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MISSOURI STATE EMPLOYEES' RETIREMENT SYSTEM

ACTUARIAL VALUATION REPORT AS OF JUNE 30, 2021

CONTRIBUTION RATE FOR FISCAL YEAR ENDING JUNE 30, 2023

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October 18, 2021

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, 2021 for the purpose of determining the employer required contribution rate for the fiscal year ending June 30, 2023. This report provides valuation results for the Missouri State Employees' Plan (MSEP). The major findings of the valuation are contained in this report, which reflects the benefit provisions in place on June 30, 2021. There have been no changes to the plan provisions since the prior valuation. However, there were several changes to the actuarial assumptions and methods as a result of completion of the five-year experience study that analyzed actuarial experience between July 1, 2015 and June 30, 2020. These changes, as well as their impact on the current valuation results, are discussed further in the Executive Summary 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 MSEP 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 MSEP. 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 D.

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In order to prepare the results in this report, we have utilized appropriate actuarial models that were developed for this purpose. These models use assumptions about future contingent events along with recognized actuarial approaches to develop the needed results. 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.

As we prepare this report, the world is recovering from the COVID-19 pandemic. We have considered available information, but do not believe there is sufficient data yet to warrant the modification of any of our assumptions. We will continue to monitor the situation and advise the Board in the future of any adjustment we believe would be appropriate.

The actuarial computations presented in this report are for purposes of determining the funding amounts for MSEP 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,

Patrice Beckham

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

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

This report presents the results of the June 30, 2021 actuarial valuation of the Missouri State Employees' Plan (MSEP). 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, 2023;
- Disclose asset and liability measurements as well as the current funded status of MSEP on the valuation date;
- Compare the actual and expected experience of MSEP during the plan year ended June 30, 2021;
- Assess and disclose the key risks associated with funding the System; and
- Analyze and report on trends in MSEP contributions, assets and liabilities over the past several years.

Changes to Actuarial Assumptions and Methods

A five-year comprehensive experience study was performed in 2021, including analysis of both the economic and demographic assumptions. All of the recommended changes to the assumptions and methods were adopted by the Board at their June 17, 2021 meeting. Please see the Experience Study report, dated August 4, 2021, for more detail on the change in the assumptions and methods. Significant changes include:

- The individual salary increase assumption was increased to partially reflect the higher merit salary increases that were observed in the experience.
- The mortality assumption was changed to a generational approach using the Pub-2010 General Members Below Median Mortality Table, scaled 104%, set back two years for males and set forward one year for females and projected forward with 75% of Scale MP-2020 for years after 2020.
- The retirement assumption was modified with separate assumptions for MSEP, MSEP 2000 and MSEP 2011.
- The termination assumption was changed from select and ultimate tables to a single table based on service only. In addition, the termination rates are now unisex.
- Changes in the UAAL due to actuarial gains/losses or assumption changes will be amortized as a level percentage of payroll, over closed 25-year periods, applied prospectively starting with the 2021 actuarial valuation.

The net impact on the current valuation results due to the new set of actuarial assumptions and methods is summarized in the following table.

	Prior Assumptions	Current Assumptions	Difference
Actuarial Accrued Liability ($M)	$14,595	$15,111	$516
Actuarial Value of Assets ($M)	8,909	8,909	0
Unfunded Actuarial Accrued Liability ($M)	**$5,685**	**$6,201**	**$516**
Funded Ratio	61.0%	59.0%	(2.0%)
Normal Cost Rate	8.47%	8.83%	0.36%
UAAL Amortization Rate	17.86%	19.38%	1.52%
Actuarial Contribution Rate	26.33%	28.21%	1.88%
Member Contribution Rate	(1.90%)	(1.88%)	0.02%
Employer Contribution Rate	**24.43%**	**26.33%**	**1.90%**
Employer Contribution Amount ($M)	**$510.1**	**$552.7**	**$42.6**

Experience Impacting the June 30, 2021 Valuation

The actuarial valuation results provide a "snapshot" view of the System's financial condition on the measurement date of June 30, 2021. The unfunded actuarial accrued liability (UAAL) for MSEP increased from $5.547 billion last year to $6.201 billion this year and the funded ratio decreased from 61.1% to 59.0%. In addition, the employer contribution rate increased from 23.51% of pay last year to 26.33% of pay in this year's valuation, an increase of 2.82% of pay. The key factors impacting the 2021 valuation results include:

- The net rate of return on the market value of assets for fiscal year 2021 was 26.4%, as reported by MOSERS. However, due to the use of an asset smoothing method, the rate of return on the actuarial value of assets was 7.3%, which was higher than the assumed return of 6.95%. As a result, there was an actuarial gain on assets of $31 million which lowered the unfunded actuarial accrued liability. The employer contribution rate decreased by 0.11% as a result of the asset gain.

- There was a net liability loss of $130 million for fiscal year 2021, i.e., the actuarial accrued liability was higher than expected. The most significant source of loss was due to larger salary increases than expected for continuing active members (6.9% actual versus 3.4% expected). The loss from salary experience was partially offset by an actuarial gain from lower COLAs than assumed. The net liability loss increased the UAAL and increased the employer contribution rate by 0.45%.

- There was a decline of 6.9% in the number of active members in the 2021 valuation (42,829 compared to 45,999 in the prior valuation). This trend has occurred regularly over the last 10-15 years and has a material impact on the actuarial contribution rate. The contribution on the unfunded actuarial accrued liability (UAAL) is developed based on the assumption that covered payroll will increase 2.25% in each future year. When the active population declines, covered payroll does not increase as expected and the UAAL contribution rate increases in order to collect the same dollar amount of UAAL payment. Payroll was fairly flat from the 2020 to the 2021 valuation which resulted in an increase in the employer contribution rate of 0.69%.

- Because the benefit structure is different for MSEP 2011 members, including an employee contribution rate of 4%, the ongoing cost of the System declines as a larger percentage of active members are covered by MSEP 2011. The number of active members covered by the MSEP 2011 Plan decreased from 23,075 in the 2020 valuation to 22,369 in the 2021 valuation, but the percentage of total active members in MSEP 2011 increased from 50% to 52%. The normal cost rate decreased by 0.06% and the effective member contribution rate increased by 0.10% which both served to reduce the employer contribution rate.

While the plan experience includes factors that both increase and decrease the UAAL and employer contribution rate, the most significant impact on the 2021 valuation was due to the change in the actuarial assumptions and methods (see page 1).

A summary of the key results from the June 30, 2021 actuarial valuation, compared to the prior valuation, is shown in the following table.

	June 30, 2021	June 30, 2020
Unfunded Actuarial Accrued Liability ($M)	$6,201	$5,547
Funded Ratio (Actuarial Assets)	58.96%	61.10%
Normal Cost Rate	8.83%	8.53%
UAAL Amortization Rate	19.38%	16.78%
Total Actuarial Required Contribution	28.21%	25.31%
Member Contribution Rate	(1.88%)	(1.80%)
Employer Contribution Rate	26.33%	23.51%

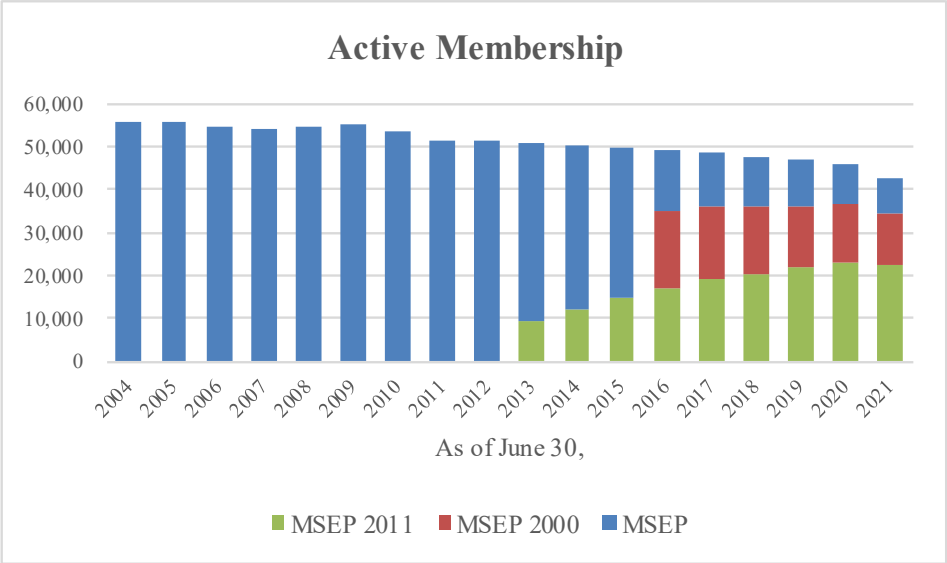
Further detail on the changes and actuarial experience affecting the valuation results can be found in the following sections of this Executive Summary.

Actual Experience for the Last Plan Year

Numerous factors contributed to the change in the MSEP assets, liabilities, and actuarial required contribution rate between June 30, 2020 and June 30, 2021. The components are examined in the following discussion.

Membership

There was a decline of 6.9% in the number of active members in the current valuation (42,829 compared to 45,999 in the prior valuation). As shown in the following graph, the active membership has declined about 23% over the last 17 years from 55,914 active members in the 2004 valuation to 42,829 in the current valuation. A decline in the size of the active membership puts a strain on the system's contribution rate because covered payroll generally does not increase, as assumed, and consequently, the UAAL amortization payment is higher as a percent of payroll. Note that while the UAAL amortization contribution rate is higher when covered payroll does not increase as assumed, the dollar amount of the UAAL amortization payment is the same.



Note: Split between MSEP and MSEP 2000 is not available prior to June 30, 2016.
MSEP 2011 active counts are not available for June 30, 2011 or June 30, 2012.

The percentage of active members covered by the MSEP 2011 Plan has increased each year as actives covered by the MSEP or MSEP 2000 Plans leave covered employment and are replaced by new hires. The number of active members covered by the MSEP 2011 Plan decreased from 23,075 in the 2020 valuation to 22,369 in the 2021 valuation, but the percentage of the overall active population grew from 50% to 52% due to the decline in the active count. Because the benefit structure is different for MSEP 2011 members, including an employee contribution rate of 4%, the ongoing cost of the System declines as a larger percentage of active members are covered by MSEP 2011.

As is expected in a mature retirement system, the number of members receiving benefits increased from 50,857 last year to 52,223 in the current valuation. In addition, the average benefit amount for this group increased (1.1%), which is to be expected.

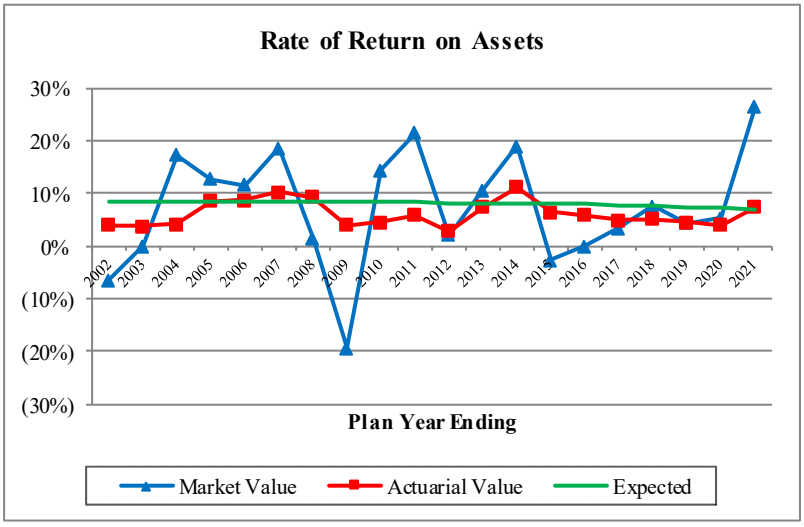
System Assets

As of June 30, 2021, MSEP had net assets of $9.520 billion, when measured on a market value basis, an increase of $1.609 billion from the prior year value of $7.911 billion. 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 implemented in the June 30, 2018 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 ($927 million) was established on a schedule to evenly recognize the amount over a closed seven-year period beginning June 30, 2018.

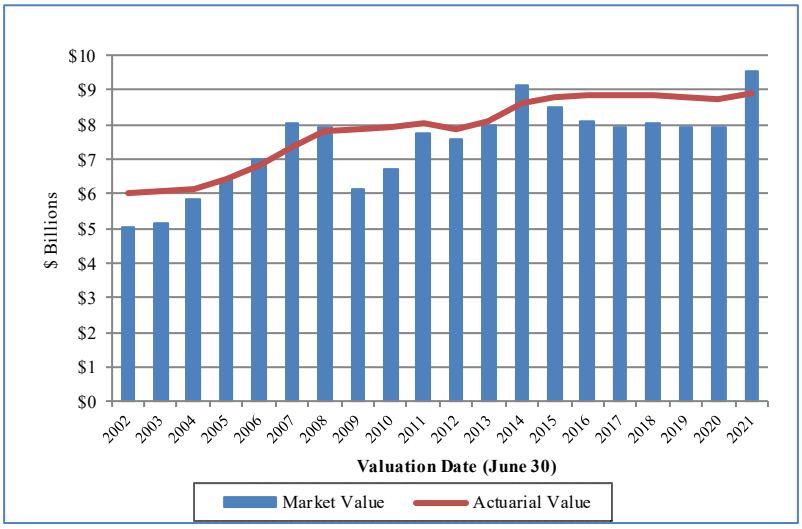
In the current valuation, the actuarial value of assets for MSEP is $8.909 billion, an increase of $198 million from the prior year. The components of the change in the asset values are shown in the following table.

	Market Value ($M)		Actuarial Value ($M)	
Net Assets, June 30, 2020	$	7,910.83	$	8,711.22
- Employer and Member Contributions	+	504.68	+	504.68
- Miscellaneous Income	+	0.08	+	0.08
- Benefit Payments	-	919.84	-	919.84
- Net Investment Income	+	2,033.00	+	621.93
- Administrative Expenses	-	8.82	-	8.82
Net Assets, June 30, 2021	$	9,519.93	$	8,909.25
Estimated Net Rate of Return		26.4%		7.3%

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 2021 was 7.3%, which is higher than the assumed investment return of 6.95% during that period. As a result, there was an actuarial gain on the smoothed value of assets of $31 million. The investment return on the market value of assets for the year ending June 30, 2021 of 26.4%, as reported by MOSERS, was well above the assumed rate of return. As a result, it produced an investment income surplus for the year ended June 30, 2021 of $1.498 billion. There is currently a net deferred investment gain of $611 million (market value of assets exceeds actuarial 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.



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 or 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.

The UAAL, using both the actuarial and market value of assets, is shown as of June 30, 2021 in the following table:

	Actuarial Value of Assets	Market Value of Assets
Actuarial Accrued Liability	$15,110,646,537	$15,110,646,537
Value of Assets	8,909,251,051	9,519,930,080
Unfunded Actuarial Accrued Liability	$6,201,395,486	$5,590,716,457
Funded Ratio	58.96%	63.00%

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

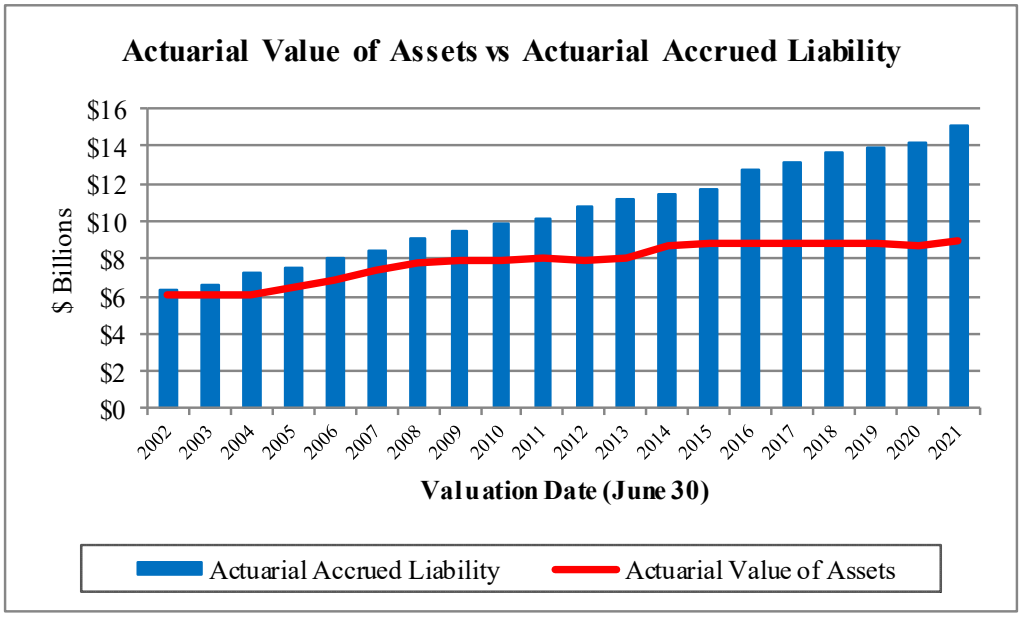
The net change in the UAAL from June 30, 2020 to June 30, 2021 was an increase of $654.2 million. The components of this net change are shown in the following table:

	($ Millions)
Unfunded Actuarial Accrued Liability, June 30, 2020	$5,547.2
- Expected increase due to amortization method	44.0
- Investment experience	(31.0)
- Liability experience	130.1
- Change to actuarial assumptions	515.9
- Other experience	(4.8)
Unfunded Actuarial Accrued Liability, June 30, 2021	$6,201.4

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 in the table above.

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, reflecting any changes due to actuarial assumptions and methods, or benefit provision changes. Overall, MSEP experienced a net actuarial loss of $99.1 million, the net result of an actuarial loss of $130.1 million on System liabilities and a $31.0 million gain on actuarial assets. The liability loss was the net result of various components of actuarial gains and losses for the year ending June 30, 2021. The most significant source of liability loss was larger than expected salary increases for continuing active members. 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, the System's liabilities have grown faster than the System's assets since FY 2009. Some of the growth is due to significant changes in the actuarial assumptions during this timeframe, including lowering the investment return assumption from 8.50% to 6.95%. As a result, the unfunded portion of the actuarial accrued liability has increased.

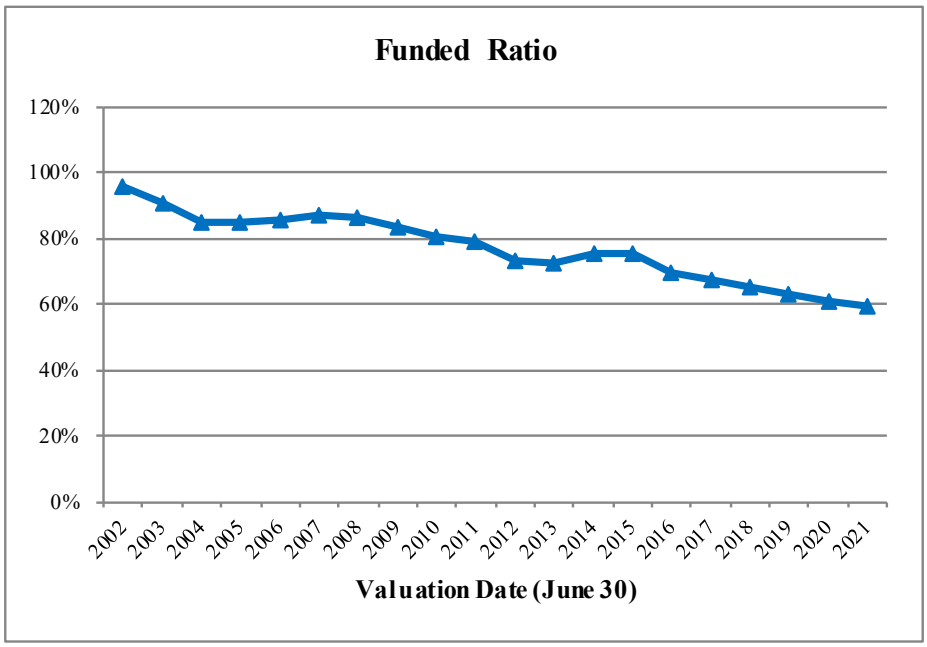


An evaluation of the UAAL on a pure dollar basis may not provide a complete analysis since only the difference between the assets and liabilities (which are both very large numbers) is reflected. Another way to evaluate the UAAL and the progress made in its funding is to track the funded ratio, the ratio 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 below (in millions).

	6/30/2016	6/30/2017	6/30/2018	6/30/2019	6/30/2020	6/30/2021
Using Actuarial Value of Assets:						
- Funded Ratio	69.6%	67.5%	64.9%	62.9%	61.1%	59.0%
- UAAL ($M)	$3,873	$4,280	$4,782	$5,175	$5,547	$6,201
Using Market Value of Assets:						
- Funded Ratio	63.6%	60.4%	59.0%	56.7%	55.5%	63.0%
- UAAL ($M)	$4,641	$5,207	$5,578	$6,041	$6,348	$5,591

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.

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



As the graph above shows, the System's funded ratio has declined over the past 20 years. It is important to note that historical trends are not simply a reflection of past investment performance and other actuarial experience. Changes to actuarial assumptions and methods, benefit provisions and the System's funding policy have also had a significant impact on valuation results over time. The Board adopted new assumptions several times during this period which had the general impact of decreasing the funded ratio.

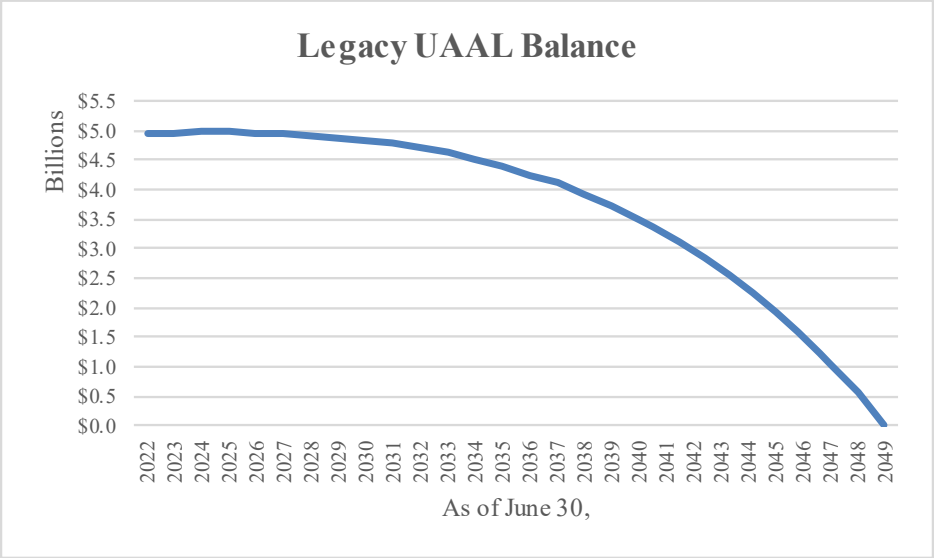
Actuarial Required Contribution Rate

The System is funded by contributions from employers (actuarially determined) and from 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, which includes a component for administrative expenses.
- 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 and 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. Effective with the June 30, 2021 valuation, the amortization period for new bases will be amortized over closed 25 year period. However, the bases established prior to June 30, 2021 continue to be amortized on their original schedule. As required by statute, any change in the UAAL due to modification of the System's benefit structure is amortized over a closed period of 20 years. The total UAAL amortization payment is the sum of the payments for each of the amortization bases.

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 legacy UAAL base is expected to hold steady for about six years before starting to decline as illustrated in the following graph:



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* 2021	2020
1. Normal Cost Rate	8.83%	8.53%
2. UAAL Contribution Rate	19.38%	16.78%
3. Total Actuarial Required Contribution Rate	28.21%	25.31%
4. Member Contribution Rate	(1.88%)	(1.80%)
5. Employer Contribution Rate	26.33%	23.51%

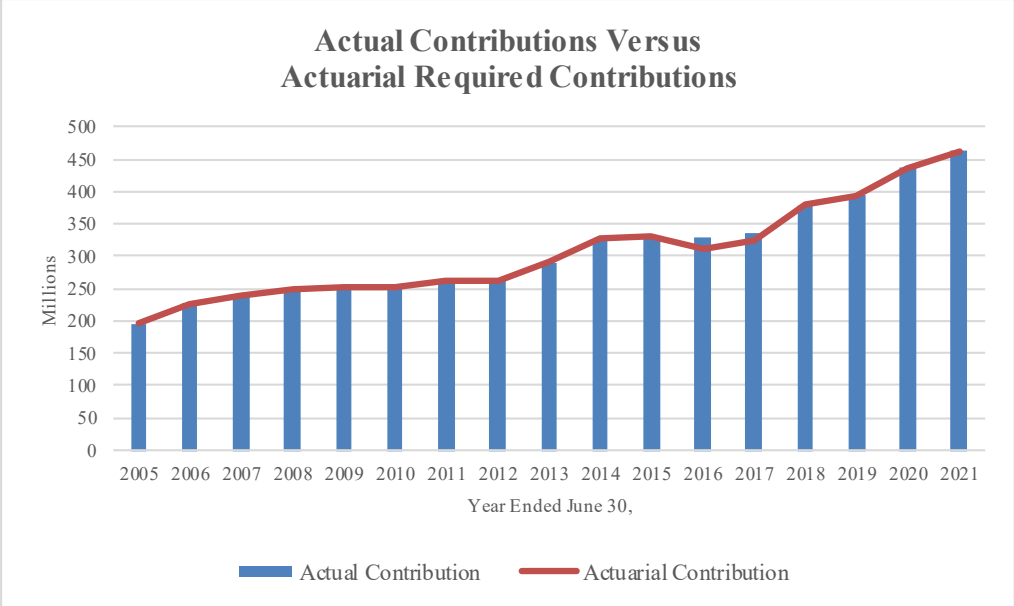
*Note different assumptions were used in the two valuation reports so results are not directly comparable.

The total actuarial contribution rate in the June 30, 2021 valuation is 28.21%. The member contribution rate (as a percentage of total payroll) is anticipated to be 1.88%, resulting in an employer contribution rate for the fiscal year ending June 30, 2023 of 26.33%.

The following table shows the reconciliation of the Computed Employer Contribution Rate from the June 30, 2020 to June 30, 2021 valuation:

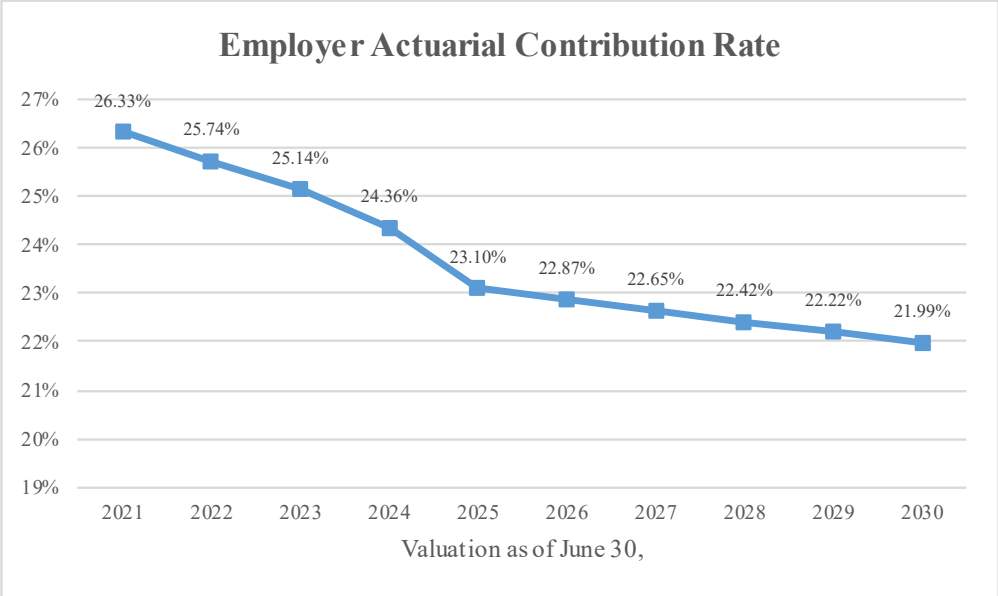
	% of Payroll
6/30/2020 Computed Employer Contribution Rate	**23.51%**
Asset (Gain)/Loss	(0.11%)
Liability (Gain)/Loss	0.45%
Change to Actuarial Assumptions	1.90%
Projected Payroll Lower than Expected	0.69%
Change in Normal Cost Rate	(0.06%)
Change in Effective Member Contribution Rate	(0.10%)
Other Experience	0.05%
6/30/2021 Computed Employer Contribution Rate	**26.33%**

Historically, MOSERS employers have contributed the full actuarial contribution as shown in the graph below which compares the actuarially determined employer contribution 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 decrease 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, are also expected to decrease the employer contribution rate. To the extent the size of the active group continues to decline in future years, there may be a slower increase in the effective member contribution rate. Future experience (both investment and demographic), which is not modeled here, will also have an impact on the ultimate level of MSEP contributions.

The following graph of the projected employer contribution rate over the next ten years reflects the impact due to the recognition of the current deferred investment experience ($611 million gain). Once the deferred investment experience is recognized, the employer contribution rate continues to decline due to the normal cost rate decreasing from more MSEP 2011 members in the System as well as increases in the effective employee contribution rate.



The net deferred investment gain (market value of assets minus the actuarial value) is $611 million as of June 30, 2021. Absent unfavorable investment experience in future years, the net deferred investment gain 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, 2021 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	$15,110,646,537	$15,110,646,537
Asset Value	(8,909,251,051)	(9,519,930,080)
Unfunded Actuarial Accrued Liability	$6,201,395,486	$5,590,716,457
Funded Ratio	59.0%	63.0%
Normal Cost Rate	8.83%	8.83%
UAAL Contribution Rate	19.38%	17.47%
Total Contribution Rate	28.21%	26.30%
Member Contribution Rate	(1.88%)	(1.88%)
Employer Contribution Rate	26.33%	24.42%

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.

As we prepare this report, the world is recovering from the COVID-19 pandemic. We have considered available information, but do not believe there is sufficient data yet to warrant the modification of any of our assumptions. We will continue to monitor the situation and advise the Board in the future of any adjustment we believe would be appropriate.

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

SUMMARY OF PRINCIPAL RESULTS
($ in millions)

Valuation Date Contribution for Fiscal Year Ending	June 30, 2021 June 30, 2023	June 30, 2020 June 30, 2022	% Change
Computed Employer Contribution			
Annual Amount (Estimated)	$552.7	$495.9	11.5%
Percentage of Covered Payroll	26.33%	23.51%	12.0%
Projected Payroll for FYE 2023 and 2022	$2,099	$2,109	(0.5%)
Benefit Payments During Prior Year	$920	$874	5.3%
Membership			
Number of			
- Active Members	42,829	45,999	(6.9%)
- Retirees and Beneficiaries	52,223	50,857	2.7%
- Terminated Vested Members	16,959	16,300	4.0%
- Leave-of-Absence Members	191	247	(22.7%)
- Long Term Disability Members	613	651	(5.8%)
- Terminated Nonvested Members	25,613	21,735	17.8%
- Total	138,428	135,789	1.9%
- Reported Payroll	$1,962	$1,981	(1.0%)
Assets			
Market Value (MVA)	$9,520	$7,911	20.3%
Actuarial Value (AVA)	$8,909	$8,711	2.3%
Ratio - Actuarial Value to Market Value	93.58%	110.11%	
Return on Market Value*	26.4%	5.2%	
Return on Actuarial Value	7.3%	3.9%	
Actuarial Information			
Actuarial Accrued Liability (AAL)	$15,111	$14,258	6.0%
Unfunded Actuarial Accrued Liability (UAAL)	$6,201	$5,547	11.8%
Funded Ratio (Actuarial Value of Assets)	59.0%	61.1%	(3.4%)
Ratio of AVA to Reported Payroll	4.5	4.4	
Ratio of AAL to Reported Payroll	7.7	7.2	
Normal Cost Rate	8.83%	8.53%	3.5%
UAAL Contribution Rate	19.38%	16.78%	15.5%
Total Contribution Rate	28.21%	25.31%	11.5%
Member Contribution Rate	(1.88%)	(1.80%)	4.4%
Employer Contribution Rate	26.33%	23.51%	12.0%

* As reported by MOSERS.

This report presents the actuarial valuation results of the Missouri State Employees' Retirement System as of June 30, 2021. 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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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, 2021. 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, 2020 and ending June 30, 2021.

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

	Market Value	Actuarial Value
1. Assets at June 30, 2020	7,910,830,533	8,711,224,151
2. Contributions		
State Contributions	463,293,368	463,293,368
Employee Contributions	37,571,263	37,571,263
Member Purchases of Service Credit	1,520,330	1,520,330
Service Transfer Contributions	2,298,914	2,298,914
Total	504,683,875	504,683,875
3. Investment Income, Net of Investment Expenses	2,032,991,086	621,918,439
4. Miscellaneous Income	80,121	80,121
5. Benefit Payments and Transfers Out		
Monthly Benefit Payments	831,968,945	831,968,945
BackDROP and Lump Sum Payments	79,363,265	79,363,265
Inactive Vested Lump Sum Payments	92,059	92,059
Service Transfer Payments	2,520,166	2,520,166
Contribution Refunds	5,894,157	5,894,157
Total	919,838,592	919,838,592
6. Administrative and Misc. Expenses	8,816,943	8,816,943
7. Assets at June 30, 2021 (1) + (2) + (3) + (4) - (5) - (6)	9,519,930,080	8,909,251,051
8. Rate of Return, Net of Investment Expenses*	26.4%	7.3%

* Based on the approximation formula: (2 x 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

TABLE 2
DEVELOPMENT OF ACTUARIAL VALUE OF ASSETS

Under the current asset smoothing method, the difference between the dollar amount of 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 is recognized evenly over a closed seven-year period, beginning June 30, 2018.

Fiscal Year End June 30,	2018	2019	2020	2021
A. Market Value of Assets, Beginning of Year	$ 7,941,650,400	$ 8,034,508,424	$ 7,916,465,279	$ 7,910,830,533
B. Contributions During Year	413,179,927	429,323,185	476,091,401	504,683,875
C. Miscellaneous Income	0	0	0	80,121
D. Benefit Payments and Expenses During Year	896,510,729	861,022,406	882,214,402	928,655,535
E. Expected Rate of Return	7.50%	7.25%	7.10%	6.95%
F. Expected Net Investment Income	577,826,541	567,126,565	547,898,876	535,319,903
G. Expected Market Value of Assets, End of Year	8,036,146,139	8,169,935,768	8,058,241,154	8,022,258,897
H. Market Value of Assets, End of Year	8,034,508,424	7,916,465,279	7,910,830,533	9,519,930,080
I. Excess/(Shortfall) of Net Investment Income	$ (1,637,715)	$ (253,470,489)	$ (147,410,621)	$ 1,497,671,183

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

Plan Year Ended	Asset Gain/(Loss)	Gain/(Loss) Recognized in Prior Years	Gain/(Loss) Recognized This Year		Gain/(Loss) Deferred to Future Years
6/30/2017	(927,023,550)	(397,295,808)	(132,431,936)	*	(397,295,806)
6/30/2018	(1,637,715)	(982,629)	(327,543)		(327,543)
6/30/2019	(253,470,489)	(101,388,196)	(50,694,098)		(101,388,195)
6/30/2020	(147,410,621)	(29,482,124)	(29,482,124)		(88,446,373)
6/30/2021	1,497,671,183	0	299,534,237		1,198,136,946
Total	168,128,808	(529,148,757)	86,598,536		610,679,029

A. Market Value of Assets as of June 30, 2021	$	9,519,930,080
B. Total Deferred Investment Experience	$	610,679,029
C. Actuarial Value of Assets as of June 30, 2021 (A. - B.)	$	8,909,251,051
D. Ratio of Actuarial Value to Market Value		93.6%

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

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In the previous section, an analysis of System's current assets was given as of June 30, 2021. 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 D.

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). Effective June 30, 2021, 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 25-year periods. Bases established prior to June 30, 2021 will continue to be amortized on their original schedule. 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, 2021, as amended by any legislation in the 2021 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. Tables 6 and 7 show the gain/(loss) analysis in total and by source for the System. Table 8 shows historical data for gain/(loss) experience by source.

TABLE 3
UNFUNDED ACTUARIAL ACCRUED LIABILITY
As of June 30, 2021

	(1) Actuarial Present Value	(2) Present Value of Future Normal Cost Contributions	(3) = (1) - (2) Actuarial Accrued Liabilities
Active Members			
Service retirement benefits based on service rendered before and likely to be rendered after valuation date	$5,603,652,696	$716,391,681	$4,887,261,015
Disability benefits likely to be paid to present active members who become totally and permanently disabled	103,634,873	58,855,653	44,779,220
Survivor benefits likely to be paid to widows and children of present active members who die before retiring	60,406,791	16,087,169	44,319,622
Separation benefits likely to be paid to present active members	381,830,475	285,616,219	96,214,256
Active Member Totals	$6,149,524,835	$1,076,950,722	$5,072,574,113
Members on Leave of Absence & LTD Service retirement benefits based on service rendered before the valuation date			77,977,265
Terminated Vested Members Service retirement benefits based on service rendered before the valuation date			886,871,740
Retired Lives			9,037,922,330
Pending Refunds			35,301,089
Total Actuarial Accrued Liability			$15,110,646,537
Actuarial Value of Assets			8,909,251,051
Unfunded Actuarial Accrued Liability			$6,201,395,486
Funded Ratio			59.0%

TABLE 4
AMORTIZATION SCHEDULE FOR LEGACY UAAL

This amortization schedule for the outstanding balance of the legacy UAAL as of June 30, 2022 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 projected UAAL amortization schedule for the legacy UAAL.

As of June 30	Outstanding Balance (BOY)	Amortization Years Remaining	Contributions ($M)
2022	4,952	27	320
2023	4,965	26	327
2024	4,971	25	335
2025	4,971	24	342
2026	4,962	23	350
2027	4,945	22	358
2028	4,919	21	366
2029	4,882	20	374
2030	4,834	19	383
2031	4,775	18	391
2032	4,702	17	400
2033	4,615	16	409
2034	4,513	15	418
2035	4,394	14	428
2036	4,257	13	437
2037	4,101	12	447
2038	3,923	11	457
2039	3,723	10	467
2040	3,499	9	478
2041	3,247	8	489
2042	2,968	7	500
2043	2,657	6	511
2044	2,313	5	522
2045	1,934	4	534
2046	1,516	3	546
2047	1,056	2	559
2048	552	1	571
2049	0	0	0

TABLE 5
ACTUARIAL BALANCE SHEET

ASSETS		
Actuarial Value of Assets		$ 8,909,251,051
Unfunded Actuarial Accrued Liability		6,201,395,486
Present Value of Future Normal Costs		1,076,950,722
Total Assets		$ 16,187,597,259
LIABILITIES		
Present Value of Future Benefits		
Active members		
Retirement	$ 5,603,652,696	
Withdrawal	381,830,475	
Death	60,406,791	
Disability	103,634,873	
Total		$ 6,149,524,835
Inactive members		
Currently receiving benefits	9,037,922,330	
Not currently receiving benefits	1,000,150,094	
Total		$ 10,038,072,424
Total Liabilities		$ 16,187,597,259

TABLE 6
ANALYSIS OF GAIN/(LOSS)

	(1) Actuarial Accrued Liabilities	(2) Valuation Assets	(3) = (1) - (2) UAAL
(1) Value at start of year	$ 14,258,408,888	$ 8,711,224,151	$ 5,547,184,737
(2) Total normal cost from last valuation	152,097,309	0	152,097,309
(3) Actual contributions (Employer and Member)	0	500,864,631	(500,864,631)
(4) Miscellaneous Income	0	80,121	(80,121)
(5) Benefit payments	(919,838,592)	(919,838,592)	0
(6) Administrative expenses	0	(8,816,943)	8,816,943
(7) Service Purchases/Transfers	3,819,244	3,819,244	0
(8) Interest on (1) through (7) at 6.95%	970,233,161	590,947,260	379,285,901
(9) Expected value before changes	$ 14,464,720,010	$ 8,878,279,872	$ 5,586,440,138
(10) Change in actuarial assumptions	515,859,705	0	515,859,705
(11) Expected value after changes: (9) + (10)	$ 14,980,579,715	$ 8,878,279,872	$ 6,102,299,843
(12) Actual value at end of year	15,110,646,537	8,909,251,051	6,201,395,486
(13) Gain / (Loss)	$ (130,066,822)	$ 30,971,179	$ (99,095,643)
(14) Gain / (Loss) as percent of expected actuarial accrued liability: $14,464,720,010	(0.9%)	0.2%	(0.7%)

TABLE 7
GAIN/(LOSS) ANALYSIS BY SOURCE

Type of Activity	Gain or (Loss) for Year Ended 6/30/2021	
Age & Service Retirements. If members retire at older ages or with lower final average pay than assumed, there is a gain. If younger ages or higher average pays, a loss.	($34,800,000)	(0.2%)
Death-in-Service Benefits. If survivor claims are less than assumed, there is a gain. If more claims, there is a loss.	12,400,000	0.1%
Withdrawal From Employment. If more liabilities are released by withdrawals than assumed, there is a gain. If smaller releases, a loss.	(35,600,000)	(0.2%)
Long Term Disability. The occurrence of a gain or loss depends upon the age at disability and the incidence of disability.	(1,300,000)	(0.0%)
Salary Increases. If there are smaller salary increases than assumed, there is a gain. If greater increases, a loss.	(128,000,000)	(0.9%)
Investment Income. If there is greater investment return on assets than assumed, there is a gain. If less return, a loss.	31,000,000	0.2%
Retiree Mortality. If more deaths than assumed, there is a gain. if fewer deaths, a loss.	17,800,000	0.1%
COLAs. If Cost of Living Adjustments are less than expected, a gain; if more a loss.	45,400,000	0.3%
Other. Miscellaneous gains and losses resulting from data adjustments, timing of financial transactions, valuation methods, etc.	(6,000,000)	(0.0%)
Gain (or Loss) During Year From Experience	($99,100,000)	(0.7%)

TABLE 8
HISTORICAL EXPERIENCE GAINS AND LOSSES BY SOURCE

Year Ending June 30	Gain (Loss) By Risk Area									Total Exper. Gain (Loss)	Exper. Gain (Loss) as % of AAL	Accrued Liability Beginning of Year
	Salary Increases	Investments	Age & Service Retirement	Disability	Death In-Service	Withdrawal	Death Retired Lives&	COLAs	Other			
1998	(56.9)	325.9	9.6	0.2	(0.3)	(1.7)	16.3		(48.3)	244.8	5.5	4,484
1999	(21.9)	299.8	(1.3)	(0.3)	(0.9)	1.7	10.5		(58.1)	229.5	4.7	4,919
2000*	(6.4)	162.0	1.7	(0.5)	(0.7)	8.9	18.5		(34.7)	148.8	2.7	5,506
2001*	(23.2)	(67.9)	(59.8)	(1.0)	(0.2)	(28.2)	(13.1)		(66.1)	(259.5)	(4.4)	5,921
2002	115.0	(284.6)	(14.4)	(0.5)	(1.3)	(21.4)	37.1		(62.6)	(232.8)	(3.8)	6,065
2003	7.7	(314.1)	(27.2)	(0.6)	(2.6)	(14.6)	9.6		(63.1)	(404.9)	(6.5)	6,294
2004*	(40.0)	(240.1)	(51.5)	(1.4)	(1.3)	(6.7)	(4.3)		(53.8)	(399.1)	(6.0)	6,662
2005	(3.4)	(196.6)	3.1	(2.0)	(1.7)	(0.9)	(11.7)		(35.5)	(248.7)	(3.4)	7,230
2006	(29.5)	38.0	(1.7)	(2.3)	(2.4)	15.5	(21.1)		(3.6)	(7.1)	(0.1)	7,578
2007	(11.5)	179.4	(17.3)	(2.1)	(2.4)	3.8	(29.7)		(43.0)	77.2	1.0	8,013
2008*	(10.5)	78.3	(22.9)	(2.0)	(3.4)	6.6	8.7		(49.8)	5.0	0.1	8,500
2009*	(15.9)	(354.3)	8.8	(1.5)	0.0	(31.3)	(39.8)		(37.6)	(471.6)	(5.2)	9,128
2010	23.2	(313.6)	(19.0)	8.4	8.0	(30.6)	4.7		(56.9)	(375.8)	(3.9)	9,495
2011	49.6	(204.0)	(52.8)	10.8	7.5	(21.0)	32.7		(60.4)	(237.6)	(2.4)	9,853
2012*	12.3	(447.2)	(24.3)	8.3	8.9	8.1	10.3		(53.6)	(477.2)	(4.7)	10,124
2013**	60.4	(313.7)	6.7	11.1	7.4	2.0	(7.7)	(3.1)	(70.4)	(307.3)	(2.8)	10,794
2014	52.6	249.5	(6.9)	(4.2)	(2.5)	(12.7)	6.3	18.0	(68.3)	231.8	2.1	11,135
2015	51.4	(137.9)	(29.1)	(1.6)	(0.5)	15.6	18.9	30.0	(54.0)	(107.2)	(0.9)	11,495
2016***	(59.3)	(320.4)	7.5	(1.2)	3.0	(8.3)	16.9	50.3	(70.0)	(381.5)	(3.3)	11,728
2017*	17.0	(232.1)	(53.3)	(0.6)	6.2	(28.2)	14.3	68.3	(2.2)	(210.5)	(1.6)	12,751
2018***	85.3	(202.1)	(51.8)	(0.9)	7.2	(38.0)	20.1	43.3	17.9	(119.0)	(0.9)	13,152
2019*	24.9	(241.2)	(26.4)	(2.3)	7.1	1.5	6.4	29.5	(44.2)	(244.7)	(1.8)	13,613
2020*	(60.6)	(274.4)	(19.2)	(3.1)	7.1	(4.1)	9.1	20.2	3.7	(321.3)	(2.3)	13,958
2021*	**(128.0)**	**30.8**	**(34.8)**	**(1.3)**	**12.4**	**(35.6)**	**17.8**	**45.4**	**(5.9)**	**(99.2)**	**(0.7)**	**14,258**

* Revision in assumptions.
** Revision in asset valuation method.
*** Revision in assumptions & asset valuation method.
& Prior to the 2013 valuation, this amount included COLAs.

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The previous two sections were devoted to a discussion of the assets and liabilities the Missouri State Employees' Retirement System. 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 UAAL 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, 2021 actuarial valuation will be used to determine the employer contribution rate for the plan year ending June 30, 2023. In this context, the term "contribution rate" means the percentage, which is applied to a particular active member payroll to determine the actual employer contribution amount (i.e., in dollars) for the group.

Contribution Rate Summary

Table 9 shows the development of the June 30, 2022 projected UAAL. In Table 10, the amortization payment related to the UAAL is developed. Table 11 develops the computed employer contribution rate for the Plan and the estimated amount of required State contributions. Table 12 shows estimated contribution amounts for each department 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 D.

TABLE 9
PROJECTED UAAL AS OF JUNE 30, 2022

(1) Unfunded Actuarial Accrued Liability at June 30, 2021	$6,201,395,486
(2) Expected Contribution Rate for Year Ending June 30, 2022*	25.31%
(3) Normal Cost Rate for Year Ending June 30, 2022	8.83%
(4) Contribution Rate Applied to UAAL [(2) - (3)]	16.48%
(5) Projected Payroll for the Year After the Valuation Date	$2,053,002,812
(6) Expected UAAL Contribution [(4) * (5)]	$338,334,863
(7) Interest on (1) and (6) to June 30, 2022 at 6.95%	$419,437,325
(8) Projected UAAL at June 30, 2022 [(1) - (6) + (7)]	$6,282,497,948

*The Total Contribution Rate was the employer rate of 23.51% plus the weighted average member rate of 1.80% of payroll.

TABLE 10
UAAL CONTRIBUTION RATE

Amortization Base	Original Amount	Remaining Payments	Projected June 30, 2022 Balance	Annual Payment*
2018 Legacy UAAL	$ 4,861,507,879	27	$ 4,951,993,017	$ 320,218,960
2019 Assumption Changes	74,340,841	28	75,242,356	4,776,757
2019 Experience Base	259,714,456	28	262,863,955	16,687,906
2020 Assumption Changes	124,766,739	29	125,516,840	7,831,829
2020 Experience Base	196,930,919	29	198,114,873	12,361,703
2021 Assumption Changes	515,859,705	25	515,859,705	34,739,368
2021 Experience Base	$ 152,907,202	25	152,907,202	10,297,179
Total			**$ 6,282,497,948**	**$ 406,913,702**

* Payment amount reflects mid-year timing.

1. Total UAAL Amortization Payments	$ 406,913,702
2. Expected Payroll for FYE 2023	$ 2,099,195,375
3. UAAL Amortization Payment Rate (1) / (2)	19.38%

TABLE 11
COMPUTED EMPLOYER CONTRIBUTION RATE FOR THE FISCAL YEAR ENDING JUNE 30, 2023

ACTUARIAL VALUATION RESULTS AS OF JUNE 30, 2021

	Percent of Payroll		
	MSEP & MSEP 2000	MSEP 2011	Weighted Average
A. Normal Cost			
(1) Service retirement benefits	6.38 %	4.87 %	5.66 %
(2) Termination benefits	1.81	2.53	2.15
(3) Survivor benefits	0.11	0.14	0.13
(4) Disability benefits	0.46	0.46	0.46
(5) Administrative expenses	0.43	0.43	0.43
(6) Total	9.19	8.43	8.83
B. Less Member Contributions	0.00	4.00	1.88
C. Employer Normal Cost [A(6) - B]	9.19	4.43	6.95
D. Unfunded Actuarial Accrued Liabilities (UAAL) (level percent-of-payroll amortization with layered bases)			19.38
E. TOTAL COMPUTED EMPLOYER CONTRIBUTION RATE [C. + D.]			**26.33 %**
F. ESTIMATED EMPLOYER CONTRIBUTION ($Millions)#			**$552.7**

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.

TABLE 12
EARLY PAYMENT AMOUNTS BY DEPARTMENT FOR FISCAL YEAR 2023
(UAAL CONTRIBUTION RATE: 19.38% OF PAYROLL)

Section 104.436, RSMo. describes the certified contribution rate a department shall pay in accordance with its ordinary course payrolls during each fiscal year. Per a Board Rule adopted during 2020, a department may elect to pre-pay the amount for the unfunded actuarial accrued liabilities (UAAL) only or the total contribution which also includes the normal cost rate, at 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, as either an additional amount paid by the department 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.

				One-Time Payment, Adjusted for Expected Payroll Contributions to Date:			
Department	Expected Payroll for FY 2023	Total FY 2023 UAAL Payments	FY 2023 UAAL Contribution Rate	July 15*	September 1**	November 1***	Additional Payroll Contributions
State of Missouri	1,762,516,066	341,650,873	19.38%	331,289,756	278,403,287	225,230,816	6.95%
Environmental Improvement & Energy Resource Authority	199,102	38,594	19.38%	37,424	31,449	25,443	6.95%
Missouri Agriculture & Small Business Development Authority	281,318	54,531	19.38%	52,877	44,436	35,949	6.95%
Missouri Consolidated Health Care Plan (MCHCP)	2,948,781	571,600	19.38%	554,265	465,783	376,823	6.95%
Missouri Development Finance Board	419,452	81,308	19.38%	78,842	66,256	53,602	6.95%
Missouri Housing Development Commission	6,306,908	1,222,548	19.38%	1,185,472	996,226	805,956	6.95%
Missouri Public Entity Risk Management Fund	721,068	139,774	19.38%	135,535	113,899	92,145	6.95%
Missouri Technology Corporation	49,709	9,636	19.38%	9,344	7,852	6,352	6.95%
Missouri Wine and Grape Board	253,025	49,047	19.38%	47,560	39,967	32,334	6.95%
Harris Stowe State University	10,984,838	2,129,331	19.38%	2,064,756	1,735,142	1,403,746	6.95%
Lincoln University	15,761,937	3,055,336	19.38%	2,962,678	2,489,722	2,014,208	6.95%
Missouri Southern State University	17,805,786	3,451,522	19.38%	3,346,849	2,812,564	2,275,390	6.95%
Missouri State University	100,962,200	19,570,786	19.38%	18,977,270	15,947,775	12,901,896	6.95%
Missouri Western State University	17,945,863	3,478,675	19.38%	3,373,179	2,834,691	2,293,291	6.95%
Northwest Missouri State University	33,703,429	6,533,164	19.38%	6,335,035	5,323,722	4,306,940	6.95%
Southeast Missouri State University	41,397,177	8,024,541	19.38%	7,781,184	6,539,010	5,290,119	6.95%
State Technical College of Missouri	10,373,037	2,010,738	19.38%	1,949,759	1,638,503	1,325,564	6.95%
Truman State University	27,335,906	5,298,866	19.38%	5,138,169	4,317,922	3,493,238	6.95%
University of Central Missouri	49,229,773	9,542,832	19.38%	9,253,430	7,776,230	6,291,042	6.95%
Total	2,099,195,375	406,913,702	19.38%	394,573,384	331,584,436	268,254,854	6.95%

* One-time payment is for fiscal year payments and assumes no other contributions during the fiscal year have been made.
** Fiscal year payments are assume to be made for all of July and August, in addition to the one-time payment.
*** Fiscal year payments are assumed to be made for all of July, August, September and October, in addition to the one-time payment.

TABLE 12
EARLY PAYMENT AMOUNTS BY DEPARTMENT FOR FISCAL YEAR 2023

(continued)

(TOTAL EMPLOYER CONTRIBUTION RATE: 26.33% OF PAYROLL)

Department	Expected Payroll for FY 2023	Total FY 2023 Payments	FY 2023 Contribution Rate	One-Time Payment, Adjusted for Expected Payroll Contributions to Date: July 15*	September 1**	November 1***	Additional Payroll Contributions
State of Missouri	1,762,516,066	464,070,480	26.33%	449,996,789	378,160,155	305,935,039	0.00%
Environmental Improvement & Energy Resource Authority	199,102	52,424	26.33%	50,834	42,719	34,560	0.00%
Missouri Agriculture & Small Business Development Authority	281,318	74,071	26.33%	71,825	60,359	48,831	0.00%
Missouri Consolidated Health Care Plan (MCHCP)	2,948,781	776,414	26.33%	752,868	632,682	511,845	0.00%
Missouri Development Finance Board	419,452	110,442	26.33%	107,093	89,997	72,808	0.00%
Missouri Housing Development Commission	6,306,908	1,660,609	26.33%	1,610,248	1,353,191	1,094,744	0.00%
Missouri Public Entity Risk Management Fund	721,068	189,857	26.33%	184,099	154,710	125,162	0.00%
Missouri Technology Corporation	49,709	13,088	26.33%	12,691	10,665	8,628	0.00%
Missouri Wine and Grape Board	253,025	66,621	26.33%	64,601	54,288	43,919	0.00%
Harris Stowe State University	10,984,838	2,892,308	26.33%	2,804,594	2,356,874	1,906,733	0.00%
Lincoln University	15,761,937	4,150,118	26.33%	4,024,259	3,381,834	2,735,935	0.00%
Missouri Southern State University	17,805,786	4,688,263	26.33%	4,546,084	3,820,356	3,090,703	0.00%
Missouri State University	100,962,200	26,583,347	26.33%	25,777,164	21,662,146	17,524,875	0.00%
Missouri Western State University	17,945,863	4,725,146	26.33%	4,581,848	3,850,411	3,115,018	0.00%
Northwest Missouri State University	33,703,429	8,874,113	26.33%	8,604,991	7,231,307	5,850,193	0.00%
Southeast Missouri State University	41,397,177	10,899,877	26.33%	10,569,321	8,882,054	7,185,663	0.00%
State Technical College of Missouri	10,373,037	2,731,221	26.33%	2,648,392	2,225,608	1,800,537	0.00%
Truman State University	27,335,906	7,197,544	26.33%	6,979,267	5,865,110	4,744,928	0.00%
University of Central Missouri	49,229,773	12,962,199	26.33%	12,569,099	10,562,592	8,545,234	0.00%
Total	2,099,195,375	552,718,142	26.33%	535,956,067	450,397,058	364,375,355	0.00%

* One-time payment is for fiscal year payments and assumes no other contributions during the fiscal year have been made.
** Fiscal year payments are assumed to be made for all of July and August, in addition to the one-time payment.
*** Fiscal year payments are assumed to be made for all of July, August, September, and October, in addition to the one-time payment.

The June 30, 2021 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 MSEP, 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, 2021. 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 lower cost benefit structure, until all new employees are covered under MSEP 2011 benefits, the normal cost percentage will continue to decrease. In addition, MSEP 2011 members 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.*** To the extent that assumption does not occur, i.e., the size of the active membership declines or increases, the actual valuation results are expected to be different than those shown here.

The 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, 2021 will make employee contributions and participate in the MSEP 2011 plan.

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.

TABLE 13
PROJECTION OF FUTURE ACTUARIAL VALUATION RESULTS
AS OF JUNE 30, 2021

Projection Based on Assumptions Outlined in Appendix D
(Amounts in thousands)

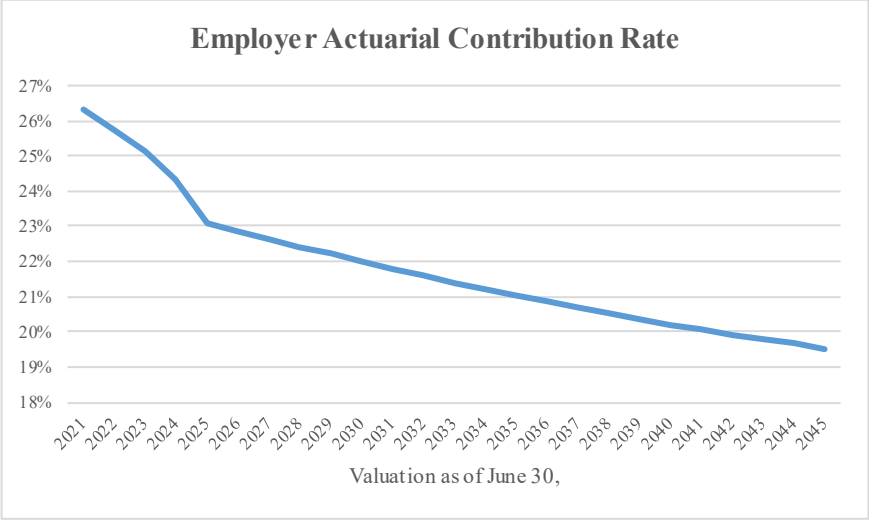
Valuation as of June 30, (1)	Covered Payroll at Valuation (2)	Actuarial Accrued Liability (AAL) (3)	Actuarial Value of Assets (AVA) (4)	Unfunded AAL (5)	Funded Ratio Using AVA (6)	Normal Cost Rate (7)	UAAL Amortization Payment Rate (8)	Actuarial Contribution Rate (9)	Member Contribution Rate (10)	Employer Actuarial Contribution Rate (11)	Estimated Dollar Amount of Employer Contribution* (12)
2021	$2,053,003	$15,110,647	$8,909,251	$6,201,395	59.0%	8.83%	19.38%	28.21%	1.88%	26.33%	$547,292
2022	2,078,588	15,329,134	9,190,704	6,138,430	60.0%	8.69%	19.09%	27.78%	2.04%	25.74%	543,674
2023	2,112,175	15,533,167	9,525,883	6,007,284	61.3%	8.58%	18.75%	27.33%	2.19%	25.14%	540,331
2024	2,149,287	15,717,313	9,895,023	5,822,290	63.0%	8.47%	18.24%	26.71%	2.35%	24.36%	533,210
2025	2,188,877	15,879,955	10,407,801	5,472,154	65.5%	8.37%	17.23%	25.60%	2.50%	23.10%	515,230
2026	2,230,431	16,019,953	10,597,903	5,422,050	66.2%	8.27%	17.24%	25.51%	2.64%	22.87%	520,140
2027	2,274,334	16,142,149	10,758,443	5,383,706	66.6%	8.19%	17.24%	25.43%	2.78%	22.65%	525,439
2028	2,319,817	16,238,996	10,904,602	5,334,394	67.2%	8.11%	17.23%	25.34%	2.92%	22.42%	530,736
2029	2,367,242	16,310,534	11,037,482	5,273,052	67.7%	8.05%	17.21%	25.26%	3.04%	22.22%	537,056
2030	2,416,993	16,357,623	11,158,771	5,198,853	68.2%	7.98%	17.18%	25.16%	3.17%	21.99%	542,926
2031	2,468,966	16,382,677	11,272,216	5,110,461	68.8%	7.92%	17.15%	25.07%	3.28%	21.79%	549,774
2032	2,523,056	16,385,554	11,378,390	5,007,164	69.4%	7.87%	17.10%	24.97%	3.38%	21.59%	556,857
2033	2,579,237	16,369,605	11,482,124	4,887,482	70.1%	7.82%	17.05%	24.87%	3.48%	21.39%	564,214
2034	2,637,747	16,335,734	11,585,415	4,750,319	70.9%	7.78%	17.00%	24.78%	3.57%	21.21%	572,420
2035	2,698,820	16,288,049	11,693,814	4,594,235	71.8%	7.74%	16.93%	24.67%	3.65%	21.02%	580,603
2036	2,762,148	16,227,837	11,810,414	4,417,422	72.8%	7.71%	16.86%	24.57%	3.72%	20.85%	589,662
2037	2,828,115	16,158,434	11,939,663	4,218,771	73.9%	7.68%	16.78%	24.46%	3.78%	20.68%	599,120
2038	2,897,100	16,084,262	12,088,051	3,996,211	75.2%	7.65%	16.69%	24.34%	3.83%	20.51%	609,020
2039	2,969,382	16,010,153	12,262,079	3,748,074	76.6%	7.63%	16.59%	24.22%	3.88%	20.34%	619,321
2040	3,044,842	15,941,900	12,469,305	3,472,595	78.2%	7.61%	16.49%	24.10%	3.91%	20.19%	630,567
2041	3,123,167	15,884,924	12,717,295	3,167,629	80.1%	7.60%	16.38%	23.98%	3.93%	20.05%	642,431
2042	3,204,144	15,843,768	13,012,801	2,830,967	82.1%	7.59%	16.27%	23.86%	3.95%	19.91%	654,514
2043	3,287,361	15,821,794	13,361,501	2,460,293	84.4%	7.58%	16.16%	23.74%	3.96%	19.78%	667,124
2044	3,372,718	15,821,610	13,768,439	2,053,170	87.0%	7.57%	16.05%	23.62%	3.97%	19.65%	679,865
2045	3,459,871	15,843,712	14,236,689	1,607,023	89.9%	7.55%	15.94%	23.49%	3.98%	19.51%	692,306

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

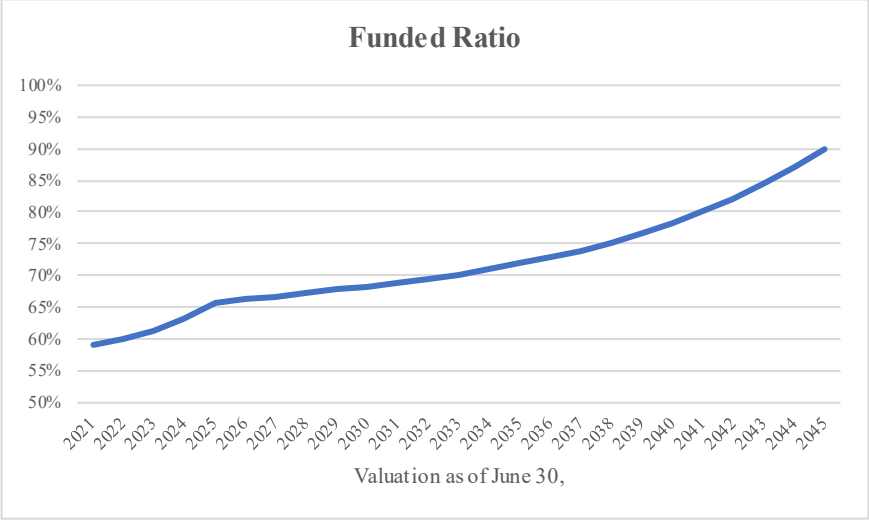
Note: Projections assume the size of the active population remains constant over the projection period and all actuarial assumptions are met in the future.

TABLE 13
PROJECTION OF FUTURE ACTUARIAL VALUATION RESULTS
AS OF JUNE 30, 2021

(continued)



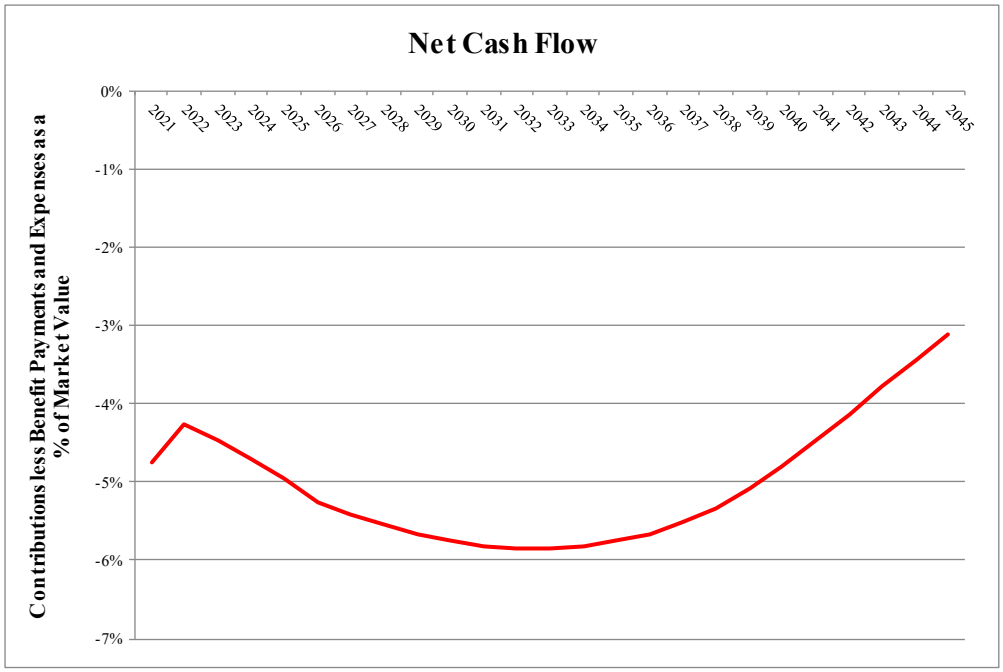
The employer contribution rate is projected to steadily decline due to the recognition of the deferred investment experience, as well as an increased proportion of the membership being covered under the MSEP 2011 Plan (lower cost and employee contributions).



The current results show that the funded ratio is expected to improve gradually over time. With the current amortization policy, the System is not expected to reach full funding by the end of this projection period.

TABLE 14
PROJECTION OF FUTURE NET CASH FLOWS
AS OF JUNE 30, 2021

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)
2021	$519,615	$961,959	$9,015	($451,359)	$9,519,930	(4.74%)
2022	586,370	989,972	9,218	(412,820)	9,714,785	(4.25%)
2023	586,762	1,023,021	9,426	(445,684)	9,963,038	(4.47%)
2024	587,400	1,056,678	9,638	(478,916)	10,194,557	(4.70%)
2025	584,649	1,090,417	9,855	(515,623)	10,407,801	(4.95%)
2026	570,990	1,117,898	10,076	(556,984)	10,597,903	(5.26%)
2027	580,183	1,151,559	10,303	(581,679)	10,758,443	(5.41%)
2028	589,929	1,183,737	10,535	(604,342)	10,904,602	(5.54%)
2029	599,859	1,213,567	10,772	(624,480)	11,037,482	(5.66%)
2030	610,532	1,239,733	11,014	(640,215)	11,158,771	(5.74%)
2031	621,192	1,264,801	11,262	(654,871)	11,272,216	(5.81%)
2032	632,530	1,285,380	11,515	(664,366)	11,378,390	(5.84%)
2033	644,035	1,304,025	11,774	(671,764)	11,482,124	(5.85%)
2034	656,008	1,317,735	12,039	(673,767)	11,585,415	(5.82%)
2035	668,768	1,329,579	12,310	(673,122)	11,693,814	(5.76%)
2036	681,422	1,337,562	12,587	(668,727)	11,810,414	(5.66%)
2037	694,868	1,340,904	12,870	(658,907)	11,939,663	(5.52%)
2038	708,631	1,339,556	13,160	(644,085)	12,088,051	(5.33%)
2039	722,748	1,332,971	13,456	(623,680)	12,262,079	(5.09%)
2040	737,461	1,321,890	13,759	(598,188)	12,469,305	(4.80%)
2041	752,683	1,307,524	14,068	(568,909)	12,717,295	(4.47%)
2042	768,354	1,291,299	14,385	(537,331)	13,012,801	(4.13%)
2043	784,364	1,274,106	14,709	(504,451)	13,361,501	(3.78%)
2044	800,683	1,258,157	15,040	(472,513)	13,768,439	(3.43%)
2045	817,221	1,243,395	15,378	(441,552)	14,236,689	(3.10%)



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 (MOSERS 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.

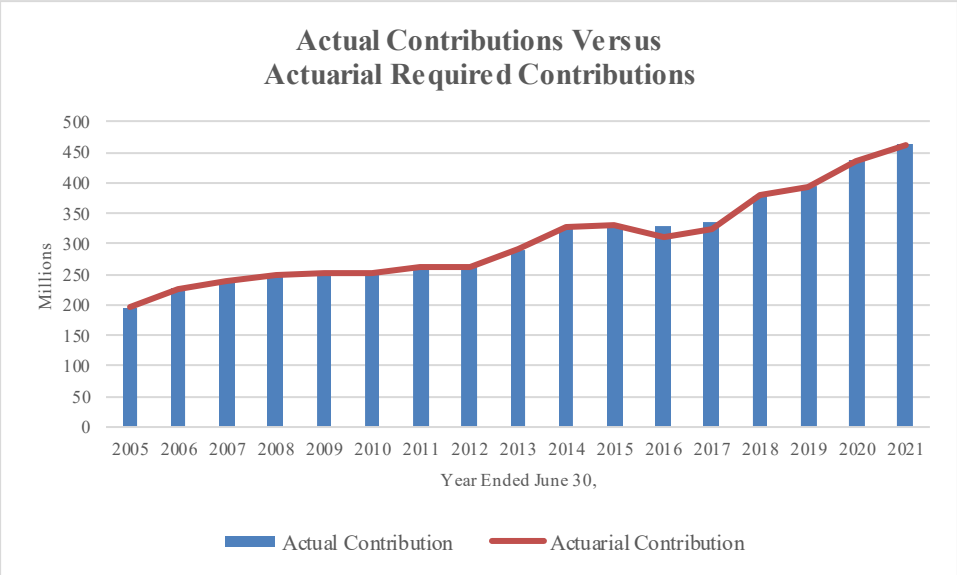
The term "risk" is most commonly associated with an outcome with undesirable results. However, in the actuarial world, risk can be translated as uncertainty. The actuarial valuation process uses many actuarial assumptions to project how future contributions and investment returns will meet the cash flow 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.

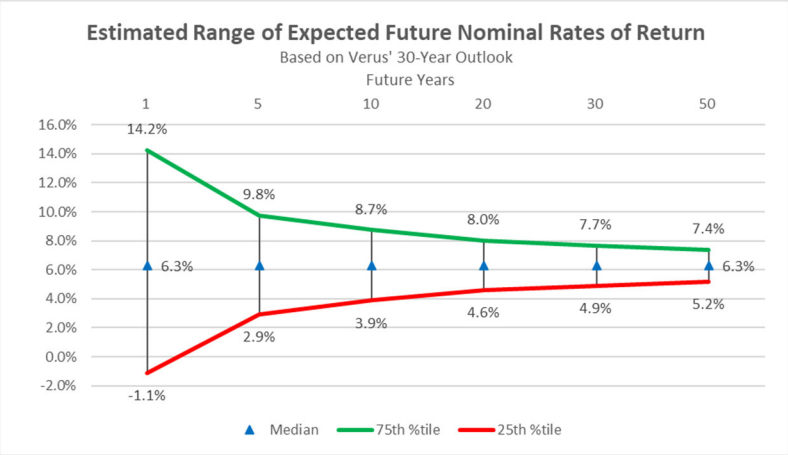
There is typically a direct correlation between healthy, well-funded retirement plans and consistent contributions equal to the full actuarial contribution rate each year. Historically, MOSERS covered employers have contributed the full actuarial rate. However, the System's contributions were slightly above the actuarial rate during FY 2016 and FY 2017 due to minimum contribution rates set in the funding policy. The following graph displays the System's historical contribution levels over the past 17 years.



One of the most positive factors regarding the MOSERS' funding is the commitment by covered employers 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 MSEP Plan is only 59% funded. Additional analysis of the Plan's historical funding indicates that the funded ratio was close to 100% in 2001. Several factors have occurred since that time which have impacted the funded status of the Plan. The actuarial assumptions have been changed eight times in the last ten years, resulting in an ultimate 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 assumption causing a decline in the funded ratio. 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 and the size of plan assets compared to payroll (see Table 15). Given the underlying capital market assumptions provided by MOSERS' investment consultant, Verus, in 2021 when the experience study was performed and the System's asset allocation, the distribution of returns over time is illustrated in the graph on the next page.

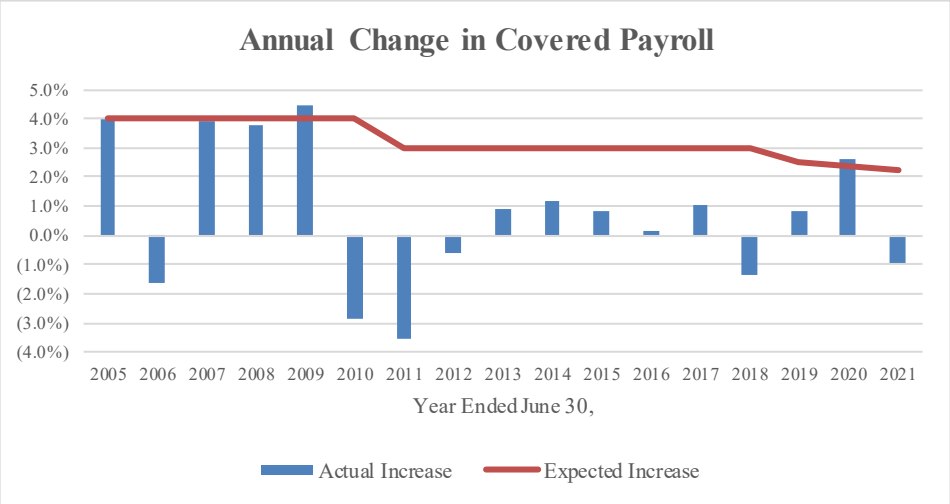
As the graph illustrates, in any single year the rate of return is expected to fall between -1% and 14% about 50% of the time. This volatility in the investment return creates significant risk to funding a retirement plan because of the volatility it creates in the contribution rate. As Table 15 explains, if the actual return is 10% different than the expected return, it would result in an increase in the actuarial contribution rate of 3.27% once the experience is fully recognized in the asset smoothing method (five years).



A key demographic risk for all retirement systems, including MOSERS, 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, as experienced with the COVID-19 pandemic. This type of event is also 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.

Another funding risk for the MSEP Plan is the decline in the active membership. The active member count has been steadily declining since 2009 as shown in the following graph, with an overall decrease of about 22%. This is important because the unfunded actuarial accrued liability (UAAL) is amortized with payments that are calculated as a level-percent of payroll. When payroll does not grow as expected, the UAAL contribution rate increases because the dollar amount of the UAAL payment is divided by a smaller payroll amount. The reduction in the number of active members also mutes the positive impact of the MSEP 2011 Plan on the employer contribution rate.

The decline in the number of active members over this period, coupled with low salary increases for state employees, has resulted in actual payroll changes that are far below the expected increase (based on the payroll growth assumption). The following graph shows the actual versus expected payroll growth from 2005 through 2021. In the early part of the period, actual increases were reasonably close to the expected increase, but since 2009 – when the number of active members started to decline – actual payroll growth has been low and even negative. While this does not necessarily impact the amount of the UAAL payment directly, it does cause the UAAL contribution rate to be higher.



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 15
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	5,859,486,975	1,737,454,454	3.37	2.27%
6/30/2005	6,431,033,445	1,806,600,560	3.56	2.40%
6/30/2006	6,983,737,684	1,777,277,138	3.93	2.65%
6/30/2007	8,056,993,537	1,846,643,330	4.36	2.94%
6/30/2008	7,934,030,312	1,916,527,398	4.14	2.79%
6/30/2009	6,163,086,701	2,002,402,087	3.08	2.07%
6/30/2010	6,727,623,355	1,945,095,321	3.46	2.33%
6/30/2011	7,768,709,373	1,875,569,816	4.14	2.79%
6/30/2012	7,581,882,309	1,864,069,493	4.07	2.74%
6/30/2013	7,993,837,570	1,880,212,950	4.25	2.86%
6/30/2014	9,136,781,826	1,902,719,928	4.80	3.23%
6/30/2015	8,516,654,912	1,918,527,768	4.44	2.99%
6/30/2016	8,109,161,214	1,921,528,936	4.22	2.84%
6/30/2017	7,945,358,298	1,941,969,786	4.09	2.75%
6/30/2018	8,034,508,424	1,915,143,002	4.20	2.83%
6/30/2019	7,916,465,279	1,930,764,635	4.10	2.76%
6/30/2020	7,910,830,533	1,980,910,473	3.99	2.69%
6/30/2021	9,519,930,080	1,961,975,052	4.85	3.27%

* 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 as of June 30, 2021 are about 485% of covered payroll. Consequently, underperforming the investment return assumption by 10.00% (i.e., earn -3.05% for one year) is equivalent to about 49% 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 3.27% of payroll once it is fully recognized in the asset smoothing method.

TABLE 15
HISTORICAL ASSET VOLATILITY RATIOS

(continued)

The following graph shows a comparison of MSEP's 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 MSEP 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. MSEP's funded ratio is lower than the median funded ratio for systems in the Public Plan Database. This fact, coupled with the reduction in active members/covered payroll over the last decade, likely explains the lower asset volatility ratio.

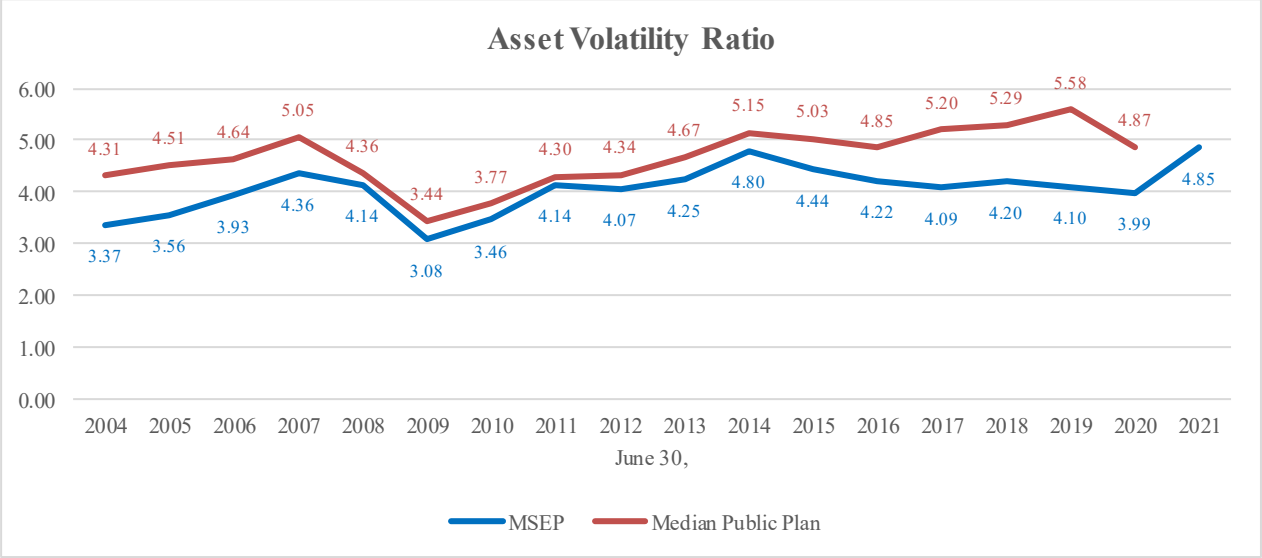


TABLE 16
LIABILITY MATURITY MEASUREMENTS

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.

Fiscal Year End	Retiree Liability (a)	Total Actuarial Accrued Liability (b)	Retiree Percentage (a) / (b)	Covered Payroll (c)	Ratio (b) / (c)
6/30/10	5,012,677,769	9,853,155,445	50.87%	1,945,095,321	5.07
6/30/11	5,357,794,617	10,123,544,043	52.92%	1,875,569,816	5.40
6/30/12	5,749,411,068	10,793,651,577	53.27%	1,864,069,493	5.79
6/30/13	6,062,654,441	11,134,637,484	54.45%	1,880,212,950	5.92
6/30/14	6,347,728,717	11,494,571,835	55.22%	1,902,719,928	6.04
6/30/15	6,695,661,737	11,727,618,410	57.09%	1,918,527,768	6.11
6/30/16	7,305,895,284	12,751,162,753	57.30%	1,921,528,936	6.64
6/30/17	7,559,623,100	13,152,273,895	57.48%	1,941,969,786	6.77
6/30/18	8,073,692,664	13,612,763,961	59.31%	1,915,143,002	7.11
6/30/19	8,430,014,943	13,957,626,309	60.40%	1,930,764,635	7.23
6/30/20	8,701,290,590	14,258,408,888	61.03%	1,980,910,473	7.20
6/30/21	9,037,922,330	15,110,646,537	59.81%	1,961,975,052	7.70

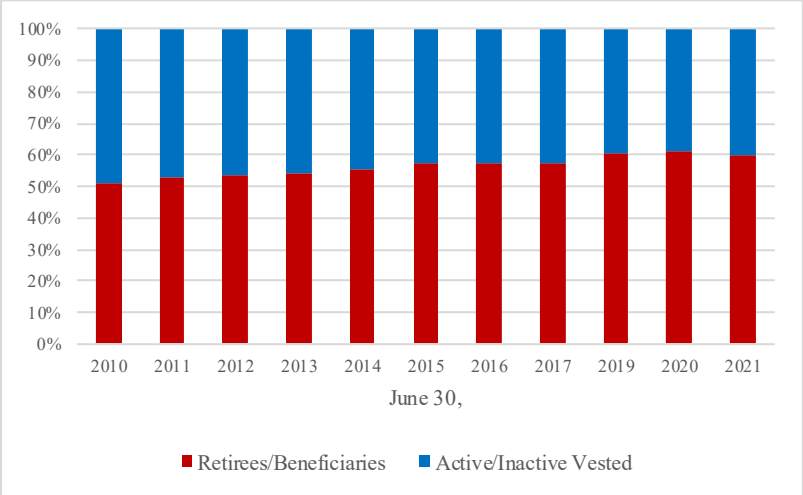
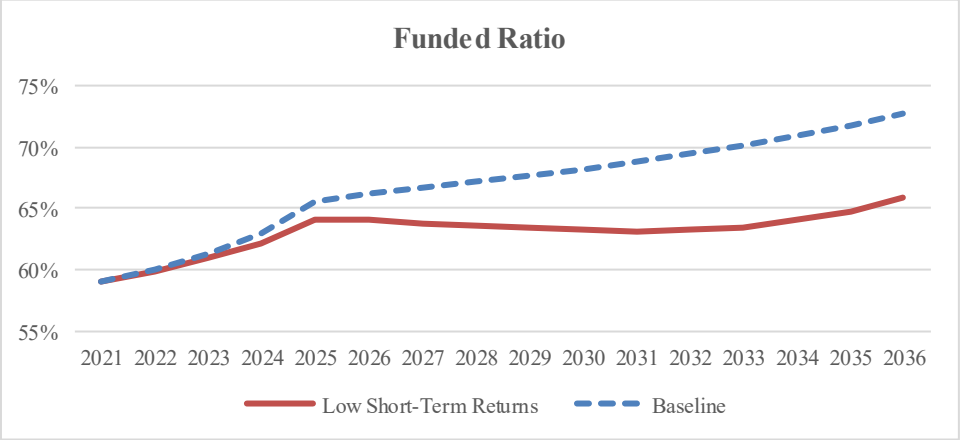


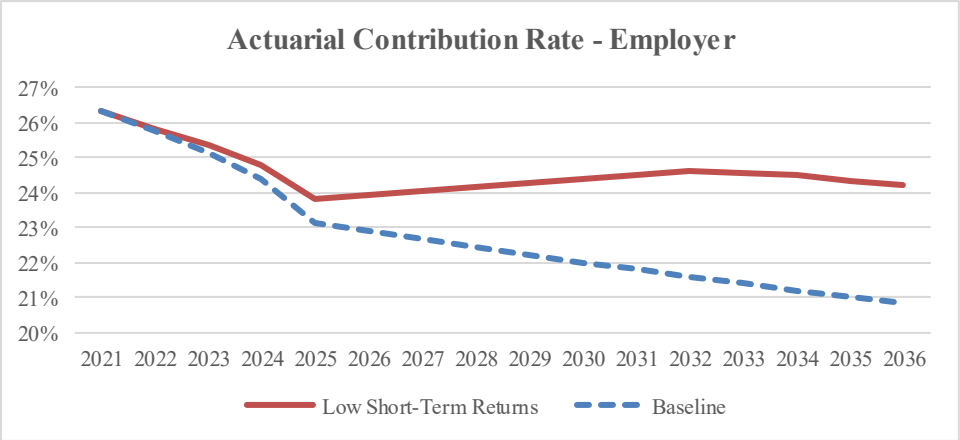
TABLE 17
SCENARIO TESTING

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 improves for the next four years as deferred investment gains are recognized. In the scenario with low short-term returns, the funded ratio remains steady at around 63% until 2033 (about 7% lower than the baseline scenario), before beginning to increase.

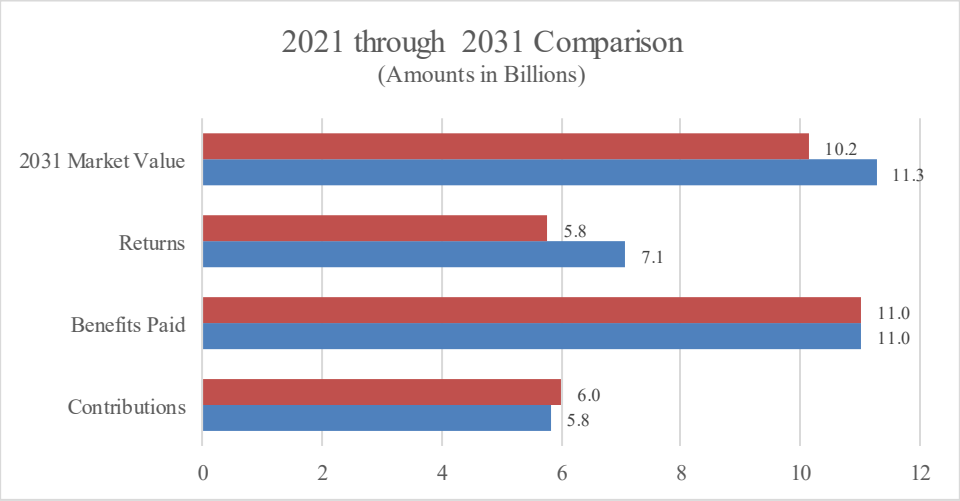


In both scenarios, the employer contribution rate decreases for the next four years as deferred investment gains are recognized. In the scenario with low short-term returns, the employer contribution rate remains steady around 24% of pay, while the baseline scenario rate continues to decline due to the normal cost rate decreasing as more MSEP 2011 members are in the System as well as increases in the effective member contribution rate.

TABLE 17
SCENARIO TESTING

(continued)

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 2031 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 2031 market value of assets is $1.2 billion 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 $1.3 billion less than assumed. Also note that even though contributions are only slightly higher under the low short-term return scenario ($6.0 billion vs $5.8 billion) over the ten-year period, contributions would continue to be higher in the future as the asset losses flow through the smoothing method.

TABLE 18
COMPARISON OF VALUATION RESULTS UNDER ALTERNATE INVESTMENT RETURN ASSUMPTIONS

($ in millions)

This exhibit compares the key June 30, 2021 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%**
Contributions					
Total Normal Cost	11.27%	9.96%	8.83%	7.86%	7.03%
Member Contributions	(1.88%)	(1.88%)	(1.88%)	(1.88%)	(1.88%)
Employer Normal Cost	9.39%	8.08%	6.95%	5.98%	5.15%
Unfunded Actuarial Accrued Liability	22.92%	21.15%	19.38%	17.61%	15.82%
Total Employer Contribution Rate	32.31%	29.23%	26.33%	23.59%	20.97%
Total Employer Contribution Amount	$678.3	$613.6	$552.7	$495.2	$440.2
Actuarial Accrued Liability	$16,888.8	$15,958.6	$15,110.6	$14,335.8	$13,626.1
Actuarial Value of Assets	$8,909.3	$8,909.3	$8,909.3	$8,909.3	$8,909.3
Unfunded Actuarial Accrued Liability	$7,979.5	$7,049.4	$6,201.4	$5,426.5	$4,716.9
Funded Ratio	52.8%	55.8%	59.0%	62.1%	65.4%

Note: All other assumptions are unchanged for purposes of this sensitivity analysis.
Numbers may not add due to rounding.

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 19
SCHEDULE OF FUNDING PROGRESS

($ in millions)

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*	$6,118	$7,230	$1,112	84.6%	$1,737	64.0%
June 30, 2005	6,435	7,578	1,143	84.9%	1,807	63.3%
June 30, 2006	6,837	8,013	1,176	85.3%	1,777	66.2%
June 30, 2007	7,377	8,500	1,123	86.8%	1,847	60.8%
June 30, 2008*	7,838	9,128	1,290	85.9%	1,917	67.3%
June 30, 2009*	7,876	9,495	1,619	83.0%	2,002	80.9%
June 30, 2010	7,923	9,853	1,930	80.4%	1,945	99.2%
June 30, 2011	8,022	10,124	2,102	79.2%	1,876	112.0%
June 30, 2012*	7,897	10,794	2,897	73.2%	1,864	155.4%
June 30, 2013*	8,096	11,135	3,039	72.7%	1,880	161.6%
June 30, 2014	8,638	11,495	2,857	75.1%	1,903	150.1%
June 30, 2015	8,792	11,728	2,936	75.0%	1,919	153.0%
June 30, 2016*	8,878	12,751	3,873	69.6%	1,922	201.5%
June 30, 2017*	8,872	13,152	4,280	67.5%	1,942	220.4%
June 30, 2018*	8,830	13,613	4,782	64.9%	1,915	249.7%
June 30, 2019*	8,782	13,958	5,175	62.9%	1,931	268.0%
June 30, 2020*	8,711	14,258	5,547	61.1%	1,981	280.0%
June 30, 2021*	8,909	15,111	6,201	59.0%	1,962	316.1%

* Revision to actuarial assumptions and/or methods.
Note: Information before 2017 was produced by prior actuary. Numbers may not add due to rounding.

TABLE 20
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	$ 5,012,677,769	$ 4,840,477,676	$ 7,923,377,393	100.0	100.0	60.1
2011	599,761	5,357,794,617	4,765,149,665	8,022,481,408	100.0	100.0	55.9
2012	5,431,451	5,749,411,068	5,038,809,058	7,897,167,203	100.0	100.0	42.5
2013	14,507,994	6,062,654,441	5,057,475,049	8,096,436,929	100.0	100.0	39.9
2014	27,111,467	6,347,728,717	5,119,731,651	8,637,758,955	100.0	100.0	44.2
2015	42,731,658	6,695,631,737	4,989,255,015	8,792,485,658	100.0	100.0	41.2
2016	60,618,379	7,305,895,284	5,384,649,090	8,878,057,191	100.0	100.0	28.1
2017	78,979,370	7,559,623,100	5,513,671,425	8,872,381,848	100.0	100.0	22.4
2018	103,784,514	8,073,692,664	5,435,286,783	8,830,410,210	100.0	100.0	12.0
2019	128,255,311	8,430,014,943	5,399,356,055	8,782,383,977	100.0	100.0	4.2
2020	157,133,312	8,701,290,590	5,399,984,986	8,711,224,151	100.0	98.3	0.0
2021	187,797,531	9,037,922,330	5,884,926,676	8,909,251,051	100.0	96.5	0.0

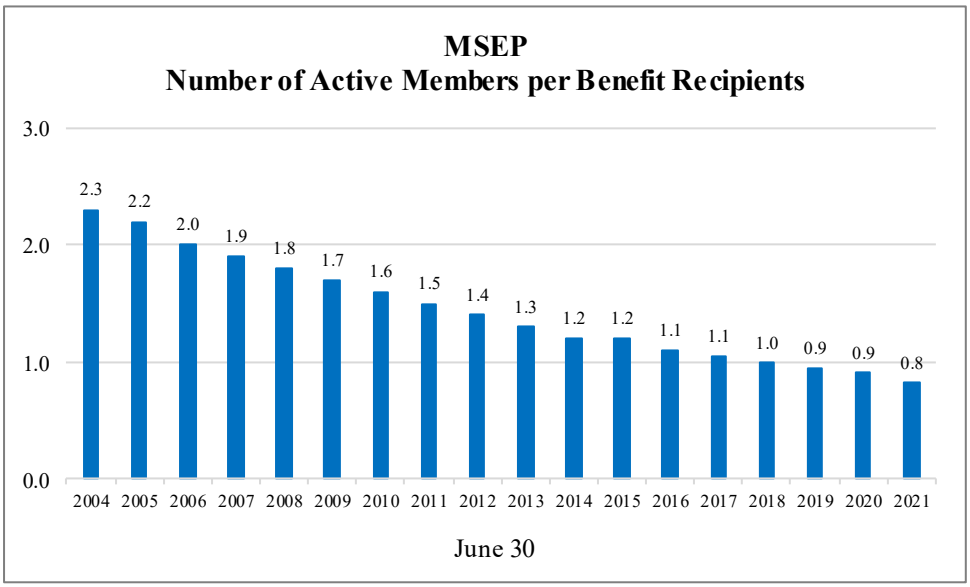
TABLE 21
HISTORICAL EMPLOYER CONTRIBUTIONS

($ in millions)

Fiscal Year Ending	Actuarially Determined Employer Contribution	Actual Dollar Amount	Percent Contributed
June 30, 2005	$195.6	$195.6	100.0%
June 30, 2006	227.2	227.2	100.0%
June 30, 2007	239.5	239.5	100.0%
June 30, 2008	249.8	249.8	100.0%
June 30, 2009	252.1	252.1	100.0%
June 30, 2010	251.2	251.2	100.0%
June 30, 2011	263.4	263.4	100.0%
June 30, 2012	263.4	263.4	100.0%
June 30, 2013	290.3	290.3	100.0%
June 30, 2014	326.4	326.4	100.0%
June 30, 2015	329.8	329.8	100.0%
June 30, 2016	310.1	330.0	106.4%
June 30, 2017	322.8	335.2	103.8%
June 30, 2018	379.6	379.6	100.0%
June 30, 2019	394.2	394.2	100.0%
June 30, 2020	436.9	436.9	100.0%
June 30, 2021	463.3	463.3	100.0%

TABLE 22
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	55,914	$1,737	$31,074		24,757	2.3	$324.6	
2005	55,944	1,807	32,293	3.9	25,780	2.2	348.1	7.2
2006	54,493	1,777	32,615	1.0	27,052	2.0	373.6	7.3
2007	54,363	1,847	33,969	4.2	28,692	1.9	406.4	8.8
2008	54,542	1,917	35,139	3.4	30,132	1.8	434.6	6.9
2009	55,057	2,002	36,370	3.5	31,637	1.7	465.4	7.1
2010	53,478	1,945	36,372	0.0	33,251	1.6	493.7	6.1
2011	51,660	1,876	36,306	(0.2)	35,315	1.5	525.6	6.5
2012	51,332	1,864	36,314	0.0	37,308	1.4	558.6	6.3
2013	50,833	1,880	36,988	1.9	39,139	1.3	589.9	5.6
2014	50,621	1,903	37,588	1.6	41,000	1.2	618.7	4.9
2015	49,980	1,919	38,386	2.1	42,964	1.2	650.9	5.2
2016	49,464	1,922	38,847	1.2	44,828	1.1	680.8	4.6
2017	48,910	1,942	39,705	2.2	46,560	1.1	710.2	4.3
2018	47,806	1,915	40,061	0.9	48,207	1.0	744.9	4.9
2019	46,864	1,931	41,199	2.8	49,696	0.9	779.9	4.7
2020	45,999	1,981	43,064	4.5	50,857	0.9	810.5	3.9
2021	42,829	1,962	45,809	6.4	52,223	0.8	841.7	3.8



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MEMBER DATA RECONCILIATION

	Active Members	Inactive Vested	Inactive Nonvested	Leave of Absence	Long-term Disability	Retirees and Beneficiaries	Total
As of June 30, 2020	45,999	16,300	21,735	247	651	50,857	135,789
Changes in status:							
a) Retirement	(1,842)	(647)	0	(13)	(67)	2,569	0
b) Death	(85)	(57)	0	(1)	(22)	(1,740)	(1,905)
c) Non-vested termination	(3,115)	0	3,195	(73)	(7)	0	0
d) Leave of absence	(144)	0	(2)	146	0	0	0
e) Vested termination	(1,604)	1,673	0	(17)	(52)	0	0
f) Contribution refund	(1,045)	(83)	(1,029)	(21)	(8)	0	(2,186)
g) Beneficiary in receipt	0	0	0	0	0	572	572
h) Long-term disability	(100)	(12)	(1)	(8)	121	0	0
h) Disability retirement	0	0	0	0	0	0	0
i) Return to active service	605	(206)	(296)	(92)	(3)	(8)	0
j) Expired benefit	0	0	0	0	0	(33)	(33)
k) Transfer to MPERS	(33)	(15)	0	0	0	0	(48)
k) Data adjustment	(5)	6	(3)	0	0	6	4
Total changes in status	(7,368)	659	1,864	(79)	(38)	1,366	(3,596)
New entrants	4,198	0	2,014	23	0	0	6,235
Net Change	(3,170)	659	3,878	(56)	(38)	1,366	2,639
As of June 30, 2021	42,829	16,959	25,613	191	613	52,223	138,428

SUMMARY OF MEMBERSHIP DATA

A. ACTIVE MEMBERS	June 30, 2021	June 30, 2020	% Change
1. Number of Active Members			
(a) MSEP	8,102	9,492	(14.6)
(b) MSEP 2000	12,358	13,432	(8.0)
(c) MSEP 2011	22,369	23,075	(3.1)
(d) Total	42,829	45,999	(6.9)
2. Annualized Reported Salary			
(a) MSEP	$ 433,453,923	$ 482,841,171	(10.2)
(b) MSEP 2000	599,693,363	605,329,395	(0.9)
(c) MSEP 2011	928,827,766	892,739,907	4.0
(d) Total	$ 1,961,975,052	$ 1,980,910,473	(1.0)
3. Accumulated Member Contributions	$ 134,944,772	$ 117,316,579	15.0
4. Active Member Averages			
(a) Age	45.9	45.5	0.9
(b) Service	11.0	10.8	1.9
(c) Compensation	$ 45,809	$ 43,064	6.4
B. INACTIVE MEMBERS			
1. Number of Inactive Members			
(a) Terminated vested	16,959	16,300	4.0
(b) Terminated nonvested (refund only)	25,613	21,735	17.8
(c) Leave of absence	191	247	(22.7)
(d) Long-term disability	613	651	(5.8)
(e) Total	43,376	38,933	11.4
2. Accumulated Member Contributions	$ 52,852,759	$ 39,816,733	32.7
3. Inactive Member Averages			
(a) Age (vesteds only)	49.3	49.0	0.6
(b) Monthly benefit	$ 508	$ 526	(3.4)
(c) Accumulated member contributions	$ 1,218	$ 1,023	19.1
C. RETIREES, DISABLEDS, AND BENEFICIARIES			
1. Number of Members			
(a) Service retirees and disableds	46,306	45,177	2.5
(b) Beneficiaries	5,917	5,680	4.2
(c) Total	52,223	50,857	2.7
2. Total Monthly Benefits			
(a) Service retirees and disableds	$ 63,781,600	$ 61,562,518	3.6
(b) Beneficiaries	6,356,879	5,982,316	6.3
(c) Total	$ 70,138,479	$ 67,544,834	3.8
3. Average Age			
(a) Service retirees and disableds	70.9	70.7	0.3
(b) Beneficiaries	72.4	72.3	0.1
(c) Total	71.1	70.8	0.4

MEMBERSHIP DATA BY GROUP

Valuation Group	Number	Payroll	Group Averages		
			Salary	Age(yrs.)	Service(yrs.)
Regular State Employees	40,667	$ 1,839,915,686	$ 45,243	45.7	10.8
Elected Officials	6	659,976	109,996	48.7	4.1
Legislative Clerks	4	133,884	33,471	69.5	23.0
Legislators	195	7,013,774	35,968	51.5	3.7
Uniformed Water Patrol	9	695,171	77,241	43.8	17.9
Conservation Department	1,261	59,803,569	47,426	45.1	14.5
School-Term Salaried Employees	673	52,076,345	77,379	57.2	21.9
Administrative Law Judges	14	1,676,647	119,761	62.9	26.7
Total MSEP	**42,829**	**$ 1,961,975,052**	**$ 45,809**	**45.9**	**11.0**

The total number of System active members includes 8,102 MSEP members, 12,358 MSEP 2000 members and 22,369 MSEP 2011 members.

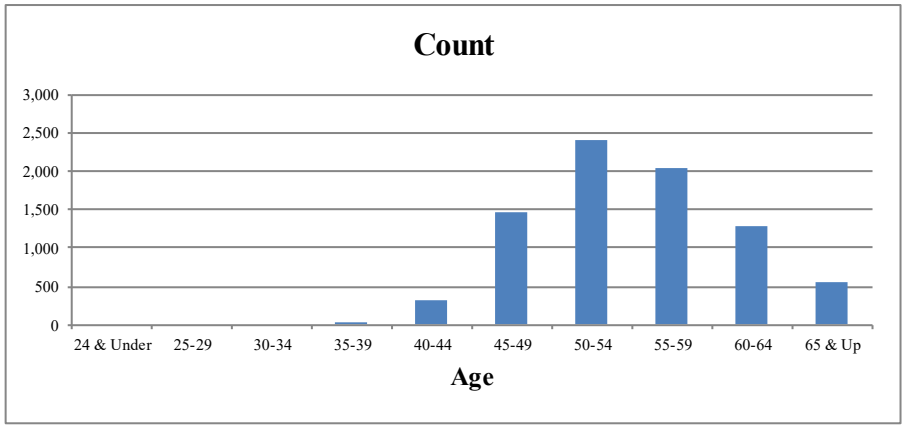
Type of Benefit Payment	No.	Monthly Benefit	Group Averages	
			Benefit	Age(yrs.)
Retirement	46,305	$ 63,781,405	$ 1,377	70.9
Disability	1	195	195	65.0
Survivor of Active Member	1,759	1,674,606	952	63.7
Survivor of Retired Member	4,158	4,682,273	1,126	76.1
Total MSEP	**52,223**	**$ 70,138,479**	**$ 1,343**	**71.1**

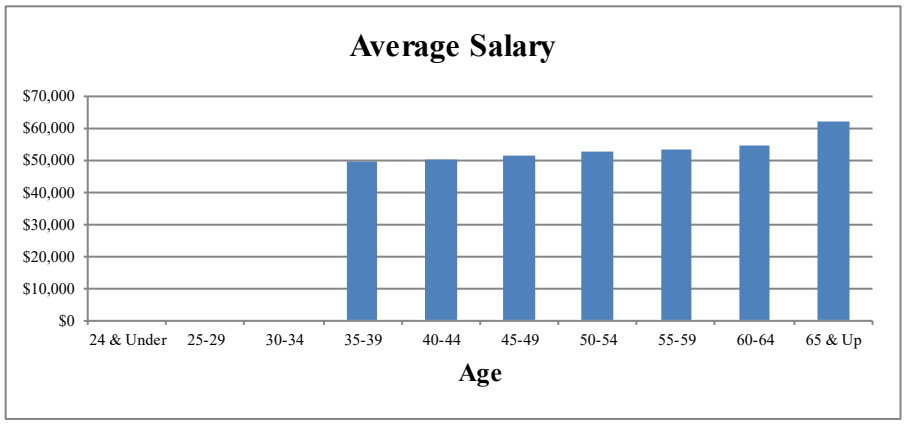
This valuation also includes 16,959 terminated vested members, 25,613 terminated members who have a refund pending, 191 members on leave and 613 members on long-term disability.

ACTIVE MEMBERS
AS OF JUNE 30, 2021

MSEP

	Count of Members			Reported Annualized Earnings for Current Members		
Age	Male	Female	Total	Male	Female	Total
24 & Under	0	0	0	$ 0	$ 0	$ 0
25-29	0	0	0	0	0	0
30-34	0	0	0	0	0	0
35-39	0	2	2	0	98,361	98,361
40-44	80	244	324	4,271,872	11,919,363	16,191,235
45-49	511	965	1,476	28,425,636	47,560,617	75,986,253
50-54	842	1,564	2,406	48,887,809	78,393,904	127,281,713
55-59	792	1,258	2,050	47,470,637	62,114,979	109,585,616
60-64	548	746	1,294	34,270,977	36,018,954	70,289,931
65 & Up	259	291	550	18,685,856	15,334,958	34,020,814
Total	3,032	5,070	8,102	$ 182,012,787	$ 251,441,136	$ 433,453,923

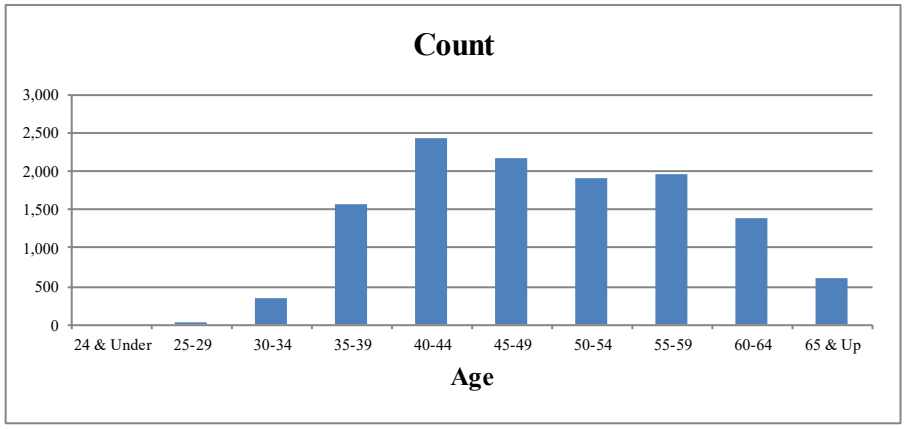


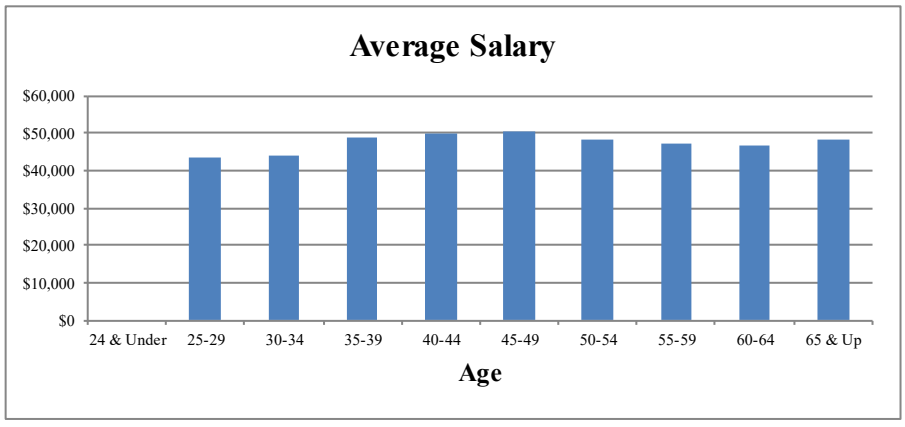


ACTIVE MEMBERS
AS OF JUNE 30, 2021

MSEP 2000

	Count of Members			Reported Annualized Earnings for Current Members		
Age	Male	Female	Total	Male	Female	Total
24 & Under	0	0	0	$ 0	$ 0	$ 0
25-29	1	0	1	43,229	0	43,229
30-34	122	223	345	5,381,862	9,780,061	15,161,923
35-39	625	940	1,565	31,981,613	44,120,537	76,102,150
40-44	906	1,519	2,425	47,203,758	73,189,787	120,393,545
45-49	834	1,330	2,164	45,240,767	63,845,101	109,085,868
50-54	747	1,163	1,910	40,084,018	52,617,493	92,701,511
55-59	733	1,216	1,949	38,516,004	53,440,247	91,956,251
60-64	538	854	1,392	27,522,942	37,284,353	64,807,295
65 & Up	265	342	607	13,962,304	15,479,287	29,441,591
Total	4,771	7,587	12,358	$ 249,936,497	$ 349,756,866	$ 599,693,363

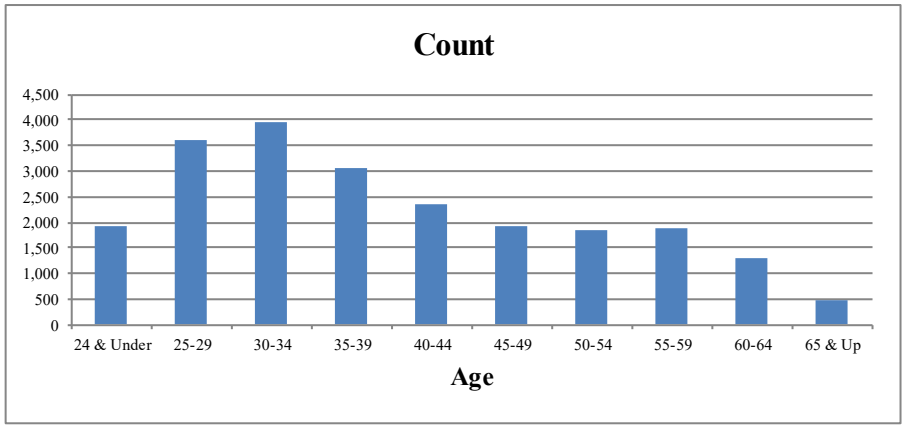


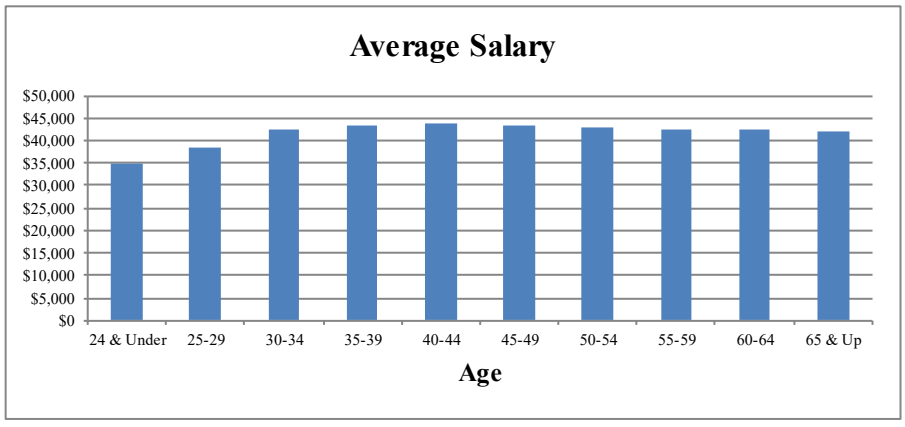


ACTIVE MEMBERS
AS OF JUNE 30, 2021

MSEP 2011

	Count of Members			Reported Annualized Earnings for Current Members		
Age	Male	Female	Total	Male	Female	Total
24 & Under	739	1,170	1,909	$ 27,658,242	$ 39,178,296	$ 66,836,538
25-29	1,449	2,154	3,603	58,905,657	79,547,753	138,453,410
30-34	1,615	2,346	3,961	72,292,629	95,185,524	167,478,153
35-39	1,138	1,905	3,043	53,608,556	78,902,254	132,510,810
40-44	835	1,508	2,343	40,166,792	62,673,641	102,840,433
45-49	667	1,278	1,945	31,930,988	52,217,533	84,148,521
50-54	634	1,230	1,864	30,048,538	50,247,653	80,296,191
55-59	626	1,260	1,886	29,405,677	50,348,579	79,754,256
60-64	487	826	1,313	22,617,117	32,874,505	55,491,622
65 & Up	242	260	502	11,343,338	9,674,494	21,017,832
Total	8,432	13,937	22,369	$ 377,977,534	$ 550,850,232	$ 928,827,766

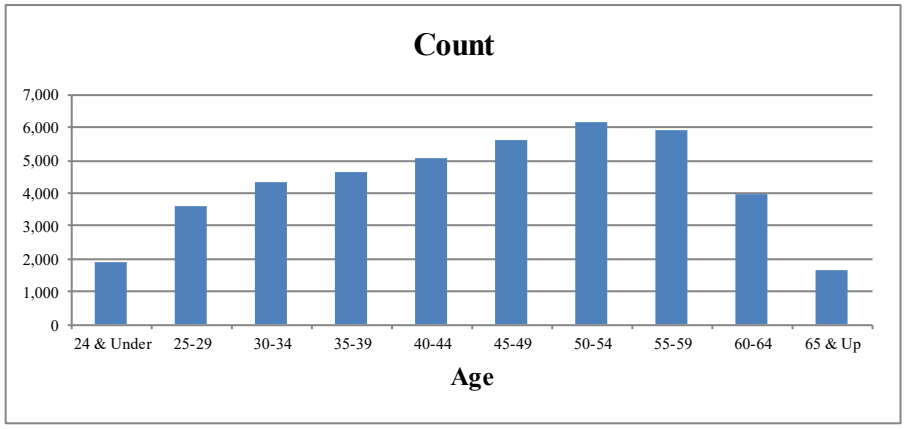


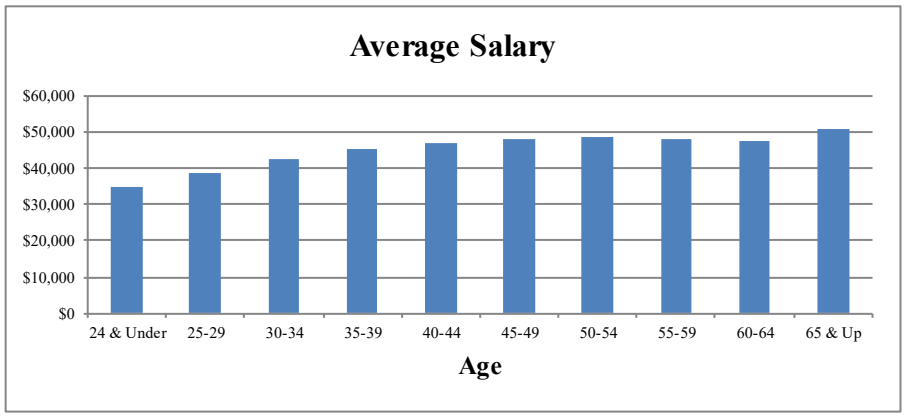


ACTIVE MEMBERS
AS OF JUNE 30, 2021

TOTAL

	Count of Members			Reported Annualized Earnings for Current Members		
Age	Male	Female	Total	Male	Female	Total
24 & Under	739	1,170	1,909	$ 27,658,242	$ 39,178,296	$ 66,836,538
25-29	1,450	2,154	3,604	58,948,886	79,547,753	138,496,639
30-34	1,737	2,569	4,306	77,674,491	104,965,585	182,640,076
35-39	1,763	2,847	4,610	85,590,169	123,121,152	208,711,321
40-44	1,821	3,271	5,092	91,642,422	147,782,791	239,425,213
45-49	2,012	3,573	5,585	105,597,391	163,623,251	269,220,642
50-54	2,223	3,957	6,180	119,020,365	181,259,050	300,279,415
55-59	2,151	3,734	5,885	115,392,318	165,903,805	281,296,123
60-64	1,573	2,426	3,999	84,411,036	106,177,812	190,588,848
65 & Up	766	893	1,659	43,991,498	40,488,739	84,480,237
Total	16,235	26,594	42,829	$ 809,926,818	$ 1,152,048,234	$ 1,961,975,052





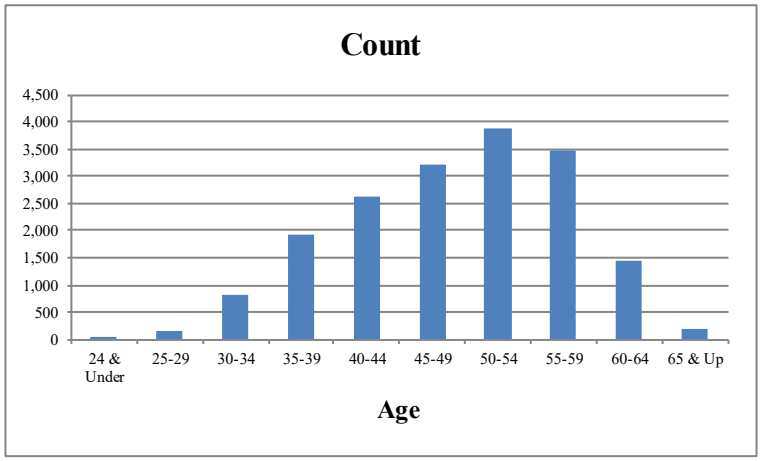
AGE AND SERVICE DISTRIBUTION
AS OF JUNE 30, 2021

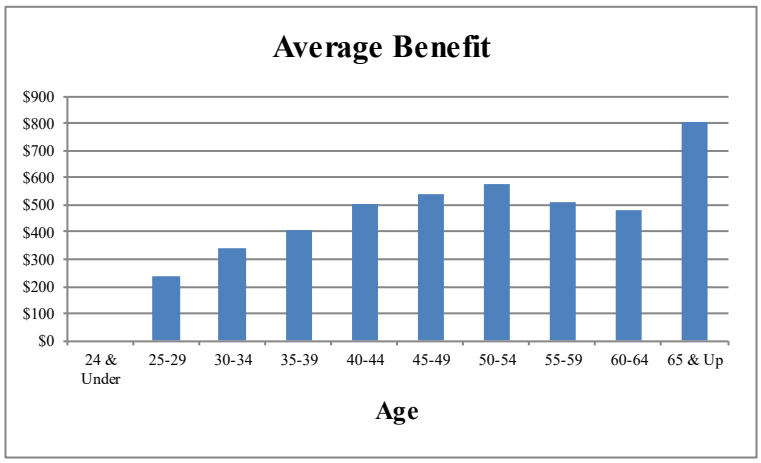
Age		0-4	5-9	10-14	15-19	20-24	25-29	30-34	Over 34	Total
24 & Under	Number	1,897	12	0	0	0	0	0	0	1,909
	Total Salary	$ 66,370,830	$ 465,708	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 66,836,538
	Average Sal.	$ 34,987	$ 38,809	$ 0	$ 0	$ 0	$ 0	$ 0	$ 0	$ 35,011
25-29	Number	3,020	583	1	0	0	0	0	0	3,604
	Total Salary	$ 114,473,349	$ 23,971,118	$ 52,172	$ 0	$ 0	$ 0	$ 0	$ 0	$ 138,496,639
	Average Sal.	$ 37,905	$ 41,117	$ 52,172	$ 0	$ 0	$ 0	$ 0	$ 0	$ 38,429
30-34	Number	2,347	1,640	311	8	0	0	0	0	4,306
	Total Salary	$ 94,922,210	$ 73,369,115	$ 14,063,306	$ 285,445	$ 0	$ 0	$ 0	$ 0	$ 182,640,076
	Average Sal.	$ 40,444	$ 44,737	$ 45,220	$ 35,681	$ 0	$ 0	$ 0	$ 0	$ 42,415
35-39	Number	1,824	1,358	1,064	349	15	0	0	0	4,610
	Total Salary	$ 76,387,558	$ 62,360,973	$ 52,338,402	$ 16,898,960	$ 725,428	$ 0	$ 0	$ 0	$ 208,711,321
	Average Sal.	$ 41,879	$ 45,921	$ 49,190	$ 48,421	$ 48,362	$ 0	$ 0	$ 0	$ 45,274
40-44	Number	1,458	1,163	955	1,047	454	15	0	0	5,092
	Total Salary	$ 62,100,771	$ 54,489,311	$ 46,335,111	$ 52,475,162	$ 23,377,839	$ 647,019	$ 0	$ 0	$ 239,425,213
	Average Sal.	$ 42,593	$ 46,852	$ 48,518	$ 50,120	$ 51,493	$ 43,135	$ 0	$ 0	$ 47,020
45-49	Number	1,294	929	789	903	1,255	399	16	0	5,585
	Total Salary	$ 55,856,249	$ 44,008,139	$ 38,238,975	$ 44,521,775	$ 64,392,964	$ 21,415,262	$ 787,278	$ 0	$ 269,220,642
	Average Sal.	$ 43,166	$ 47,372	$ 48,465	$ 49,304	$ 51,309	$ 53,672	$ 49,205	$ 0	$ 48,204
50-54	Number	1,220	899	766	797	1,228	981	261	28	6,180
	Total Salary	$ 52,997,269	$ 40,987,713	$ 35,169,267	$ 38,099,473	$ 63,221,862	$ 54,127,830	$ 14,113,741	$ 1,562,260	$ 300,279,415
	Average Sal.	$ 43,440	$ 45,593	$ 45,913	$ 47,804	$ 51,484	$ 55,176	$ 54,076	$ 55,795	$ 48,589
55-59	Number	1,187	948	802	841	1,007	594	393	113	5,885
	Total Salary	$ 50,931,899	$ 41,771,823	$ 37,238,813	$ 39,096,377	$ 51,011,856	$ 32,079,038	$ 22,976,746	$ 6,189,571	$ 281,296,123
	Average Sal.	$ 42,908	$ 44,063	$ 46,432	$ 46,488	$ 50,657	$ 54,005	$ 58,465	$ 54,775	$ 47,799
60-64	Number	756	702	608	571	631	350	220	161	3,999
	Total Salary	$ 32,652,375	$ 30,353,980	$ 27,420,501	$ 26,578,865	$ 31,262,854	$ 19,246,555	$ 13,876,878	$ 9,196,840	$ 190,588,848
	Average Sal.	$ 43,191	$ 43,239	$ 45,100	$ 46,548	$ 49,545	$ 54,990	$ 63,077	$ 57,123	$ 47,659
65 & Up	Number	269	302	274	236	209	131	92	146	1,659
	Total Salary	$ 11,532,279	$ 13,190,354	$ 12,940,525	$ 11,584,484	$ 11,046,391	$ 8,230,978	$ 6,078,993	$ 9,876,233	$ 84,480,237
	Average Sal.	$ 42,871	$ 43,677	$ 47,228	$ 49,087	$ 52,854	$ 62,832	$ 66,076	$ 67,645	$ 50,922
Total	Number	15,272	8,536	5,570	4,752	4,799	2,470	982	448	42,829
	Total Salary	$ 618,224,789	$ 384,968,234	$ 263,797,072	$ 229,540,541	$ 245,039,194	$ 135,746,682	$ 57,833,636	$ 26,824,904	$ 1,961,975,052
	Average Sal.	$ 40,481	$ 45,099	$ 47,360	$ 48,304	$ 51,060	$ 54,958	$ 58,894	$ 59,877	$ 45,809

INACTIVE VESTED MEMBERS
AS OF JUNE 30, 2021

	Count of Members*			Monthly Deferred Benefits*		
Age	Male	Female	Total	Male	Female	Total
24 & Under	13	9	22	$ 717	$ 297	$ 1,014
25-29	73	81	154	18,542	18,524	37,066
30-34	335	470	805	121,320	154,796	276,116
35-39	803	1,121	1,924	345,402	434,230	779,632
40-44	998	1,643	2,641	541,685	792,138	1,333,823
45-49	1,181	2,040	3,221	698,684	1,049,207	1,747,891
50-54	1,386	2,494	3,880	875,232	1,353,988	2,229,220
55-59	1,202	2,252	3,454	722,139	1,039,629	1,761,768
60-64	508	947	1,455	285,223	413,139	698,362
65 & Up	88	119	207	94,773	72,324	167,097
Total	6,587	11,176	17,763	$ 3,703,717	$ 5,328,272	$ 9,031,989

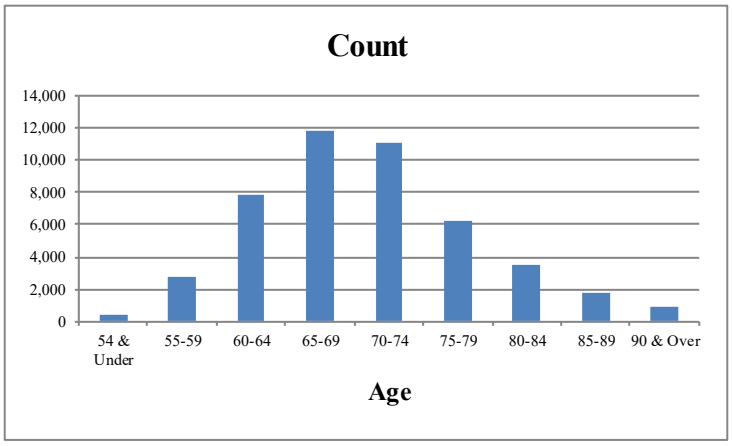
* There are 191 members currently on leave and 613 members on LTD. Their counts and estimated deferred monthly benefits are included.

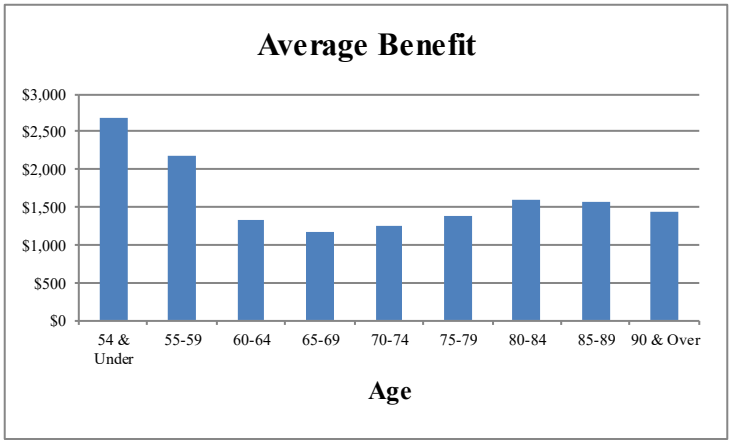




RETIRED AND DISABLED MEMBERS
AS OF JUNE 30, 2021

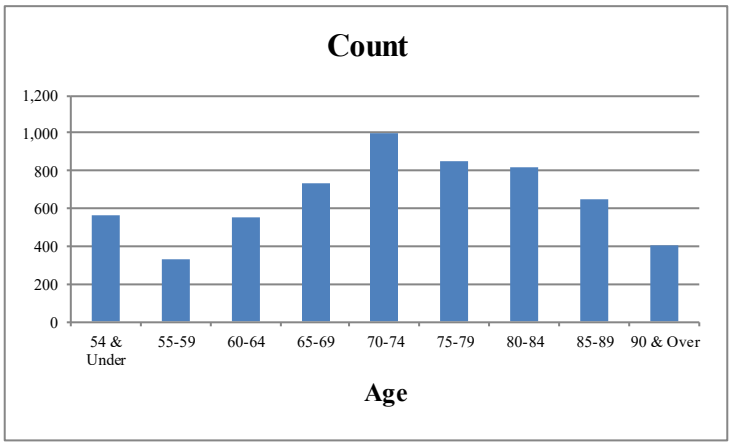
	Count of Members			Monthly Benefits		
Age	Male	Female	Total	Male	Female	Total
54 & Under	156	285	441	$ 429,193	$ 757,901	$ 1,187,094
55-59	993	1,826	2,819	2,267,939	3,876,564	6,144,503
60-64	2,745	5,128	7,873	3,966,175	6,583,486	10,549,661
65-69	4,378	7,405	11,783	5,709,102	8,060,652	13,769,754
70-74	4,382	6,674	11,056	6,427,424	7,473,637	13,901,061
75-79	2,557	3,682	6,239	4,477,490	4,179,799	8,657,289
80-84	1,327	2,119	3,446	2,890,671	2,620,975	5,511,646
85-89	613	1,108	1,721	1,384,464	1,343,413	2,727,877
90 & Over	263	665	928	568,628	764,087	1,332,715
Total	17,414	28,892	46,306	$ 28,121,086	$ 35,660,514	$ 63,781,600

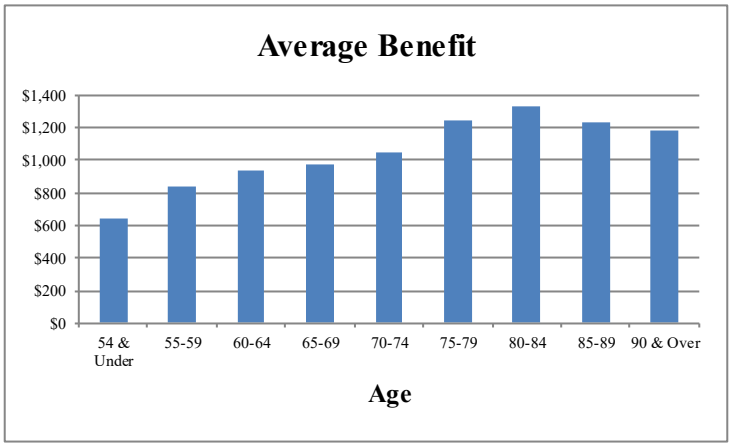




BENEFICIARIES RECEIVING BENEFITS
AS OF JUNE 30, 2021

	Count of Members			Monthly Benefits		
Age	Male	Female	Total	Male	Female	Total
54 & Under	219	348	567	$ 125,601	$ 242,261	$ 367,862
55-59	101	231	332	71,819	206,168	277,987
60-64	156	395	551	115,592	399,191	514,783
65-69	205	530	735	153,165	565,905	719,070
70-74	248	754	1,002	191,530	861,250	1,052,780
75-79	184	665	849	150,586	902,314	1,052,900
80-84	195	624	819	163,227	922,450	1,085,677
85-89	153	498	651	116,194	684,718	800,912
90 & Over	91	320	411	58,752	426,156	484,908
Total	1,552	4,365	5,917	$ 1,146,466	$ 5,210,413	$ 6,356,879





RETIRED LIVES BENEFITS PAYABLE AS OF JUNE 30, 2021
TABULATED BY OPTION AND TYPE OF BENEFIT

MSEP Benefits

Type of Benefit	No.	Total Monthly Benefits
Service Retirement		
Life Annuity	5,911	$ 8,256,205
50% Joint and Survivor	5,125	9,150,719
100% Joint and Survivor	3,119	6,175,568
5-Year Certain and Life	139	171,733
10-Year Certain and Life	176	189,691
Survivor Beneficiary	2,709	3,466,973
Total	17,179	27,410,889
Disability Retirement	1	195
Death-in-Service	1,414	1,517,715
Total	**18,594**	**$ 28,928,799**

MSEP 2000 Benefits

Type of Benefit	No.	Total Monthly Benefits
Service Retirement		
Life Annuity	19,681	$ 23,458,814
50% Joint and Survivor	4,592	7,725,557
100% Joint and Survivor	5,574	7,220,509
5-Year Certain and Life	19	25,206
10-Year Certain and Life	898	741,834
15-Year Certain and Life	759	549,446
Survivor Beneficiary	1,446	1,214,793
Total	32,969	40,936,159
Death-in-Service	336	153,327
Total	**33,305**	**$ 41,089,486**

RETIRED LIVES BENEFITS PAYABLE AS OF JUNE 30, 2021
TABULATED BY OPTION AND TYPE OF BENEFIT

MSEP 2011 Benefits

Type of Benefit	No.	Total Monthly Benefits
Service Retirement		
Life Annuity	190	$ 69,567
50% Joint and Survivor	24	9,130
100% Joint and Survivor	73	26,452
5-Year Certain and Life	0	0
10-Year Certain and Life	10	4,152
15-Year Certain and Life	15	6,822
Survivor Beneficiary	3	507
Total	315	116,630
Death-in-Service	9	3,564
Total	**324**	**$ 120,194**

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SALARY INCREASES
DURING PLAN YEAR 2020-2021

Age	Count	Salary Increases	
		Actual*	Expected
Under 20	26	14.1%	6.8%
20 - 24	1,038	10.4%	5.2%
25 - 29	2,849	8.5%	4.3%
30 - 34	3,694	7.7%	3.9%
35 - 39	4,166	7.6%	3.6%
40 - 44	4,671	7.3%	3.4%
45 - 49	5,363	7.2%	3.2%
50 - 54	5,755	6.3%	3.2%
55 - 59	5,511	6.4%	3.2%
60 - 64	3,566	5.4%	3.1%
65 & Over	1,388	4.1%	3.1%
Total	**38,027**		
Average		**6.9%**	**3.4%**

** Excludes new entrants and terminations.*

	Payroll Growth				
	2021	2020	2019	2018	2017
Actual**	-0.96%	2.60%	0.8%	-1.4%	1.1%
Assumed	2.25%	2.35%	2.5%	3.0%	3.0%

** Based on reported payroll.

ACTIVE MEMBERS WHO RETIRED WITH SERVICE RETIREMENT BENEFITS DURING PLAN YEAR 2020-2021

Age	Male		Female		Total	
	Actual	Expected	Actual	Expected	Actual	Expected
Under 50	0	0.4	2	0.8	2	1.2
50	4	0.9	7	4.6	11	5.5
51	11	2.4	17	6.4	28	8.8
52	13	7.6	27	15.7	40	23.3
53	16	10.5	31	25.3	47	35.7
54	32	18.9	33	28.7	65	47.6
55	28	18.0	41	30.3	69	48.3
56	30	22.9	47	30.8	77	53.7
57	44	34.8	53	47.1	97	81.9
58	33	30.3	61	48.3	94	78.5
59	31	34.0	63	52.6	94	86.6
60	42	38.0	58	56.1	100	94.0
61	43	36.0	80	51.2	123	87.1
62	58	61.7	105	96.5	163	158.1
63	57	46.0	67	64.8	124	110.8
64	51	32.3	77	49.1	128	81.3
65	59	58.5	98	83.8	157	142.3
66	48	43.2	75	55.6	123	98.8
67	36	22.2	45	27.4	81	49.6
68	32	19.0	30	19.4	62	38.4
69	16	14.5	24	18.0	40	32.5
70 & Over	62	65.1	55	59.3	117	124.4
Total	**746**	**616.8**	**1,096**	**871.6**	**1,842**	**1,488.4**

	Male	Female	Total
Average age at retirement	62.1 years	61.5 years	61.7 years
Average service at retirement	22.2 years	22.3 years	22.3 years

ACTIVE MEMBERS WHO BECAME DISABLED DURING PLAN YEAR 2020-2021

Age	Male		Female		Total	
	Actual	Expected	Actual	Expected	Actual	Expected
Under 25	0	0.8	0	1.2	0	2.0
25 - 29	1	1.7	1	2.4	2	4.1
30 - 34	1	1.9	1	2.8	2	4.7
35 - 39	1	4.7	5	7.6	6	12.3
40 - 44	3	7.0	7	12.4	10	19.3
45 - 49	6	9.8	13	17.7	19	27.5
50 - 54	12	13.5	13	23.5	25	37.0
55 - 59	13	14.3	13	25.3	26	39.6
60 & Over	4	8.7	6	13.9	10	22.6
Total	**41**	**62.3**	**59**	**106.9**	**100**	**169.1**

	Male	Female	Total
Average age at disability	51.7 years	49.5 years	50.4 years
Average service at disability	12.8 years	9.1 years	10.6 years

ACTIVE MEMBERS WHO DIED DURING PLAN YEAR 2020-2021

Age	Male		Female		Total	
	Actual	Expected	Actual	Expected	Actual	Expected
Under 30	1	0.8	0	0.5	1	1.2
30 - 34	0	0.7	0	0.6	0	1.2
35 - 39	1	0.8	1	0.9	2	1.6
40 - 44	3	1.0	1	1.3	4	2.3
45 - 49	5	1.9	8	2.4	13	4.3
50 - 54	8	3.7	3	4.3	11	8.0
55 - 59	8	6.7	10	6.6	18	13.3
60 - 64	12	8.7	9	6.4	21	15.0
65 & Over	9	9.4	6	4.4	15	13.8
Total	**47**	**33.7**	**38**	**27.1**	**85**	**60.8**

	Male	Female	Total
Average age at death	56.3 years	56.3 years	56.3 years
Average service at death	14.6 years	19.4 years	16.7 years

Of the 85 active members who died in service during plan year 2020-2021, 84 members had a benefit payable to a survivor.

ACTIVE MEMBERS WHO TERMINATED EMPLOYMENT WITH A DEFERRED BENEFIT DURING PLAN YEAR 2020-2021

Age	Male		Female		Total	
	Actual	Expected	Actual	Expected	Actual	Expected
Under 30	39	25.5	46	32.7	85	58.3
30 - 34	101	73.4	132	107.9	233	181.3
35 - 39	102	83.7	141	125.1	243	208.9
40 - 44	94	70.7	144	123.5	238	194.2
45 - 49	87	60.8	151	108.7	238	169.5
50 - 54	82	46.5	145	80.9	227	127.4
55 - 59	68	19.6	98	34.8	166	54.4
60 & Over	66	3.4	108	5.4	174	8.8
Total	**639**	**383.7**	**965**	**619.1**	**1,604**	**1,002.8**

	Male	Female	Total
Average age at termination	44.6 years	45.4 years	45.1 years
Average service at termination	11.6 years	11.0 years	11.3 years

ACTIVE MEMBERS WHO TERMINATED EMPLOYMENT WITHOUT A DEFERRED BENEFIT PAYABLE DURING PLAN YEAR 2020-2021

Age	Male		Female		Total	
	Actual	Expected	Actual	Expected	Actual	Expected
Under 20	7	0.0	29	0.0	36	0.0
20 - 24	354	149.7	536	254.5	890	404.2
25 - 29	416	238.7	616	378.1	1,032	616.8
30 - 34	275	173.3	415	293.8	690	467.1
35 - 39	161	112.2	265	223.7	426	335.9
40 - 44	100	82.2	182	175.6	282	257.8
45 - 49	97	76.7	175	163.9	272	240.6
50 - 54	79	70.4	141	145.1	220	215.4
55 - 59	55	67.8	100	138.0	155	205.8
60 - 64	36	44.8	77	80.2	113	125.0
65 - 69	15	14.3	13	14.6	28	28.9
70 & Over	10	6.8	6	5.8	16	12.6
Total	**1,605**	**1,036.8**	**2,555**	**1,873.2**	**4,160**	**2,910.1**

Service	Male		Female		Total	
	Actual	Expected	Actual	Expected	Actual	Expected
0 - 1	655	387.3	1,124	741.5	1,779	1,128.9
1 - 2	411	276.1	656	498.7	1,067	774.8
2 - 3	250	167.0	383	288.8	633	455.8
3 - 4	185	126.6	247	206.1	432	332.6
4 - 5	104	79.8	145	138.2	249	217.9
Total	**1,605**	**1,036.8**	**2,555**	**1,873.2**	**4,160**	**2,910.1**

	Male	Female	Total
Average age at termination	33.5 years	34.1 years	33.9 years
Average service at termination	1.7 years	1.6 years	1.6 years

COMPARISON OF ACTUAL TO EXPECTED DEATHS AMONG RETIRED LIVES (SERVICE RETIREMENT ONLY) DURING PLAN YEAR 2020-2021

Age	Male			Female			Total		
	Actual	Expected	Exposures	Actual	Expected	Exposures	Actual	Expected	Exposures
Under 50	0	0.0	0	0	0.0	1	0	0.0	1
50 - 54	0	0.6	112	1	0.8	225	1	1.3	337
55 - 59	6	6.2	881	12	8.0	1,639	18	14.2	2,520
60 - 64	34	25.3	2,590	51	33.9	4,851	85	59.2	7,441
65 - 69	94	61.4	4,369	77	74.9	7,184	171	136.3	11,553
70 - 74	134	93.7	4,330	107	107.3	6,516	241	201.0	10,846
75 - 79	132	87.8	2,514	149	100.2	3,656	281	188.0	6,170
80 - 84	99	80.7	1,355	135	101.2	2,129	234	181.9	3,484
85 - 89	83	67.7	648	121	94.7	1,136	204	162.3	1,784
90 - 94	47	41.2	236	90	84.3	583	137	125.4	819
95 - 99	13	12.4	49	43	32.0	144	56	44.3	193
100 & Over	1	1.8	5	10	7.5	23	11	9.3	28
Total	**643**	**478.8**	**17,089**	**796**	**644.6**	**28,087**	**1,439**	**1,123.4**	**45,176**
Average Ages	**77.1**	**78.8**	**70.8**	**79.5**	**80.5**	**70.6**	**78.5**	**79.8**	**70.7**

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MSEP (Missouri State Employees' Plan)	MSEP 2000 (Missouri State Employees' Plan 2000)	MSEP 2011 (Missouri State Employees' Plan 2011)
DEFINITIONS **Participants** All MOSERS members, vested former members, retirees and survivors who first became members prior to July 1, 2000 and who do **not** elect to transfer to the MSEP 2000 plan. Election is made at the time benefits commence.	(1) All new employees who first become members on or after July 1, 2000, except full-time teaching and senior administrative personnel of the regional colleges and universities hired on or after July 1, 2002 who will be participants in the Colleges and Universities Retirement Plan (CURP). (2) MSEP active members and vested former members who elect to transfer to the MSEP 2000 plan prior to retirement. (3) MSEP retirees who elect to transfer to the MSEP 2000 plan during the election window from July 1, 2000 through June 30, 2001, and their survivors. (4) MSEP non-vested terminations rehired on or after July 1, 2000. (5) Members hired prior to January 1, 2011 participating in the CURP for six years may elect to change to MOSERS. Transferred service is for vesting purposes only.	(1) All new employees who first become employees on or after January 1, 2011, except full-time teaching and senior administrative personnel of the regional colleges and universities hired on or after July 1, 2002 who will be participants in the Colleges and Universities Retirement Plan (CURP). (2) Members hired on or after January 1, 2011 participating in the CURP for six years may elect to change to MOSERS. Transferred service is for vesting purposes only.

MSEP (Missouri State Employees' Plan)	MSEP 2000 (Missouri State Employees' Plan 2000)	MSEP 2011 (Missouri State Employees' Plan 2011)
Final average earnings		
The average annual compensation of a member for the three consecutive years of service during which pay was highest (overtime pay is included for purposes of determining Average Compensation). Non-recurring lump sum payments are excluded. Unused sick leave may be converted to additional credited service (usable only for benefit computation, not eligibility).	The average annual compensation of a member for the three consecutive years of service during which pay was highest (overtime pay is included for purposes of determining Average Compensation). Non-recurring lump sum payments are excluded. Unused sick leave may be converted to additional credited service (usable only for benefit computation, not eligibility).	The average annual compensation of a member for the three consecutive years of service during which pay was highest (overtime pay is included for purposes of determining Average Compensation). Non-recurring lump sum payments are excluded. Unused sick leave may be converted to additional credited service (usable only for benefit computation, not eligibility).
Member contributions		
None.	Same as MSEP.	4.0% of salary, with interest credited to member contributions based on the 52-week Treasury bill rate (4% prior to June 30, 2014).

MSEP (Missouri State Employees' Plan)	MSEP 2000 (Missouri State Employees' Plan 2000)	MSEP 2011 (Missouri State Employees' Plan 2011)
ELIGIBILITY FOR BENEFITS		
Normal retirement		
Members of the General Assembly: Age 55 with completion of at least 3 full biennial assemblies.	*Members of the General Assembly:* The earliest of attaining: (1) Age 55 with completion of at least 3 full biennial assemblies. (2) Age 50 with completion of at least 3 full biennial assemblies and with age plus credited service equal to 80 or more.	*Members of the General Assembly:* The earliest of attaining: (1) Age 62 with completion of at least 3 full biennial assemblies. (2) Age 55 with completion of at least 3 full biennial assemblies and with age plus credited service equal to 90 or more.
Statewide Elected Officials: The earliest of attaining: (1) Age 65 with at least 4 years of credited service. (2) Age 60 with at least 15 years of credited service. (3) Age 50 with age plus credited service equal to 80 or more.	*Statewide Elected Officials:* The earliest of attaining: (1) Age 55 with at least 4 years of credited service. (2) Age 50 with age plus credited service equal to 80 or more.	*Statewide Elected Officials:* The earliest of attaining: (1) Age 62 with at least 4 years of credited service as a statewide elected official. (2) Age 55 with age plus credited service equal to 90 or more.
General Employees: The earliest of attaining: (1) Age 65 and active with at least 4 years of credited service. (2) Age 65 with at least 5 years of credited service. (3) Age 60 with at least 15 years of credited service. (4) Age 48 with age plus credited service equal to 80 or more.	*General Employees:* The earliest of attaining: (1) Age 62 with at least 5 years of credited service. (2) Age 48 with age plus credited service equal to 80 or more.	*General Employees:* The earliest of attaining: (1) Age 67 with at least 5 years of credited service. (2) Age 55 with age plus credited service equal to 90 or more.

MSEP (Missouri State Employees' Plan)	MSEP 2000 (Missouri State Employees' Plan 2000)	MSEP 2011 (Missouri State Employees' Plan 2011)
Uniformed Water Patrol Employees: The earliest of attaining: (1) Age 55 and active with at least 4 years of credited service. (2) Age 55 with at least 5 years of credited service. (3) Age 48 with age plus credited service equal to 80 or more. *Administrative Law Judges:* The earliest of attaining: (1) Age 62 and active with at least 12 years of credited service. (2) Age 60 with at least 15 years of credited service. (3) Age 55 with at least 20 years of credited service.		
Early retirement for general employees		
Age 55 with at least 10 years of credited service.	Age 57 with at least 5 years of credited service.	Age 62 with at least 5 years of credited service.

MSEP (Missouri State Employees' Plan)	MSEP 2000 (Missouri State Employees' Plan 2000)	MSEP 2011 (Missouri State Employees' Plan 2011)
MONTHLY BENEFITS PAYABLE **Normal Retirement** *Members of the General Assembly:* $150 per month per biennial assembly served. *Statewide Elected Officials:* 1) Less than 12 years of credited service: 1.6% of Average Compensation times years of credited service. 2) 12 or more years of credited service: 50% of pay of the highest elected position held prior to retirement. *General Employees:* 1.6% of Average Compensation times years of credited service. 2.1% of Average Compensation times years of credited service for any period of non-social security covered employment transferred from the Public School Retirement System. *Uniformed Water Patrol:* 2.13% of Average Compensation times years of credited service.	*Members of the General Assembly:* 1/24 of pay times first 24 years of credited service as a member of the General Assembly. *Statewide Elected Officials:* 1/24 of pay (of the highest elected position held prior to retirement) times the first 12 years of credited service as a statewide elected official. *General Employees:* 1.7% of Average Compensation times years of credited service. Temporary Benefit: If member retires between ages 48 and 62 with age plus credited service equal to 80 or more, a temporary benefit is payable until the attainment of the minimum age at which reduced social security benefits are payable, in the amount of 0.8% of Average Compensation times years of credited service.	*Members of the General Assembly:* 1/24 of pay times first 24 years of credited service as a member of the General Assembly. *Statewide Elected Officials:* 1/24 of pay (of the highest elected position held prior to retirement) times the first 12 years of credited service as a statewide elected official. *General Employees:* 1.7% of Average Compensation times years of credited service. Temporary Benefit: If member retires between ages 55 and 62 with age plus credited service equal to 90 or more, a temporary benefit is payable until the attainment of the minimum age at which reduced social security benefits are payable, in the amount of 0.8% of Average Compensation times years of credited service.

MSEP (Missouri State Employees' Plan)	MSEP 2000 (Missouri State Employees' Plan 2000)	MSEP 2011 (Missouri State Employees' Plan 2011)
Administrative Law Judges: 50% of Compensation	Non-Social Security Covered Service: 2.5% of Average Compensation times years of credited service for any period of non-social security covered employment transferred from the Public School Retirement System.	Non-Social Security Covered Service: 2.5% of Average Compensation times years of credited service for any period of non-social security covered employment transferred from the Public School Retirement System.
Early retirement for general employees		
Normal retirement amount reduced by ½% for each month that retirement precedes eligibility for normal retirement. 1) Less than 15 years of service: Normal retirement amount actuarially reduced for years younger than age 65. 2) 15 years but less than 20 years of service, and less than the number of years of service necessary for age and service to total 80: Normal retirement amount actuarially reduced for years younger than age 60. 3) 20 or more years of service, but less than the number of years of service necessary for age and service to total 80: Normal retirement amount reduced for years younger than the 80 and out eligibility date.	Normal retirement amount reduced by ½% for each month that retirement precedes eligibility for normal retirement, age 62.	Normal retirement amount reduced by ½% for each month that retirement precedes eligibility for normal retirement, age 67.

<table>
<tr><th>MSEP
(Missouri State Employees' Plan)</th><th>MSEP 2000
(Missouri State Employees' Plan 2000)</th><th>MSEP 2011
(Missouri State Employees' Plan 2011)</th></tr>
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Vested deferred benefits

Benefits for employees who terminate prior to eligibility for an immediate benefit are considered to be vested in accordance with the following schedule (benefits commence at the age the individual would have been eligible for early or normal retirement, considering years of credited service). Unused sick leave is not converted.

Years of Service	General Assembly	Elected Officials	General Employees
4		100%	
5			100%
6*	100%		

*3 Assemblies

Death prior to retirement

The surviving spouse benefit is computed as if the member had been normal retirement age on the date of death and elected the joint and 100% survivor optional form of payment, provided the member had at least 5 years of credited service and was married on the date of death. If no eligible spouse survives, 80% of the member's life income annuity is paid to eligible children until age 21. If the death is duty related, the service requirement is waived and the minimum

</td><td>

Benefits for employees who terminate prior to eligibility for an immediate benefit are considered to be vested in accordance with the following schedule (benefits commence at age 57 for early retirement or 62 for normal retirement). Unused sick leave is not converted. CURP to MOSERS transfers with 6 years of service are immediately vested.

Years of Service	General Assembly	Elected Officials	General Employees
4		100%	
5			100%
6*	100%		

*3 Assemblies, HB1455 prospectively

The surviving spouse benefit is computed as if the member had been normal retirement age on the date of death and elected the joint and 100% survivor optional form of payment, provided the member had at least 5 years of credited service (3 full assemblies for a member of the General Assembly, 4 years of credited service for a statewide elected official). If no eligible spouse survives, 80% of the member's life income annuity is paid to eligible children until age 21. If the death is duty related, the service requirement is waived

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Benefits for employees who terminate prior to eligibility for an immediate benefit are considered to be vested in accordance with the following schedule (benefits commence at age 67 normal retirement). Unused sick leave is not converted.

Years of Service	General Assembly	Elected Officials	General Employees
4		100%	
6*	100%		
5			100%

*3 Assemblies, HB1455 prospectively

The surviving spouse benefit is computed as if the member had been normal retirement age on the date of death and elected the joint and 100% survivor optional form of payment, provided the member had at least 5 years of credited service (2 full assemblies for a member of the General Assembly, 4 years of credited service for a statewide elected official). If no eligible spouse survives, 80% of the member's life income annuity is paid to eligible children until age 21. If the death is duty related, the service requirement is waived

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MSEP (Missouri State Employees' Plan)	MSEP 2000 (Missouri State Employees' Plan 2000)	MSEP 2011 (Missouri State Employees' Plan 2011)
spouse benefit is 50% of Average Compensation (rate of compensation for members of the General Assembly).	and the minimum spouse benefit is 50% of Average Compensation (rate of compensation for members of the General Assembly).	and the minimum spouse benefit is 50% of Average Compensation (rate of compensation for members of the General Assembly).
Death after retirement		
50% of the benefit the retired member was receiving on the date of death (the normal form of payment), or the benefit payable under the joint and survivor or period certain form of payment, if the member elected an optional form of payment at time of retirement and provided the member was married on their date of retirement. Effective July 1, 2000, a member who is not married at retirement but marries thereafter may designate a spouse as beneficiary within one year of marriage. Additionally, a member may designate a new spouse as beneficiary within one year of marriage in the event of the death of the spouse the member was married to at the date of retirement (this provision does not apply to period certain annuities).	The benefit payable under the joint and survivor or period certain form of payment, if the member elected an optional form of payment at time of retirement. A member who is not married at retirement but marries thereafter may designate a spouse as beneficiary within one year of marriage. Additionally, a member may designate a new spouse as beneficiary within one year of marriage in the event of the death of the spouse the member was married to at the date of retirement (this provision does not apply to period certain annuities).	The benefit payable under the joint and survivor or period certain form of payment, if the member elected an optional form of payment at time of retirement. A member who is not married at retirement but marries thereafter may designate a spouse as beneficiary upon completion of one year of marriage. Additionally, a member may designate a new spouse as beneficiary upon completion of one year of marriage in the event of the death of the spouse the member was married to at the date of retirement (this provision does not apply to period certain annuities).

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<tr><th>MSEP
(Missouri State Employees' Plan)</th><th>MSEP 2000
(Missouri State Employees' Plan 2000)</th><th>MSEP 2011
(Missouri State Employees' Plan 2011)</th></tr>
<tr><td>Disability

Normal retirement benefits become payable at the time the member is eligible for normal retirement, and are computed based on: i) the service that would have accrued to the member if active employment had continued; and ii) the member's rate of pay at the time of disability (if the member retires on or after August 28, 1999, the member's rate of pay is based on the rate of pay at the time of disability indexed to the time of benefit commencement). An exception is Uniformed Water Patrol employees who are eligible for an immediate occupational disability benefit equal to 50% of pay at time of disability.

Post-retirement benefit adjustments

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

<table>
<tr><th>Increase in CPI</th><th>Formula 1 Benefit Increase</th><th>Formula 2 Benefit Increase</th></tr>
<tr><td>5.00% or less</td><td>4%</td><td>80% of CPI increase</td></tr>
<tr><td>5.01% - 6.24%</td><td>80% of CPI increase</td><td>80% of CPI increase</td></tr>
<tr><td>6.25% or more</td><td>5%</td><td>5%</td></tr>
</table>
</td><td>Normal retirement benefits become payable at the time the member is eligible for normal retirement, and are computed based on: i) the service that would have accrued to the member if active employment had continued; and ii) the member's rate of pay at the time of disability indexed to the time of benefit commencement. The annual percentage increase in the pay used to compute benefits is the lesser of: i) 80% of the CPI increase and ii) 5%.

Benefits are increased to retired members (including survivors) annually in accordance with the following:

Members of the General Assembly:
Benefit is adjusted annually based on the increase in the pay for an active member of the General Assembly.</td><td>Normal retirement benefits become payable at the time the member is eligible for normal retirement, and are computed based on: i) the service that would have accrued to the member if active employment had continued; and ii) the member's rate of pay at the time of disability indexed to the time of benefit commencement. The annual percentage increase in the pay used to compute benefits is the lesser of: i) 80% of the CPI increase and ii) 5%.

Benefits are increased to retired members (including survivors) annually in accordance with the following:

Members of the General Assembly:
Benefit is adjusted annually based on the increase in the pay for an active member of the General Assembly.</td></tr>
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MSEP (Missouri State Employees' Plan)	MSEP 2000 (Missouri State Employees' Plan 2000)	MSEP 2011 (Missouri State Employees' Plan 2011)
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. Statewide Elected Officials with 12 or more years of service have their benefit adjusted annually based on the increase in the pay for an active statewide elected official in the member's highest elected position. Members who are fully vested and work beyond age 65 will have their monthly benefit increased upon retirement. The percentage increase in benefit is equal to all COLAs for the years between age 65 and date of retirement, not to exceed 65% and counts toward the Formula 1 65% maximum.	*Statewide Elected Officials:* Benefit is adjusted annually based on the increase in the pay for an active statewide elected official in the retired member's highest elected position. *General Employees:* Annual benefit percentage increase equal to the lesser of: i) 80% of the CPI increase, and 5%. CPI: For the basis of determining CPI, the average monthly reported CPI for the prior calendar year is divided by the average monthly reported CPI for the second prior calendar year to determine the current year increases, if any. If this amount is less than one, benefits are not reduced, nor is there any cumulative effect on future years' determination of CPI. Timing of Increase: Benefits are adjusted on the anniversary of the effective date of retirement for most members. Members retiring under the BackDROP provisions have an anniversary based on the retroactive starting date for the BackDROP.	*Statewide Elected Officials:* Benefit is adjusted annually based on the increase in the pay for an active statewide elected official in the retired member's highest elected position. *General Employees:* Annual benefit percentage increase equal to the lesser of: i) 80% of the CPI increase, and 5%. CPI: For the basis of determining CPI, the average monthly reported CPI for the prior calendar year is divided by the average monthly reported CPI for the second prior calendar year to determine the current year increases, if any. If this amount is less than one, benefits are not reduced, nor is there any cumulative effect on future years' determination of CPI. Timing of Increase: Benefits are adjusted on the anniversary of the effective date of retirement. For inactive vested General Employees who enter retirement, the first COLA will not be granted until the second anniversary of the effective date of retirement.

MSEP (Missouri State Employees' Plan)	MSEP 2000 (Missouri State Employees' Plan 2000)	MSEP 2011 (Missouri State Employees' Plan 2011)
Pop-up provision		
Benefits to members who choose a survivor form of payment and whose spouse precedes the member in death, will "pop-up" or revert to the amount the member would have received had he/she not elected a survivor option.	Same.	Same.
Portability		
Purchase/Transfer Provisions (in addition to military). Effective August 28, 1999, a member may purchase up to four years of non-federal full-time Missouri public service, provided the member is not vested in another retirement system for that same service.	Purchase/Transfer Provisions (in addition to military). A member may purchase up to four years of non-federal full-time Missouri public service, provided the member is not vested in another retirement system for that same service. Local vested service credit granted after 10 years of state service if the other retirement plan agrees to transfer assets equal to the accrued liability to MOSERS.	May purchase qualifying public sector service at full actuarial cost.

MSEP (Missouri State Employees' Plan)	MSEP 2000 (Missouri State Employees' Plan 2000)	MSEP 2011 (Missouri State Employees' Plan 2011)
BackDROP To be eligible to participate in the BackDROP, a member must have been eligible to retire under normal retirement age and/or service conditions for at least two years. A retroactive starting date is established for BackDROP purposes which is the later of: 1) the member's normal retirement date or 2) five years prior to the annuity starting date under the retirement plan selected by the member. A member may elect the BackDROP period for the accumulation of the BackDROP account in 12 month increments prior to their actual retirement date or back to the earliest possible date. This results in a BackDROP period of one to five years depending upon the individual situation. A theoretical BackDROP account is accumulated that includes 90% of the value of the benefit payments that would have been paid during the BackDROP period had the member retired at the retroactive starting date with their respective option election. These payments include applicable post-retirement benefit increases.	Same as MSEP.	Not eligible for the BackDROP.

MSEP (Missouri State Employees' Plan)	MSEP 2000 (Missouri State Employees' Plan 2000)	MSEP 2011 (Missouri State Employees' Plan 2011)
The member is paid the resulting lump sum value of the BackDROP account as of the annuity starting date or as three equal annual installments beginning at the annuity starting date. The annuity benefit payable from the actual retirement date is computed with years of service and average pay as of the retroactive starting date for the BackDROP. Post-retirement benefit increases that occurred during the BackDROP period are applied in the calculation of the monthly annuity.		

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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 Board adopted the current asset smoothing method 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. Effective June 30, 2021, 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 25-year periods. Bases established prior to June 30, 2021 will continue to be amortized on their original schedule. 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 and demographic assumptions was performed in 2021 and the results were presented to the Board. Below is a summary of the changes to methods and assumptions since the prior year:

- Effective June 30, 2021, subsequent changes in the UAAL due to actuarial gains/losses or assumption changes are amortized as a level percentage of payroll, over closed 25-year periods.
- The merit component of the salary increase assumption was adjusted to partially reflect observed experience.
- The mortality assumption was changed to reflect the Pub-2010 General Members Below Median Mortality Table. Specifically, the retiree mortality has been changed to be 104% of the Pub-2010 General Members Below Median Table set back two years for males and 104% of the Pub-2010 General Members Below Median Table set forward one year for females. Future generational mortality improvement is reflected by using 100% of Scale MP-2020 through 2020 and 75% of Scale MP-2020 for years after 2020.
- The retirement assumption was changed to have separate tables for MSEP, MSEP 2000 and MSEP 2011. The tables were simplified to reduce the complexity of the select and ultimate retirement assumption by only using rates for first eligibility for unreduced retirement and rates for the years thereafter.
- The termination assumption was changed from select and ultimate tables to a single table based on service only. In addition, the rates are now unisex.
- The disability assumption was adjusted to partially reflect observed experience.
- The refund election assumption was changed to assume the member elects the more valuable option between a refund and a deferred annuity.
- The percentage of members who are assumed to be married was decreased from 60% to 50% for pre-retirement death benefits and from 70% to 65% upon retirement.
- The military service purchase assumption was reduced from 4 months to 3 months for MSEP and MSEP 2000 members.
- Minor adjustments were made to the loads used to estimate the cost of the immediate unreduced survivor annuity payable to a deferred member's beneficiary upon death.

ACTUARIAL ASSUMPTIONS

An experience study which analyzed the System's economic and demographic assumptions was performed in 2021 and the results were presented to the Board. The assumptions listed below are a result of that experience study. The next experience study is scheduled for 2026.

Economic Assumptions

1. Investment Return — 6.95%, compounded annually, net of investment expenses.

2. Inflation — 2.25% per year

3. Salary Increases — Rates vary by service. Sample rates are as follows:

	Rates by Service			
Years	Inflation	Productivity	Merit	Total
0	2.25%	0.25%	7.50%	10.00%
1	2.25	0.25	2.50	5.00
2	2.25	0.25	2.25	4.75
3	2.25	0.25	2.00	4.50
4	2.25	0.25	1.85	4.35
5	2.25	0.25	1.70	4.20
10	2.25	0.25	1.00	3.50
15	2.25	0.25	0.75	3.25
20	2.25	0.25	0.50	3.00
25+	2.25	0.25	0.25	2.75

General Assembly members have a flat 2.50% assumption

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. Interest on Member Contributions — 1.50% per year

7. Administrative Expenses — Actual prior year expenses, included in normal cost rate.

Demographic Assumptions

1. Mortality — The mortality assumption includes an appropriate level of conservatism that reflects expected future mortality improvement.

   a. Post-retirement (Retirees) — Pub-2010 General Members Below Median Healthy Retiree mortality table, scaled by 104%, set back two years for males and set forward one year for females. Mortality projected generationally from 2010 to 2020 using Scale MP-2020 and 75% of Scale MP-2020 for years after 2020.

   b. Post-retirement (Beneficiaries) — Pub-2010 General Members Below Median Contingent Survivor mortality table, set back two years for males and set forward one year for females. Mortality projected generationally from 2010 to 2020 using Scale MP-2020 and 75% of Scale MP-2020 for years after 2020.

   c. Pre-retirement — Pub-2010 General Members Below Median Employee mortality table, set back two years for males and set forward one year for females. Mortality projected generationally from 2010 to 2020 using Scale MP-2020 and 75% of Scale MP-2020 for years after 2020.

   d. Long-term disability — Pub-2010 Non-Safety Disabled Retiree mortality table, without mortality projection.

2. Retirement

MSEP

Early Retirement	
Age	Rate
55-56	1%
57-59	2
60-61	8
62	25
63-64	5

Unreduced Retirement	
Age	Rate
48-61	17%
62	21
63-64	17
65-66	30
67-69	25
70	40
71-77	25
78	100

MSEP 2000

Early Retirement	
Age	Rate
57-59	3%
60-61	5

Unreduced Retirement	
Age	Rate
48-57	35%
58-60	20
61	12
62	16
63	12
64	20
65	27
66	30
67-69	25
70	30
71-77	25
78	100

MSEP 2011

Early Retirement	
Age	Rate
62-64	10%
65	15
66	20

Unreduced Retirement	
Age	Rate
55-57	40%
58-66	15
67-77	20
78	100

3. Termination

General Employees

Sample Rates	
Service	Rate
1	27.00%
5	12.75
10	7.00
15	4.30
20	2.25
25	1.25

Elected Officials and Legislators

Service	Rate
0-3	5.00%
4-7	12.00
8+	35.00

4. Disability

Sample Rates	
Age	Rate
25	0.03%
30	0.07
35	0.11
40	0.22
45	0.32
50	0.43
55	0.54
60	0.59
65	0.64

Other Assumptions

1. Form of Payment

   MSEP – 50% joint and survivor
   MSEP 2000 and MSEP 2011 – Straight life annuity

2. Marital Status

   a. Percent married

      65% married at retirement, 50% of those dying in active service are married

   b. Spouse's age

      Females assumed to be three years younger than males.

3. Pay Increase Timing

   Beginning of the fiscal year.

4. Decrement Timing

   Decrements of all types are assumed to occur mid-year.

5. Eligibility Testing

   Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur.

6. Benefit Service

   Exact fractional service is used to determine the amount of the benefit payable.

7. Decrement Relativity

   Decrement rates are used directly from the experience study, without adjustment for multiple decrement table effects.

8. Decrement Operation

   Disability and withdrawal do not operate during normal retirement eligibility.

9. Other Liability Adjustments

   Pre-Retirement Survivor Benefits for Spouse of Terminated Vested Member

Age	Male/Female
<30	1.56/1.42
30-39	1.26/1.20
40-49	1.11/1.08
>50	1.02/1.02

   These factors are used to estimate the cost of immediate unreduced survivor annuities upon the death of a vested member.

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. MSEP 2000 Election	All regular state employees hired on or before June 30, 2000 are assumed to elect MSEP 2000 prior to age 62 if eligible for the benefit and MSEP on or after age 62. Elected Officials, General Assembly, and Uniformed Water Patrol Members hired before July 1, 2000 are assumed to elect MSEP at retirement.
12. Service Adjustment	It is assumed that each member will be granted months of service credit for unused leave and military service purchases at retirement in the following amounts: <u>MSEP / MSEP 2000</u> 7 months (4 months of unused leave; 3 months of military service purchases) <u>MSEP 2011</u> 5 months (5 months of unused leave; not eligible for military service purchases)
13. Forfeitures	For MSEP 2011 members only: Value the greater of the refund amount or the present value of the deferred benefit.
14. Salary and Benefit Limits	For purposes of the valuation, no limits were applied to member compensation or benefits.
15. Commencement age for deferred vested benefit	Normal Retirement Date

Data Adjustments

Active and retired member data was reported as of May 31, 2021. It was brought forward to June 30, 2021 by adding one month of service for all active members, one month of contributions and interest for MSEP 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 less than a $100 annualized salary were assumed to receive the average active member pay.

When the option of choosing plans is available, terminated vested members are reported with two records, one with benefits under the MSEP plan and one with benefits under the MSEP 2000 plan. Because it is unknown what the member will elect at retirement, both records are valued and the plan that produces the higher present value of future benefits is used for valuation purposes.

For any retired member who has elected a joint and survivor benefit yet has no beneficiary date of birth provided, it was assumed that the beneficiary is 3 years younger for male retirees and 3 years older for female retirees.

TECHNICAL VALUATION PROCEDURES

Other Valuation Procedures

Salary increases are assumed to apply to annual amounts.

Decrements 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.

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Actuarial Accrued Liability	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".
Actuarial Assumptions	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.
Accrued Service	Service credited under the system which was rendered before the date of the actuarial valuation.
Actuarial Equivalent	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.
Actuarial Cost Method	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".
Experience Gain (Loss)	The difference between actual experience and actuarial assumptions anticipated experience during the period between two actuarial valuation dates.
Actuarial Present Value	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.
Amortization	Paying off an interest-discounted amount with periodic payments of interest and principal, as opposed to paying off with lump sum payment.
Normal Cost	The actuarial present value of retirement system benefits allocated to the current year by the actuarial cost method.
Unfunded Actuarial Accrued Liability	The difference between actuarial accrued liability and the valuation assets. Sometimes referred to as "unfunded actuarial liability" or "unfunded accrued liability". Most retirement systems have unfunded actuarial accrued liability. They arise each time new benefits are added and each time an actuarial loss is realized.

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