TULSA COUNTY EMPLOYEES' RETIREMENT SYSTEM

ACTUARIAL VALUATION
Plan Year: July 1, 2019 to June 30, 2020

Prepared by

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Consulting Actuary

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October 7, 2019

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Board of Trustees
Tulsa County Employees'
Retirement System
500 South Denver
Tulsa, OK 74103

RE: Tulsa County Employees' Retirement System 2019 Actuary's Report

Dear Board of Trustees:

As part of our engagement with the Board, we performed an actuarial valuation of the Tulsa County Employees' Retirement System as of July 1, 2019 for the Plan Year ending June 30, 2020. Our findings are set forth in this actuary's report. This report reflects the benefit provision and contribution rates in effect as of July 1, 2019.

In preparing this report, we relied, without audit, on information (some oral and some in writing) supplied by the County. This information includes, but is not limited to, statutory provisions, member census data, and financial information. We found this information to be reasonably consistent and comparable with information used for other purposes. The valuation results depend on the integrity of this information. If any of this information is inaccurate or incomplete, our results may be different, and our calculations may need to be revised.

Actuarial assumptions, including discount rates, mortality tables, and others identified in this report, and actuarial cost methods are prescribed by the System's Board. These parties are responsible for selecting the plan's funding policy, actuarial valuation methods, asset valuation methods, and assumptions. The policies, methods, and assumptions used in this valuation are those that have been so prescribed and are described in this report. The System is solely responsible for communicating to Milliman any changes required thereto.

This valuation is based on an investment return assumption of 7.25% as adopted by the System's Board. That assumption is considered a *prescribed assumption* as defined by Actuarial Standard of Practice 27 (ASOP 27). As outlined in our Experience Study dated June 2018, using Milliman's capital market outlook, we would recommend a discount rate lower than 7.25%. Since the time of that Experience Study, Milliman's capital market outlook has lowered even further. Using a lower investment return assumption would result in significantly higher liabilities as well as a significantly higher actuarially determined contribution.

This valuation report is only an estimate of the System's financial condition as of a single date. It can neither predict the System's future condition nor guarantee future financial soundness. Actuarial valuations do not affect the ultimate cost of System benefits, only the timing of System contributions. While the valuation is based on an array of individually reasonable assumptions, other assumption sets may also be reasonable and valuation results based on those assumptions would be different. No one set of assumptions is uniquely correct. Determining results using alternative assumptions is outside the scope of our engagement.

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; 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. Due to the limited scope of our assignment, we did not perform an analysis of the potential range of future measurements. The Board of Trustees has the final decision regarding the appropriateness of the assumptions and actuarial cost methods, and the Board has adopted them as indicated in this report.

Actuarial computations presented in this report are for purposes of determining the recommended funding amounts for the System. The calculations in the enclosed report have been made on a basis consistent with our understanding of the System's funding requirements and goals. Actuarial computations for financial reporting under GASB Statements No. 67 and 68 are presented in a separate report.

Milliman's work is prepared solely for the use and benefit of Tulsa County. To the extent that Milliman's work is not subject to disclosure under applicable public records laws, Milliman's work may not be provided to third parties without Milliman's prior written consent. Milliman does not intend to benefit or create a legal duty to any third party recipient of its work product. Milliman's consent to release its work product to any third party may be conditioned on the third party signing a Release, subject to the following exception(s):

(a) The County may provide a copy of Milliman's work, in its entirety, to the System's professional service advisors who are subject to a duty of confidentiality and who agree to not use Milliman's work for any purpose other than to benefit the System.

(b) The County may provide a copy of Milliman's work, in its entirety, to other governmental entities, as required by law.

No third party recipient of Milliman's work product should rely upon Milliman's work product. Such recipients should engage qualified professionals for advice appropriate to their own specific needs.

The consultants who worked on this assignment are retirement actuaries. Milliman's advice is not intended to be a substitute for qualified legal or accounting counsel.

The signing actuaries are independent of the plan sponsor. We are not aware of any relationship that would impair the objectivity of our work.

We hereby certify that, to the best of our knowledge and belief, this report, including all costs and liabilities based on actuarial assumptions and methods adopted by the System's Board, is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices. We are members of the American Academy of Actuaries and meet the Qualification Standards to render the actuarial opinion contained herein.

We respectfully submit the following report, and we look forward to discussing it with you.

Sincerely,

Michael J. Zwiener, FSA
Consulting Actuary

Michael A. Sudduth, FSA
Consulting Actuary

MJZ/MAS/crd

Tulsa County Employees' Retirement System

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Tulsa County Employees' Retirement System

July 1, 2019 Actuarial Valuation

Introduction

In this report, we present the results of the July 1, 2019 actuarial valuation for the Tulsa County Employees' Retirement System.

PURPOSES OF THE VALUATION

The actuarial valuation of the Plan is intended to accomplish several purposes:

* In general, the determination of current levels of employer contributions which, considering prior funding, expected future employee contributions, and expected future investment returns, will accumulate monies sufficient to meet benefit payments when due under the terms of the Plan;

* Review of plan experience for the year ended on the day before the valuation date to ascertain whether the assumptions and methods employed for valuation purposes are reflective of actual events and remain appropriate for prospective application; and

* Assess the relative funded position of the plan, i.e., through a comparison of plan assets and projected plan liabilities.

Tulsa County Employees' Retirement System

July 1, 2019 Actuarial Valuation

Discussion of Valuation Results

1. Contributions for the current and prior plan years are shown below.

	07/01/2018	07/01/2019
Actuarially Determined Contribution (Employer and Employee)	$14,074,054	$15,464,563
Percent of Payroll	18.40%	19.23% *
Actual Contribution	$13,078,385	N/A

* Approximately 3.00% is payable by members (2.50% of base pay for July 1, 2019 through December 31, 2019 and 3.50% of base pay for January 1, 2020 through June 30, 2020), and the remaining 16.28% is payable by the County.

Contributions to the Fund (based on the combined employer and employee rate of 16.5% of employee base salary) during the year ended June 30, 2019 fell short of our recommendation by approximately $996,000. The System's Board has adopted a resolution setting the combined employer and employee rate equal to 17.5% of employee base salary effective July 1, 2019 and 18.5% effective July 1, 2020.

2. Actuarial Assumptions, Methods and Plan Provisions

The employee contribution rate was increased from 2.50% of base pay to 3.50% of base pay effective January 1, 2020.

All other actuarial assumptions, methods and plan provisions remained the same as the prior year.

Summaries of the plan provisions and actuarial assumptions and methods are found in Sections D and E, respectively.

3. Plan Assets

On a market value basis, fund assets decreased from $291,452,345 on July 1, 2018 to $289,081,193 on July 1, 2019. Investment income, net of expenses, was $6,516,046, for return of 2.27%. This included $8,602,110 in interest and dividends, less $916,690 in net depreciation in fair value and $1,169,374 in expenses. During the prior year, net investment income was $15,689,401, for return of 5.60%.

Total contributions to the plan for the plan year were $13,078,385, compared to

$12,740,001 for the prior year. Benefit payments totaled $21,805,708 for the year ended June 30, 2019, and refunds of contributions totaled $159,875. During the prior year, benefit payments and refunds were $21,060,579 and $67,540, respectively.

On an actuarial value basis, assets are $305,279,902 at July 1, 2019. On an actuarial basis, investment income was $9,757,783, for a return of 3.25%. The development of the actuarial value of assets is presented in Section C, page 4. The asset valuation method is the five-year expected return method which is described in Section E, pages 2 and 3.

4. Funded Status – Accumulated Benefits

The funded status of the Plan on an ongoing basis, as measured by the relationship between the market value of plan assets to the present value of benefits accrued to date decreased from the prior year as the table below shows.

	07/01/2018	07/01/2019
a) Present Value Vested Accrued Benefits	$330,471,921	$337,148,961
b) Present Value All Accrued Benefits	340,054,045	344,212,754
c) Market Value of Assets	291,452,345	289,081,193
d) Ratio: (c)/(a)	88.2%	85.7%
e) Ratio: (c)/(b)	85.7%	84.0%

The interest discount used for this purpose is 7.25%.

The breakout of vested and accrued benefits by participant category is shown in Section C, page 10.

5. Plan Population

The number of active participants included in the liability calculations increased from 1,736 on July 1, 2018 to 1,803 on July 1, 2019. The average age and service are 44.1 and 8.4 years, respectively, compared to 44.3 and 8.7 years on July 1, 2018.

The distribution of active participants by age and service is shown in Section F, page 2.

The number of retirees and beneficiaries paid directly from fund assets increased from 1,274 to 1,297 on July 1, 2019. The number of deferred vested participants increased from 617 to 653 as of July 1, 2019.

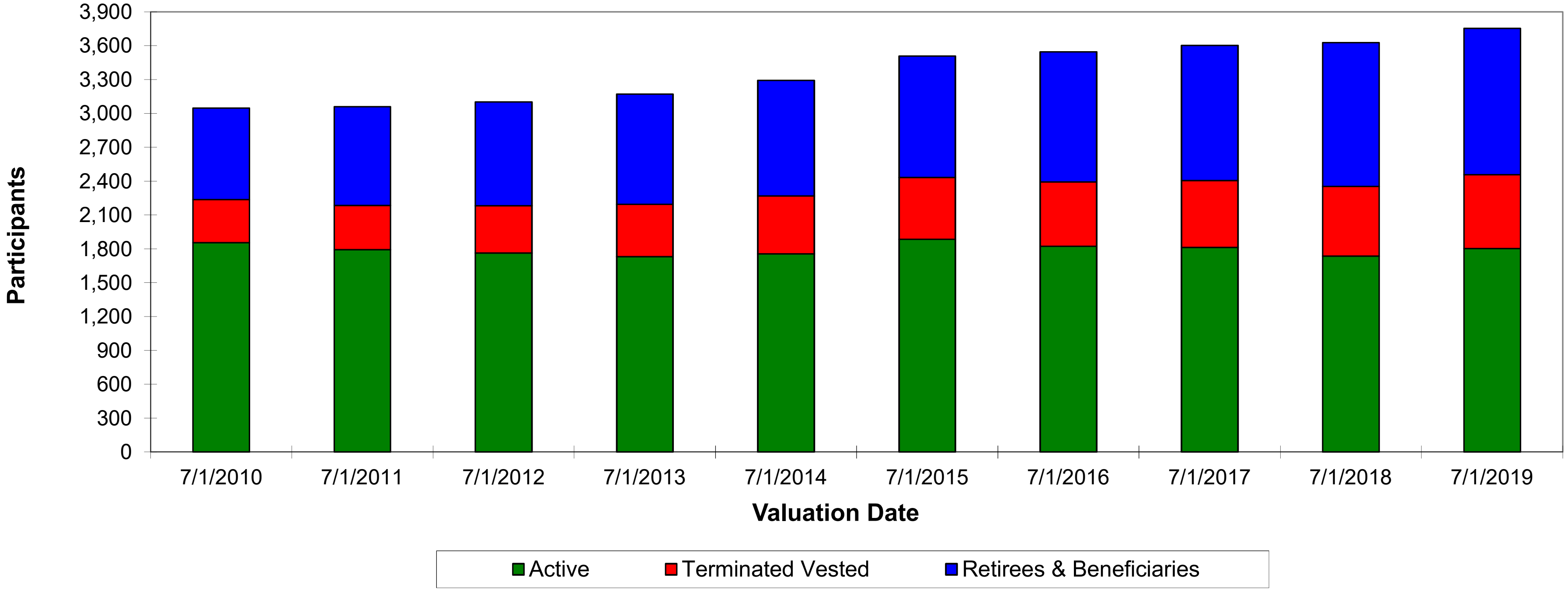
A summary of all participant data can be found in Section F, page 1. A reconciliation of active, retired and deferred vested participants to the prior year can be found in Section F, page 3.

6. Plan Experience

Overall plan experience for the past year resulted in an actuarial loss. A detailed description of the reasons for this loss is presented in Section C, page 7.

Tulsa County Employees' Retirement System

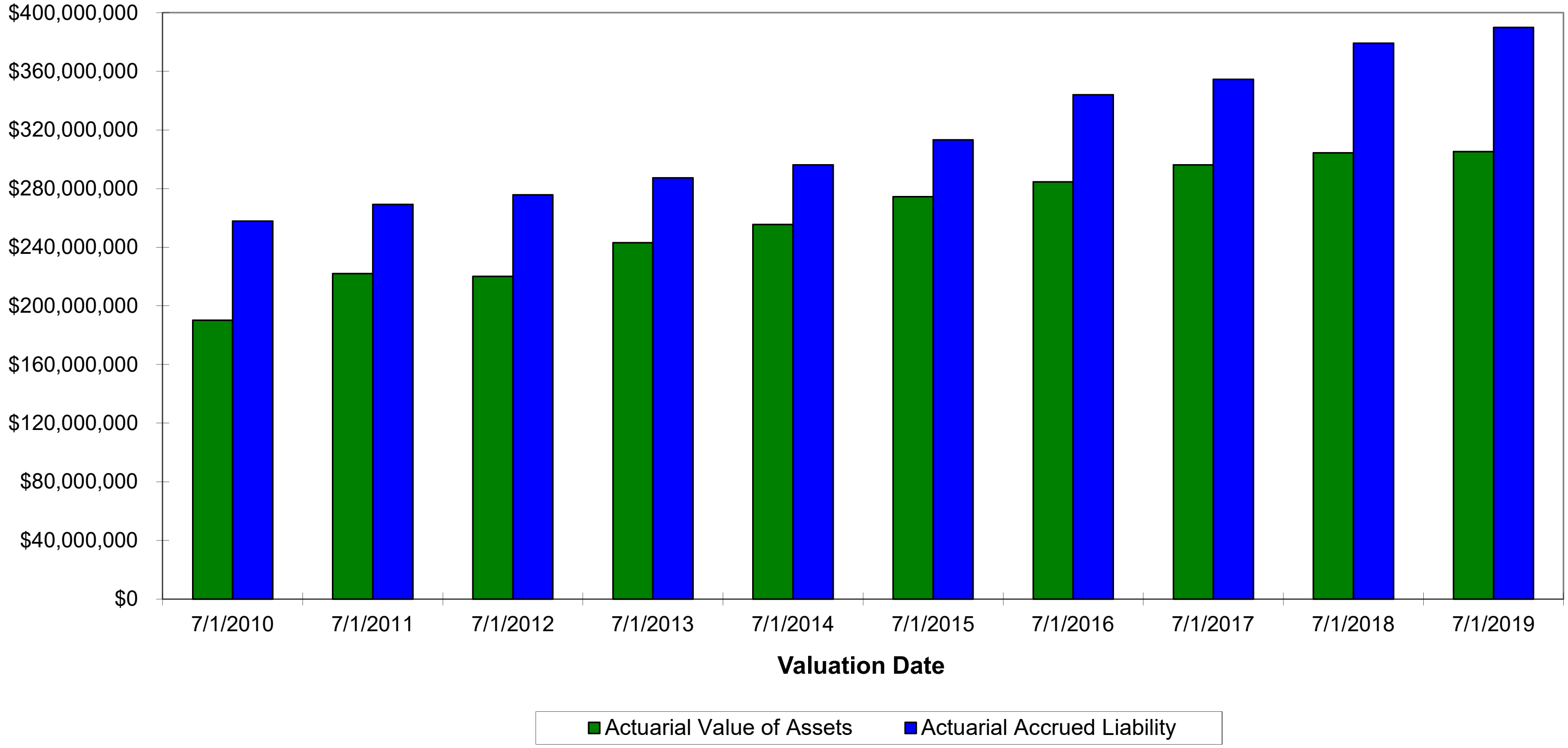
Participant Data



Valuation Date	**7/1/2010**	**7/1/2011**	**7/1/2012**	**7/1/2013**	**7/1/2014**	**7/1/2015**	**7/1/2016**	**7/1/2017**	**7/1/2018**	**7/1/2019**
Active	1,855	1,793	1,762	1,730	1,756	1,885	1,822	1,813	1,736	1,803
Terminated Vested	381	391	419	465	512	547	571	592	617	653
Retirees & Beneficiaries	812	875	920	977	1,024	1,076	1,153	1,197	1,274	1,297
Total	**3,048**	**3,059**	**3,101**	**3,172**	**3,292**	**3,508**	**3,546**	**3,602**	**3,627**	**3,753**

Tulsa County Employees' Retirement System

Assets/Liabilities



Valuation Date	**7/1/2010**	**7/1/2011**	**7/1/2012**	**7/1/2013**	**7/1/2014**	**7/1/2015**	**7/1/2016**	**7/1/2017**	**7/1/2018**	**7/1/2019**
Actuarial Value of Assets	$190,225,597	$221,965,809	$220,054,747	$242,984,123	$255,438,010	$274,395,287	$284,471,252	$296,144,461	$304,409,317	$305,279,902
Actuarial Accrued Liability	$257,852,722	$269,204,062	$275,715,158	$287,305,715	$296,203,690	$313,153,419	$344,077,391	$354,580,936	$379,190,526	$389,820,389

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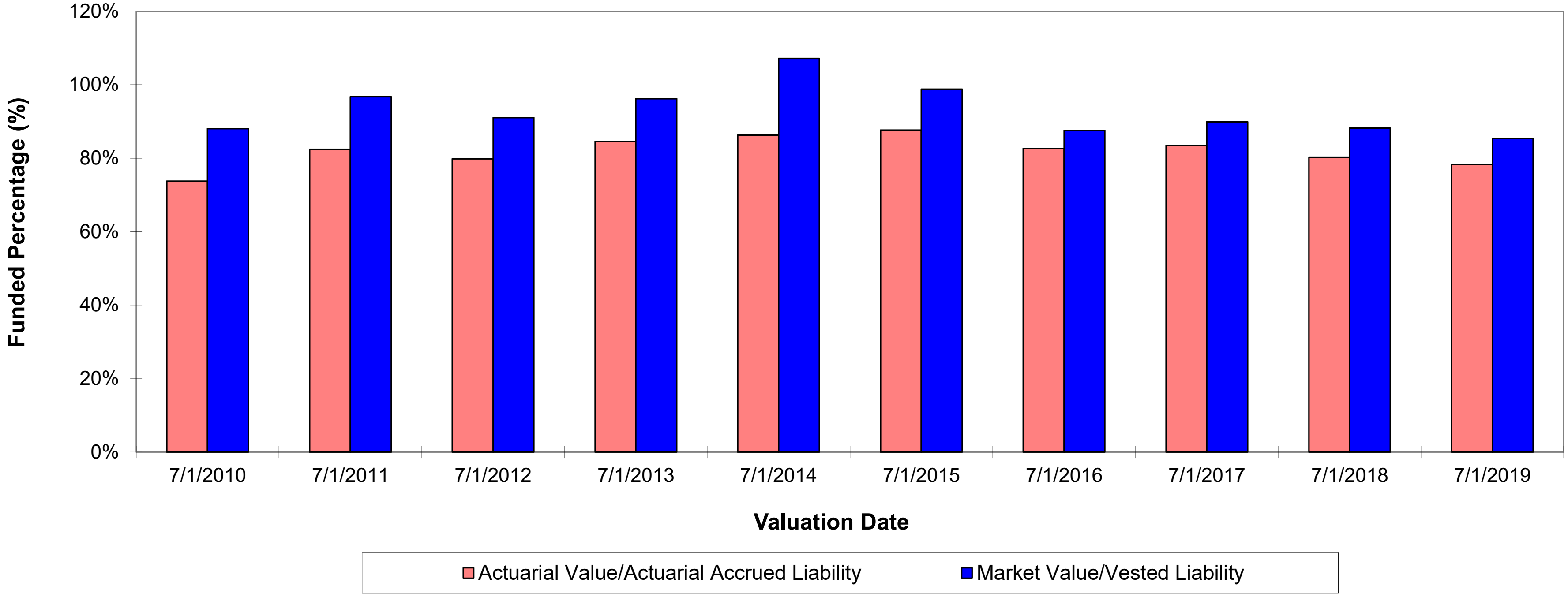
Tulsa County Employees' Retirement System

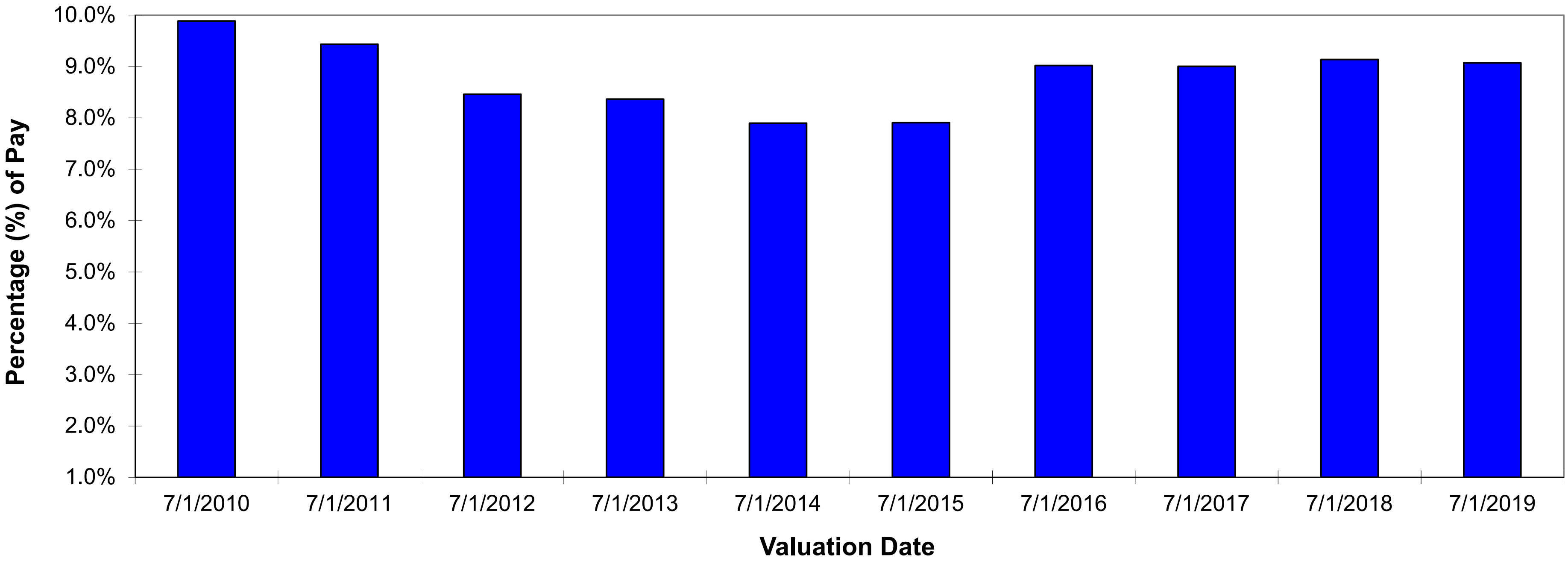
Funded Ratios: Assets vs. Liabilities



Valuation Date	7/1/2010	7/1/2011	7/1/2012	7/1/2013	7/1/2014	7/1/2015	7/1/2016	7/1/2017	7/1/2018	7/1/2019
AAV/Actuarial Accrued Liability	74%	82%	80%	85%	86%	88%	83%	84%	80%	78%
MV/Vested Liability	88%	97%	91%	96%	107%	99%	88%	90%	88%	85%

Tulsa County Employees' Retirement System

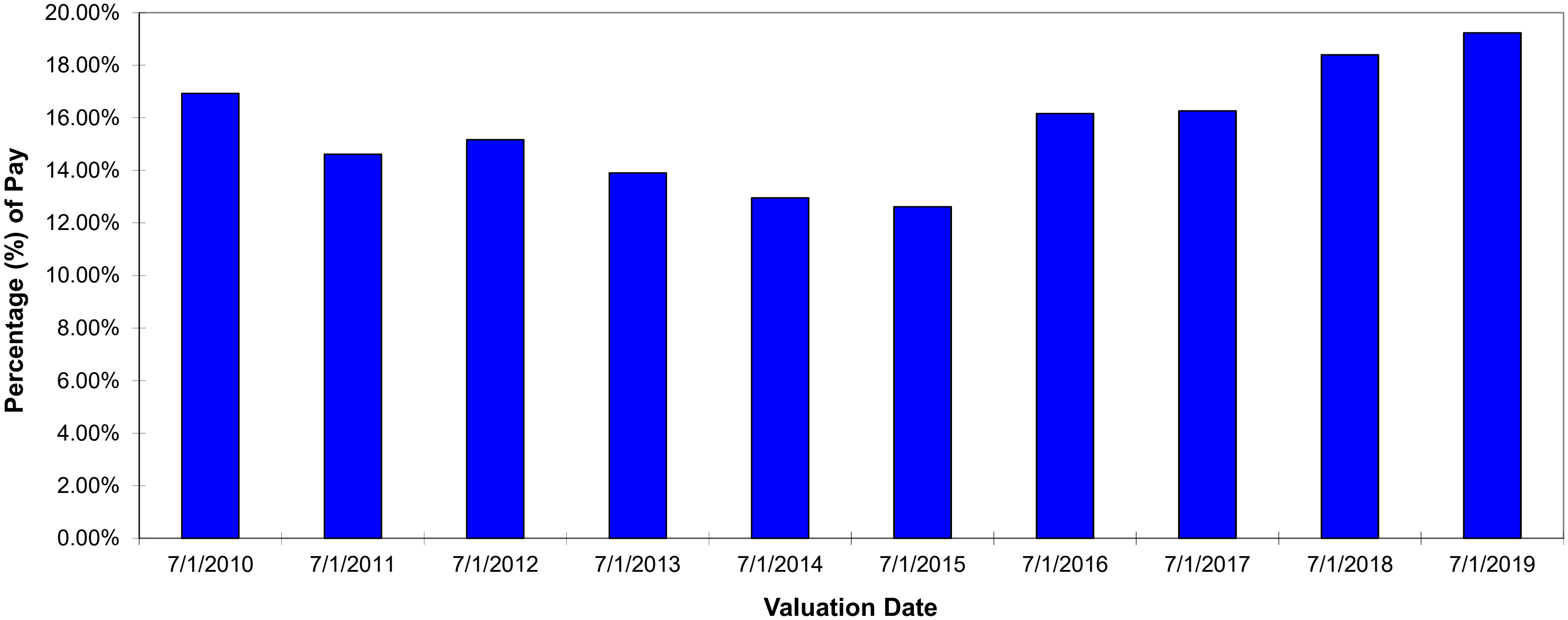
Normal Cost as a Percent of Covered Pay



Valuation Date	7/1/2010	7/1/2011	7/1/2012	7/1/2013	7/1/2014	7/1/2015	7/1/2016	7/1/2017	7/1/2018	7/1/2019
Normal Cost	$6,760,298	$6,414,335	$5,675,567	$5,635,815	$5,714,048	$6,073,055	$6,903,490	$6,910,312	$6,985,751	$7,291,869
As % of Pay	9.9%	9.4%	8.5%	8.4%	7.9%	7.9%	9.0%	9.0%	9.1%	9.1%

Tulsa County Employees' Retirement System

Annual Required Contribution (ARC) / Actuarially Determined Contribution (ADC) as a Percentage of Covered Pay



Valuation Date	7/1/2010	7/1/2011	7/1/2012	7/1/2013	7/1/2014	7/1/2015	7/1/2016	7/1/2017	7/1/2018	7/1/2019
ADC as % of Pay	16.93%	14.61%	15.17%	13.90%	12.96%	12.62%	16.16%	16.26%	18.40%	19.23%

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Tulsa County Employees' Retirement System

Statement of Assets

Assets	Market Value
1. Cash	$ 392,839
2. Receivables	2,967,343
3. Money Market Mutual Funds	10,882,676
4. Government and Agency Obligations	66,939,656
5. Corporate Bonds	70,115,935
6. Domestic Equities	109,202,733
7. International Equities	25,974,705
8. Judgments	4,581,667
Total Assets	291,057,554
Liabilities	
1. Accounts Payable and Accrued Expenses	145,474
2. Due to Brokers for Unsettled Trades	1,830,887
Total Liabilities	1,976,361
Net Assets	$ 289,081,193

Tulsa County Employees' Retirement System

Development of Market Value of Assets

1. Market Value of Assets as of July 1, 2018	$	291,452,345
2. Additions:		
Employee Contributions	$	1,974,991
Employer Contributions		11,103,394
Net Appreciation/(Depreciation) in Fair Value		(916,690)
Interest and Dividends		8,602,110
Total		20,763,805
3. Deductions:		
Benefit Payments	$	21,805,708
Refund of Contributions		159,875
Administrative Expenses		95,999
Investment Expenses		1,073,375
Total		23,134,957
4. Net Change		(2,371,152)
5. Market Value of Assets as of June 30, 2019	$	289,081,193
6. Net Rate of Return		2.27%

Tulsa County Employees' Retirement System

Historical Investment Results *

Year Ended June 30	Annual Return	Total Cumulative	5-Year Rolling Average	10-Year Rolling Average	15-Year Rolling Average	20-Year Rolling Average
1995	9.0%	9.0%				
1996	12.3%	10.6%				
1997	13.7%	11.6%				
1998	14.8%	12.4%				
1999	10.3%	12.0%	12.0%			
2000	5.2%	10.8%	11.2%			
2001	2.7%	9.6%	9.2%			
2002	0.5%	8.4%	6.6%			
2003	4.8%	8.0%	4.6%			
2004	13.3%	8.6%	5.2%	8.6%		
2005	7.4%	8.4%	5.6%	8.4%		
2006	9.6%	8.5%	7.0%	8.1%		
2007	16.4%	9.1%	10.2%	8.4%		
2008	-6.2%	8.0%	7.8%	6.2%		
2009	-11.2%	6.6%	2.7%	3.9%	6.6%	
2010	17.8%	7.2%	4.6%	5.1%	7.1%	
2011	18.3%	7.8%	6.2%	6.6%	7.5%	
2012	1.0%	7.5%	3.2%	6.7%	6.6%	
2013	13.0%	7.7%	7.1%	7.5%	6.5%	
2014	17.2%	8.2%	13.3%	7.8%	7.0%	8.2%
2015	0.1%	7.8%	9.6%	7.1%	6.6%	7.7%
2016	0.0%	7.4%	6.0%	6.1%	6.4%	7.1%
2017	9.3%	7.5%	7.7%	5.4%	7.0%	6.9%
2018	5.6%	7.4%	6.3%	6.7%	7.1%	6.5%
2019	2.3%	7.2%	3.4%	8.2%	6.3%	6.1%

* Computed net of expenses

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Tulsa County Employees' Retirement System

Development of Actuarial Value of Assets

1.	Actuarial Value at Beginning of Year	$304,409,317
2.	Market Value at End of Year	289,081,193
3.	Market Value at Beginning of Year	291,452,345
4.	Non-Investment Cash Flows [1]	(8,887,198)
5.	Investment Income	
	a. Market Total: (2) - (3) - (4)	6,516,046
	b. Assumed Rate of Return	7.25%
	c. Expected Investment Return [2]	20,808,134
	d. Gain/(Loss): (5a) - (5c)	(14,292,088)
6.	Phased-In Recognition of Investment Gains/(Losses)	
	a. Current Year: 80% x (5d)	(11,433,670)
	b. 60% of Gain/(Loss) during Plan Year End June 30, 2018	(2,764,489)
	c. 40% of Gain/(Loss) during Plan Year End June 30, 2017	2,159,151
	d. 20% of Gain/(Loss) during Plan Year End June 30, 2016	(4,159,701)
	e. Phased-In Investment Gain to be Recognized in Future Years	(16,198,709)
7.	Preliminary Actuarial Value End of Year: (2) - (6e)	305,279,902
8.	Final Actuarial Value End of Year: Minimum of 120% x (2) or (7), but not less than 80% x (2)	$305,279,902
9.	Excess of Market Value over Actuarial Value: (2) - (8)	(16,198,709)
10.	Approximate Rate of Return on Actuarial Value	3.25%

[1] Contributions less Benefit Payments

[2] Assumed Rate times (3) + (4) times Assumed Rate/2

Tulsa County Employees' Retirement System

Accrued Liability and Normal Cost

	July 1, 2018	July 1, 2019
1. Actuarial Accrued Liability		
Active Participants	$ 140,477,923	$ 145,461,235
Deferred Vested Participants	27,264,686	29,117,521
Retired Participants and Beneficiaries	211,447,917	215,241,633
Total	379,190,526	389,820,389
2. Actuarial Value of Assets	304,409,317	305,279,902
3. Unfunded Accrued Liability/(Surplus)	74,781,209	84,540,487
4. Entry Age Normal Cost		
Retirement Benefits	$ 5,437,128	$ 5,692,136
Withdrawal Benefits	1,342,456	1,357,857
Death Benefits	83,147	85,986
Disability Benefits	30,697	32,004
Return of Contributions	92,323	123,886
Total Normal Cost (Beginning of Year)	6,985,751	7,291,869
5. Valuation Compensation	$ 76,499,726	$ 80,413,486
6. Normal Cost as a Percentage of Pay	9.13%	9.07%

Tulsa County Employees' Retirement System

Actuarial (Gain)/Loss Calculations

1.	Unfunded Accrued Liability/(Surplus) as of July 1, 2018	$ 74,781,209
2.	Normal Cost as of July 1, 2018	6,985,751
3.	Interest on (1) and (2) at 7.25% to June 30, 2019	5,928,105
4.	Contributions with Interest to June 30, 2019	13,544,182
5.	Expected Unfunded Liability at June 30, 2019: (1) + (2) + (3) - (4)	74,150,883
6.	Change Due to Assumption Changes	0
7.	Change Due to Plan Changes	14,758
8.	Expected Unfunded Liability at June 30, 2019: (5) + (6) + (7)	74,165,641
9.	Actual Unfunded Accrued Liability as of June 30, 2019	84,540,487
10.	Actuarial (Gain)/Loss: (9) - (8)	10,374,846

Tulsa County Employees' Retirement System

Details of Actuarial (Gain)/Loss

1. Expected Unfunded Liability as of June 30, 2019		$ 74,165,641
2. (Gain)/Loss due to:		
Actuarial Value of Assets	$ 11,995,368	
Active Salaries and Data	1,796,699	
New Entrants	437,123	
Rehires	148,267	
Active Turnover	(983,843)	
Active Retirements	(191,303)	
Active Mortality	108,965	
Active Disability	5,044	
Inactive Mortality	(2,853,521)	
Deferred Vested Retirements	(20,550)	
Data Corrections	201,907	
Other	(269,310)	
Total	10,374,846	
3. Actual Unfunded Accrued Liability as of June 30, 2019		84,540,487

Tulsa County Employees' Retirement System

Schedule of Amortization Bases

Date Established	Description	Initial Amount	Remaining Years on 7/1/2019	Outstanding Balance on 7/1/2018	Contribution to Base	Outstanding Balance on 7/1/2019	Mid-Year Amortization Payment
7/1/2017	Unfunded Accrued Liability	$58,436,475	14	$56,890,683	$4,802,179	$56,213,078	$5,630,647
7/1/2018	Actuarial Loss	10,396,105	19	10,396,105	726,245	10,423,578	849,623
7/1/2018	Assumption Changes	7,494,421	19	7,494,421	523,540	7,514,227	612,483
7/1/2019	Actuarial Loss	10,374,846	20	N/A	N/A	10,374,846	819,071
7/1/2019	Plan Amendment	14,758	20	N/A	N/A	14,758	1,165
				74,781,209	6,051,964	84,540,487	7,912,989

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Tulsa County Employees' Retirement System

Development of Required Contribution

	July 1, 2018		July 1, 2019	
	Amount	Percent of Payroll	Amount	Percent of Payroll
Costs				
1. Normal Cost (mid - year)	$7,234,554	9.46%	$7,551,574	9.39%
2. Amortization of Unfunded Liability (mid-year)	6,839,500	8.94%	7,912,989	9.84%
3. Total Contribution Requirement: (1) + (2)	14,074,054	18.40%	15,464,563	19.23%

Tulsa County Employees' Retirement System

Statement of Accumulated Plan Benefits

	July 1, 2018	July 1, 2019
1. Accumulated Plan Benefits		
a. Actuarial Present Value of Vested Benefits		
i. Retirees and Beneficiaries	$ 211,447,917	$ 215,241,633
ii. Active Participants	91,759,318	94,120,970
iii. Deferred Vested Participants	27,264,686	29,117,521
iv. Total Vested Benefits	330,471,921	338,480,124
b. Actuarial Present Value of Non-Vested Benefits	9,582,124	9,941,719
c. Total Actuarial Present Value of Accumulated Plan Benefits	340,054,045	348,421,843
2. Market Value of Assets	$ 291,452,345	$ 289,081,193
3. Funded Ratio		
a. Vested Benefits: (2)/(1aiv)	88.2%	85.4%
b. Accumulated Benefits: (2)/(1c)	85.7%	83.0%

Tulsa County Employees' Retirement System

Reserve Development

1. Reserve Amounts

a. Accrued Liability for Inactive Participants		244,359,154
b. Accumulated Employee Contributions		6,207,901
c. Accrued Liability for Active Participants		139,253,334
d. Total Reserve		389,820,389

2. Changes in Reserve

a. Reserve at July 1, 2018		379,190,526
b. Interest	26,695,061	
c. Benefit Payments	(21,965,583)	
d. Benefit Accrual Net of Gains and Losses	7,506,149	
e. Liability (Gain)/Loss	(1,620,522)	
f. Assumption Changes	0	
g. Plan Amendments	14,758	
h. Net Change		10,629,863
i. Reserve at July 1, 2019		389,820,389

Tulsa County Employees' Retirement System

July 1, 2019 Actuarial Valuation

Summary of Plan Provisions

The following is a summary of the principal eligibility and benefit provisions of the Plan on which this valuation is based. As such, it is not intended to include all of the provisions of the Plan document. For exact benefit descriptions and other provisions, please refer to the legal Plan provisions.

Name:	Tulsa County Employees' Retirement System
Effective Date:	July 1, 1965
Amendment Date:	The most recent amendment reflected in the valuation was approved June 17, 2019.

ELIGIBILITY

An employee shall be eligible for participation as of the first day of employment as a regular full-time employee.

Employee Contributions:	Employees currently contribute 2.50% of base pay. The contribution rate will increase to 3.50% of base pay on January 1, 2020.
Credited Service:	A year is earned for each consecutive 12-month period in which an employee works at least 6 months.
Earnings:	Average base payroll, excluding overtime, allowances, etc.

NORMAL RETIREMENT

Eligibility if Hired Before 07/01/2017:	Later of age 62 and five years of participation. Or, if earlier, when age in years and months plus years and months of participation total 80 or more.
Eligibility if Hired After 06/30/2017:	Later of age 65 and five years of participation. Or, if earlier, when age in years and months plus years and months of participation total 90 or more.

Benefit: A monthly benefit, which is the following percentage of three-year final average monthly pay:

Years of Credited Service	Percentage for Members Vested on 06/30/2010	Percentage for Members Not Vested on 06/30/2010
5	12.5	10.0
6	15.0	12.0
7	17.5	14.0
8	20.0	16.0
9	22.5	18.0
10	25.0	20.0
11	28.0	22.0
12	31.0	24.0
13	34.0	26.0
14	37.0	28.0
15	40.0	30.0
16	42.0	34.0
17	44.0	38.0
18	46.0	42.0
19	48.0	46.0
20	50.0	50.0

Beyond 20 years, there will be a 1.5% increase in the percentage for each additional year of Credited Service, with the maximum benefit equal to 100% of three-year final average monthly pay.

Normal Form of Payment: Members Vested on 06/30/2010: Joint and 70% Survivor Annuity

Members Not Vested on 06/30/2010: Joint and 67% Survivor Annuity

EARLY RETIREMENT

Eligibility: Attained age 55 and vested

Benefit: Benefit calculated in same way as normal retirement benefit, actuarially reduced for early commencement

DEFERRED RETIREMENT

Eligibility:	Continued employment after Normal Retirement Date
Benefit:	Accrued Monthly Pension determined on Deferred Retirement Date, payable under the same forms as Normal Retirement

TERMINATION

Vesting:	100% after 5 years of participation
Benefit:	Accrued benefit calculated in same manner as normal retirement benefit, payable at age 62 if hired before 07/01/2017 or payable at age 65 if hired after 06/30/2017 Non-vested employees receive a return of their cumulative contributions.

SPOUSES' DEATH BENEFIT

Eligibility:	Spouses of vested participants who die while employed, after termination or while retired
Benefit:	Members Vested on 06/30/2010: A life annuity, payable monthly to the surviving spouse, equal to 70% of the benefit the employee had accrued or was receiving on the date of death. Members Not Vested on 06/30/2010: A life annuity, payable monthly to the surviving spouse, equal to 67% of the benefit the employee had accrued or was receiving on the date of death. In all cases, the benefit is deferred to the date the employee would have been eligible for benefits.

DISABILITY

Eligibility:	Employee who is totally and permanently disabled after 8 years of participation. The disability must occur from County employment.
Benefit:	A monthly benefit which is the following percentage of three-year final average monthly pay:

Percentage Percentage

Years of Credited Service	for Members Vested on 06/30/2010	for Members Not Vested on 06/30/2010
8	20.0	16.0
9	22.5	18.0
10	25.0	20.0
11	28.0	22.0
12	31.0	24.0
13	34.0	26.0
14	37.0	28.0
15	40.0	30.0
16	40.0	34.0
17	40.0	38.0
18 or more	40.0	40.0

Summary of Actuarial Assumptions and Methods

ACTUARIAL ASSUMPTIONS

Interest: (Effective 07/01/2016)	7.25% per annum, compounded annually, which includes a 2.5% assumed rate of inflation, as prescribed by the System's Board
Compensation Increases: (Effective 07/01/2014)	The rates, which include a 2.5% inflation rate, are as follows:

Age	Percent
20-34	5.0%
35-49	3.5%
50-70	2.5%

Mortality: (Effective 07/01/2018)	Actives: RP-2014 Employees Mortality Table, male and female rates, with generational projection from 2006 based on the MP-2017 Improvement Scale Healthy Inactives: RP-2014 Healthy Annuitant Mortality Table, male and female rates, with generational projection from 2006 based on the MP-2017 Improvement Scale Disabled Inactives: RP-2014 Disabled Mortality Table, male and female rates
Turnover: (Effective 07/01/2014)	Crocker, Sarason and Straight T-7 rates, increased by 0.2 for the first year and 0.1 for the second year. Selected ultimate rates are:

Age	Rate per 1,000
25	.0968
30	.0931
35	.0872
40	.0777
45	.0638
50	.0425
55	.0157
60	.0015

Disability: Various rates based on age. Selected rates are:

Age	Rate per 1,000 Male	Rate per 1,000 Female
25	.106	.124
30	.128	.128
40	.173	.198
50	.226	.399
55	.366	.573
60	.492	.623
65	.570	.605

Expenses: None assumed. That is, the interest rate is net of expenses.

Retirement: (Effective 07/01/2018) Employees are assumed to retire at the following rates upon attaining age 62 (age 65 if hired after 06/30/2017) with 5 years of participation or any age with 80 points (90 points if hired after 06/30/2017):

Age	Rate
Under 55	0%
55-64	20%
65-69	30%
70	100%

Marital Status: Percentage Married: 85%

Age Difference: Males are assumed to be four years older than their spouses.

ACTUARIAL FUNDING METHOD

Entry Age Normal

The actuarial present value of future benefits determined by the initial valuation is split into the unfunded accrued liability and the actuarial present value of future normal costs. The unfunded accrued liability is adjusted in subsequent years for principle payments, interest accruals, plan amendments, changes in actuarial assumptions, and actuarial experience gains and losses. The actuarial present value of future normal costs is funded over future covered payroll.

Effective July 1, 2018, each year's change in unfunded accrued liability is amortized as a separate layer over 20 years as a level percent of pay, with 2.5% per year projected payroll growth. The unfunded accrued liability that existed prior to July 1, 2018 will continue to be

amortized on a closed basis over a 30 year period, measured from July 1, 2003, as a level percent of pay, with 2.5% per year projected payroll growth. Prior to July 1, 2003, actuarial gains and losses were amortized over 15 years and benefit improvements over 20 years.

ACTUARIAL VALUE OF ASSETS

Valuation assets were determined using the five-year expected return method without phase-in.

Under this method, a gain or loss for a year is determined by calculating the difference between the expected market value of assets and the actual market value of assets at the valuation date. The expected market value of assets is equal to the market value of assets at the prior valuation date, plus contributions, minus disbursements, all adjusted with interest at the valuation rate to the current valuation date. Ultimately, the actuarial value of assets is equal to the market value less:

(a) 4/5 of the prior year's gain/(loss)
(b) 3/5 of the second preceding year's gain/(loss)
(c) 2/5 of the third preceding year's gain/(loss)
(d) 1/5 of the fourth preceding year's gain/(loss)

The final actuarial value of assets cannot be less than 80% or greater than 120% of the market value of assets. The method became effective with the July 1, 2014 valuation.

Tulsa County Employees' Retirement System

Summary of Participants

	July 1, 2018	July 1, 2019
1. Active Participants		
a. Count	1,736	1,803
b. Total Payroll	$ 77,822,290	$ 81,458,307
c. Average Payroll	$ 44,829	$ 45,179
d. Covered Payroll	$ 76,499,726	$ 80,413,486
e. Average Age	44.3	44.1
f. Average Service	8.7	8.4
2. Retired Participants and Beneficiaries		
a. Count	1,274	1,297
b. Total Monthly Benefits	$ 1,795,095	$ 1,839,692
c. Average Monthly Benefits	$ 1,409.02	$ 1,418.42
3. Vested Terminated Participants		
a. Count	617	653
b. Total Monthly Benefits	$ 416,104	$ 447,067
c. Average Monthly Benefits	$ 674.40	$ 684.64

Tulsa County Employees' Retirement System

Average Monthly Accrued Benefits by Age and Service

Attained Age	Years of Service									
	0 to 4	5 to 9	10 to 14	15 to 19	20 to 24	25 to 29	30 to 34	35 to 39	40 +	Total
Under 20	18									18
	16									16
20 to 24	130	3								133
	61	315								67
25 to 29	169	29	1							199
	99	393	878							146
30 to 34	135	47	22							204
	133	478	847							289
35 to 39	85	52	45	9						191
	147	546	1,030	1,820						542
40 to 44	67	45	42	24	10					188
	132	542	1,015	1,921	2,114					761
45 to 49	69	29	34	26	33	8				199
	153	496	1,069	1,976	2,593	3,108				1,121
50 to 54	58	29	39	20	18	19	6			189
	142	437	1,053	1,781	2,472	3,032	3,042			1,153
55 to 59	67	40	44	24	28	11	4	7		225
	126	503	1,062	2,025	2,077	3,138	2,923	3,280		1,117
60 to 64	36	34	34	22	19	7	8	9	1	170
	170	662	979	1,695	2,179	3,159	4,041	3,830	5,370	1,382
65 to 69	9	15	16	11	3	3	1	2		60
	216	549	970	2,054	2,302	3,664	4,708	7,139		1,420
70 to 74	4	6	2	4	2	1	1			20
	147	475	533	1,379	2,580	3,130	5,016			1,166
75 +	2		3	1				1		7
	103		601	1,270				5,289		1,224
Total	849	329	282	141	113	49	20	19	1	1,803
	118	512	1,008	1,878	2,326	3,127	3,600	4,052	5,370	770

Tulsa County Employees' Retirement System

Summary of Changes in Participant Data

	Active Participants	Retired Participants and Beneficiaries	Terminated Vested Participants	Total
Count as of July 1, 2018	1,736	1,274	617	3,627
New Entrants	348	0	0	348
Returned to Active Status	5	0	(5)	0
Retired	(39)	60	(21)	0
Became Disabled	0	0	0	0
Died with Beneficiary	(2)	(15)	(5)	(22)
New Beneficiaries	0	17	5	22
Died without Beneficiary	(2)	(41)	0	(43)
New QDRO Alternate Payees	0	2	0	2
Terminated with Vesting-Money Left In	(65)	0	65	0
Terminated with Vesting-Money Withdrawn	(1)	0	0	(1)
Terminated without Vesting	(177)	0	0	(177)
Withdrew Contributions	0	0	(3)	(3)
Data Corrections	0	0	0	0
Net Changes	67	23	36	126
Count as of July 1, 2019	1,803	1,297	653	3,753

Actuarial Standard of Practice No. 51 (ASOP 51)

The purpose of this appendix is to identify, assess, and provide illustrations of risks that are significant to the Plan, and in some cases to the Plan's participants.

The results of the actuarial valuation are based on one set of assumptions, as adopted by the System's Board. However, it is almost certain that future experience will not exactly match the assumptions. As an example, investments may perform better or worse than assumed in any single year and over any longer time horizon. It is therefore important to consider the potential impacts of these potential differences when making decisions that may affect the future financial health of the Plan, or of the Plan's participants.

In addition, as plans mature they accumulate larger pools of assets and liabilities. This increases the potential risk to plan funding and the finances of those who are responsible for plan funding. As an example, it is more difficult for a plan sponsor to deal with the effects of a 10% investment loss on a plan with $1 Billion in assets and liabilities than if the same plan sponsor is responsible for a 10% investment loss on a plan with $1 Million in assets and liabilities. Since pension plans make long-term promises and rely on long-term funding, it is important to consider how mature the plan is today, and how mature it may become in the future.

Actuarial Standard of Practice No. 51 (ASOP 51) addresses these issues by providing actuaries with guidance for assessing and disclosing the risk associated with measuring pension liabilities and the determination of pension plan contributions. Specifically, it directs the actuary to:

- Identify risks that may be significant to the plan.
- Assess the risks identified as significant to the plan.
- Disclose plan maturity measures and historical information that are significant to understanding the plan's risks.

ASOP 51 states that if in the actuary's professional judgment, a more detailed assessment would be significantly beneficial in helping the individuals responsible for the plan to understand the risks identified by the actuary, then the actuary should recommend that such an assessment be performed.

This appendix uses the framework of ASOP 51 to communicate important information about: significant risks to the Plan, the Plan's maturity, and relevant historical Plan data.

Maturity Risk

- Definition: This is the potential for total plan liabilities to become more heavily weighted toward inactive liabilities over time.
- Identification: The Plan is subject to maturity risk because as Plan assets and liabilities continue to grow, the impact of any gains or losses on the assets or liabilities also becomes larger.
- Assessment: Currently assets are equal to 22.1 times last year's contributions indicating a one-year asset loss of 10% would be equal to 2.2 times last year's contributions.

Investment Risk

- Definition: The potential that investment returns will be different than expected.
- Identification: To the extent that actual investment returns differ from the assumed investment return, the plan's future assets, funding contributions and funded status may differ significantly from those presented in this valuation.

Interest Rate Risk

- Definition: The potential that interest rates will be different than expected.
- Identification: The pension liabilities reported herein have been calculated by computing the present value of expected future benefit payments using the interest rate(s) described in the report. If interest rate(s) in future valuations are different from those used in this valuation, future pension liabilities, funding contributions and funded status may differ significantly from those presented in this valuation. As a general rule, using a higher interest rate to compute the present value of future benefit payments will result in a lower pension liability, and vice versa. One aspect that can be used to estimate the impact of different interest rates is the plan's duration.
- Assessment: If the interest rate changes by 1%, the estimated percentage change in pension liability is approximately 10%.

Contribution Risk

- Definition: This is the possibility that actual future contributions deviate from expected future contributions.
- Identification: The System is subject to the contribution risk that less than the actuarially determined contribution will be made. This could occur if actual payroll is less than projected. If contributions are deferred to the future, investment income is lost in the intervening period and the System becomes more expensive. The County's actual contribution has been significantly less than the full actuarially determined contribution in three out of the last ten years.

Demographic Risks

- Definition: The potential that mortality or other demographic experience will be different than expected.
- Identification: The pension liabilities reported herein have been calculated by assuming that participants will follow patterns of demographic experience (e.g. mortality, withdrawal, disability, retirement, form of payment election, etc.) as described in the report. If actual demographic experience or future demographic assumptions are different from what is assumed to occur in this valuation, future pension liabilities, funding contributions and funded status may differ significantly from those presented in this valuation.