



**Cavanaugh Macdonald**  
CONSULTING, LLC

*The experience and dedication you deserve*

***MISSOURI STATE EMPLOYEES’  
RETIREMENT SYSTEM***

**ACTUARIAL VALUATION REPORT  
as of June 30, 2017**

**Contribution Rates for Fiscal Year Ending  
June 30, 2019**





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# Cavanaugh Macdonald

CONSULTING, LLC

*The experience and dedication you deserve*

September 8, 2017

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, 2017 for the purpose of determining the employer required contribution rate for the plan year ending June 30, 2019. This report provides valuation results for the Missouri State Employees' Plan (MSEPs). The major findings of the valuation are contained in this report, which reflects the benefit provisions in place on June 30, 2017.

There were changes to the actuarial assumptions and plan provisions since the prior valuation. At their meeting on June 22, 2017, the Board reaffirmed the change in the investment return assumption from 7.65% to 7.50% for the June 30, 2017 actuarial valuation. In addition, Senate Bill 62 (SB 62), which contained changes to the benefit structure for MSEP 2011, was passed by the 2017 Legislature. The provisions of the bill decreased vesting from ten to five years of service, but also included provisions that essentially offset the cost of the vesting change. As a result, SB 62 had no impact on the employer contribution rate and created a decrease to the UAAL of \$1.6 million.

This is the first actuarial valuation report prepared by Cavanaugh Macdonald Consulting, LLC (CMC). As part of our transition work, we replicated the June 30, 2016 actuarial valuation. Results were well within acceptable limits, but as is typical in a takeover situation, there were some differences in the key valuation results. Based on our experience, these differences are neither unusual nor significant. In our replication, we matched the actuarial liability within 0.6% and the normal cost rate within 4.2%.

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.

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Board of Trustees  
September 8, 2017  
Page 2

We further certify that all costs, liabilities, rates of interest and other factors for MSEPs 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 MSEPs. Nevertheless, the emerging costs will vary from those presented in this report to the extent actual experience differs from that projected by the actuarial assumptions. The MOSERS Board has the final decision regarding the appropriateness of the assumptions and adopted them as indicated in Appendix C.

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

The actuarial computations presented in this report are for purposes of determining the funding amounts for MSEPs 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 requirements and goals. 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 Standard No. 67 will be presented in a completely separate report.

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

On the basis of the foregoing, we hereby certify that, to the best of our knowledge and belief, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices. We are members of the American Academy of Actuaries and meet the Qualification Standards to render the actuarial opinion contained herein. We are available to answer any questions on the material contained in the report or to provide explanations or further details as may be appropriate.

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

Sincerely,

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

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

A handwritten signature in black ink that reads 'Joseph A. Nichols'.

Joseph A. Nichols, ASA, EA, MSPA, MAAA, FCA  
Consulting Actuary



## SECTION 1 – BOARD SUMMARY

This report presents the results of the June 30, 2017 actuarial valuation of the Missouri State Employees Plan (MSEPs). The primary purposes of performing this actuarial valuation are to:

- Determine the employer contribution rate defined in the Missouri state statutes and dictated by the Board’s funding policy for the fiscal year ending June 30, 2019;
- Disclose asset and liability measurements as well as the current funded status of MSEPs on the valuation date;
- Compare the actual and expected experience of MSEPs during the plan year ended June 30, 2017; and
- Analyze and report on trends in MSEPs contributions, assets and liabilities over the past several years.

### Key Results

The actuarial valuation results provide a “snapshot” view of the System’s financial condition on June 30, 2017. The MSEPs unfunded actuarial accrued liability (UAAL) increased from \$3.873 billion last year to \$4.280 billion this year and the funded ratio decreased from 69.6% to 67.5%. In addition, the employer actuarial contribution rate increased from 19.45% of pay last year to 20.21% of pay in this year’s valuation, an increase of 0.76% of pay.

The valuation results reflect net unfavorable experience for the past plan year as demonstrated by an UAAL that was higher than expected (actual UAAL of \$4.280 billion compared to an expected UAAL of \$4.069 billion). The unfavorable experience was due to a combination of an experience loss on assets and an experience gain on MSEPs liabilities.

A summary of the key results from the June 30, 2017 actuarial valuation is shown in the following table. Further detail on the changes and experience losses affecting valuation results can be found in the following sections of this Board Summary.

|  | June 30, 2017 | June 30, 2016 |
|--|---------------|---------------|
| Unfunded Actuarial Accrued Liability (\$M) | \$4,280       | \$3,873       |
| Funded Ratio (Actuarial Assets)            | 67.46%        | 69.60%        |
| Normal Cost Rate                           | 8.39%         | 8.60%         |
| UAAL Amortization Rate                     | 13.16%        | 12.26%        |
| Total Actuarial Required Contribution      | 21.55%        | 20.86%        |
| Member Contribution Rate                   | (1.34%)       | (1.41%)       |
| Employer Contribution Rate                 | 20.21%        | 19.45%        |



## SECTION 1 – BOARD SUMMARY

### Replication Results

This is the first actuarial valuation report prepared by Cavanaugh Macdonald Consulting, LLC (CMC). As part of our transition work, we replicated the June 30, 2016 actuarial valuation. Results were well within acceptable limits, but as is typical in a takeover situation, there were some differences in the key valuation results. Based on our experience, these differences are neither unusual nor significant. A summary of the key actuarial measurements in the replication results is shown in the following table:

| Dollars in Thousands             | June 30, 2016 Valuation Results |                  |         |
|----------------------------------|---------------------------------|------------------|---------|
|                                  | CMC                             | GRS              | CMC/GRS |
| Present Value of Future Benefits | \$13,633,859,529                | \$13,754,353,387 | 99.1%   |
| Actuarial Accrued Liability      | 12,668,934,391                  | 12,751,162,753   | 99.4%   |
| Normal Cost Rate                 | 8.24%                           | 8.60%            | 95.8%   |

### Assumption Changes

There was one change to the actuarial assumptions from last year's valuation. At their June 17, 2017 meeting, the Board reaffirmed the scheduled decrease in the investment return assumption from 7.65% to 7.50%, per the Board's policy. The remaining assumptions and methods used in this year's valuation are unchanged from last year. The impact of the change in the investment return assumption (before the impact of SB 62) is shown below.

|                                      | 7.65%                | 7.50%                | Difference    |
|--------------------------------------|----------------------|----------------------|---------------|
| Actuarial Accrued Liability          | \$12,951,415,168     | \$13,153,969,954     | \$202,554,786 |
| Actuarial Value of Assets            | <u>8,872,381,848</u> | <u>8,872,381,848</u> | -             |
| Unfunded Actuarial Accrued Liability | \$4,079,033,320      | \$4,281,588,106      | \$202,554,786 |
| Normal Cost                          | 8.11%                | 8.38%                | 0.27%         |
| UAAL Amortization                    | <u>12.71%</u>        | <u>13.17%</u>        | <u>0.46%</u>  |
| Actuarial Contribution               | 20.82%               | 21.55%               | 0.73%         |

Had the investment return assumption remained at 7.65% for this valuation, the actuarial contribution rate would have been 0.04% less than the rate determined in last year's valuation (20.86%).

### Benefit Provision Changes

Senate Bill 62, passed in the 2017 session and signed into law on July 14, made the following changes to the MSEP 2011 benefit provisions:

- MSEP 2011 active members are now eligible for:
  - Normal Retirement at age 67 with 5 years of service (previously age 67 with 10 years of service)
  - Early Retirement at age 62 with 5 years of service (previously age 62 with 10 years of service)
  - Vested after 5 years of service (previously 10 years of service)
- Cost-of-living adjustments for MSEP 2011 vested former members now commence on the second anniversary of the annuity starting date (previously commenced on first anniversary).



## SECTION 1 – BOARD SUMMARY

- Service credit for unused sick leave is only applied for MSEP 2011 members who terminate service at their early or normal retirement date.
- Survivor benefits for MSEP 2011 terminated vested members start at the date the member would have been eligible for normal retirement, not at date of death.

The change in MSEP 2011 plan provisions created a very small net decrease in liabilities and no impact on the actuarial contribution rate. Results using the current and previous benefit provisions are shown below:

|                                      | Prior Provisions     | With SB 62*          | Difference     |
|--------------------------------------|----------------------|----------------------|----------------|
| Actuarial Accrued Liability          | \$13,153,969,954     | \$13,152,273,895     | (\$1,696,059)  |
| Actuarial Value of Assets            | <u>8,872,381,848</u> | <u>8,872,381,848</u> | -              |
| Unfunded Actuarial Accrued Liability | \$4,281,588,106      | \$4,279,892,047      | (\$1,696,059)  |
| Normal Cost                          | 8.38%                | 8.39%                | 0.01%          |
| UAAL Amortization                    | <u>13.17%</u>        | <u>13.16%</u>        | <u>(0.01%)</u> |
| Actuarial Contribution               | 21.55%               | 21.55%               | 0.00%          |

\*The change in liability due to the vested terminated buyout program will be reflected in the June 30, 2018 valuation.

### Experience for the Last Plan Year

Numerous factors contributed to the change in the MSEPs assets, liabilities, and actuarial required contribution rate between June 30, 2016 and June 30, 2017. The components are examined in the following discussion.

#### Assets

As of June 30, 2017, MSEPs had net assets of \$7.945 billion, when measured on a market value basis, a decrease of \$164 million from the prior year value of \$8.109 billion.

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. The resulting amount is called the actuarial value of assets. In this year's valuation, the actuarial value of assets for MSEPs is \$8.872 billion, a decrease of \$6 million from the prior year. The components of change in the asset values are shown in the following table:

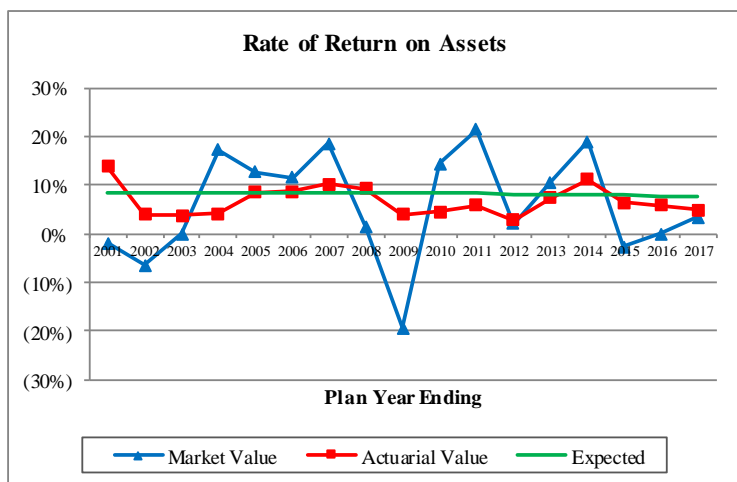
|                                     | Market Value (\$M) | Actuarial Value (\$M) |
|-------------------------------------|--------------------|-----------------------|
| <b>Net Assets, June 30, 2016</b>    | \$ 8,109.16        | \$ 8,878.06           |
| - Employer and Member Contributions | + 366.33           | + 366.33              |
| - Benefit Payments                  | - 793.96           | - 793.96              |
| - Net Investment Income             | + 272.59           | + 430.71              |
| - Administrative Expenses           | - 8.76             | - 8.76                |
| <b>Net Assets, June 30, 2017</b>    | \$ 7,945.36        | \$ 8,872.38           |
| Estimated Net Rate of Return        | 3.45%              | 4.97%                 |



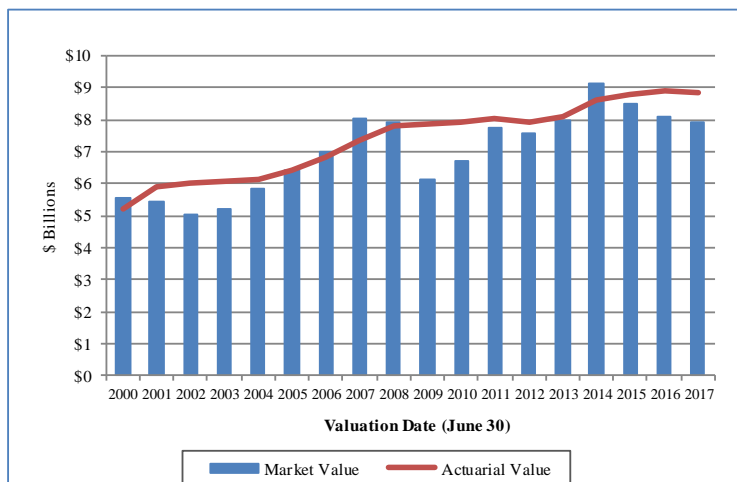


## SECTION 1 – BOARD SUMMARY

The estimated rate of return on the actuarial value of assets was 4.97%, which is lower than the investment return assumption in place for FY 2017 of 7.65%. As a result, there was an experience loss on assets of \$232 million. The investment return on the market value of assets for FY 2017 of 3.45% increased the deferred investment loss from \$769 million in last year’s valuation to \$927 million in the current valuation. 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.*



*As is expected when using an asset smoothing method, the actuarial value of assets has been both higher and lower than the market value of assets over a longer time period.*

### 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 (UAAL). The dollar amount of unfunded actuarial accrued liability is reduced if the contributions to the System exceed the normal cost for the year plus interest on the prior year’s UAAL.





## SECTION 1 – BOARD SUMMARY

The unfunded actuarial accrued liability is shown as of June 30, 2017 in the following table:

|                                      | Actuarial<br>Value of Assets | Market<br>Value of Assets |
|--------------------------------------|------------------------------|---------------------------|
| Actuarial Accrued Liability          | \$13,152,273,895             | \$13,152,273,895          |
| Value of Assets                      | <u>8,872,381,848</u>         | <u>7,945,358,298</u>      |
| Unfunded Actuarial Accrued Liability | \$4,279,892,047              | \$5,206,915,597           |
| Funded Ratio                         | 67.46%                       | 60.41%                    |

See Section 4 of the report for the detailed development of the unfunded actuarial accrued liability.

The net change in the UAAL from June 30, 2016 to June 30, 2017 was an increase of \$407 million. The components of this net change are shown in the following table:

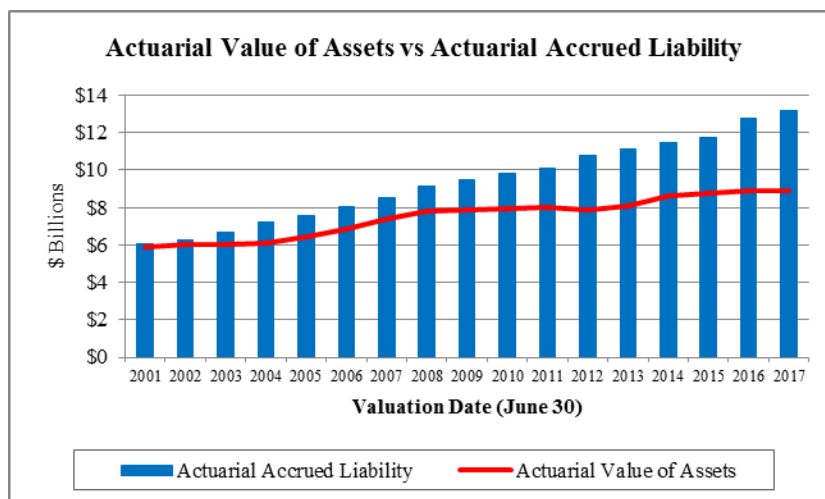
|  | (\$ Millions) |
|--|---------------|
| <b>Unfunded Actuarial Accrued Liability, June 30, 2016</b> | \$3,873.0     |
| - Expected increase from amortization method               | 97.7          |
| - Actual vs. Expected Contributions                        | (12.9)        |
| - Investment experience                                    | 232.1         |
| - Liability experience                                     | (21.6)        |
| - Change from revised assumptions/methods                  | 202.6         |
| - Change from benefit changes                              | (1.7)         |
| - Transition/actuarial software                            | (88.5)        |
| - Other experience   | (0.8)         |
| <b>Unfunded Actuarial Accrued Liability, June 30, 2017</b> | \$4,279.9     |

As shown above, various components impacted the dollar amount of the UAAL. Actuarial gains (losses), which result from actual experience that is more (less) favorable than anticipated based on the actuarial assumptions, are reflected in the UAAL and are measured as the difference between the expected UAAL and the actual UAAL, taking into account any changes due to actuarial assumptions and methods, or benefit provision changes. Overall, MSEPs experienced a net actuarial loss of \$210 million. The actuarial loss may be explained by considering the separate experience of assets and liabilities. As noted earlier, there was a \$22 million experience gain on the System liabilities and an experience loss of \$232 million on the actuarial value of assets. The liability gain was the net result of various components of actuarial gains and losses, the largest of which was a gain from cost-of-living adjustments that were lower than expected. A breakdown of the components of experience gains and losses can be found in Table 7 of this report.

As the following graph of historical actuarial assets and accrued liabilities shows, the System's liabilities have been growing at a faster pace than the System's assets since 2001. The actuarial required contribution has been made each year, but unfavorable asset and liability experience, along with significant changes in the actuarial assumptions, has caused MSEPs to go from almost 100% funded in 2001 to the current 67% level.



**SECTION 1 – BOARD SUMMARY**

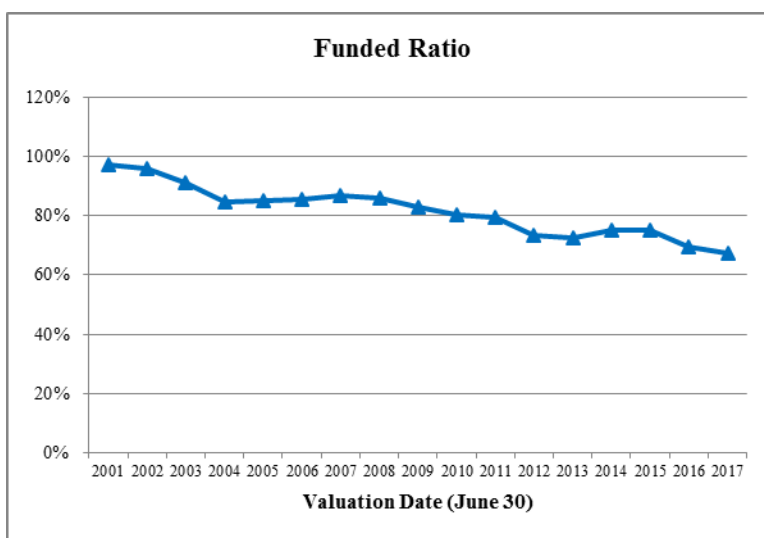


An evaluation of the UAAL on a pure dollar basis may not provide a complete analysis since only the difference between the assets and liabilities (which are both very large numbers) is reflected. Another way to evaluate the UAAL and the progress made in its funding is to track the funded ratio, the ratio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

|              | 6/30/2012 | 6/30/2013 | 6/30/2014 | 6/30/2015 | 6/30/2016 | 6/30/2017 |
|--------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Funded Ratio | 73.2%     | 72.7%     | 75.1%     | 75.0%     | 69.6%     | 67.5%     |
| UAAL (\$M)   | \$2,897   | \$3,039   | \$2,857   | \$2,936   | \$3,873   | \$4,280   |

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. If the funded ratios were shown using the market value of assets, the results would differ.

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





## SECTION 1 – BOARD SUMMARY

### 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.
- 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.

The UAAL contribution rate is determined by calculating the amortization payment, as a level percentage of payroll, over a closed 30-year period that began in 2014 (27 years remain as of June 30, 2017). This methodology results in payments that are lower amounts than level dollar payments in the initial years of the amortization period, but increase each year in the future with the assumed payroll growth assumption of 3%. Because the UAAL contribution rate is determined as a level percent of payroll, the dollar amount of the UAAL contribution is scheduled to increase 3% each year in the future even if all actuarial assumptions are met. In addition, the UAAL is expected to increase for nearly ten years before starting to decline, even if all actuarial assumptions are met.

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* |         |
|---|--------------------|---------|
|   | 2017               | 2016    |
| 1. Normal Cost Rate                           | 8.39%              | 8.60%   |
| 2. UAAL Contribution Rate                     | 13.16%             | 12.26%  |
| 3. Total Actuarial Required Contribution Rate | 21.55%             | 20.86%  |
| 4. Member Contribution Rate                   | (1.34%)            | (1.41%) |
| 5. Employer Contribution Rate                 | 20.21%             | 19.45%  |

The total actuarial contribution rate in the June 30, 2017 valuation is 21.55%. The member contribution rate (as a percentage of total payroll) is anticipated to be 1.34%, resulting in an employer contribution for the fiscal year ending June 30, 2019 of 20.21%. This amount is above the minimum employer contribution of 16.97%.



**SECTION 1 – BOARD SUMMARY**

The following table shows the reconciliation of the Computed Employer Contribution Rate from June 30, 2016 to June 30, 2017:

|  | <b>% of Payroll</b> |
|--|---------------------|
| <b>6/30/2016 Computed Employer Contribution Rate</b> | <b>19.45%</b>       |
| Asset (Gain)/Loss                                    | 0.76%               |
| Liability (Gain)/Loss                                | (0.07%)             |
| Assumption Changes                                   | 0.72%               |
| Projected Payroll Lower than Expected                | 0.05%               |
| Additional UAAL Contribution*                        | (0.04%)             |
| Normal Cost  | (0.13%)             |
| Change in Effective Employee Contribution Rate       | 0.07%               |
| Plan Provision Changes                               | 0.00%               |
| Transition/Actuarial Software                        | (0.65%)             |
| Other Experience                                     | 0.05%               |
| <b>6/30/2017 Computed Employer Contribution Rate</b> | <b>20.21%</b>       |

\* Impact, if any, of the Policy Minimum Employer Contribution Rate in excess of the Computed Employer Contribution Rate.

As the following table of computed employer contribution rates and actual contribution amounts shows, the employer contribution has been at 100% of the full actuarial contribution in all years:

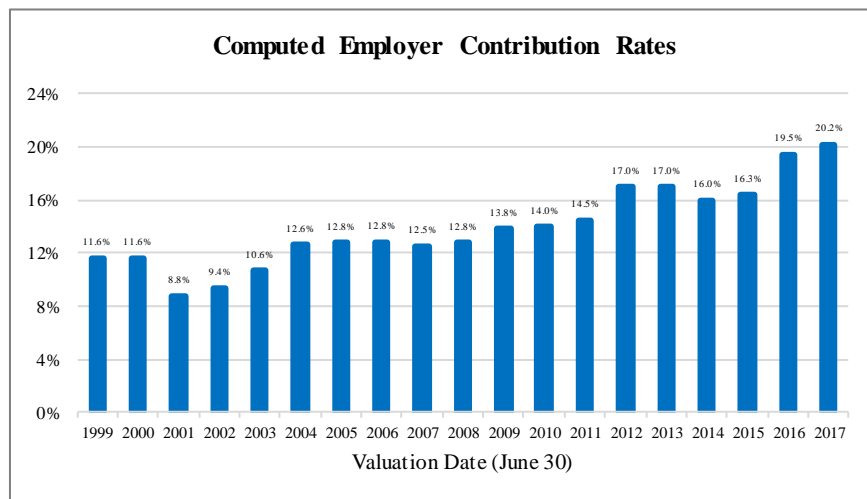
| <b>Fiscal Year Ending</b> | <b>Actuarially Determined<br/>Employer Contribution</b> | <b>Actual<br/>Dollar Amount</b> | <b>Percent<br/>Contributed</b> |
|---------------------------|---|---------------------------------|--------------------------------|
| June 30, 2005             | \$195.6   | \$195.6                         | 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             | 330.0   | 330.0                           | 100.0%                         |
| June 30, 2017             | 322.8   | 335.2                           | 103.8%                         |



## SECTION 1 – BOARD SUMMARY

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The historical computed employer contribution rates, determined on each valuation date, are shown graphically below:



The computed employer contribution rate, which is determined based on the snapshot of the System taken on the valuation date, is anticipated to increase over the short term as the deferred investment experience is recognized through the asset smoothing method. Anticipated increases in the employee contributions, as a percentage of total payroll, will provide some offset to the increased UAAL payment. Future experience (both investment and demographic) will also have an impact on the ultimate level of MSEP's contributions.

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

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

| <b>Valuation Date</b>                       | June 30, 2017 | June 30, 2016 |          |
|---|---------------|---------------|----------|
| <b>Contribution for Fiscal Year Ending</b>  | June 30, 2019 | June 30, 2018 | % Change |
| <b>Computed Employer Contribution</b>       |               |               |          |
| Annual Amount (Estimated)                   | \$423         | \$397         | 6.5%     |
| Percentage of Covered Payroll               | 20.21%        | 19.45%        | 3.9%     |
| <b>Benefit Payments</b>                     | \$794         | \$757         | 4.9%     |
| <b>Membership</b>                           |               |               |          |
| Number of                                   |               |               |          |
| - Active Members                            | 48,910        | 49,464        | (1.1%)   |
| - Retirees and Beneficiaries                | 46,560        | 44,828        | 3.9%     |
| - Terminated Vested Members                 | 19,578        | 19,512        | 0.3%     |
| - Leave-of-Absence Members                  | 178           | 132           | 34.8%    |
| - Long Term Disability Members              | 849           | 928           | (8.5%)   |
| - Terminated Nonvested Members              | 3,899         | 3,233         | 20.6%    |
| - Total                                     | 116,075       | 118,097       | (1.7%)   |
| - Reported Payroll                          | \$1,942       | \$1,922       | 1.0%     |
| <b>Assets</b>                               |               |               |          |
| Market Value (MVA)                          | \$7,945       | \$8,109       | (2.0%)   |
| Actuarial Value (AVA)                       | \$8,872       | \$8,878       | (0.1%)   |
| Ratio - Actuarial Value to Market Value     | 111.67%       | 109.48%       |          |
| Return on Market Value                      | 3.45%         | 0.02%         |          |
| Return on Actuarial Value                   | 4.97%         | 5.76%         |          |
| <b>Actuarial Information</b>                |               |               |          |
| Actuarial Accrued Liability (AAL)           | \$13,152      | \$12,751      | 3.1%     |
| Unfunded Actuarial Accrued Liability (UAAL) | \$4,280       | \$3,873       | 10.5%    |
| Funded Ratio                                | 67.5%         | 69.6%         | (3.1%)   |
| Amortization Period                         | 27 years      | 28 years      |          |
| Ratio of AVA to Payroll                     | 4.6           | 4.6           |          |
| Ratio of AAL to Payroll                     | 6.8           | 6.6           |          |
| Normal Cost Rate                            | 8.39%         | 8.60%         | (2.4%)   |
| UAAL Contribution Rate                      | 13.16%        | 12.26%        | 7.3%     |
| Total Contribution Rate                     | 21.55%        | 20.86%        | 3.3%     |
| Member Contribution Rate                    | (1.34%)       | (1.41%)       | (5.0%)   |
| Employer Contribution Rate                  | 20.21%        | 19.45%        | 3.9%     |



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

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This report presents the actuarial valuation results of the Missouri State Employees' Retirement System as of June 30, 2017. 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 includes some historical funding information that was required by the Governmental Accounting Standards Board (GASB) in the past.





### **SECTION 3 – SYSTEM ASSETS**

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In many respects, an actuarial valuation can be thought of as an inventory process. The inventory is taken as of the actuarial valuation date, which for this valuation is June 30, 2017. 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, 2016 and ending June 30, 2017.

#### **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, 2016                       | 8,109,161,214 | 8,878,057,191   |
| 2. Contributions                                 |               |                 |
| State Contributions                              | 335,217,422   | 335,217,422     |
| Employee Contributions                           | 25,439,343    | 25,439,343      |
| Member Purchases of Service Credit               | 1,691,046     | 1,691,046       |
| Service Transfer Contributions                   | 3,977,803     | 3,977,803       |
| Total  | 366,325,614   | 366,325,614     |
| 3. Investment Income, Net of Investment Expenses | 272,595,668   | 430,723,241     |
| 4. Benefit Payments and Transfers Out            |               |                 |
| Monthly Benefit Payments                         | 700,281,256   | 700,281,256     |
| BackDROP and Lump Sum Payments                   | 87,019,072    | 87,019,072      |
| Service Transfer Payments                        | 1,843,792     | 1,843,792       |
| Contribution Refunds                             | 4,820,737     | 4,820,737       |
| Total  | 793,964,857   | 793,964,857     |
| 5. Administrative and Misc. Expenses             | 8,759,341     | 8,759,341       |
| 6. Assets at June 30, 2017                       | 7,945,358,298 | 8,872,381,848   |
| (1) + (2) + (3) - (4) - (5)                      |               |                 |
| 7. Rate of Return, Net of Investment Expenses*   | 3.45%         | 4.97%           |

\* Based on the approximation formula:  $I / [.5 \times (A+B-I)]$ , where

I = Investment Increment

A = Beginning of year asset value

B = End of year asset value

**SECTION 3 – SYSTEM ASSETS****TABLE 2  
DEVELOPMENT OF ACTUARIAL VALUE OF ASSETS**

| <b>Valuation Date: June 30</b>                              | <b>2014</b>          | <b>2015</b>          | <b>2016</b>          | <b>2017</b>          |
|---|----------------------|----------------------|----------------------|----------------------|
| A. Actuarial Value at Beginning of Year                     | \$ 8,096,436,929     | \$ 8,637,758,955     | \$ 8,792,485,658     | \$ 8,878,057,191     |
| B. Market Value at End of Year                              | 9,136,781,826        | 8,516,654,912        | 8,109,161,214        | 7,945,358,298        |
| C. Market Value at Beginning of Year                        | 7,993,837,570        | 9,136,781,826        | 8,516,654,912        | 8,109,161,214        |
| D. Cash Flow  |                      |                      |                      |                      |
| D1. Contributions   | 345,557,293          | 353,287,107          | 356,565,911          | 366,325,614          |
| D2. Benefit payments  | (680,436,106)        | (728,265,800)        | (757,310,503)        | (793,964,857)        |
| D3. Administrative expenses                                 | (7,336,922)          | (8,077,692)          | (8,489,375)          | (8,759,341)          |
| D4. Net   | <u>(342,215,735)</u> | <u>(383,056,385)</u> | <u>(409,233,967)</u> | <u>(436,398,584)</u> |
| E. Investment Income, Net of Investment Expenses            |                      |                      |                      |                      |
| E1. Market total (B - C - D4)                               | 1,485,159,991        | (237,070,529)        | 1,740,269            | 272,595,668          |
| E2. Assumed rate  | 8.00%                | 8.00%                | 8.00%                | 7.65%                |
| E3. Amount for immediate recognition (A + .5 * D4) * E2     | 634,026,325          | 675,698,461          | 687,029,494          | 662,479,129          |
| E4. Amount for phased-in recognition (E1 - E3)              | 851,133,666          | (912,768,990)        | (685,289,225)        | (389,883,461)        |
| F. Unrecognized Gains/(Losses) From Prior Years             | (102,599,359)        | 499,022,871          | (275,830,746)        | (768,895,977)        |
| G. Phased-in Recognition of Investment Income (E4 + F) / 5* | 249,511,436          | (137,915,373)        | (192,223,994)        | (231,755,888)        |
| H. End of Year Adjustment                                   | 0                    | 0                    | 0                    | 0                    |
| I. Actuarial Value at End of Year                           |                      |                      |                      |                      |
| I1. Preliminary value (A + D4 + E3 + G + H)                 | 8,637,758,955        | 8,792,485,658        | 8,878,057,191        | 8,872,381,848        |
| I2. Upper corridor limit: 125% x B                          | 11,420,977,283       | 10,645,818,640       | 10,136,451,518       | 9,931,697,873        |
| I3. Lower corridor limit: 80% x B                           | 7,309,425,461        | 6,813,323,930        | 6,487,328,971        | 6,356,286,638        |
| I4. Corridor adjustment                                     | 0                    | 0                    | 0                    | 0                    |
| I5. Funding value end of year: I1 + I4                      | 8,637,758,955        | 8,792,485,658        | 8,878,057,191        | 8,872,381,848        |
| J. Difference Between Market and Actuarial Values (B - I5)  | 499,022,871          | (275,830,746)        | (768,895,977)        | (927,023,550)        |
| K. Actuarial Value Rate of Return                           | 11.15%               | 6.37%                | 5.76%                | 4.97%                |
| L. Market Value Rate of Return                              | 18.99%               | (2.65%)              | 0.02%                | 3.45%                |
| M. Actuarial Value as a % of Market Value: I5 / B           | 95%                  | 103%                 | 109%                 | 112%                 |
| N. Net Cash Flow as a % of Actuarial Value D4 / I5          | (4.0%)               | (4.4%)               | (4.6%)               | (4.9%)               |

\* Phased-in over 3 years prior to 2016.

The actuarial value of assets recognizes assumed investment income (line E3) fully each year. Differences between actual and assumed investment income (line E4) are phased-in over an open 5-year period. During periods when investment performance exceeds the assumed rate, the actuarial value of assets will tend to be less than market value. During periods when investment performance is less than assumed, the actuarial value will tend to be greater than market value.



## SECTION 4 – SYSTEM LIABILITIES

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In the previous section, an analysis of System's current assets was given as of June 30, 2017. In this section, the discussion will focus on the commitments (future benefit payments) of the System, which are referred to as its liabilities.

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

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

Table 4 illustrates the amortization schedule of the UAAL, given the Board's funding policy that amortizes the UAAL over a closed 30-year period, beginning with the June 30, 2014 actuarial valuation, with payments calculated as a level percentage of payroll.

All liabilities reflect the benefit provisions in place as of June 30, 2017, as amended by any legislation in the 2017 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, 2017**

|  | (1)                        | (2)   | (3) = (1) - (2)                     |
|--|----------------------------|---|-------------------------------------|
|  | Actuarial<br>Present Value | Present Value<br>of Future Normal<br>Cost Contributions | Actuarial<br>Accrued<br>Liabilities |
| <b>Active Members</b>  |                            |   |                                     |
| Service retirement benefits based on service rendered before and likely to be rendered after valuation date  | \$5,333,879,237            | \$741,465,417   | \$4,592,413,820                     |
| Disability benefits likely to be paid to present active members who become totally and permanently disabled  | 155,214,308                | 98,421,685  | 56,792,623                          |
| Survivor benefits likely to be paid to widows and children of present active members who die before retiring | 62,950,941                 | 16,883,733  | 46,067,208                          |
| Separation benefits likely to be paid to present active members  | 222,057,440                | 141,299,477   | 80,757,963                          |
| <b>Active Member Totals</b>  | <b>\$5,774,101,926</b>     | <b>\$998,070,312</b>                                    | <b>\$4,776,031,614</b>              |
| <b>Members on Leave of Absence &amp; LTD</b>   |                            |   |                                     |
| Service retirement benefits based on service rendered before the valuation date                              |                            |   | 107,083,816                         |
| <b>Terminated Vested Members</b>   |                            |   |                                     |
| Service retirement benefits based on service rendered before the valuation date                              |                            |   | 702,658,035                         |
| <b>Retired Lives</b>   |                            |   | 7,559,623,100                       |
| <b>Pending Refunds</b>   |                            |   | 6,877,330                           |
| <b>Total Actuarial Accrued Liability</b>   |                            |   | <b>\$13,152,273,895</b>             |
| <b>Actuarial Value of Assets</b>   |                            |   | <b>8,872,381,848</b>                |
| <b>Unfunded Actuarial Accrued Liability</b>  |                            |   | <b>\$4,279,892,047</b>              |
| <b>Funded Ratio</b>  |                            |   | <b>67.5%</b>                        |



**SECTION 4 – SYSTEM LIABILITIES**

**TABLE 4**  
**AMORTIZATION SCHEDULE FOR UAAL**  
**(Based on the current 7.5% investment return assumption)**  
**(\$ in millions)**

| Fiscal Year Ending June 30 | Projected Active Member Payroll | Unfunded Actuarial Accrued Liability (BOY) | UAAL Adjusted for Wage Inflation (BOY) | Amortization Years Remaining | Annual Contributions |              | UAAL as % of Payroll | BOY Funded Ratio* |
|----------------------------|---------------------------------|--|--|------------------------------|----------------------|--------------|----------------------|-------------------|
|                            |                                 |  |  |                              | Dollars (\$M)        | % of Payroll |                      |                   |
| 2018                       | \$2,031                         | \$4,280                                    | \$4,280                                | 28                           | \$249                | 12.26 %      | 210.74 %             | 67.5 %            |
| 2019                       | 2,092                           | 4,343                                      | 4,216                                  | 27                           | 275                  | 13.16        | 207.61               | 66.2              |
| 2020                       | 2,155                           | 4,383                                      | 4,131                                  | 26                           | 284                  | 13.16        | 203.43               | 65.2              |
| 2021                       | 2,219                           | 4,417                                      | 4,042                                  | 25                           | 292                  | 13.16        | 199.03               | 64.4              |
| 2022                       | 2,286                           | 4,446                                      | 3,950                                  | 24                           | 301                  | 13.16        | 194.52               | 63.8              |
| 2023                       | 2,354                           | 4,469                                      | 3,855                                  | 23                           | 310                  | 13.16        | 189.81               | 63.4              |
| 2024                       | 2,425                           | 4,483                                      | 3,754                                  | 22                           | 319                  | 13.16        | 184.86               | 63.1              |
| 2025                       | 2,498                           | 4,488                                      | 3,649                                  | 21                           | 329                  | 13.16        | 179.69               | 62.9              |
| 2026                       | 2,573                           | 4,484                                      | 3,540                                  | 20                           | 339                  | 13.16        | 174.29               | 62.8              |
| 2027                       | 2,650                           | 4,469                                      | 3,425                                  | 19                           | 349                  | 13.16        | 168.66               | 62.8              |
| 2028                       | 2,729                           | 4,443                                      | 3,306                                  | 18                           | 359                  | 13.16        | 162.78               | 62.9              |
| 2029                       | 2,811                           | 4,404                                      | 3,181                                  | 17                           | 370                  | 13.16        | 156.65               | 63.1              |
| 2030                       | 2,896                           | 4,350                                      | 3,051                                  | 16                           | 381                  | 13.16        | 150.24               | 63.4              |
| 2031                       | 2,982                           | 4,281                                      | 2,915                                  | 15                           | 392                  | 13.16        | 143.56               | 63.9              |
| 2032                       | 3,072                           | 4,196                                      | 2,774                                  | 14                           | 404                  | 13.16        | 136.58               | 64.4              |
| 2033                       | 3,164                           | 4,091                                      | 2,626                                  | 13                           | 416                  | 13.16        | 129.30               | 65.1              |
| 2034                       | 3,259                           | 3,966                                      | 2,472                                  | 12                           | 429                  | 13.16        | 121.71               | 66.0              |
| 2035                       | 3,357                           | 3,819                                      | 2,311                                  | 11                           | 442                  | 13.16        | 113.78               | 67.1              |
| 2036                       | 3,457                           | 3,648                                      | 2,143                                  | 10                           | 455                  | 13.16        | 105.50               | 68.4              |
| 2037                       | 3,561                           | 3,449                                      | 1,967                                  | 9                            | 469                  | 13.16        | 96.86                | 70.0              |
| 2038                       | 3,668                           | 3,222                                      | 1,784                                  | 8                            | 483                  | 13.16        | 87.85                | 71.8              |
| 2039                       | 3,778                           | 2,963                                      | 1,593                                  | 7                            | 497                  | 13.16        | 78.44                | 74.0              |
| 2040                       | 3,891                           | 2,670                                      | 1,394                                  | 6                            | 512                  | 13.16        | 68.62                | 76.4              |
| 2041                       | 4,008                           | 2,339                                      | 1,185                                  | 5                            | 527                  | 13.16        | 58.37                | 79.3              |
| 2042                       | 4,128                           | 1,968                                      | 968                                    | 4                            | 543                  | 13.16        | 47.67                | 82.6              |
| 2043                       | 4,252                           | 1,552                                      | 741                                    | 3                            | 560                  | 13.16        | 36.51                | 86.3              |
| 2044                       | 4,380                           | 1,089                                      | 505                                    | 2                            | 576                  | 13.16        | 24.85                | 90.5              |
| 2045                       | 4,511                           | 573  | 258                                    | 1                            | 594                  | 13.16        | 12.69                | 95.1              |
| 2046                       | 4,646                           | 0  | 0                                      | 0                            | 611                  | 13.16        | 0.00                 | 100.0             |



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

ASSETS

|                                      |    |                    |
|--------------------------------------|----|--------------------|
| Actuarial Value of Assets            | \$ | 8,872,381,848      |
| Unfunded Actuarial Accrued Liability |    | 4,279,892,047      |
| Present Value of Future Normal Costs |    | <u>998,070,312</u> |
| Total Assets                         | \$ | 14,150,344,207     |

LIABILITIES

Present Value of Future Benefits

Active members

|            |    |                      |                  |
|------------|----|----------------------|------------------|
| Retirement | \$ | 5,333,879,237        |                  |
| Withdrawal |    | 222,057,440          |                  |
| Death      |    | 62,950,941           |                  |
| Disability |    | 155,214,308          |                  |
| Total      |    | <u>5,774,101,926</u> | \$ 5,774,101,926 |

Inactive members

|                                  |  |                      |                  |
|----------------------------------|--|----------------------|------------------|
| Currently receiving benefits     |  | 7,559,623,100        |                  |
| Not currently receiving benefits |  | 816,619,181          |                  |
| Total                            |  | <u>8,376,242,281</u> | \$ 8,376,242,281 |

|                   |    |                |
|-------------------|----|----------------|
| Total Liabilities | \$ | 14,150,344,207 |
|-------------------|----|----------------|



**SECTION 4 – SYSTEM LIABILITIES****TABLE 6  
ANALYSIS OF GAIN/(LOSS)**

|   | (1)<br>Actuarial<br>Accrued<br>Liabilities | (2)<br>Valuation<br>Assets | (3) = (1) - (2)<br>UAAL |
|---|--|----------------------------|-------------------------|
| (1) Value at start of year  | \$ 12,751,162,753                          | \$ 8,878,057,191           | \$ 3,873,105,562        |
| (2) Total normal cost from last valuation   | 141,910,018                                | 0                          | 141,910,018             |
| (3) Actual contributions (Employer and Member)  | 0  | 360,656,765                | (360,656,765)           |
| (4) Benefit payments  | (793,964,857)                              | (793,964,857)              | 0                       |
| (5) Administrative expenses   | 0  | (8,759,341)                | 8,759,341               |
| (6) Service Purchases/Transfers   | 5,668,849                                  | 5,668,849                  | 0                       |
| (7) Interest on (1), (2), (3), (4), (5) and (6) at 7.65%                                  | <u>956,723,352</u>                         | <u>662,786,712</u>         | <u>293,936,640</u>      |
| (8) Expected value before changes   | \$ 13,061,500,115                          | \$ 9,104,445,319           | \$ 3,957,054,796        |
| (9) Change from benefit changes (SB 62)   | (1,696,059)                                | 0                          | (1,696,059)             |
| (10) Change in investment return assumption   | 202,554,786                                | 0                          | 202,554,786             |
| (11) Transition/actuarial software  | (88,518,832)                               | 0                          | (88,518,832)            |
| (12) Expected value after changes: (8) + (9) + (10) + (11)                                | \$ 13,173,840,010                          | \$ 9,104,445,319           | \$ 4,069,394,691        |
| (13) Actual value at end of year  | 13,152,273,895                             | 8,872,381,848              | 4,279,892,047           |
| (14) Gain / (Loss)  | \$ 21,566,115                              | \$ (232,063,471)           | \$ (210,497,356)        |
| (15) Gain / (Loss) as percent of expected actuarial accrued liabilities: \$13,061,500,115 | 0.2%                                       | (1.8%)                     | (1.6%)                  |



**TABLE 7**  
**GAIN/(LOSS) ANALYSIS BY SOURCE**

| Type of Activity   | Gain or (Loss)<br>for Year Ended 6/30/2017 |        |
|--|--|--------|
| <b>Age &amp; Service Retirements.</b> 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. | (\$53,337,396)                             | (0.4%) |
| <b>Death-in-Service Benefits.</b> If survivor claims are less than assumed, there is a gain. If more claims, there is a loss.  | 6,165,742                                  | 0.0%   |
| <b>Withdrawal From Employment.</b> If more liabilities are released by withdrawals than assumed, there is a gain. If smaller releases, a loss.                                       | (28,207,416)                               | (0.2%) |
| <b>Long Term Disability.</b> The occurrence of a gain or loss depends upon the age at disability and the incidence of disability.  | (566,348)                                  | (0.0%) |
| <b>Pay Increases.</b> If there are smaller pay increases than assumed, there is a gain. If greater increases, a loss.  | 16,990,648                                 | 0.1%   |
| <b>Investment Income.</b> If there is greater investment return on assets than assumed, there is a gain. If less return, a loss.   | (232,063,471)                              | (1.8%) |
| <b>Retiree Mortality.</b> If more deaths than assumed, there is a gain. If fewer deaths, a loss.   | 14,330,274                                 | 0.1%   |
| <b>COLAs.</b> If Cost of Living Adjustments are less than expected, a gain; if more a loss.  | 68,345,099                                 | 0.5%   |
| <b>Other.</b> Miscellaneous gains and losses resulting from data adjustments, timing of financial transactions, valuation methods, etc.  | (2,154,488)                                | (0.0%) |
| <b>Gain (or Loss) During Year From Experience</b>  | (\$210,497,356)                            | (1.6%) |



SECTION 4 – SYSTEM LIABILITIES

**TABLE 8  
HISTORICAL EXPERIENCE GAINS AND LOSSES BY SOURCE**

| Year<br>Ending<br>June 30 | Gain (Loss) By Risk Area |                |                                |              |                         |               |                   |             |              | Total<br>Exper.<br>Gain<br>(Loss) | Exper.<br>Gain<br>(Loss)<br>as % of<br>AAL | Accrued<br>Liability<br>Beginning<br>of Year |
|---------------------------|--------------------------|----------------|--------------------------------|--------------|-------------------------|---------------|-------------------|-------------|--------------|-----------------------------------|--|--|
|                           | Salary<br>Increases      | Investments    | Age &<br>Service<br>Retirement | Disability   | Death<br>In-<br>Service | Withdrawal    | Retired<br>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                                       |
| <b>2017*</b>              | <b>17.0</b>              | <b>(232.1)</b> | <b>(53.3)</b>                  | <b>(0.6)</b> | <b>6.2</b>              | <b>(28.2)</b> | <b>14.3</b>       | <b>68.3</b> | <b>(2.2)</b> | <b>(210.5)</b>                    | <b>(1.6)</b>                               | <b>12,751</b>                                |

\* Revision in assumptions.

\*\* Revision in asset valuation method.

\*\*\* Revision in assumptions & asset valuation method.

# Prior to the 2013 valuation, this amount included COLAs.



## **SECTION 5 – EMPLOYER CONTRIBUTIONS**

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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 deal with this deficiency in an orderly fashion.

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

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

### **Description of Contribution Rate Components**

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

In general, contributions are computed in accordance with a level percent-of-payroll funding objective. The contribution rate based on the June 30, 2017 actuarial valuation will be used to determine the employer contribution rate for the plan year ending June 30, 2019. 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**

In Table 9 the amortization payment related to the unfunded actuarial accrued liability, as of June 30, 2017, is developed. Table 10 develops the computed employer contribution rate for the Plan and the estimated amount of required State contributions. Table 11 shows a summary what the actuarial results would be under different investment return assumptions.

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



**TABLE 9**  
**UAAL CONTRIBUTION RATE**

|  |               |
|--|---------------|
| (1) Total Contribution Rate as a Percent-of-Payroll for the Year after the Valuation Date (as determined by the prior valuation) |               |
| (a) Total Normal Cost Rate Beginning of Year   | 8.60%         |
| (b) UAAL Beginning of Year   | <u>12.26%</u> |
| (c) Total Contribution Rate Beginning of Year*   | 20.86%        |
| (2) UAAL on Valuation Date   | 4,279,892,047 |
| (3) Expected Interest on UAAL at 7.50%   | 320,991,904   |
| (4) Projected Payroll for the Year After the Valuation Date  | 2,030,854,231 |
| (5) Total Normal Cost [ (1)(a) x (4) ]   | 174,653,464   |
| (6) 1/2 Year Interest on Normal Cost at 7.50%  | 6,431,102     |
| (7) Total Expected Contributions [ (1)(c) x (4) ]  | 423,636,193   |
| (8) 1/2 Year Interest on Contributions at 7.50%  | 15,599,161    |
| (9) Projected UAAL [ (2) + (3) + (5) + (6) - (7) - (8) ]   | 4,342,733,163 |
| (10) Amortization Factor (27 years)  | 15.77829      |
| (11) Projected Payroll for Second Year after Valuation Date  | 2,091,779,858 |
| (12) UAAL Contribution Rate [ (9) / (10) / (11) ]  | 13.16%        |

\*The Total Contribution Rate was the employer rate of 19.45% plus the weighted average member rate of 1.41% of payroll.



**SECTION 5 – EMPLOYER CONTRIBUTIONS**

**TABLE 10  
COMPUTED EMPLOYER CONTRIBUTION RATE  
FOR THE FISCAL YEAR ENDING JUNE 30, 2019**

**ACTUARIAL VALUATION RESULTS AS OF JUNE 30, 2017**

|  | Percents of Payroll             |                  | Weighted<br>Average |
|--|---------------------------------|------------------|---------------------|
|  | <u>MSEP &amp;<br/>MSEP 2000</u> | <u>MSEP 2011</u> |                     |
| A. Normal Cost   |                                 |                  |                     |
| (1) Service retirement benefits  | 6.49 %                          | 4.82 %           | 5.95 %              |
| (2) Termination benefits   | 0.94                            | 1.49             | 1.12                |
| (3) Survivor benefits  | 0.13                            | 0.14             | 0.13                |
| (4) Disability benefits  | 0.78                            | 0.74             | 0.76                |
| (5) Administrative expenses  | 0.43                            | 0.43             | 0.43                |
| (6) Total  | <u>8.77</u>                     | <u>7.62</u>      | <u>8.39</u>         |
| B. Less Member Contributions   | 0.00                            | 4.00             | 1.34                |
| C. Employer Normal Cost [A(6) - B]   | 8.77                            | 3.62             | 7.05                |
| D. Unfunded Actuarial Accrued Liabilities (UAAL)<br>(27-year level percent-of-payroll amortization*) |                                 |                  | <u>13.16</u>        |
| <b>E. TOTAL COMPUTED EMPLOYER CONTRIBUTION RATE [C. + D.]</b>  |                                 |                  | <b>20.21 %</b>      |
| <b>F. POLICY MINIMUM EMPLOYER CONTRIBUTION RATE</b>  |                                 |                  | <b>16.97 %</b>      |
| <b>G. ESTIMATED EMPLOYER CONTRIBUTION (\$Millions)#</b>  |                                 |                  | <b>\$422.7</b>      |

The amortization period is a 30-year closed period beginning with the June 30, 2014 valuation determining the contribution rate for the fiscal year ending June 30, 2016 as described in the Funding Policy adopted by the Board as of June 30, 2013. As of the June 30, 2017 valuation, 27 years remain starting with the fiscal year ending June 30, 2019 and concluding with the fiscal year ending June 30, 2045.

At the September 18, 2014 meeting, the Board adopted a policy minimum contribution rate so that the employer shall not fall below the fiscal 2015 rate (16.97% of payroll) until the plan is 80% funded.

\* This corresponds to an amortization factor of 15.77829 applied to the unfunded actuarial accrued liability at the beginning of the applicable fiscal year assuming payroll growth of 3% per year.

# 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 into the applicable fiscal year using the valuation assumption of 3% per year.



TABLE 11  
COMPARISON OF VALUATION RESULTS UNDER ALTERNATE  
INVESTMENT RETURN ASSUMPTIONS

| Investment Return Assumption                        | 6.50%      | 7.00%      | 7.50%      | 8.00%      | 8.50%      |
|---|------------|------------|------------|------------|------------|
| <b>Contributions</b>                                |            |            |            |            |            |
| Total Normal Cost                                   | 10.58%     | 9.40%      | 8.39%      | 7.50%      | 6.73%      |
| Member Contributions                                | 1.34%      | 1.34%      | 1.34%      | 1.34%      | 1.34%      |
| Employer Normal Cost                                | 9.24%      | 8.06%      | 7.05%      | 6.16%      | 5.39%      |
| Unfunded Actuarial Accrued Liability                | 16.08%     | 14.64%     | 13.16%     | 11.64%     | 10.10%     |
| <b>Total Employer Contribution</b>                  | 25.32%     | 22.70%     | 20.21%     | 17.80%     | 15.49%     |
| <b>Total Employer Contribution (\$ in millions)</b> | \$529.6    | \$474.8    | \$422.7    | \$372.3    | \$324.0    |
| <b>Actuarial Value of Assets</b>                    | \$8,872.4  | \$8,872.4  | \$8,872.4  | \$8,872.4  | \$8,872.4  |
| <b>Actuarial Accrued Liability</b>                  | \$14,649.4 | \$13,867.7 | \$13,152.3 | \$12,496.1 | \$11,893.0 |
| <b>Funded Ratio</b>                                 | 60.6%      | 64.0%      | 67.5%      | 71.0%      | 74.6%      |

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





## SECTION 6 – PROJECTIONS

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The June 30, 2017 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, but such projections are not included in this report.

For MSEPs, projections are particularly important and insightful due to the multiple-tiered benefit structure. The current valuation produces a normal cost and accrued liability based on the composition of active members on the valuation date, June 30, 2017. Without a tiered structure, systems can assume that the normal cost, as a percentage of payroll, will remain relatively level. However, since all new employees are covered under a less costly benefit structure, until all new employees are covered under 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.

These projections assume that all actuarial assumptions are met in all future years, including the investment return assumption of 7.50%, and that the Employers 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 also based on the current plan provisions and assume that all new members joining after June 30, 2017 will make employee contributions and be 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.



SECTION 6 – PROJECTIONS

**TABLE 12**  
**30-YEAR PROJECTION OF ACTUARIAL VALUATION RESULTS**  
**AS OF JUNE 30, 2017**

| Projection Based on 7.50% Investment Return |                                  |                                       |                                     |                  |                            |                      |                                    |                                 |                               |   |  |
|---|----------------------------------|---------------------------------------|-------------------------------------|------------------|----------------------------|----------------------|------------------------------------|---------------------------------|-------------------------------|---|--|
| 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) |
| 2017  | \$2,030,854                      | \$13,152,274                          | \$8,872,382                         | \$4,279,892      | 67.5%                      | 8.39%                | 13.16%                             | 21.55%                          | 1.34%                         | 20.21%                                    | \$422,749  |
| 2018  | 2,040,899                        | 13,449,162                            | 8,907,741                           | 4,541,421        | 66.2%                      | 8.21%                | 14.16%                             | 22.37%                          | 1.54%                         | 20.83%                                    | 437,873  |
| 2019  | 2,064,407                        | 13,728,438                            | 8,955,227                           | 4,773,211        | 65.2%                      | 8.09%                | 15.01%                             | 23.10%                          | 1.73%                         | 21.37%                                    | 454,399  |
| 2020  | 2,094,871                        | 13,988,753                            | 9,015,599                           | 4,973,154        | 64.4%                      | 7.96%                | 15.74%                             | 23.70%                          | 1.90%                         | 21.80%                                    | 470,382  |
| 2021  | 2,125,425                        | 14,217,083                            | 9,074,058                           | 5,143,026        | 63.8%                      | 7.82%                | 16.41%                             | 24.23%                          | 2.07%                         | 22.16%                                    | 485,124  |
| 2022  | 2,159,568                        | 14,434,477                            | 9,148,776                           | 5,285,702        | 63.4%                      | 7.70%                | 17.01%                             | 24.71%                          | 2.25%                         | 22.46%                                    | 499,590  |
| 2023  | 2,195,124                        | 14,628,780                            | 9,224,216                           | 5,404,564        | 63.1%                      | 7.59%                | 17.57%                             | 25.16%                          | 2.42%                         | 22.74%                                    | 514,146  |
| 2024  | 2,236,188                        | 14,801,434                            | 9,303,590                           | 5,497,845        | 62.9%                      | 7.52%                | 18.04%                             | 25.56%                          | 2.57%                         | 22.99%                                    | 529,523  |
| 2025  | 2,283,030                        | 14,948,471                            | 9,383,153                           | 5,565,319        | 62.8%                      | 7.43%                | 18.43%                             | 25.86%                          | 2.71%                         | 23.15%                                    | 544,377  |
| 2026  | 2,325,775                        | 15,054,092                            | 9,447,383                           | 5,606,709        | 62.8%                      | 7.32%                | 18.84%                             | 26.16%                          | 2.85%                         | 23.31%                                    | 558,402  |
| 2027  | 2,375,281                        | 15,139,609                            | 9,515,987                           | 5,623,622        | 62.9%                      | 7.25%                | 19.17%                             | 26.42%                          | 2.98%                         | 23.44%                                    | 573,469  |
| 2028  | 2,427,392                        | 15,204,517                            | 9,589,299                           | 5,615,218        | 63.1%                      | 7.16%                | 19.46%                             | 26.62%                          | 3.11%                         | 23.51%                                    | 587,800  |
| 2029  | 2,484,775                        | 15,248,101                            | 9,668,291                           | 5,579,809        | 63.4%                      | 7.08%                | 19.69%                             | 26.77%                          | 3.22%                         | 23.55%                                    | 602,719  |
| 2030  | 2,546,377                        | 15,268,878                            | 9,751,878                           | 5,517,001        | 63.9%                      | 7.00%                | 19.88%                             | 26.88%                          | 3.32%                         | 23.56%                                    | 617,924  |
| 2031  | 2,606,063                        | 15,256,625                            | 9,830,117                           | 5,426,509        | 64.4%                      | 6.91%                | 20.08%                             | 26.99%                          | 3.42%                         | 23.57%                                    | 632,677  |
| 2032  | 2,672,095                        | 15,225,768                            | 9,918,405                           | 5,307,364        | 65.1%                      | 6.85%                | 20.23%                             | 27.08%                          | 3.50%                         | 23.58%                                    | 648,983  |
| 2033  | 2,740,553                        | 15,183,585                            | 10,026,311                          | 5,157,274        | 66.0%                      | 6.79%                | 20.36%                             | 27.15%                          | 3.59%                         | 23.56%                                    | 665,044  |
| 2034  | 2,813,052                        | 15,126,665                            | 10,153,214                          | 4,973,451        | 67.1%                      | 6.75%                | 20.46%                             | 27.21%                          | 3.65%                         | 23.56%                                    | 682,638  |
| 2035  | 2,890,839                        | 15,066,605                            | 10,311,948                          | 4,754,657        | 68.4%                      | 6.71%                | 20.52%                             | 27.23%                          | 3.71%                         | 23.52%                                    | 700,323  |
| 2036  | 2,966,357                        | 14,986,248                            | 10,488,581                          | 4,497,667        | 70.0%                      | 6.66%                | 20.61%                             | 27.27%                          | 3.76%                         | 23.51%                                    | 718,312  |
| 2037  | 3,048,846                        | 14,900,109                            | 10,699,245                          | 4,200,863        | 71.8%                      | 6.63%                | 20.65%                             | 27.28%                          | 3.81%                         | 23.47%                                    | 737,031  |
| 2038  | 3,134,495                        | 14,819,656                            | 10,959,677                          | 3,859,979        | 74.0%                      | 6.60%                | 20.66%                             | 27.26%                          | 3.85%                         | 23.41%                                    | 755,799  |
| 2039  | 3,223,388                        | 14,740,733                            | 11,269,176                          | 3,471,557        | 76.4%                      | 6.57%                | 20.65%                             | 27.22%                          | 3.88%                         | 23.34%                                    | 774,909  |
| 2040  | 3,317,627                        | 14,678,311                            | 11,644,692                          | 3,033,619        | 79.3%                      | 6.55%                | 20.61%                             | 27.16%                          | 3.91%                         | 23.25%                                    | 794,489  |
| 2041  | 3,412,558                        | 14,624,850                            | 12,082,779                          | 2,542,071        | 82.6%                      | 6.52%                | 20.55%                             | 27.07%                          | 3.93%                         | 23.14%                                    | 813,356  |
| 2042  | 3,511,562                        | 14,590,577                            | 12,597,113                          | 1,993,464        | 86.3%                      | 6.50%                | 20.42%                             | 26.92%                          | 3.94%                         | 22.98%                                    | 831,166  |
| 2043  | 3,612,466                        | 14,576,640                            | 13,192,538                          | 1,384,102        | 90.5%                      | 6.48%                | 20.15%                             | 26.63%                          | 3.96%                         | 22.67%                                    | 843,514  |
| 2044  | 3,716,817                        | 14,580,324                            | 13,869,185                          | 711,139          | 95.1%                      | 6.46%                | -0.33%                             | 6.13%                           | 3.97%                         | 2.16%                                     | 82,692   |
| 2045  | 3,826,217                        | 14,613,767                            | 14,638,132                          | (24,365)         | 100.2%                     | 6.45%                | -0.34%                             | 6.11%                           | 3.98%                         | 2.13%                                     | 83,943   |
| 2046  | 3,935,774                        | 14,667,905                            | 14,692,952                          | (25,048)         | 100.2%                     | 6.44%                | -0.33%                             | 6.11%                           | 3.98%                         | 2.13%                                     | 86,347   |

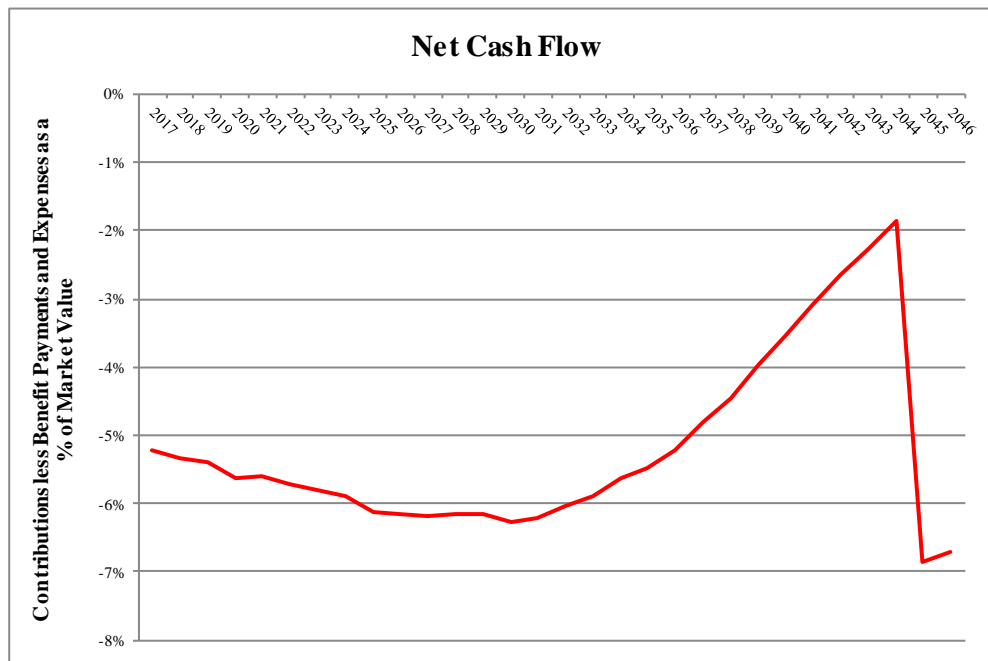
\* Amounts shown are contributions in the fiscal year ending two years after the valuation date.



SECTION 6 – PROJECTIONS

**TABLE 13**  
**30-YEAR PROJECTION OF NET CASH FLOWS**  
**AS OF JUNE 30, 2017**

| Projection Based on 7.50% Investment Return |                         |                      |                             |                    |                                  |                                 |
|---|-------------------------|----------------------|-----------------------------|--------------------|----------------------------------|---------------------------------|
| 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) |
| 2017  | \$423,636               | \$829,902            | \$8,978                     | (\$415,244)        | \$7,945,358                      | (5.23%)                         |
| 2018  | 439,814                 | 863,666              | 9,203                       | (433,055)          | 8,110,726                        | (5.34%)                         |
| 2019  | 461,808                 | 899,617              | 9,433                       | (447,242)          | 8,270,029                        | (5.41%)                         |
| 2020  | 483,915                 | 947,629              | 9,669                       | (473,382)          | 8,426,571                        | (5.62%)                         |
| 2021  | 503,726                 | 972,895              | 9,910                       | (479,080)          | 8,567,751                        | (5.59%)                         |
| 2022  | 523,263                 | 1,011,636            | 10,158                      | (498,531)          | 8,713,611                        | (5.72%)                         |
| 2023  | 542,415                 | 1,044,878            | 10,412                      | (512,875)          | 8,850,245                        | (5.80%)                         |
| 2024  | 562,625                 | 1,081,293            | 10,672                      | (529,340)          | 8,982,253                        | (5.89%)                         |
| 2025  | 583,543                 | 1,131,860            | 10,939                      | (559,256)          | 9,107,090                        | (6.14%)                         |
| 2026  | 601,445                 | 1,157,990            | 11,213                      | (567,757)          | 9,210,273                        | (6.16%)                         |
| 2027  | 621,374                 | 1,185,003            | 11,493                      | (575,123)          | 9,312,380                        | (6.18%)                         |
| 2028  | 641,317                 | 1,210,456            | 11,780                      | (580,919)          | 9,414,509                        | (6.17%)                         |
| 2029  | 661,447                 | 1,236,711            | 12,075                      | (587,339)          | 9,518,287                        | (6.17%)                         |
| 2030  | 681,665                 | 1,272,244            | 12,377                      | (602,955)          | 9,623,192                        | (6.27%)                         |
| 2031  | 700,510                 | 1,290,550            | 12,686                      | (602,727)          | 9,719,774                        | (6.20%)                         |
| 2032  | 721,199                 | 1,301,663            | 13,003                      | (593,468)          | 9,823,837                        | (6.04%)                         |
| 2033  | 742,142                 | 1,314,580            | 13,328                      | (585,767)          | 9,945,304                        | (5.89%)                         |
| 2034  | 763,744                 | 1,316,755            | 13,662                      | (566,673)          | 10,083,866                       | (5.62%)                         |
| 2035  | 786,597                 | 1,335,566            | 14,003                      | (562,972)          | 10,252,617                       | (5.49%)                         |
| 2036  | 807,739                 | 1,338,107            | 14,353                      | (544,721)          | 10,437,861                       | (5.22%)                         |
| 2037  | 831,420                 | 1,330,218            | 14,712                      | (513,510)          | 10,655,922                       | (4.82%)                         |
| 2038  | 855,090                 | 1,326,364            | 15,080                      | (486,354)          | 10,922,697                       | (4.45%)                         |
| 2039  | 878,696                 | 1,309,457            | 15,457                      | (446,218)          | 11,237,637                       | (3.97%)                         |
| 2040  | 903,058                 | 1,301,231            | 15,843                      | (414,016)          | 11,617,811                       | (3.56%)                         |
| 2041  | 926,851                 | 1,283,627            | 16,239                      | (373,015)          | 12,059,886                       | (3.09%)                         |
| 2042  | 950,580                 | 1,266,671            | 16,645                      | (332,737)          | 12,577,627                       | (2.65%)                         |
| 2043  | 972,476                 | 1,253,506            | 17,061                      | (298,091)          | 13,175,960                       | (2.26%)                         |
| 2044  | 989,788                 | 1,230,851            | 17,488                      | (258,551)          | 13,855,090                       | (1.87%)                         |
| 2045  | 234,547                 | 1,219,609            | 17,925                      | (1,002,987)        | 14,626,150                       | (6.86%)                         |
| 2046  | 240,476                 | 1,209,037            | 18,373                      | (986,934)          | 14,683,192                       | (6.72%)                         |





## **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 14**  
**SCHEDULE OF FUNDING PROGRESS**

| Actuarial Valuation Date | Actuarial Value of Assets (a) | Actuarial Accrued Liability (AAL) (b) | Unfunded Actuarial Accrued Liability (UAAL) (b - a) | Funded Ratio (a / b) | Covered Payroll (c) | UAAL as a % of Covered Payroll [(b - a) / c] |
|--------------------------|-------------------------------|---------------------------------------|---|----------------------|---------------------|--|
| June 30, 2004            | \$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%                                       |

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



**TABLE 15**  
**HISTORICAL EMPLOYER CONTRIBUTIONS**

| <b>Fiscal Year Ending</b> | <b>Actuarially Determined<br/>Employer Contribution</b> | <b>Actual<br/>Dollar Amount</b> | <b>Percent<br/>Contributed</b> |
|---------------------------|---|---------------------------------|--------------------------------|
| 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             | 330.0   | 330.0                           | 100.0%                         |
| June 30, 2017             | 322.8   | 335.2                           | 103.8%                         |

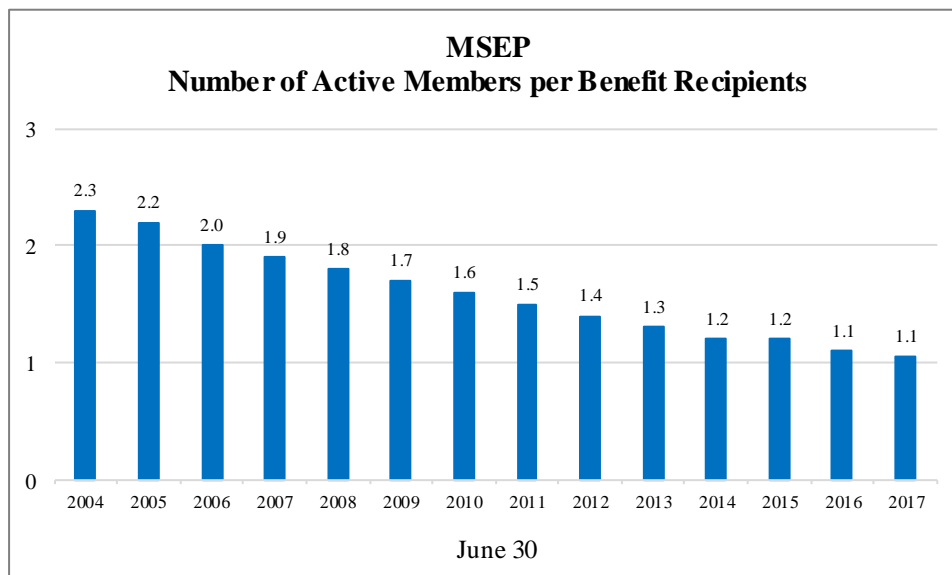
Notes: Information before 2017 was produced by the prior actuary.



SECTION 7 – OTHER INFORMATION

**TABLE 16  
HISTORICAL MEMBER STATISTICS**

| Valuation Date<br>June 30 | Active Members |                        |                      |         | Retired Members |                    |                                |         |
|---------------------------|----------------|------------------------|----------------------|---------|-----------------|--------------------|--------------------------------|---------|
|                           | Number         | Payroll<br>\$ Millions | Average Salary<br>\$ | % Incr. | Number          | Active/<br>Retired | Annual Benefits<br>\$ 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     |







**APPENDIX A – MEMBERSHIP DATA**

**MEMBER DATA RECONCILIATION**

|                             | <b>Active Members</b> | <b>Inactive Vested</b> | <b>Inactive Nonvested</b> | <b>Leave of Absence</b> | <b>Long-term Disability</b> | <b>Retirees and Beneficiaries</b> | <b>Total</b> |
|-----------------------------|-----------------------|------------------------|---------------------------|-------------------------|-----------------------------|-----------------------------------|--------------|
| As of June 30, 2016         | 49,464                | 19,512                 | 3,233                     | 132                     | 928                         | 44,828                            | 118,097      |
| Changes in status:          |                       |                        |                           |                         |                             |                                   |              |
| a) Retirement               | (1,876)               | (773)                  | 0                         | (2)                     | (79)                        | 2,730                             | 0            |
| b) Death                    | (78)                  | (71)                   | 0                         | (1)                     | (25)                        | (1,354)                           | (1,529)      |
| c) Non-vested termination   | (2,287)               | 0                      | 2,321                     | (22)                    | (12)                        | 0                                 | 0            |
| d) Leave of absence         | (122)                 | (1)                    | (1)                       | 124                     | 0                           | 0                                 | 0            |
| e) Vested termination       | (1,140)               | 1,222                  | 0                         | (12)                    | (70)                        | 0                                 | 0            |
| f) Contribution refund      | (1,278)               | (19)                   | (3,033)                   | (16)                    | (8)                         | 0                                 | (4,354)      |
| g) Beneficiary in receipt   | 0                     | 0                      | 0                         | 0                       | 0                           | 459                               | 459          |
| h) Long-term disability     | (111)                 | (6)                    | (1)                       | (5)                     | 123                         | 0                                 | 0            |
| i) Disability retirement    | 0                     | 0                      | 0                         | 0                       | 0                           | 0                                 | 0            |
| j) Return to active service | 501                   | (281)                  | (136)                     | (49)                    | (7)                         | (28)                              | 0            |
| k) Expired benefit          | 0                     | 0                      | 0                         | 0                       | 0                           | (62)                              | (62)         |
| l) Transfer to MPERS        | (36)                  | (19)                   | 0                         | 0                       | 0                           | 0                                 | (55)         |
| m) Data adjustment          | <u>(19)</u>           | <u>14</u>              | <u>0</u>                  | <u>(3)</u>              | <u>(1)</u>                  | <u>(13)</u>                       | <u>(22)</u>  |
| Total changes in status     | (6,446)               | 66                     | (850)                     | 14                      | (79)                        | 1,732                             | (5,563)      |
| New entrants                | 5,892                 | 0                      | 1,516                     | 32                      | 0                           | 0                                 | 7,440        |
| Net Change                  | (554)                 | 66                     | 666                       | 46                      | (79)                        | 1,732                             | 1,877        |
| As of June 30, 2017         | 48,910                | 19,578                 | 3,899                     | 178                     | 849                         | 46,560                            | 119,974      |



**APPENDIX A – MEMBERSHIP DATA**

**SUMMARY OF MEMBERSHIP DATA**

| <b>A. ACTIVE MEMBERS</b>                         | <b>June 30, 2017</b>    | <b>June 30, 2016</b>    | <b>% Change</b> |
|--|-------------------------|-------------------------|-----------------|
| 1. Number of Active Members                      |                         |                         |                 |
| (a) MSEP   | 12,977                  | 14,551                  | (10.8)          |
| (b) MSEP 2000                                    | 16,950                  | 17,975                  | (5.7)           |
| (c) MSEP 2011                                    | 18,983                  | 16,938                  | 12.1            |
| (d) Total  | <u>48,910</u>           | <u>49,464</u>           | (1.1)           |
| 2. Annualized Reported Salary                    |                         |                         |                 |
| (a) MSEP   | \$ 611,186,626          | \$ 667,926,207          | (8.5)           |
| (b) MSEP 2000                                    | 679,044,458             | 691,166,904             | (1.8)           |
| (c) MSEP 2011                                    | 651,738,702             | 562,435,825             | 15.9            |
| (d) Total  | <u>\$ 1,941,969,786</u> | <u>\$ 1,921,528,936</u> | 1.1             |
| 3. Accumulated Member Contributions              | \$ 62,971,479           | \$ 47,797,134           | 31.7            |
| 4. Active Member Averages                        |                         |                         |                 |
| (a) Age  | 45.4                    | 45.5                    | (0.2)           |
| (b) Service                                      | 11.0                    | 11.2                    | (1.8)           |
| (c) Compensation                                 | \$ 39,705               | \$ 38,847               | 2.2             |
| <b>B. INACTIVE MEMBERS</b>                       |                         |                         |                 |
| 1. Number of Inactive Members                    |                         |                         |                 |
| (a) Terminated vested                            | 19,578                  | 19,512                  | 0.3             |
| (b) Terminated nonvested (refund only)           | 3,899                   | 3,233                   | 20.6            |
| (c) Leave of absence                             | 178                     | 132                     | 34.8            |
| (d) Long-term disability                         | 849                     | 928                     | (8.5)           |
| (e) Total  | <u>24,504</u>           | <u>23,805</u>           | 2.9             |
| 2. Accumulated Member Contributions              | \$ 7,442,984            | \$ N/A                  | N/A             |
| 3. Inactive Member Averages                      |                         |                         |                 |
| (a) Age (vesteds only)                           | 48.4                    | N/A                     | N/A             |
| (b) Monthly benefit (vesteds only)               | \$ 487                  | \$ N/A                  | N/A             |
| (c) Accumulated member contributions             | \$ 304                  | \$ N/A                  | N/A             |
| <b>C. RETIREES, DISABLEDS, AND BENEFICIARIES</b> |                         |                         |                 |
| 1. Number of Members                             |                         |                         |                 |
| (a) Service retirees and disableds               | 41,365                  | 39,803                  | 3.9             |
| (b) Beneficiaries                                | 5,195                   | 5,025                   | 3.4             |
| (c) Total  | <u>46,560</u>           | <u>44,828</u>           | 3.9             |
| 2. Total Monthly Benefits                        |                         |                         |                 |
| (a) Service retirees and disableds               | \$ 54,121,380           | \$ 51,929,552           | 4.2             |
| (b) Beneficiaries                                | 5,061,637               | 4,805,032               | 5.3             |
| (c) Total  | <u>\$ 59,183,017</u>    | <u>\$ 56,734,584</u>    | 4.3             |



**APPENDIX A – MEMBERSHIP DATA**

**MEMBERSHIP DATA BY GROUP**

| Valuation Group                | Number        | Payroll                 | Group Averages   |             |               |
|--------------------------------|---------------|-------------------------|------------------|-------------|---------------|
|                                |               |                         | Salary           | Age(yrs.)   | Service(yrs.) |
| Regular State Employees        | 46,219        | \$ 1,785,837,129        | \$ 38,639        | 45.1        | 10.7          |
| Elected Officials              | 6             | 659,985                 | 109,998          | 44.0        | 1.3           |
| Legislative Clerks             | 11            | 381,400                 | 34,673           | 65.5        | 19.6          |
| Legislators                    | 193           | 6,941,688               | 35,967           | 51.7        | 4.8           |
| Uniformed Water Patrol         | 10            | 697,444                 | 69,744           | 41.0        | 15.2          |
| Conservation Department        | 1,373         | 61,206,748              | 44,579           | 44.3        | 14.1          |
| School-Term Salaried Employees | 1,076         | 83,638,379              | 77,731           | 57.7        | 21.8          |
| Administrative Law Judges      | 22            | 2,607,013               | 118,501          | 59.8        | 22.7          |
| <b>Total MSEP</b>              | <b>48,910</b> | <b>\$ 1,941,969,786</b> | <b>\$ 39,705</b> | <b>45.4</b> | <b>11.0</b>   |

The total number of System active members includes 12,977 MSEP members, 16,950 MSEP 2000 members and 18,983 MSEP 2011 members.

| Type of Benefit Payment    | No.           | Monthly Benefit      | Group Averages  |             |
|----------------------------|---------------|----------------------|-----------------|-------------|
|                            |               |                      | Benefit         | Age(yrs.)   |
| Retirement                 | 41,362        | \$ 54,120,422        | \$ 1,308        | 69.9        |
| Disability                 | 3             | 958                  | 319             | 63.7        |
| Survivor of Active Member  | 1,686         | 1,515,470            | 899             | 62.9        |
| Survivor of Retired Member | 3,509         | 3,546,167            | 1,011           | 75.7        |
| <b>Total MSEP</b>          | <b>46,560</b> | <b>\$ 59,183,017</b> | <b>\$ 1,271</b> | <b>70.1</b> |

This valuation also includes 19,578 terminated vested members, 3,899 terminated members who have a refund pending, 178 members on leave and 849 members on long-term disability.

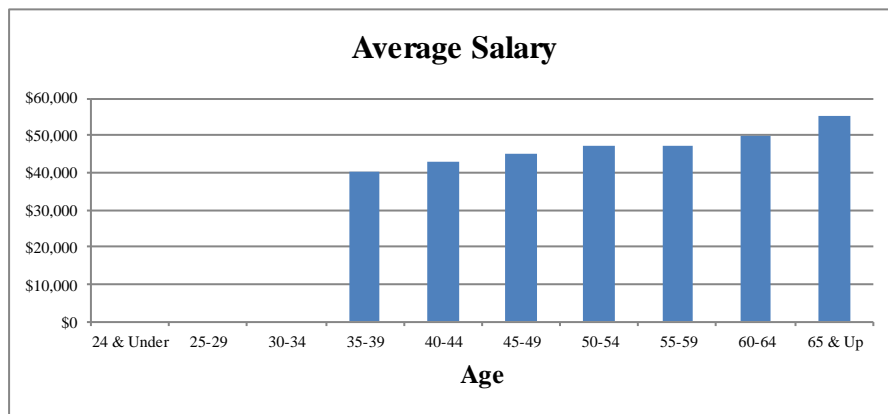
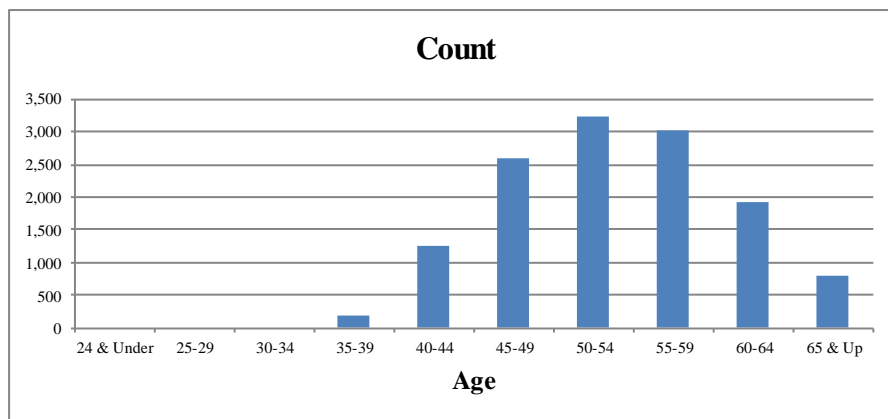


**APPENDIX A – MEMBERSHIP DATA**

**ACTIVE MEMBERS  
AS OF JUNE 30, 2017**

**MSEP**

| Age        | Count of Members |            |            | Reported Annualized Earnings for Current Members |                   |                   |
|------------|------------------|------------|------------|--|-------------------|-------------------|
|            | 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      | 48               | 140        | 188        | 2,089,501  | 5,450,436         | 7,539,937         |
| 40-44      | 430              | 816        | 1,246      | 19,460,309                                       | 34,288,320        | 53,748,629        |
| 45-49      | 908              | 1,686      | 2,594      | 43,658,248                                       | 73,290,289        | 116,948,537       |
| 50-54      | 1,253            | 1,971      | 3,224      | 64,129,700                                       | 87,329,311        | 151,459,011       |
| 55-59      | 1,191            | 1,813      | 3,004      | 62,962,609                                       | 78,533,679        | 141,496,288       |
| 60-64      | 797              | 1,126      | 1,923      | 45,794,815                                       | 50,103,742        | 95,898,557        |
| 65 & Up    | <u>357</u>       | <u>441</u> | <u>798</u> | <u>23,765,451</u>                                | <u>20,330,216</u> | <u>44,095,667</u> |
| Total      | 4,984            | 7,993      | 12,977     | \$ 261,860,633                                   | \$ 349,325,993    | \$ 611,186,626    |



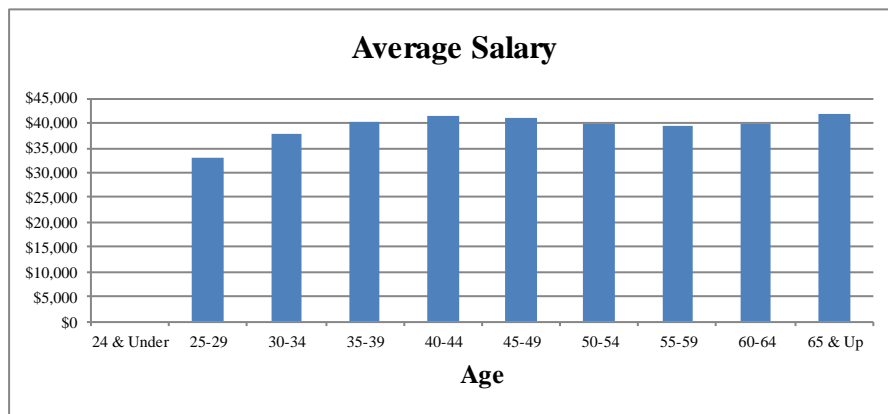
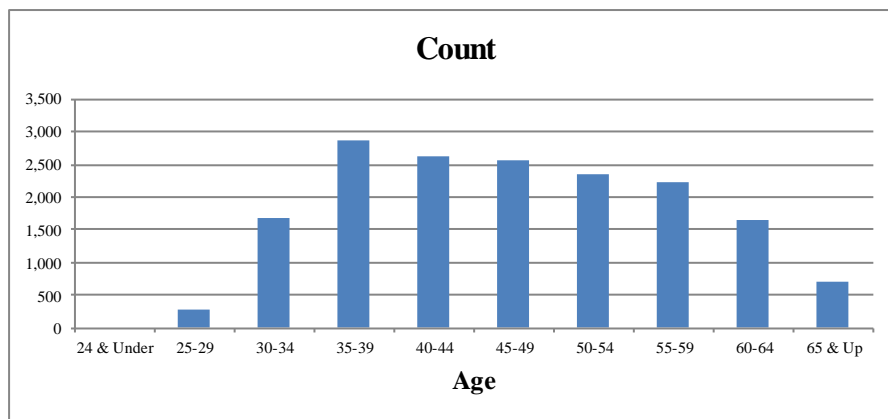


**APPENDIX A – MEMBERSHIP DATA**

**ACTIVE MEMBERS  
AS OF JUNE 30, 2017**

**MSEP 2000**

| <u>Age</u>   | <u>Count of Members</u> |               |               | <u>Reported Annualized Earnings for Current Members</u> |                       |                       |
|--------------|-------------------------|---------------|---------------|---|-----------------------|-----------------------|
|              | <u>Male</u>             | <u>Female</u> | <u>Total</u>  | <u>Male</u>   | <u>Female</u>         | <u>Total</u>          |
| 24 & Under   | 0                       | 0             | 0             | \$ 0  | \$ 0                  | \$ 0                  |
| 25-29        | 103                     | 176           | 279           | 3,478,390   | 5,743,605             | 9,221,995             |
| 30-34        | 721                     | 972           | 1,693         | 28,729,235  | 35,574,308            | 64,303,543            |
| 35-39        | 1,083                   | 1,793         | 2,876         | 45,048,803  | 70,882,863            | 115,931,666           |
| 40-44        | 1,017                   | 1,601         | 2,618         | 44,636,652  | 63,655,521            | 108,292,173           |
| 45-49        | 993                     | 1,562         | 2,555         | 44,967,684  | 59,467,210            | 104,434,894           |
| 50-54        | 864                     | 1,481         | 2,345         | 37,513,518  | 55,943,668            | 93,457,186            |
| 55-59        | 839                     | 1,390         | 2,229         | 35,855,220  | 52,176,168            | 88,031,388            |
| 60-64        | 658                     | 985           | 1,643         | 29,167,315  | 36,508,292            | 65,675,607            |
| 65 & Up      | <u>352</u>              | <u>360</u>    | <u>712</u>    | <u>16,334,137</u>                                       | <u>13,361,869</u>     | <u>29,696,006</u>     |
| <b>Total</b> | <b>6,630</b>            | <b>10,320</b> | <b>16,950</b> | <b>\$ 285,730,954</b>                                   | <b>\$ 393,313,504</b> | <b>\$ 679,044,458</b> |



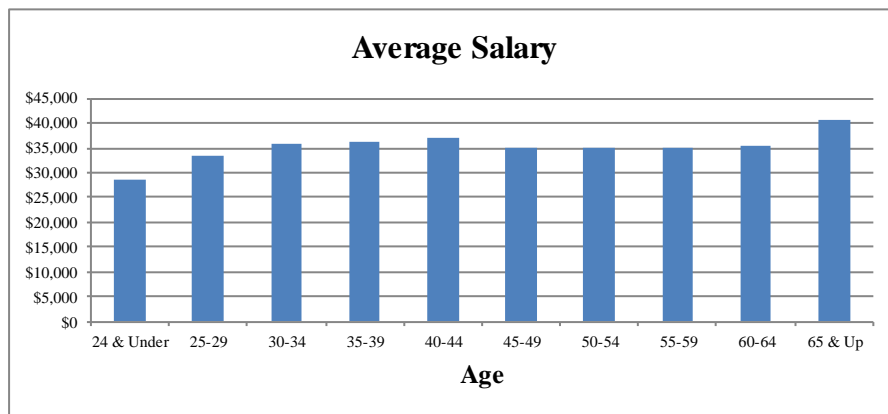
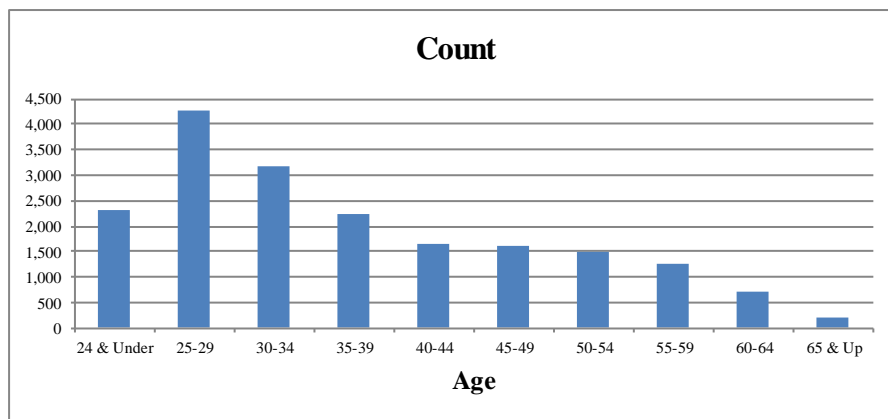


**APPENDIX A – MEMBERSHIP DATA**

**ACTIVE MEMBERS  
AS OF JUNE 30, 2017**

**MSEP 2011**

| <u>Age</u>   | <u>Count of Members</u> |               |               | <u>Reported Annualized Earnings for Current Members</u> |                       |                       |
|--------------|-------------------------|---------------|---------------|---|-----------------------|-----------------------|
|              | <u>Male</u>             | <u>Female</u> | <u>Total</u>  | <u>Male</u>   | <u>Female</u>         | <u>Total</u>          |
| 24 & Under   | 1,007                   | 1,329         | 2,336         | \$ 30,067,533   | \$ 36,785,387         | \$ 66,852,920         |
| 25-29        | 1,873                   | 2,395         | 4,268         | 64,393,290  | 77,429,959            | 141,823,249           |
| 30-34        | 1,305                   | 1,876         | 3,181         | 48,934,182  | 64,894,143            | 113,828,325           |
| 35-39        | 877                     | 1,374         | 2,251         | 34,516,796  | 47,010,973            | 81,527,769            |
| 40-44        | 616                     | 1,019         | 1,635         | 24,532,119  | 35,774,465            | 60,306,584            |
| 45-49        | 518                     | 1,080         | 1,598         | 19,755,808  | 36,123,203            | 55,879,011            |
| 50-54        | 507                     | 991           | 1,498         | 19,532,142  | 32,907,915            | 52,440,057            |
| 55-59        | 469                     | 801           | 1,270         | 17,880,624  | 26,675,955            | 44,556,579            |
| 60-64        | 305                     | 423           | 728           | 11,612,978  | 14,082,562            | 25,695,540            |
| 65 & Up      | <u>102</u>              | <u>116</u>    | <u>218</u>    | <u>4,471,695</u>  | <u>4,356,973</u>      | <u>8,828,668</u>      |
| <b>Total</b> | <b>7,579</b>            | <b>11,404</b> | <b>18,983</b> | <b>\$ 275,697,167</b>                                   | <b>\$ 376,041,535</b> | <b>\$ 651,738,702</b> |



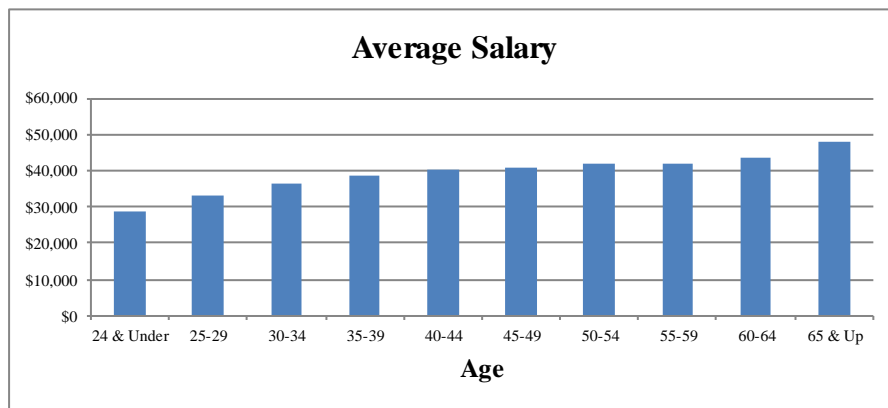
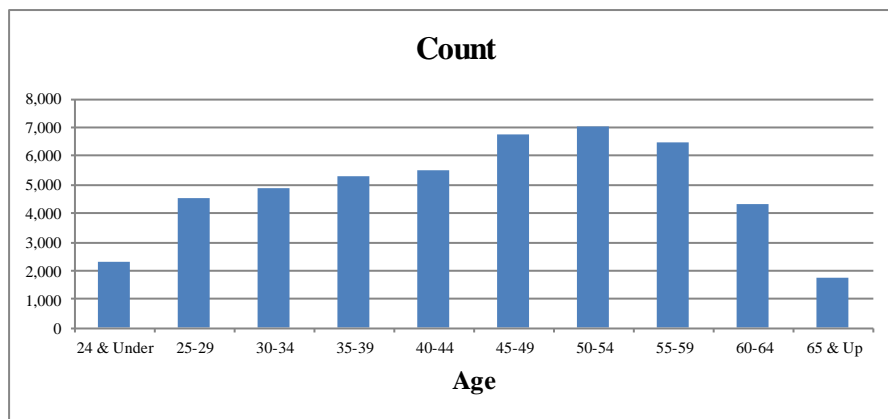


**APPENDIX A – MEMBERSHIP DATA**

**ACTIVE MEMBERS  
AS OF JUNE 30, 2017**

**TOTAL**

| <u>Age</u> | <u>Count of Members</u> |               |              | <u>Reported Annualized Earnings for Current Members</u> |                   |                   |
|------------|-------------------------|---------------|--------------|---|-------------------|-------------------|
|            | <u>Male</u>             | <u>Female</u> | <u>Total</u> | <u>Male</u>   | <u>Female</u>     | <u>Total</u>      |
| 24 & Under | 1,007                   | 1,329         | 2,336        | \$ 30,067,533   | \$ 36,785,387     | \$ 66,852,920     |
| 25-29      | 1,976                   | 2,571         | 4,547        | 67,871,680  | 83,173,564        | 151,045,244       |
| 30-34      | 2,026                   | 2,848         | 4,874        | 77,663,417  | 100,468,451       | 178,131,868       |
| 35-39      | 2,008                   | 3,307         | 5,315        | 81,655,100  | 123,344,272       | 204,999,372       |
| 40-44      | 2,063                   | 3,436         | 5,499        | 88,629,080  | 133,718,306       | 222,347,386       |
| 45-49      | 2,419                   | 4,328         | 6,747        | 108,381,740   | 168,880,702       | 277,262,442       |
| 50-54      | 2,624                   | 4,443         | 7,067        | 121,175,360   | 176,180,894       | 297,356,254       |
| 55-59      | 2,499                   | 4,004         | 6,503        | 116,698,453   | 157,385,802       | 274,084,255       |
| 60-64      | 1,760                   | 2,534         | 4,294        | 86,575,108  | 100,694,596       | 187,269,704       |
| 65 & Up    | <u>811</u>              | <u>917</u>    | <u>1,728</u> | <u>44,571,283</u>                                       | <u>38,049,058</u> | <u>82,620,341</u> |
| Total      | 19,193                  | 29,717        | 48,910       | \$ 823,288,754  | \$ 1,118,681,032  | \$ 1,941,969,786  |





**APPENDIX A – MEMBERSHIP DATA**

**AGE AND SERVICE DISTRIBUTION  
AS OF JUNE 30, 2017**

| Age                   |              | 0-4            | 5-9            | 10-14          | 15-19          | 20-24          | 25-29          | 30-34         | Over 34       | Total            |
|-----------------------|--------------|----------------|----------------|----------------|----------------|----------------|----------------|---------------|---------------|------------------|
| <b>24 &amp; Under</b> | Number       | 2,327          | 9              | 0              | 0              | 0              | 0              | 0             | 0             | 2,336            |
|                       | Total Salary | \$ 66,590,409  | \$ 262,511     | \$ 0           | \$ 0           | \$ 0           | \$ 0           | \$ 0          | \$ 0          | \$ 66,852,920    |
|                       | Average Sal. | \$ 28,616      | \$ 29,168      | \$ 0           | \$ 0           | \$ 0           | \$ 0           | \$ 0          | \$ 0          | \$ 28,619        |
| <b>25-29</b>          | Number       | 3,988          | 541            | 18             | 0              | 0              | 0              | 0             | 0             | 4,547            |
|                       | Total Salary | \$ 131,870,539 | \$ 18,606,882  | \$ 567,823     | \$ 0           | \$ 0           | \$ 0           | \$ 0          | \$ 0          | \$ 151,045,244   |
|                       | Average Sal. | \$ 33,067      | \$ 34,394      | \$ 31,546      | \$ 0           | \$ 0           | \$ 0           | \$ 0          | \$ 0          | \$ 33,219        |
| <b>30-34</b>          | Number       | 2,808          | 1,529          | 525            | 12             | 0              | 0              | 0             | 0             | 4,874            |
|                       | Total Salary | \$ 99,231,027  | \$ 59,172,943  | \$ 19,304,248  | \$ 423,650     | \$ 0           | \$ 0           | \$ 0          | \$ 0          | \$ 178,131,868   |
|                       | Average Sal. | \$ 35,339      | \$ 38,700      | \$ 36,770      | \$ 35,304      | \$ 0           | \$ 0           | \$ 0          | \$ 0          | \$ 36,547        |
| <b>35-39</b>          | Number       | 2,059          | 1,363          | 1,338          | 539            | 16             | 0              | 0             | 0             | 5,315            |
|                       | Total Salary | \$ 73,894,644  | \$ 53,882,624  | \$ 54,754,912  | \$ 21,771,155  | \$ 696,037     | \$ 0           | \$ 0          | \$ 0          | \$ 204,999,372   |
|                       | Average Sal. | \$ 35,889      | \$ 39,532      | \$ 40,923      | \$ 40,392      | \$ 43,502      | \$ 0           | \$ 0          | \$ 0          | \$ 38,570        |
| <b>40-44</b>          | Number       | 1,554          | 1,062          | 1,082          | 1,331          | 456            | 14             | 0             | 0             | 5,499            |
|                       | Total Salary | \$ 58,054,643  | \$ 42,707,693  | \$ 43,871,324  | \$ 57,305,427  | \$ 19,753,294  | \$ 655,005     | \$ 0          | \$ 0          | \$ 222,347,386   |
|                       | Average Sal. | \$ 37,358      | \$ 40,214      | \$ 40,547      | \$ 43,054      | \$ 43,319      | \$ 46,786      | \$ 0          | \$ 0          | \$ 40,434        |
| <b>45-49</b>          | Number       | 1,575          | 1,051          | 981            | 1,367          | 1,311          | 419            | 43            | 0             | 6,747            |
|                       | Total Salary | \$ 57,151,446  | \$ 40,906,630  | \$ 38,255,511  | \$ 59,043,894  | \$ 60,166,798  | \$ 19,951,175  | \$ 1,786,988  | \$ 0          | \$ 277,262,442   |
|                       | Average Sal. | \$ 36,287      | \$ 38,922      | \$ 38,996      | \$ 43,192      | \$ 45,894      | \$ 47,616      | \$ 41,558     | \$ 0          | \$ 41,094        |
| <b>50-54</b>          | Number       | 1,352          | 995            | 974            | 1,277          | 1,149          | 931            | 365           | 24            | 7,067            |
|                       | Total Salary | \$ 48,385,799  | \$ 38,179,440  | \$ 36,993,287  | \$ 55,160,790  | \$ 53,703,987  | \$ 45,920,732  | \$ 18,028,092 | \$ 984,127    | \$ 297,356,254   |
|                       | Average Sal. | \$ 35,788      | \$ 38,371      | \$ 37,981      | \$ 43,196      | \$ 46,740      | \$ 49,324      | \$ 49,392     | \$ 41,005     | \$ 42,077        |
| <b>55-59</b>          | Number       | 1,166          | 912            | 930            | 1,254          | 979            | 663            | 444           | 155           | 6,503            |
|                       | Total Salary | \$ 42,449,438  | \$ 33,979,410  | \$ 34,976,223  | \$ 53,255,158  | \$ 44,838,767  | \$ 33,779,521  | \$ 23,763,334 | \$ 7,042,404  | \$ 274,084,255   |
|                       | Average Sal. | \$ 36,406      | \$ 37,258      | \$ 37,609      | \$ 42,468      | \$ 45,801      | \$ 50,950      | \$ 53,521     | \$ 45,435     | \$ 42,147        |
| <b>60-64</b>          | Number       | 639            | 663            | 728            | 892            | 588            | 408            | 225           | 151           | 4,294            |
|                       | Total Salary | \$ 23,782,431  | \$ 25,783,776  | \$ 27,260,697  | \$ 37,300,165  | \$ 27,889,550  | \$ 23,282,075  | \$ 13,537,777 | \$ 8,433,233  | \$ 187,269,704   |
|                       | Average Sal. | \$ 37,218      | \$ 38,890      | \$ 37,446      | \$ 41,816      | \$ 47,431      | \$ 57,064      | \$ 60,168     | \$ 55,849     | \$ 43,612        |
| <b>65 &amp; Up</b>    | Number       | 184            | 288            | 300            | 348            | 214            | 145            | 103           | 146           | 1,728            |
|                       | Total Salary | \$ 7,640,390   | \$ 11,768,559  | \$ 12,064,105  | \$ 15,206,722  | \$ 10,835,898  | \$ 8,588,010   | \$ 6,387,382  | \$ 10,129,275 | \$ 82,620,341    |
|                       | Average Sal. | \$ 41,524      | \$ 40,863      | \$ 40,214      | \$ 43,697      | \$ 50,635      | \$ 59,228      | \$ 62,013     | \$ 69,379     | \$ 47,813        |
| <b>Total</b>          | Number       | 17,652         | 8,413          | 6,876          | 7,020          | 4,713          | 2,580          | 1,180         | 476           | 48,910           |
|                       | Total Salary | \$ 609,050,766 | \$ 325,250,468 | \$ 268,048,130 | \$ 299,466,961 | \$ 217,884,331 | \$ 132,176,518 | \$ 63,503,573 | \$ 26,589,039 | \$ 1,941,969,786 |
|                       | Average Sal. | \$ 34,503      | \$ 38,660      | \$ 38,983      | \$ 42,659      | \$ 46,231      | \$ 51,231      | \$ 53,817     | \$ 55,859     | \$ 39,705        |

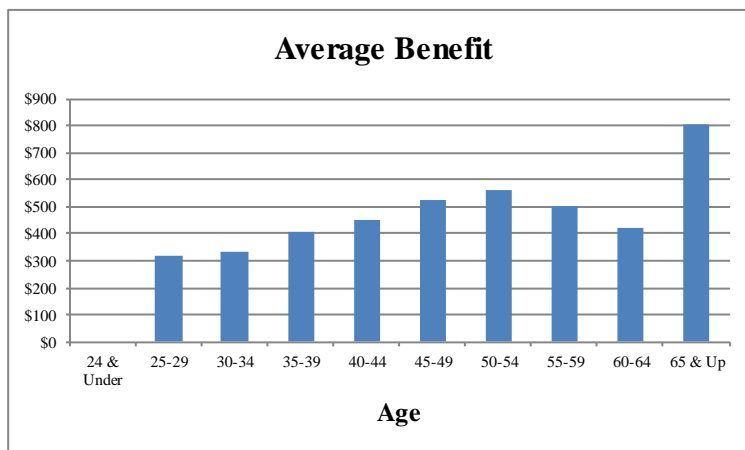
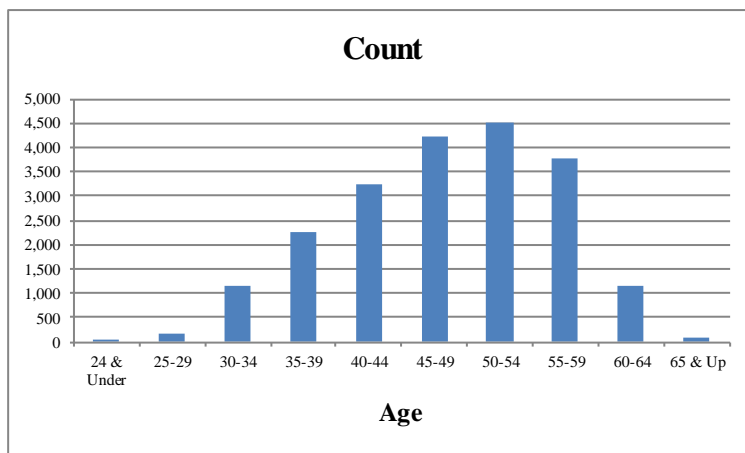




**INACTIVE VESTED MEMBERS  
AS OF JUNE 30, 2017**

| Age        | Count of Members* |           |           | Monthly Deferred Benefits* |               |               |
|------------|-------------------|-----------|-----------|----------------------------|---------------|---------------|
|            | Male              | Female    | Total     | Male                       | Female        | Total         |
| 24 & Under | 25                | 3         | 28        | \$ 4,163                   | \$ 106        | \$ 4,269      |
| 25-29      | 61                | 111       | 172       | 21,080                     | 33,463        | 54,543        |
| 30-34      | 454               | 704       | 1,158     | 156,496                    | 233,077       | 389,573       |
| 35-39      | 844               | 1,421     | 2,265     | 363,518                    | 557,732       | 921,250       |
| 40-44      | 1,153             | 2,070     | 3,223     | 532,108                    | 915,185       | 1,447,293     |
| 45-49      | 1,536             | 2,709     | 4,245     | 851,149                    | 1,371,621     | 2,222,770     |
| 50-54      | 1,610             | 2,887     | 4,497     | 1,039,201                  | 1,500,658     | 2,539,859     |
| 55-59      | 1,234             | 2,543     | 3,777     | 704,821                    | 1,195,078     | 1,899,899     |
| 60-64      | 419               | 741       | 1,160     | 200,651                    | 292,222       | 492,873       |
| 65 & Up    | <u>41</u>         | <u>39</u> | <u>80</u> | <u>37,336</u>              | <u>27,333</u> | <u>64,669</u> |
| Total      | 7,377             | 13,228    | 20,605    | \$ 3,910,523               | \$ 6,126,475  | \$ 10,036,998 |

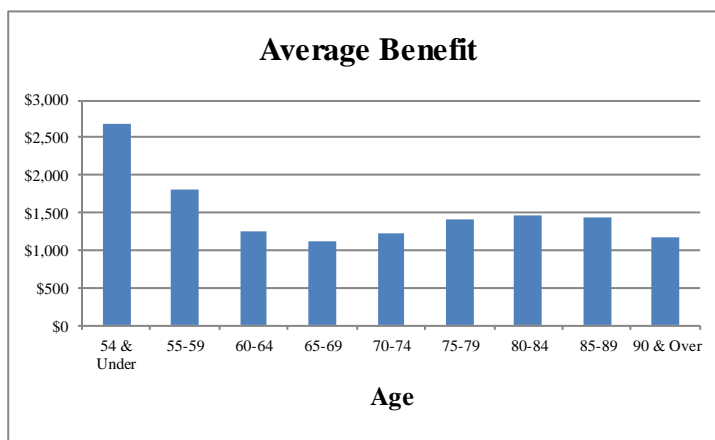
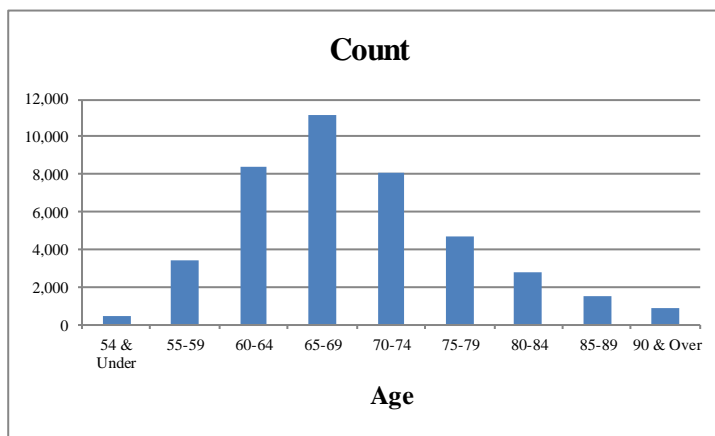
\* There are 178 members currently on leave and 849 members on LTD. Their counts and estimated deferred monthly benefits are included.





**RETIRED MEMBERS  
AS OF JUNE 30, 2017**

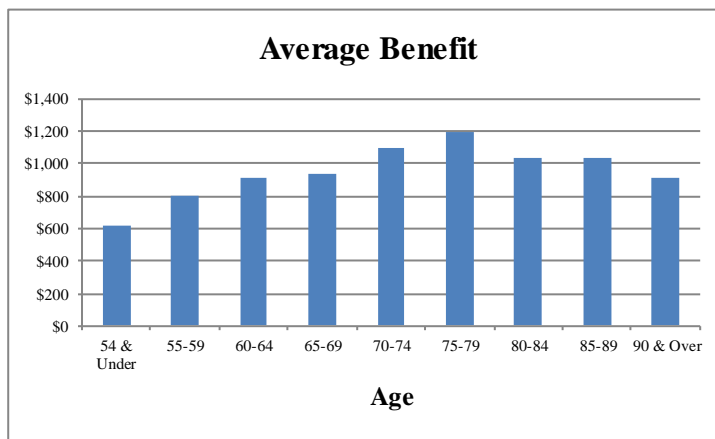
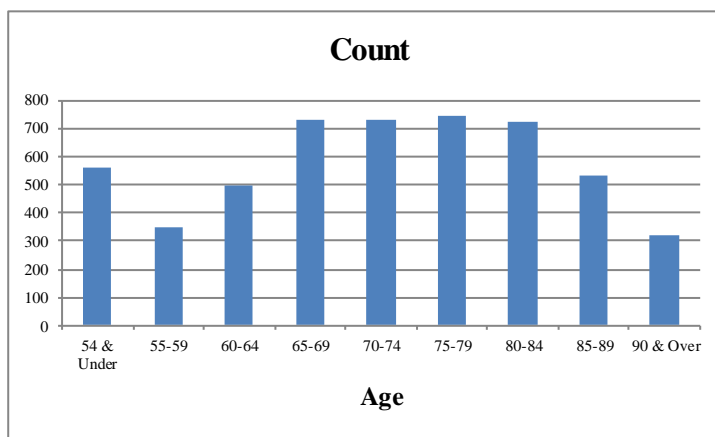
| <u>Age</u> | <u>Count of Members</u> |               |              | <u>Monthly Benefits</u> |                |                |
|------------|-------------------------|---------------|--------------|-------------------------|----------------|----------------|
|            | <u>Male</u>             | <u>Female</u> | <u>Total</u> | <u>Male</u>             | <u>Female</u>  | <u>Total</u>   |
| 54 & Under | 166                     | 349           | 515          | \$ 472,798              | \$ 905,211     | \$ 1,378,009   |
| 55-59      | 1,134                   | 2,262         | 3,396        | 2,080,650               | 4,053,764      | 6,134,414      |
| 60-64      | 3,109                   | 5,312         | 8,421        | 4,178,524               | 6,306,555      | 10,485,079     |
| 65-69      | 4,387                   | 6,753         | 11,140       | 5,570,337               | 6,811,884      | 12,382,221     |
| 70-74      | 3,348                   | 4,697         | 8,045        | 5,022,942               | 4,878,794      | 9,901,736      |
| 75-79      | 1,885                   | 2,831         | 4,716        | 3,484,891               | 3,118,533      | 6,603,424      |
| 80-84      | 1,051                   | 1,718         | 2,769        | 2,129,421               | 1,917,977      | 4,047,398      |
| 85-89      | 542                     | 983           | 1,525        | 1,125,218               | 1,076,663      | 2,201,881      |
| 90 & Over  | <u>228</u>              | <u>610</u>    | <u>838</u>   | <u>371,244</u>          | <u>615,974</u> | <u>987,218</u> |
| Total      | 15,850                  | 25,515        | 41,365       | \$ 24,436,025           | \$ 29,685,355  | \$ 54,121,380  |





**BENEFICIARIES RECEIVING BENEFITS  
AS OF JUNE 30, 2017**

| <u>Age</u> | <u>Count of Members</u> |               |              | <u>Monthly Benefits</u> |                |                |
|------------|-------------------------|---------------|--------------|-------------------------|----------------|----------------|
|            | <u>Male</u>             | <u>Female</u> | <u>Total</u> | <u>Male</u>             | <u>Female</u>  | <u>Total</u>   |
| 54 & Under | 228                     | 334           | 562          | \$ 118,398              | \$ 231,739     | \$ 350,137     |
| 55-59      | 105                     | 245           | 350          | 64,672                  | 217,791        | 282,463        |
| 60-64      | 141                     | 359           | 500          | 102,849                 | 356,321        | 459,170        |
| 65-69      | 205                     | 525           | 730          | 139,689                 | 543,326        | 683,015        |
| 70-74      | 182                     | 550           | 732          | 145,253                 | 661,359        | 806,612        |
| 75-79      | 183                     | 562           | 745          | 148,272                 | 741,613        | 889,885        |
| 80-84      | 174                     | 550           | 724          | 123,892                 | 622,887        | 746,779        |
| 85-89      | 135                     | 399           | 534          | 84,566                  | 468,614        | 553,180        |
| 90 & Over  | <u>87</u>               | <u>231</u>    | <u>318</u>   | <u>45,049</u>           | <u>245,347</u> | <u>290,396</u> |
| Total      | 1,440                   | 3,755         | 5,195        | \$ 972,640              | \$ 4,088,997   | \$ 5,061,637   |





**RETIRED LIVES BENEFITS PAYABLE AS OF JUNE 30, 2017  
TABULATED BY OPTION AND TYPE OF BENEFIT**

**MSEP Benefits**

| <b>Type of Benefit</b>   | <b>No.</b>    | <b>Total Monthly Benefits</b> |
|--------------------------|---------------|-------------------------------|
| Service Retirement       |               |                               |
| Life Annuity             | 5,805         | \$ 6,941,503                  |
| 50% Joint and Survivor   | 5,204         | 8,092,343                     |
| 100% Joint and Survivor  | 3,016         | 5,395,341                     |
| 5-Year Certain and Life  | 139           | 132,844                       |
| 10-Year Certain and Life | 173           | 172,077                       |
| Survivor Beneficiary     | 2,577         | 2,800,684                     |
| Total                    | <u>16,914</u> | <u>23,534,792</u>             |
| Disability Retirement    | 3             | 958                           |
| Death-in-Service         | 1,465         | 1,432,089                     |
| <b>Total</b>             | <b>18,382</b> | <b>\$ 24,967,839</b>          |

**MSEP 2000 Benefits**

| <b>Type of Benefit</b>   | <b>No.</b>    | <b>Total Monthly Benefits</b> |
|--------------------------|---------------|-------------------------------|
| Service Retirement       |               |                               |
| Life Annuity             | 16,847        | \$ 19,555,473                 |
| 50% Joint and Survivor   | 4,039         | 6,572,683                     |
| 100% Joint and Survivor  | 4,725         | 6,165,142                     |
| 5-Year Certain and Life  | 23            | 28,386                        |
| 10-Year Certain and Life | 766           | 634,820                       |
| 15-Year Certain and Life | 623           | 428,314                       |
| Survivor Beneficiary     | 932           | 745,483                       |
| Total                    | <u>27,955</u> | <u>34,130,301</u>             |
| Death-in-Service         | 220           | 82,065                        |
| <b>Total</b>             | <b>28,175</b> | <b>\$ 34,212,366</b>          |

There are 3 MSEP 2011 members receiving benefits totaling \$2,812 payable monthly.



**SALARY INCREASES  
DURING PLAN YEAR 2016-2017**

| Age            | Count         | Salary Increases |             |
|----------------|---------------|------------------|-------------|
|                |               | Actual*          | Expected    |
| Under 20       | 15            | -1.5%            | 5.7%        |
| 20 - 24        | 1,142         | 7.4%             | 5.0%        |
| 25 - 29        | 3,387         | 6.7%             | 4.5%        |
| 30 - 34        | 4,040         | 5.2%             | 4.1%        |
| 35 - 39        | 4,708         | 4.9%             | 3.9%        |
| 40 - 44        | 5,024         | 4.2%             | 3.8%        |
| 45 - 49        | 6,272         | 3.7%             | 3.6%        |
| 50 - 54        | 6,737         | 3.2%             | 3.6%        |
| 55 - 59        | 6,129         | 3.1%             | 3.6%        |
| 60 - 64        | 4,371         | 2.8%             | 3.5%        |
| 65 & Over      | 1,077         | 2.9%             | 3.5%        |
| <b>Total</b>   | <b>42,902</b> |                  |             |
| <b>Average</b> |               | <b>4.0%</b>      | <b>3.8%</b> |

\* Excludes new entrants and terminations.

|         | Payroll Growth |      |      |
|---------|----------------|------|------|
|         | 2017           | 2016 | 2015 |
| Actual  | 1.1%           | 0.2% | 0.8% |
| Assumed | 3.0%           | 0.0% | 3.0% |



**ACTIVE MEMBERS WHO RETIRED WITH  
SERVICE RETIREMENT BENEFITS  
DURING PLAN YEAR 2016-2017**

| Age          | Male       |              | Female       |              | Total        |                |
|--------------|------------|--------------|--------------|--------------|--------------|----------------|
|              | Actual     | Expected     | Actual       | Expected     | Actual       | Expected       |
| Under 50     | 1          | 0.0          | 10           | 3.2          | 11           | 3.2            |
| 50           | 5          | 1.4          | 7            | 7.4          | 12           | 8.8            |
| 51           | 11         | 4.6          | 17           | 9.6          | 28           | 14.2           |
| 52           | 20         | 11.3         | 27           | 18.7         | 47           | 30.0           |
| 53           | 25         | 19.9         | 34           | 27.8         | 59           | 47.7           |
| 54           | 20         | 18.9         | 46           | 32.6         | 66           | 51.5           |
| 55           | 22         | 23.8         | 60           | 41.8         | 82           | 65.6           |
| 56           | 27         | 24.7         | 54           | 36.9         | 81           | 61.6           |
| 57           | 40         | 35.9         | 63           | 49.3         | 103          | 85.3           |
| 58           | 32         | 34.6         | 59           | 58.0         | 91           | 92.6           |
| 59           | 37         | 40.0         | 63           | 55.5         | 100          | 95.6           |
| 60           | 38         | 51.6         | 77           | 77.8         | 115          | 129.3          |
| 61           | 48         | 43.3         | 88           | 60.8         | 136          | 104.1          |
| 62           | 70         | 78.1         | 100          | 102.3        | 170          | 180.5          |
| 63           | 49         | 55.2         | 60           | 85.8         | 109          | 141.0          |
| 64           | 61         | 44.5         | 79           | 58.6         | 140          | 103.1          |
| 65           | 67         | 57.5         | 86           | 77.0         | 153          | 134.5          |
| 66           | 49         | 43.0         | 67           | 54.7         | 116          | 97.8           |
| 67           | 31         | 29.3         | 42           | 31.7         | 73           | 61.0           |
| 68           | 19         | 19.2         | 19           | 19.2         | 38           | 38.3           |
| 69           | 43         | 31.9         | 43           | 29.0         | 86           | 60.9           |
| 70 & Over    | 29         | 50.1         | 31           | 41.6         | 60           | 91.7           |
| <b>Total</b> | <b>744</b> | <b>718.7</b> | <b>1,132</b> | <b>979.2</b> | <b>1,876</b> | <b>1,697.9</b> |

|                               | Male       | Female     | Total      |
|-------------------------------|------------|------------|------------|
| Average age at retirement     | 61.8 years | 60.8 years | 61.2 years |
| Average service at retirement | 22.2 years | 22.6 years | 22.5 years |



**ACTIVE MEMBERS WHO BECAME DISABLED  
DURING PLAN YEAR 2016-2017**

| Age          | Male      |             | Female    |              | Total      |              |
|--------------|-----------|-------------|-----------|--------------|------------|--------------|
|              | Actual    | Expected    | Actual    | Expected     | Actual     | Expected     |
| Under 25     | 0         | 0.8         | 0         | 1.0          | 0          | 1.8          |
| 25 - 29      | 2         | 2.0         | 1         | 2.6          | 3          | 4.5          |
| 30 - 34      | 1         | 2.1         | 4         | 2.9          | 5          | 5.0          |
| 35 - 39      | 3         | 5.1         | 2         | 8.4          | 5          | 13.5         |
| 40 - 44      | 4         | 7.7         | 5         | 12.7         | 9          | 20.4         |
| 45 - 49      | 8         | 11.3        | 13        | 19.5         | 21         | 30.8         |
| 50 - 54      | 8         | 15.6        | 16        | 26.1         | 24         | 41.7         |
| 55 - 59      | 9         | 15.6        | 24        | 26.0         | 33         | 41.6         |
| 60 & Over    | 4         | 6.9         | 7         | 10.4         | 11         | 17.3         |
| <b>Total</b> | <b>39</b> | <b>67.1</b> | <b>72</b> | <b>109.6</b> | <b>111</b> | <b>176.7</b> |

|                               | Male       | Female     | Total      |
|-------------------------------|------------|------------|------------|
| Average age at disability     | 49.3 years | 51.2 years | 50.5 years |
| Average service at disability | 10.1 years | 10.4 years | 10.3 years |



**ACTIVE MEMBERS WHO DIED  
DURING PLAN YEAR 2016-2017**

| Age          | Male      |             | Female    |             | Total     |             |
|--------------|-----------|-------------|-----------|-------------|-----------|-------------|
|              | Actual    | Expected    | Actual    | Expected    | Actual    | Expected    |
| Under 30     | 3         | 0.8         | 1         | 0.5         | 4         | 1.3         |
| 30 - 34      | 1         | 0.7         | 1         | 0.6         | 2         | 1.3         |
| 35 - 39      | 0         | 0.8         | 4         | 0.9         | 4         | 1.8         |
| 40 - 44      | 3         | 1.1         | 1         | 1.3         | 4         | 2.4         |
| 45 - 49      | 1         | 2.2         | 3         | 2.6         | 4         | 4.8         |
| 50 - 54      | 8         | 4.4         | 2         | 4.8         | 10        | 9.2         |
| 55 - 59      | 10        | 7.3         | 6         | 6.8         | 16        | 14.1        |
| 60 - 64      | 9         | 9.4         | 11        | 6.4         | 20        | 15.8        |
| 65 & Over    | 13        | 8.9         | 1         | 4.1         | 14        | 13.0        |
| <b>Total</b> | <b>48</b> | <b>35.7</b> | <b>30</b> | <b>28.1</b> | <b>78</b> | <b>63.8</b> |

|                          | Male       | Female     | Total      |
|--------------------------|------------|------------|------------|
| Average age at death     | 57.1 years | 53.0 years | 55.5 years |
| Average service at death | 15.6 years | 13.3 years | 14.7 years |

Of the 78 active members who died in service during plan year 2016-2017, 27 members had a benefit payable to a survivor.





**ACTIVE MEMBERS WHO TERMINATED EMPLOYMENT  
WITH A DEFERRED BENEFIT  
DURING PLAN YEAR 2016-2017**

| Age          | Male       |              | Female     |              | Total        |                |
|--------------|------------|--------------|------------|--------------|--------------|----------------|
|              | Actual     | Expected     | Actual     | Expected     | Actual       | Expected       |
| Under 30     | 20         | 18.2         | 40         | 31.8         | 60           | 50.0           |
| 30 - 34      | 90         | 82.6         | 119        | 108.4        | 209          | 191.0          |
| 35 - 39      | 101        | 88.4         | 156        | 150.7        | 257          | 239.2          |
| 40 - 44      | 90         | 81.5         | 121        | 130.9        | 211          | 212.4          |
| 45 - 49      | 79         | 72.4         | 123        | 125.1        | 202          | 197.5          |
| 50 - 54      | 69         | 55.4         | 115        | 90.6         | 184          | 146.0          |
| 55 - 59      | 28         | 18.8         | 61         | 30.1         | 89           | 48.9           |
| 60 & Over    | 16         | 1.3          | 21         | 1.6          | 37           | 2.9            |
| <b>Total</b> | <b>493</b> | <b>418.5</b> | <b>756</b> | <b>669.2</b> | <b>1,249</b> | <b>1,087.8</b> |

|                                | Male       | Female     | Total      |
|--------------------------------|------------|------------|------------|
| Average age at termination     | 42.3 years | 42.7 years | 42.6 years |
| Average service at termination | 10.4 years | 10.7 years | 10.6 years |



**ACTIVE MEMBERS WHO TERMINATED EMPLOYMENT  
WITHOUT A DEFERRED BENEFIT PAYABLE  
DURING PLAN YEAR 2016-2017**

| Age          | Male         |                | Female       |                | Total        |                |
|--------------|--------------|----------------|--------------|----------------|--------------|----------------|
|              | Actual       | Expected       | Actual       | Expected       | Actual       | Expected       |
| Under 20     | 8            | 0.0            | 13           | 0.0            | 21           | 0.0            |
| 20 - 24      | 256          | 152.0          | 349          | 209.6          | 605          | 361.6          |
| 25 - 29      | 422          | 294.7          | 584          | 411.2          | 1,006        | 705.9          |
| 30 - 34      | 254          | 184.4          | 367          | 290.2          | 621          | 474.6          |
| 35 - 39      | 140          | 120.6          | 261          | 225.8          | 401          | 346.4          |
| 40 - 44      | 97           | 85.9           | 187          | 167.0          | 284          | 252.9          |
| 45 - 49      | 81           | 80.4           | 158          | 172.8          | 239          | 253.2          |
| 50 - 54      | 61           | 72.7           | 136          | 152.5          | 197          | 225.2          |
| 55 - 59      | 30           | 60.4           | 86           | 119.5          | 116          | 179.9          |
| 60 - 64      | 40           | 42.8           | 52           | 61.7           | 92           | 104.5          |
| 65 - 69      | 12           | 11.0           | 13           | 11.9           | 25           | 22.8           |
| 70 & Over    | 5            | 2.6            | 2            | 1.5            | 7            | 4.1            |
| <b>Total</b> | <b>1,406</b> | <b>1,107.5</b> | <b>2,208</b> | <b>1,823.7</b> | <b>3,614</b> | <b>2,931.2</b> |

| Service      | Male         |                | Female       |                | Total        |                |
|--------------|--------------|----------------|--------------|----------------|--------------|----------------|
|              | Actual       | Expected       | Actual       | Expected       | Actual       | Expected       |
| 0 - 1        | 554          | 424.8          | 939          | 762.6          | 1,493        | 1,187.4        |
| 1 - 2        | 338          | 278.6          | 521          | 458.0          | 859          | 736.6          |
| 2 - 3        | 221          | 190.3          | 323          | 278.0          | 544          | 468.3          |
| 3 - 4        | 156          | 133.7          | 267          | 204.0          | 423          | 337.6          |
| 4 - 5        | 137          | 80.1           | 158          | 121.1          | 295          | 201.3          |
| <b>Total</b> | <b>1,406</b> | <b>1,107.5</b> | <b>2,208</b> | <b>1,823.7</b> | <b>3,614</b> | <b>2,931.2</b> |

|                                | Male       | Female     | Total      |
|--------------------------------|------------|------------|------------|
| Average age at termination     | 33.3 years | 34.7 years | 34.2 years |
| Average service at termination | 1.7 years  | 1.6 years  | 1.7 years  |



**COMPARISON OF ACTUAL TO EXPECTED DEATHS  
AMONG RETIRED LIVES  
(SERVICE RETIREMENT ONLY)  
DURING PLAN YEAR 2016-2017**

| Age          | Male       |              |               | Female     |              |               | Total        |              |               |
|--------------|------------|--------------|---------------|------------|--------------|---------------|--------------|--------------|---------------|
|              | Actual     | Expected     | Exposures     | Actual     | Expected     | Exposures     | Actual       | Expected     | Exposures     |
| Under 45     | 0          | 0.0          | 0             | 0          | 0.0          | 0             | 0            | 0.0          | 0             |
| 50 - 54      | 2          | 0.6          | 111           | 0          | 0.9          | 274           | 2            | 1.5          | 385           |
| 55 - 59      | 7          | 7.0          | 986           | 15         | 9.6          | 1,968         | 22           | 16.6         | 2,954         |
| 60 - 64      | 42         | 28.8         | 2,942         | 57         | 35.2         | 5,061         | 99           | 64.0         | 8,003         |
| 65 - 69      | 76         | 60.8         | 4,348         | 70         | 68.1         | 6,552         | 146          | 128.9        | 10,900        |
| 70 - 74      | 69         | 67.3         | 3,151         | 91         | 72.6         | 4,435         | 160          | 139.9        | 7,586         |
| 75 - 79      | 73         | 64.5         | 1,845         | 93         | 75.7         | 2,775         | 166          | 140.1        | 4,620         |
| 80 - 84      | 66         | 64.6         | 1,074         | 116        | 83.6         | 1,757         | 182          | 148.3        | 2,831         |
| 85 - 89      | 75         | 58.2         | 561           | 94         | 88.1         | 1,031         | 169          | 146.3        | 1,592         |
| 90 - 94      | 44         | 37.9         | 220           | 82         | 72.3         | 510           | 126          | 110.2        | 730           |
| 95 - 99      | 23         | 12.0         | 45            | 41         | 31.0         | 136           | 64           | 43.0         | 181           |
| 100 & Over   | 1          | 0.4          | 1             | 4          | 5.8          | 16            | 5            | 6.2          | 17            |
| <b>Total</b> | <b>478</b> | <b>402.1</b> | <b>15,284</b> | <b>663</b> | <b>543.0</b> | <b>24,515</b> | <b>1,141</b> | <b>945.0</b> | <b>39,799</b> |

|                |             |             |             |             |             |             |             |             |             |
|----------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| <b>Average</b> |             |             |             |             |             |             |             |             |             |
| <b>Ages</b>    | <b>77.6</b> | <b>77.5</b> | <b>69.8</b> | <b>79.2</b> | <b>79.6</b> | <b>69.7</b> | <b>78.5</b> | <b>78.7</b> | <b>69.7</b> |



APPENDIX C – SUMMARY OF PLAN PROVISIONS

| MSEP<br>(Missouri State Employees' Plan)  | MSEP 2000<br>(Missouri State Employees' Plan 2000)   | MSEP 2011<br>(Missouri State Employees' Plan 2011)   |
|---|--|--|
| <p><b>DEFINITIONS</b></p> <p><b>Participants</b></p> <p>All MOSERS members, vested former members, retirees and survivors who first became members prior to July 1, 2000 and who do <b>not</b> elect to transfer to the MSEP 2000 plan. Election is made at the time benefits commence.</p> | <ol style="list-style-type: none"> <li>(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).</li> <li>(2) MSEP active members and vested former members who elect to transfer to the MSEP 2000 plan prior to retirement.</li> <li>(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.</li> <li>(4) MSEP non-vested terminations rehired on or after July 1, 2000.</li> <li>(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.</li> </ol> | <ol style="list-style-type: none"> <li>(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).</li> <li>(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.</li> </ol> |



**APPENDIX C – SUMMARY OF PLAN PROVISIONS**

| <b>MSEP<br/>(Missouri State Employees' Plan)</b>   | <b>MSEP 2000<br/>(Missouri State Employees' Plan 2000)</b>   | <b>MSEP 2011<br/>(Missouri State Employees' Plan 2011)</b>   |
|--|--|--|
| <p><b>Final average earnings</b></p> <p>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).</p> <p><b>Member contributions</b></p> <p>None.</p> | <p>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).</p> <p>Same as MSEP.</p> | <p>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).</p> <p>4.0% of salary, with interest credited to member contributions based on the 52-week Treasury bill rate (4% prior to June 30, 2014).</p> |



**APPENDIX C – SUMMARY OF PLAN PROVISIONS**

| <b>MSEP<br/>(Missouri State Employees' Plan)</b>   | <b>MSEP 2000<br/>(Missouri State Employees' Plan 2000)</b>   | <b>MSEP 2011<br/>(Missouri State Employees' Plan 2011)</b>  |
|--|--|---|
| <p><b>ELIGIBILITY FOR BENEFITS</b></p>   |  |   |
| <p><b>Normal retirement</b></p>  |  |   |
| <p><i>Members of the General Assembly:</i><br/>Age 55 with completion of at least 3 full biennial assemblies.</p> <p><i>Statewide Elected Officials:</i><br/>The earliest of attaining:<br/>(1) Age 65 with at least 4 years of credited service.<br/>(2) Age 60 with at least 15 years of credited service.<br/>(3) Age 50 with age plus credited service equal to 80 or more.</p> <p><i>General Employees:</i><br/>The earliest of attaining:<br/>(1) Age 65 and active with at least 4 years of credited service.<br/>(2) Age 65 with at least 5 years of credited service.<br/>(3) Age 60 with at least 15 years of credited service.<br/>(4) Age 48 with age plus credited service equal to 80 or more.</p> | <p><i>Members of the General Assembly:</i><br/>The earliest of attaining:<br/>(1) Age 55 with completion of at least 3 full biennial assemblies.<br/>(2) Age 50 with completion of at least 3 full biennial assemblies and with age plus credited service equal to 80 or more.</p> <p><i>Statewide Elected Officials:</i><br/>The earliest of attaining:<br/>(1) Age 55 with at least 4 years of credited service.<br/>(2) Age 50 with age plus credited service equal to 80 or more.</p> <p><i>General Employees:</i><br/>The earliest of attaining:<br/>(1) Age 62 with at least 5 years of credited service.<br/>(2) Age 48 with age plus credited service equal to 80 or more.</p> | <p><i>Members of the General Assembly:</i><br/>The earliest of attaining:<br/>(1) Age 62 with completion of at least 3 full biennial assemblies.<br/>(2) Age 55 with completion of at least 3 full biennial assemblies and with age plus credited service equal to 90 or more.</p> <p><i>Statewide Elected Officials:</i><br/>The earliest of attaining:<br/>(1) Age 62 with at least 4 years of credited service as a statewide elected official.<br/>(2) Age 55 with age plus credited service equal to 90 or more.</p> <p><i>General Employees:</i><br/>The earliest of attaining:<br/>(1) Age 67 with at least 10 years of credited service (5 years effective January 1, 2018).<br/>(2) Age 55 with age plus credited service equal to 90 or more.</p> |



APPENDIX C – SUMMARY OF PLAN PROVISIONS

| MSEP<br>(Missouri State Employees' Plan)  | MSEP 2000<br>(Missouri State Employees' Plan 2000)       | MSEP 2011<br>(Missouri State Employees' Plan 2011)  |
|---|--|---|
| <p><i>Uniformed Water Patrol Employees:</i><br/>The earliest of attaining:</p> <ul style="list-style-type: none"> <li>(1) Age 55 and active with at least 4 years of credited service.</li> <li>(2) Age 55 with at least 5 years of credited service.</li> <li>(3) Age 48 with age plus credited service equal to 80 or more.</li> </ul> <p><i>Administrative Law Judges:</i><br/>The earliest of attaining:</p> <ul style="list-style-type: none"> <li>(1) Age 62 and active with at least 12 years of credited service.</li> <li>(2) Age 60 with at least 15 years of credited service.</li> <li>(3) Age 55 with at least 20 years of credited service.</li> </ul> <p><b>Early retirement for general employees</b></p> <p>Age 55 with at least 10 years of credited service.</p> | <p>Age 57 with at least 5 years of credited service.</p> | <p>Age 62 with at least 10 years of credited service (5 years effective January 1, 2018).</p> |



**APPENDIX C – SUMMARY OF PLAN PROVISIONS**

| <b>MSEP<br/>(Missouri State Employees' Plan)</b>   | <b>MSEP 2000<br/>(Missouri State Employees' Plan 2000)</b>   | <b>MSEP 2011<br/>(Missouri State Employees' Plan 2011)</b>   |
|--|--|--|
| <p><b>MONTHLY BENEFITS PAYABLE</b></p>   |  |  |
| <p><b>Normal Retirement</b></p>  |  |  |
| <p><i>Members of the General Assembly:</i><br/>\$150 per month per biennial assembly served.</p> <p><i>Statewide Elected Officials:</i></p> <ol style="list-style-type: none"> <li>1) Less than 12 years of credited service:<br/>1.6% of Average Compensation times years of credited service.</li> <li>2) 12 or more years of credited service:<br/>50% of pay of the highest elected position held prior to retirement.</li> </ol> <p><i>General Employees:</i><br/>1.6% of Average Compensation times years of credited service.</p> <p>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.</p> <p><i>Uniformed Water Patrol:</i><br/>2.13% of Average Compensation times years of credited service.</p> | <p><i>Members of the General Assembly:</i><br/>1/24 of pay times first 24 years of credited service as a member of the General Assembly.</p> <p><i>Statewide Elected Officials:</i><br/>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.</p> <p><i>General Employees:</i><br/>1.7% of Average Compensation times years of credited service.</p> <p><b>Temporary Benefit:</b><br/>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.</p> | <p><i>Members of the General Assembly:</i><br/>1/24 of pay times first 24 years of credited service as a member of the General Assembly.</p> <p><i>Statewide Elected Officials:</i><br/>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.</p> <p><i>General Employees:</i><br/>1.7% of Average Compensation times years of credited service.</p> <p><b>Temporary Benefit:</b><br/>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.</p> |





APPENDIX C – SUMMARY OF PLAN PROVISIONS

| <b>MSEP<br/>(Missouri State Employees' Plan)</b>   | <b>MSEP 2000<br/>(Missouri State Employees' Plan 2000)</b>   | <b>MSEP 2011<br/>(Missouri State Employees' Plan 2011)</b>   |
|--|--|--|
| <p><i>Administrative Law Judges:</i><br/>50% of Compensation</p> <p><b>Early retirement for general employees</b></p> <p>Normal retirement amount reduced by ½% for each month that retirement precedes eligibility for normal retirement.</p> <ol style="list-style-type: none"> <li>1) Less than 15 years of service: Normal retirement amount actuarially reduced for years younger than age 65.</li> <li>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.</li> <li>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.</li> </ol> | <p>Non-Social Security Covered Service:<br/>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.</p> <p>Normal retirement amount reduced by ½% for each month that retirement precedes eligibility for normal retirement, age 62.</p> | <p>Non-Social Security Covered Service:<br/>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.</p> <p>Normal retirement amount reduced by ½% for each month that retirement precedes eligibility for normal retirement, age 67.</p> |



**APPENDIX C – SUMMARY OF PLAN PROVISIONS**

| <b>MSEP<br/>(Missouri State Employees' Plan)</b>  |                  |                   |                   | <b>MSEP 2000<br/>(Missouri State Employees' Plan 2000)</b>  |                  |                   |                   | <b>MSEP 2011<br/>(Missouri State Employees' Plan 2011)</b>   |                  |                   |                   |
|---|------------------|-------------------|-------------------|---|------------------|-------------------|-------------------|--|------------------|-------------------|-------------------|
| <b>Vested deferred benefits</b>   |                  |                   |                   |   |                  |                   |                   |  |                  |                   |                   |
| 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.  |                  |                   |                   | 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 converted. CURP to MOSERS transfers with 6 years of service are immediately vested.   |                  |                   |                   | 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 for any new deferred vested members on or after January 1, 2018.  |                  |                   |                   |
| Years of Service  | General Assembly | Elected Officials | General Employees | Years of Service  | General Assembly | Elected Officials | General Employees | Years of Service   | General Assembly | Elected Officials | General Employees |
| 4   |                  | 100%              |                   | 4   |                  | 100%              |                   | 4  |                  | 100%              |                   |
| 5   |                  |                   | 100%              | 5   |                  |                   | 100%              | 6*   | 100%             |                   |                   |
| 6*  | 100%             |                   |                   | 6*  | 100%             |                   |                   | 10**   |                  |                   | 100%              |
| *3 Assemblies   |                  |                   |                   | *3 Assemblies, HB1455 prospectively   |                  |                   |                   | *3 Assemblies, HB1455 prospectively<br>**5 years of service for General Employees on or after January 1, 2018.   |                  |                   |                   |
| <b>Death prior to retirement</b>  |                  |                   |                   |   |                  |                   |                   |  |                  |                   |                   |
| 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 |                  |                   |                   | 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 |                  |                   |                   | 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 |                  |                   |                   |



**APPENDIX C – SUMMARY OF PLAN PROVISIONS**

| <b>MSEP<br/>(Missouri State Employees' Plan)</b>  | <b>MSEP 2000<br/>(Missouri State Employees' Plan 2000)</b>   | <b>MSEP 2011<br/>(Missouri State Employees' Plan 2011)</b>   |
|---|--|--|
| <p>spouse benefit is 50% of Average Compensation (rate of compensation for members of the General Assembly).</p> <p><b>Death after retirement</b></p> <p>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).</p> | <p>service requirement is waived and the minimum spouse benefit is 50% of Average Compensation (rate of compensation for members of the General Assembly).</p> <p>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).</p> | <p>service requirement is waived and the minimum spouse benefit is 50% of Average Compensation (rate of compensation for members of the General Assembly).</p> <p>*Effective January 1, 2018, the surviving spouse benefit for terminated vested participants is payable when member would have reached normal retirement age.</p> <p>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).</p> |



APPENDIX C – SUMMARY OF PLAN PROVISIONS

| <b>MSEP</b><br><b>(Missouri State Employees' Plan)</b>  | <b>MSEP 2000</b><br><b>(Missouri State Employees' Plan 2000)</b> | <b>MSEP 2011</b><br><b>(Missouri State Employees' Plan 2011)</b> |                            |               |    |                     |               |                     |                     |               |    |    |   |   |
|---|--|--|----------------------------|---------------|----|---------------------|---------------|---------------------|---------------------|---------------|----|----|---|---|
| <p><b>Disability</b></p> <p>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.</p> <p><b>Post-retirement benefit adjustments</b></p> <p>Benefits are increased to retired members (including survivors) annually in accordance with the following formulas:</p> <table border="1" data-bbox="205 1154 747 1377"> <thead> <tr> <th>Increase in CPI</th> <th>Formula 1 Benefit Increase</th> <th>Formula 2 Benefit Increase</th> </tr> </thead> <tbody> <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> </tbody> </table> | Increase in CPI  | Formula 1 Benefit Increase                                       | Formula 2 Benefit Increase | 5.00% or less | 4% | 80% of CPI increase | 5.01% - 6.24% | 80% of CPI increase | 80% of CPI increase | 6.25% or more | 5% | 5% | <p>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%.</p> <p>Benefits are increased to retired members (including survivors) annually in accordance with the following:</p> <p><i>Members of the General Assembly:</i><br/>Benefit is adjusted annually based on the increase in the pay for an active member of the General Assembly.</p> | <p>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%.</p> <p>Benefits are increased to retired members (including survivors) annually in accordance with the following:</p> <p><i>Members of the General Assembly:</i><br/>Benefit is adjusted annually based on the increase in the pay for an active member of the General Assembly.</p> |
| Increase in CPI   | Formula 1 Benefit Increase                                       | Formula 2 Benefit Increase                                       |                            |               |    |                     |               |                     |                     |               |    |    |   |   |
| 5.00% or less   | 4%   | 80% of CPI increase  |                            |               |    |                     |               |                     |                     |               |    |    |   |   |
| 5.01% - 6.24%   | 80% of CPI increase  | 80% of CPI increase  |                            |               |    |                     |               |                     |                     |               |    |    |   |   |
| 6.25% or more   | 5%   | 5%   |                            |               |    |                     |               |                     |                     |               |    |    |   |   |



**APPENDIX C – SUMMARY OF PLAN PROVISIONS**

| <b>MSEP<br/>(Missouri State Employees' Plan)</b>   | <b>MSEP 2000<br/>(Missouri State Employees' Plan 2000)</b>  | <b>MSEP 2011<br/>(Missouri State Employees' Plan 2011)</b>   |
|--|---|--|
| <p>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.</p> <p>Members first hired on or after August 28, 1997 receive COLAs based solely on Formula 2.</p> <p>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.</p> <p>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.</p> | <p><i>Statewide Elected Officials:</i><br/>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.</p> <p><i>General Employees:</i><br/>Annual benefit percentage increase equal to the lesser of: i) 80% of the CPI increase, and 5%.</p> <p>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.</p> <p>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.</p> | <p><i>Statewide Elected Officials:</i><br/>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.</p> <p><i>General Employees:</i><br/>Annual benefit percentage increase equal to the lesser of: i) 80% of the CPI increase, and 5%.</p> <p>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.</p> <p>Timing of Increase: Benefits are adjusted on the anniversary of the effective date of retirement.</p> |



**APPENDIX C – SUMMARY OF PLAN PROVISIONS**

| <b>MSEP<br/>(Missouri State Employees' Plan)</b>   | <b>MSEP 2000<br/>(Missouri State Employees' Plan 2000)</b>  | <b>MSEP 2011<br/>(Missouri State Employees' Plan 2011)</b>                                |
|--|---|---|
| <p><b>Pop-up provision</b></p> <p>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.</p> <p><b>Portability</b></p> <p>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.</p> | <p>Same.</p> <p>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.</p> | <p>Same.</p> <p>May purchase qualifying public sector service at full actuarial cost.</p> |



**APPENDIX C – SUMMARY OF PLAN PROVISIONS**

| <b>MSEP<br/>(Missouri State Employees' Plan)</b>   | <b>MSEP 2000<br/>(Missouri State Employees' Plan 2000)</b> | <b>MSEP 2011<br/>(Missouri State Employees' Plan 2011)</b> |
|--|--|--|
| <p><b>BackDROP</b></p> <p>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.</p> <p>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.</p> <p>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.</p> | <p>Same as MSEP.</p>                                       | <p>Not eligible for the BackDROP.</p>                      |



**APPENDIX C – SUMMARY OF PLAN PROVISIONS**

| <b>MSEP<br/>(Missouri State Employees' Plan)</b>  | <b>MSEP 2000<br/>(Missouri State Employees' Plan 2000)</b> | <b>MSEP 2011<br/>(Missouri State Employees' Plan 2011)</b> |
|---|--|--|
| <p>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.</p> <p>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.</p> |  |  |





## 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 AVA is based on an open five-year smoothing method and is determined by spreading the difference between the actual investment income on market value and expected investment income on actuarial value. The difference is added to the net unrecognized gains or losses from previous years (difference between the beginning of year market value and beginning of year actuarial value) and then divided by 5 to create a phased-in amount. This phased-in amount is then added to the expected AVA at the valuation date (BOY AVA plus actual cash flow plus expected investment income). The AVA is limited by a corridor and must be no less than 80% of MVA and no greater than 125% of MVA.

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

The assumed rate of investment return was decreased from 7.65% to 7.50%.



**APPENDIX D – SUMMARY OF ACTUARIAL ASSUMPTIONS**

**ACTUARIAL ASSUMPTIONS**

**Economic Assumptions**

- 1. Investment Return 7.50%, compounded annually, net of investment expenses. (7.65% in June 30, 2016 valuation)
- 2. Inflation 2.50% per year
- 3. Salary Increases Rates vary by service. Sample rates are as follows:

| Rates by Service |        |
|------------------|--------|
| Years            | Rate   |
| 1                | 8.75 % |
| 2                | 5.50   |
| 3                | 4.50   |
| 4                | 4.25   |
| 5                | 4.00   |
| 9                | 3.75   |
| 10               | 3.50   |
| 25+              | 3.25   |

General Assembly members have a flat 3.00% assumption

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

The assumed rate of investment return was decreased from 7.65% to 7.50%.

- 4. Payroll Growth 3.00% per year
- 5. Cost-of-Living Adjustment (COLA) 4.00% on a compounded basis when a minimum COLA of 4.00% is in effect. 2.00% on a compounded basis when no minimum COLA is in effect.
- 6. Interest on Member Contributions 1.50% per year

**Demographic Assumptions**

- 1. Mortality
  - The mortality assumption includes an appropriate level of conservatism that reflects expected future mortality improvement.
  - a. Post-retirement RP-2014 Healthy Annuitant mortality table, projected from 2006 to 2026 with Scale MP-2015 and scaled by 120%



**APPENDIX D – SUMMARY OF ACTUARIAL ASSUMPTIONS**

b. Pre-retirement RP-2014 Employee mortality table, projected from 2006 to 2026 with Scale MP-2015 and scaled by 95% for males and 90% for females

c. Long-term disability RP-2014 Disabled mortality table, projected from 2006 to 2026 with Scale MP-2015 and scaled by 95% for males and 90% for females

**2. Retirement Assumption**

| Retirement Age | Normal Retirement    |                      |                      | MSEP 2011** | Early Retirement |                    |                  |
|----------------|----------------------|----------------------|----------------------|-------------|------------------|--------------------|------------------|
|                | MSEP and MSEP 2000*  |                      |                      |             | Retirement Age   | MSEP and MSEP 2000 | MSEP 2011        |
|                | Percent Retiring     |                      |                      |             |                  | Percent Retiring   | Percent Retiring |
|                | 1 <sup>st</sup> Year | 2 <sup>nd</sup> Year | 3 <sup>rd</sup> Year |             |                  |                    |                  |
| 48             | 20 %                 |                      |                      |             |                  |                    |                  |
| 49             | 20                   | 10 %                 |                      |             |                  |                    |                  |
| 50             | 20                   | 10                   | 21 %                 |             |                  |                    |                  |
| 51             | 20                   | 10                   | 21                   |             |                  |                    |                  |
| 52             | 20                   | 10                   | 21                   |             |                  |                    |                  |
| 53             | 20                   | 10                   | 21                   |             |                  |                    |                  |
| 54             | 20                   | 10                   | 21                   |             |                  |                    |                  |
| 55             | 20                   | 10                   | 21                   | 45 %        |                  |                    |                  |
| 56             | 20                   | 10                   | 21                   | 45          |                  |                    |                  |
| 57             | 20                   | 10                   | 21                   | 35          | 57               | 2.4 %              |                  |
| 58             | 20                   | 10                   | 21                   | 35          | 58               | 3.1                |                  |
| 59             | 20                   | 10                   | 21                   | 30          | 59               | 3.0                |                  |
| 60             | 20                   | 10                   | 21                   | 35          | 60               | 5.1                |                  |
| 61             | 19                   | 10                   | 21                   | 25          | 61               | 6.0                |                  |
| 62             | 18                   | 22                   | 29                   | 40          | 62               | 6.0                | 10 %             |
| 63             | 16                   | 18                   | 24                   | 30          | 63               | 6.0                | 10               |
| 64             | 15                   | 17                   | 17                   | 20          | 64               | 6.0                | 10               |
| 65             | 19                   | 19                   | 27                   | 30          | 65               |                    | 50               |
| 66             | 24                   | 25                   | 28                   | 25          | 66               |                    | 50               |
| 67             | 10                   | 25                   | 23                   | 20          | 67               |                    |                  |
| 68             | 20                   | 25                   | 23                   | 20          | 68               |                    |                  |
| 69             | 20                   | 25                   | 23                   | 20          | 69               |                    |                  |
| 70             | 20                   | 25                   | 23                   | 20          | 70               |                    |                  |
| 71             | 20                   | 25                   | 23                   | 20          | 71               |                    |                  |
| 72             | 20                   | 25                   | 23                   | 20          | 72               |                    |                  |
| 73             | 20                   | 25                   | 23                   | 20          | 73               |                    |                  |
| 74             | 20                   | 25                   | 23                   | 20          | 74               |                    |                  |
| 75             | 50                   | 50                   | 23                   | 50          | 75               |                    |                  |
| 76             | 50                   | 50                   | 23                   | 50          | 76               |                    |                  |
| 77             | 75                   | 75                   | 23                   | 75          | 77               |                    |                  |
| 78             | 100                  | 100                  | 100                  | 100         | 78               |                    |                  |

\* For members hired prior to January 1, 2011.

\*\* For members hired on or after January 1, 2011.



**APPENDIX D – SUMMARY OF ACTUARIAL ASSUMPTIONS**

**3 Termination From Active Employment**

| Sample Age | Years of Service | <u>Percent of Active Members Separating within the Next Year</u> |         |        |         |            |         |
|------------|------------------|--|---------|--------|---------|------------|---------|
|            |                  | Termination**  |         | Death* |         | Disability |         |
|            |                  | Males  | Females | Males  | Females | Males      | Females |
|            | 0-1              | 24.0 %   | 27.5 %  |        |         |            |         |
|            | 1-2              | 19.0   | 21.5    |        |         |            |         |
|            | 2-3              | 15.5   | 16.3    |        |         |            |         |
|            | 3-4              | 13.3   | 13.5    |        |         |            |         |
|            | 4-5              | 11.2   | 11.3    |        |         |            |         |
| 25         | 5+               | 13.5 %   | 14.0 %  | 0.03 % | 0.01%   | 0.10 %     | 0.10 %  |
| 30         |                  | 10.6   | 11.0    | 0.03   | 0.02    | 0.10       | 0.10    |
| 35         |                  | 8.2  | 8.5     | 0.04   | 0.03    | 0.10       | 0.10    |
| 40         |                  | 5.8  | 6.0     | 0.05   | 0.03    | 0.36       | 0.36    |
| 45         |                  | 4.3  | 4.5     | 0.07   | 0.05    | 0.41       | 0.41    |
| 50         |                  | 2.9  | 3.0     | 0.13   | 0.08    | 0.57       | 0.57    |
| 55         |                  | 2.9  | 3.0     | 0.22   | 0.14    | 0.77       | 0.77    |
| 60         |                  | 2.9  | 3.0     | 0.40   | 0.20    | 1.02       | 1.02    |
| 65         |                  | 2.9  | 3.0     | 0.70   | 0.30    | 1.23       | 1.23    |
| 70         |                  | 2.9  | 3.0     | 1.17   | 0.50    | 1.23       | 1.23    |

\* The pre-retirement mortality table used was the RP-2014 Employee mortality table, projected from 2006 to 2026 with Scale MP-2015 and scaled by 95% for males and 90% for females. 2% of the deaths in active service are assumed to be duty related.

\*\* Does not apply to Elected Officials and Legislators.

**Elected Officials and Legislators**

| Years of Service | Percent of Active Members Separating within the Next Year |
|------------------|---|
|                  | Termination   |
|                  | Male/Female   |
| 0-1              | 8.0 %   |
| 1-2              | 8.0   |
| 2-3              | 8.0   |
| 3-4              | 8.0   |
| 4-5              | 12.0  |
| 5-6              | 12.0  |
| 6-7              | 12.0  |
| 7+               | 35.0  |



**APPENDIX D – SUMMARY OF ACTUARIAL ASSUMPTIONS**

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**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 70% married at retirement, 60% 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   | 1.57/1.31   |
| 30-39 | 1.24/1.13   |
| 40-49 | 1.09/1.05   |
| >50   | 1.02/1.01   |

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



**APPENDIX D – SUMMARY OF ACTUARIAL ASSUMPTIONS**

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|  |   |
|--|---|
|  | 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 and MSEP on or after age 62. Elected Officials, General Assembly, and Uniformed Water Patrol Members hired before July 1, 2000 and Administrative Law Judges hired before April 26, 2005 are assumed to elect MSEP at retirement. |
| 12. Service Adjustment                           | It is assumed that each member will be granted 8 months of service credit, 4 months for unused leave upon retirement and 4 months for military service purchases. For members hired on or after January 1, 2011 it is assumed that each member will be granted 5 months for unused leave.   |
| 13. Forfeitures                                  | MSEP - For those hired on or after January 1, 2011, 50% of state employees terminating at first vesting eligibility are assumed to take a refund and forfeit their deferred pension. This percentage decreases to 0% at first retirement eligibility.   |
| 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  |



## **APPENDIX D – SUMMARY OF ACTUARIAL ASSUMPTIONS**

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### **Data Adjustments**

Active and retired member data was reported as of May 31, 2017. It was brought forward to June 30, 2017 by adding one month of service for all active 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.

For members reported with no gender, the member is assumed to be male.

Due to limitations in our valuation program, members who are not eligible for normal retirement prior to age 85 had their date of birth adjusted.

### **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.



## APPENDIX E – GLOSSARY OF TERMS

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





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