Missouri Department of Transportation and Highway Patrol Employees' Retirement System (MPERS)

Actuarial Valuation Report

June 30, 2017

Table of Contents

GRS Retirement Consulting

800.521.0498 | P: 248.799.9000 | F: 248.799.9020 | www.grsconsulting.com

September 18, 2017

Retirement Board
Missouri Department of Transportation
and Highway Patrol Employees' Retirement System
1913 William Street
Jefferson City, Missouri 65102-1930

Ladies and Gentlemen:

The results of the regular annual actuarial valuation as of June 30, 2017 of the Missouri Department of Transportation and Highway Patrol Employees' Retirement System, as established by Chapter 104 of the Missouri Revised Statutes, are presented in this report. Reports providing accounting and financial reporting information that are intended to comply with the Governmental Accounting Standards Board Statements No. 67 and No. 68 will be provided separately. The purposes of this valuation were:

- to measure the System's funding progress;
- to determine the employer contribution rate for Fiscal Year 2019; and
- to provide certain supplemental schedules for use in the System's CAFR.

Your attention is directed particularly to the summary of the results on pages 1-13.

This report was prepared at the request of the Board and is intended for use by the Retirement System and those designated or approved by the Board. This report may be provided to parties other than the System only in its entirety and only with the permission of the Board. This report should not be relied on for any purpose other than the purpose described. GRS is not responsible for unauthorized use of this report.

The member statistical data required for the valuation together with pertinent data on financial operations was furnished by your Executive Director and his staff. Member data was reviewed for reasonableness, but was not audited by the actuary. Financial data was received in aggregate and reviewed for reasonableness. Individual investments were not reviewed. Assets are not audited by the actuary. We are not responsible for the accuracy or completeness of the data provided by MPERS.

The cooperation of the Executive Director and the staff in furnishing materials requested for this valuation, and the complete and excellent condition of the records, is acknowledged with appreciation.

The valuation results summarized in this report involve actuarial calculations that require assumptions about future events. The assumptions are established by the Board after consulting with the actuary. We believe that the assumptions and methods used in this report are reasonable and appropriate for the purpose for which they have been used. However, other assumptions and methods could also be reasonable and could result in materially different results. In addition, because it is not possible or practical to consider every possible contingency, we may use summary information, estimates or simplifications of calculations to facilitate the modeling of future events. We may also exclude factors or data that are deemed to be immaterial.

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; and changes in plan provisions or applicable law. This report does not contain an analysis of the potential range of such future measurements.

To the best of our knowledge, this report is complete and accurate and was made in accordance with standards of practice promulgated by the Actuarial Standards Board. The actuarial assumptions used for the valuation produce results which, individually and in the aggregate, are reasonable. The actuarial assumptions used in making the valuation are shown in Section E of this report.

The employer contributions determined in this report are based on Board funding policy. This policy is discussed on page 4 of this report. We commend the Board for its aggressive monitoring and updating of the funding policy over the recent past. However, continued employer contributions at the current level do not guarantee benefit security. We therefore encourage the Board to continue to routinely monitor and update its funding policy and to continue to consider benefit security when doing so.

This report has been prepared by individuals who have substantial experience valuing public employee retirement systems. Heidi G. Barry is a Member of the American Academy of Actuaries (MAAA) and meets the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein.

The signing individuals are independent of the plan sponsor.

Respectfully submitted,

Heidi G. Barry, ASA, FCA, MAAA

Kenneth G. Alberts

HGB/KGA:dj

2248

Summary

This report contains the results of the June 30, 2017 valuation. The table below shows a summary of the data used in the valuation as well as the unfunded actuarial accrued liability for the two experience rated groups. This data was the basis for determining valuation results and recommended employer contribution rates.

	Non-Uniformed				
	Civilian Patrol Employees	**MoDOT Employees**	**Non-Uniformed Total**	**Uniformed Patrol**	**Total**
Participants					
Active Members					
Closed Plan	317	1,761	2,078	565	2,643
Year 2000 Plan (also closed)	441	1,724	2,165	393	2,558
Year 2011 Tier (open)	361	1,588	1,949	306	2,255
Total Active Members	1,119	5,073	6,192	1,264	7,456
Total Active Members Prior Year	*1,148*	*5,039*	*6,187*	*1,254*	*7,441*
Retiree -- Regular Pensioners					
Closed Plan	480	3,487	3,967	927	4,894
Year 2000 Plan (also closed)	548	3,229	3,777	6	3,783
Year 2011 Tier (open)	0	0	0	0	0
Total Regular Pensioners	1,028	6,716	7,744	933	8,677
Self Insured Disability Pensioners	3	47	50	3	53
Fully Insured Disability Pensioners	12	82	94	7	101
Terminated Vested Members	242	1,917	2,159	165	2,324
Total	**2,404**	**13,835**	**16,239**	**2,372**	**18,611**
Active Member Valuation Payroll	$46,882,549	$216,529,976	$ 263,412,525	$ 85,566,687	$ 348,979,212
Active Mem. Val. Payroll Prior Year	*$46,345,740*	*$210,473,695*	*$ 256,819,435*	*$ 82,979,944*	*$ 339,799,379*
Unfunded Actuarial Accrued Liability	N/A	N/A	$1,206,542,635	$423,113,951	$1,629,656,586

The June 30, 2017 valuation results are used to determine the contribution rate for the plan year beginning July 1, 2018. A summary of valuation results and recommended contribution rates follows.

Summary (Continued)

The **total contribution rate** for the plan year beginning July 1, 2018 is shown below:

	FY 2019 Employer Contribution Rates Expressed as % of Active Payroll for Total Benefits				
	Non-Uniformed				
	Civilian Patrol Employees	MoDOT Employees	Total	Uniformed Patrol Total	Combined Rate (System Total)
Benefit Normal Cost	9.96%	9.96%	9.96%	15.98%	11.46%
Expenses	1.21%	1.21%	1.21%	1.21%	1.21%
Disability Insurance	0.53%	0.53%	0.53%	0.53%	0.53%
Total Normal Cost	11.70%	11.70%	11.70%	17.72%	13.20%
Unfunded Liability	46.30%	46.30%	46.30%	40.28%	44.80%
Total	58.00%	58.00%	58.00%	58.00%	58.00%
Projected $	$29,128,620	$134,532,347	$163,660,967	$53,163,481	$216,824,448
Prior Year Projected $	*$28,795,095*	*$130,769,517*	*$159,564,612*	*$51,556,310*	*$211,120,922*

The projected dollar amounts are the total employer rate multiplied by the valuation payroll projected to the fiscal year the rate is effective. The projection factor is 1.0712 for Non-Uniformed and 1.0712 for Uniformed. Actual contributions will be based on the actual payroll during the 2019 Fiscal Year. The total contribution is based on a 7-year amortization period for unfunded retiree liabilities and a 22-year amortization period for other unfunded liabilities from July 1, 2018 in accordance with Board policy adopted September 17, 2009. In accordance with Board Policy adopted September 26, 2014, a minimum Employer contribution of 58% of payroll was included to establish a Contribution Stabilization Reserve Fund.

The contributions above are Employer contributions only. In addition, Employee contributions are estimated to be (on average) 1.02% for Non-Uniformed members and 0.70% for Uniformed members.

The combined contribution rate (58% of active payroll) is less than the actual benefit payout rate (66% of active payroll). The difference is intended to be made up by investment return. The ability to contribute less than the benefit payout is one of the advantages of a funded retirement plan.

Prior year projected dollars (FY 2018) are based on rates of 58.00% for Non-Uniform and 58.00% for Uniform.

Summary (Continued)

Benefit, Assumptions and Methods for the June 30, 2017 valuation: There were no changes in benefits for the June 30, 2017 valuation. The assumptions and methods used were those adopted by the Board from the July 1, 2007 through June 30, 2012 Experience Study and titled Alternate 1 in that report. The Board formally adopted these new assumptions at the June 20, 2013 Board meeting. The next Experience Study is scheduled to follow the June 30, 2017 valuation.

Experience: System assets earned an 11.2% return on a market basis, although the fund recognized a 6.2% rate of return on an actuarial basis after accounting for the smoothing of the 2015 and 2016 losses (please see page C-2). In aggregate, there was an experience gain of $5 million (approximately 0.1% of beginning of year liabilities). This gain was made up of a $31 million investment loss and a $36 million liability gain and contributed to an increase in funding status from 55.5% to 57.1%. Pages A-9 and A-10 show the derivation of the gain/(loss) in aggregate and by division.

The main sources of the liability gain for the Non-Uniformed group was due to the retiree COLA (the COLA was less than expected) and post-retirement deaths (more deaths than expected). The main source for the liability gain for the Uniformed group was due to the retiree COLA (the COLA was less than expected). The table below shows a comparison of actual demographic activity versus expected activity (based on the prior year's valuation assumptions).

Demographic Experience

	Non-Uniformed				Uniformed			
	Number Count			General	Number Count			General
	Actual	Expected	A/E%	Direction	Actual	Expected	A/E%	Direction
Retirement	208	245.4	85%	Gain	34	27.7	123%	Loss
Death	2	5.0	40%	Loss	0	0.7	0%	Gain
Disability	18	13.5	133%	Gain	2	0.8	250%	Gain
Vested Terminations	102	88.5	115%	Loss	6	10.0	60%	Loss
Other Terminations	262	229.6	114%	Gain	14	10.2	137%	Gain
Post-Retirement Death	305	239.7	127%	Gain	22	24.8	89%	Gain

Although both divisions had liability gains, the aggregate gains for the Uniformed division was less than the recognized investment losses, resulting in an experience loss of $4 million, in aggregate. For the Non-Uniformed division, liability gains more than offset recognized investment losses resulting in an experience gain of $9 million, in aggregate.

Summary (Continued)

Funding Policy:
Permanent Policy: The total contribution will be based on normal cost plus an 18-year amortization of unfunded actuarial accrued liabilities. The amortization period is a closed 18-year period starting July 1, 2018.

Temporary Accelerated Policy: The total contribution is based on normal cost plus a 7-year amortization period for unfunded retiree liabilities and a 22-year amortization period for other unfunded liabilities. Both amortization periods are closed periods starting July 1, 2018.

In accordance with RSMo 105.684, an accelerated amortization schedule was prepared and presented to the Board. This temporary accelerated policy was adopted by the Retirement Board on September 17, 2009 and will remain in effect until such time as the retiree liability becomes 100% funded or the permanent policy produces a higher contribution rate.

In September 2014, the Board adopted a contribution stabilization reserve fund from experience gains in an effort to keep the employer contribution rate at or near 58%, in the near term. In February 2015, the Board established a maximum of $250 million in the contribution stabilization reserve fund. The contribution stabilization reserve fund is expected to result in the fund becoming more than 100% funded by the end of the amortization period, if experience is exactly as assumed.

Rate Reconciliation: The table below shows the computed rate last year and the approximate effect of the changes that occurred during the year.

	Non-Uniform	Uniform
Computed employer contribution rate, prior valuation	58.00%	58.00%
Effects of:		
Change in disability premiums	0.00%	0.00%
Data reporting improvement*	(0.05%)	(0.01%)
Change in assumptions and methods	0.00%	0.00%
Phase-in of 2011 Tier members	(0.33%)	(0.29%)
16/17 recognized investment loss/(gain)	1.31%	1.66%
16/17 liability experience loss/(gain)	(1.84%)	(0.91%)
Change in administrative expenses	0.01%	0.01%
Change due to payroll increase other than expected	0.64%	0.28%
Misc (demographic, payroll weighting, component interaction, etc.	(1.22%)	(2.32%)
Increase in Contribution Stabilization Reserve Fund	1.48%	1.58%
Computed employer contribution rate, current valuation	58.00%	58.00%

* *Result of receiving information to identify members who retired from deferred status and are, therefore, not eligible for the $5,000 death benefit.*

Summary (Continued)

Funded Status of Retiree Liability: The chart below indicates the funding status of retiree liabilities on a funding value asset basis and a market value asset basis:

	June 30, 2017			June 30, 2016
Asset Basis	**Non-Uniformed**	**Uniformed**	**Total**	**Total**
Funding Value	82.8%	99.6%	87.0%	84.3%
Market Value	82.7%	99.4%	86.9%	80.4%

Total Plan Funded Status: The plan is currently 57.14% funded on an actuarial value of assets basis or 57.06% funded on a market value of assets basis.

If not for the minimum contribution rate and the contribution stabilization reserve, the permanent funding policy would have resulted in the larger employer contribution for the Uniformed division and the temporary policy would have resulted in the larger employer contribution for the Non-Uniformed division, using current valuation assumptions.

Experience Study: The next experience study is scheduled to be completed prior to the June 30, 2018 valuation. Based on recent trends in forward looking forecasts of the economic environment, it is likely that we will recommend lowering the price inflation assumption (and corresponding wage inflation, COLA, and investment return assumptions). Based on the simplified modeling we performed for the Board at the November 2016 Trustee Education Retreat as well as some initial testing we performed with this valuation, we believe that the Board's minimum employer contribution of 58% of payroll would still be the controlling contribution if the Board lowered all the economic assumptions by ½% (50 basis points). Larger changes in economic assumptions (or the same or smaller changes combinded with changes in demographic assumptions) may have a different result.

Summary (Concluded)

Plan Provisions: There were no plan provisions intentionally excluded from the valuation that were in effect on the valuation date. However, certain disability benefits are funded through third party insurance. The premiums for this insurance are included in the normal cost. The liabilities for these disability benefits are not included in the accrued liabilities of the plan, since they are liabilities of the insurance carrier.

It is our understanding that, as of the valuation date, there is pending legislation regarding the vesting requirement for the 2011 Tier members. The changes in the pending legislation have not been reflected in this report. However, this change is not expected to have a material effect on the computation of actuarial accrued liabilities.

One plan change was made after the valuation date, which allows for deferred vested members to elect a lump sum distribution during a window period. Members electing this option will receive less than 50% of the liabilities released, resulting in a gain to the System. The effect of this change is expected to be small and will be reflected in the June 30, 2018 valuation, which is after the window period.

Data Enhancements: Improvements in data reporting now identify those retirees who retired from deferred status and, therefore, are not eligible for the $5,000 death benefit. The reduction in accrued liabilities resulting from this additional information was approximately $860,000 and is detailed on pages 4, A-9 and A-10.

Look Forward: Before recognizing any fiscal year 2018 activity, the fund is positioned to recognize an investment loss of approximately $23 million next year (see page C-2). Since this is less than the current contribution stabilization reserve fund of $220 million, this loss, by itself, is not expected to result in an increase in the employer contribution rate under the current funding policy. However, this loss, if not offset by other experience gains, will put downward pressure on the funded status of the plan. Should experience losses, in total, exceed $220 million in fiscal year 2018, there will be upward pressure on employer contribution rates.

Recommendation: In accordance with changes in actuarial standards along with more recent changes in forecasts of future economic conditions, we recommend that economic assumptions be reviewed annually each spring before the next valuation cycle begins.

Conclusion: Based upon the results of the June 30, 2017 regular annual actuarial valuation, it is our opinion that the Missouri Department of Transportation and Highway Patrol Employees' Retirement System continues to be financed in accordance with actuarial principles of level percent-of-payroll financing. This statement is based upon the fact that the employer is contributing to the System based upon actuarially determined rates and presumes a continuation of payment of actuarially determined contributions. In addition, we commend the 2009 Board in its decision to more aggressively address the unfunded retiree liability issue, the 2011 Board in its decision to reflect the near term downsizing of MoDOT, and the 2014 Board for establishing the contribution stabilization reserve fund, which effectively accelerated the funding of the UAAL.

Other Observations

General Implications of Contribution Allocation Procedure or Funding Policy on Future Expected Plan Contributions and Funded Status

Given the plan's contribution allocation procedure, if all actuarial assumptions are met (including the assumption of the plan earning 7.75% on the actuarial value of assets), it is expected that:

1) The unfunded actuarial accrued liabilities will be fully amortized after 18 years, based on the permanent funding policy;
2) The funded status of the plan will increase gradually towards a 100% funded ratio and then slightly exceed 100%; and
3) The unfunded accrued liability will follow the pattern shown on page A-5.

Limitations of Funded Status Measurements

Unless otherwise indicated, a funded status measurement presented in this report is based upon the actuarial accrued liability and the actuarial value of assets. Unless otherwise indicated, with regard to any funded status measurements presented in this report:

1) The measurement is inappropriate for assessing the sufficiency of plan assets to cover the estimated cost of settling the plan's benefit obligations, in other words, of transferring the obligations to an unrelated third party in an arm's length market value type transaction.
2) The measurement is dependent upon the actuarial cost method which, in combination with the plan's amortization policy, affects the timing and amounts of future contributions. A funded status measurement in this report of 100% is not synonymous with no required future contributions. If the funded status were 100%, the plan would still require future normal cost contributions (i.e., contributions to cover the cost of the active membership accruing an additional year of service credit).
3) The measurement would produce a different result if the market value of assets were used instead of the actuarial value of assets, unless the market value of assets is used in the measurement.

Limitations of Project Scope

Actuarial standards do not require the actuary to evaluate the ability of the plan sponsor or other contributing entity to make required contributions to the plan when due. Such an evaluation was not within the scope of this project and is not within the actuary's domain of expertise. Consequently, the actuary performed no such evaluation.

Risks to Future Employer Contribution Requirements

There are ongoing risks to future employer contribution requirements to which the Retirement System is exposed, such as:

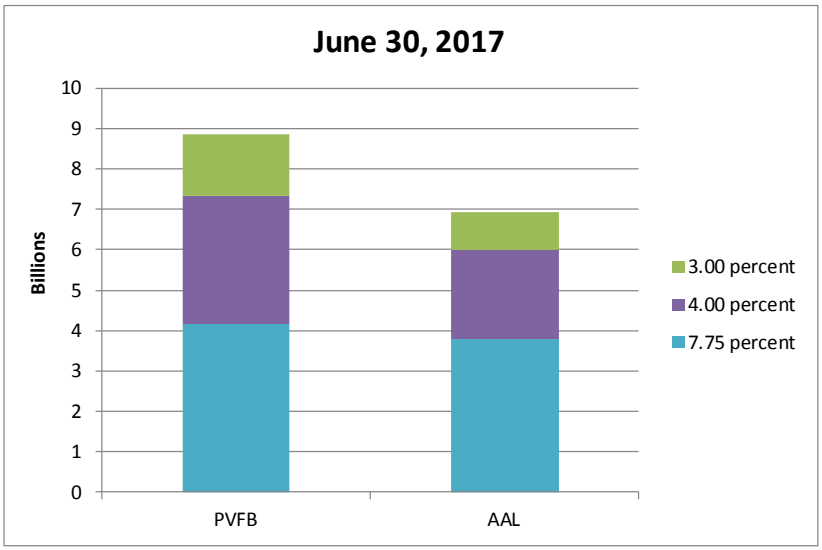
- Actual and Assumed Investment Rate of Return
- Actual and Assumed Mortality Rates
- Amortization Policy

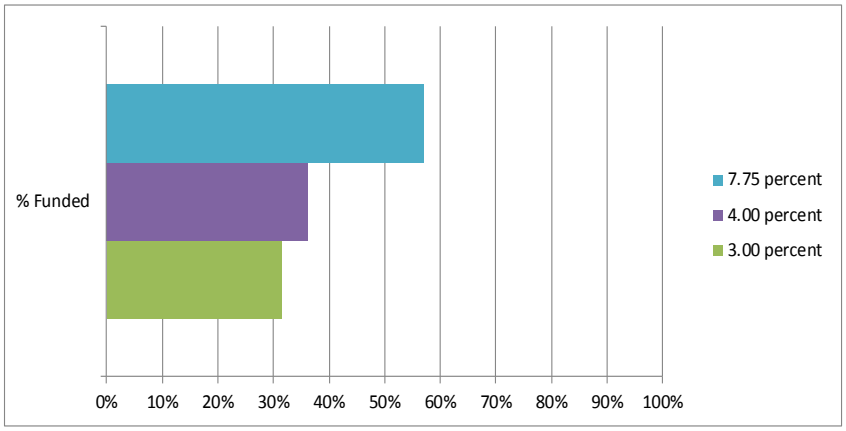
Summary of Key Valuation Results

Actuarial Present Value	June 30, 2017 (1) Actuarial Present Value	(2) Portion Covered By Future Normal Cost Contributions	(3) Actuarial Accrued Liabilities (1) - (2)	June 30, 2016 Actuarial Accrued Liabilities
Active Members				
Service retirement benefits based on service rendered before and likely to be rendered after valuation date	$ 1,485,844,642	$ 309,043,214	$ 1,176,801,428	$ 1,160,003,566
Disability benefits likely to be paid to present active members who become totally and permanently disabled*	22,250,958	12,238,926	10,012,032	10,062,974
Survivor benefits likely to be paid to widows and children of present active members who die before retiring	17,033,205	6,329,407	10,703,798	10,581,784
Separation benefits likely to be paid to present active members	50,593,137	29,855,838	20,737,299	16,411,369
Active Member Totals	$ 1,575,721,942	$ 357,467,385	$ 1,218,254,557	$ 1,197,059,693
Terminated Vested Members	96,137,842		96,137,842	94,531,170
Retired Lives	2,488,051,331		2,488,051,331	2,470,142,141
Total Actuarial Accrued Liability	$ 4,159,911,115	$ 357,467,385	$ 3,802,443,730	$3,761,733,004
Actuarial Value of Assets			2,172,787,144	2,086,654,348
Unfunded Actuarial Accrued Liability			$ 1,629,656,586	$1,675,078,656
Contribution Stabilization Reserve Fund			$ 219,560,390	$ 188,315,769
Total Amount Financed			$ 1,849,216,976	$1,863,394,425

* *The amounts presented for this category represent liabilities for retirement benefits for active members that may become participants of the long-term disability plan until they reach normal retirement eligibility. These are not liabilities for active members currently on long-term disability.*

Summary of Key Valuations Results – (Concluded)





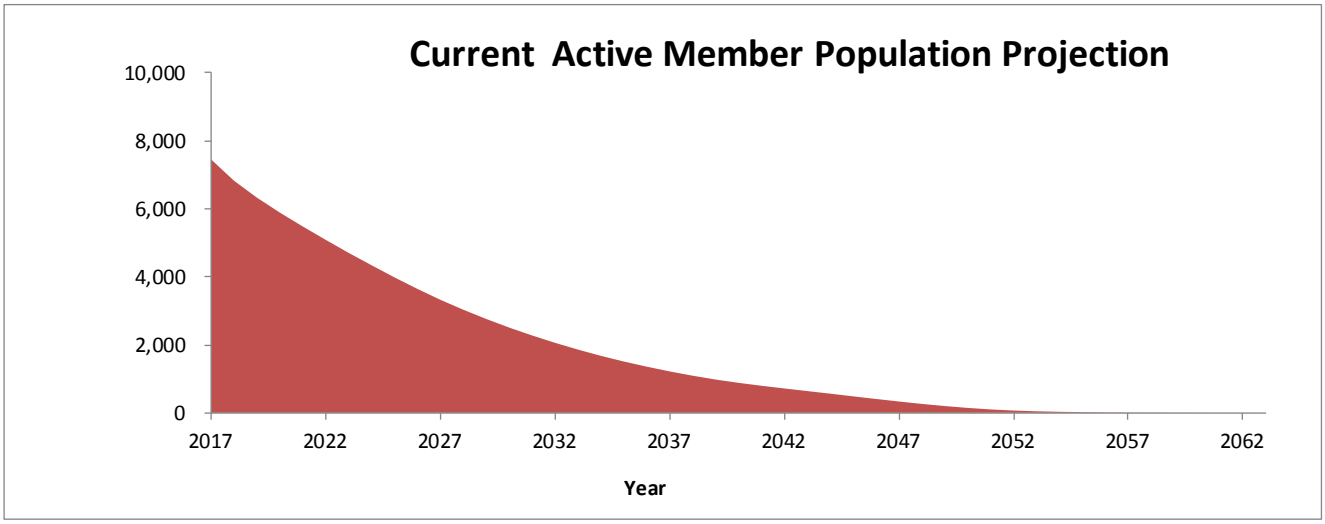
The first chart, above, shows the Present Value of Future Benefits (PVFB) and the Actuarial Accrued Liability (AAL) at three different interest rates. Using an interest rate of 3.00% (the current valuation price inflation assumption) we obtain a value of $8.9 billion PVFB and $6.9 billion AAL. This is akin to the cost (in uninflated or 2017 dollars) of all future expected benefit payments to current members of the System (PVFB) and the portion that is allocated to the post AAL.

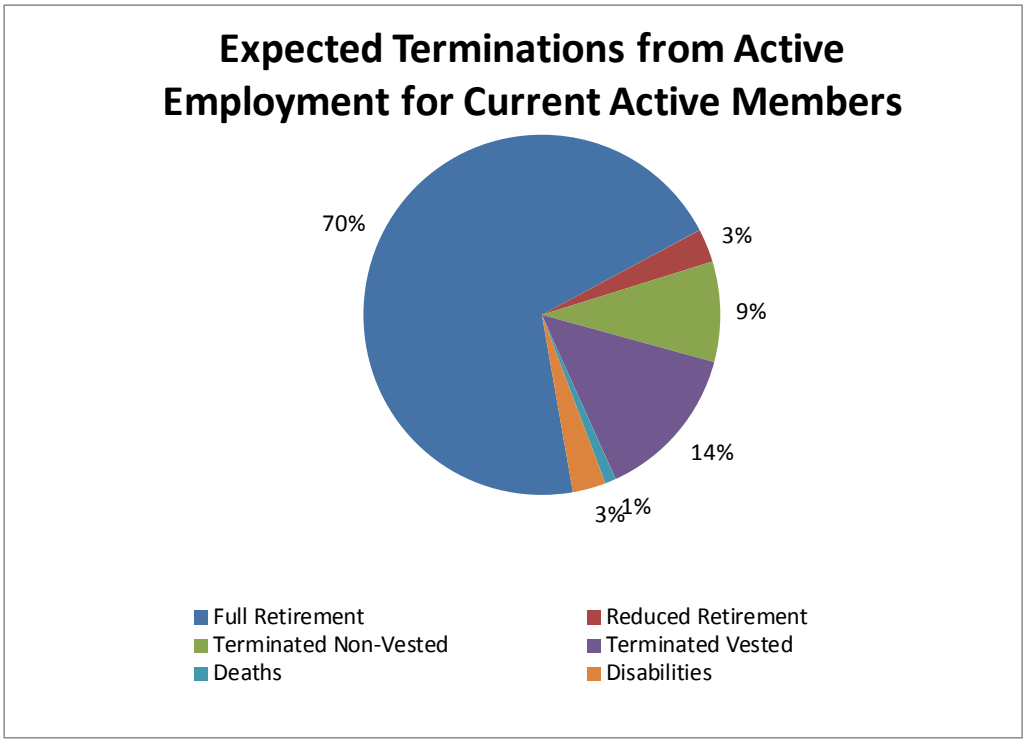
Using an interest rate of 4.00%, the PVFB is $7.3 billion, the AAL is $6.0 billion. The 4.00% interest rate is shown as an estimate of the return that might be achieved with "risk free" investments (U.S. Treasuries and their "safe" fixed income securities) in a 3.00% inflationary environment. The difference between these first two measurements is an estimate of the value of pre-funding the System with little to no investment risk. (Note: this rate is not intended to reflect the current inflation and interest rates environment.)

Using an investment return of 7.75% (the current valuation assumed investment return based on the current investment portfolio), the PVFB is $4.2 billion and the AAL is $3.8 billion. The difference between the 2nd and 3rd measures (4.00% interest and 7.75% interest) is the estimate of the reward the System expects to receive as a result of investing in a balanced portfolio instead of "risk free" securities.

The second chart funded status (AAL/Actuarial Value of Assets) at each interest rate. This illustration was not intended to satisfy the recommended actuarial standards regarding solvency measures.

Expected Development of Present Populations as of June 30, 2017

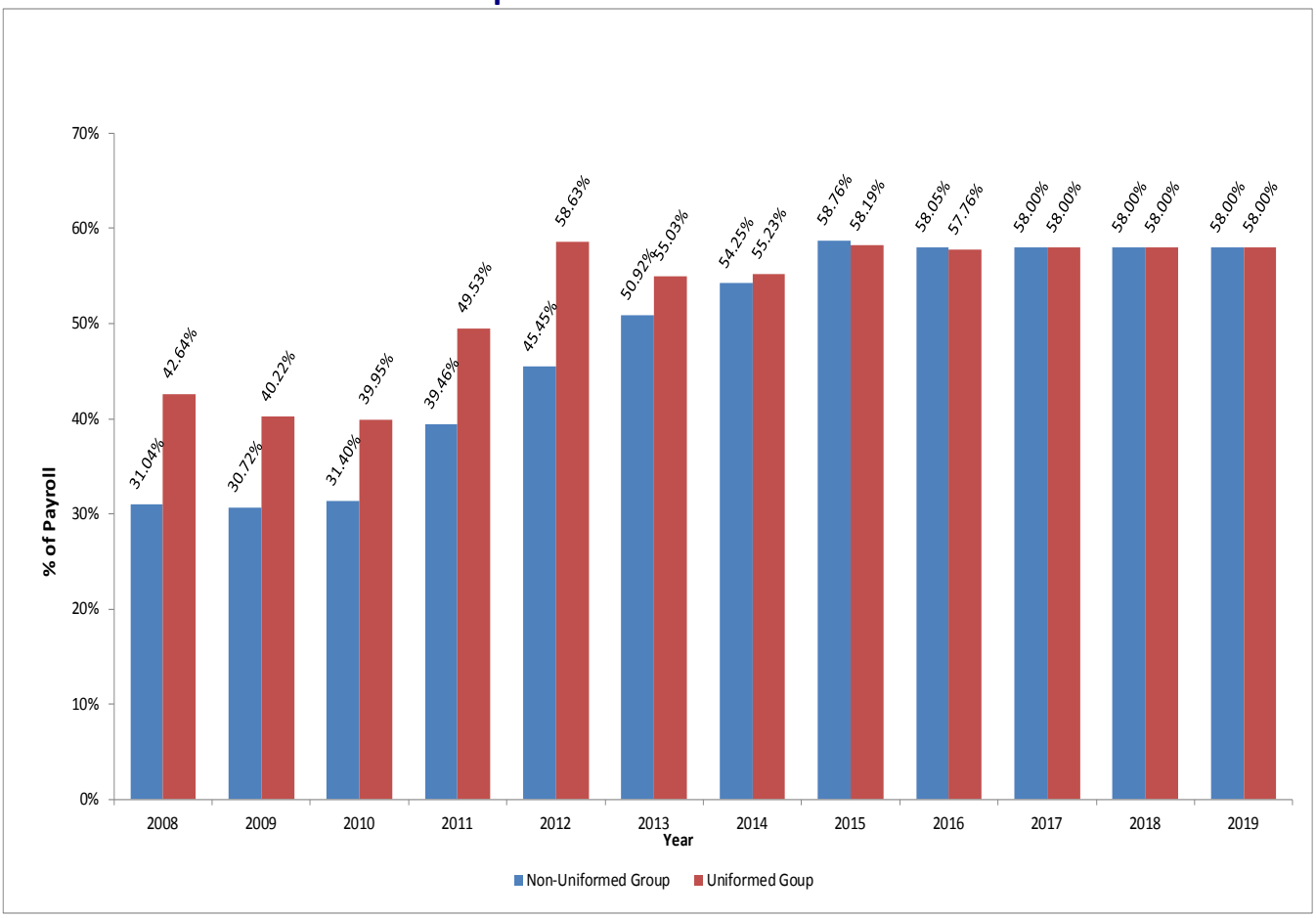




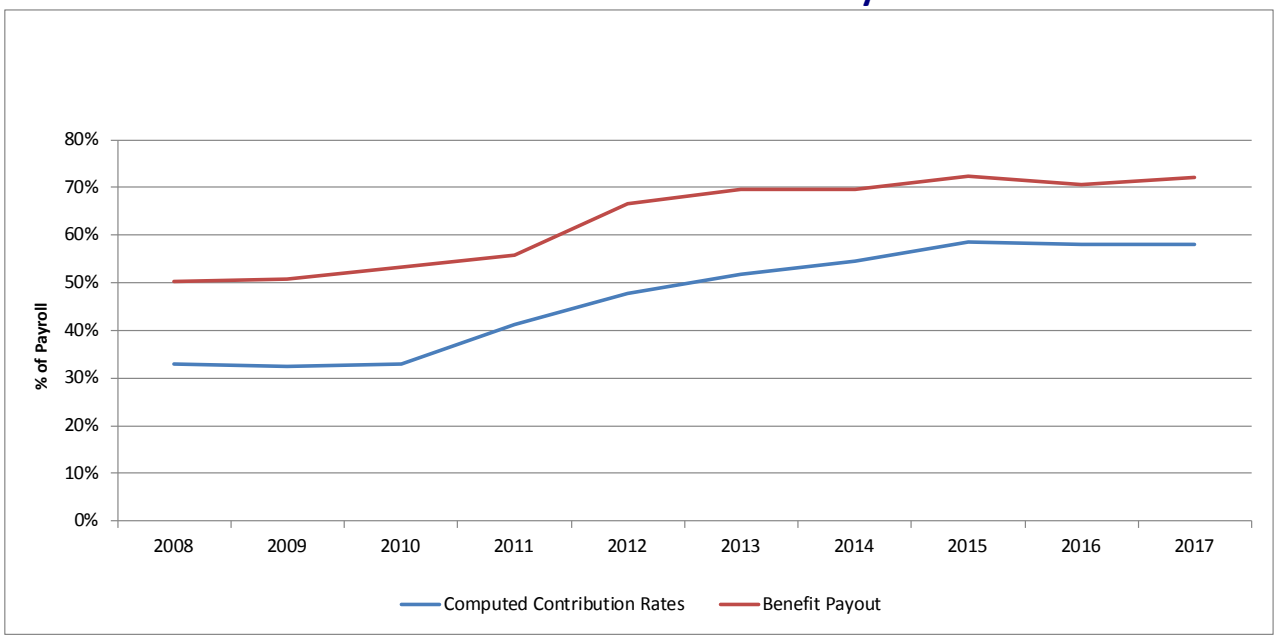
The charts above show the expected future development of the present population in simplified terms. The Retirement System presently covers 7,456 active members. Eventually, 9% of the population is expected to terminate covered employment prior to retirement and forfeit eligibility for an employer provided benefit. Of the present population, 87% is expected to receive monthly retirement benefits either by retiring directly from active service, or by separating from service with a vested benefit, and 4% of the present population is expected to become eligible for death-in-service or disability benefits. Within 10 years, over half of the covered membership is expected to consist of new hires.

Historical Contribution Rates and Benefit Payouts

Computed Contribution Rates

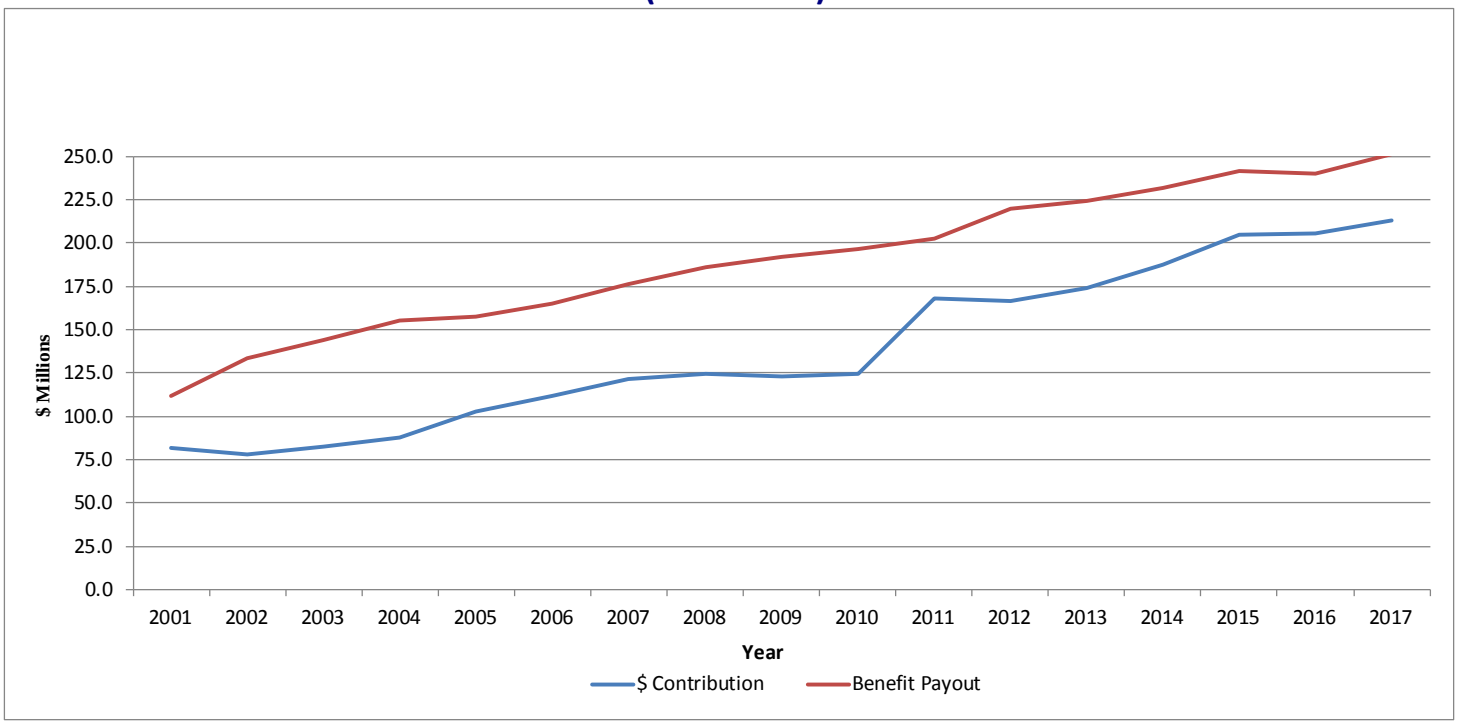


Contribution Rates vs. Benefit Payout



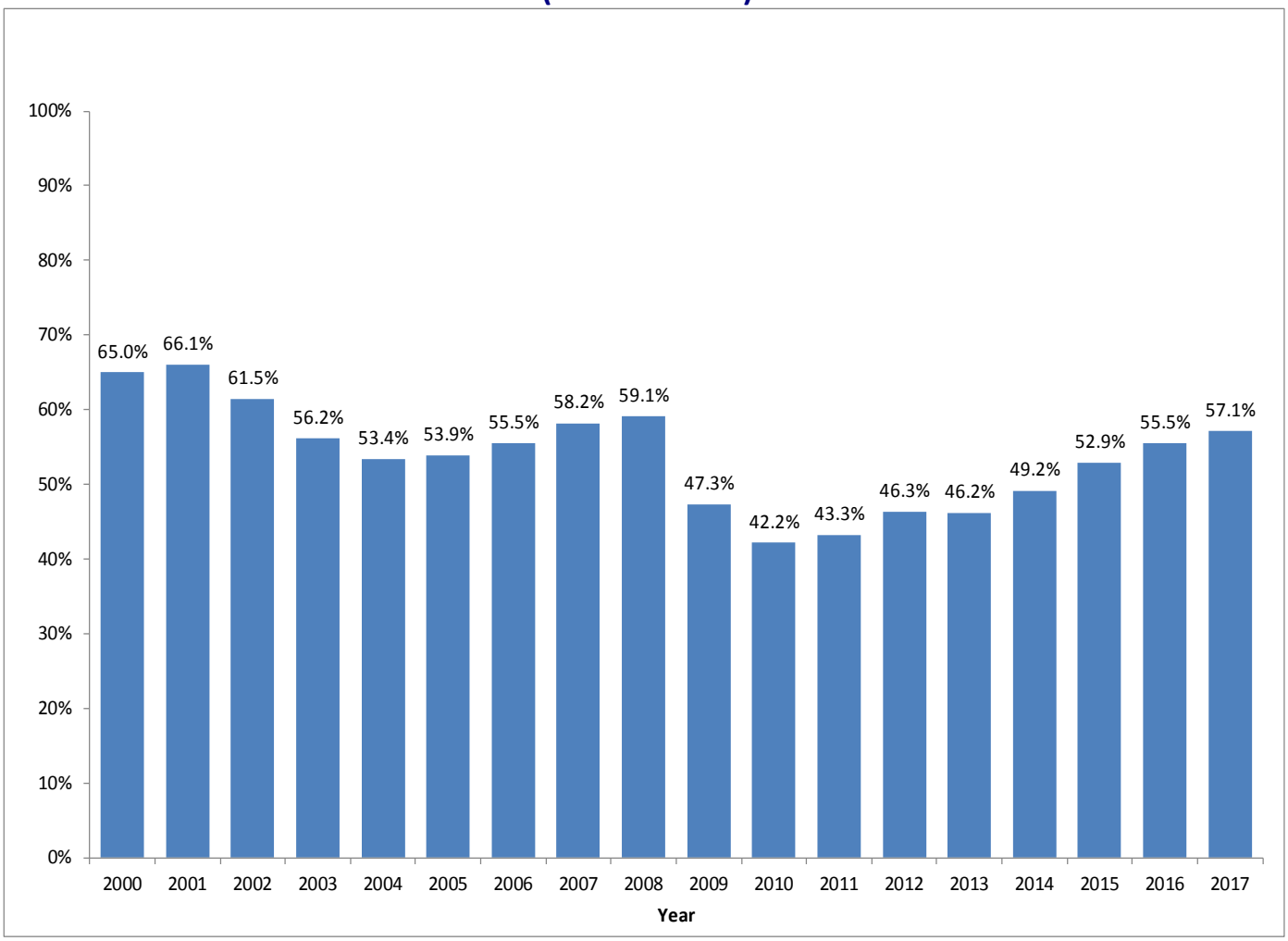
Historical Contribution Rates and Benefit Payouts (Concluded)

Contribution Dollars vs. Benefit Payout Dollars (in millions)



Historical Funded Ratios

Actuarial Value of Assets as Percents of Accrued Liabilities (Funded Ratio)



The funded status shown herein is not appropriate to assess the sufficiency of plan assets to cover the estimated cost of settling the Plan's benefit obligations. A funded status below 100% is an indication that additional contributions will be needed in the future, if experience is exactly as assumed. However, a funded status at or above 100% (by itself) cannot be used to determine the need for future contributions.

SECTION A

VALUATION RESULTS

Computed Contributions to Support Benefits for Fiscal Year 2019
Contributions Computed as of June 30, 2017

	Non-Uniformed Employees			Uniformed Patrol			
Contributions for	Closed & Year 2000	2011 Tier	Total	Closed & Year 2000	2011 Tier	Total	MPERS Total
Normal Cost							
Age & service benefits	9.80%	7.32%	9.17%	15.94%	12.30%	15.31%	10.70%
Disability benefits #	0.47%	0.57%	0.50%	0.24%	0.20%	0.23%	0.43%
Survivor benefits	0.19%	0.23%	0.20%	0.28%	0.20%	0.27%	0.22%
Separation benefits	1.14%	1.03%	1.11%	0.96%	0.43%	0.87%	1.05%
Total Normal Cost	11.60%	9.15%	10.98%	17.42%	13.13%	16.68%	12.40%
Member Contributions	0.00%	4.00%	1.02%	0.00%	4.00%	0.70%	0.94%
Employer Normal Cost	11.60%	5.15%	9.96%	17.42%	9.13%	15.98%	11.46%
Unfunded Actuarial Accrued Liabilities*			46.30%			40.28%	44.80%
Expense Provision			1.21%			1.21%	1.21%
Subtotal			57.47%			57.47%	57.47%
Disability Insurance			0.53%			0.53%	0.53%
Total Contribution Rate			58.00%			58.00%	58.00%
Projected Dollar Contribution			$163,660,967			$53,163,481	$216,824,448
Prior Year							
Total Contribution Rate			58.00%			58.00%	58.00%
Projected Dollar Contribution			$159,564,612			$51,556,310	$211,120,922

\# *Includes costs for benefits payable after conversion to normal retirement and/or benefits payable to survivors. Costs for disability benefits payable prior to conversion are shown under Disability Insurance which is outsourced.*

* *Amortized as a level-percentage of payroll over a 7-year amortization period for unfunded retiree liabilities and a 22-year amortization period for other unfunded liabilities from July 1, 2018.*

Development of Contribution Stabilization Reserve Fund as of June 30, 2017

	Non-Uniformed Employees	Uniformed Patrol	Total
Beginning of Year Contribution Stabilization Reserve Fund	$ 134,898,911	$ 53,416,858	$ 188,315,769
Growth (to maintain contribution rate)	23,193,407	8,051,214	31,244,621
Reduction (to match contribution rate)	-	-	-
End of Year Contribution Stabilization Reserve Fund	$ 158,092,318	$ 61,468,072	$ 219,560,390

At the September 25, 2014 Board meeting, the Board adopted the use of a contribution stabilization reserve fund that would result in an MPERS employer contribution of 58.00% of pay.

At the February 19, 2015 Board meeting, the Board adopted to cap the contribution stabilization reserve fund at $250 million. Furthermore, the Board adopted a motion that if MPERS experienced a loss, MPERS would deplete the entire reserve fund if a loss of that magnitude were to be realized.

In order to determine the current amount of the contribution stabilization reserve fund for the separate groups, we determined the amount of growth needed to achieve a 58.00% contribution rate for each group.

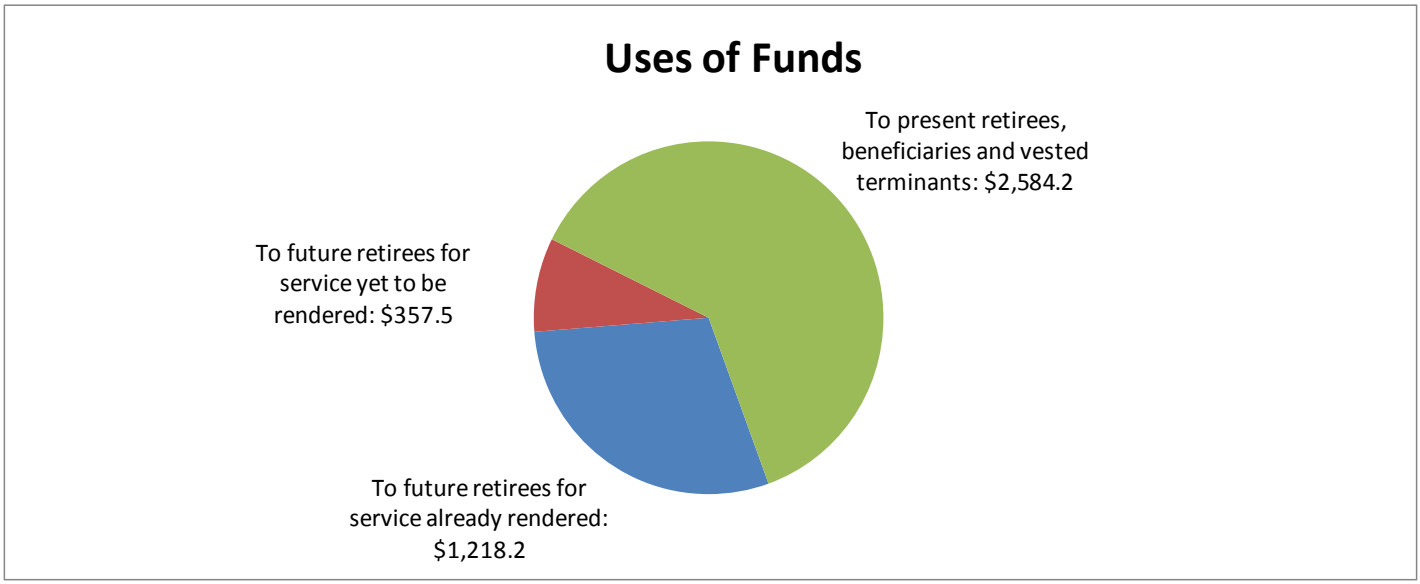
Development of Liabilities
as of June 30, 2017

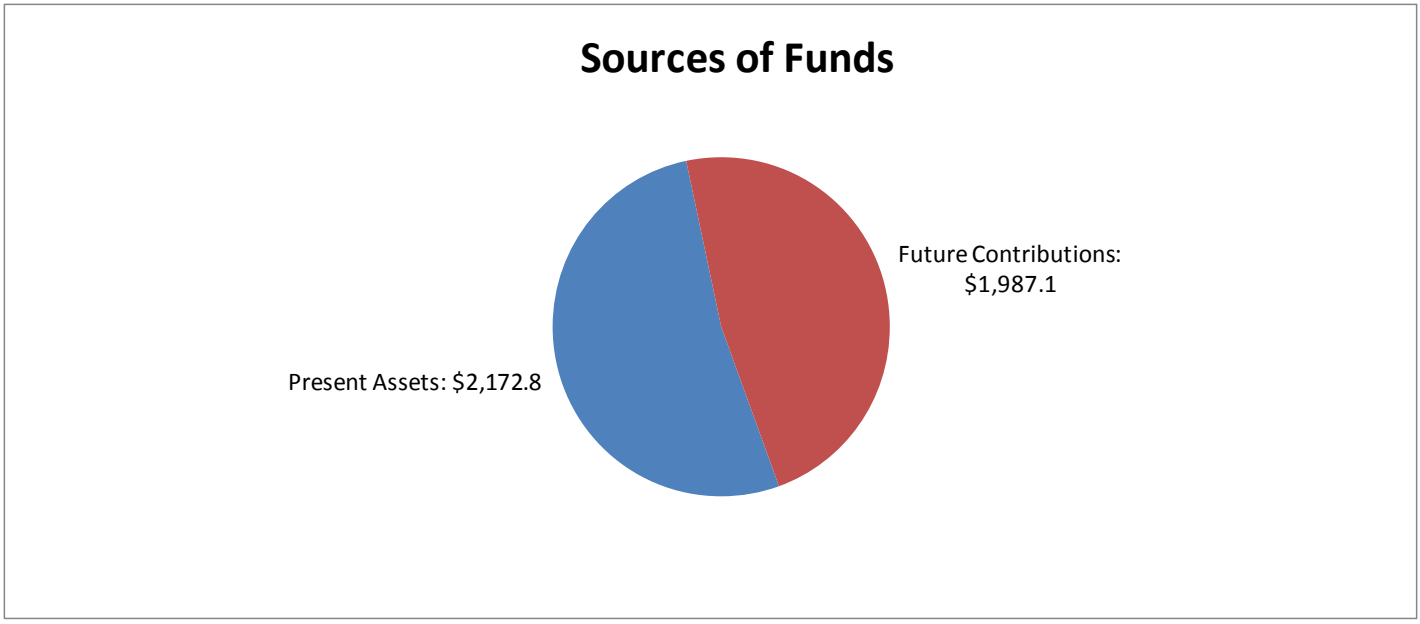
	Non-Uniformed Employees	Uniformed Patrol	Total
Present Value of Future Benefits - Inactives			
Retirees and Survivors	$1,843,968,336	$624,201,481	$2,468,169,817
Disability Pensioners	16,800,703	3,080,811	19,881,514
Vested Terminated Employees	82,505,432	13,632,410	96,137,842
Subtotal PVFB - Inactives	1,943,274,471	640,914,702	2,584,189,173
Present Value of Future Benefits - Actives			
Age & Service benefits	961,350,124	524,494,518	1,485,844,642
Normal and Work Related Disability benefits	18,192,683	4,058,275	22,250,958
Survivor benefits	11,759,385	5,273,820	17,033,205
Separation benefits	42,756,336	7,836,801	50,593,137
Subtotal PVFB - Actives	1,034,058,528	541,663,414	1,575,721,942
Total Present Value of Future Benefits	2,977,332,999	1,182,578,116	4,159,911,115
Less Present Value of Future Entry Age Normal Costs	224,390,000	133,077,385	357,467,385
Equals Actuarial Accrued Liability	2,752,942,999	1,049,500,731	3,802,443,730
Less Actuarial Value of Assets	1,546,400,364	626,386,780	2,172,787,144
Equals Unfunded Actuarial Accrued Liability	1,206,542,635	423,113,951	1,629,656,586
Plus Contribution Stabilization Reserve Fund	158,092,318	61,468,072	219,560,390
Equals Total Amount Financed	1,364,634,953	484,582,023	1,849,216,976
Amortization Payment on UAAL*	$ 130,646,600	$ 36,921,121	$ 167,567,721
as a % of Projected Payroll	46.30%	40.28%	44.80%

* *Amortized as a level-percentage of payroll over a 7-year amortization period for unfunded retiree liabilities and a 22-year amortization period for other unfunded liabilities from July 1, 2018.*

System Resources and Obligations
Sources and Uses of $4,159.9 Million
as of June 30, 2017

($ Millions)





Financing Unfunded Actuarial Accrued Liabilities (UAAL) Which Were Calculated Using a Wage Inflation Assumption of 3.50%* and an Investment Return Assumption of 7.75% Compounded Annually 7/22 Year Amortization*

Fiscal Year Ending June 30	Active Employee Payroll	Unfunded Actuarial Accrued Liability at End of Year	Annual UAAL Contributions During Fiscal Year		UAAL at Year End as % of Payroll
			Dollars	% of Payroll	
2017	$ 348,979,212	$ 1,629,656,586			
2018	361,193,484	1,587,947,971	$ 161,814,681	44.80%	439.6%
2019	373,835,256	1,537,126,693	167,478,195	44.80%	411.2%
2020	386,919,490	1,476,280,712	173,339,932	44.80%	381.5%
2021	400,461,672	1,404,420,103	179,406,829	44.80%	350.7%
2022	414,477,831	1,320,470,764	185,686,068	44.80%	318.6%
2023	428,984,555	1,223,267,634	192,185,081	44.80%	285.2%
2024	443,999,014	1,111,547,376	198,911,558	44.80%	250.3%
2025	459,538,979	983,940,475	205,873,463	44.80%	214.1%
2026	475,622,843	930,507,672	124,908,206	26.26%	195.6%
2027	492,269,643	868,394,740	129,279,993	26.26%	176.4%
2028	509,499,081	796,770,101	133,804,793	26.26%	156.4%
2029	527,331,549	714,732,169	138,487,961	26.26%	135.5%
2030	545,788,153	621,303,732	143,335,039	26.26%	113.8%
2031	564,890,738	515,425,884	148,351,766	26.26%	91.2%
2032	584,661,914	395,951,492	153,544,078	26.26%	67.7%
2033	605,125,081	261,638,138	158,918,120	26.26%	43.2%
2034	626,304,459	111,140,513	164,480,255	26.26%	17.7%
2035	648,225,115	(56,997,788)	170,237,064	26.26%	(8.8)%
2036	670,912,994	(244,353,117)	176,195,361	26.26%	(36.4)%
2037	694,394,949	(250,000,000)	(12,800,629)	(1.84)%	(36.0)%
2038	718,698,772	(250,000,000)	(18,660,886)	(2.60)%	(34.8)%
2039	743,853,229	(250,000,000)	(18,660,886)	(2.51)%	(33.6)%
2040	769,888,092	(250,000,000)	(18,660,886)	(2.42)%	(32.5)%

* *Amortized as a level-percentage of payroll over a 7-year amortization period for unfunded retiree liabilities and a 22-year amortization period for other unfunded liabilities from July 1, 2018. Payroll was assumed to increase 3.50%.*

Historical Funding Progress
June 30, 2017

Year Ending June 30	Actuarial Asset Value	Entry Age Accrued Liability	Unfunded Accrued Liability (UAAL)	Funded Ratio	Estimated Covered Payroll**	UAAL as a Percentage of Covered Payroll
2008	$ 1,783,902,280	$ 3,019,633,781	$ 1,235,731,501	59.08%	$ 375,600,448	329.00%
2009	1,471,496,660	3,113,393,645	1,641,896,985	47.26%	379,590,273	432.54%
2010#	1,375,844,573	3,258,866,925	1,883,022,352	42.22%	378,063,006	498.07%
2011	1,427,290,718	3,297,589,869	1,870,299,151	43.28%	362,654,376	515.72%
2012#	1,531,033,613	3,306,278,671	1,775,245,058	46.31%	341,637,559	519.63%
2013#	1,657,402,393	3,583,975,559	1,926,573,166	46.24%	329,481,506	584.73%
2014	1,795,264,291	3,650,241,741	1,854,977,450	49.18%	336,590,797	551.11%
2015	1,967,001,509	3,715,845,651	1,748,844,142	52.94%	342,264,593	510.96%
2016	2,086,654,348	3,761,733,004	1,675,078,656	55.47%	344,275,147	486.55%
2017	**2,172,787,144**	**3,802,443,730**	**1,629,656,586**	**57.14%**	**356,142,973**	**457.58%**

** *Values are estimated from contribution rate and amount.*
\# *New assumptions and/or methods adopted.*

Historical Employer Contributions
Non-Uniformed Group
June 30, 2017

Valuation Date	Fiscal Year Ending June 30,	Estimated Covered Payroll**	Actual Employer Contributions	Actual Employer Contribution %	Annually Determined Employer Contribution (ADEC) %	Annually Determined Employer Contribution (ADEC) $	Percentage of ADEC Contributed
June 30, 2006	2008	$ 307,243,438	$ 95,368,363	31.04%	31.04%	$ 95,368,363	100.00%
June 30, 2007	2009	311,718,239	95,759,843	30.72%	30.72%	95,759,843	100.00%
June 30, 2008	2010#	310,637,016	97,540,023	31.40%	31.40%	97,540,023	100.00%
June 30, 2009	2011	294,637,164	116,263,825	39.46%	39.46%	116,263,825	100.00%
June 30, 2010	2012#	268,722,565	122,134,406	45.45%	45.45%	122,134,406	100.00%
June 30, 2011	2013	254,928,368	129,809,525	50.92%	50.92%	129,809,525	100.00%
June 30, 2012	2014#	259,720,022	140,898,112	54.25%	54.25%	140,898,112	100.00%
June 30, 2013	2015	258,737,537	152,034,177	58.76%	58.76%	152,034,177	100.00%
June 30, 2014	2016	260,714,141	151,344,559	58.05%	58.05%	151,344,559	100.00%
June 30, 2015	**2017**	**269,522,202**	**156,322,877**	**58.00%**	**58.00%**	**156,322,877**	**100.00%**

** *Values are estimated from contribution rate and amount.*

\# *New assumptions and/or methods adopted.*

Includes non-uniformed employees of MoDOT, Patrol, and MPERS.

This information is presented in draft form for review by the System's auditor. Please let us know if there are any items that the auditor changes so that we may maintain consistency with the System's financial statements.

Historical Employer Contributions
Uniformed Patrol Group
June 30, 2017

Valuation Date	Fiscal Year Ending June 30,	Estimated Covered Payroll**	Actual Employer Contributions	Actual Employer Contribution %	Annually Determined Employer Contribution (ADEC) %	Annually Determined Employer Contribution (ADEC) $	Percentage of ADEC Contributed
June 30, 2006	2008	$ 68,357,010	$ 29,147,429	42.64%	42.64%	$ 29,147,429	100.00%
June 30, 2007	2009	67,872,034	27,298,132	40.22%	40.22%	27,298,132	100.00%
June 30, 2008	2010#	67,425,990	26,936,683	39.95%	39.95%	26,936,683	100.00%
June 30, 2009	2011	68,017,212	33,688,925	49.53%	49.53%	33,688,925	100.00%
June 30, 2010	2012#	72,914,994	42,750,061	58.63%	58.63%	42,750,061	100.00%
June 30, 2011	2013	74,553,138	41,026,592	55.03%	55.03%	41,026,592	100.00%
June 30, 2012	2014#	76,870,775	42,455,729	55.23%	55.23%	42,455,729	100.00%
June 30, 2013	2015	83,527,056	48,604,394	58.19%	58.19%	48,604,394	100.00%
June 30, 2014	2016	83,561,006	48,264,837	57.76%	57.76%	48,264,837	100.00%
June 30, 2015	**2017**	**86,620,771**	**50,240,047**	**58.00%**	**58.00%**	**50,240,047**	**100.00%**

** *Values are estimated from contribution rate and amount.*

\# *New assumptions and/or methods adopted.*

This information is presented in draft form for review by the System's auditor. Please let us know if there are any items that the auditor changes so that we may maintain consistency with the System's financial statements.

Development of Gain/(Loss)
July 1, 2016 to June 30, 2017

	UAAL =	AAL -	Assets
Beginning of Year Values (at July 1)	$ 1,675,078,656	$ 3,761,733,004	$ 2,086,654,348
Normal Cost	49,933,711	49,933,711	0
Contributions	(213,198,963)	0	213,198,963
Disbursements	0	(255,799,610)	(255,799,610)
Interest	123,492,067	283,557,004	160,064,937
Expected Value Before Any Changes	1,635,305,471	3,839,424,109	2,204,118,638
Effect of Data Improvements*	(861,636)	(861,636)	0
Effect of Changes in Assumptions & Methods	0	0	0
Effect of Adjustment	0	0	0
Expected Value After Changes	1,634,443,835	3,838,562,473	2,204,118,638
End of Year Values (at June 30)	1,629,656,586	3,802,443,730	2,172,787,144
Gain/(Loss) for Year	$ 4,787,249	$ 36,118,743	$ (31,331,494)

** Result of receiving information identifying those members who retired from deferred status and are, therefore, not eligible for the $5,000 death benefit.*

Development of Gain/(Loss)
July 1, 2016 to June 30, 2017

	Total	Non-Uniformed	Uniformed
Beginning of Year UAAL (at July 1)	$ 1,675,078,656	$ 1,251,609,457	$ 423,469,199
Normal Cost	49,933,711	33,890,535	16,043,176
Contributions	(213,198,963)	(161,332,987)	(51,865,976)
Interest	123,492,067	92,061,338	31,430,729
Net Change in LTD Assets	0	0	0
Expected Value Before Any Changes	1,635,305,471	1,216,228,343	419,077,128
Effect of Data Improvements*	(861,636)	(803,466)	(58,170)
Effect of Changes in Assumptions & Methods	0	0	0
Effect of Adjustment	0	0	0
Expected Value After Changes	1,634,443,835	1,215,424,877	419,018,958
End of Year UAAL (at June 30)	1,629,656,586	1,206,542,635	423,113,951

Aggregate Gain/(Loss) for Year	$ 4,787,249	$ 8,882,242	$ (4,094,993)
Gain/(Loss) as a % of Beginning of Year Liabilities	0.13%	0.32%	(0.40)%

Asset Gain/(Loss) for Year	$ (31,331,494)	$ (22,210,274)	$ (9,121,220)
Liability Gain/(Loss) for Year	36,118,743	31,092,516	5,026,227
Aggregate Gain/(Loss) for Year	$ 4,787,249	$ 8,882,242	$ (4,094,993)

* *Result of receiving information identifying those members who retired from deferred status and are, therefore, not eligible for the $5,000 death benefit.*

Risk Measures

($ Thousands)

Valuation Date June 30	(1) Accrued Liabilities (AAL)	(2) Market Value of Assets	(3) Unfunded AAL (1)-(2)	(4) Valuation Payroll	(5) Funded Ratio (2)/(1)	(6) Liability/ Payroll (1)/(4)	(7) Assets/ Payroll (2)/(4)	(8) Unfunded/ Payroll (3)/(4)	(9) Portfolio Rate of Return	(10) 10-Year Trailing Average	(11) Non-Investment Net Cash Flow	(12) Non-Investment Net Cash Flow Percent of Beginning of Year Assets (11)/(12[Prior Year])
2016	$ 3,761,733	$ 1,992,074	$ 1,769,659	$ 339,799	53.0%	1,107.0%	586.2%	520.8%	1.1%	N/A	$ (38,725)	(1.9)%
2017	3,802,444	2,169,775	1,632,669	348,979	57.1%	1,089.6%	621.8%	467.8%	11.2%	N/A	(42,601)	(2.1)%

(5) The funded ratio is the most widely known measure of a plan's financial strength, but the trend in the funded ratio is much more important than the absolute ratio. The funded ratio should trend to 100%. As it approaches 100%, it is important to re-evaluate the level of investment risk in the portfolio and potentially to re-evaluate the assumed rate of return.

(6) and (7) the ratio of liabilities and assets to payroll gives an indication of both maturity and volatility. Many systems have values between 500% and 700%. Values significantly above that range may indicate difficulty in supporting the benefit level as a level % of payroll.

(8) The ratio of unfunded liability to payroll gives an indication of the plan's sensitivity to differences between assumed and actual experience related to the employer contributions. A value above approximately 300% or 400% may indicate high volatility relative to small gains and losses.

(9) and (10) Investment return is probably the largest single risk that most systems face. The year-by-year return and the 10-year geometric average give an indicator of the realism of the System's assumed return.

(11 and 12) Non-Divestment Net Cash Flow is a measure of both risk and maturity. For a mature plan the absolute value of (12) should be in the order of the assumed real rate of return over wage inflation (currently assumed to be 4.25%). A more negative number indicates a plan that is more at risk of fund depletion and more sensitive to annual gains and losses.

SECTION B

SUMMARY OF BENEFITS

Missouri Department of Transportation and Highway Patrol Employees' Retirement System
Summary of Benefit Provisions Evaluated as of June 30, 2017

Closed Plan	Year 2000 Plan	2011 Tier

Participation

Participants include:

All MPERS active members, vested terminated members, disability recipients, retirees and survivors who first became members prior to July 1, 2000 and who do not elect to transfer to the Year 2000 Plan at retirement.

Participation

Participants include:

1. All active employees who first became members on or after July 1, 2000 but prior to January 1, 2011.
2. Closed Plan active members and vested former members who elect to transfer to the Year 2000 Plan at retirement.
3. Closed Plan retirees who elected to transfer to the Year 2000 Plan during the election window from July 1, 2000 through July 1, 2001, and their survivors.
4. Closed Plan members who left state employment prior to becoming vested (not eligible for a future retirement benefit) and return to work in a benefit eligible position on or after July 1, 2000.

Participation

Participants include:

1. All employees who first become members on or after January 1, 2011.

Closed Plan	Year 2000 Plan	2011 Tier
Normal Retirement Eligibility (unreduced benefit)	**Normal Retirement Eligibility (unreduced benefit)**	**Normal Retirement Eligibility (unreduced benefit)**
Non-Uniformed Employees: The earlier of attaining: 1. Age 65 with at least 4 years of creditable service. 2. Age 60 with at least 15 years of creditable service. 3. Age 48 with age plus creditable service equal to 80 or more. 4. Age 65 with at least 5 years of service (deferred).*	***Non-Uniformed Employees:*** The earlier of attaining: 1. Age 62 with at least 5 years of creditable service. 2. Age 48 with age plus creditable service equal to 80 or more.	***Non-Uniformed Employees:*** The earlier of attaining: 1. Age 67 with at least 10 years of creditable service. 2. Age 55 with age plus creditable service equal to 90 or more.
Uniformed Patrol Employees Only: The earlier of attaining: 1. Age 55 with at least 4 years of creditable service. 2. Mandatory retirement at age 60. 3. Age 48 with age plus creditable service equal to 80 or more.	***Uniformed Patrol Employees Only:*** The earlier of attaining: 1. Mandatory retirement at age 60. 2. Age 48 with age plus creditable service equal to 80 or more.	***Uniformed Patrol Employees Only:*** The earlier of attaining: 1. Age 55 with at least 10 years of creditable service. 2. Mandatory retirement at age 60.
Final Average Pay Used for Benefit Determination	**Final Average Pay Used for Benefit Determination**	**Final Average Pay Used for Benefit Determination**
Final Average Pay is the average annual pay of a member for the three consecutive years of service during which pay was highest (overtime pay is included for purposes of determining average pay). Employees retiring after reaching retirement eligibility will receive 1/12 of a year of creditable service for every 168 hours of unused sick leave (usable only for benefit computation, not eligibility).	Final Average Pay is the average annual pay of a member for the three consecutive years of service during which pay was highest (overtime pay is included for purposes of determining average pay). All vested members will receive 1/12 of a year of creditable service for every 168 hours of unused sick leave (usable only for benefit computation, not eligibility).	Final Average Pay is the average annual pay of a member for the three consecutive years of service during which pay was highest (overtime pay is included for purposes of determining average pay). All vested members will receive 1/12 of a year of creditable service for every 168 hours of unused sick leave (usable only for benefit computation, not eligibility).

**See Chapter 104.010.1(32) RSMo*

Closed Plan	Year 2000 Plan	2011 Tier
Normal Retirement Benefit Amount	**Normal Retirement Benefit Amount**	**Normal Retirement Benefit Amount**
Non-Uniformed Employees: Life Benefit: 1.6% of final average pay times years of creditable service. ***Uniformed Patrol Employees:*** Life Benefit: 2.1333% of final average pay times years of creditable service. Special Benefit: $90 per month payable until age 65. Offset by any amount earned from gainful employment. This benefit does not apply to uniformed members hired on or after January 1, 1995.	***All Employees:*** Life Benefit: 1.7% of final average pay times years of creditable service. Temporary Benefit: If member retires between ages 48 and 62 with age plus creditable service equal to 80 or more, a temporary benefit is payable in the amount of 0.8% of final average pay times years of creditable service until attainment of age 62 or death, whichever occurs first. All Uniformed Patrol members are eligible for the temporary benefit until age 62.	***All Employees:*** Life Benefit: 1.7% of final average pay times years of creditable service. Temporary Benefit: If member retires between ages 55 and 62 with age plus creditable service equal to 90 or more, a temporary benefit is payable in the amount of 0.8% of final average pay times years of creditable service until attainment of age 62 or death, whichever occurs first. All Uniformed Patrol members are eligible for the temporary benefit until age 62.
Early Retirement (reduced benefit)	**Early Retirement (reduced benefit)**	**Early Retirement (reduced benefit)**
Eligibility: Non-Uniformed Employees Age 55 with at least 10 years of creditable service. ***Amount:*** Normal retirement amount reduced by 0.6% for each month that retirement precedes eligibility for normal retirement. ***Uniformed Patrol*** members are not eligible for early retirement.	***Eligibility: All Employees*** Age 57 with at least 5 years of creditable service. ***Amount:*** Normal retirement amount reduced by 0.5% for each month that retirement precedes eligibility for normal retirement.	***Eligibility: All Active Non-Uniformed Employees*** Age 62 with at least 10 years of creditable service. ***Amount:*** Normal retirement amount reduced by 0.5% for each month that retirement precedes eligibility for normal retirement. ***Uniformed Patrol*** members are not eligible for early retirement.

Closed Plan	Year 2000 Plan	2011 Tier
Vested Deferred Benefits	**Vested Deferred Benefits**	**Vested Deferred Benefits**
Eligibility: All Employees Fully vested in accrued pension with 5 years of creditable service. The benefit will commence at the age the individual is eligible for early or normal retirement, considering years of creditable service.	***Eligibility: All Employees*** Fully vested in accrued pension with 5 years of creditable service. The benefit will commence at the age the individual is eligible for early or normal retirement considering years of creditable service. Normal retirement eligibility begins at age 62.	***Eligibility: All Employees*** Fully vested in accrued pension with 10 years of creditable service. The benefit will commence at the age the individual is eligible for normal retirement considering years of creditable service. Normal retirement eligibility begins at age 67.
Minimum Base Benefit	**Minimum Base Benefit**	**Minimum Base Benefit**
Receive a monthly base benefit of no less than $15 for each full year of creditable service. Must be eligible to receive a normal or early retirement benefit the first of the month immediately following the date you leave state employment. Not required to immediately start drawing a benefit.	Same.	Same.
Death Prior to Retirement	**Death Prior to Retirement**	**Death Prior to Retirement**
The spouse of the member who dies after accruing 5 years of creditable service may elect to receive an annuity as if the employee had retired on the date of death and elected a joint and 100% survivor annuity. If no eligible spouse survives or upon the death of the spouse, 80% of the member's accrued annuity will be paid to eligible children until age 21. If the member has 3 or more, but less than 5 years of creditable service, the surviving spouse may elect to receive an annuity equal to 25% of the accrued benefit. If the death is duty-related, there is no service requirement and the minimum annuity is 50% of the final average pay (FAP) to the surviving spouse or eligible children.	The spouse of the member who dies after accruing 5 years of creditable service may elect to receive an annuity as if the employee had retired on the date of death and elected a joint and 100% survivor annuity. If no eligible spouse survives or upon the death of the spouse, 80% of the member's accrued annuity will be paid to eligible children until age 21. If the death is duty related, there is no service requirement and the minimum annuity is 50% of the final average pay (FAP) to the surviving spouse or eligible children.	The spouse of the member who dies after accruing 10 years of creditable service may elect to receive an annuity as if the employee had retired on the date of death and elected a joint and 100% survivor annuity. If no eligible spouse survives or upon the death of the spouse, 80% of the member's accrued annuity will be paid to eligible children until age 21. If the death is duty related, there is no service requirement and the minimum annuity is 50% of the final average pay (FAP) to the surviving spouse or eligible children.

Closed Plan	Year 2000 Plan	2011 Tier
Death After Retirement	**Death After Retirement**	**Death After Retirement**
The benefit payable is 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. A member who is not married at retirement but marries thereafter may designate a spouse as beneficiary. Additionally, a member may designate a new spouse as beneficiary in the event of the death of the spouse the member was married to at the date of retirement. The election must be completed within one year of the date of marriage. For period certain annuities, beneficiaries may be changed at any time.	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. Additionally, a member may designate a new spouse as beneficiary in the event of the death of the spouse the member was married to at the date of retirement. The election must be completed within one year of the date of marriage. For period certain annuities, beneficiaries may be changed at any time.	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. Additionally, a member may designate a new spouse as beneficiary in the event of the death of the spouse the member was married to at the date of retirement. The election must be completed within one year of the date of marriage. For period certain annuities, beneficiaries may be changed at any time.
Pop-Up Provision	**Pop-Up Provision**	**Pop-Up Provision**
Benefits to members who choose a reduced 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 reduced survivor option.	Same.	Same.

Closed Plan	Year 2000 Plan	2011 Tier
$5,000 Death Benefit MPERS provides a $5,000 death benefit for a designated beneficiary(ies) of members who retire from service or were approved for normal or work-related disability benefits after September 28, 1985. Members who die while on terminated vested status or long-term disability status do not qualify for this benefit. Long-term disability recipients who retire on or after September 28, 1985 are eligible to receive this benefit.	**$5,000 Death Benefit** MPERS provides a $5,000 death benefit for a designated beneficiary(ies) of members who retire from service or were approved for work-related disability benefits. Members who die while on terminated vested status or long-term disability status do not qualify for this benefit. Long-term disability recipients who retire are eligible to receive this benefit.	**$5,000 Death Benefit** MPERS provides a $5,000 death benefit for a designated beneficiary(ies) of members who retire from service or were approved for work-related disability benefits. Members who die while on terminated vested status or long-term disability status do not qualify for this benefit. Long-term disability recipients who retire are eligible to receive this benefit.
Purchase of Service **Military:** Prior to retirement, qualifying members may purchase up to a maximum of 4 years military service that includes active service, and/or active and inactive duty training from which they were honorably discharged. All months the member is eligible for must be purchased. This service credit ***can*** be used to satisfy the vesting requirement. Periods of military service cannot coincide with employment in a state agency.	**Purchase of Service** **Military:** Prior to retirement, qualifying members may purchase up to a maximum of 4 years military service that includes active service from which they were honorably discharged. All months the member is eligible for must be purchased. This service credit ***cannot*** be used to satisfy the vesting requirement. Periods of military service cannot coincide with employment in a state agency.	**Purchase of Service** **Military:** Not available.
Police Service: Prior to retirement, uniformed patrol members only, may purchase up to a maximum of 4 years police service. Members must purchase all months of service they are eligible for.	**Police Service:** Not available.	**Police Service:** Not available.

Closed Plan	Year 2000 Plan	2011 Tier
Portability: Section 105.691 allows vested members to acquire (purchase/transfer) service credit for any non-federal, full-time public sector employment within Missouri. Service may be purchased/transferred by using the member's own money and/or using the value of the retirement benefit in the prior retirement plan if that plan has an agreement with MPERS. Any non-federal public employment **not covered** by a retirement plan must be purchased.	**Portability:** Same as Closed Plan Section 105.691. In addition, Section 104.1090 provides that in-state vested service with another retirement system may be granted after 10 years of state service if the other retirement plan agrees to transfer assets equal to the accrued liability to MPERS. Service may be purchased/transferred by using the member's own money and/or using the value of the retirement benefit in the prior retirement plan if that plan has an agreement with MPERS. Any non-federal public employment **not covered** by a retirement plan must be purchased.	**Portability:** Same as Closed Plan Section 105.691.
Public Employment Prior Service (Subsidized Purchase)	**Public Employment Prior Service (Subsidized Purchase)**	**Public Employment Prior Service (Subsidized Purchase)**
Section 104.040.6 allows, prior to retirement, members may purchase up to a maximum of 4 years full-time "public employment." Public employment refers to employment with a city, county, municipality, public school, or other political subdivision. Federal and out-of-state employment is not eligible. Members must purchase all months of service they are eligible for up to 4 years.	Not available.	Not available.
Disability	**Disability**	**Disability**
Benefits that may be payable during the period of disability (whether Normal, Work-related, or LTD) are administered through a separate program and were not considered for purposes of the valuation. Normal retirement benefits become payable at the time a disabled member becomes 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.	Benefits that may be payable during the period of disability (whether Normal, Work-related, or LTD) are administered through a separate program and were not considered for purposes of the valuation. Normal retirement benefits become payable at the time a disabled member becomes 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 increased by 80% of CPI to the retirement date.	Benefits that may be payable during the period of disability (whether Normal, Work-related, or LTD) are administered through a separate program and were not considered for purposes of the valuation. Normal retirement benefits become payable at the time a disabled member becomes 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 increased by 80% of CPI to the retirement date.

Closed Plan	Year 2000 Plan	2011 Tier
Post-Retirement Benefit Adjustments	**Post-Retirement Benefit Adjustments**	**Post-Retirement Benefit Adjustments**
For active and inactive employees hired prior to August 28, 1997 and current retirees, the benefits of pensioners and their beneficiaries are increased annually by 80% of the increase in the Consumer Price Index (subject to a maximum increase of 5% and a minimum of 4%). These increases are made until the total of the increases reaches 65% of initial benefit at which time the increases will have the minimum removed. For employees hired on or after August 28, 1997 the annual percentage increase is equal to the lesser of: i) 80% of the CPI-U increase, or ii) 5%.	Benefits are increased to retired members (including survivors) annually in accordance with the following: Annual benefit percentage increase equal to the lesser of: i) 80% of the CPI-U increase, or ii) 5%.	Benefits are increased to retired members (including survivors) annually in accordance with the following: Annual benefit percentage increase equal to the lesser of: i) 80% of the CPI-U increase, or ii) 5%.
Member Contributions	**Member Contributions**	**Member Contributions**
None.	None.	4% contributions with interest credited annually at a rate equal to the investment rate published by the US Department of Treasury for 52-week treasury bill, nearest the preceding July 1st. The state of Missouri employer shall pick up and pay the contributions. A deduction shall be made from each member's compensation equal to the amount of the member's contributions picked up by the employer.

The Closed Plan and Year 2000 Plan
BackDROP Option

Legislation effective January 1, 2002 provides a Deferred Retirement Option Provision (BackDROP) to members of MPERS. It is available in both the Closed Plan and the Year 2000 Plan.

To be eligible to participate in the BackDROP, a member must have been eligible to retire under normal 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.

The BackDROP period for the accumulation of the BackDROP amount is from the retroactive starting date to the annuity starting date. This results in a BackDROP period of one to five years depending upon the individual situation.

A theoretical BackDROP account is accumulated that includes 90% of the value of the benefit payments that would have been paid during the BackDROP period had the member retired at the retroactive starting date. These payments include applicable post-retirement benefit increases. These payments do not include any reduction for spouse options during the BackDROP period. The member may choose the BackDROP period in twelve-month increments or their maximum period, not to exceed 60 months.

The member is paid the resulting lump sum value of the BackDROP account as of the annuity starting date or as three equal annual installments beginning at the annuity starting date.

The annuity benefit payable from the actual retirement date is computed with years of service and final 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.

Sample Benefit Computation for Closed Plan Members
Retiring July 1, 2017
Non-Uniformed Employee

	Data	Description
A.	$40,000	Final Average Pay
B.	20	Years of Creditable Service
C.	60	Age of Retiree
D.	50%	Automatic percentage to continue to spouse after retirant's death

Sample Computation Steps

E.	Retirement Benefit Formula:	0.016 x 20 x $40,000 = $12,800

Benefit payable to:

F.	Retiree while spouse is alive (E)	$ 12,800
G.	Spouse after retiree's death (D x E)	$ 6,400
H.	Retiree after spouse's death	$ 12,800

Year Ended June 30	Annual Amount Payable if Price Inflation is 3.0% and Post-Retirement Increases are 2.4%
2017	$12,800
2018	13,107
2019	13,422
2020	13,744
2021	14,074
2022	14,412
2023	14,757
2024	15,112
2025	15,474
2026	15,846

Sample Benefit Computation for Closed Plan Members
Retiring July 1, 2017
Uniformed Patrol

	Data	Description
A.	$40,000	Final Average Pay
B.	20	Years of Creditable Service
C.	60	Age of Retiree
D.	50%	Automatic percentage to continue to spouse after retirant's death

Sample Computation Steps

E.	Retirement Benefit Formula:	0.021333 x 20 x $40,000 = $17,066

Benefit payable to:

F.	Retiree while spouse is alive (E)	$ 17,066
G.	Spouse after retiree's death (D x E)	$ 8,533
H.	Retiree after spouse's death	$ 17,066

Amounts shown below do not include the $1,080 annual supplementary benefit payable to age 65.

Year Ended June 30	Annual Amount Payable if Price Inflation is 3.0% and Post-Retirement Increases are 2.4%
2017	$17,066
2018	17,476
2019	17,895
2020	18,324
2021	18,764
2022	19,215
2023	19,676
2024	20,148
2025	20,632
2026	21,127

Sample Benefit Computation for Year 2000 Plan Members Retiring July 1, 2017

	Data	Description
A.	$40,000	Final Average Pay
B.	20	Years of Creditable Service
C.	60 (67 for 2011 Tier)	Age of Retiree
D.	0%	Automatic percentage to continue to spouse after retirant's death

E1. Retirement Benefit Formula:	0.017 x 20 x $40,000 = $13,600
E2. Supplemental Benefit Formula:	.008 x 20 x $40,000 = $6,400

Benefit payable to:

F1. Retiree prior to age 62 (E1+E2)	$ 20,000
F2. Retiree after age 62 (E1)	$ 13,600
G. Spouse after retiree's death (D x E)	$ 0

Year Ended June 30	Annual Amount Payable if Price Inflation is 3.0% and Post-Retirement Increases are 2.4%
2017	$20,000
2018	20,480
2019	14,261
2020	14,603
2021	14,953
2022	15,312
2023	15,680
2024	16,056
2025	16,441
2026	16,836

SECTION C

FINANCIAL INFORMATION

Summary of Fund Operations

	2017	2016
Market Value of Fund (Beginning of Fiscal Year)	$1,992,073,946	$2,009,367,134
Post Valuation Audit Adjustment	0	0
Contributions		
Employee	3,238,502	2,503,824
Employer	206,562,924	199,609,396
Transfer from MOSERS	1,744,107	2,729,679
Service Purchase (Employee)	1,653,430	978,689
Total Contributions	$ 213,198,963	$ 205,821,588
Investment Return		
Interest	$ 26,033,764	$ 23,605,837
Dividends	6,297,805	6,964,635
Real Estate	30,697,647	24,492,986
Realized Capital Gains	316,321,752	251,657,093
Realized Capital Losses	(190,575,101)	(162,446,691)
Miscellaneous Income	20,295	2,622
Securities Lending Income	277,561	203,359
Other	30,080	14,174
Total Investment Return	$ 189,103,803	$ 144,494,015
Other Income (Rental Income and Misc)	614	5
Increase (Decrease) in Unrealized Appreciation	61,658,198	(99,358,040)
Benefit Payments		
Retirement Payments	$ 228,814,921	$ 224,925,074
Retirement Payments - BackDROP	16,887,349	10,677,166
Death Benefits	855,153	820,000
Long-Term Disability Payments	60,352	66,389
Insured Disability Program	1,620,418	1,567,825
Employee Contribution Refunds	321,328	198,106
Service Transfer Payments - Employer	2,724,631	1,921,451
Total Benefit Payments	$ 251,284,152	$ 240,176,011
Expenses		
Investment	$ 30,460,874	$ 23,703,885
Other	4,515,458	4,370,860
Total Expenses	$ 34,976,332	$ 28,074,745
Market Value of Fund (End of Fiscal Year)	$2,169,775,040	$1,992,073,946

Missouri MPERS
Development of Actuarial Value of Assets

Valuation Date of June 30	2013	2014	2015	2016	2017	2018	2019
A. Actuarial value at beginning of year	$1,531,033,613	$1,657,402,393	$1,795,264,291	$1,967,001,509	$2,086,654,348		
B. Market value at end of year	1,681,869,871	1,937,268,639	2,009,367,134	1,992,073,946	2,169,775,040		
C. Market value at beginning of year	1,538,652,957	1,681,869,871	1,937,268,639	2,009,367,134	1,992,073,946		
D. Cash flow							
D1. Contributions	173,703,401	187,398,786	205,047,170	205,821,588	213,198,963		
D2. Benefit Payments	(224,522,459)	(231,384,708)	(241,714,875)	(240,176,011)	(251,284,152)		
D3. Administrative Expenses	(2,988,544)	(3,753,702)	(4,066,944)	(4,370,860)	(4,515,458)		
D4. Non-Investment Net Cash Flow	(53,807,602)	(47,739,624)	(40,734,649)	(38,725,283)	(42,600,647)		
E. Investment income							
E1. Market Total (B - C - D4)	197,024,516	303,138,392	112,833,144	21,432,095	220,301,741		
E2. Assumed Rate of Return	8.25%	7.75%	7.75%	7.75%	7.75%		
E3. Amount for Immediate Recognition (A+.5xD4)xE2	124,090,709	126,598,775	137,554,515	150,942,012	160,064,937		
E4. Amount for Phased-In Recognition	72,933,807	176,539,617	(24,721,371)	(129,509,917)	60,236,804		
F. Phased-in recognition of investment income							
F1. Current Year (33 1/3% of E4)	24,311,269	58,846,539	(8,240,457)	(43,169,972)	20,078,935		
F2. First Prior Year	(24,155,060)	24,311,269	58,846,539	(8,240,457)	(43,169,972)	$20,078,935	
F3. Second Prior Year	55,929,464	(24,155,061)	24,311,270	58,846,539	(8,240,457)	(43,169,973)	$20,078,934
F4. Total Recognized Investment Gain (F1 + F2 + F3)	56,085,673	59,002,747	74,917,352	7,436,110	(31,331,494)	(23,091,038)	20,078,934
G. Actuarial value at end of year (A + D4 + E3 + F4)	1,657,402,393	1,795,264,291	1,967,001,509	2,086,654,348	2,172,787,144		
Less LTD Assets	0	0	0	0	0		
H. Preliminary Plan AVA	1,657,402,393	1,795,264,291	1,967,001,509	2,086,654,348	2,172,787,144		
I. Corridor (Maximum of 120% of Market Value)	2,018,243,845	2,324,722,367	2,411,240,561	2,390,488,735	2,603,730,048		
J. Corridor (Minimum of 80% of Market Value)	1,345,495,897	1,549,814,911	1,607,493,707	1,593,659,157	1,735,820,032		
K. Additional Investment Gain/(Loss) recognized due to corridor	0	0	0	0	0		
L. Final Plan AVA after corridor adjustment, if any	1,657,402,393	1,795,264,291	1,967,001,509	2,086,654,348	2,172,787,144		
difference between market and actuarial values	24,467,478	142,004,348	42,365,625	(94,580,402)	(3,012,104)		
Market Rate of Return	13.03%	18.28%	5.89%	1.08%	11.18%		
Ratio of Funding Value to Market Value	98.55%	92.67%	97.89%	104.75%	100.14%		
Funding Value Rate of Return	11.98%	11.36%	11.97%	8.13%	6.23%		

Allocation of Assets Between Groups

The division between the Uniformed Patrol and Non-Uniformed Employee groups is in proportion to their market value of assets, as shown below:

Allocation of Funding Value of Assets	June 30 2017	June 30 2016
1. Funding Value of Assets	$2,172,787,144	$2,086,654,348
2. Reported Market Value of Assets		
a) Uniformed Patrol	625,518,429	568,784,148
b) Non-Uniformed Employees	1,544,256,611	1,423,289,798
c) Total	2,169,775,040	1,992,073,946
3. Funding Value of Assets Split		
a) Uniformed Patrol		
(2a) / (2c) x (1)	626,386,780	595,789,086
b) Non-Uniformed Employees		
(2b) / (2c) x (1)	1,546,400,364	1,490,865,262
4. Total Assets Allocated	2,172,787,144	2,086,654,348

SECTION D

SUMMARY OF MEMBER DATA

Civilian Patrol Closed Active Members as of June 30, 2017 by Attained Age and Years of Service

Attained Age	Count by Complete Years of Service to Valuation Date							Totals	
	0-4	5-9	10-14	15-19	20-24	25-29	30+	No.	Valuation Payroll
Under 20									
20-24									
25-29									
30-34									
35-39			1	6	2			9	$ 390,108
40-44		1		18	19			38	1,852,187
45-49		1	2	19	30	15		67	3,340,371
50-54	1		2	20	36	23	13	95	4,571,860
55-59		1		16	20	15	20	72	3,362,143
60					3	3	2	8	365,255
61				1	1	1	1	4	178,737
62				1	1	1	1	4	236,050
63					3		1	4	256,597
64				3	1		2	6	248,130
65							1	1	91,974
66					2	1		3	130,752
67					1			1	38,936
68					1	1	1	3	106,338
69					1			1	36,700
70									
Over 70					1			1	37,559
Totals	**1**	**3**	**5**	**84**	**122**	**60**	**42**	**317**	**$15,243,697**

Average Age: 51.9 years
Average Service: 23.5 years
Average Pay: $48,087

Civilian Patrol Year 2000 Active Members as of June 30, 2017 by Attained Age and Years of Service

Attained Age	Count by Complete Years of Service to Valuation Date							Totals	
	0-4	5-9	10-14	15-19	20-24	25-29	30+	No.	Valuation Payroll
Under 20									
20-24									
25-29	4	8						12	$ 478,868
30-34		42	17					59	2,656,547
35-39	5	29	59	13				106	5,139,566
40-44	3	14	21	16				54	2,472,886
45-49	5	13	32	13	1			64	2,678,766
50-54		20	26	14				60	2,553,871
55-59	1	15	19	13	3			51	2,166,595
60		1	1	1				3	98,686
61		5		1				6	224,391
62		3	3	1				7	247,824
63			1	1				2	78,129
64	1	2	1	2				6	198,793
65		1	1	1				3	112,891
66		1		1				2	76,775
67			1	1				2	76,861
68									
69				1				1	52,263
70									
Over 70		1	2					3	79,058
Totals	**19**	**155**	**184**	**79**	**4**			**441**	**$19,392,770**

Average Age: 44.8 years
Average Service: 11.2 years
Average Pay: $43,975

Civilian Patrol 2011 Tier Active Members as of June 30, 2017 by Attained Age and Years of Service

Attained Age	Count by Complete Years of Service to Valuation Date							Totals	
	0-4	5-9	10-14	15-19	20-24	25-29	30+	No.	Valuation Payroll
Under 20									
20-24	35							35	$ 1,057,437
25-29	75	6						81	2,880,778
30-34	43	17						60	2,253,452
35-39	27	7						34	1,179,722
40-44	24	5						29	1,008,242
45-49	38	7						45	1,467,284
50-54	23	5						28	971,348
55-59	22	2						24	674,638
60	7	1						8	247,224
61	2	1						3	88,373
62	2	1						3	84,205
63	2	1						3	79,295
64	3							3	90,201
65	1							1	26,120
66	2	2						4	137,763
67									
68									
69									
70									
Over 70									
Totals	**306**	**55**						**361**	**$12,246,082**

Average Age: 38.5 years
Average Service: 2.8 years
Average Pay: $33,923

MoDOT Closed Active Members
as of June 30, 2017
by Attained Age and Years of Service

Attained Age	Count by Complete Years of Service to Valuation Date							Totals	
	0-4	5-9	10-14	15-19	20-24	25-29	30+	No.	Valuation Payroll
Under 20									
20-24									
25-29									
30-34									
35-39			1	55	1			57	$ 2,613,394
40-44				139	87			226	11,343,949
45-49		3	3	104	257	91	2	460	23,988,990
50-54		3	1	82	163	191	62	502	26,327,387
55-59		1	1	77	122	66	87	354	18,010,522
60				14	14	8	9	45	2,209,247
61				11	11	12	3	37	1,732,633
62				7	15	2	7	31	1,545,399
63				3	10	2	3	18	918,015
64				1	5	1	1	8	400,827
65				3	3	2	3	11	520,574
66				4	1		2	7	342,409
67				1			1	2	97,726
68									
69							2	2	226,129
70									
Over 70							1	1	84,210
Totals		**7**	**6**	**501**	**689**	**375**	**183**	**1,761**	**$90,361,411**

Average Age: 50.9 years
Average Service: 23.3 years
Average Pay: $51,313

MoDOT Year 2000 Active Members
as of June 30, 2017
by Attained Age and Years of Service

Attained Age	Count by Complete Years of Service to Valuation Date							Totals	
	0-4	5-9	10-14	15-19	20-24	25-29	30+	No.	Valuation Payroll
Under 20									
20-24									
25-29	3	17	2					22	$ 770,436
30-34	9	103	96					208	8,743,092
35-39	9	70	191	69				339	15,139,443
40-44	8	79	128	76	1			292	12,558,954
45-49	10	68	108	56				242	10,084,001
50-54	7	53	111	67		1		239	9,807,566
55-59	10	56	111	65	1	1		244	9,672,927
60		9	21	6	1			37	1,434,264
61	2	7	10	6				25	985,077
62		9	15	4				28	1,140,708
63	2	3	9	5				19	737,262
64		2	11	1			1	15	603,232
65		1	5	1				7	271,425
66			2					2	78,806
67		1						1	43,872
68			3					3	129,336
69									
70									
Over 70		1						1	33,429
Totals	**60**	**479**	**823**	**356**	**3**	**2**	**1**	**1,724**	**$72,233,830**

Average Age: 45.5 years
Average Service: 11.9 years
Average Pay: $41,899

MoDOT 2011 Tier Active Members
as of June 30, 2017
by Attained Age and Years of Service

Attained Age	Count by Complete Years of Service to Valuation Date							Totals	
	0-4	5-9	10-14	15-19	20-24	25-29	30+	No.	Valuation Payroll
Under 20	1							1	$ 27,434
20-24	199							199	6,267,200
25-29	346	5						351	12,905,936
30-34	260	7						267	9,053,488
35-39	208	1						209	6,926,819
40-44	138							138	4,614,854
45-49	149	3						152	5,042,213
50-54	120	1						121	4,111,427
55-59	106							106	3,430,778
60	10							10	330,422
61	11							11	410,470
62	7							7	204,528
63	5							5	205,317
64									
65	2							2	62,857
66	3							3	136,304
67	1							1	23,818
68	1							1	29,682
69	1							1	30,878
70	2							2	90,597
Over 70	1							1	29,713
Totals	**1,571**	**17**						**1,588**	**$53,934,735**

Average Age: 36.7 years
Average Service: 2.2 years
Average Pay: $33,964

Uniformed Patrol Closed Active Members
as of June 30, 2017
by Attained Age and Years of Service

Attained Age	Count by Complete Years of Service to Valuation Date							Totals	
	0-4	5-9	10-14	15-19	20-24	25-29	30+	No.	Valuation Payroll
Under 20									
20-24									
25-29									
30-34									
35-39		1		8				9	$ 697,927
40-44				47	49			96	7,644,575
45-49	1		1	27	180	26		235	19,132,883
50-54				6	63	84	16	169	14,094,979
55-59				1	11	18	24	54	4,572,606
60					1		1	2	170,099
61									
62									
63									
64									
65									
66									
67									
68									
69									
70									
Over 70									
Totals	**1**	**1**	**1**	**89**	**304**	**128**	**41**	**565**	**$46,313,069**

Average Age: 48.5 years
Average Service: 23.4 years
Average Pay: $81,970

Uniformed Patrol Year 2000 Active Members as of June 30, 2017 by Attained Age and Years of Service

Attained Age	Count by Complete Years of Service to Valuation Date							Totals	
	0-4	5-9	10-14	15-19	20-24	25-29	30+	No.	Valuation Payroll
Under 20									
20-24									
25-29	1	10						11	$ 614,668
30-34	1	88	34					123	7,091,591
35-39		28	91	14				133	8,681,567
40-44		9	50	32				91	6,096,109
45-49		4	12	9				25	1,613,409
50-54		3	3	3				9	586,404
55-59					1			1	78,981
60									
61									
62									
63									
64									
65									
66									
67									
68									
69									
70									
Over 70									
Totals	**2**	**142**	**190**	**58**	**1**			**393**	**$24,762,729**

Average Age: 37.3 years
Average Service: 11.6 years
Average Pay: $63,009

Uniformed Patrol 2011 Tier Active Members as of June 30, 2017 by Attained Age and Years of Service

Attained Age	Count by Complete Years of Service to Valuation Date							Totals	
	0-4	5-9	10-14	15-19	20-24	25-29	30+	No.	Valuation Payroll
Under 20									
20-24	38							38	$ 1,577,586
25-29	130	28						158	7,512,274
30-34	42	30						72	3,571,736
35-39	15	8						23	1,095,173
40-44	5	3						8	385,305
45-49	4	2						6	299,578
50-54	1							1	49,237
55-59									
60									
61									
62									
63									
64									
65									
66									
67									
68									
69									
70									
Over 70									
Totals	**235**	**71**						**306**	**$14,490,889**

Average Age: 29.0 years
Average Service: 3.3 years
Average Pay: $47,356

Growth of Active Member Payroll

Actuarial Valuation for June 30,	Number	Covered Payroll	Average Pay	% Change in Average Pay from Prior Year
1989	8,181	$194,452,400	$23,769	(0.5)%
1990	8,256	211,414,753	25,607	7.7 %
1991	8,308	220,856,988	26,584	3.8 %
1992	8,591	228,503,592	26,598	0.1 %
1993	8,658	236,236,082	27,285	2.6 %
1994	8,849	242,864,780	27,445	0.6 %
1995	8,904	250,529,253	28,137	2.5 %
1996	9,023	264,196,115	29,280	4.1 %
1997	8,997	280,209,116	31,145	6.4 %
1998	8,871	284,889,796	32,115	3.1 %
1999	9,140	298,673,247	32,678	1.8 %
2000	9,171	312,532,009	34,078	4.3 %
2001	9,087	327,049,257	35,991	5.6 %
2002	8,695	312,747,492	35,969	(0.1)%
2003	8,892	318,744,192	35,846	(0.3)%
2004	9,002	328,210,887	36,460	1.7 %
2005	9,193	345,695,867	37,604	3.1 %
2006	9,033	348,614,699	38,593	2.6 %
2007	8,640	360,842,421	41,764	8.2 %
2008	8,599	369,424,653	42,961	2.9 %
2009	8,784	377,652,245	42,993	0.1 %
2010	8,457	369,911,252	43,740	1.7 %
2011	8,231	361,639,001	43,936	0.4 %
2012	7,458	329,293,168	44,153	0.5 %
2013	7,319	323,205,767	44,160	0.0 %
2014	7,390	332,085,689	44,937	1.8 %
2015	7,358	334,400,980	45,447	1.1 %
2016	7,441	339,799,379	45,666	0.5 %
2017	7,456	348,979,212	46,805	2.5 %
			Ten-Year Average:	1.2 %

Count and Total Monthly Benefits
Civilian Patrol Closed Retired (Non-Disabled)
Members and Survivors
as of June 30, 2017
by Attained Age

Age	Number	Monthly Amount
Less than 20		
20-24		
25-29		
30-34		
35-39		
40-44		
45-49		
50-54	9	$ 20,863
55-59	30	40,793
60-64	60	94,084
65-69	77	120,084
70-74	61	79,993
75-79	78	171,890
80-84	92	155,752
85-89	55	84,942
90-94	15	19,792
95-99	3	3,811
100-104		
105 & Over		
TOTAL	**480**	**$ 792,004**

Count and Total Monthly Benefits of Civilian Patrol Year 2000 Retired (Non-Disabled) Members and Survivors as of June 30, 2017 by Attained Age

Age	Number	Monthly Amount
Less than 20		
20-24		
25-29		
30-34		
35-39		
40-44		
45-49		
50-54	10	$ 28,619
55-59	80	182,761
60-64	142	241,856
65-69	156	215,165
70-74	121	182,871
75-79	33	38,154
80-84	3	1,011
85-89	1	2,205
90-94	2	4,109
95-99		
100-104		
105 & Over		
TOTAL	**548**	**$ 896,751**

Count and Total Monthly Benefits of MoDOT Closed Retired (Non-Disabled) Members and Survivors as of June 30, 2017 by Attained Age

Age	Number	Monthly Benefit Amount
Less than 20	3	$ 3,494
20-24	1	795
25-29		
30-34		
35-39	1	570
40-44	5	3,204
45-49	14	10,287
50-54	41	62,005
55-59	174	245,877
60-64	306	436,437
65-69	377	540,570
70-74	402	714,629
75-79	711	1,710,468
80-84	733	1,695,178
85-89	476	982,795
90-94	193	321,437
95-99	45	47,842
100-104	4	2,377
105 & Over	1	145
TOTAL	**3,487**	**$ 6,778,110**

Count and Total Monthly Benefits of MoDOT Year 2000 Retired (Non-Disabled) Members and Survivors as of June 30, 2017 by Attained Age

Age	Number	Monthly Benefit Amount
Less than 20	9	$ 2,387
20-24	2	559
25-29		
30-34		
35-39	3	2,172
40-44	3	2,936
45-49	9	10,612
50-54	149	448,068
55-59	579	1,549,763
60-64	799	1,480,088
65-69	826	1,307,503
70-74	620	1,098,602
75-79	166	272,524
80-84	23	32,276
85-89	20	36,086
90-94	15	25,110
95-99	6	7,069
100-104		
105 & Over		
TOTAL	**3,229**	**$ 6,275,755**

Count and Total Monthly Benefits of Uniformed Patrol Closed Retired (Non-Disabled) Members and Survivors as of June 30, 2017 by Attained Age

Age	Number	Monthly Benefit Amount
Less than 20	3	$ 3,989
20-24		
25-29		
30-34	1	1,300
35-39	1	1,710
40-44	6	15,306
45-49	5	11,928
50-54	22	93,367
55-59	114	494,150
60-64	162	809,867
65-69	153	719,353
70-74	175	861,100
75-79	126	599,728
80-84	80	379,647
85-89	52	216,553
90-94	25	74,023
95-99	2	5,621
100-104		
105 & Over		
TOTAL	**927**	**$ 4,287,642**

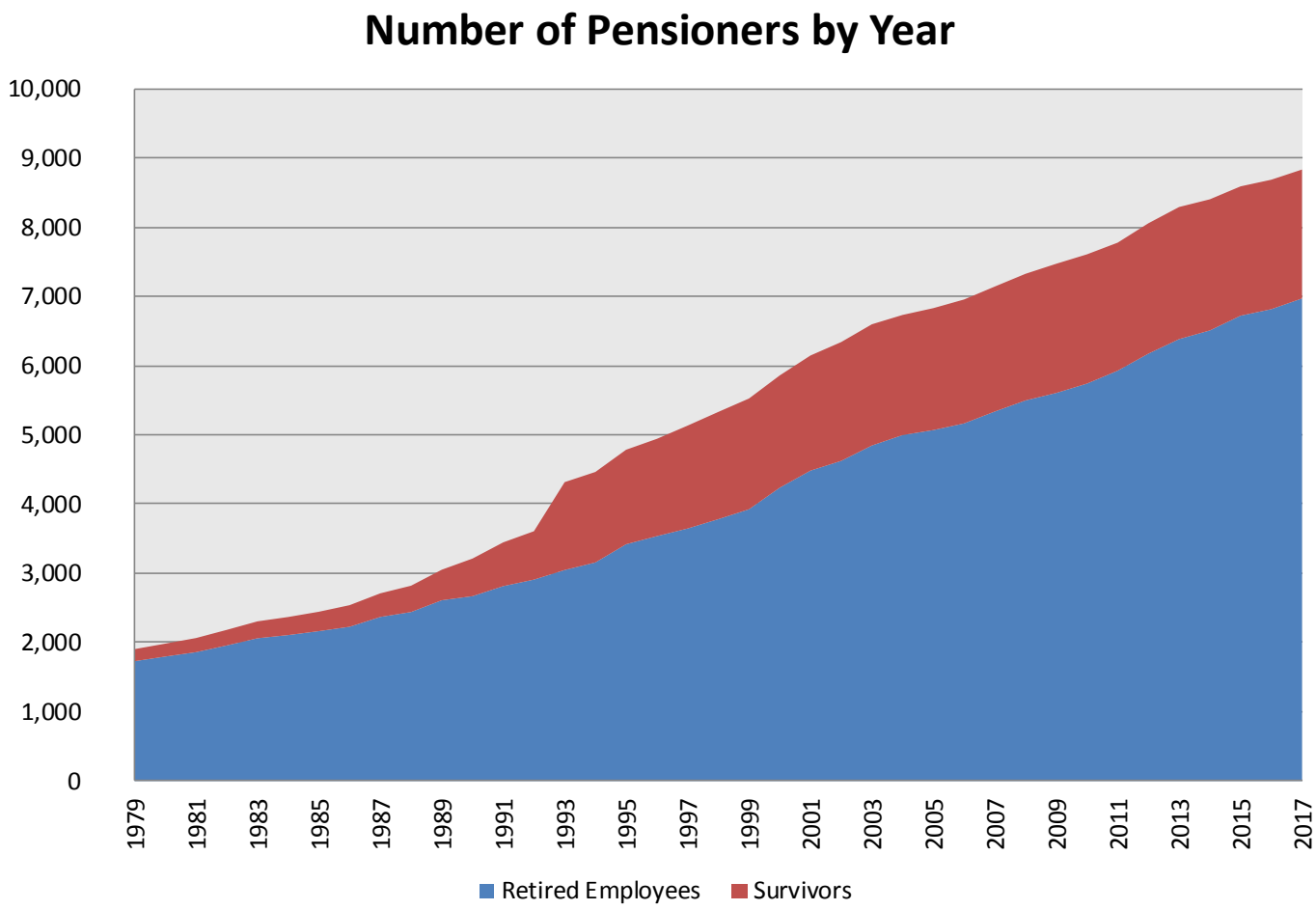
Count and Total Monthly Benefits of Uniformed Patrol Year 2000 Retired (Non-Disabled) Members and Survivors as of June 30, 2017 by Attained Age

Age	Number	Monthly Amount
Less than 20	2	$ 398
20-24		
25-29		
30-34		
35-39		
40-44	2	2,541
45-49		
50-54		
55-59	1	4,391
60-64	1	888
65-69		
70-74		
75-79		
80-84		
85-89		
90-94		
95-99		
100-104		
105 & Over		
TOTAL	**6**	**$ 8,218**

Growth of Pension Population by Year

Year	Retired Employees	Survivors	Total	% Increase	Annual Benefits	Active Payroll	Benefits as a % of Payroll
1979	1,730	174	1,904	5.6%			
1980	1,797	186	1,983	4.1%			
1981	1,860	204	2,064	4.1%			
1982	1,957	225	2,182	5.7%			
1983	2,061	244	2,305	5.6%			
1984	2,107	261	2,368	2.7%			
1985	2,164	280	2,444	3.2%			
1986	2,227	312	2,539	3.9%			
1987	2,369	341	2,710	6.7%			
1988	2,440	380	2,820	4.1%			
1989	2,610	441	3,051	8.2%			
1990	2,669	543	3,212	5.3%			
1991	2,814	632	3,446	7.3%			
1992	2,908	699	3,607	4.7%			
1993	3,047	1,269	4,316	19.7%			
1994	3,156	1,307	4,463	3.4%			
1995	3,419	1,365	4,784	7.2%			
1996	3,536	1,405	4,941	3.3%			
1997	3,646	1,486	5,132	3.9%			
1998	3,781	1,549	5,330	3.9%	$ 80,686,152	$284,889,796	28.3%
1999	3,924	1,600	5,524	3.6%	91,512,311	298,673,247	30.6%
2000	4,236	1,621	5,857	6.0%	100,794,676	312,532,009	32.3%
2001	4,482	1,663	6,145	4.9%	115,998,915	327,049,257	35.5%
2002	4,623	1,716	6,339	3.2%	125,623,460	312,747,492	40.2%
2003	4,845	1,751	6,596	4.1%	136,320,125	318,744,192	42.8%
2004	4,996	1,735	6,731	2.0%	142,359,307	328,210,887	43.4%
2005	5,068	1,761	6,829	1.5%	148,340,170	345,695,867	42.9%
2006	5,164	1,790	6,954	1.8%	155,230,301	348,614,699	44.5%
2007	5,336	1,805	7,141	2.7%	164,048,455	360,842,421	45.5%
2008	5,496	1,829	7,325	2.6%	172,112,941	369,424,653	46.6%
2009	5,604	1,866	7,470	2.0%	179,850,466	377,652,245	47.6%
2010	5,739	1,867	7,606	1.8%	187,267,535	369,911,252	50.6%
2011	5,926	1,849	7,775	2.2%	191,892,660	361,639,001	53.1%
2012	6,172	1,883	8,055	3.6%	201,906,768	329,293,168	61.3%
2013	6,382	1,908	8,290	2.9%	210,904,464	323,205,767	65.3%
2014	6,507	1,894	8,401	1.3%	217,149,528	332,085,689	65.4%
2015	6,720	1,868	8,588	2.2%	223,021,512	334,400,980	66.7%
2016	6,814	1,870	8,684	1.1%	227,218,908	339,799,379	66.9%
2017	6,969	1,862	8,831	1.7%	231,168,516	348,979,212	66.2%

Growth of Pension Population by Year



Self-Insured Disabled Retired Members
as of June 30, 2017

Age	Number	Monthly Amount
Less than 20		
20-24		
25-29		
30-34		
35-39		
40-44	2	$ 4,736
45-49	4	5,813
50-54	7	3,483
55-59	13	19,989
60-64	8	15,285
65-69	10	11,515
70-74	6	9,106
75-79	2	2,644
80-84		
85-89	1	110
90-94		
95-99		
100-104		
105 & Over		
TOTAL	**53**	**$ 72,681**

These members became disabled prior to outsourcing disability claims. Liabilities for these members include benefits payable during and after the period of disability.

Fully Insured Disabled Retired Members as of June 30, 2017

Age	Number	Monthly Amount
Less than 20		
20-24		
25-29	3	$ 10,359
30-34	3	5,937
35-39	1	2,083
40-44	13	27,038
45-49	15	27,929
50-54	25	39,265
55-59	27	29,881
60-64	14	10,390
65-69		
70-74		
75-79		
80-84		
85-89		
90-94		
95-99		
100-104		
105 & Over		
TOTAL	**101**	**$ 152,882**

These members became disabled after disability claims became outsourced. Liabilities for these members during the period of disability are an obligation of the insurance company and not included in this valuation. Liabilities for these members after the period of disability are included in the valuation.

SECTION E

ASSUMPTIONS USED IN THE VALUATION AND GLOSSARY

Summary of Valuation Method and Assumptions
June 30, 2017

The actuarial assumptions used in the valuation are shown in this Section of the report unless stated otherwise. The assumptions were established for the June 30, 2013 actuarial valuation, following a five-year actuarial investigation. They were adopted by the Board. The assumptions will be reviewed in detail in the next experience study which will be performed after this valuation.

An actuarial valuation is based upon an actuarial cost method, an asset valuation method, and actuarial assumptions. These methods and assumptions are chosen by the Board of Trustees after consultation with the Actuary and other advisors.

The actuarial cost method is called the Entry Age Actuarial Cost Method. This method is consistent with the Board's level percent-of-payroll funding objective. With this method, the level percent-of-payroll is determined that will fund a member's retirement benefit over the member's entire working lifetime, from date of hire (Entry Age) to date of exit from the active member population. Differences in the past between assumed and actual experience become part of unfunded actuarial accrued liabilities and are amortized with level percent-of-payroll contributions. This cost method was first used in the ***June 30, 1999*** valuation.

The asset valuation method is a three-year smoothed market value method in which assumed investment return is recognized immediately each year and differences between actual and assumed investment return are phased-in over a closed three-year period. This asset valuation method is intended to give recognition to the long term accuracy of market values while filtering out and dampening short term market swings. This method was first used in the ***June 30, 1999*** valuation.

Economic Assumptions

The investment return rate used in making the valuations was 7.75% per year, compounded annually (net after investment expenses). The ***wage inflation rate*** was assumed to be 3.50%. The real rate of return over wage growth is defined to be the portion of total investment return, which is more than the rate of wage inflation. The 7.75% investment return rate and 3.50% wage inflation rate translates to an assumed real rate of return over wage growth net of expenses of 4.25%. Based upon other assumptions, the net real rate of return over price inflation is 4.75%.

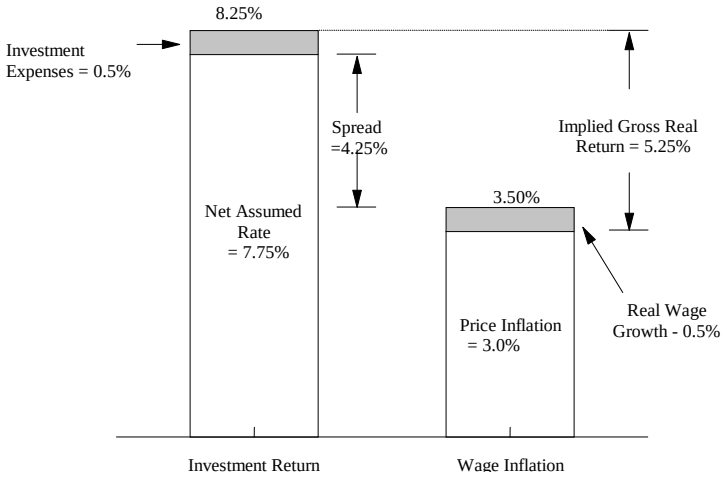
Pay increase assumptions for merit and seniority for individual active members are shown on pages E-5 and E-6. Part of the total assumed pay increase at each age is for merit and/or seniority, and the other 3.50% recognizes wage inflation. ***The active member payroll*** for all members is assumed to increase 3.50% annually for all years.

The price inflation rate is assumed to be 3.00% annually. This is the inflation rate upon which the post-retirement increases are based. The difference between wage and price inflation of 0.5% is attributable to overall productivity increases and macroeconomic factors.

The number of active members is assumed to continue at the present number.

Summary of Valuation Method and Assumptions
June 30, 2017 (Continued)

Economic Assumptions



Reviewing the Investment Return Assumption

The review of the investment return assumption in this report are forward-looking measures of likely investment return outcomes for the asset classes in the current investment policy. For purposes of this analysis, we have analyzed the System's investment policy with the capital market assumptions from eight nationally recognized investment consultants.

The investment consultants who have shared their capital market assumptions with us are (in alphabetical order) BNY Mellon, JPMorgan, Marquette, Mercer, NEPC, PCA, RVK, and VOYA. It is important to understand that, in general, no two investment consultants will consider the same asset classes. Moreover, there are differences in investment horizons, price inflation, the treatment of investment expenses, excess manager performance (i.e., alpha), geometric vs. arithmetic averages, and other technical differences.

We have incorporated the assumptions of these eight consultants into our Capital Market Assumption Modeler (CMAM). To the best of our ability, we have adapted the System's investment policy to fit with the eight consultants' assumptions adjusting for these known differences in assumptions and methodology. In the following charts, all returns are net of investment expenses only and have no assumption for excess manager performance (alpha).

Summary of Valuation Method and Assumptions
June 30, 2017 (Continued)

Investment Consultant	Investment Consultant Expected Nominal Return	Investment Consultant Inflation Assumption	Expected Real Return (2)–(3)	Actuary Inflation Assumption	Expected Nominal Return (4)+(5)	Investment Expenses	Expected Nominal Return Net of Expenses (6)-(7)		Standard Deviation of Expected Return (1-Year)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)		(9)
1	6.02%	2.20%	3.82%	3.00%	6.82%	0.00%	6.82%		11.28%
2	6.03%	2.00%	4.03%	3.00%	7.03%	0.00%	7.03%		9.77%
3	6.52%	2.26%	4.26%	3.00%	7.26%	0.00%	7.26%		9.63%
4	6.92%	2.50%	4.42%	3.00%	7.42%	0.00%	7.42%		12.09%
5	6.99%	2.50%	4.49%	3.00%	7.49%	0.00%	7.49%		11.43%
6	7.55%	2.25%	5.30%	3.00%	8.30%	0.00%	8.30%		8.81%
7	7.70%	2.21%	5.48%	3.00%	8.48%	0.00%	8.48%		11.65%
8	8.00%	2.25%	5.75%	3.00%	8.75%	0.00%	8.75%		15.11%
Average	**6.96%**	**2.27%**	**4.69%**	**3.00%**	**7.69%**	**0.00%**	**7.69%**		**11.22%**

Investment Consultant	Distribution of 20-Year Average Geometric Net Nominal Return			Probability of Exceeding 7.75%
	40th	50th	60th	
(1)	(2)	(3)	(4)	(5)
1	5.59%	6.23%	6.86%	27.27%
2	6.04%	6.58%	7.14%	29.67%
3	6.29%	6.83%	7.37%	33.37%
4	6.07%	6.75%	7.43%	35.45%
5	6.25%	6.89%	7.53%	36.73%
6	7.45%	7.94%	8.44%	53.93%
7	7.21%	7.86%	8.52%	51.75%
8	6.88%	7.72%	8.56%	49.61%
Average	**6.47%**	**7.10%**	**7.73%**	**39.72%**

Based on the current asset allocation policy as well as the current price inflation assumption, the investment return assumption is reasonable. Both the price inflation assumption and the investment return assumption will be reviewed in the Plan's next experience study which will be issued after this valuation. It is important to note that as the economy and forward looking expectations have changed since the last experience study, the current assumptions have become aggressive. While we have stated that the assumptions are reasonable for this valuation, that may not continue in the future, if recent trends in forward looking expectations continue.

Summary of Valuation Method and Assumptions
June 30, 2017 (Concluded)

Non-Economic Assumptions

The mortality tables, for post-retirement mortality, used in evaluating allowances to be paid to non-disabled pensioners were the RP-2000 Combined Healthy Mortality Tables projected 16 years and set back 1 year for males and females. Pre-retirement mortality used was 70% for males and 50% for females of the post-retirement tables set back 1 year for males and set back 1 year for females. Disabled pension mortality was based on PBGC Disabled Mortality tables. Related values are shown on page E-7. The healthy mortality tables include a margin for mortality improvement. The margin is in the 16-year projection. The disabled mortality tables do not include a margin for mortality improvement.

The probabilities of age and service retirement are shown on page E-9. Upon retirement, members are assumed to pick the BackDROP period that when combined with the remaining annuity produces the highest liability.

The probabilities of withdrawal from service are shown on pages E-11 and E-12. ***The probabilities of disability*** are shown on page E-10.

Employer contributions were assumed to be ***paid in equal installments*** throughout the employer fiscal year.

Present assets (cash & investments) were used with a market value adjustment. Assets may be used in the valuation prior to the final audit. The exact method is shown on page C-2.

The data about persons now covered and about present assets were furnished by the System's administrative staff. Although examined for general reasonableness, the data was not audited by the Actuary. Data was furnished as of May 31 and assumed to be statistically equivalent to June 30.

The actuarial valuation computations were made by or under the supervision of a Member of the American Academy of Actuaries (MAAA) who has experience performing public plan valuations.

Age Based Salary Scale

All Plan Participants

Age	Salary Increase Assumptions for an Individual Member					
	Non-Uniformed			Uniformed		
	Merit & Seniority	Base (Economic)	Increase Next Year	Merit & Seniority	Base (Economic)	Increase Next Year
20	4.40%	3.50%	7.90%	6.00%	3.50%	9.50%
21	4.11%	3.50%	7.61%	6.00%	3.50%	9.50%
22	3.84%	3.50%	7.34%	6.00%	3.50%	9.50%
23	3.60%	3.50%	7.10%	5.48%	3.50%	8.98%
24	3.38%	3.50%	6.88%	4.89%	3.50%	8.39%
25	3.18%	3.50%	6.68%	4.25%	3.50%	7.75%
26	3.08%	3.50%	6.58%	3.54%	3.50%	7.04%
27	2.90%	3.50%	6.40%	3.38%	3.50%	6.88%
28	2.82%	3.50%	6.32%	3.08%	3.50%	6.58%
29	2.66%	3.50%	6.16%	2.78%	3.50%	6.28%
30	2.59%	3.50%	6.09%	2.48%	3.50%	5.98%
31	2.44%	3.50%	5.94%	2.18%	3.50%	5.68%
32	2.39%	3.50%	5.89%	1.88%	3.50%	5.38%
33	2.25%	3.50%	5.75%	1.76%	3.50%	5.26%
34	2.20%	3.50%	5.70%	1.65%	3.50%	5.15%
35	2.09%	3.50%	5.59%	1.54%	3.50%	5.04%
36	1.97%	3.50%	5.47%	1.43%	3.50%	4.93%
37	1.87%	3.50%	5.37%	1.31%	3.50%	4.81%
38	1.76%	3.50%	5.26%	1.24%	3.50%	4.74%
39	1.60%	3.50%	5.10%	1.16%	3.50%	4.66%
40	1.44%	3.50%	4.94%	1.09%	3.50%	4.59%
41	1.23%	3.50%	4.73%	1.01%	3.50%	4.51%
42	1.09%	3.50%	4.59%	0.94%	3.50%	4.44%
43	0.95%	3.50%	4.45%	0.86%	3.50%	4.36%
44	0.81%	3.50%	4.31%	0.79%	3.50%	4.29%
45	0.68%	3.50%	4.18%	0.71%	3.50%	4.21%
46	0.56%	3.50%	4.06%	0.64%	3.50%	4.14%
47	0.43%	3.50%	3.93%	0.56%	3.50%	4.06%
48	0.31%	3.50%	3.81%	0.53%	3.50%	4.03%
49	0.18%	3.50%	3.68%	0.49%	3.50%	3.99%
50	0.12%	3.50%	3.62%	0.45%	3.50%	3.95%
51	0.06%	3.50%	3.56%	0.41%	3.50%	3.91%
52	0.06%	3.50%	3.56%	0.38%	3.50%	3.88%
53	0.00%	3.50%	3.50%	0.35%	3.50%	3.85%
54	0.00%	3.50%	3.50%	0.32%	3.50%	3.82%
55	0.00%	3.50%	3.50%	0.29%	3.50%	3.79%
56	0.00%	3.50%	3.50%	0.26%	3.50%	3.76%
57	0.00%	3.50%	3.50%	0.23%	3.50%	3.73%
58	0.00%	3.50%	3.50%	0.23%	3.50%	3.73%
59	0.00%	3.50%	3.50%	0.23%	3.50%	3.73%
60	0.00%	3.50%	3.50%	0.23%	3.50%	3.73%
Ref.	11			403		

Service Based Salary Scale

Non-Uniformed Plan Participants

% Merit Increases in Salaries Next Year*	
Service Index	**Rate**
1	8.0%
2	7.0%
3	4.5%
4	4.0%
Ref	519

Uniformed Plan Participants

% Merit Increases in Salaries Next Year*	
Service Index	**Rate**
1	10.0%
2	10.0%
Ref	518

* *For Non-Uniformed members with 4 or less years of service and Uniformed members with 2 or less years of service, the service based table overwrites the age based table on page E-5.*

Post-Retirement Mortality

Age	Regular		Disabled		Age	Regular		Disabled	
	Male	Female	Male	Female		Male	Female	Male	Female
21	0.00025	0.00015	0.04589	0.02630	61	0.00521	0.00467	0.05928	0.03390
22	0.00027	0.00015	0.04589	0.02630	62	0.00603	0.00537	0.06109	0.03470
23	0.00028	0.00015	0.04589	0.02630	63	0.00688	0.00614	0.06242	0.03550
24	0.00029	0.00015	0.04589	0.02630	64	0.00799	0.00706	0.06346	0.03620
25	0.00031	0.00016	0.04589	0.02630	65	0.00900	0.00796	0.06441	0.03700
26	0.00032	0.00017	0.04380	0.02570	66	0.01017	0.00896	0.06527	0.03780
27	0.00034	0.00018	0.04142	0.02530	67	0.01169	0.01011	0.06622	0.03860
28	0.00035	0.00018	0.03905	0.02470	68	0.01304	0.01123	0.06736	0.03940
29	0.00036	0.00019	0.03686	0.02420	69	0.01426	0.01241	0.06869	0.04020
30	0.00038	0.00020	0.03439	0.02370	70	0.01580	0.01372	0.07021	0.04110
31	0.00041	0.00023	0.03221	0.02320	71	0.01744	0.01545	0.07192	0.04210
32	0.00046	0.00027	0.03040	0.02270	72	0.01929	0.01687	0.07372	0.04330
33	0.00052	0.00031	0.02869	0.02220	73	0.02142	0.01877	0.07562	0.04470
34	0.00058	0.00034	0.02736	0.02180	74	0.02386	0.02053	0.07771	0.04650
35	0.00065	0.00037	0.02641	0.02140	75	0.02662	0.02275	0.07999	0.04920
36	0.00071	0.00040	0.02584	0.02120	76	0.03019	0.02472	0.08256	0.05290
37	0.00078	0.00042	0.02575	0.02100	77	0.03365	0.02723	0.08626	0.05780
38	0.00083	0.00045	0.02594	0.02080	78	0.03805	0.03048	0.09139	0.06310
39	0.00088	0.00048	0.02622	0.02080	79	0.04297	0.03360	0.09909	0.06860
40	0.00091	0.00051	0.02679	0.02090	80	0.04853	0.03709	0.10716	0.07460
41	0.00095	0.00055	0.02736	0.02100	81	0.05481	0.04100	0.11600	0.08130
42	0.00099	0.00061	0.02822	0.02130	82	0.06234	0.04538	0.12559	0.08850
43	0.00104	0.00067	0.02898	0.02160	83	0.07078	0.05031	0.13604	0.09620
44	0.00109	0.00074	0.02983	0.02190	84	0.07890	0.05586	0.14735	0.10430
45	0.00115	0.00081	0.03059	0.02240	85	0.08917	0.06213	0.15970	0.11280
46	0.00122	0.00087	0.03135	0.02290	86	0.09898	0.07034	0.17338	0.12210
47	0.00129	0.00093	0.03230	0.02350	87	0.10974	0.07972	0.18810	0.13220
48	0.00136	0.00099	0.03354	0.02420	88	0.12355	0.09035	0.20425	0.14320
49	0.00144	0.00107	0.03487	0.02490	89	0.13898	0.10064	0.22135	0.15510
50	0.00152	0.00116	0.03639	0.02570	90	0.15359	0.11356	0.23988	0.16820
51	0.00160	0.00127	0.03810	0.02640	91	0.17202	0.12550	0.26021	0.18250
52	0.00180	0.00143	0.03990	0.02720	92	0.18736	0.13782	0.28234	0.19800
53	0.00193	0.00161	0.04171	0.02810	93	0.20644	0.15022	0.30647	0.21500
54	0.00211	0.00182	0.04370	0.02880	94	0.22270	0.16506	0.33203	0.23300
55	0.00231	0.00206	0.04579	0.02950	95	0.23893	0.17704	0.35996	0.25250
56	0.00267	0.00239	0.04807	0.03010	96	0.25906	0.18838	0.39036	0.27390
57	0.00314	0.00281	0.05045	0.03070	97	0.27496	0.19891	0.42351	0.29720
58	0.00357	0.00321	0.05273	0.03150	98	0.29040	0.21182	0.45961	0.32260
59	0.00407	0.00362	0.05520	0.03230	99	0.31029	0.22039	0.49809	0.34950
60	0.00459	0.00410	0.05729	0.03310	100	0.32496	0.22771	0.53998	0.37890
Ref	#508sb1x1	#509sb1x1	#250sb0x0.95	#251sb0x1		#508sb1x1	#509sb1x1	#250sb0x0.95	#251sb0x1

Pre-Retirement mortality is 70% of the regular post-retirement mortality values for males and 50% of the regular post-retirement mortality values for females.

Joint Life Retirement Values
(7.75% Interest)

Sample Attained Ages	Present Value of $1 Monthly for Life		Percent Dying Next Year		Future Life Expectancy (years)	
	Men	Women	Men	Women	Men	Women
50	$147.46	$147.37	0.1516%	0.1159%	33.34	35.39
55	142.23	142.00	0.2313%	0.2064%	28.61	30.63
60	135.19	134.87	0.4593%	0.4099%	24.03	26.02
65	126.18	125.80	0.9002%	0.7955%	19.69	21.67
70	115.18	114.73	1.5803%	1.3715%	15.71	17.66
75	101.84	101.56	2.6618%	2.2752%	12.07	14.01
80	86.45	86.42	4.8531%	3.7094%	8.86	10.73
Ref:	#508sb1x1	#509sb1x1				

The present values shown above are for illustrative purposes only and include a 50% survivor benefit but do not include the value of future post-retirement increases. Males are assumed to be 3 years older than their spouses.

Rates of Retirement

	Closed and Year 2000 Plans					2011 Tier			
	Non-Uniformed				Uniformed	Non-Uniformed			Uniformed
	Male		Female			Normal			
Age	Normal	Early	Normal	Early	Normal	Age & Service	Rule of 90	Early	Normal
50	0.3000		0.2500		0.3500				
51	0.2500		0.2000		0.1500				
52	0.2600		0.2000		0.1500				
53	0.2600		0.2000		0.1500				
54	0.2400		0.2400		0.1500				
55	0.2700	0.0300	0.3200	0.0300	0.2000		0.3000		0.3000
56	0.3000	0.0300	0.3500	0.0300	0.1500		0.3000		0.3000
57	0.2600	0.0400	0.2900	0.0300	0.3000		0.3000		0.3000
58	0.2200	0.0200	0.2500	0.0300	0.3500		0.3000		0.3000
59	0.2500	0.0400	0.3000	0.0300	0.5000		0.3000		0.3000
60	0.1900	0.0800	0.2200	0.0600	1.0000		0.3000		1.0000
61	0.1800	0.0400	0.2200	0.0500	1.0000		0.3000		1.0000
62	0.4500	0.3000	0.3600	0.3000	1.0000		0.3000	0.1000	1.0000
63	0.3700	0.4000	0.2200	0.3000	1.0000		0.3000	0.1000	1.0000
64	0.2500	0.4000	0.2000	0.2500	1.0000		0.3000	0.1000	1.0000
65	0.3500		0.3500		1.0000		0.3000	0.1000	1.0000
66	0.4000		0.4500		1.0000		0.3000	0.1000	1.0000
67	0.2500		0.4000		1.0000	0.5000	0.3000		1.0000
68	0.3000		0.4000		1.0000	0.5000	0.3000		1.0000
69	0.3000		0.4000		1.0000	0.5000	0.3000		1.0000
70	0.4000		0.5000		1.0000	1.0000	1.0000		1.0000
71	0.5000		0.5000		1.0000	1.0000	1.0000		1.0000
72	0.5000		1.0000		1.0000	1.0000	1.0000		1.0000
73	0.5000								
74	1.0000								
Ref	2265	2267	2266	2268	2264	1873	1875	1262	1875

Rates of Disability

All Plan Participants

Age	Non-Uniformed		Uniformed		Age	Non-Uniformed		Uniformed	
	Male	Female	Male	Female		Male	Female	Male	Female
21	0.0000	0.0006	0.0000	0.0000	51	0.0037	0.0059	0.0022	0.0022
22	0.0004	0.0006	0.0000	0.0000	52	0.0041	0.0063	0.0024	0.0024
23	0.0004	0.0007	0.0000	0.0000	53	0.0046	0.0067	0.0028	0.0028
24	0.0004	0.0007	0.0000	0.0000	54	0.0054	0.0071	0.0031	0.0031
25	0.0004	0.0007	0.0001	0.0001	55	0.0062	0.0074	0.0035	0.0035
26	0.0004	0.0007	0.0001	0.0001	56	0.0072	0.0078	0.0039	0.0039
27	0.0004	0.0008	0.0002	0.0002	57	0.0082	0.0082	0.0043	0.0043
28	0.0007	0.0008	0.0002	0.0002	58	0.0093	0.0086	0.0048	0.0048
29	0.0009	0.0008	0.0002	0.0002	59	0.0102	0.0090	0.0052	0.0052
30	0.0009	0.0008	0.0002	0.0002	60	0.0112	0.0090	0.0058	0.0058
31	0.0011	0.0009	0.0002	0.0002	61	0.0120	0.0090	0.0063	0.0063
32	0.0011	0.0010	0.0002	0.0002	62	0.0126	0.0090	0.0070	0.0070
33	0.0011	0.0011	0.0002	0.0002	63	0.0128	0.0090	0.0077	0.0077
34	0.0011	0.0012	0.0002	0.0002	64	0.0128	0.0090	0.0077	0.0077
35	0.0013	0.0013	0.0002	0.0002	65	0.0000	0.0090	0.0000	0.0000
36	0.0013	0.0014	0.0002	0.0002	66	0.0000	0.0090	0.0000	0.0000
37	0.0013	0.0015	0.0003	0.0003	67	0.0000	0.0090	0.0000	0.0000
38	0.0015	0.0015	0.0003	0.0003	68	0.0000	0.0090	0.0000	0.0000
39	0.0017	0.0016	0.0004	0.0004	69	0.0000	0.0090	0.0000	0.0000
40	0.0017	0.0017	0.0005	0.0005	70	0.0000	0.0090	0.0000	0.0000
41	0.0018	0.0021	0.0006	0.0006	71	0.0000	0.0090	0.0000	0.0000
42	0.0020	0.0025	0.0006	0.0006	72	0.0000	0.0090	0.0000	0.0000
43	0.0021	0.0029	0.0007	0.0007	73	0.0000	0.0090	0.0000	0.0000
44	0.0022	0.0032	0.0008	0.0008	74	0.0000	0.0090	0.0000	0.0000
45	0.0023	0.0036	0.0009	0.0009	75	0.0000	0.0090	0.0000	0.0000
46	0.0026	0.0040	0.0011	0.0011	76	0.0000	0.0090	0.0000	0.0000
47	0.0028	0.0044	0.0012	0.0012	77	0.0000	0.0090	0.0000	0.0000
48	0.0030	0.0048	0.0014	0.0014	78	0.0000	0.0090	0.0000	0.0000
49	0.0031	0.0052	0.0016	0.0016	79	0.0000	0.0090	0.0000	0.0000
50	0.0033	0.0055	0.0019	0.0019	80	0.0000	0.0090	0.0000	0.0000
Ref	#186x0.8	#517x0.6	#19x0.75	#19x0.75		#186x0.8	#517x0.6	#19x0.75	#19x0.75

Rates of Separation from Active Employment
Less Than 5 Year of Service

All Plan Participants

Service	Non-Uniformed		Uniformed	
	Male	Female	Male	Female
0-1	0.3000	0.2000	0.1000	0.1000
1-2	0.1600	0.1400	0.0700	0.0700
2-3	0.0900	0.1100	0.0325	0.0325
3-4	0.0700	0.0900	0.0300	0.0300
4-5	0.0550	0.0500	0.0275	0.0275
Ref	852	853	851	851

This assumption was first used in the June 30, 2013 valuation.

Rates of Separation from Active Employment
More Than 5 Years of Service

All Plan Participants

Age	Non-Uniformed		Uniformed	
	Male	Female	Male	Female
25	0.0575	0.0510	0.0270	0.0270
26	0.0575	0.0510	0.0270	0.0270
27	0.0575	0.0510	0.0270	0.0270
28	0.0554	0.0510	0.0270	0.0270
29	0.0533	0.0510	0.0270	0.0270
30	0.0512	0.0510	0.0270	0.0270
31	0.0492	0.0510	0.0270	0.0270
32	0.0472	0.0510	0.0261	0.0261
33	0.0452	0.0493	0.0236	0.0236
34	0.0432	0.0476	0.0213	0.0213
35	0.0412	0.0459	0.0191	0.0191
36	0.0393	0.0442	0.0170	0.0170
37	0.0375	0.0425	0.0152	0.0152
38	0.0356	0.0408	0.0136	0.0136
39	0.0338	0.0391	0.0122	0.0122
40	0.0321	0.0374	0.0113	0.0113
41	0.0304	0.0357	0.0105	0.0105
42	0.0287	0.0340	0.0098	0.0098
43	0.0271	0.0323	0.0092	0.0092
44	0.0256	0.0306	0.0085	0.0085
45	0.0241	0.0289	0.0079	0.0079
46	0.0226	0.0272	0.0072	0.0072
47	0.0213	0.0255	0.0065	0.0065
48	0.0200	0.0238	0.0058	0.0058
49	0.0188	0.0221	0.0052	0.0052
50	0.0176	0.0204	0.0046	0.0046
51	0.0165	0.0187	0.0038	0.0038
52	0.0155	0.0170	0.0033	0.0033
53	0.0146	0.0153	0.0029	0.0029
54	0.0137	0.0136	0.0028	0.0028
55	0.0129	0.0119	0.0023	0.0023
56	0.0123	0.0102	0.0025	0.0025
57	0.0116	0.0085	0.0019	0.0019
58	0.0111	0.0068	0.0019	0.0019
59	0.0107	0.0051	0.0018	0.0018
60	0.0104	0.0034	0.0017	0.0017
61	0.0102	0.0017		
62	0.0101	0.0000		
63	0.0101	0.0000		
64	0.0102	0.0000		
65	0.0104	0.0000		
66	0.0107	0.0000		
67	0.0111	0.0000		
68	0.0111	0.0000		
69	0.0111	0.0000		
Ref	#63x0.7	#684x0.85	#1272x1	#1272x1

Miscellaneous and Technical Assumptions

Administrative Expenses: 1.21% of payroll, based upon actual results from previous year.

Disability Expenses: 0.53% of payroll included in contribution. Retirement system pays premium directly to an outside insurance company or TPA.

Marriage Assumption: 90% of participants are assumed to be married for purposes of death-in-service benefits. Applies to disabled members entitled to future retirement benefits also. Male spouses are assumed to be 3 years older than females if beneficiary information is not available.

Pay Increase Timing: Beginning of (Fiscal) year.

This is equivalent to assuming that reported pays represent amounts paid to members during the year ended on the valuation date.

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

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.

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

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

Normal Form of Benefit: The assumed normal form of benefit is a 50% joint & survivor benefit for married members in the Closed Plan and a straight life benefit for all other members.

Optional Benefit Factors: Optional Benefit Factors are in accordance with tables adopted by the Board. We believe these factors are reasonably close to actuarial equivalence based on valuation assumptions.

Deferred Joint and Survivor: For the purpose of valuing the Joint and Survivor option it was assumed that all deferred members would choose closed plan benefits.

Other: Turnover decrements do not operate during retirement eligibility.

Miscellaneous Adjustments: The calculated normal and early retirement benefits for the Closed and Year 2000 plans were increased by 3.0% for Uniformed and 2.6% for Non-Uniformed to account for the inclusion of unused sick leave in the calculation of Average Pay. The calculated normal and early retirement benefits for the 2011 Tier plan were increased by 1.5% for Uniformed and 1.0% for Non-Uniformed to account for the inclusion of unused sick leave in the calculation of Average Pay. Post disability benefit liabilities were increased by 50% for all future disabilities to account for potential survivor benefits payable by the retirement system during the period of disability. Current self-insured disability retirant liabilities are increased by 23% to account for future survivor benefits. Liabilities for future deferred members were increased by 2% to account for potential survivor benefits payable if the member dies during the deferred period. The rationale for this load is based on the associated liabilities for the current deferred members.

Contribution Stabilization Reserve Fund: The contribution stabilization reserve fund affects the total amount of UAAL financed and is assumed to grow at the investment return rate.

Miscellaneous and Technical Assumptions

Death Prior to Retirement:	100% of deaths in service are assumed to be non-duty.
Gainful Employment Offset:	30% of the $90 per month special benefit is assumed to be offset by gainful employment.
Death after Retirement:	For purposes of valuing the 50% death after retirement benefit, 100% of closed active members are assumed to be married.
Beneficiaries:	Male spouses are assumed to be 3 years older than females if beneficiary information is not available.
Minimum Benefit Eligibility:	Deferred benefits and death prior to retirement benefits are assumed to be eligible for the minimum base benefit along with normal and early retirement benefits.
Active Plan Choice:	It was assumed that active members eligible for the Closed plan would choose the Closed plan benefits at retirement.
Joint and Survivor Factors:	For purposes of Death Prior to Retirement, the actuarial reduction for Closed members was calculated using the current valuation assumptions. The reduction for the Y2K and 2011 Tier benefits was calculated in accordance with 104.1027 RSMo.

Data

Active and retired member data was reported as of May 31. It was brought forward to June 30 by adding one month of service for all active members and otherwise making no other adjustments. It was assumed that the population as of May 31 was statistically equivalent to the population as of June 30. Financial information is reported as of June 30.

Salary Adjustments: Salary from data as provided in prior valuations was used for two active members on leave. Salary for new hires was annualized. Last year's salary as provided in the current valuation data was used if current year's salary was less than 100.

Disabled Member Data: Y2K and 2011 Tier data as provided are increased by 80% of CPI from date of disability to the valuation date and projected increases from the valuation date to the retirement date at 2.0% annually. For purposes of valuing these benefits, the 2.0% projected annual increases are backed out and replaced with 2.4% (80% of the current 3.0% CPI assumption) projected annual increases.

Reconciliation and Review: Reported data was reconciled to data reported for the prior year and reviewed for completeness and reasonableness. Any questions arising from this review were discussed with System staff. Upon completion of the review control totals (see page 1), were shared with the Executive Director and discussed to ensure MPERS also agreed that the data was reasonable.

Method of Financing Future Benefits for Present Active Members

The valuation was prepared in accordance with Section 104.1066 of the Missouri Revised Statutes, which requires the use of the entry-age normal actuarial cost method for determining normal cost and level percent-of-payroll financing of unfunded actuarial accrued liabilities. Details of the application of these methods are described below.

Normal cost and the allocation of present values between service rendered before and after the valuation date were determined using an individual entry-age actuarial cost method having the following characteristics:

(i) the annual normal cost for each individual active member, payable from the date of employment to the date of retirement, is sufficient to accumulate the value of the member's benefit at the time of retirement; and

(ii) each annual normal cost is a constant percentage of the member's year by year projected covered pay.

The ***Value of Future Benefits*** was calculated using the benefits assumed to be payable in the future to current active, terminated vested and retired members. It was assumed that current active and retired Uniformed Patrol members hired prior to July 1, 2000 would elect to retain the benefits under the current plan. Computed costs were increased in accordance with the loads described on page E-13.

The ***Present Value of Future Normal Costs*** was defined as the average normal cost rate multiplied by the present value of future payroll for the group.

The ***Actuarial Accrued Liabilities*** were defined as the difference between the present value of future benefits and the present value of future normal costs.

The Contribution Stabilization Reserve Fund (CSR) is set by the Board based on deferred recognition of gains in an effort to stabilize employer contributions from year to year. The fund is capped at $250,000,000.

Actuarial Accrued Liabilities, less pension assets as of June 30, 2017, resulted in ***Unfunded Actuarial Accrued Liabilities (UAAL).*** The UAAL plus the CSR was amortized using the following funding policy.

Permanent Policy: The total contribution will be based on normal cost plus an 18-year amortization of unfunded actuarial accrued liabilities. The amortization period is a closed 18-year period starting July 1, 2018.

Temporary Accelerated Policy: The total contribution is based on normal cost plus a 7-year amortization period for unfunded retiree liabilities and a 22-year amortization period for other unfunded liabilities. Both amortization periods are closed periods starting July 1, 2018.

This temporary accelerated policy was adopted by the Retirement Board on September 17, 2009 and will remain in effect until such time as the retiree liability becomes 100% funded or the permanent policy produces a higher contribution rate.

Post-Valuation Date Activity: No other adjustments were made to the valuation results to reflect other post-valuation date activity.

June 30, 2017 Actuarial Valuation
Glossary

Actuarial Accrued Liability. The difference between (i) the actuarial present value of future plan benefits, and (ii) the actuarial present value of future normal cost. Sometimes referred to as "accrued liability" or "past service liability."

Accrued Service. The service credited under the plan which was rendered before the date of the actuarial valuation.

Actuarial Assumptions. Estimates of future plan 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.

Actuarial Cost Method. A mathematical budgeting procedure for allocating the dollar amount of the "actuarial present value of future plan benefits" between the actuarial present value of future normal cost and the actuarial accrued liability. Sometimes referred to as the "actuarial funding method."

Actuarial Equivalent. A series of payments is called an actuarial equivalent of another series of payments if the two series have the same actuarial present value.

Actuarial Present Value. The amount of funds presently required to provide a payment or series of payments in the future. It is determined by discounting the future payments at a predetermined rate of interest, taking into account the probability of payment.

Actuarial value of Assets. Also referred to as funding value of assets, smoothed market value of assets, or valuation assets.

Valuation assets recognize assumed investment return fully each year. Differences between actual and assumed investment return are phased-in over a closed 3-year period. This treatment helps remove the timing of investment activities from the valuation process. During periods when investment performance exceeds the assumed rate, valuation assets will tend to be less than market value. During periods when investment performance is less than the assumed rate, valuation assets will tend to be greater than market value. If assumed rates are exactly realized for 3 consecutive years, valuation assets will become equal to market value.

Actuary. A person who is trained in the applications of probability and compound interest to problems in business and finance that involve payment of money in the future, contingent upon the occurrence of future events. Most actuaries in the United States are Members of the American Academy of Actuaries. The Society of Actuaries is an international research, education and membership organization for actuaries in the life and health insurance, employee benefits, and pension fields. It administers a series of examinations leading initially to Associateship and the designation ASA and ultimately to Fellowship with the designation FSA.

June 30, 2017 Actuarial Valuation
Glossary (Concluded)

Amortization. Paying off an interest-bearing liability by means of periodic payments of interest and principal, as opposed to paying it off with a lump sum payment.

Experience Gain (Loss). A measure of the difference between actual experience and that expected based upon a set of actuarial assumptions during the period between two actuarial valuation dates, in accordance with the actuarial cost method being used.

Normal Cost. The annual cost assigned, under the actuarial funding method, to current and subsequent plan years. Sometimes referred to as "current service cost." Any payment toward the unfunded actuarial accrued liability is not part of the normal cost.

Plan Termination Liability. The actuarial present value of future plan benefits based on the assumption that there will be no further accruals for future service and salary. The termination liability will generally be less than the liabilities computed on a "going concern" basis and is not normally determined in a routine actuarial valuation.

Reserve Account. An account used to indicate that funds have been set aside for a specific purpose and are not generally available for other uses.

Unfunded Actuarial Accrued Liability. The difference between the actuarial accrued liability and actuarial value of assets. Sometimes referred to as "unfunded accrued liability."

The existence of unfunded actuarial accrued liabilities is not in itself bad, any more than a mortgage on a house is bad. Unfunded actuarial accrued liabilities do not represent a debt that is payable today. What is important is the ability to amortize the unfunded actuarial accrued liabilities and the trend in their amount (after due allowance for devaluation of the dollar).

Valuation Payroll. Active member payroll that is intended to reflect the annual salary considered as covered compensation for Retirement System benefits.

SECTION F

FINANCIAL PRINCIPLES AND OPERATIONAL TECHNIQUES

Financial Principles and Operational Techniques of the Retirement System

Promises Made, and To Be Paid For. As each year is completed, the Retirement System in effect hands an "IOU" to each member then acquiring a year of service credit -- the "IOU" says: "The Missouri Department of Transportation and Highway Patrol Employees' Retirement System owes you one year's worth of retirement benefits, payments in cash commencing when you qualify for retirement."

The principal related financial question is: When shall the money required to cover the "IOU" be contributed? This year, when the benefit of the member's service is received? Or, some future year when the "IOU" becomes a cash demand?

The objective of level percent-of-payroll financing is that this year's taxpayers contribute the money to cover the IOUs being handed out this year. By following this objective, ***the employer contribution rate will remain approximately level from year to year*** --- and will not have to be increased for future generations of taxpayers. However, "Level percent-of-payroll" does NOT mean "Fixed percent-of-payroll." The level percent-of-payroll is an estimate that may change from one year to the next.

(There are systems which have a design for deferring contributions to future taxpayers, lured by a lower contribution rate now and putting aside the consequence that the contribution rate must then relentlessly grow much greater over decades of time.)

An inevitable by-product of the level-cost design is the accumulation of reserve assets, for decades, and the income produced when the assets are invested. ***Invested assets are a by-product and not the objective.*** Investment income becomes the 3rd contributor for benefits to employees, and is interlocked with the contribution amounts required from employees and employer.

Financial Principles and Operational Techniques of the Retirement System (Concluded)

Translated to actuarial terminology, this level-cost objective means that the contribution rates must total at least the following:

Normal Cost (the value assigned to service being rendered this year)

. . . plus . . .

Interest on Unfunded Actuarial Accrued Liabilities (the difference between liabilities for service already rendered and the accrued assets of the Retirement System).

Computing Contributions to Support System Benefits. From a given schedule of benefits and from the employee data and asset data furnished by the system, the actuary determines the contribution rates to support the benefits, by means of ***an actuarial valuation.***

An actuarial valuation has a number of ingredients such as: the rate of investment return which plan assets will earn; the rates of withdrawal of active members who leave covered employment; the rates of mortality; the rates of disability; the rates of pay increases and the assumed age or ages at actual retirement.

In an actuarial valuation the actuary must assume what the above rates will be, for the next year and for decades in the future. Only the subsequent actual experience of the plan can indicate the degree of accuracy of the assumptions.

Reconciling Differences Between Assumed Experience and Actual Experience. Once actual experience has occurred and has been observed, it will not coincide exactly with assumed experience, regardless of the skill of the actuary and the many calculations made. Most retirement systems cope with such differences by having annual actuarial valuations. Each actuarial valuation is a complete recalculation of assumed future experience, taking into account all past differences between assumed and actual experience. The result is ***continuing adjustments to the financial position.***

Actuarial Valuation Process

The ***actuarial valuation*** is the mathematical process by which the contribution rate is determined, and the flow of activity constituting the valuation may be summarized as follows:

A . ***Covered people data*** furnished by plan administrator, including:

Retired lives now receiving benefits

Former employees with vested benefits not yet payable

Active employees

B . + ***Asset data*** (cash & investments), furnished by the plan administrator

C . + ***Benefit provisions*** which specify eligibility and amounts of pensions

D . + ***Assumptions concerning future experience in various risk areas,*** which are established by the Retirement Board after consulting with the actuary

E . + ***The funding method*** for employer contributions (the long-term, planned pattern for employer contributions)

F . + ***Mathematically combining the assumptions, the funding method, and the data***

G . = Determination of:

Plan Financial Position and/or

New Employer Contribution Rate

Meaning of "Unfunded Actuarial Accrued Liabilities"

"Actuarial accrued liabilities" are the portion of the present value of plan promises to pay benefits in the future that are not covered by future normal cost contributions. A liability has been established ("accrued") because the service has been rendered but the resulting monthly cash benefit may not be payable until years in the future. Actuarial accrued liabilities are the result of complex mathematical calculations, which are made by the plan's actuary.

If "actuarial accrued liabilities" exceed the plan's accrued assets (cash & investments), the difference is ***"unfunded actuarial accrued liabilities."*** This is the usual condition. If the plan's assets equaled the plan's "actuarial accrued liabilities," then the plan would be termed "fully funded." This is an unusual condition.

Each time a plan adds a new benefit, which applies to service already rendered, an "actuarial accrued liability" is created, which is also an "unfunded actuarial accrued liability" because the plan can't print instant cash to cover the value of the new benefit promises. Payment for such unfunded actuarial accrued liabilities is spread over a period of years, commonly in the 20-30 year range.

Unfunded actuarial accrued liabilities can occur in another way: if actual plan experience is less favorable than assumed plan experience, the difference is added to unfunded actuarial accrued liabilities. In plans where benefits are directly related to an employee's pay near time of retirement, unfunded actuarial accrued liabilities rose dramatically during the 1970's. Unexpected rates of pay increase created additional actuarial accrued liabilities, which could not be matched by reasonable investment results. More recent experience has generally been more favorable with some reductions in unfunded actuarial accrued liabilities.

The existence of unfunded actuarial accrued liabilities is not bad, but the changes from year to year in the amount of unfunded actuarial accrued liabilities are important, --- "bad" or "good" or somewhere in between.

Even though unfunded actuarial accrued liabilities don't constitute a bill payable immediately, it is important that policy-makers prevent the amount from becoming unreasonably high and ***it is vital for plans to have a sound method for making payments toward them*** so that they are controlled.

SECTION G

SUPPLEMENTAL INFORMATION FOR COMPREHENSIVE ANNUAL FINANCIAL REPORTING

GRS Retirement Consulting

800.521.0498 | P: 248.799.9000 | F: 248.799.9020 | www.grsconsulting.com

September 18, 2017

Retirement Board
Missouri Department of Transportation
and Highway Patrol Employees' Retirement System
1913 William Street
Jefferson City, Missouri 65102-1930

Ladies and Gentlemen:

This report was prepared at the request of the Board and is intended for use by the Retirement System and those designated or approved by the Board. This report may be provided to parties other than the System only in its entirety and only with the permission of the Board. GRS is not responsible for unauthorized use of this report. This report should not be relied on for any purpose other than the purpose described.

The basic financial objective of the Missouri Department of Transportation and Highway Patrol Employees' Retirement System (MPERS) is to establish and receive contributions which:

(1) when expressed in terms of percents of active member payroll, will remain approximately level from generation to generation of Missouri citizens, and

(2) when combined with present assets and future investment returns, will be sufficient to meet the present and future financial obligations of MPERS.

In order to measure progress toward this fundamental objective, MPERS has annual actuarial valuations performed. The valuations (i) measure the present financial position, and (ii) establish contribution rates that provide for the current cost and level percent-of-payroll amortization of unfunded actuarial liabilities over a reasonable period. An actuarial valuation was performed based upon benefit conditions, data and assumptions as of June 30, 2017. This valuation indicates that contribution rates for the period beginning July 1, 2018 that are at least equal to the calculated contribution rates will meet the Board's financial objective. The calculated contribution rates are 58.00% of payroll for the 6,192 Non-Uniformed employees and 58.00% of payroll for the 1,264 Uniformed patrol employees.

The plan administrative staff provides the actuary with data for the actuarial valuation. The actuary relies on the data after reviewing it for internal and year to year consistency. Member data was not audited by the actuary. The actuary summarizes and tabulates population data in order to analyze longer term trends. We are not responsible for the accuracy or completeness of the data provided by MPERS.

Gabriel, Roeder, Smith & Company was responsible for the following schedules found in the Actuarial Section:

- Summary of Actuarial Assumptions and Methods
  - Probabilities of Separation from Active Employment
  - Individual Salary Increases
  - Joint Life Retirement Values
  - Probabilities of Retirement for Members
  - Probabilities of Disability for Members
- Summary of Member Data Included in Valuations
  - Active Members by Attained Age and Years of Service
  - Schedule of Active Member Valuation Data
- Solvency Test
- Derivation of Financial Experience
- Schedule of Retirees and Beneficiaries Added and Removed
- Summary of Plan Provisions
- Legislative Changes

Gabriel, Roeder, Smith & Company was responsible for the following schedules found in the Financial Section:

- Schedule of Changes in the Employer's Net Pension Liability
- Schedule of Employer's Net Pension Liability
- Schedule of Employer Contributions
- Schedule of the Actuarially Determined Contributions

Actuarial valuations are based upon assumptions regarding future activity in specific risk areas including the rates of investment return and payroll growth, eligibility for the various classes of benefits, and longevity among retired lives. These assumptions are adopted by the Board. The assumptions and the methods comply with the requirements of the Governmental Accounting Standards Board. Each actuarial valuation takes into account all prior differences between actual and assumed experience in each risk area and adjusts the contribution rates as needed. Actuarial methods and assumptions were adopted by the Board pursuant to the June 30, 2012 Experience Study. Gabriel, Roeder, Smith & Company has produced the following reports as of June 30, 2017:

- Annual Actuarial Valuation Report
- GASB Nos. 67 and 68 Valuation Report

In order to gain a full understanding of the condition of this plan, these reports should be read in their entirety.

To the best of our knowledge, the report is complete and accurate and was made in accordance with standards of practice promulgated by the Actuarial Standards Board. The actuarial assumptions used for the valuation produce results which, individually and in the aggregate, are reasonable.

The employer contributions determined in this report are based on Board funding policy. This policy is discussed on page 4 of the annual actuarial valuation report. We commend the Board for its aggressive monitoring and updating of the funding policy over the recent past. However, continued employer contributions at the current level do not guarantee benefit security. We therefore encourage the Board to continue to routinely monitor and update its funding policy and to continue to consider benefit security when doing so.

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.

This report has been prepared by individuals who have substantial experience valuing public employee retirement systems. Heidi Barry is a Member of the American Academy of Actuaries (MAAA) and meets the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein.

The signing individuals are independent of the plan sponsor.

Based upon the valuation results, it is our opinion that the Missouri Department of Transportation and Highway Patrol Employees' Retirement System continues to operate in accordance with actuarial principles of level percent-of-payroll financing. It is important to the well-being of the System that it continues to receive contributions at the actuarially determined levels. It is also important to continue to monitor both the total funded status and the funded status of the retiree liabilities to ensure that the funding policy is consistent with the expected life span of the respective unfunded obligation.

Respectfully submitted,

Heidi G. Barry, ASA, FCA, MAAA

Kenneth G. Alberts

Solvency Test

The MPERS funding objective is to meet long term benefit promises through contributions that remain approximately level from year to year as a percent of member payroll. If the contributions to the System are level in concept and soundly executed, the System will ***pay all promised benefits when due – the ultimate test of financial soundness.***

A solvency test is one means of checking a system's progress under its funding program. In a solvency test for a non-contributory plan, the plan's present assets (cash and investments) are compared with: 1) The liabilities for future benefits to present retired lives, and 2) The liabilities for service already rendered by members. In a system that has been following the discipline of level percent-of-payroll financing, the liabilities for future benefits to present retired lives (liability 1) will be fully covered by present assets (except in rare circumstances). In addition, the liabilities for service already rendered by members (liability 2) will be partially covered by the remainder of present assets. The larger the funded portion of liability 2, the stronger the condition of the system.

The schedule below illustrates the history of liability 2 of the System.

Val. Date June 30	(1) Member Contributions	(2) Retirees and Benef.	(3) Active and Inactive Members	Present Valuation Assets	Portion of Present Values Covered by Present Assets			
					(1)	(2)	(3)	Total
	----------$ Millions----------							
2008	0	1,873	1,147	1,784	100%	95%	0%	59%
2009	0	1,947	1,166	1,471	100%	76%	0%	47%
2010#	0	2,034	1,225	1,376	100%	68%	0%	42%
2011	0	2,045	1,253	1,427	100%	70%	0%	43%
2012#	0	2,133	1,173	1,531	100%	72%	0%	46%
2013#	1	2,333	1,250	1,657	100%	71%	0%	46%
2014	2	2,384	1,264	1,795	100%	75%	0%	49%
2015	3	2,444	1,269	1,967	100%	80%	0%	53%
2016	5	2,470	1,287	2,087	100%	84%	0%	55%
2017	8	2,488	1,306	2,173	100%	87%	0%	57%

 # New assumptions and/or methods adopted.

Derivation of Experience Gain/(Loss)

Actual experience will never coincide exactly with assumed experience (except by coincidence). Gains and losses may offset each other over a period of years, but sizeable year-to-year variations from assumed experience are common. Detail on the derivation of the experience gain/(loss) is shown below:

	$ Millions
UAAL Beginning of Year (at July 1)	$ 1,675,078,656
Normal Cost	49,933,711
Contributions	(213,198,963)
Interest	123,492,067
Net Change in LTD Assets	-
Expected UAAL Before Any Changes	1,635,305,471
Effect of Data Improvements*	(861,636)
Effect of Changes in Assumptions & Methods	-
Effect of Adjustment	-
Expected UAAL After Changes	1,634,443,835
End of Year UAAL (at June 30)	$ 1,629,656,586
Gain/(Loss) for Year	$ 4,787,249
Gain/(Loss) as a percent of actuarial accrued liabilities at start of year ($3,761.7 million)	0.1%

** Result of receiving disability information on retired members who are at or past normal retirement age.*

Valuation Date June 30	Experience Gain/(Loss) as % of Beginning Accrued Liability
2008	(0.2)%
2009	(12.6)%
2010	(3.8)%
2011	2.2 %
2012	3.2 %
2013	2.1 %
2014	2.1 %
2015	2.4 %
2016	1.1 %
2017	**0.1 %**

Summary of Actuarial Assumptions and Methods

Valuation Date:	June 30, 2017
Actuarial Cost Method:	Entry Age
Amortized Method:	Closed, level percent-of-payroll
Remaining Amortization Period:	15 years#
Asset Valuation Method:	3-year smoothing
Actuarial Assumptions:	
Investment Rate of Return:	7.75%
Projected Salary Increase:	3.50% to 11.00%
Cost-of-Living Adjustments:	2.40% Compound
Includes Wage Inflation at:	3.50%

 # Single equivalent period.

An actuarial valuation is based upon an actuarial cost method, an asset valuation method, and actuarial assumptions. These methods and assumptions are chosen by the Board of Trustees after consultation with the Actuary and other advisors.

The actuarial cost method is called the Entry Age Actuarial Cost Method. This method is consistent with the Board's level percent-of-payroll funding objective. With this method, the level percent-of-payroll is determined that will fund a member's retirement benefit over the member's entire working lifetime, from date of hire (Entry Age) to date of exit from the active member population. Differences in the past between assumed and actual experience become part of unfunded actuarial accrued liabilities and are amortized with level percent-of-payroll contributions. This cost method was first used in the ***June 30, 1999*** valuation.

The asset valuation method is a three-year smoothed market value method in which assumed investment return is recognized immediately each year and differences between actual and assumed investment return are phased-in over a closed three-year period. This asset valuation method is intended to give recognition to the long term accuracy of market values while filtering out and dampening short term market swings. This method was first used in the ***June 30, 1999*** valuation.

The actuarial assumptions used in producing the valuation fall into two broad classes: economic assumptions, and demographic assumptions. Economic assumptions refer to long term rates of investment return, wage growth, covered population growth, and inflation. Demographic assumptions refer to retirement rates, turnover rates, disability rates, merit and seniority pay increases, and mortality rates. The current assumptions are based upon a 2007-2012 study of experience of the MPERS. The assumptions are reviewed from time to time to keep them reasonably current with expected experience. The next experience study is scheduled to follow the June 30, 2017 valuation.

Economic Assumptions

The investment return rate used in making the valuation was 7.75% per year, compounded annually (net after administrative expenses). This rate of return is not the assumed real rate of return. The real rate of return over wage inflation is defined to be the portion of investment return which is more than the wage inflation rate. Considering wage inflation recognition of 3.50%, the 7.75% rate translates to an assumed real rate of return over wage inflation of 4.25%. This rate was first used for the ***June 30, 2013*** valuation.

Summary of Actuarial Assumptions and Methods (Concluded)

Pay increase assumptions for individual active members are shown on Tables VI and VII. Part of the assumption for each age is for a merit and/or seniority increase, and the other 3.50% recognizes wage inflation. These rates were first used for the **June 30, 2013** valuation.

Price Inflation is assumed to be 3.0%. This results in a 2.4% annual COLA assumption. It is assumed that the 2.4% COLA will always be paid.

The Active Member Group size is assumed to remain constant at its present level.

The active member payroll for all members is assumed to increase 3.50% annually.

Non-Economic Assumptions

The mortality table used to measure retired life mortality was the RP-2000 Combined Healthy Mortality Table projected 16 years and set back 1 year for males and females. Related values are shown on Table I. This table was first used for the **June 30, 2013** valuation. Disabled pension mortality was based on PBGC Disabled Mortality tables. The healthy mortality tables include a margin for mortality improvement. The margin is in the 16-year projection. The disabled mortality tables do not include a margin for mortality improvement.

The probabilities of retirement for members eligible to retire are shown on Table II. The rates for full retirement were first used in the **June 30, 2013** valuation. The rates for reduced retirement were first used in the **June 30, 2013** valuation. Upon retirement, members are assumed to pick the BackDROP period that when combined with the remaining annuity produces the highest liability.

The probabilities of disability for members eligible to retire are shown on Table III. The rates for disability were first used in the **June 30, 2013** valuation.

The probabilities of withdrawal from service, death-in-service and disability are shown for sample ages on Tables IV and V. The death-in-service and disability rates were first used in the **June 30, 2013** valuation. The withdrawal rates were first used in the **June 30, 2013** valuation.

The data about persons now covered and about present assets was furnished by the System's administrative staff. Although examined for general reasonableness, the data was not audited by the Actuary. Data was furnished as of May 31 and assumed to be statistically equivalent to June 30.

The actuarial valuation computations were made by or under the supervision of a Member of the American Academy of Actuaries (MAAA).

Table I
Joint Life Retirement Values
(7.75% Interest)

Sample Attained Ages	Present Value of $1 Monthly for Life		Percent Dying Next Year		Future Life Expectancy (years)	
	Men	Women	Men	Women	Men	Women
50	$147.46	$147.37	0.1516%	0.1159%	33.34	35.39
55	142.23	142.00	0.2313%	0.2064%	28.61	30.63
60	135.19	134.87	0.4593%	0.4099%	24.03	26.02
65	126.18	125.80	0.9002%	0.7955%	19.69	21.67
70	115.18	114.73	1.5803%	1.3715%	15.71	17.66
75	101.84	101.56	2.6618%	2.2752%	12.07	14.01
80	86.45	86.42	4.8531%	3.7094%	8.86	10.73
Ref:	#508sb1x1	#509sb1x1				

The present values shown above are for illustrative purposes only and include a 50% survivor benefit but do not include the value of future post-retirement increases. Males are assumed to be 3 years older than their spouses.

Table II
Rates of Retirement

	Closed and Year 2000 Plans					2011 Tier			
	Non-Uniformed				Uniformed	Non-Uniformed			Uniformed
	Male		Female			Normal			
Age	Normal	Early	Normal	Early	Normal	Age & Service	Rule of 90	Early	Normal
50	0.3000		0.2500		0.3500				
51	0.2500		0.2000		0.1500				
52	0.2600		0.2000		0.1500				
53	0.2600		0.2000		0.1500				
54	0.2400		0.2400		0.1500				
55	0.2700	0.0300	0.3200	0.0300	0.2000		0.3000		0.3000
56	0.3000	0.0300	0.3500	0.0300	0.1500		0.3000		0.3000
57	0.2600	0.0400	0.2900	0.0300	0.3000		0.3000		0.3000
58	0.2200	0.0200	0.2500	0.0300	0.3500		0.3000		0.3000
59	0.2500	0.0400	0.3000	0.0300	0.5000		0.3000		0.3000
60	0.1900	0.0800	0.2200	0.0600	1.0000		0.3000		1.0000
61	0.1800	0.0400	0.2200	0.0500	1.0000		0.3000		1.0000
62	0.4500	0.3000	0.3600	0.3000	1.0000		0.3000	0.1000	1.0000
63	0.3700	0.4000	0.2200	0.3000	1.0000		0.3000	0.1000	1.0000
64	0.2500	0.4000	0.2000	0.2500	1.0000		0.3000	0.1000	1.0000
65	0.3500		0.3500		1.0000		0.3000	0.1000	1.0000
66	0.4000		0.4500		1.0000		0.3000	0.1000	1.0000
67	0.2500		0.4000		1.0000	0.5000	0.3000		1.0000
68	0.3000		0.4000		1.0000	0.5000	0.3000		1.0000
69	0.3000		0.4000		1.0000	0.5000	0.3000		1.0000
70	0.4000		0.5000		1.0000	1.0000	1.0000		1.0000
71	0.5000		0.5000		1.0000	1.0000	1.0000		1.0000
72	0.5000		1.0000		1.0000	1.0000	1.0000		1.0000
73	0.5000								
74	1.0000								
Ref	2265	2267	2266	2268	2264	1873	1875	1262	1875

Table III
Rates of Disability

All Plan Participants

	Non-Uniformed		Uniformed			Non-Uniformed		Uniformed	
Age	Male	Female	Male	Female	Age	Male	Female	Male	Female
21	0.0000	0.0006	0.0000	0.0000	51	0.0037	0.0059	0.0022	0.0022
22	0.0004	0.0006	0.0000	0.0000	52	0.0041	0.0063	0.0024	0.0024
23	0.0004	0.0007	0.0000	0.0000	53	0.0046	0.0067	0.0028	0.0028
24	0.0004	0.0007	0.0000	0.0000	54	0.0054	0.0071	0.0031	0.0031
25	0.0004	0.0007	0.0001	0.0001	55	0.0062	0.0074	0.0035	0.0035
26	0.0004	0.0007	0.0001	0.0001	56	0.0072	0.0078	0.0039	0.0039
27	0.0004	0.0008	0.0002	0.0002	57	0.0082	0.0082	0.0043	0.0043
28	0.0007	0.0008	0.0002	0.0002	58	0.0093	0.0086	0.0048	0.0048
29	0.0009	0.0008	0.0002	0.0002	59	0.0102	0.0090	0.0052	0.0052
30	0.0009	0.0008	0.0002	0.0002	60	0.0112	0.0090	0.0058	0.0058
31	0.0011	0.0009	0.0002	0.0002	61	0.0120	0.0090	0.0063	0.0063
32	0.0011	0.0010	0.0002	0.0002	62	0.0126	0.0090	0.0070	0.0070
33	0.0011	0.0011	0.0002	0.0002	63	0.0128	0.0090	0.0077	0.0077
34	0.0011	0.0012	0.0002	0.0002	64	0.0128	0.0090	0.0077	0.0077
35	0.0013	0.0013	0.0002	0.0002	65	0.0000	0.0090	0.0000	0.0000
36	0.0013	0.0014	0.0002	0.0002	66	0.0000	0.0090	0.0000	0.0000
37	0.0013	0.0015	0.0003	0.0003	67	0.0000	0.0090	0.0000	0.0000
38	0.0015	0.0015	0.0003	0.0003	68	0.0000	0.0090	0.0000	0.0000
39	0.0017	0.0016	0.0004	0.0004	69	0.0000	0.0090	0.0000	0.0000
40	0.0017	0.0017	0.0005	0.0005	70	0.0000	0.0090	0.0000	0.0000
41	0.0018	0.0021	0.0006	0.0006	71	0.0000	0.0090	0.0000	0.0000
42	0.0020	0.0025	0.0006	0.0006	72	0.0000	0.0090	0.0000	0.0000
43	0.0021	0.0029	0.0007	0.0007	73	0.0000	0.0090	0.0000	0.0000
44	0.0022	0.0032	0.0008	0.0008	74	0.0000	0.0090	0.0000	0.0000
45	0.0023	0.0036	0.0009	0.0009	75	0.0000	0.0090	0.0000	0.0000
46	0.0026	0.0040	0.0011	0.0011	76	0.0000	0.0090	0.0000	0.0000
47	0.0028	0.0044	0.0012	0.0012	77	0.0000	0.0090	0.0000	0.0000
48	0.0030	0.0048	0.0014	0.0014	78	0.0000	0.0090	0.0000	0.0000
49	0.0031	0.0052	0.0016	0.0016	79	0.0000	0.0090	0.0000	0.0000
50	0.0033	0.0055	0.0019	0.0019	80	0.0000	0.0090	0.0000	0.0000
Ref	#186x0.8	#517x0.6	#19x0.75	#19x0.75		#186x0.8	#517x0.6	#19x0.75	#19x0.75

Table IV
Rates of Separation from Active Employment
Less Than 5 Years of Service

All Plan Participants

Service	Non-Uniformed		Uniformed	
	Male	Female	Male	Female
0-1	0.3000	0.2000	0.1000	0.1000
1-2	0.1600	0.1400	0.0700	0.0700
2-3	0.0900	0.1100	0.0325	0.0325
3-4	0.0700	0.0900	0.0300	0.0300
4-5	0.0550	0.0500	0.0275	0.0275
Ref	852	853	851	851

Table V
Rates of Separation from Active Employment
More Than 5 Years of Service

All Plan Participants

Age	Non-Uniformed		Uniformed	
	Male	Female	Male	Female
25	0.0575	0.0510	0.0270	0.0270
26	0.0575	0.0510	0.0270	0.0270
27	0.0575	0.0510	0.0270	0.0270
28	0.0554	0.0510	0.0270	0.0270
29	0.0533	0.0510	0.0270	0.0270
30	0.0512	0.0510	0.0270	0.0270
31	0.0492	0.0510	0.0270	0.0270
32	0.0472	0.0510	0.0261	0.0261
33	0.0452	0.0493	0.0236	0.0236
34	0.0432	0.0476	0.0213	0.0213
35	0.0412	0.0459	0.0191	0.0191
36	0.0393	0.0442	0.0170	0.0170
37	0.0375	0.0425	0.0152	0.0152
38	0.0356	0.0408	0.0136	0.0136
39	0.0338	0.0391	0.0122	0.0122
40	0.0321	0.0374	0.0113	0.0113
41	0.0304	0.0357	0.0105	0.0105
42	0.0287	0.0340	0.0098	0.0098
43	0.0271	0.0323	0.0092	0.0092
44	0.0256	0.0306	0.0085	0.0085
45	0.0241	0.0289	0.0079	0.0079
46	0.0226	0.0272	0.0072	0.0072
47	0.0213	0.0255	0.0065	0.0065
48	0.0200	0.0238	0.0058	0.0058
49	0.0188	0.0221	0.0052	0.0052
50	0.0176	0.0204	0.0046	0.0046
51	0.0165	0.0187	0.0038	0.0038
52	0.0155	0.0170	0.0033	0.0033
53	0.0146	0.0153	0.0029	0.0029
54	0.0137	0.0136	0.0028	0.0028
55	0.0129	0.0119	0.0023	0.0023
56	0.0123	0.0102	0.0025	0.0025
57	0.0116	0.0085	0.0019	0.0019
58	0.0111	0.0068	0.0019	0.0019
59	0.0107	0.0051	0.0018	0.0018
60	0.0104	0.0034	0.0017	0.0017
61	0.0102	0.0017		
62	0.0101	0.0000		
63	0.0101	0.0000		
64	0.0102	0.0000		
65	0.0104	0.0000		
66	0.0107	0.0000		
67	0.0111	0.0000		
68	0.0111	0.0000		
69	0.0111	0.0000		
Ref	#63x0.7	#684x0.85	#1272x1	#1272x1

Table VI
Age Based Salary Scale

All Plan Participants

Age	Salary Increase Assumptions for an Individual Member					
	Non-Uniformed			Uniformed		
	Merit & Seniority	Base (Economic)	Increase Next Year	Merit & Seniority	Base (Economic)	Increase Next Year
20	4.40%	3.50%	7.90%	6.00%	3.50%	9.50%
21	4.11%	3.50%	7.61%	6.00%	3.50%	9.50%
22	3.84%	3.50%	7.34%	6.00%	3.50%	9.50%
23	3.60%	3.50%	7.10%	5.48%	3.50%	8.98%
24	3.38%	3.50%	6.88%	4.89%	3.50%	8.39%
25	3.18%	3.50%	6.68%	4.25%	3.50%	7.75%
26	3.08%	3.50%	6.58%	3.54%	3.50%	7.04%
27	2.90%	3.50%	6.40%	3.38%	3.50%	6.88%
28	2.82%	3.50%	6.32%	3.08%	3.50%	6.58%
29	2.66%	3.50%	6.16%	2.78%	3.50%	6.28%
30	2.59%	3.50%	6.09%	2.48%	3.50%	5.98%
31	2.44%	3.50%	5.94%	2.18%	3.50%	5.68%
32	2.39%	3.50%	5.89%	1.88%	3.50%	5.38%
33	2.25%	3.50%	5.75%	1.76%	3.50%	5.26%
34	2.20%	3.50%	5.70%	1.65%	3.50%	5.15%
35	2.09%	3.50%	5.59%	1.54%	3.50%	5.04%
36	1.97%	3.50%	5.47%	1.43%	3.50%	4.93%
37	1.87%	3.50%	5.37%	1.31%	3.50%	4.81%
38	1.76%	3.50%	5.26%	1.24%	3.50%	4.74%
39	1.60%	3.50%	5.10%	1.16%	3.50%	4.66%
40	1.44%	3.50%	4.94%	1.09%	3.50%	4.59%
41	1.23%	3.50%	4.73%	1.01%	3.50%	4.51%
42	1.09%	3.50%	4.59%	0.94%	3.50%	4.44%
43	0.95%	3.50%	4.45%	0.86%	3.50%	4.36%
44	0.81%	3.50%	4.31%	0.79%	3.50%	4.29%
45	0.68%	3.50%	4.18%	0.71%	3.50%	4.21%
46	0.56%	3.50%	4.06%	0.64%	3.50%	4.14%
47	0.43%	3.50%	3.93%	0.56%	3.50%	4.06%
48	0.31%	3.50%	3.81%	0.53%	3.50%	4.03%
49	0.18%	3.50%	3.68%	0.49%	3.50%	3.99%
50	0.12%	3.50%	3.62%	0.45%	3.50%	3.95%
51	0.06%	3.50%	3.56%	0.41%	3.50%	3.91%
52	0.06%	3.50%	3.56%	0.38%	3.50%	3.88%
53	0.00%	3.50%	3.50%	0.35%	3.50%	3.85%
54	0.00%	3.50%	3.50%	0.32%	3.50%	3.82%
55	0.00%	3.50%	3.50%	0.29%	3.50%	3.79%
56	0.00%	3.50%	3.50%	0.26%	3.50%	3.76%
57	0.00%	3.50%	3.50%	0.23%	3.50%	3.73%
58	0.00%	3.50%	3.50%	0.23%	3.50%	3.73%
59	0.00%	3.50%	3.50%	0.23%	3.50%	3.73%
60	0.00%	3.50%	3.50%	0.23%	3.50%	3.73%
Ref.	11			403		

Table VII
Service Based Salary Scale

Non-Uniformed Plan Participants

% Merit Increases in Salaries Next Year*	
Service Index	**Rate**
1	8.0%
2	7.0%
3	4.5%
4	4.0%
Ref	519

Uniformed Plan Participants

% Merit Increases in Salaries Next Year*	
Service Index	**Rate**
1	10.0%
2	10.0%
Ref	518

* *For Non-Uniformed members with 4 or less years of service and Uniformed members with 2 or less years of service, the service based table overwrites the age based table on page G-10.*