



**Cavanaugh Macdonald**  
CONSULTING, LLC

*The experience and dedication you deserve*

***MISSOURI STATE EMPLOYEES'  
RETIREMENT SYSTEM - JUDGES***

**ACTUARIAL VALUATION REPORT  
AS OF JUNE 30, 2020**

**CONTRIBUTION RATE FOR FISCAL YEAR ENDING  
JUNE 30, 2022**







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# Cavanaugh Macdonald

CONSULTING, LLC

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September 8, 2020

Board of Trustees  
Missouri State Employees' Retirement System  
907 Wildewood Drive  
Jefferson City, MO 65102

Dear Members of the Board:

At your request, we performed an actuarial valuation of the Missouri State Employees' Retirement System (MOSERS) as of June 30, 2020 for the purpose of determining the employer required contribution rate for the fiscal year ending June 30, 2022. This report provides valuation results for the Missouri State Employees' Retirement System - Judges (Judges). The major findings of the valuation are contained in this report, which reflects the benefit provisions in place on June 30, 2020. There have been no changes to the plan provisions or actuarial methods since the prior valuation, but the set of economic assumptions have changed since the last valuation.

In July 2018 after extensive analysis, the MOSERS Board adopted a plan to phase-in a change in the set of economic assumptions over a three-year period (2018 through 2020 valuations). The scheduled economic assumption changes included price inflation, cost of living adjustments, general wage growth, payroll growth, and the investment return assumption. The nominal investment return assumption decreased from 7.50% to 7.25% in the June 30, 2018 actuarial valuation, then to 7.10% in the June 30, 2019 actuarial valuation, and finally to 6.95% in the June 30, 2020 actuarial valuation. The assumption changes are discussed in further detail in the Executive Summary section of this report.

In preparing our report, we relied, without audit, on information (some oral and some in writing) supplied by the System's staff. This information includes, but is not limited to, statutory provisions, member data and financial information. We found this information to be reasonably consistent and comparable with the information received in the prior year. 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.

We further certify that all costs, liabilities, rates of interest and other factors for Judges have been determined on the basis of actuarial assumptions and methods which are individually reasonable (taking into account the experience of each Plan and reasonable expectations); and which, in combination, offer the best estimate of anticipated experience affecting Judges. Nevertheless, the emerging costs will vary from those presented in this report to the extent actual experience differs from that projected by the actuarial assumptions. The MOSERS Board has the final decision regarding the appropriateness of the assumptions and adopted them as indicated in Appendix C.



Board of Trustees  
September 8, 2020  
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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 actuarial computations presented in this report are for purposes of determining the funding amounts for Judges as set out in the Missouri state statutes. The calculations in the enclosed report have been made on a basis consistent with our understanding of MOSERS' funding policy. Determinations for purposes other than meeting these requirements may be significantly different from the results contained in this report. Accordingly, additional determinations may be needed for other purposes. For example, actuarial computations for purposes of fulfilling financial accounting requirements for the System under Governmental Accounting Standards No. 67 and No. 68 will be presented in separate reports.

The consultants who worked on this assignment are pension actuaries with substantive experience valuing public retirement systems. Cavanaugh Macdonald's advice is not intended to be a substitute for qualified legal or accounting counsel.

On the basis of the foregoing, we hereby certify that, to the best of our knowledge and belief, this report 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 are available to answer any questions on the material contained in the report or to provide explanations or further details as may be appropriate.

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

Sincerely,

A handwritten signature in blue ink that reads 'Patrice Beckham'.

Patrice A. Beckham, FSA, EA, FCA, MAAA  
Principal and Consulting Actuary

A handwritten signature in blue ink that reads 'Bryan K. Hoge'.

Bryan K. Hoge, FSA, EA, FCA, MAAA  
Consulting Actuary



## SECTION 1 – EXECUTIVE SUMMARY

This report presents the results of the June 30, 2020 actuarial valuation of the Missouri State Employees’ System – Judges (Judges). The primary purposes of performing the actuarial valuation are to:

- Determine the employer contribution rate, as defined in the Missouri state statutes and set out in the Board’s funding policy, for the fiscal year ending June 30, 2022;
- Disclose asset and liability measurements as well as the current funded status of Judges on the valuation date;
- Compare the actual and expected experience of Judges during the plan year ended June 30, 2020;
- Assess and disclose the key risks associated with funding the System; and
- Analyze and report on trends in Judges’ contributions, assets and liabilities over the past several years.

### Changes Since the Prior Valuation

In July 2018 after extensive analysis, the MOSERS Board adopted a plan to phase-in a change in the set of economic assumptions over a three-year period (2018 through 2020 valuations). The scheduled economic assumption changes included price inflation, cost of living adjustments, general wage growth, payroll growth, and the investment return assumption. The nominal investment return assumption decreased from 7.50% to 7.25% in the June 30, 2018 actuarial valuation, then to 7.10% in the June 30, 2019 actuarial valuation, and finally to 6.95% in the June 30, 2020 actuarial valuation. The MOSERS board confirmed the final step in the phase-in of the set of economic assumptions shown below for the June 30, 2020 actuarial valuation.

Economic Assumption	Effective June 30, 2018	Effective June 30, 2019	Effective June 30, 2020
1. Investment Return	7.25%	7.10%	6.95%
2. Inflation	2.50%	2.35%	2.25%
3. Cost-of-Living Adjustment (COLA)	2.00%	1.88%	1.80%
4. General Wage Growth	2.75%	2.60%	2.50%
5. Payroll Growth	2.50%	2.35%	2.25%

The net impact of the scheduled change in the set of economic assumptions was an increase of \$6.3 million in the actuarial accrued liability and an increase of 0.78% in the employer contribution rate.

Another change reflected in the June 30, 2020 valuation was the programming of our valuation software for the cost of living adjustment for Judges members who work beyond normal retirement age. These members receive a benefit adjustment upon retirement equal to the COLAs granted between their normal retirement age (but no earlier than age 60) and the date of retirement (not to exceed 65%). Periodically, the valuation software used to calculate the liabilities is updated with additional features and enhancements to accommodate some of the more complex benefit provisions. As the result of a recent update, the valuation programming was modified to more directly reflect the Formula 1 cost-of-living adjustment formula for these Judges members. The impact of this programming refinement was a decrease in the actuarial accrued liability of \$11.8 million and a decrease in the employer contribution rate of 1.83%.



## SECTION 1 – EXECUTIVE SUMMARY

### Key Results

The actuarial valuation results provide a “snapshot” view of the System’s financial condition on June 30, 2020. The unfunded actuarial accrued liability (UAAL) for Judges decreased from \$445.3 million last year to \$444.1 million this year and the funded ratio increased from 27.9% to 28.9%. In addition, the employer actuarial contribution rate decreased from 63.38% of pay last year to 61.94% of pay in this year’s valuation, a decrease of 1.44% of pay. This change was impacted by various events over the past year. The most significant impact was due to the COLA programming refinements (1.83% decrease). Additional factors were the change in the economic assumptions (0.78% increase) and unfavorable investment experience on the actuarial value of assets (0.46% increase). The effective employee contribution rate also increased from the prior valuation by 0.15% due to the higher percentage of active members covered by the Judges 2011 Plan, which lowered the employer contribution rate.

The valuation results reflect net unfavorable experience of \$1.4 million for the past plan year as demonstrated by an UAAL that was higher than expected (actual UAAL of \$444.1 million compared to an expected UAAL of \$442.7 million). The unfavorable experience was due to the net impact of an actuarial loss on the actuarial value of assets (\$4.6 million) and a net actuarial gain on liabilities (\$3.1 million). The most significant sources of liability gain were lower cost-of-living adjustments than expected, based on the valuation assumptions, as well as lower salary increases than expected.

A summary of the key results from the June 30, 2020 actuarial valuation, compared to the prior valuation, is shown in the following table. Further detail on the changes and actuarial experience affecting the valuation results can be found in the following sections of this Executive Summary.

	June 30, 2020	June 30, 2019
Unfunded Actuarial Accrued Liability (\$M)	\$444.1	\$445.3
Funded Ratio (Actuarial Assets)	28.9%	27.9%
Normal Cost Rate	20.53%	21.28%
UAAL Amortization Rate	43.67%	44.21%
Total Actuarial Required Contribution	64.20%	65.49%
Member Contribution Rate	(2.26%)	(2.11%)
Employer Contribution Rate	61.94%	63.38%

### Experience for the Last Plan Year

Numerous factors contributed to the change in the Judges assets, liabilities, and actuarial required contribution rate between June 30, 2019 and June 30, 2020. The components are examined in the following discussion.

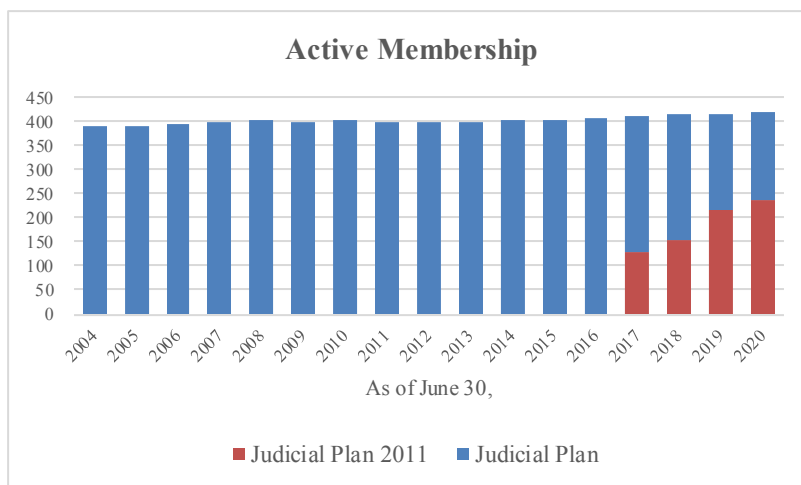
### Membership

There was very little change in the number of active members in this valuation compared to the prior valuation (418 active members in the current valuation versus 414 in the prior valuation). As shown in the following graph, the active population has remained relatively steady over the last 16 years, which is typical for a statewide Judges system.





## SECTION 1 – EXECUTIVE SUMMARY



Note: Split between MSEP and MSEP 2011 is not available prior to June 30, 2017.

The percentage of active members covered by the Judicial 2011 Plan has increased over time as actives covered by the Judicial Plan leave the bench and are replaced by new judges. The number of active members covered by the Judicial 2011 Plan increased from 216 in the 2019 valuation (about 52% of the total active population) to 235 (about 56% of total active population) in the 2020 valuation. Because the benefit structure is different for the Judicial 2011 members, including an employee contribution rate of 4%, the ongoing cost of the System declines as a larger percentage of active members is covered by the Judicial 2011 Plan. As a result of the increase in the number of active members covered by the Judicial 2011 Plan, the effective member contribution rate increased 0.15% and the normal cost rate decreased by 0.47% (before the assumption and COLA programming refinements). The combined impact (decline of 0.62% of covered payroll) was a significant factor in the decrease in the employer contribution rate.

As is expected in a mature retirement system, the number of members receiving benefits increased from 585 last year to 590 in the current valuation. In addition, the average benefit amount for this group increased (3.0%), which is to be expected.

### System Assets

As of June 30, 2020, Judges had net assets of \$167.3 million, when measured on a market value basis, an increase of \$9.0 million from the prior year value of \$158.3 million. However, the market value of assets is not used directly in the calculation of the unfunded actuarial accrued liability and the employer actuarial contribution rate. An asset valuation method, which smoothes the effect of market fluctuations, is applied to determine the value of assets used in the valuation, called the actuarial value of assets. The current asset valuation method was first implemented in the June 30, 2018 actuarial valuation. Under this method, the difference between the dollar amount of the actual and assumed investment return on the market value of assets is recognized evenly over a closed five-year period. In addition, to transition from the prior to the new smoothing method, the total unrecognized investment experience as of June 30, 2017 (\$11.9 million) was established on a schedule to evenly recognize the amount over a closed seven-year period beginning June 30, 2018.

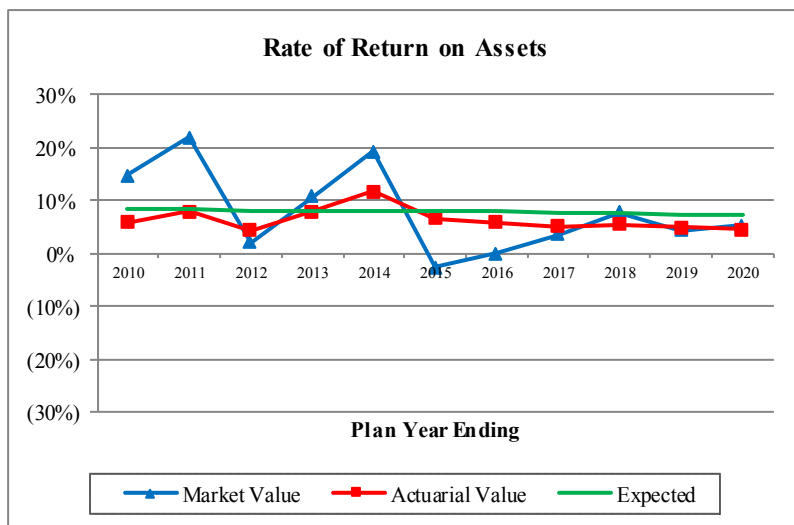
In the current valuation, the actuarial value of assets for Judges is \$180.7 million, an increase of \$8.5 million from the prior year. The components of change in the asset values are shown in the following table.



**SECTION 1 – EXECUTIVE SUMMARY**

	<b>Market Value (\$M)</b>		<b>Actuarial Value (\$M)</b>	
<b>Net Assets, June 30, 2019</b>	\$	158.33	\$	172.22
- Employer and Member Contributions	+	40.49	+	40.49
- Benefit Payments	-	39.62	-	39.62
- Net Investment Income	+	8.16	+	7.69
- Administrative Expenses	-	0.07	-	0.07
<b>Net Assets, June 30, 2020</b>	\$	167.29	\$	180.71
Estimated Net Rate of Return		5.2%		4.5%

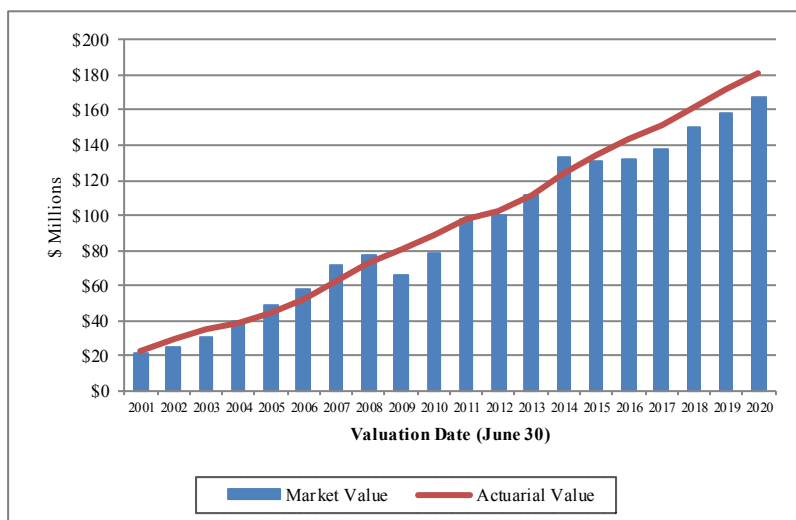
Due to the scheduled recognition of the current and prior investment experience in the asset smoothing method, the estimated rate of return on the actuarial value of assets for FY 2020 was 4.5%, which is lower than the investment return assumption of 7.10% for the period July 1, 2019 to June 30, 2020. As a result, there was an actuarial loss on the smoothed value of assets of \$4.6 million. The investment return on the market value of assets for the year ending June 30, 2020 of 5.2%, as reported by MOSERS, was below the assumed rate of return. As a result, it produced an investment income shortfall for the year ended June 30, 2020 of \$3.1 million. There is currently a net deferred investment loss of \$13.4 million (actuarial value of assets exceeds market value). Please see Section 3 of this report for more detailed information on the market and actuarial value of assets.



*The rate of return of the actuarial value of assets has been less volatile than the market value return, illustrating the benefit of using an asset smoothing method. However, during this time period, the rate of return on actuarial assets has been at or below the assumed rate of return for most years, resulting in actuarial losses.*



## SECTION 1 – EXECUTIVE SUMMARY



*An asset smoothing method is used to mitigate the volatility in the market value of assets. By using a smoothing method, the actuarial (or smoothed) value can be, and actually should be, both above and below the pure market value.*

*Note the asset smoothing method changed with the 2018 valuation.*

### System Liabilities

The actuarial accrued liability is that portion of the present value of future benefits that will not be paid by future normal costs. The difference between this liability and the actuarial value of assets as of the valuation date is called the unfunded actuarial accrued liability. The dollar amount of the UAAL is reduced if the contributions to the System exceed the normal cost for the year plus interest on the prior year's UAAL.

Note that until 1999, the Judges Plan was funded on a pay-as-you-go basis so no advance funding occurred. Since that time the funding of the Plan has steadily increased, but the funded ratio is still very low and the amount of the UAAL is significant for a plan of this size. As the State continues to fund the Judges Plan, the funded ratio is expected to increase and eventually reach 100% if all actuarial assumptions are met in future years.

The UAAL, using both the actuarial and market value of assets, is shown as of June 30, 2020 in the following table:

	Actuarial Value of Assets	Market Value of Assets
Actuarial Accrued Liability	\$624,847,011	\$624,847,011
Value of Assets	<u>180,713,310</u>	<u>167,288,066</u>
Unfunded Actuarial Accrued Liability	\$444,133,701	\$457,558,945
Funded Ratio	28.92%	26.77%

See Section 4 of the report for the detailed development of the UAAL.



## SECTION 1 – EXECUTIVE SUMMARY

The net change in the UAAL from June 30, 2019 to June 30, 2020 was a decrease of \$1.2 million. The components of this net change are shown in the following table:

	(\$ Millions)
<b>Unfunded Actuarial Accrued Liability, June 30, 2019</b>	\$445.3
- Expected increase from amortization method	3.3
- Investment experience	4.6
- Liability experience	(3.1)
- Change to economic assumptions	6.3
- Refinement of COLA programming	(11.8)
- Other experience	<u>(0.5)</u>
<b>Unfunded Actuarial Accrued Liability, June 30, 2020</b>	\$444.1

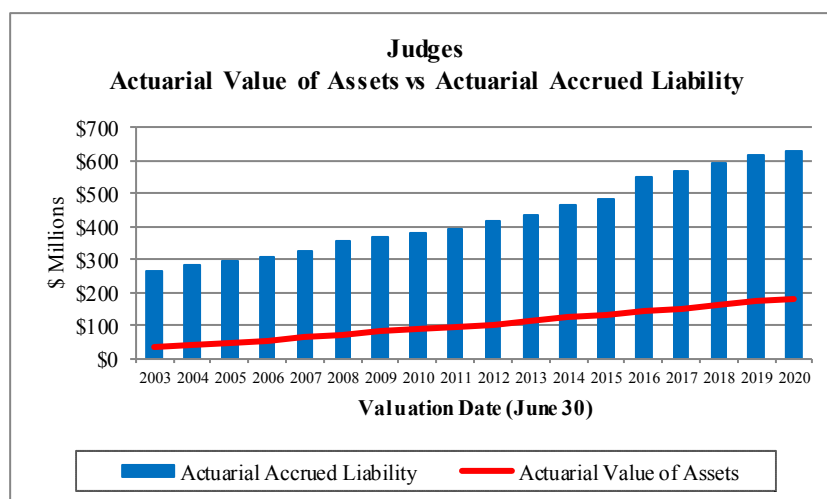
As shown above, various components impacted the dollar amount of the UAAL. The UAAL is amortized as a level-percent of payroll. This methodology results in dollar payment amounts that are lower in the early part of the amortization period but increase each year in the future with the assumed payroll growth assumption (currently 2.25%). Given the amortization period and the actuarial assumptions, the current amortization payment is less than the interest on the UAAL. As a result, even if all assumptions are met the dollar amount of the UAAL is expected to increase as evidenced in the first row of this table.

Actuarial gains (losses), which result from actual experience that is more (less) favorable than anticipated based on the actuarial assumptions in place in the prior valuation, are reflected in the UAAL and are measured as the difference between the expected UAAL and the actual UAAL, taking into account any changes due to actuarial assumptions and methods, benefit provision changes or valuation programming changes. Overall, Judges experienced a net actuarial loss of \$1.4 million, the net result of an actuarial loss of \$4.6 million on actuarial assets and a \$3.1 million actuarial gain on System liabilities. The most significant sources of liability gain were lower cost-of-living adjustments than expected, based on the valuation assumptions, as well as lower salary increases than expected. A breakdown of the components of actuarial gains and losses can be found in Table 7 of this report.

As the following graph of historical actuarial assets and actuarial accrued liabilities shows, due to the magnitude of the contributions to the Plan, the assets have been growing at a faster rate than the liabilities. As a result, the Plan's funded ratio has steadily improved over time.



**SECTION 1 – EXECUTIVE SUMMARY**



An evaluation of the UAAL on a pure dollar basis may not provide a complete analysis since only the difference between the assets and liabilities (which are both large numbers) is reflected. Another way to evaluate the UAAL and the progress made in its funding is to track the funded ratio, the ratio of the actuarial value of assets to the actuarial accrued liability. The funded status information, using both the actuarial value of assets and the market value of assets, is shown in the following table (in millions).

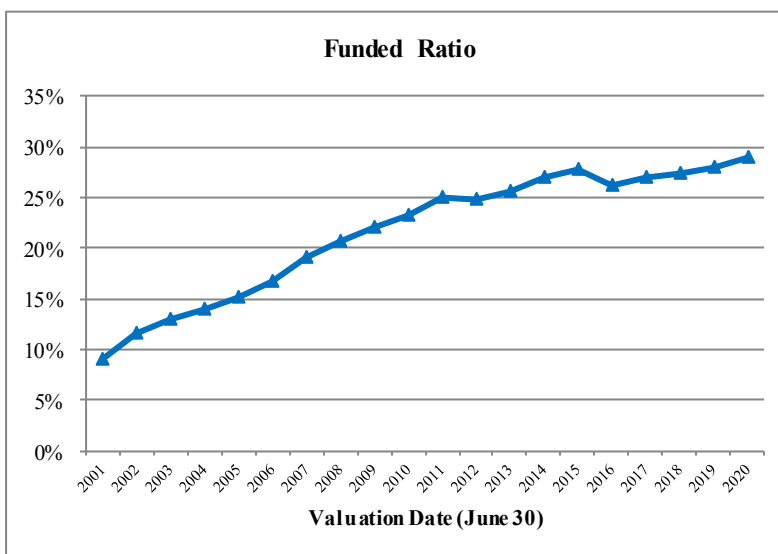
	6/30/2015	6/30/2016	6/30/2017	6/30/2018	6/30/2019	6/30/2020
Using Actuarial Value of Assets:						
- Funded Ratio	27.8%	26.2%	26.9%	27.3%	27.9%	28.9%
- UAAL (\$M)	\$349	\$404	\$413	\$432	\$445	\$444
Using Market Value of Assets:						
- Funded Ratio	27.1%	24.1%	24.4%	25.3%	25.6%	26.8%
- UAAL (\$M)	\$352	\$416	\$427	\$444	\$459	\$458

Note that the funded ratio does not indicate whether or not the System assets are sufficient to settle benefits earned to date. The funded ratio, by itself, also may not be indicative of future funding requirements. As shown in the table above, the funded ratios differ using the market value of assets.



## SECTION 1 – EXECUTIVE SUMMARY

The funded ratio over a longer period is shown in the following graph:



Typically plans that have been in existence as long as Judges (over 40 years) have a funded ratio well above the current level of 29%. However, until 1999, Judges was funded on a pay-as-you-go basis. As a result, each year’s contribution was equal to the benefit payments and administrative expenses for that year only, i.e., the funded ratio was 0%. As a result of a change in funding policy that required contributions to equal the normal cost plus an amortization payment on the UAAL, the funded ratio has steadily increased over time. Assuming future experience follows the current actuarial assumptions, continued contributions under the current funding policy will allow the funded ratio to increase, until the UAAL is fully amortized in 2050, and the funded ratio reaches 100%.

### Actuarial Required Contribution Rate

The Plan is funded by contributions from employers (actuarially determined) and employees hired after December 31, 2010 (4.00% of pay). Under the Entry Age Normal cost method, the actuarial contribution rate consists of two components:

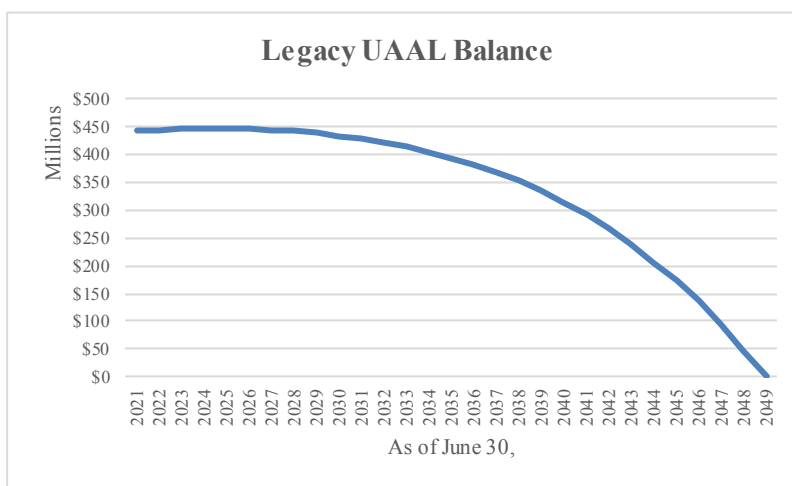
- A “normal cost” for the portion of projected liabilities allocated by the actuarial cost method to service of members during the year following the valuation date.
- An “unfunded actuarial accrued liability contribution” for the excess of the portion of projected liabilities allocated to service to date over the actuarial value of assets.

Under the System’s current funding policy, the UAAL contribution rate is determined by amortizing the UAAL using the layered amortization method. To implement this method, the projected UAAL developed in the June 30, 2018 valuation was amortized as a level-percent of payroll over a closed, 30-year period. In subsequent years (starting with the 2019 valuation), changes to the projected UAAL that are generated by actuarial experience that is different than expected or changes in assumptions and methods will be amortized as a level-percent of payroll over separate closed, 30-year periods beginning on that date. Any change in the UAAL due to changes in the benefit provisions will be amortized over a closed 20-year period, as required by statute. Note that the use of closed amortization periods for each layer will eventually result in the System being fully funded if the full actuarial contribution is made and all actuarial assumptions are met in the future.



**SECTION 1 – EXECUTIVE SUMMARY**

The level-percent of payroll methodology for UAAL payments results in dollar payment amounts that are lower than the level-dollar payment method in the early portion of the amortization period, but increase each year in the future with the assumed payroll growth assumption (currently 2.25%). Because the UAAL contribution rate is determined as a level-percent of payroll, the dollar amount of the UAAL contribution is scheduled to increase 2.25% each year in the future, even if all actuarial assumptions are met. If covered payroll increases, as expected based on the assumption, the contribution rate will remain stable. However, if actual payroll increases are lower than 2.25% the UAAL contribution rate will increase. Note that with this payment methodology the dollar amount of the UAAL is expected to hold steady for about eight years before starting to decline as illustrated in the following graph of the legacy UAAL base:



See Section 5 of the report for the detailed development of the employer contribution rate, which is summarized in the following table:

Contribution Rates	June 30 Valuation*	
	2020	2019
1. Normal Cost Rate	20.53%	21.28%
2. UAAL Contribution Rate	43.67%	44.21%
3. Total Actuarial Required Contribution Rate	64.20%	65.49%
4. Member Contribution Rate	(2.26%)	(2.11%)
5. Employer Contribution Rate	61.94%	63.38%

\*Note different assumptions were used in the two valuation reports so results are not directly comparable.

The total actuarial required contribution rate in the June 30, 2020 valuation is 64.20%. The member contribution rate (as a percentage of total payroll) is anticipated to be 2.26%, resulting in an employer contribution rate for the fiscal year ending June 30, 2022 of 61.94%. This amount exceeds the minimum employer contribution of 58.45%, as required by the Funding Policy.

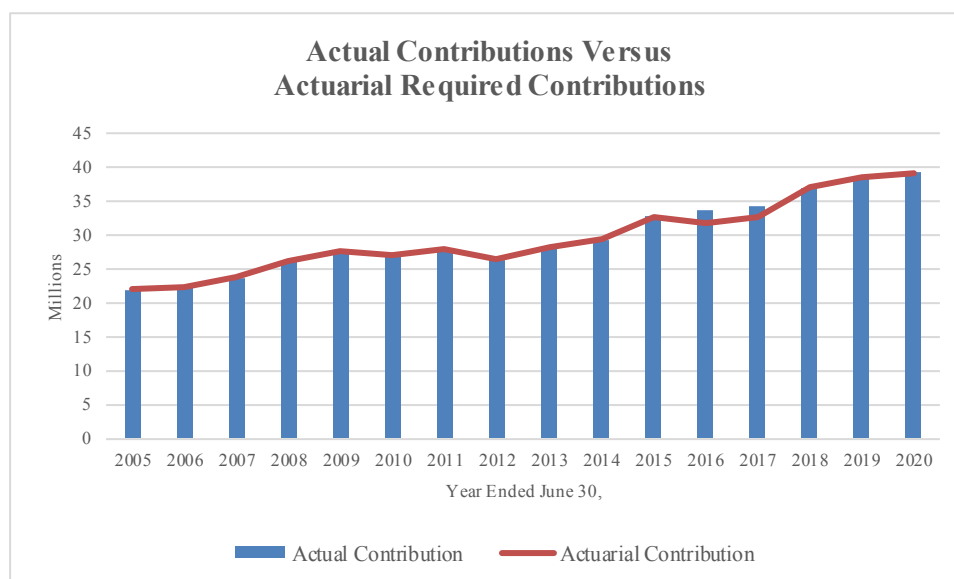


**SECTION 1 – EXECUTIVE SUMMARY**

The following table shows the reconciliation of the Computed Employer Contribution Rate from June 30, 2019 to June 30, 2020 valuation:

	<b>% of Payroll</b>
<b>6/30/2019 Computed Employer Contribution Rate</b>	<b>63.38%</b>
Asset (Gain)/Loss	0.46%
Liability (Gain)/Loss	(0.32%)
Change to Economic Assumptions	0.78%
Refinement of COLA programming	(1.83%)
Projected Payroll Lower than Expected	0.16%
Change in Normal Cost Rate	(0.47%)
Change in Effective Member Contribution Rate	(0.15%)
Other Experience	(0.07%)
<b>6/30/2020 Computed Employer Contribution Rate</b>	<b>61.94%</b>

The state of Missouri has historically contributed the full actuarial contribution as shown in the graph below which compares the computed employer contribution rates and actual contribution amounts:

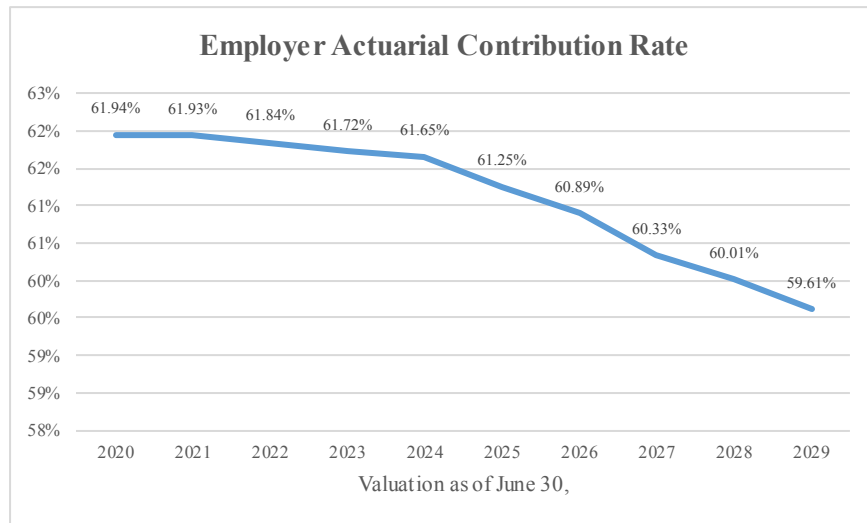


The computed employer contribution rate, which is determined based on the snapshot of the System taken on each valuation date, is anticipated to increase over the short-term as the deferred investment experience is recognized through the asset smoothing method. Anticipated increases in member contributions, as a percentage of total payroll, will provide an offset to the increase in the employer contribution rate. Future experience (both investment and demographic), which is not modeled here, will also have an impact on the ultimate level of contributions for the Judges System. The following graph of the projected employer contribution rate over the next ten years reflects the impact of the recognition of the deferred investment experience (\$13.4 million). Once the deferred investment experience is recognized, the employer contribution rate begins to decline as the normal cost rate decreases and the effective employee contribution rate increases due to more Judges 2011 members joining the System.





**SECTION 1 – EXECUTIVE SUMMARY**



The net deferred investment losses (difference between the actuarial value and market value of assets) is \$13.4 million as of June 30, 2020. Absent favorable investment experience in future years, the deferred investment losses will eventually be reflected in the actuarial value of assets in future years. While the use of an asset smoothing method is a common procedure for public retirement systems, it is important to recognize the potential impact of the deferred investment experience. This is accomplished by comparing the key valuation results from the June 30, 2020 actuarial valuation using both the actuarial and market value of assets (see table below):

	Using Actuarial Value of Assets	Using Market Value of Assets
Actuarial Accrued Liability	\$624,847,011	\$624,847,011
Asset Value	<u>(180,713,310)</u>	<u>(167,288,066)</u>
Unfunded Actuarial Accrued Liability	\$444,133,701	\$457,558,945
Funded Ratio	28.9%	26.8%
Normal Cost Rate	20.53%	20.53%
UAAL Contribution Rate	<u>43.67%</u>	<u>45.03%</u>
Total Contribution Rate	64.20%	65.56%
Member Contribution Rate	<u>(2.26%)</u>	<u>(2.26%)</u>
Employer Contribution Rate	61.94%	63.30%



## SECTION 1 – EXECUTIVE SUMMARY

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A typical retirement plan faces many different risks. The term “risk” is most commonly associated with an outcome with undesirable results. However, in the actuarial world risk can be translated as uncertainty. The actuarial valuation process uses many actuarial assumptions to project how future contributions and investment returns will meet the cash flow needs for future benefit payments. Of course, we know that actual experience will not unfold exactly as anticipated by the assumptions and that uncertainty, whether favorable or unfavorable, creates risk. Actuarial Standard of Practice Number 51 defines risk as the potential of actual future measurements to deviate from expected results due to actual experience that is different than the actuarial assumptions. Risk evaluation is an important part of managing a defined benefit plan. Please see Section 7 of this report for an in-depth discussion of the specific risks facing MOSERS.

The next page contains a comprehensive summary of valuation results for the current and prior year. Detailed exhibits deriving the results are in the following sections.

**SECTION 1 – EXECUTIVE SUMMARY****SUMMARY OF PRINCIPAL RESULTS**  
(\$ in millions)

<b>Valuation Date</b>	<b>June 30, 2020</b>	<b>June 30, 2019</b>	
<b>Contribution for Fiscal Year Ending</b>	<b>June 30, 2022</b>	<b>June 30, 2021</b>	<b>% Change</b>
<b>Computed Employer Contribution</b>			
Annual Amount (Estimated)	\$40.1	\$40.3	(0.5%)
Percentage of Covered Payroll	61.94%	63.38%	(2.3%)
<b>Benefit Payments During Prior Year</b>	\$39.6	\$37.6	5.3%
<b>Membership</b>			
Number of			
- Active Members	418	414	1.0%
- Retirees and Beneficiaries	590	585	0.9%
- Terminated Vested Members	35	36	(2.8%)
- Leave-of-Absence Members	0	0	0.0%
- Long Term Disability Members	0	0	0.0%
- Total	1,043	1,035	0.8%
- Reported Payroll	\$61.5	\$60.4	1.8%
<b>Assets</b>			
Market Value (MVA)	\$167.3	\$158.3	5.7%
Actuarial Value (AVA)	\$180.7	\$172.2	4.9%
Ratio - Actuarial Value to Market Value	108%	109%	
Return on Market Value*	5.2%	4.3%	
Return on Actuarial Value	4.5%	4.9%	
<b>Actuarial Information</b>			
Actuarial Accrued Liability (AAL)	\$624.8	\$617.5	1.2%
Unfunded Actuarial Accrued Liability (UAAL)	\$444.1	\$445.3	(0.3%)
Funded Ratio (Actuarial Value of Assets)	28.9%	27.9%	3.6%
Ratio of AVA to Payroll	2.9	2.9	
Ratio of AAL to Payroll	10.2	10.2	
Normal Cost Rate	20.53%	21.28%	(3.5%)
UAAL Contribution Rate	43.67%	44.21%	(1.2%)
Total Contribution Rate	64.20%	65.49%	(2.0%)
Member Contribution Rate	(2.26%)	(2.11%)	7.1%
Employer Contribution Rate	61.94%	63.38%	(2.3%)

\* As reported by MOSERS.



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## **SECTION 2 – SCOPE OF THE REPORT**

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This report presents the actuarial valuation results of the Missouri State Employees' Retirement System – Judges as of June 30, 2020. This valuation was prepared at the request of the MOSERS Board.

Please pay particular attention to our actuarial certification letter, where the guidelines employed in the preparation of this report are outlined. We also comment on the sources and reliability of both the data and the actuarial assumptions upon which our findings are based. Those comments are the basis for our certification that this report is complete and accurate to the best of our knowledge and belief.

A summary of the findings which result from this valuation is presented in the previous section. Section 3 describes the assets and investment experience of the System. Sections 4 and 5 describe how the obligations of the System are to be met under the System's funding policy. Section 6 contains projections of future valuation results, assuming all actuarial assumptions are met. Section 7 discloses key maturity measurements and discusses the key risks facing the funding of the System. Section 8 includes some historical funding information that was required by the Governmental Accounting Standards Board (GASB) in the past.



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### **SECTION 3 – SYSTEM ASSETS**

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In many respects, an actuarial valuation can be thought of as an inventory process. The inventory is taken as of the actuarial valuation date, which for this valuation is June 30, 2020. On that date, the assets available for the payment of benefits are appraised. The assets are compared with the liabilities of the System, which are generally in excess of assets. The actuarial process then leads to a method of determining the contributions needed by members and the employer in the future to balance the System assets and liabilities.

#### **Market Value of Assets**

The current market value represents the "snapshot" or "cash-out" value of System assets as of the valuation date. In addition, the market value of assets provides a basis for measuring investment performance from time to time. Table 1 shows a summary of changes to both the market and the actuarial value assets for the year beginning June 30, 2019 and ending June 30, 2020.

#### **Actuarial Value of Assets**

Neither the market value of assets, representing a "cash-out" value of System assets, nor the book values of assets, representing the cost of investments, may be the best measure of the System's ongoing ability to meet its obligations.

To arrive at a suitable value of assets for the actuarial valuation, a technique for determining the actuarial value of assets is used which dampens swings in the market value while still indirectly recognizing market values.

Table 2 shows the development of the actuarial value of assets (AVA) as of the valuation date.



TABLE 1  
ASSET SUMMARY

	Judges	
	Market Value	Actuarial Value
1. Assets at June 30, 2019	158,332,990	172,224,529
2. Contributions		
State Contributions	39,174,515	39,174,515
Employee Contributions	1,314,570	1,314,570
Member Purchases of Service Credit	0	0
Total	40,489,085	40,489,085
3. Investment Income, Net of Investment Expenses	8,162,709	7,696,414
4. Benefit Payments		
Monthly Benefit Payments	39,622,268	39,622,268
Contribution Refunds	0	0
Total	39,622,268	39,622,268
5. Administrative and Misc. Expenses	74,450	74,450
6. Assets at June 30, 2020 (1) + (2) + (3) - (4) - (5)	167,288,066	180,713,310
7. Rate of Return, Net of Investment Expenses*	5.2%	4.5%

\* Based on the approximation formula:  $(2 \times I) / (A+B-I)$ , where  
I = Investment Increment  
A = Beginning of year asset value  
B = End of year asset value

Market value return reported by MOSERS





SECTION 3 – SYSTEM ASSETS

TABLE 2
DEVELOPMENT OF ACTUARIAL VALUE OF ASSETS

Under the current asset smoothing method, the difference between the actual and assumed investment return on the market value of assets will be recognized evenly over a closed five-year period. The method was first implemented with the June 30, 2018 valuation. Deferred asset experience as of June 30, 2017 will be recognized evenly over a closed seven-year period, beginning June 30, 2018.

Table with 5 columns: Fiscal Year End June 30, 2018, 2019, 2020, 2021. Rows include Market Value of Assets, Contributions, Benefit Payments, Expected Rate of Return, Expected Net Investment Income, Expected Market Value of Assets, and Excess/(Shortfall) of Net Investment Income.

The table below shows the development of gain/(loss) to be recognized in the current year:

Table with 5 columns: Plan Year Ended, Asset Gain/(Loss), Gain/(Loss) Recognized in Prior Years, Gain/(Loss) Recognized This Year, Gain/(Loss) Deferred to Future Years. Rows show data for 6/30/2017, 6/30/2018, 6/30/2019, 6/30/2020, and a Total row.

Table with 2 columns: Description, Value. Rows include Market Value of Assets as of June 30, 2020, Total Deferred Investment Experience, Actuarial Value of Assets as of June 30, 2020 (A. - B.), and Ratio of Actuarial Value to Market Value.

\* The unrecognized investment experience as of June 30, 2017 will be recognized over a closed seven-year period.



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## SECTION 4 – SYSTEM LIABILITIES

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In the previous section, an analysis of System’s current assets was given as of June 30, 2020. In this section, the discussion will focus on the commitments (future benefit payments) of the System, which are referred to as its liabilities.

Table 3 contains an analysis of the actuarial present value of all future benefits (PVFB) for contributing members, inactive members, retirees and their beneficiaries. The liabilities summarized in Table 3 include the actuarial present value of all future benefits expected to be paid with respect to each member. For an active member, this value includes measures of both benefits already earned and future benefits expected to be earned. For all members, active and retired, the value extends over benefits earnable and payable for the rest of their lives and, if an optional benefit is chosen, for the lives of their surviving spouses.

The actuarial assumptions used to determine liabilities are based on the results of the latest experience study. These assumptions are outlined in Appendix C.

The Board’s funding policy amortizes the UAAL using a “layered” bases method. Under this method, the “Legacy UAAL”, as determined in the June 30, 2018 valuation, is amortized over a closed 30-year period (see Table 4). Subsequent changes in the UAAL due to actuarial gains/losses or assumption changes are separately financed by establishing amortization bases and payments, as a level percentage of payroll, over closed 30-year periods. Any change in the System’s benefit structure shall be amortized over a closed period of 20 years, as set out in state statutes. The total UAAL amortization payment is the sum of the payments for each of the amortization bases. Note that the use of closed amortization periods will result in the System being fully funded at the end of the amortization period, if all actuarial assumptions are met.

All liabilities reflect the benefit provisions in place as of June 30, 2020, as amended by any legislation in the 2020 Legislative Session.

### **Actuarial Accrued Liability**

A fundamental principle in financing the liabilities of a retirement program is that the cost of its benefits should be related to the period in which benefits are earned, rather than to the period of benefit distribution. An actuarial cost method is a mathematical technique that allocates the present value of future benefits into annual costs. In order to do this allocation, it is necessary for the funding method to "breakdown" the present value of future benefits into two components:

- (1) that which is attributable to the past and
- (2) that which is attributable to the future.

Actuarial terminology calls the part attributable to the past the "past service liability" or the "actuarial accrued liability." The portion allocated to the future is known as the present value of future normal costs, with the specific piece of it allocated to the current year being called the "normal cost." Table 5 contains the actuarial balance sheet for the System. The Entry Age Normal actuarial cost method is used to develop the actuarial accrued liability. Table 6 shows the gain/(loss) analysis in total for the System.



**TABLE 3**  
**UNFUNDED ACTUARIAL ACCRUED LIABILITY**  
**As of June 30, 2020**

	(1)	(2)	(3) = (1) - (2)
	Actuarial Present Value	Present Value of Future Normal Cost Contributions	Actuarial Accrued Liabilities
<b>Active Members</b>			
Service retirement benefits based on service rendered before and likely to be rendered after valuation date	\$247,658,089	\$76,019,676	\$171,638,413
Disability benefits likely to be paid to present active members who become totally and permanently disabled	1,531,536	1,338,531	193,005
Survivor benefits likely to be paid to widows and children of present active members who die before retiring	5,300,341	3,520,374	1,779,967
Separation benefits likely to be paid to present active members	9,517,097	9,386,218	130,879
Active Member Totals	\$264,007,063	\$90,264,799	\$173,742,264
<b>Members on Leave of Absence &amp; LTD</b>			
Service retirement benefits based on service rendered before the valuation date			0
<b>Terminated Vested Members</b>			
Service retirement benefits based on service rendered before the valuation date			15,090,164
<b>Retired Lives</b>			436,014,583
<b>Total Actuarial Accrued Liability</b>			\$624,847,011
<b>Actuarial Value of Assets</b>			180,713,310
<b>Unfunded Actuarial Accrued Liability</b>			\$444,133,701
<b>Funded Ratio</b>			28.9%



**TABLE 4  
AMORTIZATION SCHEDULE FOR LEGACY UAAL**

This amortization schedule for the outstanding balance of the legacy UAAL as of June 30, 2021 reflects the underlying assumptions used in this valuation including an investment return assumption of 6.95% and the assumed payroll growth of 2.25%. Any change in these assumptions in the future, will impact the amortization schedule for the legacy UAAL.

As of June 30	Outstanding Balance (BOY)	Amortization Years Remaining	Contributions (\$M)
2021	442	28	28
2022	444	27	29
2023	445	26	29
2024	446	25	30
2025	446	24	31
2026	445	23	31
2027	443	22	32
2028	441	21	33
2029	438	20	34
2030	434	19	34
2031	428	18	35
2032	422	17	36
2033	414	16	37
2034	405	15	38
2035	394	14	38
2036	382	13	39
2037	368	12	40
2038	352	11	41
2039	334	10	42
2040	314	9	43
2041	291	8	44
2042	266	7	45
2043	238	6	46
2044	207	5	47
2045	173	4	48
2046	136	3	49
2047	95	2	50
2048	50	1	51
2049	0	0	0



**TABLE 5**  
**ACTUARIAL BALANCE SHEET**

ASSETS

Actuarial Value of Assets		\$	180,713,310
Unfunded Actuarial Accrued Liability			444,133,701
Present Value of Future Normal Costs			<u>90,264,799</u>
Total Assets		\$	715,111,810

LIABILITIES

Present Value of Future Benefits

Active members

Retirement	\$	247,658,089	
Withdrawal		9,517,097	
Death		5,300,341	
Disability		<u>1,531,536</u>	
Total	\$		264,007,063

Inactive members

Currently receiving benefits		436,014,583	
Not currently receiving benefits		<u>15,090,164</u>	
Total	\$		451,104,747

Total Liabilities		\$	715,111,810
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SECTION 4 – SYSTEM LIABILITIES

TABLE 6  
ANALYSIS OF GAIN/(LOSS)

	(1) Actuarial Accrued Liabilities	(2) Valuation Assets	(3) = (1) - (2) UAAL
(1) Value at start of year	\$ 617,482,705	\$ 172,224,529	\$ 445,258,176
(2) Total normal cost from last valuation	12,249,903	0	12,249,903
(3) Actual contributions (Employer and Member)	0	40,489,085	(40,489,085)
(4) Benefit payments	(39,622,268)	(39,622,268)	0
(5) Administrative expenses	0	(74,450)	74,450
(6) Interest on (1), (2), (3), (4) and (5) at 7.10%	<u>43,328,543</u>	<u>12,255,588</u>	<u>31,072,955</u>
(7) Expected value before changes	\$ 633,438,883	\$ 185,272,484	\$ 448,166,399
(8) Change in actuarial assumptions and methods	6,341,771	0	6,341,771
(9) Refinement of COLA programming	<u>(11,806,199)</u>	<u>0</u>	<u>(11,806,199)</u>
(10) Expected value after changes: (7) + (8) + (9)	\$ 627,974,455	\$ 185,272,484	\$ 442,701,971
(11) Actual value at end of year	624,847,011	180,713,310	444,133,701
(12) Gain / (Loss)	\$ 3,127,444	\$ (4,559,174)	\$ (1,431,730)
(13) Gain / (Loss) as percent of expected actuarial accrued liabilities: \$633,438,883	0.5%	(0.7%)	(0.2%)



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## SECTION 5 – EMPLOYER CONTRIBUTIONS

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The previous two sections were devoted to a discussion of the Judges' assets and liabilities. Table 5 indicates that current assets fall short of meeting the present value of future benefits (total liability). This is expected in all but a completely closed fund, where no further contributions are anticipated. In an active system, there will almost always be a difference between the actuarial value of assets and total liabilities. This deficiency has to be made up by future contributions and investment returns. An actuarial valuation sets out a schedule of future contributions that will fund this deficiency in an orderly fashion.

The method used to determine the incidence of the contributions in various years is called the actuarial cost method. Under an actuarial cost method, the contributions required to meet the difference between current assets and current liabilities are allocated each year between two elements: (1) the normal cost rate and (2) the unfunded actuarial accrued liability contribution rate.

The term "fully funded" is often applied to a system in which contributions at the normal cost rate are sufficient to pay for the benefits of existing employees as well as for those of new employees. More often than not, systems are not fully funded, either because of past benefit improvements that have not been completely funded or because of actuarial deficiencies that have occurred because experience has not been as favorable as anticipated by the actuarial assumptions. Under these circumstances, an unfunded actuarial accrued liability (UAAL) exists. Likewise, when the actuarial value of assets is greater than the actuarial accrued liability, a surplus exists.

### Description of Contribution Rate Components

The Entry Age Normal (EAN) actuarial cost method is used for the valuation. Under that method, the normal cost for each year from entry age to assumed exit age is a constant percentage of the member's year by year projected compensation. The portion of the present value of future benefits not provided by the present value of future normal costs is the actuarial accrued liability. The unfunded actuarial accrued liability represents the difference between the actuarial accrued liability and the actuarial value of assets as of the valuation date. The unfunded actuarial accrued liability is calculated each year and reflects experience gains and losses.

In general, contributions are computed in accordance with a level percent-of-payroll funding objective. The contribution rate based on the June 30, 2020 actuarial valuation will be used to determine the actuarial employer contribution rate for the plan year ending June 30, 2022. In this context, the term "contribution rate" means the percentage, which is applied to the active member payroll to determine the actual employer contribution amount (i.e., in dollars) for the group.

### Contribution Rate Summary

Table 7 shows the development of the June 30, 2021 projected UAAL. In Table 8, the amortization payment related to the UAAL is developed. Table 9 develops the computed employer contribution rate for the Plan and the estimated amount of required State contributions. Table 10 shows estimated contribution amounts if the employer contributions are paid early on July 15, September 1 or November 1. Amounts are shown for both the UAAL payment only and the total employer contribution.

The contribution rates shown in this report are based on the actuarial assumptions and cost methods described in Appendix C.



**TABLE 7**  
**PROJECTED UAAL AS OF JUNE 30, 2021**

(1) Unfunded Actuarial Accrued Liability at June 30, 2020	\$444,133,701
(2) Expected Contribution Rate for Year Ending June 30, 2021*	65.49%
(3) Normal Cost Rate for Year Ending June 30, 2021	20.53%
(4) Contribution Rate Applied to UAAL [(2) - (3)]	44.96%
(5) Projected Payroll for the Year After the Valuation Date	\$63,351,430
(6) Expected UAAL Contribution [(4) * (5)]	\$28,482,803
(7) Interest on (1) and (6) to June 30, 2021 at 6.95%	\$29,894,139
(8) Projected UAAL at June 30, 2021 [(1) - (6) + (7)]	\$445,545,037

\*The Total Contribution Rate was the employer rate of 63.38% plus the weighted average member rate of 2.11% of payroll.



SECTION 5 – EMPLOYER CONTRIBUTIONS

TABLE 8  
UAAL CONTRIBUTION RATE

Amortization Base	Original Amount	Remaining Payments	Projected June 30, 2021 Balance	Annual Payment*
2018 Legacy UAAL	\$ 435,941,756	28	\$ 442,354,455	\$ 28,082,851
2019 Assumption Changes	5,024,057	29	5,059,828	315,716
2019 Experience Base	3,858,637	29	3,886,110	242,480
2020 Assumption Changes	6,341,771	30	6,341,771	389,324
2020 Experience Base	\$ (12,097,127)	30	(12,097,127)	(742,649)
<b>Total</b>			<b>\$ 445,545,037</b>	<b>\$ 28,287,722</b>

\* Payment amount reflects mid-year timing.

- 1. Total UAAL Amortization Payments \$ 28,287,722
- 2. Expected Payroll for FYE 2022 \$ 64,776,837
- 3. UAAL Amortization Payment Rate 43.67%  
(1) / (2)



**SECTION 5 – EMPLOYER CONTRIBUTIONS**

**TABLE 9  
COMPUTED EMPLOYER CONTRIBUTION RATE  
FOR THE FISCAL YEAR ENDING JUNE 30, 2022**

**ACTUARIAL VALUATION RESULTS AS OF JUNE 30, 2020**

	Percent of Payroll		Weighted Average
	Pre 1/1/2011 Hires	Post 1/1/2011 Hires	
A. Normal Cost			
(1) Service retirement benefits	17.48 %	17.29 %	17.37 %
(2) Termination benefits	2.47	1.58	1.97
(3) Survivor benefits	0.63	0.89	0.78
(4) Disability benefits	0.26	0.31	0.29
(5) Administrative expenses	0.12	0.12	0.12
(6) Total	20.96	20.19	20.53
B. Less Member Contributions	0.00	4.00	2.26
C. Employer Normal Cost [A(6) - B]	20.96	16.19	18.27
D. Unfunded Actuarial Accrued Liabilities (UAAL) (level percent-of-payroll amortization with layered bases)			43.67
<b>E. TOTAL COMPUTED EMPLOYER CONTRIBUTION RATE [C. + D.]</b>			<b>61.94 %</b>
<b>F. POLICY MINIMUM EMPLOYER CONTRIBUTION RATE</b>			<b>58.45 %</b>
<b>G. ESTIMATED EMPLOYER CONTRIBUTION (\$Millions) #</b>			<b>\$40.1</b>

At the September 18, 2014 meeting, the Board adopted a policy minimum contribution rate so that the employer contribution rate shall not fall below the fiscal 2015 rate (58.45% of payroll) until the plan is 80% funded.

# Illustrative only. Estimated employer contribution amounts (shown in millions) are based on the greater of the Total Computed Employer Contribution Rate and the Policy Minimum Contribution Rate shown and the valuation payroll projected two years to the applicable fiscal year using the valuation assumption of 2.25% per year.



**SECTION 5 – EMPLOYER CONTRIBUTIONS**

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**TABLE 10  
EARLY PAYMENT AMOUNTS FOR FISCAL YEAR 2022**

Section 104.436, RSMo. describes the certified contribution rate the employer shall pay in accordance with its ordinary course payrolls during each fiscal year. Per a Board Rule adopted during 2020, the employer may elect to pre-pay the amount for the unfunded actuarial accrued liability (UAAL) only or the total contribution which also includes the normal cost rate, on July 15, September 1, or November 1. At the end of the fiscal year, actual payroll will be compared to assumed payroll and an adjustment will be made to the total contributions paid, in either an additional amount paid by the employer or a credit to reduce future payments.

This exhibit is for informational purposes only and all payment amounts should be confirmed with MOSERS. Payment amounts are adjusted to payment dates using the assumed rate of return (6.95%) used in the actuarial funding valuation and assuming all scheduled payments are made prior to the one-time payment date.

	<b>Expected Payroll for FY 2022</b>	<b>Total FY 2022 Payments</b>	<b>FY 2022 Contribution Rate</b>	<b>One-Time Payment, adjusted for expected payroll contributions to date:</b>			<b>Additional Payroll Contributions</b>
				<b>July 15</b>	<b>September 1</b>	<b>November 1</b>	
UAAL Payment Only	64,776,837	28,287,722	43.67%	26,286,940	23,051,002	18,648,472	18.27%
Full Employer Contribution	64,776,837	40,122,773	61.94%	37,284,902	32,695,107	26,450,642	0.00%



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## SECTION 6 – PROJECTIONS

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The June 30, 2020 valuation results present the System’s financial status at a single point in time and contribution requirements for a single fiscal year. Historical valuation results allow analysis of past trends, but no insight into future trends. A projection model provides insight into the longer term trend of (1) the projected Employer contributions; (2) the projected System funded status (ratio of actuarial assets over liabilities); (3) net cash flow patterns; and (4) the unfunded actuarial accrued liability (actuarial accrued liability minus actuarial assets). Projections can also be used to demonstrate how sensitive the valuation results are to the key variables being modeled. Such sensitivity analysis can be found in Section 7 of this report.

For Judges, projections are particularly important and insightful due to the multiple-tiered benefit structure. The current valuation produces a normal cost and actuarial accrued liability based on the composition of active members on the valuation date, June 30, 2020. Without a tiered structure, systems can assume that the normal cost, as a percentage of payroll, will remain relatively level. However, since all new employees are covered under a less costly benefit structure, until all new employees are covered under the post-2010 benefit structure, the normal cost percentage will continue to decrease. In addition, members hired after 2010 are the only group making employee contributions so projections allow for the projected payroll to be segregated by tier so that total future contributions reflect an estimate of the amounts to be contributed by employees.

The member data (active and in-pay status) is projected for each year in the future using current assumptions. After the first year, a new-member profile is used to estimate the demographics of new employees replacing members who are projected to terminate, retire, die or become disabled in future years. ***For this modeling, the number of active members is assumed to remain level over the projection period.***

These projections in this section assume that all actuarial assumptions are met in all future years, including the investment return assumption, and that the Employer makes contributions equal to the full amount of the actuarially determined contribution, as calculated by the valuation, based on the Board’s Funding Policy. The projections are based on the current plan provisions and assume that all new members joining after June 30, 2020 will make employee contributions and participate in the post-2010 benefit structure.

**The projections do not predict the System’s financial condition or its ability to pay benefits in the future and do not provide any guarantee of future financial soundness of the System nor do they, on their own, indicate future funding requirements.** Over time, a defined benefit plan’s total cost will depend on a number of factors, including the amount of benefits paid, the number of people paid benefits, plan expenses and the amount of earnings on assets invested to pay benefits. These amounts, and other variables, are uncertain and unknowable at the time the projections were prepared. Because not all of the assumptions will unfold exactly as expected, actual results will differ from the projections shown.



SECTION 6 – PROJECTIONS

**TABLE 11  
PROJECTION OF FUTURE ACTUARIAL VALUATION RESULTS  
AS OF JUNE 30, 2020**

Projection Based on Assumptions Outlined in Appendix D (Amounts in thousands)											
Valuation as of June 30, (1)	Covered Payroll at Valuation (2)	Actuarial Accrued Liability (AAL) (3)	Actuarial Value of Assets (AVA) (4)	Unfunded AAL (5)	Funded Ratio Using AVA (6)	Normal Cost Rate (7)	UAAL Amortization Payment Rate (8)	Actuarial Contribution Rate (9)	Member Contribution Rate (10)	Employer Actuarial Contribution Rate* (11)	Estimated Dollar Amount of Employer Contribution** (12)
2020	\$63,351	\$624,847	\$180,713	\$444,134	28.9%	20.53%	43.67%	64.20%	2.26%	61.94%	\$40,131
2021	64,791	638,154	188,431	449,723	29.5%	20.35%	44.06%	64.41%	2.48%	61.93%	41,039
2022	66,267	650,199	194,760	455,439	30.0%	20.12%	44.41%	64.53%	2.69%	61.84%	41,932
2023	67,808	661,141	200,779	460,361	30.4%	19.91%	44.70%	64.61%	2.89%	61.72%	42,772
2024	69,301	670,283	207,036	463,247	30.9%	19.78%	44.92%	64.70%	3.05%	61.65%	43,760
2025	70,982	678,995	216,145	462,850	31.8%	19.66%	44.79%	64.45%	3.20%	61.25%	44,525
2026	72,695	686,817	225,417	461,400	32.8%	19.55%	44.66%	64.21%	3.32%	60.89%	45,347
2027	74,474	694,057	234,875	459,182	33.8%	19.25%	44.50%	63.75%	3.42%	60.33%	46,003
2028	76,252	699,823	244,175	455,649	34.9%	19.17%	44.36%	63.53%	3.52%	60.01%	46,885
2029	78,129	705,464	253,864	451,600	36.0%	18.99%	44.21%	63.20%	3.59%	59.61%	47,714
2030	80,043	710,412	264,098	446,314	37.2%	18.87%	44.05%	62.92%	3.67%	59.25%	48,575
2031	81,983	714,773	274,857	439,916	38.5%	18.67%	43.91%	62.58%	3.72%	58.86%	49,385
2032	83,903	718,222	286,088	432,134	39.8%	18.63%	43.80%	62.43%	3.77%	58.66%	50,419
2033	85,952	721,861	298,451	423,410	41.3%	18.56%	43.66%	62.22%	3.82%	58.45%	51,457
2034	88,037	725,202	312,121	413,081	43.0%	18.49%	43.52%	62.01%	3.85%	58.45%	52,740
2035	90,231	728,569	327,413	401,155	44.9%	18.43%	43.33%	61.76%	3.88%	58.45%	54,052
2036	92,476	732,222	344,876	387,346	47.1%	18.37%	43.13%	61.50%	3.91%	58.45%	55,383
2037	94,753	736,142	364,671	371,471	49.5%	18.34%	42.93%	61.27%	3.94%	58.45%	56,772
2038	97,130	740,525	387,091	353,433	52.3%	18.31%	42.70%	61.01%	3.96%	58.45%	58,181
2039	99,539	745,349	412,399	332,950	55.3%	18.31%	42.46%	60.77%	3.97%	58.45%	59,577
2040	101,928	750,420	440,589	309,830	58.7%	18.29%	42.23%	60.52%	3.98%	58.45%	61,024
2041	104,404	755,926	471,930	283,996	62.4%	18.29%	41.98%	60.27%	3.99%	58.45%	62,500
2042	106,929	761,966	506,734	255,233	66.5%	18.30%	41.73%	60.03%	3.99%	58.45%	64,033
2043	109,551	768,699	545,361	223,338	70.9%	18.31%	41.44%	59.75%	3.99%	58.45%	65,620
2044	112,268	776,058	588,075	187,983	75.8%	18.31%	41.13%	59.44%	4.00%	58.45%	67,229

\* Reflects Policy Minimum Contribution Rate, if applicable.

\*\* Amounts shown are contributions in the fiscal year ending two years after the valuation date.

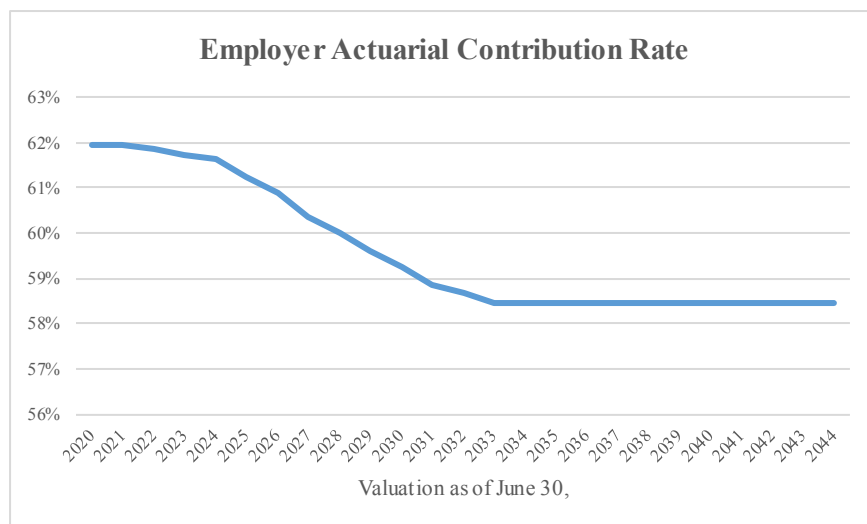
Note: Projections also assume the active population remains constant over the projection period and all actuarial assumptions are met in the future.





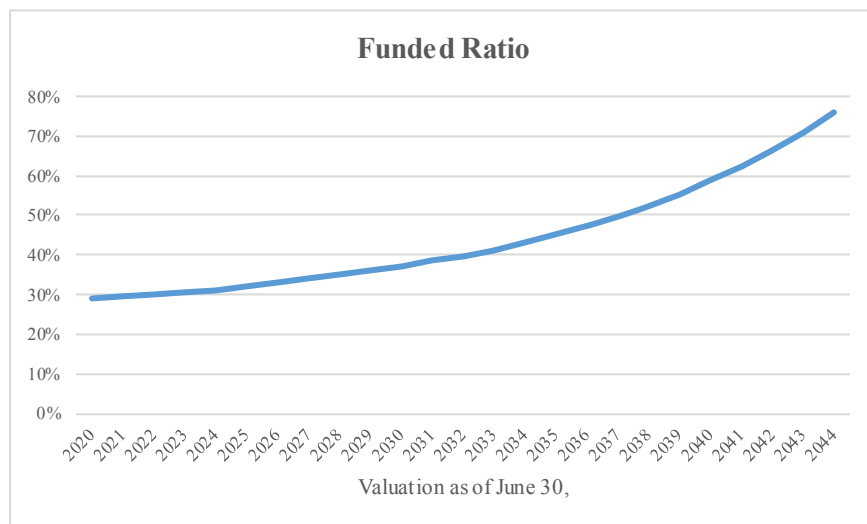
**TABLE 11  
PROJECTION OF FUTURE ACTUARIAL VALUATION RESULTS  
AS OF JUNE 30, 2020**

(continued)



Note: Reflects Policy Minimum Contribution Rate, if applicable.

The employer contribution rate trends downward over time as a greater percentage of active members are covered by Judges 2011 Plan which has a lower normal cost rate and employee contributions of 4.0% of pay. The Policy Minimum Contribution Rate applies beginning in 2033.

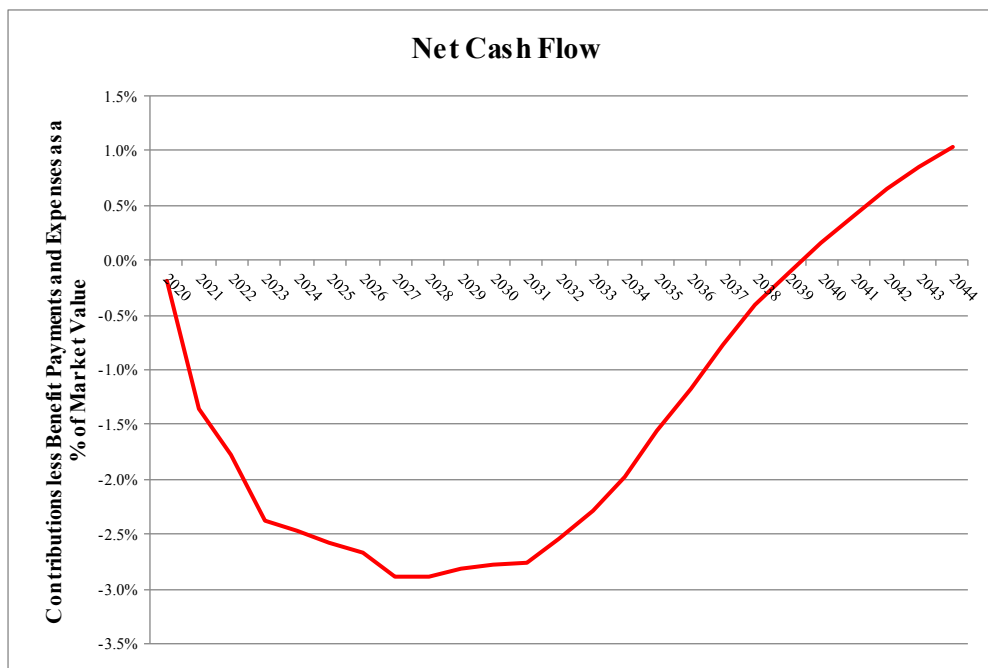


In the early stages of funding a retirement system (Judges was funded on a “pay as you go” basis until 1999), the contributions are an important part of accumulating assets and improving the funded ratio. If assumptions are met in the future, the funded ratio is expected to steadily improve.



**TABLE 12  
PROJECTION OF FUTURE NET CASH FLOWS  
AS OF JUNE 30, 2020**

Projection Based on Assumptions Outlined in Appendix D						
Amounts in thousands						
Valuation as of June 30, (1)	Total Contributions (2)	Benefit Payments (3)	Administrative Expenses (4)	Net Cash Flows (5)	Market Value of Assets (MVA) (6)	Net Cash Flow as a % of MVA (7)
2020	\$41,489	\$41,738	\$76	(\$325)	\$167,288	(0.19%)
2021	41,596	43,944	78	(2,426)	178,578	(1.36%)
2022	42,682	45,938	80	(3,335)	188,480	(1.77%)
2023	43,756	48,379	81	(4,704)	198,130	(2.37%)
2024	44,775	49,797	83	(5,105)	207,036	(2.47%)
2025	45,925	51,400	85	(5,560)	216,145	(2.57%)
2026	46,852	52,768	87	(6,003)	225,417	(2.66%)
2027	47,820	54,524	89	(6,793)	234,875	(2.89%)
2028	48,611	55,560	91	(7,040)	244,175	(2.88%)
2029	49,636	56,708	93	(7,165)	253,864	(2.82%)
2030	50,587	57,836	95	(7,344)	264,098	(2.78%)
2031	51,584	59,099	97	(7,612)	274,857	(2.77%)
2032	52,507	59,679	99	(7,272)	286,088	(2.54%)
2033	53,660	60,396	102	(6,838)	298,451	(2.29%)
2034	54,820	60,905	104	(6,189)	312,121	(1.98%)
2035	56,214	61,226	106	(5,118)	327,413	(1.56%)
2036	57,640	61,567	109	(4,036)	344,876	(1.17%)
2037	59,088	61,805	111	(2,828)	364,671	(0.78%)
2038	60,599	62,028	114	(1,542)	387,091	(0.40%)
2039	62,122	62,462	116	(456)	412,399	(0.11%)
2040	63,623	62,809	119	696	440,589	0.16%
2041	65,179	63,119	121	1,938	471,930	0.41%
2042	66,766	63,345	124	3,297	506,734	0.65%
2043	68,404	63,625	127	4,652	545,361	0.85%
2044	70,100	63,920	130	6,050	588,075	1.03%





## RISK MEASURES

Actuarial Standards of Practice are issued by the Actuarial Standards Board and are binding on credentialed actuaries practicing in the United States. These standards generally identify what the actuary should consider, document and disclose when performing an actuarial assignment. In September 2017, Actuarial Standard of Practice Number 51, *Assessment and Disclosure of Risk in Measuring Pension Obligations*, (ASOP 51) was issued as final with application to measurement dates on or after November 1, 2018. This ASOP, which applies to funding valuations, actuarial projections, and actuarial cost studies of proposed plan changes, was first applicable for the June 30, 2019 actuarial valuation for the Missouri State Employees' Retirement System – Judges (Judges or System).

A typical retirement plan faces many different risks, but the greatest risk is the inability to make benefit payments when due. If plan assets are depleted, benefits may not be paid which could create legal and litigation risk or the plan could become “pay as you go”. This risk is why consistent funding of the full actuarial contribution rate, based on reasonable assumptions and methods, is so critical to the successful funding of a retirement system.

The term “risk” is most commonly associated with an outcome with undesirable results. However, in the actuarial world, risk can be translated as uncertainty. The actuarial valuation process uses many actuarial assumptions to project how future contributions and investment returns will meet the cash flow needs for future benefit payments. Of course, we know that actual experience will not unfold exactly as anticipated by the assumptions and that uncertainty, whether favorable or unfavorable, creates risk. ASOP 51 defines risk as the potential of actual future measurements to deviate from expected results due to actual experience that is different than the actuarial assumptions.

The various risk factors for a given plan can have a significant impact – positive or negative – on the actuarial projection of liability and contribution rates.

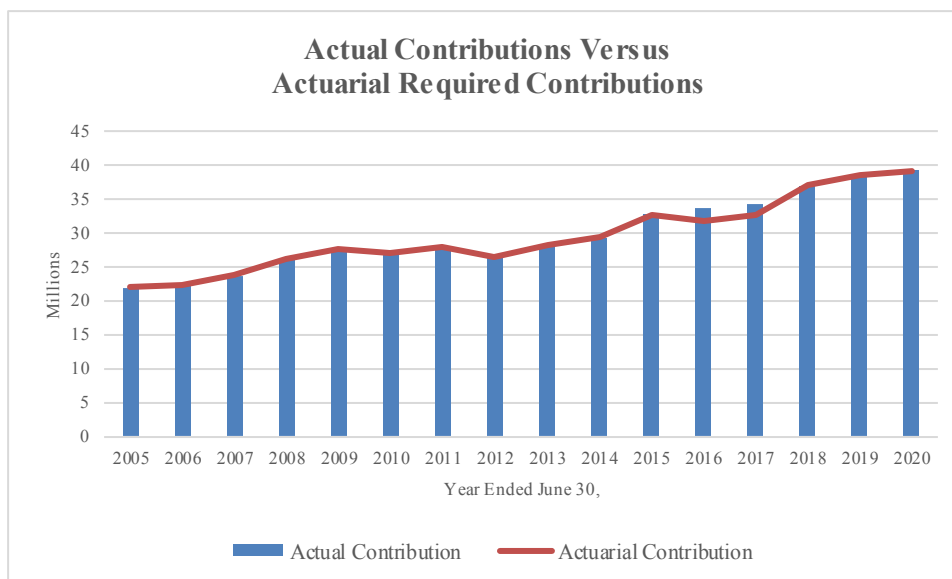
There are a number of risks inherent in the funding of a defined benefit plan. These include:

- economic risks, such as investment return and price inflation;
- demographic risks such as mortality, payroll growth, aging population, declining active membership and retirement ages;
- external risks such as the regulatory and political environment.

There is typically a direct correlation between healthy, well-funded retirement plans and consistent contributions equal to the full actuarial contribution rate each year. Historically, the state of Missouri has contributed the full actuarial contribution rate. At their September 18, 2014 meeting, the Board adopted a policy minimum contribution rate so that the employer contribution rate will not fall below the fiscal 2015 rate (58.45% of payroll) until the plan is 80% funded. As a result, the System's contributions were slightly above the actuarial rate during FY 2016 and FY 2017. The following graph displays the System's historical contribution levels over the past 16 years.



## SECTION 7 – RISK MEASURES



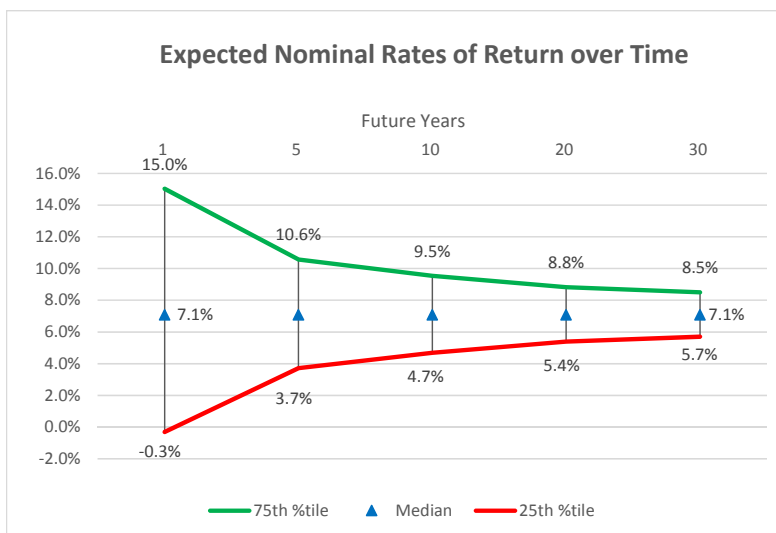
One of the most positive factors regarding the System’s funding is the State’s commitment to make contributions that are at least equal to the actuarial required contribution. This disciplined approach to funding has been illustrated by consistently contributing the full actuarial required contribution amount even with the increases that have occurred in the recent past. Despite the fact the full actuarial contribution rate has been contributed, the Judges Plan is only 29% funded. Prior to 1999, the Plan was funded using a “pay-as-you-go” method, which means that there was no cash reserve to invest and pay benefits from, and the System’s funded ratio was zero. In addition, the actuarial assumptions have been changed seven times in the last nine years, including a reduction in the investment return assumption from 8.50% in the 2011 valuation to 6.95% in the 2020 valuation. In addition, actual investment experience over this period has lagged the assumptions. However, to the extent the State continues to fund the full actuarial contribution rate in the future, we would expect the funded ratio to steadily improve if the actuarial assumptions are met.

The most significant risk factor for most systems is investment return because of the volatility of returns. Given the underlying capital market assumptions and the System’s asset allocation, a wide range of returns in any given year is to be expected.

As the following graph illustrates, in any single year the rate of return is expected to fall between 0% and 15% about 50% of the time. This volatility in the investment return from year to year creates significant risk to funding a retirement plan because of the corresponding volatility it creates in the employer contribution rate. As Table 13 explains, if the actual return is 10% different than the expected return, it would result in an increase in the actuarial contribution rate of 1.67% once the experience is fully recognized in the asset smoothing method (five years).



## SECTION 7 – RISK MEASURES



A key demographic risk for all retirement systems, including Judges, is improvements in mortality (longevity) greater than anticipated. While the actuarial assumptions reflect small, continuous improvements in mortality experience over time and these assumptions are refined every experience study, the risk arises because there is a possibility of some sudden shift, perhaps from a significant medical breakthrough that could quickly increase liabilities. Likewise, there is some possibility of a significant public health crisis that could result in a significant number of additional deaths in a short time period, which would also be significant, although more easily absorbed. While either of these events could happen, it represents a small probability and thus represents much less risk than the volatility associated with investment returns.

Many of the public retirement systems were created shortly after World War II. In general, the aging of the population, including the retirement of the baby boomers, along with earlier retirement eligibility has created a shift in the demographics of most systems. This change is not unexpected and has, in fact, been anticipated in the funding of the retirement system. Even though it was anticipated, the demographic shift and maturing of the plans have increased the risk associated with funding the system. The following exhibits summarize certain historical information that indicates how certain key risk metrics have changed over time due to the maturing of the retirement system.



**TABLE 13  
HISTORICAL ASSET VOLATILITY RATIOS**

As a retirement system matures, the size of the market value of assets is expected to increase relative to the covered payroll of active members, on which the System is funded. The size of the plan assets relative to covered payroll, sometimes referred to as the asset volatility ratio, is an important indicator of the contribution risk for the System. The higher this ratio, the more sensitive a plan’s contribution rate is to investment return volatility. In other words, it will be harder to recover from investment losses with increased contribution rates.

Valuation Date	Market Value of Assets	Covered Payroll	Asset Volatility Ratio	Change in ACR with a Return 10% Different than Assumed*
6/30/2004	39,705,632	39,878,499	1.00	0.61%
6/30/2005	48,534,166	40,016,098	1.21	0.74%
6/30/2006	57,728,934	40,270,535	1.43	0.88%
6/30/2007	72,180,820	40,846,581	1.77	1.09%
6/30/2008	77,341,103	44,542,530	1.74	1.07%
6/30/2009	65,919,546	45,505,512	1.45	0.89%
6/30/2010	78,553,877	46,112,730	1.70	1.04%
6/30/2011	98,208,033	45,888,020	2.14	1.31%
6/30/2012	99,837,257	45,835,501	2.18	1.34%
6/30/2013	111,203,538	48,697,726	2.28	1.40%
6/30/2014	132,645,657	49,587,936	2.67	1.64%
6/30/2015	130,851,263	55,656,457	2.35	1.44%
6/30/2016	132,056,351	57,421,016	2.30	1.41%
6/30/2017	137,634,941	58,150,935	2.37	1.45%
6/30/2018	150,199,575	59,551,874	2.52	1.55%
6/30/2019	158,332,990	60,380,734	2.62	1.61%
6/30/2020	167,288,066	61,450,808	2.72	1.67%

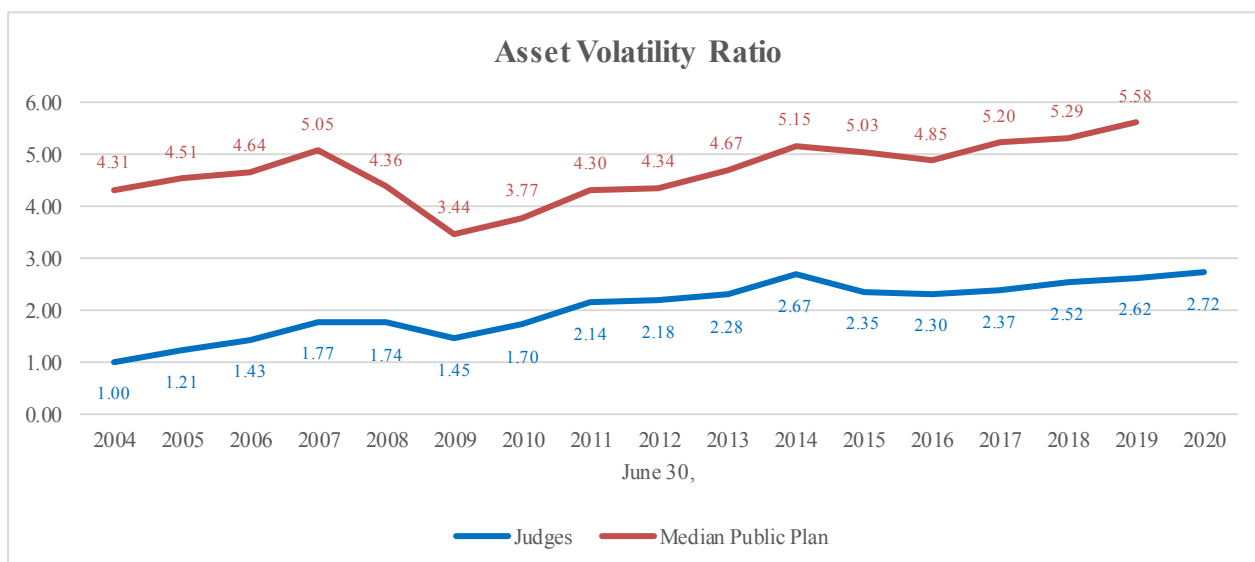
\* The impact of asset smoothing is not reflected in the impact on the Actuarial Contribution Rate (ACR). Current year assumptions are used for all years shown.

The assets at June 30, 2020 are about 2.7 times the amount of covered payroll. Consequently, underperforming the investment return assumption by 10.00% (i.e., earn -3.05% for one year) is equivalent to about 27% of payroll. While the actual impact of this experience in the first year is mitigated by the asset smoothing method and amortization of the UAAL, this table illustrates the risk associated with volatile investment returns. Such an event in one year would be expected to increase the actuarial contribution rate by 1.67% of payroll once it is fully recognized in the asset smoothing method.



**TABLE 13**  
**HISTORICAL ASSET VOLATILITY RATIOS**  
**(continued)**

The following graph shows a comparison of Judges’ historical asset volatility ratios and the historical median asset volatility ratio for a group of large public plans that are tracked in the Public Plan Database. The pattern of the change in the asset volatility ratio for Judges over time is similar to that observed in the Public Plan Database. When asset values drop significantly (like in 2009), the ratio drops as well. Most of the plans that participate in the NASRA Public Fund Survey have been accumulating assets for fifty or more years. Consequently, it is not surprising that the Judges System has a lower asset volatility ratio in comparison.



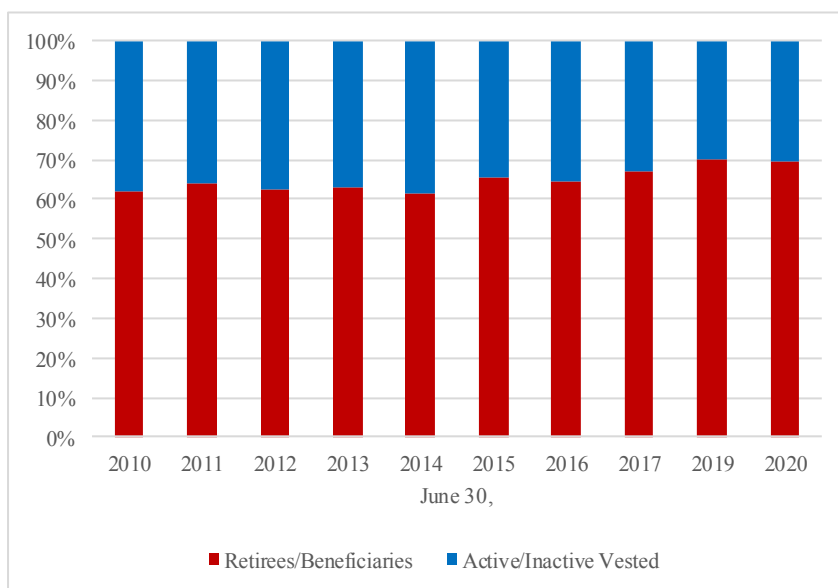


**TABLE 14  
LIABILITY MATURITY MEASUREMENTS**

Most public sector retirement systems have been in operation for many years. As a result, they have aging plan populations, and in some cases declining active populations, resulting in an increasing ratio of retirees to active members and a growing percentage of retiree liability. The retirement of the remaining baby boomers over the next decade is expected to further exacerbate the aging of the retirement system population. With more of the total liability residing with retirees, investment volatility has a greater impact on the funding of the system since it is more difficult to restore the system financially after losses occur when there is comparatively less payroll over which to spread costs.

Projections provide the most effective way of analyzing the impact of these changes on future funding measures, but studying several key metrics from the valuation can also provide some valuable insight.

<u>Fiscal Year End</u>	<u>Retiree Liability</u> (a)	<u>Total Actuarial Accrued Liability</u> (b)	<u>Retiree Percentage</u> (a) / (b)	<u>Covered Payroll</u> (c)	<u>Ratio</u> (b) / (c)
6/30/10	236,113,077	382,012,773	61.81%	46,112,730	8.28
6/30/11	251,532,354	393,484,589	63.92%	45,888,020	8.57
6/30/12	258,642,149	413,332,538	62.57%	45,835,501	9.02
6/30/13	274,911,416	435,378,358	63.14%	48,697,726	8.94
6/30/14	285,124,436	462,336,255	61.67%	49,587,936	9.32
6/30/15	316,042,514	482,969,311	65.44%	55,656,457	8.68
6/30/16	354,715,048	547,621,617	64.77%	57,421,016	9.54
6/30/17	377,099,534	564,417,925	66.81%	58,150,935	9.71
6/30/18	401,725,610	593,788,592	67.65%	59,551,874	9.97
6/30/19	434,204,353	617,482,705	70.32%	60,380,734	10.23
6/30/20	436,014,583	624,847,011	69.78%	61,450,808	10.17



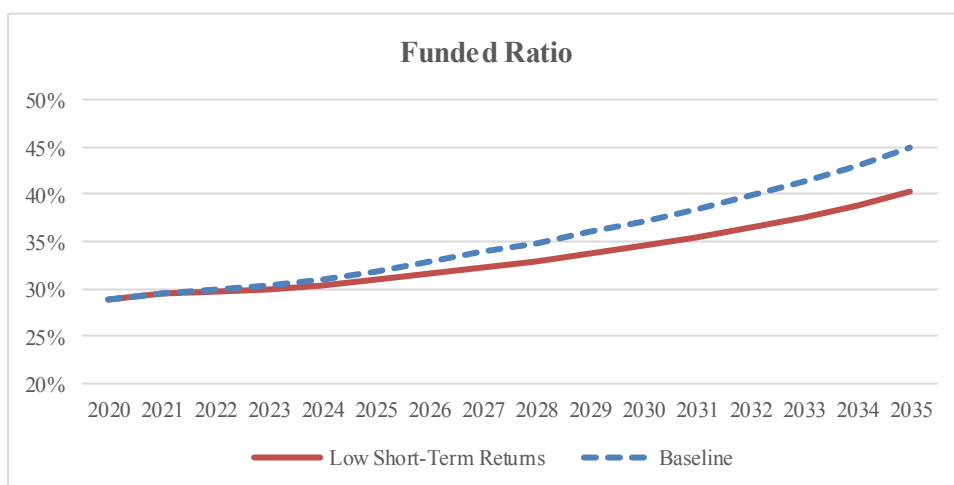




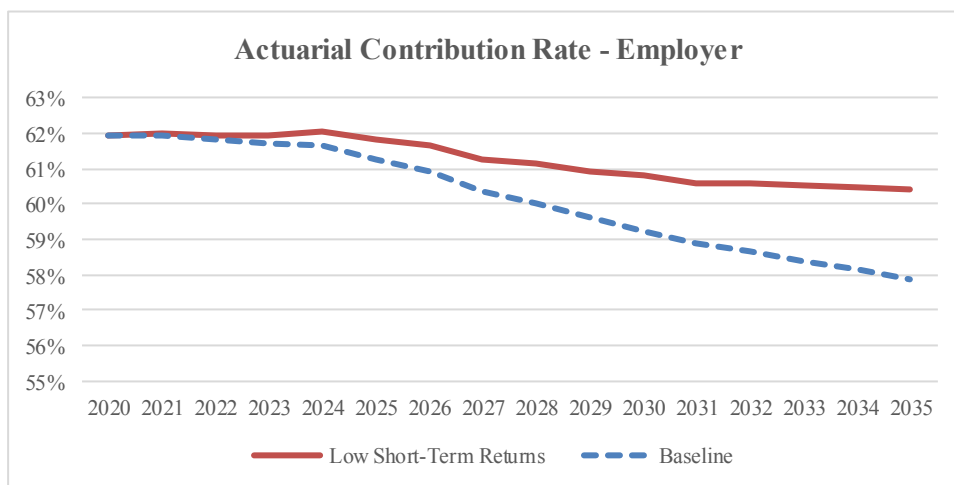
**TABLE 15  
SCENARIO TESTING**

As mentioned earlier, the most significant risk factor for most systems is investment return. There are many different tools that can be useful when assessing investment risk. One of these tools is to perform scenario testing using a projection model. Scenario testing is choosing one set of specific criteria to compare against another set of specific criteria, also known as a “what if” scenario.

Many investment consultants are projecting lower returns over the next ten years compared to the longer term (30+ years). The scenario test below shows results if actual investment returns are 1.0% less than assumed (5.95%) over the next 15 years (“Low Short-Term Returns”) compared to if all assumptions are met (“Baseline”).



In both scenarios, the funded ratio gradually increases over the next 15 years, even in the low short-term returns scenario. The most significant factor in the early stages of building an asset reserve is the contributions, rather than investment income. However, that is not to say that investment returns have no impact on the System’s funding. By the end of this period, the funded ratio is about 5% lower under the low short-term returns scenario.

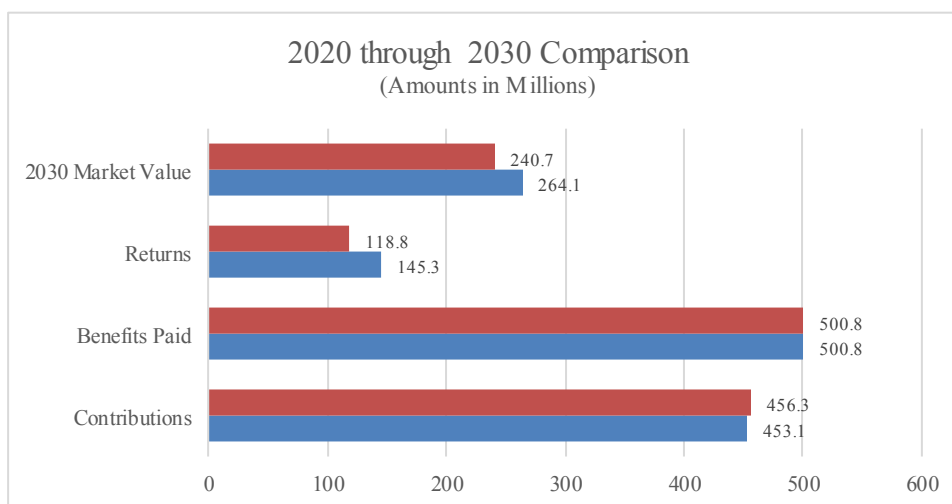




**TABLE 15**  
**SCENARIO TESTING**  
**(continued)**

Under both scenarios, the employer portion of the actuarial contribution rate remains around 62% over the next four years. Under the baseline scenario, the employer portion of the actuarial contribution rate drops to just under 58% after 15 years, which is about 2% lower than the low short-term returns scenario. Note that while the employer portion of the actuarial contribution rate falls to below 58%, the Policy Minimum Employer Contribution does not allow the employer to contribute less than 58.45% until the System is 80% funded, which is not projected to happen in the next 15 years. The steadily decreasing employer contribution rate is largely due to a decline in the normal cost rate as more members are covered by the Judges 2011 benefit structure over time, as well as increases in the effective employee contribution rate.

While it is helpful to see the funded ratio and employer contribution rate trend lines when scenario testing, it can sometimes be difficult to grasp the full impact without analyzing the impact in dollar amounts. The graph below compares the projected 2030 market value of assets under the baseline (blue bars) and the low short-term return scenario (red bars). In addition, the sum over a ten-year period of actual investment returns, benefits paid and contribution to the System are compared.



Under the low short-term return scenario, the 2030 market value of assets is about \$23 million lower when compared with the baseline. If asset returns are 1.0% lower than assumed for the next ten years, actual investment returns would be \$27 million less than assumed. Also note that even though contributions are only slightly higher under the low short-term return scenario (\$456 million vs \$453 million) over the ten year period, contributions would continue to be higher in the future as the asset losses flow through the smoothing method.



**TABLE 16**  
**COMPARISON OF VALUATION RESULTS UNDER ALTERNATE**  
**INVESTMENT RETURN ASSUMPTIONS**

(\$ in millions)

This exhibit compares the key January 1, 2020 valuation results under five (5) different investment return assumptions to illustrate the impact of different assumptions on the funding of the System. Note that only the investment return assumption is changed, as identified in the heading below. All other assumptions are unchanged for purposes of this analysis.

Investment Return Assumption	5.95%	6.45%	6.95%	7.45%	7.95%
<b>Contributions</b>					
Total Normal Cost	24.89%	22.59%	20.53%	18.68%	17.03%
Member Contributions	(2.26%)	(2.26%)	(2.26%)	(2.26%)	(2.26%)
Employer Normal Cost	22.63%	20.33%	18.27%	16.42%	14.77%
Unfunded Actuarial Accrued Liability	44.71%	44.21%	43.67%	43.07%	42.43%
<b>Total Employer Contribution</b>	67.34%	64.54%	61.94%	59.49%	57.20%
<b>Total Employer Contribution</b>	\$43.6	\$41.8	\$40.1	\$38.5	\$37.1
<b>Actuarial Accrued Liability</b>	\$687.4	\$654.9	\$624.8	\$597.0	\$571.3
<b>Actuarial Value of Assets</b>	\$180.7	\$180.7	\$180.7	\$180.7	\$180.7
<b>Unfunded Actuarial Accrued Liability</b>	\$506.7	\$474.2	\$444.1	\$416.3	\$390.6
<b>Funded Ratio</b>	26.3%	27.6%	28.9%	30.3%	31.6%

Note: All other assumptions are unchanged for purposes of this sensitivity analysis.



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## **HISTORICAL FUNDING AND OTHER INFORMATION**

This section of the report provides a historical perspective on the System’s funding and contribution practices, along with other information that may be of interest.

The information required for financial reporting by the System and participating employers is established by the Governmental Accounting Standards Board (GASB). GASB 67 separates accounting and financial reporting from funding requirements by creating disclosure and reporting requirements that are independent of the basis used for funding the System. A separate report that contains all of the information and exhibits of an actuarial nature that are necessary for the System’s financial reporting under GASB 67 will be issued in the future.

GASB Statement No. 68 establishes standards for the measurement, recognition, and display of pension expense and related liabilities. Annual pension cost is measured and disclosed on the accrual basis of accounting. A separate report containing all of the pertinent information under GASB 68 reporting will also be prepared in the future.



**TABLE 17**  
**SCHEDULE OF FUNDING PROGRESS**

Actuarial Valuation Date	Actuarial Value of Assets (a)	Actuarial Accrued Liability (AAL) (b)	Unfunded Actuarial Accrued Liability (UAAL) (b - a)	Funded Ratio (a / b)	Covered Payroll (c)	UAAL as a % of Covered Payroll [(b - a) / c]
June 30, 2004	\$39	\$280	\$241	14.0%	\$39.9	604.0%
June 30, 2005	44	292	248	15.1%	40.0	620.0%
June 30, 2006	52	309	257	16.7%	40.3	637.7%
June 30, 2007	62	327	265	18.9%	40.8	649.5%
June 30, 2008	73	355	282	20.6%	44.5	633.7%
June 30, 2009	81	369	288	22.0%	45.5	633.0%
June 30, 2010	89	382	293	23.3%	46.1	635.6%
June 30, 2011	98	393	295	25.0%	45.9	642.7%
June 30, 2012	102	413	311	24.8%	45.8	679.0%
June 30, 2013	111	435	324	25.5%	48.7	665.3%
June 30, 2014	124	462	338	28.0%	49.6	681.5%
June 30, 2015	134	483	349	27.8%	55.7	626.6%
June 30, 2016	143	548	404	26.2%	57.4	703.8%
June 30, 2017	152	564	413	26.9%	58.2	708.9%
June 30, 2018	162	594	432	27.3%	59.6	724.8%
June 30, 2019	172	617	445	27.9%	60.4	737.4%
June 30, 2020	181	625	444	28.9%	61.5	722.7%

Note: Information before 2017 was produced by the prior actuary. Numbers may not add due to rounding.



SECTION 8 – OTHER INFORMATION

TABLE 18  
SHORT-TERM SOLVENCY TEST

Fiscal Year End	Member Contributions (1)	Current Retirees and Beneficiaries (2)	Active and Inactive Members, Employer Financed Portion (3)	Actuarial Value of Assets Available for Benefits	Percentage of Actuarial Liabilities Covered by Actuarial Value of Assets Available for		
					(1)	(2)	(3)
2010	\$ 0	\$ 236,113,077	\$ 145,899,696	\$ 88,976,738	100.0	37.7	0.0
2011	59,958	251,532,354	141,892,277	98,398,628	100.0	39.1	0.0
2012	209,817	258,642,149	154,450,572	102,266,706	100.0	39.5	0.0
2013	421,753	274,911,416	160,045,189	111,140,339	100.0	40.3	0.0
2014	716,564	285,124,436	176,469,255	124,269,105	100.0	43.3	0.0
2015	1,204,757	316,042,514	165,722,040	134,349,908	100.0	42.1	0.0
2016	1,855,955	354,715,048	191,050,614	143,468,860	100.0	39.9	0.0
2017	2,232,405	377,099,534	185,085,986	151,828,631	100.0	39.7	0.0
2018	3,124,482	401,725,610	188,938,500	162,135,045	100.0	39.6	0.0
2019	4,421,019	434,204,353	178,857,333	172,224,529	100.0	38.6	0.0
2020	5,991,360	436,014,583	182,841,068	180,713,310	100.0	40.1	0.0



**TABLE 19**  
**HISTORICAL EMPLOYER CONTRIBUTIONS**

<b>Fiscal Year Ending</b>	<b>Actuarially Determined Employer Contribution</b>	<b>Actual Dollar Amount</b>	<b>Percent Contributed</b>
June 30, 2005	\$21.9	\$21.9	100.0%
June 30, 2006	22.4	22.4	100.0%
June 30, 2007	23.7	23.7	100.0%
June 30, 2008	26.2	26.2	100.0%
June 30, 2009	27.7	27.7	100.0%
June 30, 2010	27.0	27.0	100.0%
June 30, 2011	27.8	27.8	100.0%
June 30, 2012	26.3	26.3	100.0%
June 30, 2013	28.3	28.3	100.0%
June 30, 2014	29.3	29.3	100.0%
June 30, 2015	32.7	32.7	100.0%
June 30, 2016	31.6	33.6	106.3%
June 30, 2017	32.7	34.2	104.6%
June 30, 2018	36.9	36.9	100.0%
June 30, 2019	38.6	38.6	100.0%
June 30, 2020	39.2	39.2	100.0%

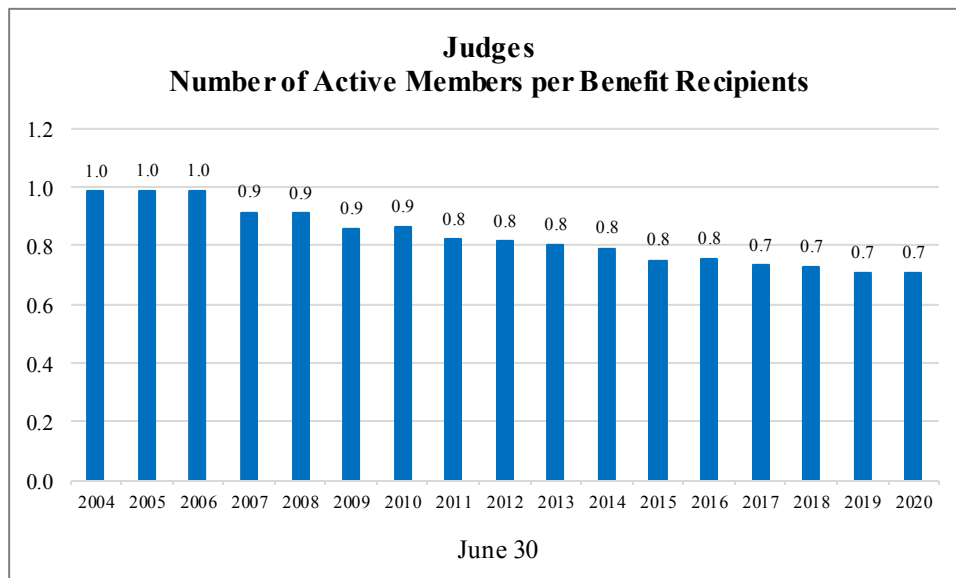




SECTION 8 – OTHER INFORMATION

**TABLE 20  
HISTORICAL MEMBER STATISTICS**

Valuation Date June 30	Active Members				Retired Members			
	Number	Payroll \$ Millions	Average Salary \$	% Incr.	Number	Active/ Retired	Annual Benefits \$ Millions	% Incr.
2004	391	\$40	\$101,911		397	1.0	\$18.0	
2005	392	40	102,082	0.2	397	1.0	18.8	4.4
2006	394	40	102,209	0.1	398	1.0	19.4	3.2
2007	400	41	102,116	(0.1)	437	0.9	21.7	11.9
2008	401	45	111,079	8.8	440	0.9	22.5	3.7
2009	397	46	114,623	3.2	463	0.9	24.0	6.7
2010	402	46	114,708	0.1	465	0.9	24.5	2.1
2011	399	46	115,008	0.3	486	0.8	26.5	8.2
2012	398	46	115,165	0.1	488	0.8	27.0	1.9
2013	400	49	121,744	5.7	497	0.8	28.4	5.2
2014	405	50	122,439	0.6	511	0.8	29.8	4.9
2015	405	56	137,423	12.2	539	0.8	32.4	8.7
2016	408	57	140,738	2.4	540	0.8	33.2	2.5
2017	410	58	141,832	0.8	559	0.7	34.6	4.2
2018	415	60	143,498	1.2	569	0.7	36.3	4.9
2019	414	60	145,847	1.6	585	0.7	38.6	6.3
2020	418	61	147,012	0.8	590	0.7	40.1	3.9





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**MEMBER DATA RECONCILIATION**

	Active Members	Inactive Vested	Leave of Absence	Long-term Disability	Retirees and Beneficiaries	Total
As of June 30, 2019	414	36	0	0	585	1,035
Changes in status:						
a) Retirement	(13)	(4)	0	0	17	0
b) Death	0	0	0	0	(18)	(18)
c) Leave of absence	0	0	0	0	0	0
d) Vested termination	(3)	3	0	0	0	0
e) Contribution refund	0	0	0	0	0	0
f) Beneficiary in receipt	0	0	0	0	7	7
g) Disability retirement	0	0	0	0	0	0
h) Return to active service	0	0	0	0	0	0
i) Expired benefit	0	0	0	0	(1)	(1)
j) Data adjustment	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
Total changes in status	(16)	(1)	0	0	5	(12)
New entrants	20	0	0	0	0	20
Net Change	4	(1)	0	0	5	8
As of June 30, 2020	418	35	0	0	590	1,043



## SUMMARY OF MEMBERSHIP DATA

A. ACTIVE MEMBERS	June 30, 2020	June 30, 2019	% Change
1. Number of Active Members			
(a) Judicial Plan	183	198	(7.6)
(b) Judicial Plan 2011	235	216	8.8
(c) Total	418	414	1.0
2. Annualized Reported Salary			
(a) Judicial Plan	\$ 27,644,728	\$ 29,443,760	(6.1)
(b) Judicial Plan 2011	33,806,080	30,936,974	9.3
(c) Total	\$ 61,450,808	\$ 60,380,734	1.8
3. Accumulated Member Contributions	\$ 5,721,491	\$ 4,421,019	29.4
4. Active Member Averages			
(a) Age	55.7	55.6	0.2
(b) Service	10.8	10.6	1.9
(c) Compensation	\$ 147,012	\$ 145,847	0.8
B. INACTIVE MEMBERS			
1. Number of Inactive Vested Members	35	36	(2.8)
2. Inactive Vested Member Averages			
(a) Age	54.1	53.9	0.4
(b) Monthly benefit	\$ 2,996	3,178	(5.7)
C. RETIREES, DISABLEDS, AND BENEFICIARIES			
1. Number of Members			
(a) Retirees	436	426	2.3
(b) Beneficiaries	154	159	(3.1)
(c) Total	590	585	0.9
2. Total Monthly Benefits			
(a) Retired	\$ 2,839,083	\$ 2,706,756	4.9
(b) Beneficiaries	503,586	509,946	(1.2)
(c) Total	\$ 3,342,669	\$ 3,216,702	3.9
3. Average Age			
(a) Retired	75.0	74.5	0.7
(b) Beneficiaries	81.1	81.3	(0.2)
(c) Total	76.6	76.3	0.4

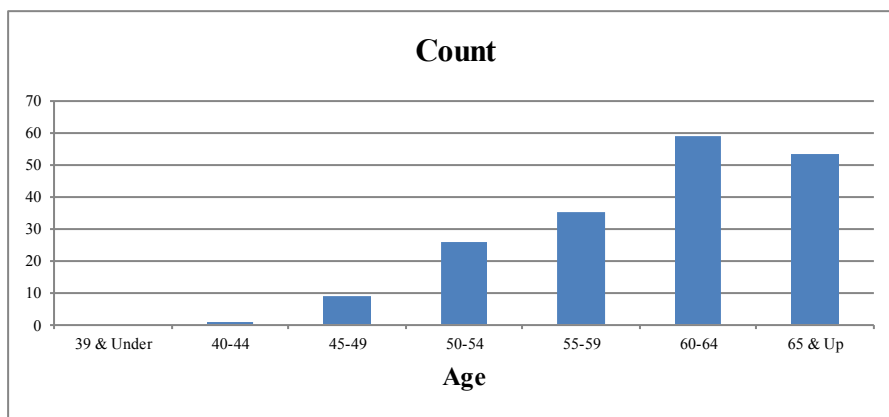


**APPENDIX A – MEMBERSHIP DATA**

**ACTIVE MEMBERS  
AS OF JUNE 30, 2020**

**HIRED BEFORE JANUARY 1, 2011**

Age	Count of Members			Reported Annualized Earnings for Current Members		
	Male	Female	Total	Male	Female	Total
39 & Under	0	0	0	\$ 0	\$ 0	\$ 0
40-44	1	0	1	153,780	0	153,780
45-49	4	5	9	602,868	731,994	1,334,862
50-54	16	10	26	2,371,396	1,499,790	3,871,186
55-59	28	7	35	4,298,536	1,057,455	5,355,991
60-64	41	18	59	6,088,039	2,786,413	8,874,452
65 & Up	<u>39</u>	<u>14</u>	<u>53</u>	<u>5,905,511</u>	<u>2,148,946</u>	<u>8,054,457</u>
Total	129	54	183	\$ 19,420,130	\$ 8,224,598	\$ 27,644,728



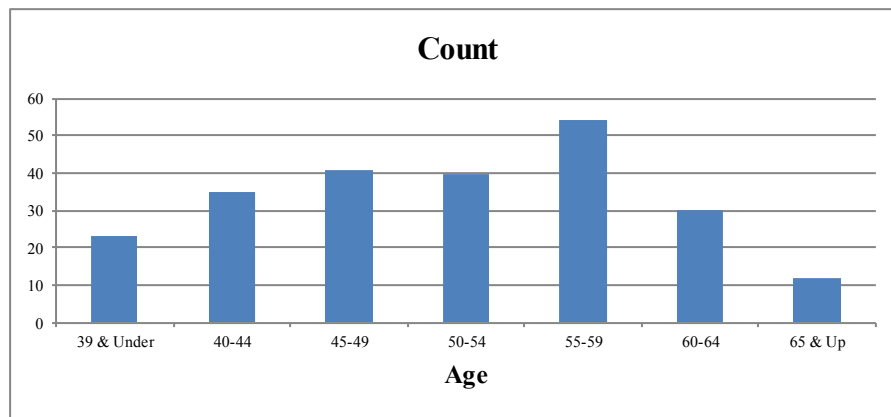


**APPENDIX A – MEMBERSHIP DATA**

**ACTIVE MEMBERS  
AS OF JUNE 30, 2020**

**HIRED ON OR AFTER JANUARY 1, 2011**

Age	Count of Members			Reported Annualized Earnings for Current Members		
	Male	Female	Total	Male	Female	Total
39 & Under	15	8	23	\$ 2,047,946	\$ 1,139,734	\$ 3,187,680
40-44	18	17	35	2,622,843	2,451,847	5,074,690
45-49	26	15	41	3,590,160	2,140,269	5,730,429
50-54	32	8	40	4,663,845	1,172,213	5,836,058
55-59	36	18	54	5,291,944	2,580,308	7,872,252
60-64	23	7	30	3,337,138	991,449	4,328,587
65 & Up	<u>11</u>	<u>1</u>	<u>12</u>	<u>1,622,604</u>	<u>153,780</u>	<u>1,776,384</u>
Total	161	74	235	\$ 23,176,480	\$ 10,629,600	\$ 33,806,080



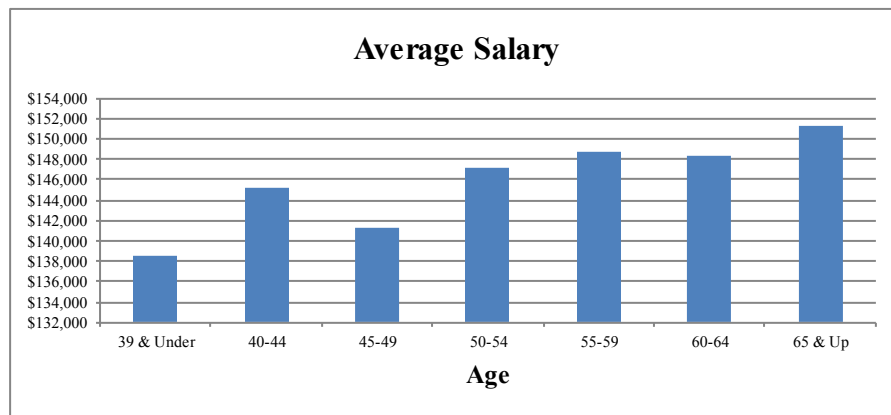
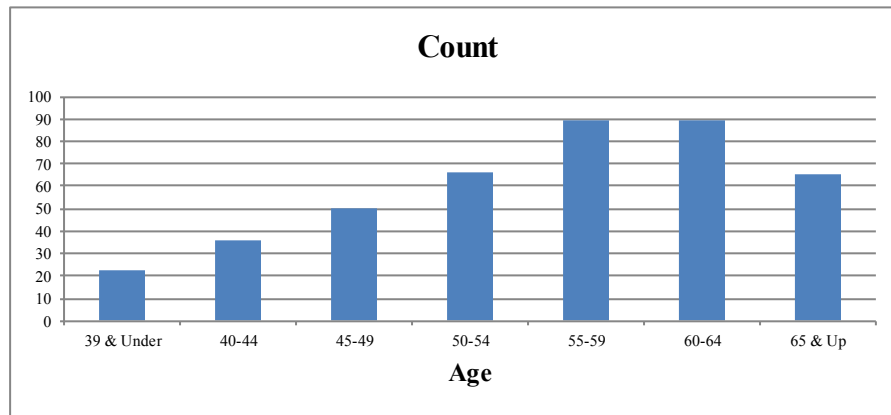


**APPENDIX A – MEMBERSHIP DATA**

**ACTIVE MEMBERS  
AS OF JUNE 30, 2020**

**TOTAL**

<u>Age</u>	<u>Count of Members</u>			<u>Reported Annualized Earnings for Current Members</u>		
	<u>Male</u>	<u>Female</u>	<u>Total</u>	<u>Male</u>	<u>Female</u>	<u>Total</u>
39 & Under	15	8	23	\$ 2,047,946	\$ 1,139,734	\$ 3,187,680
40-44	19	17	36	2,776,623	2,451,847	5,228,470
45-49	30	20	50	4,193,028	2,872,263	7,065,291
50-54	48	18	66	7,035,241	2,672,003	9,707,244
55-59	64	25	89	9,590,480	3,637,763	13,228,243
60-64	64	25	89	9,425,177	3,777,862	13,203,039
65 & Up	<u>50</u>	<u>15</u>	<u>65</u>	<u>7,528,115</u>	<u>2,302,726</u>	<u>9,830,841</u>
Total	290	128	418	\$ 42,596,610	\$ 18,854,198	\$ 61,450,808





APPENDIX A – MEMBERSHIP DATA

**AGE AND SERVICE DISTRIBUTION  
AS OF JUNE 30, 2020**

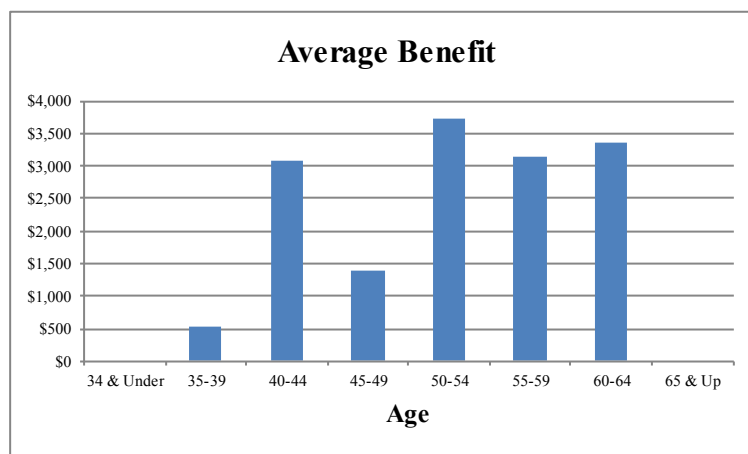
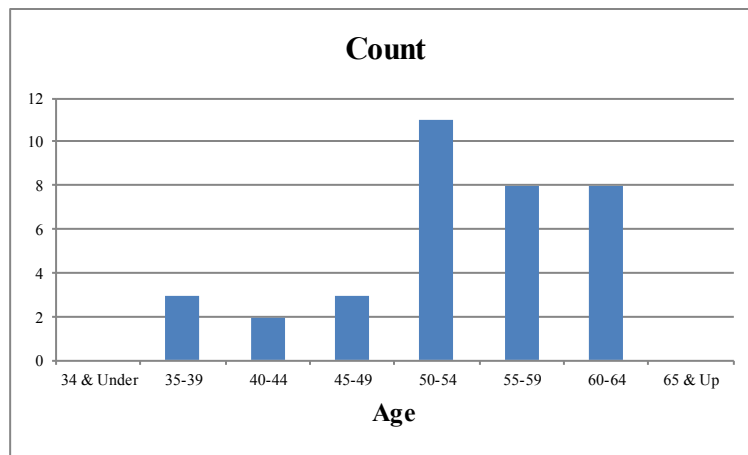
Age		0-4	5-9	10-14	15-19	20-24	25-29	Over 29	Total
<b>39 &amp; Under</b>	Number	19	4	0	0	0	0	0	23
	Total Salary	\$ 2,625,501	\$ 562,179	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 3,187,680
	Average Sal.	\$ 138,184	\$ 140,545	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 138,595
<b>40-44</b>	Number	24	12	0	0	0	0	0	36
	Total Salary	\$ 3,454,845	\$ 1,773,625	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 5,228,470
	Average Sal.	\$ 143,952	\$ 147,802	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 145,235
<b>45-49</b>	Number	27	14	9	0	0	0	0	50
	Total Salary	\$ 3,728,866	\$ 2,013,865	\$ 1,322,560	\$ 0	\$ 0	\$ 0	\$ 0	\$ 7,065,291
	Average Sal.	\$ 138,106	\$ 143,848	\$ 146,951	\$ 0	\$ 0	\$ 0	\$ 0	\$ 141,306
<b>50-54</b>	Number	23	18	11	12	2	0	0	66
	Total Salary	\$ 3,349,732	\$ 2,636,373	\$ 1,635,669	\$ 1,802,514	\$ 282,956	\$ 0	\$ 0	\$ 9,707,244
	Average Sal.	\$ 145,641	\$ 146,465	\$ 148,697	\$ 150,210	\$ 141,478	\$ 0	\$ 0	\$ 147,079
<b>55-59</b>	Number	20	34	13	11	9	2	0	89
	Total Salary	\$ 2,945,806	\$ 4,963,402	\$ 1,993,159	\$ 1,671,543	\$ 1,375,110	\$ 279,223	\$ 0	\$ 13,228,243
	Average Sal.	\$ 147,290	\$ 145,982	\$ 153,320	\$ 151,958	\$ 152,790	\$ 139,612	\$ 0	\$ 148,632
<b>60-64</b>	Number	11	19	16	9	20	11	3	89
	Total Salary	\$ 1,585,698	\$ 2,742,889	\$ 2,394,896	\$ 1,340,411	\$ 2,948,847	\$ 1,719,626	\$ 470,672	\$ 13,203,039
	Average Sal.	\$ 144,154	\$ 144,363	\$ 149,681	\$ 148,935	\$ 147,442	\$ 156,330	\$ 156,891	\$ 148,349
<b>65 &amp; Up</b>	Number	2	10	13	9	8	13	10	65
	Total Salary	\$ 291,525	\$ 1,500,894	\$ 1,920,167	\$ 1,378,080	\$ 1,181,032	\$ 1,996,267	\$ 1,562,876	\$ 9,830,841
	Average Sal.	\$ 145,763	\$ 150,089	\$ 147,705	\$ 153,120	\$ 147,629	\$ 153,559	\$ 156,288	\$ 151,244
<b>Total</b>	Number	126	111	62	41	39	26	13	418
	Total Salary	\$ 17,981,973	\$ 16,193,227	\$ 9,266,451	\$ 6,192,548	\$ 5,787,945	\$ 3,995,116	\$ 2,033,548	\$ 61,450,808
	Average Sal.	\$ 142,714	\$ 145,885	\$ 149,459	\$ 151,038	\$ 148,409	\$ 153,658	\$ 156,427	\$ 147,012





**INACTIVE VESTED MEMBERS  
AS OF JUNE 30, 2020**

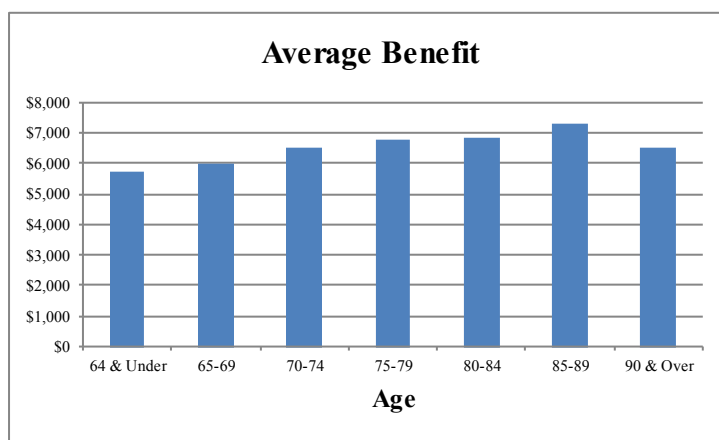
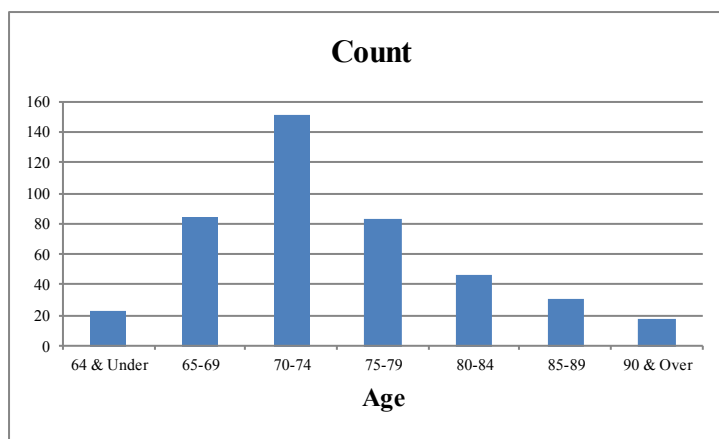
Age	Count of Members*			Monthly Deferred Benefits		
	Male	Female	Total	Male	Female	Total
34 & Under	0	0	0	\$ 0	\$ 0	\$ 0
35-39	3	0	3	1,620	0	1,620
40-44	1	1	2	5,821	369	6,190
45-49	0	3	3	0	4,198	4,198
50-54	8	3	11	34,804	6,192	40,996
55-59	6	2	8	22,201	2,827	25,028
60-64	6	2	8	17,538	9,293	26,831
65 & Up	0	0	0	0	0	0
Total	24	11	35	\$ 81,984	\$ 22,879	\$ 104,863





**RETIRED MEMBERS  
AS OF JUNE 30, 2020**

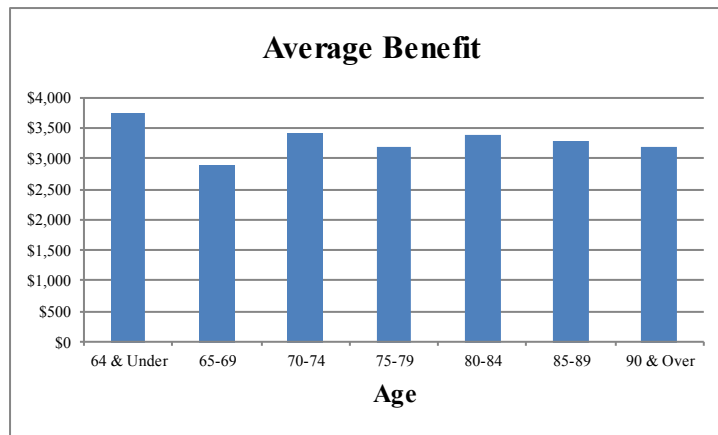
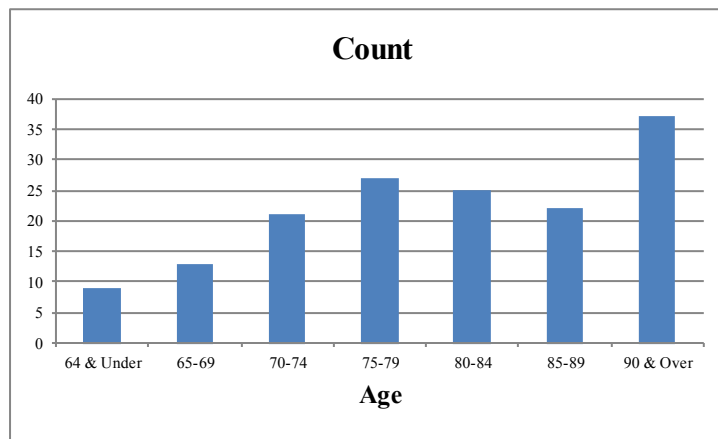
<u>Age</u>	<u>Count of Members</u>			<u>Monthly Benefits</u>		
	<u>Male</u>	<u>Female</u>	<u>Total</u>	<u>Male</u>	<u>Female</u>	<u>Total</u>
64 & Under	17	6	23	\$ 95,017	\$ 35,978	\$ 130,995
65-69	71	13	84	441,170	63,190	504,360
70-74	126	25	151	824,886	161,354	986,240
75-79	71	12	83	469,675	89,467	559,142
80-84	42	4	46	290,160	25,109	315,269
85-89	31	0	31	226,527	0	226,527
90 & Over	<u>18</u>	<u>0</u>	<u>18</u>	<u>116,550</u>	<u>0</u>	<u>116,550</u>
Total	376	60	436	\$ 2,463,985	\$ 375,098	\$ 2,839,083





**BENEFICIARIES RECEIVING BENEFITS  
AS OF JUNE 30, 2020**

<u>Age</u>	<u>Count of Members</u>			<u>Monthly Benefits</u>		
	<u>Male</u>	<u>Female</u>	<u>Total</u>	<u>Male</u>	<u>Female</u>	<u>Total</u>
64 & Under	2	7	9	\$ 8,345	\$ 25,398	\$ 33,743
65-69	1	12	13	2,854	34,696	37,550
70-74	1	20	21	2,783	68,841	71,624
75-79	1	26	27	3,491	82,299	85,790
80-84	0	25	25	0	84,456	84,456
85-89	0	22	22	0	72,186	72,186
90 & Over	<u>1</u>	<u>36</u>	<u>37</u>	<u>2,300</u>	<u>115,937</u>	<u>118,237</u>
Total	6	148	154	\$ 19,773	\$ 483,813	\$ 503,586





**RETIRED LIVES BENEFITS PAYABLE  
TABULATED BY OPTION AND TYPE OF BENEFIT  
AS OF JUNE 30, 2020**

**Judges Hired Before January 1, 2011**

<b>Type of Benefit</b>	<b>No.</b>	<b>Total Monthly Benefits</b>
Service Retirement		
Life Annuity	4	\$ 27,894
50% Joint and Survivor	428	2,800,493
100% Joint and Survivor	0	0
Survivor Beneficiary	121	405,471
Total	<u>553</u>	<u>3,233,858</u>
Death-in-Service	33	98,115
<b>Total</b>	<b>586</b>	<b>\$ 3,331,973</b>

**Judges Hired On or After January 1, 2011**

<b>Type of Benefit</b>	<b>No.</b>	<b>Total Monthly Benefits</b>
Service Retirement		
Life Annuity	2	\$ 6,999
50% Joint and Survivor	1	2,762
100% Joint and Survivor	1	935
Survivor Beneficiary	0	0
Total	<u>4</u>	<u>10,696</u>
Death-in-Service	0	0
<b>Total</b>	<b>4</b>	<b>\$ 10,696</b>



## APPENDIX B – SUMMARY OF PLAN PROVISIONS

---

### Age and Service Retirement

#### *Eligibility for Unreduced Benefit (for Members Hired Before 1/1/2011)*

The earliest of attaining:

- (1) At least 62 with 12 years of creditable service.
- (2) At least 60 with 15 years of creditable service.
- (3) At least 55 with 20 years of creditable service.

#### *Eligibility for Unreduced Benefit (for Members Hired On or After 1/1/2011)*

The earliest of attaining:

- (1) At least 67 with 12 years of creditable service.
- (2) At least 62 with 20 years of creditable service.

#### *Benefit Amount*

50% of compensation

### Early Retirement

#### *Eligibility for Reduced Benefit (for Members Hired Before 1/1/2011)*

Age 60

#### *Benefit Amount*

- (1) If between 60 and 62, years of service divided by 15 multiplied by 50% of compensation.
- (2) If at least 62, years of service divided by 12 and multiplied by 50% of compensation.

#### *Eligibility for Reduced Benefit (for Members Hired On or After 1/1/2011)*

Age 62

#### *Benefit Amount*

- (1) If between 60 and 67, years of service divided by 20 multiplied by 50% of compensation.
- (2) If at least 67, years of service divided by 12 and multiplied by 50% of compensation.

### Compensation used for Benefit Determination

The annual salary at date of termination of the highest position held.



## APPENDIX B – SUMMARY OF PLAN PROVISIONS

### Vested Deferred Benefits

Benefits for employees who terminate prior to eligibility for an immediate benefit are considered to be vested. Benefits commence once the individual qualifies for normal or early retirement based on age and service.

### Death Benefits

#### *Death Prior to Retirement*

50% of the benefit the member would have been eligible to receive based on service to age 70 is payable to an eligible spouse or minor children.

#### *Death After Retirement*

50% of the benefit the retired member was receiving at the date of death to an eligible surviving spouse for members hired before January 1, 2011.

### Disability Benefits

Disability benefits become payable at the time the member is eligible for normal retirement (50% of salary for remainder of term) and are computed based on the service that would have accrued if active employment had continued until normal retirement age, and member's compensation while an active employee.

### Post-Retirement Benefit Adjustments

Benefits are increased to benefit recipients (including survivors) annually in accordance with the following formulas:

Increase in CPI	Formula 1 Benefit Increase	Formula 2 Benefit Increase
5.00% or less	4.00%	80% of CPI increase
5.01% - 6.24%	80% of CPI increase	80% of CPI increase
6.25% or more	5.00%	5.00%

Members first hired prior to August 28, 1997 receive COLAs based on Formula 1 until an aggregate increase of 65% is reached. At that point, subsequent COLAs based on Formula 2 are granted.

Members first hired on or after August 28, 1997 receive COLAs based solely on Formula 2.

Members hired prior to January 1, 2011 who work beyond the later of age 60 or the date when first eligible for age and service retirement will have their monthly benefit increased upon retirement. The percentage increase is equal to all COLAs for the years between (i) the later of age 60 or the date when first eligible for age and service retirement and (ii) date of actual retirement, not to exceed 65%.



**APPENDIX B – SUMMARY OF PLAN PROVISIONS**

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**Member Contributions**

For members hired prior to 1/1/2011:	None
For members hired on or after 1/1/2011:	4.00% of salary, with interest credited at 4.00%.



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## ACTUARIAL METHODS

1. **Calculation of Normal Cost and Actuarial Accrued Liability:** The funding method used to determine the normal cost and actuarial accrued liability was the Entry Age Actuarial Cost Method described below.

### Entry Age Actuarial Cost Method

Under the entry age normal cost method, the actuarial present value of each member's projected benefit is allocated on a level basis over the member's compensation between the entry age of the member and their assumed exit age. The portion of the actuarial present value allocated to the valuation year is called the normal cost. The actuarial present value of benefits allocated to prior years of service is called the actuarial accrued liability. The unfunded actuarial accrued liability represents the difference between the actuarial accrued liability and the actuarial value of assets as of the valuation date. The unfunded actuarial accrued liability is calculated each year and reflects experience gains/losses.

2. **Calculation of the Actuarial Value of Assets:** Calculation of the Actuarial Value of Assets (AVA): The current asset smoothing method was first effective with the June 30, 2018 valuation. Under this method, the difference between the actual and assumed investment return on the market value of assets is recognized evenly over a five-year period. No corridor is used with the new method. In addition, the total unrecognized investment experience as of June 30, 2017 will be recognized evenly over a seven-year period beginning June 30, 2018.
3. **Amortization of the Unfunded Actuarial Accrued Liability (UAAL):** Beginning with the June 30, 2018 valuation, the UAAL is amortized using a "layered" approach. Under this method, the "Legacy UAAL", as determined in the June 30, 2018 valuation, is amortized over a closed 30-year period. Subsequent changes in the UAAL due to actuarial gains/losses or assumption changes are separately financed by establishing amortization bases and payments, as a level percentage of payroll, over closed 30-year periods. Any change in the System's benefit structure shall be amortized over a closed period of 20 years, as set out in state statutes. The total UAAL amortization payment is the sum of the payments for each of the amortization bases.

### Changes in Methods and Assumptions since the Prior Year

An experience study which analyzed the System's economic assumptions was performed in 2018 and the results were presented to the Board. Below is a summary of the changes to methods and assumptions since the prior year:

- The investment return assumption was lowered from 7.10% to 6.95%.
- The inflation assumption was lowered from 2.35% to 2.25%
- The general wage growth assumption was lowered from 2.60% to 2.50%.
- The payroll growth assumption was lowered from 2.35% to 2.25%.
- The COLA assumption was lowered from 1.88% to 1.80%.



**APPENDIX C – SUMMARY OF ACTUARIAL ASSUMPTIONS**

**ACTUARIAL ASSUMPTIONS**

An experience study which analyzed the System’s economic assumptions was performed in 2018 and the results were presented to the Board. The economic assumptions listed below are a result of that experience study. The demographic assumptions are based on an experience study performed in 2015, by the prior actuary. The next experience study is scheduled for 2021.

**Economic Assumptions**

- 1. Investment Return 6.95%, compounded annually, net of investment expenses.
- 2. Inflation 2.25% per year
- 3. Salary Increases

Sample Ages	Inflation	Productivity	Merit	Increase Next Year
25	2.25%	0.25%	2.20%	4.70%
30	2.25	0.25	2.20	4.70
35	2.25	0.25	1.48	3.98
40	2.25	0.25	0.76	3.26
45	2.25	0.25	0.60	3.10
50	2.25	0.25	0.54	3.04
55	2.25	0.25	0.44	2.94
60	2.25	0.25	0.00	2.50
65	2.25	0.25	0.00	2.50
70	2.25	0.25	0.00	2.50

- 4. Payroll Growth 2.25% per year
- 5. Cost-of-Living Adjustment (COLA)
  - 4.00% on a compounded basis when a minimum COLA of 4.00% is in effect.
  - 1.80% on a compounded basis when no minimum COLA is in effect.
- 6. Administrative Expenses Actual prior year expenses, included in normal cost rate.



**APPENDIX C – SUMMARY OF ACTUARIAL ASSUMPTIONS**

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**Demographic Assumptions**

- 1. Mortality
  - The mortality assumption includes an appropriate level of conservatism that reflects expected future mortality improvement.
  - a. Post-retirement
    - RP-2014 Healthy Annuitant mortality table, projected from 2006 to 2026 with Scale MP-2015 and scaled by 98%
  - b. Pre-retirement
    - RP-2014 Employee mortality table, projected from 2006 to 2026 with Scale MP-2015
  - c. Long-term disability
    - RP-2014 Disabled mortality table, projected from 2006 to 2026 with Scale MP-2015

Sample Ages	Pre-Retirement Mortality Rates*	
	Males	Females
25	0.03%	0.01%
30	0.03	0.02
35	0.04	0.03
40	0.05	0.04
45	0.07	0.05
50	0.13	0.09
55	0.24	0.16
60	0.42	0.23
65	0.74	0.33
70	1.23	0.55

*\* The pre-retirement mortality table used was the RP-2014 Employee mortality table, projected from 2006 to 2026 with Scale MP-2015.*



**APPENDIX C – SUMMARY OF ACTUARIAL ASSUMPTIONS**

2. Retirement Assumption

Retirement Age	<u>Hired Before 1/1/2011</u>				<u>Hired On or After 1/1/2011</u>		
	Normal Retirement		Early Retirement		Retirement Age	Normal Retirement	
	Male	Female	Male	Female		Male	Female
55	20%	3%					
56	16%	3%					
57	13%	3%					
58	9%	3%					
59	5%	3%					
60	8%	8%					
61	5%	8%					
62	8%	8%	6%	3%	62	30%	35%
63	10%	8%	6%	3%	63	20%	20%
64	12%	8%	6%	3%	64	15%	20%
65	12%	15%	6%	3%	65	30%	50%
66	20%	15%	6%	3%	66	25%	25%
67	20%	15%	6%	3%	67	20%	25%
68	30%	15%	6%	3%	68	20%	25%
69	30%	15%	6%	3%	69	30%	50%
70	100%	100%	100%	100%	70	100%	100%

3. Disability Assumption

Sample Ages		
	Males	Females
25	0.01 %	0.01 %
30	0.02	0.01
35	0.03	0.02
40	0.04	0.03
45	0.05	0.04
50	0.08	0.07
55	0.13	0.12
60	0.20	0.19
65	0.20	0.19
70	0.20	0.19





## APPENDIX C – SUMMARY OF ACTUARIAL ASSUMPTIONS

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10. Incidence of Contributions	Contributions are assumed to be received continuously throughout the year based upon the computed percent of payroll shown in this report, and the actual payroll payable at the time contributions are made. New entrant normal cost contributions are applied to the funding of new entrant benefits.
11. Forfeitures	No vested member are assumed to take a refund of employee contributions.
12. Salary and Benefit Limits	For purposes of the valuation, no limits were applied to member compensation or benefits.
13. Commencement age for deferred vested benefit	Normal retirement age

### Data Adjustments

Active and retired member data was reported as of May 31, 2020. It was brought forward to June 30, 2020 by adding one month of service for all active members, one month of contributions and interest for Judicial Plan 2011 members, and the June COLA for certain retired members. Financial information continues to be reported as of June 30. This procedure was instituted to provide sufficient time for the Board of Trustees to certify the appropriate contribution rate prior to the October 1 statutory deadline.

Active members reported with no annualized salary were assumed to receive the average active member pay.

### TECHNICAL VALUATION PROCEDURES

#### Other Valuation Procedures

Salary increases are assumed to apply to annual amounts.

Decrement are assumed to occur mid-year, except that immediate retirement is assumed for those who are at or above the age at which retirement rates are 100%. Standard adjustments are made for multiple decrements.

No actuarial liability is included for participants who terminated without being vested prior to the valuation date, except those due a refund of contributions.



## APPENDIX D – GLOSSARY OF TERMS

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<b>Actuarial Accrued Liability</b>	The difference between the actuarial present value of system benefits and the actuarial value of future normal costs. Also referred to as “accrued liability” or “actuarial liability”.
<b>Actuarial Assumptions</b>	Estimates of future experience with respect to rates of mortality, disability, turnover, retirement, rate or rates of investment income and salary increases. Decrement assumptions (rates of mortality, disability, turnover and retirement) are generally based on past experience, often modified for projected changes in conditions. Economic assumptions (salary increases and investment income) consist of an underlying rate in an inflation-free environment plus a provision for a long-term average rate of inflation.
<b>Accrued Service</b>	Service credited under the system which was rendered before the date of the actuarial valuation.
<b>Actuarial Equivalent</b>	A single amount or series of amounts of equal actuarial value to another single amount or series of amounts, computed on the basis of appropriate assumptions.
<b>Actuarial Cost Method</b>	A mathematical budgeting procedure for allocating the dollar amount of the actuarial present value of retirement system benefit between future normal cost and actuarial accrued liability. Sometimes referred to as the “actuarial funding method”.
<b>Experience Gain (Loss)</b>	The difference between actual experience and actuarial assumptions anticipated experience during the period between two actuarial valuation dates.
<b>Actuarial Present Value</b>	The amount of funds currently required to provide a payment or series of payments in the future. It is determined by discounting future payments at predetermined rates of interest and by probabilities of payment.
<b>Amortization</b>	Paying off an interest-discounted amount with periodic payments of interest and principal, as opposed to paying off with lump sum payment.
<b>Normal Cost</b>	The actuarial present value of retirement system benefits allocated to the current year by the actuarial cost method.
<b>Unfunded Actuarial Accrued Liability</b>	<p>The difference between actuarial accrued liability and the valuation assets. Sometimes referred to as “unfunded actuarial liability” or “unfunded accrued liability”.</p> <p>Most retirement systems have unfunded actuarial accrued liability. They arise each time new benefits are added and each time an actuarial loss is realized.</p>