ARIZONA STATE RETIREMENT SYSTEM

ANNUAL ACTUARIAL VALUATION
LONG TERM DISABILITY PROGRAM
AS OF JUNE 30, 2019

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December 13, 2019

Board of Trustees
Arizona State Retirement System
3300 North Central Avenue, 14th Floor
Phoenix, Arizona 85012

Re: Actuarial Valuation for the Long Term Disability Program as of June 30, 2019

Members of the Board:

We certify that the information contained in this report is accurate and fairly presents the actuarial position of the Arizona State Retirement System (ASRS) Long Term Disability Program (LTD Program) as of June 30, 2019. This report was prepared at the request of the Board and is intended for use by ASRS staff and those designated or approved by the Board. This report may be provided to parties other than ASRS only in its entirety and only with the permission of the Board.

Actuarial Valuation

The primary purposes of the actuarial valuation report are to determine the employer and member contribution rates, describe the current financial condition of the LTD Program, analyze changes in the condition of the LTD Program, and provide various summaries of the data.

Plan Provisions

The plan provisions of the LTD Program are summarized in Appendix I. Other than a change to the definition of "totally disabled," there have been no changes in plan provisions since the last valuation.

Actuarial Assumptions and Methods

The assumptions and methods applied in this actuarial valuation were adopted by the Board of Trustees on October 27, 2017 based on the Report on the Actuarial Experience Study covering a five-year period from July 1, 2011 to June 30, 2016, dated October 18, 2017. There have been no changes in actuarial assumptions and methods since the last valuation.

We believe the assumptions are internally consistent and are reasonable, based on the actual experience of ASRS.

The results of the actuarial valuation are dependent upon the actuarial assumptions used. Actual results can and almost certainly will differ, as actual experience deviates from the assumptions. Even seemingly minor changes in the assumptions can materially change the liabilities, calculated contribution rates and funding periods. A review of the impact of a different set of assumptions on the funded status of the LTD Program is outside the scope of this actuarial valuation.

The current actuarial assumptions and methods are outlined in Appendix II of this report.

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Funding Adequacy

The financial objectives of the LTD Program are to: (1) maintain reasonably stable contribution rates, and (2) achieve an ultimate funded status of 100%. In order to achieve these objectives, the Board has adopted a layered, closed 15-year amortization period with level percent of pay payments. Furthermore, the Board made the policy decision to phase in the impact to the contribution of the assumption changes over a five year period. This policy provides for a smooth transition to relatively higher contribution rates over a reasonable period of time.

The actuarial valuation includes a calculation of the contribution rates payable by members and participating employers. These rates, when applied to payroll, yield contribution amounts sufficient to fund the normal cost plus the amortization of the unfunded actuarial accrued liability. Contribution rates are set annually, based on the valuation of the preceding year. The total contribution rate calculated in this report after the phase-in policy (0.36% of payroll) will apply in the fiscal year beginning July 1, 2020. The total contribution rate calculated as part of the prior valuation (0.34% of payroll) applied in the fiscal year that began July 1, 2019. Employers and employees share equally in the total contribution rate determined as part of the valuation. The primary source of increase in the total contribution rate is the demographic losses on the disabled members which include emerging benefit offsets that are reducing the benefit less than previously assumed in the valuation.

The unfunded actuarial accrued liability (UAAL) of the LTD Program increased from $58.9 million as of June 30, 2018 to $59.9 million as of June 30, 2019. Additionally, the funded ratio—actuarial value of assets divided by the actuarial accrued liability—decreased from 75.8% to 74.8% as of June 30, 2019. The funded status is one of many metrics used to show trends and develop future expectations about the health of an advanced funded program. The funded status measure itself is not appropriate for assessing the sufficiency of plan assets to cover the estimated cost of settling the plan's benefit obligations or assessing the need for or the amount of future contributions since it does not reflect normal cost contributions, the timing of amortization payments, or future experience other than expected.

System Assets

The total market value of assets for the LTD Program decreased from $183.4 million to $174.8 million as of June 30, 2019. Table 3 reconciles the changes in the fund during the year.

Table 4 shows the development of the actuarial value of assets. The actuarial value of assets is equal to the market value of assets less a ten-year phase-in of the difference between the expected investment return and actual income on the market value of assets. The actuarial value is currently 1.7% more than the market value.

Data

The valuation was based upon information as of June 30, 2019, furnished by ASRS staff, concerning program benefits, financial transactions, plan provisions, active members, and benefit recipients. We checked for internal and year-to-year consistency, but did not audit the data. We are not responsible for the accuracy or completeness of the information provided by ASRS staff.

The tables in Appendix III show key census statistics for the various groups included in the valuation. The active member data used for the LTD Program valuation is the same as the active member data used in the June 30, 2019 actuarial valuation of the ASRS Plan. Please refer to Appendix IV of the actuarial valuation report for the ASRS Plan for more information on the active member data.

Certification

All of our work conforms with generally accepted actuarial principles and practices, and to the Actuarial Standards of Practice issued by the Actuarial Standards Board. In our opinion, our calculations also comply with the requirements of, where applicable, the Internal Revenue Code and ERISA.

The signing actuaries are independent of the plan sponsor. Ryan Falls and Joe Newton are Enrolled Actuaries, Fellows of the Society of Actuaries, and Members of the American Academy of Actuaries and Paul Wood is an Associate of the Society of Actuaries and a Member of the American Academy of Actuaries. All three meet the Qualification Standards of the American Academy of Actuaries.

Respectfully submitted,
Gabriel, Roeder, Smith & Company

R. Ryan Falls, FSA, EA, MAAA
Senior Consultant and Actuary

Joseph P. Newton, FSA, EA, MAAA
Pension Market Leader and Actuary

Paul T. Wood, ASA, FCA, MAAA
Consultant and Actuary

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SECTION A

EXECUTIVE SUMMARY

Executive Summary

Item	2019	2018
Membership		
• Number of		
- Active members	208,244	207,119
- Long term disabled (LTD)	3,189	3,358
• Valuation Payroll for subsequent fiscal year	$ 10,340,300,426	$ 9,921,214,513
Contribution rates - Before Phase In Policy	FYE 2021	FYE 2020
• Members	0.19%	0.19%
• Employers	0.19%	0.19%
Contribution rates - After Phase In Policy	FYE 2021	FYE 2020
• Members	0.18%	0.17%
• Employers	0.18%	0.17%
Assets		
• Market value (MVA)	$ 174,790,883	$ 183,443,522
• Actuarial value (AVA)	$ 177,826,870	$ 184,272,280
• Return on market value	6.0%	8.2%
• Return on actuarial value	7.3%	7.3%
Actuarial Information on AVA (smoothed)		
• Actuarial accrued liability	$ 237,710,587	$ 243,149,009
• Unfunded actuarial accrued liability (UAAL)	$ 59,883,717	$ 58,876,729
• Funded ratio	74.8%	75.8%
Actuarial Information on MVA		
• Unfunded actuarial accrued liability (UAAL)	$ 62,919,704	$ 59,705,487
• Funded ratio	73.5%	75.4%

The Board made the policy decision to phase in the impact to the contribution of the assumption changes over a five year period. This resulted in a total contribution rate of 0.36% of total payroll effective July 1, 2020. This policy provides for a smooth transition to the higher contribution rates over a reasonable period of time

SECTION B

TABLES

Table 1

Development of Employer Cost

	June 30, 2019	June 30, 2018
I. Actuarial accrued liabilities (AAL)		
A. Liabilities due to members' benefits		
1. Active members	$ 58,515,539	$ 56,049,174
2. Reserve for Open Claims	179,195,048	187,099,835
3. Total actuarial accrued liabilities	**$ 237,710,587**	**$ 243,149,009**
II. Actuarial value of assets	**$ 177,826,870**	**$ 184,272,280**
III. Unfunded actuarial accrued liability (Item I. – Item II.)	**$ 59,883,717**	**$ 58,876,729**
IV. Amortization of unfunded actuarial accrued liability		
A. Unfunded AAL amortization at beginning of fiscal year 2021	$ 7,730,117	$ 7,319,797
B. Interest to middle of year on A	284,639	269,530
C. Expected alternate contributions	(262,218)	(180,277)
D. Total unfunded actuarial accrued liability amortization (A+B+C)	**$ 7,752,538**	**$ 7,409,050**
V. Normal cost for the year		
A. Normal cost at beginning of fiscal year 2021	$ 31,654,432	$ 29,189,587
B. Interest to middle of year on A	1,165,582	1,074,821
C. Annual Assumed Administrative Fee	174,000	174,000
D. Total normal cost for the year (A+B+C)	**$ 32,994,014**	**$ 30,438,408**
VI. Total contribution for the year (Item IV. + Item V.)	**$ 40,746,553**	**$ 37,847,458**
VII. Total covered payroll (projected to 2020/2021 plan year)	**$ 10,598,807,937**	**$ 10,169,244,876**
VIII. Total contribution for fiscal year 2021 as a percentage of covered payroll (Before Phase In Policy)		
A. Member portion	0.19%	0.19%
B. Employer portion	0.19%	0.19%
C. Total	**0.38%**	**0.38%**
IX. Total contribution for fiscal year 2021 as a percentage of covered payroll (After Phase In Policy)		
A. Member portion	0.18%	0.17%
B. Employer portion	0.18%	0.17%
C. Total	**0.36%**	**0.34%**
X. Funded Status		
A. Funded Status on Actuarial Value of Assets	74.8%	75.8%
B. Market Value of Assets	$ 174,790,883	$ 183,443,522
C. Funded Status on Market Value of Assets	73.5%	75.4%

The Board made the policy decision to phase in the impact to the contribution of the assumption changes over a five year period. This resulted in a total contribution rate of 0.36% of total payroll effective July 1, 2020. This policy provides for a smooth transition to the higher contribution rates over a reasonable period of time

Table 2

UAAL Amortization Bases

Initially established in 2013, an Amortization Base, or "payment schedule," is established each time the Unfunded Actuarial Accrued Liability (UAAL) changes different than expected. As a result, a structured set of amounts are established with each actuarial valuation that are expected to eliminate the UAAL over a period consistent with the Board's funding policy. As of June 30, 2019, the UAAL is $59.9 million and the following Amortization Bases have been established to eliminate the UAAL. Further, this table indicates that the expected UAAL as of June 30, 2020 is $56.5 million. Amortization payments are assumed to increase by 2.5% per year until the base is extinguished.

Date Established	Purpose	Initial Amount	Remaining Balance as of June 30, 2019	2019/2020 Amortization Payment	Remaining Balance as of June 30, 2020	Years Remaining as of June 30, 2020	2020/2021 Amortization Payment
June 30, 2013	Fresh Start Base	$ 47,578,756	$ 35,011,416	4,671,182	$ 32,615,752	8	$ 4,787,961
June 30, 2014	Experience (Gain)/Loss	3,541,561	2,800,158	343,722	2,640,669	9	352,315
June 30, 2015	Experience (Gain)/Loss	19,808,785	16,667,821	1,901,055	15,874,273	10	1,948,581
June 30, 2016	Experience (Gain)/Loss	31,136,071	31,019,894	3,314,137	29,783,689	11	3,396,990
June 30, 2017	Experience (Gain)/Loss	19,459,869	20,338,977	2,049,364	19,661,334	12	2,100,599
June 30, 2017	Assumption Changes	(65,705,482)	(68,673,757)	(6,919,599)	(66,385,720)	12	(7,092,589)
June 30, 2018	Experience (Gain)/Loss	19,075,961	20,506,658	1,959,936	19,937,726	13	2,008,934
June 30, 2019	Experience (Gain)/Loss	2,212,550	2,212,550	0	2,378,491	14	227,326
	Total		$ 59,883,717	$ 7,319,797	$ 56,506,214		$ 7,730,117

Table 3

Reconciliation of Plan Net Assets

		June 30, 2019
1.	Market value of assets at beginning of year	$ 183,443,522
2.	Revenue for the year	
	a. Contributions for the year	
	i. Employer	$ 16,632,909
	ii. Member	16,433,942
	iii. Member reimbursement of member contributions	38,335
	iv. Total	$ 33,105,186
	b. Investment income for the year (net of investment expenses)	$ 10,319,013
	c. Total revenue	$ 43,424,199
3.	Disbursements for the year	
	a. Retirement and disability benefits	$ 50,063,178
	b. Death benefits	0
	c. Refunds	0
	d. Transfers from other plans	0
	e. Transfers to PSPRS	0
	f. Other	509,450
	g. Administrative expenses	1,504,210
	h. Total disbursements	$ 52,076,838
4.	Increase in net assets (Item 2c - Item 3h)	$ (8,652,639)
5.	Market value of assets at end of year (Item 1 + Item 4)	$ 174,790,883
6.	Actual net investment income (Item 2b, no adjustment for admin expenses)	$ 10,319,013
7.	Estimated dollar weighted market yield	6.01%

Table 4

Development of Actuarial Value of Assets

		Year Ending June 30, 2019
1.	Market value of assets at beginning of year	$ 183,443,522
2.	Net new investments	
	a. Contributions	$ 33,105,186
	b. Benefits paid	(52,076,838)
	c. Subtotal	(18,971,652)
3.	Market value of assets at end of year	$ 174,790,883
4.	Net earnings (3-1-2)	$ 10,319,013
5.	Assumed investment return rate	7.50%
6.	Expected return	$ 12,903,039
7.	Excess return (4-6)	$ (2,584,026)
8.	Development of amounts to be recognized as of June 30, 2019:	

Fiscal Year End	Remaining Deferrals of Excess (Shortfall) of Investment Income	Offsetting of Gains/(Losses)	Net Deferrals Remaining	Years Remaining	Recognized for this valuation	Remaining after this valuation
	(1)	(2)	(3) = (1) + (2)	(4)	(5) = (3) / (4)	(6) = (3) - (5)
2010	$ 0	0	$ 0	1	$ 0	$ 0
2011	0	0	0	2	0	0
2012	0	0	0	3	0	0
2013	0	0	0	4	0	0
2014	0	0	0	5	0	0
2015	0	0	0	6	0	0
2016	(828,758)	0	(828,758)	7	(118,394)	(710,364)
2017	0	0	0	8	0	0
2018	0	0	0	9	0	0
2019	(2,584,026)	0	(2,584,026)	10	(258,403)	(2,325,623)
	$ (3,412,784)	$ 0	$ (3,412,784)		$ (376,797)	$ (3,035,987)

9.	Actuarial value of assets as of June 30, 2018 (Item 3 - Item 8)	$ 177,826,870
10.	Market value of assets	$ 174,790,883
11.	Actuarial value of assets	$ 177,826,870

Table 5

Total Experience Gain or Loss

Item (1)			June 30, 2019 (2)
A. Calculation of total actuarial gain or loss			
1. Unfunded actuarial accrued liability (UAAL), previous year		$	58,876,729
2. Normal cost for the year (includes Admin expenses)			29,700,251
3. Expected contributions for the year			(35,121,931)
4. Interest at 7.5%			
a. On UAAL		$	4,415,755
b. On normal cost			1,093,625
c. On contributions			(1,293,262)
d. Total		$	4,216,118
5. Assumption change (Gains)/Losses			0
6. Legislative changes			0
7. Expected UAAL (Sum of Items 1 through 7)			57,671,167
8. Actual UAAL			59,883,717
9. Total (gain)/loss for the year (Item 9 - Item 8)		$	2,212,550
B. Source of gains and losses	% of AAL		
10. Asset (Gain)/Loss for the year	0.18%	$	438,954
11. Pay Increases (Less)/Greater than Expected	0.99%		2,396,753
12. Non-Disabled Demographic (Gains)/Losses	0.06%		144,801
13. Post-Disabled Demographic (Gains)/Losses	0.98%		(2,393,417)
14. Contribution Phase-In (Gains)/Losses	0.86%		2,091,006
15. Other (Gains)/Losses	0.19%		(465,547)
16. Total (Sum of Items 10 through 15)	0.91%	$	2,212,550

Table 6

Schedule of Funding Progress
(Dollar Amounts in Thousands)

Year End June 30,	Actuarial Accrued Liabilities	Actuarial Value of Net Assets	Assets as a % of Accrued Liabilities	Unfunded Actuarial Accrued Liabilities (UAAL)	Covereed Employee Payroll	UAAL as a % of Covered Employee Payroll
2010	$ 477,266	$ 319,308	66.9%	$ 157,958	$ 9,419,952	1.7%
2011	455,695	307,537	67.5%	148,158	9,060,631	1.6%
2012	439,706	295,786	67.3%	143,920	8,868,678	1.6%
2013	332,597	285,018	85.7%	47,579	8,752,783	0.5%
2014	328,928	279,560	85.0%	49,368	8,908,621	0.6%
2015	320,624	253,470	79.1%	67,154	9,072,377	0.7%
2016	318,840	223,464	70.1%	95,376	9,263,859	1.0%
2017	247,356	198,883	80.4%	48,473	9,598,270	0.5%
2018	243,149	184,272	75.8%	58,877	9,921,215	0.6%
2019	237,711	177,827	74.8%	59,884	10,340,300	0.6%

Table 7

Schedule of LTD Participants Added and Removed From Rolls

	Added To Rolls			Removed From Rolls			Rolls - End of Year		
Year End June 30,	Number	Annual Allowance	Average Annual Allowance	Number	Annual Allowance	Average Annual Allowance	Number	Annual Allowance	Average Annual Allowance
2010	789	$17,200,407	$ 21,800	777	$15,066,829	$ 19,391	4,724	$73,248,033	$ 15,506
2011	752	15,000,150	19,947	867	18,071,429	20,844	4,609	70,176,754	15,226
2012	709	14,394,030	20,302	878	16,419,214	18,701	4,440	68,151,570	15,349
2013	735	15,094,316	20,536	868	17,168,470	19,779	4,307	66,077,416	15,342
2014	658	13,947,128	21,196	759	14,675,124	19,335	4,206	65,349,420	15,537
2015	522	10,914,070	20,908	726	13,155,382	18,120	4,002	63,108,108	15,769
2016	538	11,688,516	21,726	743	13,500,123	18,170	3,797	61,296,501	16,143
2017	461	11,239,256	24,380	724	12,619,897	17,431	3,534	59,915,860	16,954
2018	471	11,101,908	23,571	647	13,706,082	21,184	3,358	57,311,686	17,067
2019	449	10,869,605	24,208	618	13,714,530	22,192	3,189	54,466,761	17,080

Table 8

Solvency Test

(Dollar Amounts in Thousands)

Year End June 30,	Aggregate Accrued Liabilities for: Active Member Contributions (1)	Retirees and Beneficiaries (2)	Active Members (Employer Financed Portion) (3)	Net Assets Available for Benefits	Portion of Accrued Liabilities Covered by Net Assets Available for Benefits (1)	(2)	(3)
2010	$ 0	$ 242,098	$ 235,168	$ 319,308	100%	100%	33%
2011	0	234,155	221,540	307,537	100%	100%	33%
2012	0	224,090	215,616	295,786	100%	100%	33%
2013	0	207,331	125,265	285,018	100%	100%	62%
2014	0	202,999	125,929	279,560	100%	100%	61%
2015	0	193,129	127,495	253,470	100%	100%	47%
2016	0	189,940	128,900	223,464	100%	100%	26%
2017	0	194,328	53,028	198,883	100%	100%	9%
2018	0	187,100	56,049	184,272	100%	98%	0%
2019	0	179,195	58,516	177,827	100%	99%	0%

APPENDIX I

SUMMARY OF PLAN PROVISIONS

Summary of Plan Provisions

The Arizona State Retirement System (ASRS) Long Term Disability Program (LTD Program) began on July 1, 1995. The program covers ASRS LTD Program participants who become disabled on or after July 1, 1995. ASRS members who were receiving LTD benefits prior to July 1, 1995, were transferred to the program on October 1, 1995. Contributions began July 1, 1995, and are now paid 50% by employers and 50% by active members. The major provisions of the LTD Program are summarized below.

Participation

To be eligible, members must be actively at work and engaged to work at least 20 weeks in a fiscal year and at least 20 hours each week. Coverage is contingent on payment of premiums.

Member and Employer Contributions

The contribution rate for the fiscal year beginning on July 1st is based on the results of the most recent actuarial valuation as of the last day of the preceding plan year. The member's contribution rate is equal to the required employer contribution rate. The contribution rate for fiscal year 2020 is 0.17% for each member and each employer, based on the 2018 actuarial valuation. The contribution rate for fiscal year 2021 will be 0.18% based on this valuation.

Monthly Compensation

The member's Monthly Compensation as of the date of disability is determined based the contributions remitted to ASRS.

Qualifications for Benefit

Monthly benefits are not payable until a member has been totally disabled for a period of six consecutive months.

Monthly benefits are not payable to a member whose disability is due to the following:

1. an intentionally self-inflected injury;
2. war, whether declared or not;
3. an injury incurred while engaged in a felonious criminal act or enterprise;
4. for employees hired on or after July 1, 1988, any injury, sickness, or pregnancy for which you received medical treatment within three months prior to the effective date coverage began under the LTD Income Plan. Except for any employee who becomes an active contributing member on or after July 1, 2008 and receives medical treatment within six months prior to the date coverage begins under the LTD Income Plan. This exclusion does not apply to a disability commencing after a person has been an active contributing member of a participating employer for twelve continuous months.

Monthly benefits are not payable to a member who is receiving retirement benefits from ASRS.

Totally Disabled

A member is considered totally disabled if:

1. during the first thirty months of a period of disability, the member is unable to perform all duties of the occupation held by the member when the member became totally disabled; and
2. for a member who has received monthly benefits for 24 or more total months, that a member is unable to perform any work for compensation or gain for which the member is reasonably qualified by education, training, or experience.

Benefit Amount

Benefits payable from the plan equal two-thirds of a member's monthly compensation at the time of disability. Benefits are offset by:

1. 85% of Social Security disability benefits that the member or the members dependents are eligible to receive;
2. 85% of Social Security retirement benefits that the member is eligible to receive;
3. all of any workers compensation benefits;
4. all of any payments for a veterans disability if both of the following apply:
    a. the veterans disability payment is for the same condition or a condition related to the condition currently causing the members total disability;
    b. the veterans disability is due to service in the armed forces of the United States;
5. all of any other benefits by reason of employment that are financed partly or wholly by an employer including payments for sick leave; and
6. 50% of any salary, wages, commissions, or similar pay that the member receives or is entitled to receive from any gainful employment in which the member engages.

Benefit Period

Monthly benefits cease to be payable to a member at the earliest of the following:

1. the date the member ceases to be totally disabled;
2. the date the member ceases to be under the direct care of a doctor or refuses to undergo any medical examination requested by the company selected by the Board to administer the LTD Program;
3. the date the member withdraws employee contributions with interest from the ASRS Plan and ceases to be a member; and
4. the later of following:
    a. the members normal retirement date;
    b. the month following 60 months of payments if disability occurs before age 65;
    c. the month following attainment of age 70 if disability occurs at age 65 or after but before age 69;
    d. the month following twelve-months of payments if disability occurs at or after age 69.

Administrative Expenses

Administrative expenses associated with the operation of the LTD Program are payable by the LTD Program. The current fee schedule is as follows:

Account Management Fee:	$174,000 per year
New Claims Fee:	$364 per claim
Claims Management Fee:	$26 per claim per month

APPENDIX II

SUMMARY OF ACTUARIAL ASSUMPTIONS AND METHODS

Summary of Actuarial Assumptions and Methods

The assumptions and methods applied in this actuarial valuation were adopted by the Board of Trustees on October 27, 2017 based on the Report on the Actuarial Experience Study covering a five-year period from July 1, 2011 to June 30, 2016, dated October 18, 2017. We believe the assumptions are internally consistent and are reasonable, based on the actual experience of ASRS.

I. *Valuation Date*

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

II. *Actuarial Cost Method*

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

1. The valuation is prepared on the projected benefit basis. The present value of each participant's expected benefit payable at retirement or termination is determined, based on age, service, sex, compensation, and the interest rate assumed to be earned in the future (7.50%). The calculations take into account the probability of a participant's death or termination of employment prior to becoming eligible for a benefit, as well as the possibility of his terminating with a service benefit. Future salary increases are also anticipated. The present value of the expected benefits payable on account of the active participants is added to the present value of the expected future payments to retired participants and beneficiaries to obtain the present value of all expected benefits payable from the Plan on account of the present group of participants and beneficiaries.

2. The contributions required to support the benefits of the LTD Program are determined following a level funding approach, and consist of a normal cost contribution and an unfunded accrued liability contribution, plus a component to cover administrative expenses.

3. The normal contribution is determined using the Entry Age Normal method. Under this method, a calculation is made to determine the average uniform and constant percentage rate of employer contribution which, if applied to the compensation of each new participant during the entire period of his anticipated covered service, would be required in addition to the contributions of the participant to meet the cost of all benefits payable on their behalf.

4. The unfunded accrued liability contributions are determined by subtracting the actuarial value of assets from the actuarial accrued liability. Amortization bases are established each year and amortized based on the funding policy. The current year amortization base is determined by taking the current unfunded liability less the outstanding amounts of prior year bases.

III. *Actuarial Value of Assets*

The actuarial value of assets is based on the market value of assets with a ten-year phase-in of actual investment return in excess of (less than) expected investment income. Offsetting unrecognized gains and losses are immediately recognized, with the shortest remaining bases recognized first and the net remaining bases continue to be recognized on their original timeframe. Expected investment income is determined using the assumed investment return rate and the market value of assets (adjusted for receipts and disbursements during the year). The returns are computed net of investment-related expenses. In no event will this amount exceed 130% of market value or be less than 70% of market value.

IV. *Actuarial Assumptions*

Investment Return: 7.50% per year, net of investment-related expenses (composed of an assumed 2.30% inflation rate and a 5.20% real rate of return)

Decrement Timing: All decrements are assumed to occur at the middle of the valuation year.

Disability Retirement Decrements:
Sample rates for eligible members:

Annual Rates per 100 Members	
Age	Unisex
20	0.0454
25	0.0502
30	0.0606
35	0.0925
40	0.1468
45	0.2271
50	0.3384
55	0.3970
60	0.4317

Termination of Claims in Payment due to Death or Recovery

The 2012 Group Long Term Disability Valuation Table (2012 GLDT) as proposed by the Society of Actuaries' Group Disability Experience Committee for use by the National Association of Insurance Commissioners. Specifically, rates applicable to plans with a six-month elimination period, "Own Occupation" definition of disability, initial maximum guaranteed benefit of $2,000 for active members and actual initial maximum guaranteed benefit for current LTD recipients , "No Diagnosis" cause of disability, 15% margin for recovery, 27% margin for deaths.

Offsets for Disabled Members

Members will have a minimum offset of 30% within three years of initial receipt of LTD benefits. Offsets due to overpayments will apply until the overpayments are expected to be fully recovered based on the data received from the plan administrator.

Offsets for Active Members

The valuation assumes that LTD Program benefits, after all applicable offsets, are 60% of the benefits before the offsets.

Incurred But Not Reported (IBNR)

The liability for new LTD recipients was loaded by 20% to reflect IBNR.

Census Data and Assets

- The valuation was based on members of ASRS as of June 30, 2019 and does not take into account future members.
- All census data was supplied by ASRS and was subject to reasonable consistency checks.
- Asset data was supplied by ASRS.

Administrative Expenses

Administrative expenses, based on the amounts outlined in the Plan Provisions, are incorporated into the normal cost and actuarial accrued liability as follows:

- The account management fee is explicitly included with the normal cost,
- The new claims fee is included in the active member liability, and
- The claims management fee is included in both the active member liability and the reserve for open claims.

Other Actuarial Valuation Procedures

- No provision was made in this actuarial valuation for the limitations of Internal Revenue Code Section 415.
- Internal Revenue Code Section 401(a)17 limits were applied to individual salaries.
- Valuation payroll (earnings applied to the current valuation year) is the expected payroll for the fiscal year following the valuation date.
- Adjustment for Contribution Timing – Contribution rates are increased by ½ of a year's interest to reflect the fact that contributions are made throughout the fiscal year and are further adjusted to reflect the one year lag.

For all other assumptions, see the Arizona State Retirement System Annual Actuarial Valuation – Funding report as of June 30, 2019.

APPENDIX III

DETAILED SUMMARIES OF MEMBERSHIP DATA

Table A
Reconciliation of Lives

LTD Members as of June 30, 2018	3,358
Recovered	(201)
Retired	(361)
Death	(56)
New LTD	449
LTD Members as of June 30, 2019	3,189

Table B
Summary of Open LTD Claims

Offset Description	June 30, 2018	June 30, 2019
Number	3,358	3,189
Average age	54.5	54.6
Average monthly benefit before Offset Assumption	$ 1,422	$ 1,423
Total monthly benefit before Offset Assumption	$ 4,776,000	$ 4,539,000
Average Offset Assumption	$ 123	$ 124
Total Offset Assumption	$ 413,000	$ 397,000
Average monthly benefit	$ 1,299	$ 1,299
Total monthly benefit	$ 4,363,000	$ 4,142,000

Table C
LTD Open Claims Statistics

Year Ended June 30	Number of Open Claims	Number of Active Members	Disabled Ratio	Open Claims Reserve Liability ($'s millions)	Active Payroll ($'s millions)	Liability to Payroll Ratio
2010	4,724	213,530	2.21%	$ 235.5	$ 9,420.0	2.50%
2011	4,609	208,939	2.21%	227.7	9,060.6	2.51%
2012	4,440	203,994	2.18%	217.9	8,868.7	2.46%
2013	4,307	202,693	2.12%	201.7	8,752.8	2.30%
2014	4,206	203,201	2.07%	197.6	8,908.6	2.22%
2015	4,002	203,252	1.97%	188.0	9,072.4	2.07%
2016	3,797	204,162	1.86%	189.9	9,263.9	2.05%
2017	3,534	206,055	1.72%	194.3	9,598.3	2.02%
2018	3,358	207,119	1.62%	187.1	9,921.2	1.89%
2019	3,189	208,244	1.53%	179.2	10,340.3	1.73%

Table D
Summary of Offsets

Description	Total Amount of Monthly Offset		Number of Offsets
Social Security Disability	$	2,069,111	1,984
Social Security Dependent		103,825	236
Social Security Retirement		163,766	150
Short Term Disability		4,513	3
Salary Continuance		45,287	14
Veteran's Benefits		18,627	19
Overpayment		83,001	235
All Other		76,752	63
Total Offset Before Assumption	**$**	**2,564,882**	**2,704**
Total Assumed Offsets		**397,000**	
Total Offsets	**$**	**2,961,882**	

Table E
Summary of Counts and Payments by Duration and Age

The following tables illustrate the counts and net monthly payment by duration and age as of June 30, 2019.

Age at Disability	Duration (in Years) 0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11
Below 30	4	4	6	5	4	5	4	4	3	5	6
	$4,468	$8,530	$7,621	$6,923	$7,320	$7,233	$4,522	$5,948	$2,899	$2,068	$8,106
30-39	10	26	19	30	21	33	30	23	25	40	26
	$20,835	$52,099	$37,775	$50,840	$28,570	$35,870	$42,008	$23,880	$26,956	$52,663	$28,176
40-49	40	83	75	60	90	82	99	82	85	66	81
	$89,220	$182,287	$141,051	$89,349	$142,327	$117,895	$129,502	$91,320	$98,348	$76,853	$89,829
50-59	81	197	164	189	172	127	67	50	33	25	9
	$205,047	$343,811	$240,254	$295,454	$215,554	$150,542	$97,715	$54,598	$35,858	$30,348	$9,225
Over 59	48	76	79	54	57	26	0	0	0	0	0
	$88,523	$120,079	$132,643	$88,375	$78,865	$45,457	$0	$0	$0	$0	$0
Total	**183**	**386**	**343**	**338**	**344**	**273**	**200**	**159**	**146**	**136**	**122**
	$408,093	**$706,806**	**$559,344**	**$530,941**	**$472,635**	**$356,998**	**$273,748**	**$175,746**	**$164,060**	**$161,932**	**$135,336**

Age at Disability	Duration (in Years) 11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	Over 20	Total
Below 30	7	9	5	5	6	4	3	3	5	31	**128**
	$9,266	$7,572	$3,115	$3,872	$4,453	$3,070	$2,218	$3,681	$4,817	$27,829	**$135,530**
30-39	25	26	34	25	35	33	23	32	14	19	**549**
	$34,770	$35,950	$34,235	$25,424	$38,979	$34,976	$23,249	$28,092	$12,215	$12,967	**$680,527**
40-49	46	44	46	26	21	17	9	3	1	0	**1,056**
	$62,123	$43,353	$60,503	$28,962	$19,420	$13,004	$9,531	$2,200	$810	$0	**$1,487,886**
50-59	2	0	0	0	0	0	0	0	0	0	**1,116**
	$2,602	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$1,681,010**
Over 59	0	0	0	0	0	0	0	0	0	0	**340**
	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	**$553,943**
Total	**80**	**79**	**85**	**56**	**62**	**54**	**35**	**38**	**20**	**50**	**3,189**
	$108,761	**$86,874**	**$97,854**	**$58,258**	**$62,852**	**$51,051**	**$34,999**	**$33,973**	**$17,842**	**$40,796**	**$4,538,897**

APPENDIX IV

RISKS ASSOCIATED WITH MEASURING THE ACCRUED LIABILITY AND ACTUARIALLY DETERMINED CONTRIBUTION

RISKS ASSOCIATED WITH MEASURING THE ACCRUED LIABILITY AND ACTUARIALLY DETERMINED CONTRIBUTION

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

Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions due to changing conditions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period, or additional cost or contribution requirements based on the plan's funded status); and changes in plan provisions or applicable law. The scope of an actuarial valuation does not include an analysis of the potential range of such future measurements.

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

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

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

The computed contribution rate shown on page 4 may be considered as a minimum contribution rate that complies with the Board's funding policy. The timely receipt of the actuarially determined contributions is critical to support the financial health of the plan. Users of this report should be aware that contributions made at the actuarially determined rate do not necessarily guarantee benefit security.

PLAN MATURITY MEASURES

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

	June 30, 2019	June 30, 2018	June 30, 2017
Ratio of net cash flows to market value of assets	-11%	-15%	-16%
Duration of the actuarial accrued liability	3.1	3.0	3.0

RATIO OF NET CASH FLOW TO MARKET VALUE OF ASSETS

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

DURATION OF ACTUARIAL ACCRUED LIABILITY

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

ADDITIONAL RISK ASSESSMENT

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

APPENDIX V

GLOSSARY

Glossary

Actuarial Accrued Liability (AAL): That portion, as determined by a particular Actuarial Cost Method, of the Actuarial Present Value of Future Plan Benefits which is not provided for by future Normal Costs. It is equal to the Actuarial Present Value of Future Plan Benefits minus the actuarial present value of future Normal Costs.

Actuarial Assumptions: Assumptions as to future experience under the Fund. These include assumptions about the occurrence of future events affecting costs or liabilities, such as:

- mortality, withdrawal, disablement, and retirement;
- future increases in salary;
- future rates of investment earnings and future investment and administrative expenses;
- characteristics of members not specified in the data, such as marital status;
- characteristics of future members;
- future elections made by members; and
- other relevant items.

Actuarial Cost Method or ***Funding Method:*** A procedure for allocating the Actuarial Present Value of Future Benefits to various time periods; a method used to determine the Normal Cost and the Actuarial Accrued Liability. These items are used to determine the ARC.

Actuarial Gain or ***Actuarial Loss:*** A measure of the difference between actual experience and that expected based upon a set of Actuarial Assumptions, during the period between two Actuarial Valuation dates. Through 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 Accrued Liabilities emerge which may be the same as forecasted, or may be larger or smaller than projected. Actuarial gains are due to favorable experience, e.g., the Fund'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 actuarial balance sheet deficiency while actuarial losses will lengthen the funding period.

Actuarially Equivalent: Of equal actuarial present value, determined as of a given date and based on a given set of Actuarial Assumptions.

Actuarial Present Value (APV): The value of an amount or series of amounts payable or receivable at various times, determined as of a given date by the application of a particular set of Actuarial Assumptions. For purposes of this standard, each such amount or series of amounts is:

a. adjusted for the probable financial effect of certain intervening events (such as changes in compensation levels, marital status, etc.),
b. multiplied by the probability of the occurrence of an event (such as survival, death, disability, termination of employment, etc.) on which the payment is conditioned, and
c. discounted according to an assumed rate (or rates) of return to reflect the time value of money.

Actuarial Present Value of Future Plan Benefits: The Actuarial Present Value of those benefit amounts which are expected to be paid at various future times under a particular set of Actuarial Assumptions, taking into account such items as the effect of advancement in age and past and anticipated future compensation and service credits. The Actuarial Present Value of Future Plan Benefits includes the liabilities for active members, retired members, beneficiaries receiving benefits, and inactive, nonretired members either entitled to a refund or a future retirement benefit. Expressed another way, it is the value that would have to be invested on the valuation date so that the amount invested plus investment earnings would be provide sufficient assets to pay all projected benefits and expenses when due.

Actuarial Valuation: The determination, as of a valuation date, of the Normal Cost, Actuarial Accrued Liability, Actuarial Value of Assets, and related Actuarial Present Values for a plan. An Actuarial valuation for a governmental retirement system typically also includes calculations of items needed for compliance with GASB.

Actuarial Value of Assets or ***Valuation Assets:*** The value of the Fund's assets as of a given date, used by the actuary for valuation purposes. This may be the market or fair value of plan assets, but commonly actuaries use a smoothed value in order to reduce the year-to-year volatility of calculated results, such as the funded ratio and the ARC.

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.

Amortization Method: A method for determining the Amortization Payment. The most common methods used are level dollar and level percentage of payroll. Under the Level Dollar method, the Amortization Payment is one of a stream of payments, all equal, whose Actuarial Present Value is equal to the UAAL. Under the Level Percentage of Pay method, the Amortization payment is one of a stream of increasing payments, whose Actuarial Present Value is equal to the UAAL. Under the Level Percentage of Pay method, the stream of payments increases at the assumed rate at which total covered payroll of all active members will increase.

Amortization Payment: That portion of the pension plan contribution or ARC which is designed to pay interest on and to amortize the Unfunded Actuarial Accrued Liability.
Actuarially Determined Contribution (ADC) or ***Annual Required Contribution (ARC):*** A calculated contribution for a defined benefit pension plan for the reporting period, most often determined based on the funding policy of the plan. Typically the calculated contribution has a normal cost payment and an amortization payment.

Closed Amortization Period: A specific number of years that is counted down by one each year and therefore declines to zero with the passage of time. For example if the amortization period is initially set at 30 years, it is 29 years at the end of one year, 28 years at the end of two years, etc. See Funding Period and Open Amortization Period.

Decrements: Those causes/events due to which a member's status (active-inactive-retiree-beneficiary) changes, that is: death, retirement, disability, or termination.

Defined Benefit Plan: An employer-sponsored retirement benefit that provides workers, upon attainment of designated age and service thresholds, with a monthly benefit based on the employee's salary and length of service. The value of a benefit from a defined benefit plan is generally not affected by the return on the assets that are invested to fund the benefit.

Defined Contribution Plan: A retirement plan, such as a 401(k) plan, a 403(b) plan, or a 457 plan, in which the contributions to the plan are assigned to an account for each member, and the plan's earnings are allocated to each account, and each member's benefits are a direct function of the account balance.

Employer Normal Cost: The portion of the Normal Cost to be paid by the employers. This is equal to the Normal Cost less expected member contributions.

Experience Study: A periodic review and analysis of the actual experience of the Fund which may lead to a revision of one or more actuarial assumptions. Actual rates of decrement and salary increases are compared to the actuarially assumed values and modified as deemed appropriate by the Actuary.

Funded Ratio: The ratio of the actuarial value of assets (AVA) to the actuarial accrued liability (AAL). Plans sometimes calculate a market funded ratio, using the market value of assets (MVA), rather than the AVA.

Funding Period or ***Amortization Period:*** The term "Funding Period" is used it two ways. In the first sense, it is the period used in calculating the Amortization Payment as a component of the ARC. This funding period is chosen by the Board of Trustees. In the second sense, it is a calculated item: the number of years in the future that will theoretically be required to amortize (i.e., pay off or eliminate) the Unfunded Actuarial Accrued Liability, based on the statutory employer contribution rate, and assuming no future actuarial gains or losses.

GASB: The Governmental Accounting Standards Board is an organization that exists in order to promulgate accounting standards for governmental entities.

Normal Cost: That portion of the Actuarial Present Value of pension plan benefits and expenses which is allocated to a valuation year by the Actuarial Cost Method. Any payment in respect of an Unfunded Actuarial Accrued Liability is not part of Normal Cost (see Amortization Payment). For pension plan benefits which are provided in part by employee contributions, Normal Cost refers to the total of employee contributions and employer Normal Cost unless otherwise specifically stated. Under the entry age normal cost method, the Normal Cost is intended to be the level cost (when expressed as a percentage of pay) needed to fund the benefits of a member from hire until ultimate termination, death, disability or retirement.

Open Amortization Period: An open amortization period is one which is used to determine the Amortization Payment but which does not change over time. In other words, if the initial period is set as 30 years, the same 30-year period is used in determining the Amortization Period each year. In theory, if an Open Amortization Period is used to amortize the Unfunded Actuarial Accrued Liability, the UAAL will never completely disappear, but will become smaller each year, either as a dollar amount or in relation to covered payroll.

Unfunded Actuarial Accrued Liability: The excess of the Actuarial Accrued Liability over the Actuarial Value of Assets. This value may be negative in which case it may be expressed as a negative Unfunded Actuarial Accrued Liability, also called the Funding Surplus.

Valuation Date or ***Actuarial Valuation Date:*** The date as of which the value of assets is determined and as of which the Actuarial Present Value of Future Plan Benefits is determined. The expected benefits to be paid in the future are discounted to this date.