the return on actuarial value was less than expected and so there is an actuarial loss on assets as calculated on page 9 of this report. This resulted in an actuarial loss of about $40 million (2.3% of liabilities) in this fiscal year.

There were no legislative changes or assumption changes made this year. The remaining actuarial loss of $5 million (0.28% of liabilities). This does also include the effect of the change in actuarial firms. Although we were very close to replicating the previous year results of the previous actuary there was some difference and it is included in this experience loss.

Discussion (Continued)

History of Cash Flows

We have continued showing the History of Cash Flow chart as part of Exhibit 3 (page 15). The primary result of this page is that the external cash flows out of the plan is about 6.5% as it has been the past few years. This is a measurement of the cash flows in and out of the plan before adding investment income. A level of 6.5% means that most of the investment income expected (6.5% out of 8.0%) is immediately going out of the plan. The way to improve this measurement is to increase the amounts coming into the plan and/or decrease the amount coming out of the plan.

Closing Comments

Overall, the plan had a good year. The investment returns were greater than expected. The funding percentage is still strong at 83.51%. But there are long term issues that need to be addressed. The board is already discussing how they want to change the contribution policy to increase the income into the plan. The ultimate goal needs to be around the 18-year level discussed earlier.

Again, these issues are not short term issues. There will likely need to be several steps to reach the ultimate goal. The board has already taken the first step with the changes to the COLA. A separate letter (which should be considered part of this valuation report) discusses some of the contribution possibilities in more detail. The board needs to work on an immediate increase in contributions and a change in contribution policy that will allow you the flexibility to reach the ultimate goal of healthy long term funding and sustainability. We look forward to working with the board to achieve these goals.

EXHIBIT 1
COSTS AND LIABILITIES

ACTUARIAL PRESENT VALUE OF FUTURE BENEFITS

				6/30/2017		6/30/2018
A.	Active Members					
	1.	Retirement Benefits	$	610,087,608	$	413,469,595
	2.	Disability Benefits		41,507,638		49,315,018
	3.	Death Benefits		6,969,551		3,258,787
	4.	Deferred Termination Benefits		20,379,653		14,781,709
	5.	Refunds of Contributions		1,208,309		1,944,258
	6.	Total Active Members	$	680,152,759	$	482,769,368
B.	Deferred Retirement Option Plan (DROP)					
	1.	Future DROP deposits and retirement benefits	$	*	$	175,576,594
	2.	Expected Payouts of current DROP Deposits		*		183,836,550
	3.	Total DROP Members	$	*	$	359,413,144
C.	Inactive Members					
	1.	Vested terminations	$	9,119,875	$	6,469,403
	2.	Non-vested terminations		863,988		1,285,465
	3.	Total Inactive Members	$	9,983,863	$	7,754,868
D.	Retired Members Receiving Benefits					
	1.	Service retirements	$	956,319,918	$	854,843,412
	2.	Disability retirements		83,349,751		80,862,921
	3.	Beneficiaries		66,707,858		63,213,160
	4	Total Retired Members	$	1,106,377,527	$	998,919,492
E.	Total Actuarial Present Value of Future Benefits (A6 + B3 + C3 + D4)		$	1,796,514,149	$	1,848,856,872

* The previous actuarial report did not break the DROP liability into a separate category.

EXHIBIT 1 (continued)

ANALYSIS OF NORMAL COST

		6/30/2017	6/30/2018
A.	Normal Cost (to fund current Active Members) (Percentage of Payroll)		
	1. Retirement Benefits	8.32%	8.39%
	2. Disability Benefits	1.67%	1.82%
	3. Death Benefits	0.17%	0.13%
	4. Deferred Termination Benefits	1.06%	1.03%
	5. Refunds of Contributions	0.56%	0.62%
	6. Total Normal Cost	11.78%	11.99%
B.	Present Value of Future Normal Costs		
	1. Annualized salaries (excludes DROPs)	$ 141,154,763	$ 144,111,392
	2. Projected payroll for upcoming fiscal year	150,586,955	153,112,009
	3. Present value of future salaries	1,035,794,873	1,166,442,186
	4. Dollar Value of Normal Cost (A6 X B2)	17,739,143	18,358,130
	5. Present Value of Future Normal Costs (A6 X B3)	122,016,636	139,856,418

EXHIBIT 1 (continued)

DEVELOPMENT OF UNFUNDED ACTUARIAL LIABILITY

			6/30/2017		6/30/2018
A.	Actuarial Accrued Liabilities – Active Members				
	1. Present Value of future benefits	$	680,152,759	$	482,769,368
	2. Less Present Value of future normal costs		122,016,636		139,856,418
	3. Accrued Liability - Actives	$	558,136,123	$	342,912,950
B.	Actuarial Accrued Liabilities – DROP Members				
	1. Present Value of future benefits	$	*	$	359,413,144
	2. Less present value of future Tier II Contributions		5,389,587		3,599,549
	3. Accrued Liability - DROP	$	-5,389,587	$	355,813,595
C.	Actuarial Accrued Liabilities – Inactive Members	$	9,983,863	$	7,754,868
D.	Actuarial Accrued Liabilities – Retired Members	$	1,106,377,527	$	998,919,492
E.	Total Actuarial Accrued Liabilities (A3 + B3 +C + D)	$	1,669,107,926	$	1,705,400,905
F.	Actuarial Value of Assets (Developed in Exhibit 3)		1,439,516,380		1,424,240,080
G.	Unfunded Actuarial Accrued Liability (E – F)	$	229,591,546	$	281,160,825

* The previous actuarial report did not break the DROP liability into a separate category.

EXHIBIT 1 (continued)

Actual Versus Expected Actuarial Assets

		6/30/2017	6/30/2018
1.	Actuarial assets, beginning of year	$ 1,447,342,660	$ 1,439,516,379
2.	Total contributions during year	28,318,809	28,457,460
3.	Benefits paid during year	(109,874,806)	(113,476,915)
4.	Refunds paid during year	(2,029,791)	(2,270,815)
5.	Assumed net investment income at 8%		
	a. Beginning of year assets	115,787,413	115,161,310
	b. Contributions	1,132,752	1,138,298
	c. Benefits	(4,394,992)	(4,539,077)
	d. Refunds	(81,192)	(90,832)
	e. Total	$ 112,443,981	$ 111,669,699
6.	Expected actuarial assets, end of year (Sum of items 1 through 5)	1,476,200,853	1,463,895,807
7.	Actuarial Value of Assets, end of year	1,439,516,379	1,424,240,080
8.	Asset gain/(loss) for year (7 – 6)	(36,684,474)	(39,655,727)
9.	Asset gain/(loss) as a percentage of end of year assets (8 / 7)	(2.55%)	(2.78%)

EXHIBIT 1 (continued)

ACTUARIAL GAIN OR LOSS FOR THE YEAR

			6/30/2017		6/30/2018
A.	Calculation of actuarial gain or loss				
1.	Unfunded actuarial liability (UAAL), previous year	$	241,867,961	$	229,591,546
2.	Normal cost for the year		18,275,116		17,619,121
3.	Contributions for the year		(28,318,809)		(28,457,459)
4.	Interest at 8.0%				
	a. On UAAL	$	19,349,437	$	18,367,324
	b. On normal cost		731,005		704,765
	c. On contributions		(1,132,752)		(1,138,298)
	d. Total	$	18,947,690	$	17,933,791
5.	Expected UAAL (sum of items 1 – 4)		250,771,958		236,686,998
6.	Actual UAAL		229,591,546		281,160,825
7.	Gain (loss) for the year (item 5 – item 6)	$	21,180,412	$	(44,473,826)
B.	Source of gains and losses				
8.	a. Asset gain (loss) for the year	$	(36,684,474)	$	(39,655,727)
	b. Gain (loss) from change in assumption		0		0
	c. Gain (loss) from change in method		0		0
	d. Gain (loss) from Legislative change		70,591,509		0
	e. Actuarial gain (loss) from liability experience (7 – 8a – 8b – 8c - 8d)		(12,726,623)		(4,818,099)
	f. Total Gain (loss) for the year (8a + 8b + 8c + 8d + 8e)	$	21,180,412	$	(44,473,826)
9.	Total Actuarial Accrued Liabilities (end of year)	$	1,669,107,926	$	1,705,400,905
10.	Gain (loss) components as a percentage of Actuarial Accrued Liabilities				
	a. Asset gain (loss) for the year		(2.20%)		(2.33%)
	b. Gain (loss) from change in assumption		0.00%		0.00%
	c. Gain (loss) from change in method		0.00%		0.00%
	d. Gain (loss) from Legislative change		4.23%		0.00%
	e. Actuarial gain (loss) from liability experience		(0.76%)		(0.28%)
	f. Total Gain (loss) for the year		1.27%		(2.61%)

EXHIBIT 2

DEVELOPMENT OF CONTRIBUTION RATES

			6/30/2017		6/30/2018
A.	Expected Contributions				
	1. Annualized salaries (excludes DROPs)	$	141,154,763	$	144,111,392
	2. Projected payroll for upcoming fiscal year		150,586,955		153,112,009
	3. Current Employee Contribution Rate		6.00%		6.00%
	4. Current Employer Contribution Rate		12.90%		12.90%
	5. Total Contribution Rate		18.90%		18.90%
	6. Contribution in Dollars (A2 X A5)		28,460,934		28,938,170
	7. Expected Contribution from Tier II DROP		607,507		514,665
	8. Total Expected Contributions		29,068,441		29,452,835
B.	Unfunded Actuarial Accrued Liability	$	229,591,546	$	281,160,825
C.	Calculation of 30-year Payoff Rate				
	1. 30-year Amortization of UAAL at mid-year	$	14,568,563	$	17,849,415
	2. Less Expected Tier II Contributions		607,507		514,665
	3. Contribution Needed to meet goal (C1 – C2)		13,961,056		17,334,750
	4. C3 as percentage of payroll (C3/A2)		9.27%		11.32%
	5. Normal Cost		11.78%		11.99%
	6. Total Contribution Needed to meet goal		21.05%		23.31%
D.	Calculation of 18-year Payoff Rate				
	1. 18-year Amortization of UAAL at mid-year	$	19,259,633	$	23,596,917
	2. Less Expected Tier II Contributions		607,507		514,665
	3. Contribution Needed to meet goal (D1 – D2)		18,652,126		23,082,252
	4. D3 as percentage of payroll (D3/A2)		12.39%		15.08%
	5. Normal Cost		11.78%		11.99%
	6. Total Contribution Needed to meet goal		24.17%		27.07%
E.	Calculation of Funding Period				
	1. Total Expected Contributions (A8)	$	29,068,441	$	29,452,835
	2. Amount needed to pay Normal Cost		17,739,143		18,358,130
	3. Amount remaining to payoff UAAL (E1 – E2)		11,329,298		11,094,705
	4. Years to fund UAAL using amount in E3 Based on 3% payroll growth		77.6		Infinite

EXHIBIT 3

SUMMARY OF FINANCIAL INFORMATION

(Items D-E determined by Osborn, Carreiro and Associates, Inc.)

	Plan Year Ended		
	6/30/2016	6/30/2017	6/30/2018
A. INCOME			
1. Contributions			
Employee	$ 9,379,784	$ 9,143,408	$ 9,163,176
State	19,231,804	19,175,401	19,294,283
Other	0	0	0
2. Investment Income			
Interest/Dividends	23,523,858	24,625,498	25,900,021
Realized Gain (+ URG for 16-17)	(75,859,083)	116,623,355	141,998,366
Unrealized Gain	-	-	45,856,544
Investment Expense	(8,008,898)	(8,081,509)	(8,257,292)
Net Investment Income	(60,344,123)	133,167,344	205,497,639
TOTAL INCOME	$ (31,732,535)	$ 161,486,153	$ 233,955,098
B. EXPENSES			
1. Administrative	$ 118,199	$ 130,076	$ 55,703
2. Refunds	1,699,287	2,029,791	2,270,815
3. Benefit Payments	105,056,553	109,874,806	113,476,915
TOTAL EXPENSES	$ 106,874,039	$ 112,034,673	$ 115,803,433

EXHIBIT 3 (Continued)

	6/30/2016	6/30/2017	6/30/2018
C. ASSETS (Market)			
1. Short Term			
Cash	$ 316,616	$ 278,692	$ 657,885
Money Market	195,884,803	74,574,787	169,273,146
2. Corporate Bonds	139,759,261	187,109,301	224,783,236
3. Common Stocks	860,324,064	1,026,234,099	1,020,024,248
4. U.S. Government agency obligations	108,017,423	80,821,738	58,331,725
5. Receivables			
Member contributions	498,759	204,201	245,653
State contributions	1,035,876	1,328,447	427,411
Interest and dividends	1,702,932	1,578,058	1,718,016
Miscellaneous	1,494,020	8,493,577	5,636,506
6. Liabilities	(4,164,034)	(26,301,700)	(8,624,961)
TOTAL ASSETS	$ 1,304,869,720	$ 1,354,321,200	$ 1,472,472,865
D. RATIO OF ASSETS TO ANNUAL EXPENSES:	12.21	12.09	12.72
E. INVESTMENT RETURN:	- 4.31%	10.53%	15.68%
Return on Actuarial Value of Assets:		5.39%	5.77%

EXHIBIT 3 (Continued)

	7/1/2016	7/1/2017	7/1/2018
F. DEVELOPMENT OF ACTUARIAL VALUE OF ASSETS			
1. Investment income for year	$ (60,344,123)	$ 133,167,344	$ 205,497,639
2. Expenses and fees for year	118,199	130,076	55,703
3. Actual net investment income	(60,462,322)	133,037,268	205,441,936
4. Market Value (beginning of year)	1,443,476,294	1,304,869,720	1,354,321,200
5. Contributions during year	28,611,588	28,318,809	28,457,459
6. Benefits paid during year	106,755,840	111,904,597	115,747,730
7. Expected investment income at 8%			
Market Value	115,478,104	104,389,578	108,345,696
Contributions	1,144,464	1,132,752	1,138,298
Benefits	4,270,234	4,476,184	4,629,909
Total	112,352,333	101,046,146	104,854,085
8. Investment gain for year	(172,814,656)	31,991,122	100,587,851
9. Deferral of investment gain			
Current year (75%)	(129,610,992)	23,993,342	75,440,888
Current year – 1 (50%)	(45,562,385)	(86,407,328)	15,995,561
Current year – 2 (25%)	32,700,437	(22,781,193)	(43,203,664)
Total	(142,472,940)	(85,195,179)	48,232,785
10. Market value (end of year)	1,304,869,720	1,354,321,200	1,472,872,865
11. Preliminary AVA (end of year) (10) – (9)	1,447,342,660	1,439,516,379	1,424,240,080
12. Final AVA within 20% corridor	$ 1,447,342,660	$ 1,439,516,379	$ 1,424,240,080

EXHIBIT 3 (Continued)

HISTORY OF CASH FLOW

Year Ending June 30	Contributions for the Year	Expenditures During the Year: Benefit Payments	Refund of Contributions	Expenses	Total	External Cash Flow for the Year	Market Value of Assets	External Cash Flow as Percent of Market Value
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1997	21,897,263	(23,593,197)	(902,144)	(1,274,552)	(25,770,613)	(3,873,350)	629,060,314	(0.6%)
1998	20,633,572	(26,568,398)	(1,136,696)	(1,443,527)	(29,148,321)	(8,514,749)	758,971,958	(1.1%)
1999	21,460,290	(27,868,587)	(1,218,372)	(1,776,862)	(30,863,821)	(9,403,531)	870,332,321	(1.1%)
2000	20,635,998	(32,437,078)	(860,532)	(2,231,766)	(35,529,375)	(14,893,377)	1,020,171,033	(1.5%)
2001	21,319,262	(35,505,451)	(1,134,443)	(3,179,023)	(39,818,918)	(18,499,656)	998,671,310	(1.9%)
2002	23,395,271	(40,606,836)	(658,917)	(3,545,184)	(44810,937)	(21,415,666)	875,304,832	(2.4%)
2003	23,656,596	(48,128,153)	(907,236)	(4,056,463)	(53,091,851)	(29,435,255)	891,122,027	(3.3%)
2004	23,623,171	(51,764,755)	(604,562)	(3,736,002)	(56,105,319)	(32,482,148)	981,026,764	(3.3%)
2005	23,814,179	(53,952,761)	(974,389)	(4,157,579)	(59,084,730)	(35,270,551)	1,041,898,315	(3.4%)
2006	23,956,626	(57,570,547)	(790,218)	(4,295,209)	(62,655,974)	(38,699,348)	1,098,788,670	(3.5%)
2007	23,742,542	(62,317,277)	(1,243,841)	(4,458,889)	(68,020,007)	(44,277,465)	1,186,151,377	(3.7%)
2008	24,286,799	(65,483,982)	(1,154,502)	(4,584,201)	(71,222,685)	(46,935,886)	1,242,354,294	(3.8%)
2009	24,730,528	(69,635,808)	(861,725)	(4,726,929)	(75,224,462)	(50,493,934)	994,466,871	(5.1%)
2010	26,691,696	(73,650,896)	(803,288)	(4,176,401)	(78,630,585)	(51,938,889)	1,052,235,399	(4.9%)
2011	26,574,184	(77,553,673)	(960,668)	(5,253,653)	(83,767,994)	(57,193,810)	1,298,501,306	(4.4%)
2012	26,521,075	(82,216,303)	(912,512)	(5,861,735)	(88,990,550)	(62,469,475)	1,230,012,388	(5.1%)
2013	26,712,669	(89,037,077)	(1,084,539)	(6,542,055)	(96,663,601)	(69,950,932)	1,326,032,436	(5.3%)
2014	27,499,336	(93,712,721)	(1,741,876)	(6,650,036)	(102,104,633)	(74,605,297)	1,492,232,422	(5.0%)
2015	28,197,463	(100,328,585)	(1,917,221)	(7,883,940)	(110,129,746)	(81,932,283)	1,443,476,293	(5.7%)
2016	28,611,588	(105,056,553)	(1,699,287)	(8,127,098)	(114,882,938)	(86,271,350)	1,304,869,720	(6.6%)
2017	28,318,809	(109,874,806)	(2,029,791)	(8,211,585)	(120,116,182)	(91,797,373)	1,354,321,200	(6.8%)
2018	28,457,459	(113,476,915)	(2,270,815)	(8,312,995)	(124,060,725)	(95,603,266)	1,472,472,865	(6.5%)

Column (2) includes employee and employer contributions, as well as any account reinstatement receipts during the year.
Column (5) includes both administrative and investment expenses.
Column (7) = Column (2) + Column (6)

EXHIBIT 4

EMPLOYEE PROFILE

Employee data needed for the valuation was obtained from the records furnished by the system. The following table shows a detailed breakdown of the included participants and salaries by age and years of actual ASHERS credited service. This does not include reciprocal service which determines eligibility.

All Actives – Actual Service

		Years of Service							
Age		0-5	5-10	10-15	15-20	20-25	25-30	Over 30	Total
Under 25	Count	279	11	-	-	-	-	-	290
	Salary	8,394,928	382,986	-	-	-	-	-	8,777,914
25-29	Count	231	76	-	-	-	-	-	307
	Salary	8,420,185	3,249,773	-	-	-	-	-	11,669,958
30-34	Count	175	109	50	6	-	-	-	340
	Salary	6,167,536	5,604,367	2,501,074	240,607	-	-	-	14,513,585
35-39	Count	153	74	95	80	4	-	-	406
	Salary	5,353,709	3,447,975	5,005,345	4,540,097	207,708	-	-	18,554,834
40-44	Count	142	72	80	82	45	3	-	424
	Salary	4,922,419	3,115,371	3,975,063	4,748,916	2,752,297	210,284	-	19,724,350
45-49	Count	138	80	85	69	51	55	-	478
	Salary	4,945,964	3,462,172	3,906,194	3,875,840	3,055,510	3,841,101	-	23,086,781
50-54	Count	128	74	75	73	69	76	3	498
	Salary	4,504,864	3,073,068	3,217,304	3,635,437	3,408,350	5,238,481	263,701	23,341,205
55-59	Count	95	87	48	74	59	48	-	411
	Salary	3,033,282	3,435,441	1,889,444	3,267,388	2,907,585	2,793,203	-	17,326,342
60-64	Count	53	43	39	24	1	2	-	162
	Salary	1,758,514	1,503,110	1,654,843	1,099,457	70,064	148,918	-	6,234,906
65-69	Count	11	7	4	-	1	-	-	23
	Salary	381,965	178,556	151,415	-	44,000	-	-	755,935
70 & Over	Count	3	-	1	-	-	-	-	4
	Salary	85,524	-	40,056	-	-	-	-	125,581
Total	Count	1,408	633	477	408	230	184	3	3,343
	Salary	47,968,890	27,452,820	22,340,739	21,407,741	12,445,514	12,231,987	263,701	144,111,392

Average Attained Age: 43.0 years
Average Actual Service: 9.3 years
Average Salary: $ 43,108

EXHIBIT 4

RETIREE PROFILE

Retiree data needed for the valuation was obtained from the records furnished by the administrator. The following table shows a detailed breakdown of the included retirees and beneficiaries by age and years since retirement. Benefits listed are annual amounts of annuities paid monthly.

All Retirees Receiving Annuities

		Years since Retirement							
Age		0-1	1-2	2-3	3-4	4-5	5-10	Over 10	Total
Under 45	Count	-	-	-	-	-	-	-	-
	Benefit	-	-	-	-	-	-	-	-
45-49	Count	2	-	-	1	-	-	-	3
	Benefit	54,348	-	-	44,565	-	-	-	98,913
50-54	Count	12	2	5	6	5	7	-	37
	Benefit	447,912	70,109	180,142	202,993	154,775	220,978	-	1,276,909
55-59	Count	18	30	19	27	22	25	11	152
	Benefit	629,104	975,759	644,804	1,026,549	756,461	995,331	377,374	5,405,382
60-64	Count	63	53	35	36	38	144	50	419
	Benefit	1,457,445	1,422,006	1,177,845	1,439,441	1,312,194	5,532,354	1,857,939	14,199,223
65-69	Count	34	34	29	63	63	239	181	643
	Benefit	760,900	852,048	566,782	1,620,009	1,739,772	8,160,032	6,924,259	20,623,802
70-74	Count	3	3	5	8	11	168	300	498
	Benefit	75,601	42,079	66,360	99,028	137,658	4,727,780	11,510,135	16,658,641
75-79	Count	-	-	1	2	2	20	319	344
	Benefit	-	-	3,725	6,217	8,928	366,030	11,381,231	11,766,130
80-84	Count	-	-	-	1	-	2	241	244
	Benefit	-	-	-	2,945	-	5,784	9,246,964	9,255,693
85 & Over	Count	-	-	-	-	-	-	183	183
	Benefit	-	-	-	-	-	-	5,361,999	5,361,999
Total	Count	132	122	94	144	141	605	1,285	2,523
	Benefit	3,425,311	3,362,001	2,639,658	4,441,747	4,109,788	20,008,288	46,659,900	84,646,691

Average Attained Age: 71.2 years
Average Years since Retirement: 11.5 years

Average Annual Benefit: $33,550

EXHIBIT 4

DISABLED PROFILE

Retiree data needed for the valuation was obtained from the records furnished by the administrator. The following table shows a detailed breakdown of the included retirees and beneficiaries by age and years since retirement. Benefits listed are annual amounts of annuities paid monthly.

All Disability Retirees Receiving Annuities

		Years since Retirement							
Age		0-1	1-2	2-3	3-4	4-5	5-10	Over 10	Total
Under 45	Count	1	3	1	1	2	2	1	11
	Benefit	4,388	19,754	10,546	7,670	35,871	17,347	7,694	103,270
45-49	Count	3	2	-	5	3	4	5	22
	Benefit	39,235	19,833	-	76,194	63,680	56,231	56,445	311,618
50-54	Count	4	5	7	6	7	12	11	52
	Benefit	67,947	39,571	145,622	97,225	98,313	193,485	180,299	822,462
55-59	Count	5	5	4	5	9	15	29	72
	Benefit	60,150	53,255	43,201	47,145	129,962	239,842	477,340	1,050,896
60-64	Count	2	5	6	5	5	21	37	81
	Benefit	14,246	34,774	67,144	49,750	97,304	342,158	592,140	1,197,517
65-69	Count	-	-	2	1	3	28	60	94
	Benefit	-	-	15,666	14,895	29,015	332,955	1,231,180	1,623,711
70-74	Count	-	-	-	-	-	1	51	52
	Benefit	-	-	-	-	-	3,418	1,030,597	1,034,016
75-79	Count	-	-	-	-	-	-	24	24
	Benefit	-	-	-	-	-	-	608,975	608,975
80-84	Count	-	-	-	-	-	-	12	12
	Benefit	-	-	-	-	-	-	267,260	267,260
85 & Over	Count	-	-	-	-	-	-	7	7
	Benefit	-	-	-	-	-	-	147,552	147,552
Total	Count	15	20	20	23	29	83	237	427
	Benefit	185,965	167,188	282,180	292,879	454,145	1,185,436	4,599,483	7,167,276

Average Attained Age: 63.3 years
Average Years since Retirement: 12.1 years

Average Annual Benefit: $16,785

EXHIBIT 4

SURVIVOR PROFILE

Retiree data needed for the valuation was obtained from the records furnished by the administrator. The following table shows a detailed breakdown of the included retirees and beneficiaries by age and years since retirement. Benefits listed are annual amounts of annuities paid monthly.

All Survivors Receiving Annuities

		Years since Retirement							
Age		0-1	1-2	2-3	3-4	4-5	5-10	Over 10	Total
Under 45	Count	3	-	3	3	1	10	1	21
	Benefit	78,180	-	27,000	23,259	4,365	170,306	1,840	304,951
45-49	Count	1	1	1	2	-	3	2	10
	Benefit	21,565	20,583	7,578	44,047	-	56,693	21,748	172,214
50-54	Count	-	1	3	1	2	5	4	16
	Benefit	-	5,756	60,658	24,150	24,112	45,910	54,160	214,746
55-59	Count	2	1	3	4	6	9	7	32
	Benefit	19,181	6,103	46,846	35,019	138,815	112,013	95,757	453,733
60-64	Count	7	6	5	6	4	21	14	63
	Benefit	125,290	90,879	48,422	51,925	21,396	312,820	179,070	829,803
65-69	Count	6	7	6	6	3	17	17	62
	Benefit	71,251	115,305	85,474	78,030	48,391	233,993	197,396	829,840
70-74	Count	7	6	6	7	2	13	28	69
	Benefit	108,847	78,898	84,349	123,517	29,519	201,775	440,703	1,067,607
75-79	Count	3	5	7	5	8	17	31	76
	Benefit	76,882	64,867	76,801	80,494	197,410	288,797	456,222	1,241,474
80-84	Count	5	3	3	-	2	18	28	59
	Benefit	75,972	99,645	53,487	-	31,762	356,243	435,958	1,053,067
85 & Over	Count	1	6	1	2	7	17	44	78
	Benefit	12,653	98,739	19,691	52,570	129,003	371,541	627,666	1,311,864
Total	Count	35	36	38	36	35	130	176	486
	Benefit	589,820	580,774	510,305	513,012	624,774	2,150,093	2,510,519	7,479,298

Average Attained Age: 71.9 years
Average Years since Retirement: 9.4 years

Average Annual Benefit: $15,390

EXHIBIT 4

DROP PROFILE

Retiree data needed for the valuation was obtained from the records furnished by the administrator. The following table shows a detailed breakdown of the included retirees and beneficiaries by age and years since retirement. Benefits listed are annual amounts of the current DROP deposits paid monthly.

All Current DROP Participants

		Years since Retirement							
Age		0-1	1-2	2-3	3-4	4-5	5-10	Over 10	Total
Under 45	Count	-	-	-	-	-	-	-	-
	Benefit	-	-	-	-	-	-	-	-
45-49	Count	4	2	-	-	-	-	-	6
	Benefit	148,317	80,966	-	-	-	-	-	229,282
50-54	Count	31	13	18	12	5	3	-	82
	Benefit	1,192,975	516,379	703,735	403,716	164,642	100,618	-	3,082,065
55-59	Count	18	23	17	20	7	21	3	109
	Benefit	704,213	864,258	698,329	757,043	300,092	697,624	95,909	4,117,468
60-64	Count	23	29	23	22	14	16	12	139
	Benefit	538,398	622,623	654,573	659,640	507,686	683,064	441,673	4,107,657
65-69	Count	10	5	7	7	3	-	-	32
	Benefit	91,659	57,878	57,366	100,326	73,701	-	-	380,931
70-74	Count	-	-	-	1	-	-	-	1
	Benefit	-	-	-	3,812	-	-	-	3,812
75-79	Count	-	-	-	-	-	-	-	-
	Benefit	-	-	-	-	-	-	-	-
80-84	Count	-	-	-	-	-	-	-	-
	Benefit	-	-	-	-	-	-	-	-
85 & Over	Count	-	-	-	-	-	-	-	-
	Benefit	-	-	-	-	-	-	-	-
Total	Count	86	72	65	62	29	40	15	369
	Benefit	2,675,562	2,142,103	2,114,004	1,924,537	1,046,120	1,481,307	537,582	11,921,216

Average Attained Age: 59.1 years
Average Years since Retirement: 3.0 years

Average Annual Benefit: $32,307

APPENDIX 1

PRINCIPAL PROVISIONS OF THE PLAN

EFFECTIVE DATE:	July 1, 1949.
EMPLOYEE:	Employees of the Arkansas State Highway System.
EMPLOYER:	Arkansas State Highway System.
PLAN YEAR:	July 1 to June 30.
PARTICIPATION:	Immediate upon full-time employment.
EMPLOYER CONTRIBUTIONS:	The State contributes 12.90% of the total payroll earnings of members, excluding DROP participants. The State does not contribute for members in the Tier I portion of DROP and contributes 6.9% of payroll for members in the Tier II portion of DROP.
EMPLOYEE CONTRIBUTIONS:	1. Each Member must contribute 6% of his annual Compensation while in the service of the Employer. During participation in the Tier I portion of DROP a member's contributions are suspended. 2. Within certain terms, conditions, and limitations, a Member voluntarily may make additional contributions in order to obtain creditable service for prior service.
COMPENSATION:	The total remuneration earned by an employee for services rendered during any consecutive twelve (12) months or fraction thereof.
FINAL AVERAGE COMPENSATION:	Average compensation over 36 consecutive months that produces the highest average.
CREDITED SERVICE:	Completed years and days of service since date of hire.
RECIPROCAL SERVICE:	Service completed in any reciprocal state system as defined by law. Used to determine eligibility for benefits.

Appendix 1 (Continued)

NORMAL RETIREMENT:

Eligibility: Earliest of the following:

(a) Completion of 28 years of creditable service,
(b) Age 60 and 20 years of creditable service,
(c) Age 62 and 15 years of creditable service,
(d) Age 65 and 5 years of creditable service.

Benefit Formula: Years of credited service times 2.2% of Final Average Compensation, plus post-retirement health care supplements. The minimum annual normal retirement benefit is $1,800. The health care supplements are depended on years of service at retirement, the benefits are provided as follows:

(a) For members who retired before or on June 30, 2009: $1,500 health care offset amount will be provided.

(b) For members who retire after June 30, 2009:
1. With less than 10 years of accrued service: No health care offset amount will be provided.

2. With 10 or more years of accrued service but less than 15 years of accrued service at retirement: $900 health care offset amount will be provided.

3. With 15 or more years of accrued service but less than 20 years of accrued service at retirement: $1,200 health care offset amount will be provided.

4. With 20 or more years of accrued service at retirement: $1,500 health care offset amount will be provided.

For members who retire after June 30, 2013 the health care offset is prorated for any service earned with a reciprocal retirement system.

Appendix 1 (Continued)

Normal Form:	Monthly benefit for life of Member plus, upon death, a refund of the excess (if any) of (i) the Member's accumulated contribution account at time of retirement over (ii) the total annuity payments received.
Optional Form:	Option A: 10 years certain or life, or Option B: Joint & 50% contingent survivor, with a pop up to the life only amount if the joint pensioner predeceases the member.

DEFERRED RETIREMENT OPTION PLAN (DROP):

Eligibility:	Earliest of the following: (a) Completion of 30 years of creditable service, (b) Age 60 and 20 years of creditable service, (c) Age 62 and 15 years of creditable service, (d) Age 65 and 5 years of creditable service.
Benefit:	Active members eligible for normal retirement are eligible to participate in the DROP program while continuing active employment. During DROP, the member will receive the regular retiree cost of living adjustments. A member can remain in DROP to the later of age 65 or the completion of five years of participation in DROP. DROP is divided into Tier I and Tier II. Tier I consists of the first five years of DROP participation, while Tier II is the remaining period. In Tier I, 90% of the retirement annuity will be deposited in the DROP account, whereas in Tier II, 79% of the retirement annuity will be deposited. The DROP account is credited with interest in Tier I and Tier II (as set by the Board, currently 6%). Furthermore, the member and employer contributions cease during DROP until the member enters Tier II; during Tier II participation, the member contributes 6.00% of their total payroll earnings and the employer contributes 6.90%. At actual retirement, the member will receive the DROP balance and commence receiving the regular annuity payments.

Appendix 1 (Continued)

EARLY RETIREMENT:

Eligibility:	Age 55 with 5 or more years of creditable service.
Benefit:	Normal retirement benefit earned to the date of retirement, reduced .8% for each of the first 60 months and .3% for each of the next 60 months that the early retirement date precedes the normal retirement date. The minimum annual early retirement benefit is $1,800.

DISABILITY BENEFITS:

Benefit:

1. Less than 1 Year of Creditable Service: Refund of member contributions without interest.
2. At least 1 Year of Creditable Service: Refund of member contributions with interest. Interest credits are currently 5% per annum.
3. At least 5 or more Years of Creditable Service: If he leaves his contribution account on deposit, a monthly annuity payable to the member for life based upon his years of creditable service and commencing upon disability.

TERMINATION OF SERVICE:

1. Less than 1 Year of Creditable Service: Refund of member contributions without interest.
2. At least 1 Year of Creditable Service: Refund of member contributions with interest. Interest credits are currently 5% per annum.
3. At least 5 or more Years of Creditable Service: If he leaves his contribution account on deposit, a monthly annuity payable to the member for life based upon his years of creditable service and commencing upon eligibility for retirement.

Appendix 1 (Continued)

DEATH BEFORE RETIREMENT:

1. Less than 1 Year of Creditable Service: Refund of member contributions without interest.

2. At least 1 Year of Creditable Service: Refund of member contributions with interest.

3. At least 5 Years of Creditable Service: If the beneficiary leaves the Member's contribution account on deposit, an annuity payable under either Option A or B as elected by the beneficiary and commencing at the time the Member would have become eligible for retirement.

   (a) Option A: A reduced annuity payable for 10 years in an amount equal to what the member would have received under retirement Option A.
   (b) Option B: An annuity payable for the life of the beneficiary in an amount equal to 50% of what the member would have received under retirement Option B.

4. An additional death benefit equal to $15,000.

DEATH AFTER RETIREMENT:

If no option was elected, refund of the excess (if any) of (i) the Member's accumulated account (including interest) at retirement over (ii) the total annuity payments received. If an option is elected, death benefits are payable in accordance with such option.

An additional lump sum death benefit of $7,500 is provided for retirees (not beneficiaries).

Appendix 1 (Continued)

AUTOMATIC POST RETIREMENT INCREASES:	Effective July 1 2017, the benefit increase will be the lesser of 3% or the percentage change in the Consumer Price Index for Urban Wage Earners and Clerical Workers as determined by the United States Department of Labor over the one-year period ending in the December immediately preceding the date of which the redetermined amount is being calculated. However, the redetermined amount of the benefit to be paid shall not be less than the redetermined amount of the benefit paid in the preceding year. Previously, benefits increase by 1 1/2% of the base benefit each year after June 30, 1976 through June 30, 1978, by 3% of the base benefit each year after June 30, 1978, through June 30, 1995, and by 3% of the previous year's benefit each year after June 30, 1995 for those who are retired for at least one year on the July 1 determination date. This benefit was limited by the Consumer Price Index until June 30, 1999. Effective July 1, 1999, the benefit increase is 3% with no ties to the Consumer Price Index.

APPENDIX 2

LEGISLATED PLAN CHANGES ENACTED BY THE LEGISLATURE OF THE STATE OF ARKANSAS

YEAR: 1991

1. ACT 198 — Provide a one-time payment equal to 3.0% of the July 1, 1991 annualized annuity for members retired on or prior to January 1, 1990.

2. ACT 243 — Permit members to accrue more than 35 years of creditable service. (Retroactively applied).

3. ACT 245 — Effective July 1, 1991, increase annuities by the sum of $50 per month for members receiving benefits prior to, on, or subsequent to July 1, 1991. The increase is also added to the base annuity.

4. ACT 246 — Effective July 1, 1991, increase the benefit formula multiplier to 2.06% of average compensation times number of years of creditable service.

5. ACT 380 — 4.0% ad hoc increase payable on July 1, 1991 for those members retired on June 1, 1991, based on benefit payable on June 1, 1991. The increase is also added to the base annuity.

6. ACT 381 — Benefits from reciprocal retirement systems are to be based on the highest final average salary at the time of retirement. (Retroactively applied).

YEAR: 1993

1. ACT 929 — 2.9% ad hoc increase payable on July 1, 1993 for those members retired on June 1, 1993, based on benefits payable June 1, 1993. The increase is also added to the base annuity.

2. ACT 930 — Effective July 1, 1993, the average compensation is based on a forty-eight (48) month averaging period. (Previously sixty (60) months.)

YEAR: 1995

1. ACT 407 — Cost of living increase up to 3% of the member's previous year's benefit for those members retired for at least twelve full months after the effective date of each increase. Increases are effective July 1 and will be limited to the lesser of 3% or the Consumer Price Index but may not result in a decrease in benefits otherwise payable.

Appendix 2 (Continued)

YEAR: 1997

1.	ACT 1067	Creates an active member death benefit of 10 years certain and life. Five years of service eligibility for benefit.
2.	ACT 1089	Creates a $15,000 death benefit for active and vested-terminated members.
3.	ACT 1073	Creates a DROP program for active members eligible for normal retirement.
4.	ACT 386	Increases the multiplier from 2.06% to 2.10%. Grants 2.0% ad hoc to retirees.
5.	ACT 349	Changes 48-month FAE to 36 months. Grants 2.2% ad hoc to retirees.
6.	ACT 347	Changes 10-year vesting requirement to 5 years.

YEAR: 1999

1.	ACT 311	Increases the $50 per month supplement to $125 per month to current and future retirees.
2.	ACT 1325	Active members can retire with full benefit if they have 28 years of creditable service.
3.	ACT 335	Cost of living increase will be 3% and is not limited by the Consumer Price Index.

YEAR: 2001

1.	ACT 482	Provides $7,500 lump sum death benefit for retirees (not beneficiaries).
2.	ACT 539	Increases the multiplier from 2.1% to 2.2%. Grant 4.8% ad hoc to retirees.
3.	ACT	Crediting 8% to the DROP account by taking a Board action.

YEAR: 2003

1.	ACT 776	Allows members who enter DROP prior to age 60 to remain in DROP until age 65, beyond the five-year limit previously set. During this time, known as Tier II DROP, 79% of the retirement annuity will be deposited in the DROP account. Furthermore, the member contributes 6.00% of their total payroll earnings and the employer contributes 6.90%.
2.	ACT 205	Changes the factors used for determining optional forms of payment to actuarially equivalent factors. Current retirees had their benefits increased to reflect the new factors effective July 1, 2003.

Appendix 2 (Continued)

YEAR: 2009

1. HB 1177 — Changes from 5 years vesting requirement to 10 years vesting requirement on health care coverage. Prorated the $125 per month health care supplements as follows:

   a. With less than 10 years of service at retirement: No health care supplements.

   b. With 10 or more years of service but less than 15 years of service at retirement: $75/month (or 60% of $125/month).

   c. With 15 or more years of service but less than 20 years of service at retirement: $100/month (or 80% of $125/month).

   d. With 20 or more years of service at retirement: $125/month (or100% of $125/month).

YEAR: 2011

1. HB 1213 — Establishes the cost for purchasing service credit as the actuarial equivalent cost. The actuarial cost is the increase in the liability associated with adding the additional service credit. This applies to all types of service credit including: military service, service with another State agency, and reinstatement of forfeited service.

YEAR: 2013

1. HB 1224 — Prorates the Health Care Offset paid by the Arkansas State Highway Employees Retirement System (ASHERS), for members who also have service in a reciprocal retirement system.

2. HB 1225 — Excludes lump sum termination payments (accrued leave, compensation, etc.) from inclusion in the Average Compensation and credited service used in the determination of retirement benefits paid by the Arkansas State Highway Employees Retirement System (ASHERS).

YEAR: 2017

1. ACT 610 — Cost of living increase will be the lesser of 3% or the percentage change in the Consumer Price Index for Urban Wage Earners and Clerical Workers as determined by the United States Department of Labor over the one-year period ending in the December immediately preceding the date of which the redetermined amount is being calculated. However, the redetermined amount of the benefit to be paid shall not be less than the redetermined amount of the benefit paid in the preceding year.

Appendix 2 (Continued)

2. ACT 461 A member of the Arkansas State Highway Employees' Retirement System may purchase creditable service in the retirement system, without interest, for a period not to exceed five years of service for active service by the member in the United States Armed Forces if the member (1) has five years of actual service in the system as of August 20, 2015; and (2) shows that he or she relied upon the ten-year service time requirement before applying to purchase military service credit under this ACT. The purchase of military service credit under this ACT shall be made in the form of a cash payment or automatic payroll deductions for period not to exceed three years.

APPENDIX 3

ACTUARIAL COST METHODS AND ASSUMPTIONS

INVESTMENT YIELD RATE:	8.0% per annum, compounded annually. (Effective June 30,1997):

MORTALITY:

a. Healthy Post-retirement (Effective June 30, 2015)

Male: RP-2000 Combined Healthy for males with Blue Collar adjustments, scaled at 105% with no setback. Generational mortality improvements in accordance with Scale AA from the table's base year of 2000 (both before and after the measurement date)

Female: RP-2000 Combined Healthy for females with Blue Collar adjustments, scaled at 100% with no setback. Generational mortality improvements in accordance with Scale AA from the table's base year of 2000 (both before and after the measurement date)

b. Disabled Post-retirement (Effective June 30, 2015)

Male: RP-2000 Combined Healthy for males with Blue Collar adjustments, scaled at 105% with three-year set-forward. Generational mortality improvements in accordance with Scale AA from the table's base year of 2000 (both before and after the measurement date), minimum 3% rate of mortality at all ages

Female: RP-2000 Combined Healthy for females with Blue Collar adjustments, scaled at 100% with three-year set-forward. Generational mortality improvements in accordance with Scale AA from the table's base year of 2000 (both before and after the measurement date), minimum 3% rate of mortality at all ages

c. Healthy Pre-retirement (Effective June 30, 2015)

Male: RP-2000 Combined Healthy for males with Blue Collar adjustments, scaled at 70% with no setback. Generational mortality improvements in accordance with Scale AA from the table's base year of 2000 (both before and after the measurement date)

Female: RP-2000 Combined Healthy for females with Blue Collar adjustments, scaled at 70% with no setback. Generational mortality improvements in accordance with Scale AA from the table's base year of 2000 (both before and after the measurement date)

Appendix 3 (Continued)

RETIREMENT RATES (Effective June 30, 2015):

The following probabilities of retirement were assumed for members eligible to retire:

	Early Retirement Rate	Normal Retirement Rate	
Age	Males and Females	Males	Females
48		5.0%	5.0%
49		5.0%	5.0%
50		6.5%	5.0%
51		8.0%	6.0%
52		9.5%	7.0%
53		11.0%	8.0%
54		12.5%	9.0%
55	1.0%	14.0%	10.0%
56	1.0%	15.5%	15.0%
57	2.0%	20.0%	15.0%
58	2.0%	25.0%	25.0%
59	3.0%	25.0%	25.0%
60	3.0%	15.0%	15.0%
61	8.0%	20.0%	20.0%
62	20.0%	45.0%	45.0%
63	20.0%	25.0%	25.0%
64	15.0%	25.0%	25.0%
65		40.0%	40.0%
66		40.0%	40.0%
67		40.0%	40.0%
68		40.0%	40.0%
69		40.0%	40.0%
70		100.0%	100.0%

Appendix 3 (Continued)

DISABILITY RATES (Effective June 30, 2009):

Rates based on the experience of other large public sector retirement systems through age 82; thereafter, Non-Disabled Mortality is assumed.

Age	Rates of Decrement Due to Disability
20	.00192
25	.00192
30	.00192
35	.00192
40	.00480
45	.00624
50	.01176
55	.02136
60	.03384
65	.03984

WITHDRAWAL RATES (for causes other than death, disability, or retirement) (Effective June 30, 2015):

Select and ultimate rates are used based on age and service. Sample rates are shown.

Probability of Decrement Due to Withdrawal

Years of Service

Male Members

Age	0	1	2	3	4	5+
20	.3712	.2536	.1697	.1180	.1150	.1043
30	.2925	.1998	.1313	.0862	.0756	.0578
40	.2193	.1538	.1024	.0646	.0477	.0261
50	.1628	.1242	.0894	.0582	.0368	.0159
60	.1342	.1238	.1033	.0748	.0462	.0302

Female Members

Age	0	1	2	3	4	5+
20	.4028	.3008	.2168	.1509	.1047	.0761
30	.2819	.2118	.1542	.1093	.0765	.0571
40	.1980	.1483	.1073	.0752	.0514	.0366
50	.1715	.1250	.0863	.0550	.0336	.0171
60	.1985	.1391	.0896	.0481	.0230	.0007

Appendix 3 (Continued)

SALARY SCALES (Effective June 30, 2015):

Future compensation is assumed to increase by an inflation (growth) increase rate of 2.5% plus a productivity component of 1.00%, and plus a step-rate/promotional component based on service. Rates are illustrated below:

Years of Service	Step-rate/ Promotional Component	Total Salary Scale
0	7.00%	10.50%
1	7.00%	10.50%
2	7.00%	10.50%
3	2.00%	5.50%
4	1.25%	4.75%
5-13	0.75%	4.25%
14-17	0.50%	4.00%
18-19	0.25%	3.75%
20+	0.00%	3.50%

FUTURE INCREASE IN TOTAL PAYROLL (Effective June 30, 2015):

3.0% per annum. Used for purposes of funding the Unfunded Actuarial Accrued Liability.

COST OF LIVING INCREASE (Effective June 30, 2017):

All benefit in pay status are assumed to be increased by 2.25% annually.

PROVISION FOR EXPENSE (Effective June 30, 1997):

The assumed investment return rate represents the anticipated net rate of return after payment of all administrative and investment expenses.

ELECTION RATES (Effective June 30, 2004):

After their initial vesting, members are assumed to elect the greater value of their deferred annuity or a refund of their account balances. 100% of non-vested members are assumed to take a refund.

ELECTION OF DROP ENTRY (Effective June 30, 2015):

100% of participants who are eligible to enter DROP are assumed to elect to participate in DROP, except as noted below. Members who elect into DROP are assumed to retire at the normal retirement patterns. Members who first become eligible to DROP prior to age 60 (at 30 years of service) are assumed to enter DROP after attaining 31 years of service. Members past their first eligibility are assumed to enter DROP immediately.

Appendix 3 (Continued)

INTEREST CREDITING RATE ON DROP ACCOUNTS (Effective June 30, 2012):

6.0% interest credit on DROP accounts.

DROP ACCOUNTS PAYOUT PERIOD (Effective June 30, 2015):

It is assumed that members who participate in DROP will receive their DROP accounts in equal installments over a 10-year period.

ASSET VALUATION METHOD (Adopted June 30, 2015):

The actuarial value of assets is equal to the market value of assets less a four-year phase-in of the excess (shortfall) between expected investment return and actual income with the resulting value not being less than 80% or more than 120% of the market value of assets.

The actuarial value of assets was marked to the market for June 30, 2012 valuation. This was done to prevent an expected divergence away from the market value of assets.

ACTUARIAL COST METHOD:

The funding period required to amortize the unfunded actuarial accrued liability (UAAL) is determined using the Entry Age Actuarial Cost Method.

The Individual Entry Age Normal actuarial cost method assigns the Plan's total unfunded liabilities (the actuarial present value of future benefits less the actuarial value of assets) to various periods. The unfunded actuarial accrued liability is assigned to years prior to the valuation, and the normal cost is assigned to the year following the valuation. The remaining costs are the normal costs for future years. Then each year's contribution is composed of (i) that year's normal cost, plus (ii) a payment used to reduce the unfunded actuarial accrued liability.

The normal contribution is determined using the Entry Age Normal method. Under this method, a calculation is made to determine the rate of contribution which, if applied to the compensation of each individual member during the entire period of anticipated covered service (prior to DROP entry), would be required to meet the cost of all benefits payable on his behalf. The salary-weighted average of these rates is the normal cost rate. This calculation reflects the plan provisions that apply to each individual member. The employer normal cost rate is equal to (i) the normal cost rate, minus (ii) the member contribution rate.

The actuarial accrued liability is the difference between the total present value of future benefits and the actuarial present value of future normal costs. The unfunded actuarial accrued liability (UAAL) is the excess of the actuarial accrued liability over the actuarial value of assets.

Appendix 3 (Continued)

Since the State statutes governing the System establish the current employee and State contribution rates, the actuarial valuation determines the number of years required to amortize (or fund) the UAAL on a level percentage of payroll basis, taking into account the payroll growth assumption and the normal cost expressed as a percent of pay. Because of this amortization procedure, any change in the unfunded actuarial accrued liability due to (i) actuarial gains and losses, (ii) changes in actuarial assumptions, or (iii) amendments, affects the funding period.

FUNDING OF UNFUNDED ACTUARIAL ACCRUED LIABILITY:

The total normal cost for benefits provided by the System is 12.50% of payroll, which is 6.40% of payroll less than the total contributions required by Law (12.90% from State plus 6% from employees). 12.50% of the State's 12.90% contribution is required to meet the normal cost, and the remaining 0.40% along with the 6.00% from the employee contribution plus any contributions received on behalf of members in Tier II of DROP are assumed to be utilized to fund the unfunded actuarial accrued liability over a period of years in the future, assuming that total payroll is increased by 3.0% per year

APPENDIX 4

DEFINITION OF ACTUARIAL TERMS

ACTUARIAL ACCRUED LIABILITY:

The present value of benefits payable in the future less the present value of future normal costs for present members.

ACTUARIAL VALUE OF ASSETS:

The market value of assets of the System adjusted to recognize investment earnings above or below the investment return assumption uniformly over a five-year period.

ACTUARIAL ASSUMPTIONS:

Assumptions as to future experience under the System. Assumptions include future fund earnings rates, rates of future salary increases, and rates of death (both before and after retirement), disability, retirement, and withdrawal.

ACTUARIALLY DETERMINED:

Values which have been determined utilizing the principles of actuarial science. An actuarially determined value is derived by application of the appropriate actuarial assumptions to specified values determined by provisions of the law.

ACTUARIAL GAIN OR ACTUARIAL LOSS:

A measure of the difference between actual experience and assumed experience of the System. The actuarial assumptions, rates of decrements, rates of salary increases, and rates of fund earnings have been forecasted. To the extent that actual experience differs from that assumed, actuarial liabilities emerge which may be the same as forecasted or they may be larger or smaller than projected. Actuarial gains are due to favorable experience, i.e., the System's assets earn more than projected, salaries do not increase as fast as assumed, members retire later than assumed, etc. Favorable experience means actual results produce actuarial liabilities not as large as projected by the actuarial assumptions. On the other hand, actuarial losses are the result of unfavorable experience, i.e., actual results that produce actuarial liabilities which are larger than projected. Actuarial gains will shorten the time required for funding of the unfunded actuarial accrued liability while actuarial losses will lengthen the funding period.

ACTUARIAL LIABILITIES:

The actuarially determined present value of future benefits to be provided by the System. There are separate actuarially determined present values for retired members and non-retired members. When applied to active members, benefits which will be earned through future service and future salary increases are taken into account.

APPENDIX 4 (Continued)

DEFINED BENEFITS:

Benefits which are defined by a specific formula applied to a specific member's compensation and/or specific years of service. The amount of the benefit is not a function of contributions or actual earnings on those contributions.

FUTURE BENEFITS:

Benefits specified in the law which will become payable at some time in the future when the member satisfies the requirement to receive such benefits.

FUTURE CONTRIBUTIONS:

Contributions to be made by the member or the State in the future, as required by the law.

FUNDING PERIOD:

The number of years in the future that will be required to fund (i.e., pay off or eliminate) the unfunded actuarial accrued liability, based on the actuarial assumptions and assuming no future actuarial gains or losses.

NORMAL COST:

The average annual actuarial cost of the benefits provided by the System for the current employees.

PRESENT VALUE:

The actuarially determined lump sum value as of the valuation date of a series of payments to be made in the future, where the lump sum value is equal to the sum of the discounted value of each future payment. The discounted value of each payment is the product of (a) the amount of the payment, (b) the probability that the payment will be made (based on the current actuarial assumptions as to the future experience), and (c) the time value of money (based on the current assumed interest rate).

UNFUNDED ACTUARIAL ACCRUED LIABILITY:

That portion of the actuarial accrued liability (including the present value of benefits presently being paid to retired members and the value of any miscellaneous liabilities) that exceeds the value of current assets.

FUNDED RATIO:

The ratio of the actuarial value of assets to the actuarial accrued liability. The funding ratio is a measure of the funded status of the plan.