

Pennsylvania Municipal Retirement System

**Actuarial Valuation
as of January 1, 2017**

Produced by Cheiron

May 2018

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May 7, 2018

Pennsylvania Municipal Retirement Board of the
Pennsylvania Municipal Retirement System
c/o Stephen W. Vaughn, Secretary
1721 North Front Street
Harrisburg, Pennsylvania 17102-2315

Re: PMRS 2017 Actuarial Valuation Report

Dear Members of the Board:

At your request, we have conducted the annual actuarial valuation of the Pennsylvania Municipal Retirement System (System) as of January 1, 2017. The purpose of this report is to provide the aggregate valuation results of the participating employers for the System and the analyses of the combined asset and liability performance and projections. The report provides statistics on the participating employer contribution levels for all plans participating in the system as of the valuation date, incorporating the individual Governmental Accounting Statements No. 67 and 68 (GASB 67/68) results for each plan and the new interest rate assumption adopted by the Board effective January 1, 2017.

This report reflects the actuarial liabilities for the municipal and authority employers' traditional defined benefit, which are explicitly calculated as of January 1, 2017. The liabilities for the cash balance plans are based on the member and municipal account balances, as provided by PMRS, as well as the explicit liabilities associated with retirees for these plans. The liabilities for the county plans reflect the January 1, 2016 actuarial liabilities rolled-forward reflecting explicit retiree liabilities as of January 1, 2017 and adjusted for the active and terminated vested liabilities, as well as any material changes.

The valuation results reflect the assumption change approved by the Pennsylvania Municipal Retirement Board of the Pennsylvania Municipal Retirement System ("Board") in November 2016, effective January 1, 2017.

This report was prepared for the Board for the purposes described herein and for the use by the plan auditor in completing an audit related to the matters herein. Other users of this report are not intended users as defined in the Actuarial Standards of Practice, and Cheiron assumes no duty or liability to such other users.

This report contains analyses which combine asset and liability performance and projections. PMRS is an agent multiple-employer retirement system (as defined under Governmental Accounting Standards Board Statements No. 67 and 68) for participating municipalities and counties. Assets and liabilities are separately accounted for and reported to the Public Employee Retirement Commission of the Commonwealth of Pennsylvania. We refer you to the Foreword and Board Summary which presents the general approach used in the preparation of this report, a big picture view of the System, historical trends developed by Cheiron, and future stress testing

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Pennsylvania Municipal Retirement System
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of the System. We also comment on the sources and reliability of both the data and the actuarial assumptions on which our findings are based. These comments support the information presented throughout our report.

To the best of our knowledge, this report and its contents have been prepared in accordance with generally recognized and accepted actuarial principles and practices which are consistent with the Code of Professional Conduct and applicable Actuarial Standards of Practice set out by the Actuarial Standards Board. Furthermore, as credentialed actuaries, we meet the Qualification Standards of the American Academy of Actuaries to render the opinion contained in this report. This report does not address any contractual or legal issues. We are not attorneys and our firm does not provide any legal services or advice.

Sincerely,
Cheiron



Kenneth A. Kent, FSA, FCA, MAAA
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**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2017**

FOREWORD

Cheiron performed the actuarial valuation of the Pennsylvania Municipal Retirement System (System) as of January 1, 2017. The purpose of this report is to:

- 1) **Measure and disclose**, as of the valuation date, the financial condition of the System;
- 2) **Indicate trends** in the financial progress of the System;
- 3) **Provide specific information** and documentation required by the Governmental Accounting Standards Board (GASB).

An actuarial valuation establishes and analyzes System assets and liabilities on a consistent basis and traces the progress of both from one year to the next. It includes measurement of the System's investment performance as well as an analysis of actuarial liability gains and losses.

Section I presents a summary containing our findings and disclosing important trends experienced by the System in recent years.

Section II contains details on various asset measures, together with pertinent performance measurements.

Section III shows similar information on System liabilities, measured for actuarial, accounting, and government reporting purposes.

Section IV shows the distribution of the traditional defined benefit plans' contribution rates by component.

Section V includes the required disclosures under GASB as well as additional information provided in the System's Comprehensive Annual Financial Report (CAFR).

The appendices to this report contain a summary of the System's membership at the valuation date, and the actuarial methods and assumptions used in the valuations.

As this System is an agent multiple-employer retirement system in which each of the participating municipalities are entitled to define and submit to the Board the benefit provisions for their respective employees, the actual plan provisions are not included in this report. We based our results on the plan provisions defined and submitted to the State under the 2016 Act 293 filings and 2017 Act 205 filings in preparing this valuation as provided by the System.

We have rolled forward the liabilities for all county plans to January 1, 2017. These liabilities reflect the assumption changes and material changes (such as plan changes) if applicable. These liabilities are incorporated into all of the 2017 liability calculations to provide a reasonable estimate for the aggregate System results.

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Because the System is bound by Act 205 to complete a biennial valuation for each municipality and/or authority with traditional defined benefit plans, we incorporated these results as of January 1, 2017 into this report. For municipalities with cash balance plans and all participants in pay status, the liabilities as of January 1, 2017 reflect the data as of this date, as provided by the System. Further information on these techniques can be found in Appendix B under “Method to estimate rolled forward liabilities”.

In preparing our report, we relied on information (some oral and some written) supplied by the System’s staff. This information includes, but is not limited to, plan provisions, employee data, and financial information. We performed an informal examination of the obvious characteristics of the data by plan for all the traditional defined benefit plans and in aggregate for the cash balance plans for reasonableness and consistency in accordance with Actuarial Standard of Practice No. 23 (Data Quality).

The actuarial assumptions reflect the Board’s understanding of the likely future experience of the System, as well as adopted formal procedures by the Board in the reviewing and setting of the interest rate assumption. The assumptions as a whole represent the best estimate for the future experience of the System. They reflect the experience analysis and our presentation of appropriate assumptions in accordance with the Actuarial Standards of Practice No. 27 (Selection of Economic Assumptions for Measuring Pension Obligations) and No. 35 (Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations) in performing actuarial valuations of retirement systems. To the extent the laws of the Commonwealth of Pennsylvania and/or the administrative practices of the System differ from Actuarial Standards of Practice, we have identified such deviations within the assumption section of this report.

The results of this report are dependent upon future experience conforming to these assumptions. To the extent that future experience deviates from the actuarial assumptions, the true cost for each of the plans could vary from our results.

Future valuation reports may differ significantly from the current report presented in this document due to such factors as the following: plan experience differing from that anticipated by the assumptions; changes in assumptions; and changes in plan provisions or applicable law.

Finally, in preparing this report, we have conformed to generally accepted actuarial principles and practices which are consistent with the Code of Professional Conduct, and applicable Actuarial Standards of Practice set out by the Actuarial Standards Board.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2017**

SECTION I – BOARD SUMMARY

General Comments

The primary purpose of the actuarial valuation and this report is to disclose the following as of the valuation date:

- The overall financial condition of the Pennsylvania Municipal Retirement System,
- Biennial valuation of the non-county plans participating in the System,
- Past trends and expected future trends in the System’s financial condition, and
- Information required by the Governmental Accounting Standards Board (GASB) and the System’s Financial Statements.

In this Section, we present a summary of the principal valuation results. This includes the basis upon which the January 1, 2017 valuation was completed and an examination of the current financial condition of the System. In addition, we present a review of the key historical trends followed by the System’s projected financial outlook.

The municipal plans are valued every odd year. Throughout our report, our discussion will address changes from January 1, 2015, the last time the municipal plans were valued, to January 1, 2017. In other parts of the discussion, we address the overall status of the System. In this case, we compare results from January 1, 2016 to January 1, 2017 to identify the changes in the overall System’s funded status. The January 1, 2016 valuation results reflect the explicit valuation of the cash balance and county pension plans, and a roll-forward of the liabilities for all municipal defined benefit based upon the January 1, 2015 results. The January 1, 2017 valuation results reflect the explicit valuation of the cash balance and municipal pension plans, and a roll-forward of the liabilities for all county defined benefit plans based upon the January 1, 2016 results.

A. Valuation Basis

The January 1, 2017 valuation results are based on the actuarial assumptions used for the January 1, 2016 valuation and the updated discount rate assumption. The January 1, 2016 results reflect a 5.50% interest rate assumption while the January 1, 2017 valuation, results reflect a 5.25% interest rate assumption, as adopted by the Board in November 2016, based on a formal review by the Board of this assumption in relationship to the expected investment return for municipal assets. The interest rate assumption change resulted in an overall increase in the System’s Actuarial Liability by \$58.4 million.

Below we identify the following key results of this valuation.

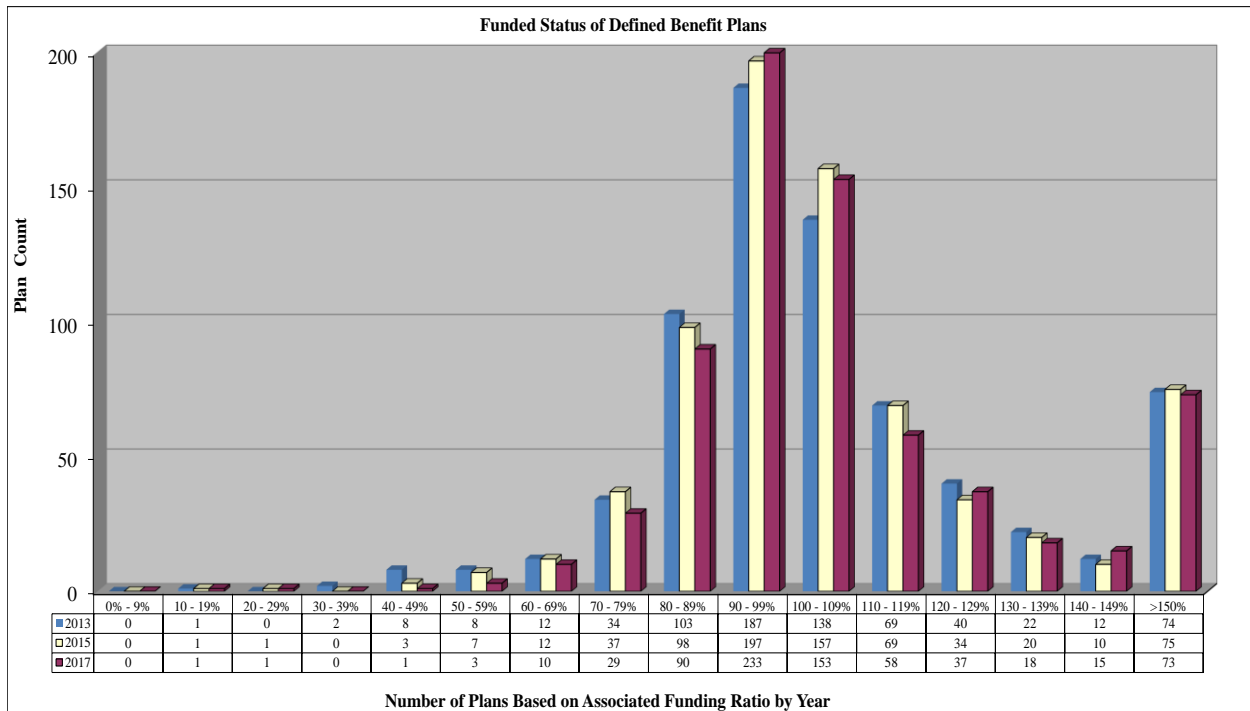
- *Unfunded Actuarial Liability (UAL):* The UAL is the excess of the System’s Actuarial Liability (AL) over the Actuarial Value of Assets (AVA). Because the System is made up of many plans, some with a UAL and others with a surplus (when the AVA is greater than the AL), the aggregate changes for each of these values combined provides the net funded level of the System. In aggregate, the System is in a deficit position of \$50.5 million as of January 1, 2017 compared to a net surplus of \$2.3 million as of January 1, 2016. Much of this deficit is due to the reduction in the interest rate from 5.50% to 5.25% effective January 1, 2017 which resulted in a net increase in the AL by \$58.4 million.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
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- On a snap shot basis, comparing the Market Value of Assets to Actuarial Liability provides information of the progress of the System’s funding status. As of January 1, 2017 the Actuarial Liability exceeded the Market Value of Assets resulting in an unfunded liability of \$169.4 million. Compared to the unfunded liability of \$156.9 million as of January 1, 2016, this was a \$12.5 million increase which again incorporates the \$58.4 million increase in liabilities due to the reduction in the interest rate assumption as well as demographic losses of \$3.2 million and plan changes of \$1.3 million.
- *Funding Ratio on Actuarial Asset Value:* This is the ratio of the System’s Actuarial Value of Assets to Actuarial Liability. The funding ratio decreased from 100.1% as of January 1, 2016 to 97.8% as of January 1, 2017.
- *System Experience:* On an Actuarial Value of Assets basis, the return is 5.50% based on the Regular Interest Rate determined by PMRS for the plan year ending December 31, 2016. However, on a Market Value of Assets basis the average investment return for the year ending December 31, 2016 resulted in a money-weighted return rate of 8.2% used to measure the System’s experience for valuation purposes.

The following chart shows a distribution of the individual employer funded status using actuarial value of assets of the plans covered by the System in 2013, 2015 and 2017. The assumption change is reflected in the chart below in the maroon bars for 2017 which still appear to exhibit continued overall funded progress.



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Under Act 205 and Act 44, plans may be considered distressed if they are less than 90% funded. As of January 1, 2017, **19% of the traditional defined benefit plans for the municipalities were less than 90% funded, which is a decrease compared to 22% and 24% as of January 1, 2015 and January 1, 2013, respectively.**

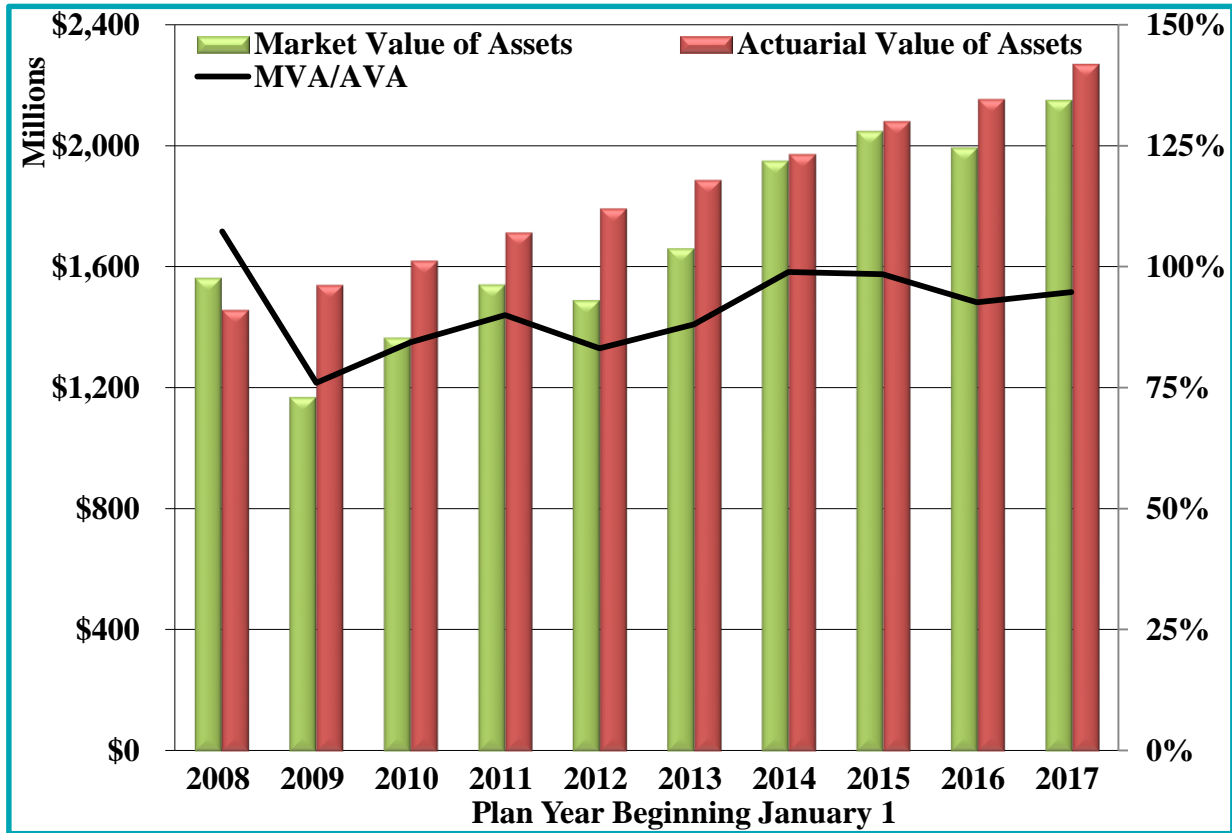
As of January 1, 2017, **49% of the traditional defined benefit plans for the municipalities were 100% funded or more, which was a slight decrease compared to 51% and 50% as of January 1, 2015 and January 1, 2013, respectively.** These overfunded plans can apply 10% of the excess assets (assets that exceed the liabilities) to reduce their MMO. On this basis, it is not uncommon for the number of plans in surplus to decline as that surplus is used to fund the plans.

In addition to the historical funded status ranges, another important relationship to review is the Actuarial Value of Assets and Market Value of Assets. The Actuarial Value of Assets is defined as the reserves being held for all benefits of the participating employers and reflects the crediting of the Regular Interest Rate and actual cash flows without regard to the actual investment return of the System.

The Market Value of Assets money-weighted returns for the plan years ended 2015 and 2016 were -0.3% and 8.2%, respectively. The Market Value deficit compared to the Actuarial Value of Assets has declined from \$159.1 million last year to \$118.9 million this year reflecting improved funded status of the System overall on a snapshot basis. The following table shows the historic relationship between the Market Value of Assets (MVA; green bars) and the Actuarial Value of Assets (AVA; red bars) along with the ratio of the MVA to the AVA (represented by the line associated with the right vertical axis) demonstrating the underlying risk of the System.

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When compared to the Market Value of Assets, any shortfall must be resolved from future investment earnings in excess of the Regular Interest Rate. As a response to the recession and slow recovery as well as a review of the System liabilities, annuity purchase rates, and the long term expected rate of return for the Market Value of Assets, the Regular Interest Rate was reduced by the Pennsylvania Municipal Retirement Board effective January 1, 2017 from 5.50% to 5.25%.

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B. Current Financial Condition

On the following pages, we summarize the key results of the January 1, 2017 valuation and how they compare to the results from the January 1, 2016 valuation.

1. System Membership:

As shown in Table I-1 below, total membership in the Retirement System increased by 2.6% from 2016 to 2017. The active participant counts reported for the Traditional Defined Benefit Plans increased by 0.4% while the active cash balance plan participation increased by 2.3%, showing a continued increased growth in the hybrid plan over the traditional defined benefit plan.

Table I-1 Membership Total			
	January 1, 2017	January 1, 2016	% Change
Traditional Defined Benefit Actives	7,728	7,698	0.4%
Cash Balance Benefit Actives	1,303	1,274	2.3%
Terminated Vesteds	1,150	1,173	-2.0%
Participants Receiving Benefit Payments	5,099	4,784	6.6%
Inactive Nonvested Participants with accounts	28	7	300.0%
Beneficiaries	600	576	4.2%
Total System Members	15,908	15,512	2.6%
Annual Salaries*	\$ 476,619,568	\$445,775,169	6.9%
Average Salary per Active Member	\$52,776	\$49,685	6.2%

* Annualized salary paid during the prior plan year for Traditional Defined Benefit plan participants and actual salary for active cash balance participants

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Table I-2 is a summary of the demographic make-up of the traditional defined benefit and cash balance plans in the System.

Table I-2 Demographic Make-up of the System			
Category	Valuation as of		Percent
	January 1, 2017	January 1, 2016	Change
Number of plans:			
Traditional Defined Benefit Plans	722	722	0.00%
Cash Balance Plans	<u>311</u>	<u>294</u>	5.78%
Total	1,033	1,016	1.67%
Active Employees in Traditional Defined Benefit Plans:			
Count	7,728	7,698	0.39%
Average Age	48.1	48.1	-0.03%
Average Service	12.4	12.6	-1.64%
Total Payroll*	\$ 422,621,214	\$ 394,133,120	7.23%
Average Pay	\$ 54,687	\$ 51,199	6.81%
Active Employees in Cash Balance Plans:			
Count	1,303	1,274	2.28%
Average Age	50.3	50.7	-0.72%
Average Service	11.9	12.4	-3.72%
Total Payroll*	\$ 53,998,354	\$ 51,642,049	4.56%
Average Pay*	\$ 41,442	\$ 40,535	2.24%
Total Active PMRS Participants	9,031	8,972	0.66%
Inactive Nonvested Participants with account balances:	28	7	300.00%
Deferred Vested Participants:			
Traditional Defined Benefit Plans	834	872	-4.36%
Cash Balance Plans	316	301	4.98%
Pensioners:			
Count	5,099	4,784	6.58%
Average Age	69.7	69.6	0.10%
Average Monthly Benefit	\$ 1,334	\$ 1,298	2.75%
Number of New Awards	447	339	31.86%
Average New Monthly Benefit	\$ 1,562	\$ 1,574	-0.76%
Number Receiving Legislated COLA	277	220	25.91%
Survivor Beneficiaries:			
Count	600	576	4.17%
Average Age	74.3	74.2	0.19%
Average Monthly Benefit	\$ 935	\$ 895	4.38%
Total Inactive Participants Count	6,877	6,540	5.15%

* Annualized salary paid during the prior plan year for Traditional Defined Benefit plan participants and actual salary for active cash balance participants.

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SECTION I – BOARD SUMMARY

2. System Assets and Liabilities:

Table I-3 presents a comparison between the January 1, 2016 and January 1, 2017 System assets, liabilities, unfunded actuarial liability, and funding ratios for traditional defined benefit non-county, traditional defined benefit county, and non-county cash balance plans. While this valuation was prepared to support the municipal plans, we have rolled forward county participant active and vested terminated liabilities from the 2016 valuation. Retiree liabilities were explicitly valued. Liabilities for the non-county cash balance plans are based on the member and municipal accounts, as provided by PMRS, and the explicit retiree liabilities.

On an Actuarial Value of Asset basis, the total funding ratio decreased from 100.1% as of January 1, 2016 to 97.8% as of January 1, 2017. However, the overall funding ratio on a market value basis remained at 92.7% for both years.

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Table I-3 Total Plan Assets and Liabilities (\$ thousands)			
	January 1, 2017	January 1, 2016	% Change to Baseline
Traditional Defined Benefit (Non-county) Plans:			
Actives	\$ 1,058,864	\$ 1,008,220	5.0%
Terminated Vesteds	80,001	73,850	8.3%
In Pay Status	937,977	843,753	11.2%
Total Actuarial Liability ¹	\$ 2,076,842	\$ 1,925,823	7.8%
Actuarial Value of Assets ²	2,068,136	1,949,912	6.1%
Unfunded/(Surplus) of Actuarial Liability	\$ 8,706	\$ (24,089)	
Traditional Defined Benefit (County) Plans:			
Actives	\$ 69,830	\$ 66,498	5.0%
Terminated Vesteds	10,895	10,079	8.1%
In Pay Status	43,070	39,192	9.9%
Total Actuarial Liability ¹	\$ 123,795	\$ 115,769	6.9%
Actuarial Value of Assets ²	120,399	113,785	5.8%
Unfunded/(Surplus) of Actuarial Liability	\$ 3,396	\$ 1,984	
Cash Balance Plans:			
Actives	\$ 77,236	\$ 76,757	0.6%
Terminated Vesteds	15,307	11,440	33.8%
In Pay Status	27,586	21,552	28.0%
Total Actuarial Liability	\$ 120,129	\$ 109,749	9.5%
Actuarial Value of Assets ²	121,239	109,749	10.5%
Unfunded/(Surplus) of Actuarial Liability	\$ (1,110)	\$ 0	
Total of All Plans			
Actives	\$ 1,205,930	\$ 1,151,475	4.7%
Terminated Vesteds	106,203	95,369	11.4%
In Pay Status	1,008,633	904,497	11.5%
Total Actuarial Liability	\$ 2,320,766	\$ 2,151,341	7.9%
Market Value of Assets	\$ 2,151,378	\$ 1,994,491	7.9%
Actuarial Value of Assets (summation of above) ²	\$ 2,309,774	\$ 2,173,446	6.3%
Expenses in Excess of Assessment	5,814	4,668	24.6%
Actuarial Value of Asset Adjustment ³	(45,310)	(24,488)	85.0%
Final Actuarial Value of Assets ⁴	\$ 2,270,278	\$ 2,153,626	5.4%
Unfunded/(Surplus) using Actuarial Value	\$ 50,488	\$ (2,285)	
Funding Ratio on Actuarial Asset Value	97.8%	100.1%	-2.3%
Unfunded/(Surplus) using Market Asset Value	\$ 169,388	\$ 156,850	8.0%
Funding Ratio on Market Asset Value	92.7%	92.7%	0.0%

1 County plan liabilities are estimated in odd years and municipal defined benefit liabilities are estimated in even years based upon a roll-forward of the prior year's liabilities; Liabilities associated with participants in non-operational plans are included in the Non-County Plan Liabilities

2 The assets shown above are attributable to the traditional defined benefit, cash balance, non-county and county plans based upon updated data and information provided. The cash balance 2017 assets reflect un-distributable forfeitures associated with terminated plan participants.

3 The actuarial value of asset adjustment reflects the total difference between the retiree reserve and the retiree liabilities as well as differences from plans entering and exiting the System as of plan year end.

4 The final Actuarial Value of Assets reflect the asset value based on member, municipal, retiree, disability & DROP reserve accounts as approved by the Board and provided by PMRS in the 2015 and 2016 CAFR.

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Table I-4 presents a summary of the January 1, 2017 municipal traditional defined benefit plans that are in a surplus or underfunded position.

Table I-4		
Funded Status of Municipalities		
	January 1, 2017	January 1, 2015
A. Municipal Plans in a surplus position		
1. Number of plans with a surplus	354	364
2. Actuarial Value of Assets in plans with a surplus	\$733,627,708	\$706,681,600
3. Actuarial Liability in plans with a surplus	<u>620,805,414</u>	<u>596,027,513</u>
4. Amount of surplus (2. – 3.)	\$112,822,294	\$110,654,087
B. Municipal Plans in an underfunded position		
1. Number of underfunded plans	364	353
2. Actuarial Value of Assets in underfunded plans	\$1,334,508,645	\$1,163,743,859
3. Actuarial Liability in underfunded plans	<u>1,456,032,055</u>	<u>1,259,881,712</u>
4. Amount of (unfunded) liability (2. – 3.)	(\$121,523,410)	(\$96,137,853)

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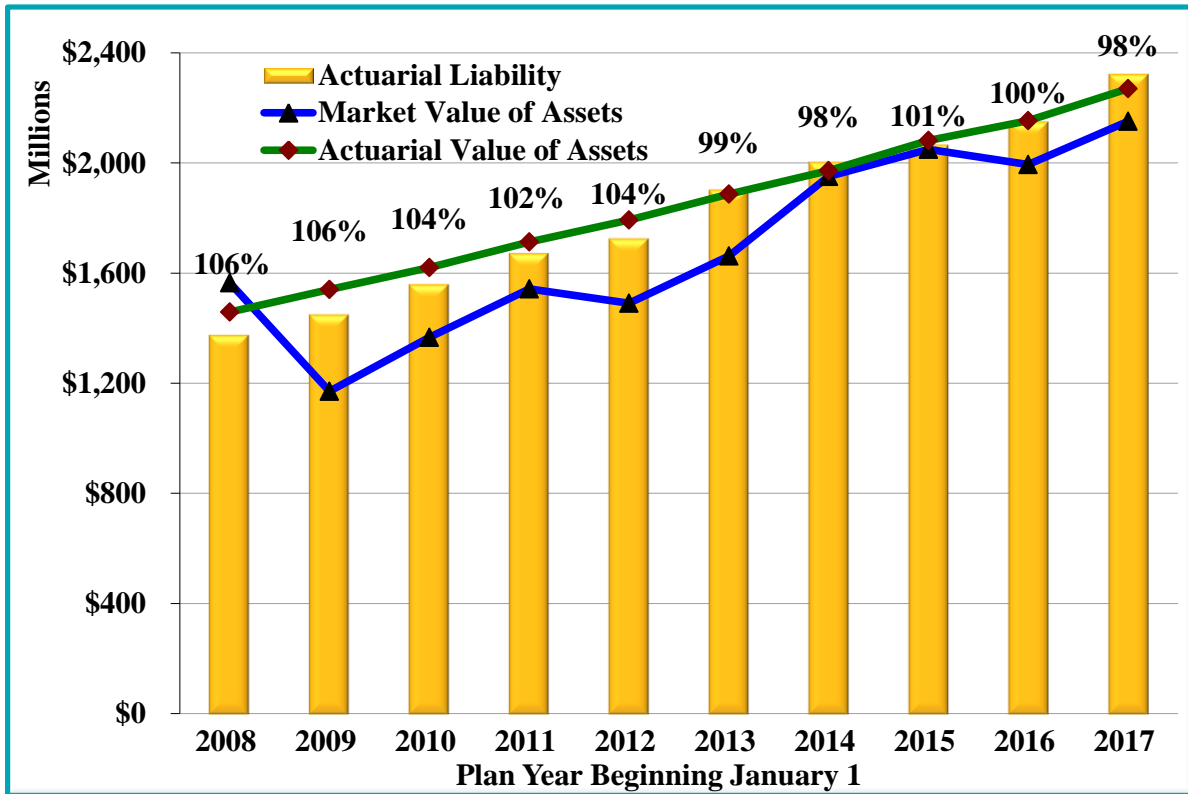
SECTION I – BOARD SUMMARY

C. Historical Trends

Even though the attention given to the valuation reflects the most recently computed actuarial liability and funding ratio, it is important to remember that each valuation is merely a snapshot of the long-term progress of the System. It is equally important to judge a current year’s valuation result relative to historical trends, as well as trends expected into the future.

In the chart below, we present the historical trends for the total System (i.e. traditional defined benefit, cash balance, county and non-county) market and actuarial value of assets compared to the total System actuarial liabilities. We have included the funding ratio (Actuarial Value of Assets divided by the Actuarial Liability) across the top of each bar to show the progress of the System since 2008.

Pennsylvania Municipal Retirement System Assets and Liabilities – 2008 to 2017

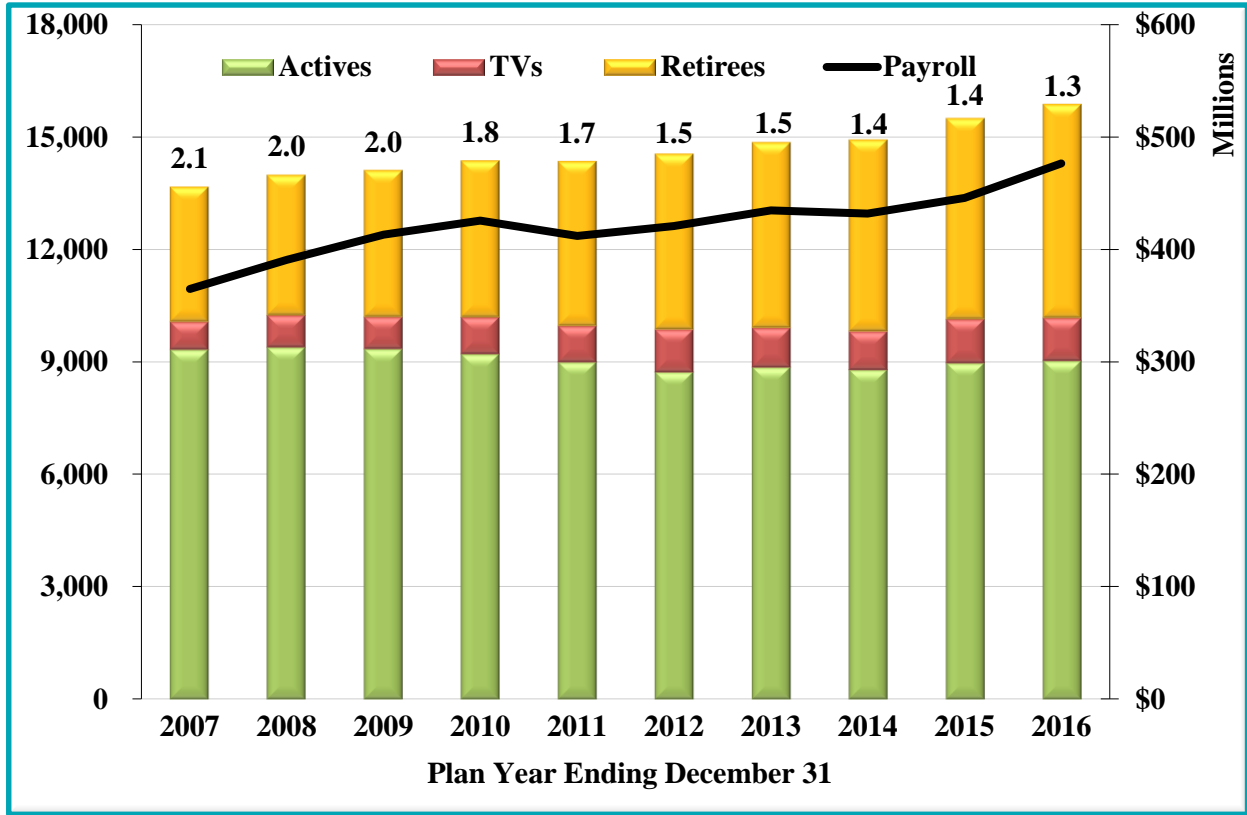


In 2017, the Regular Interest Rate (investment rate assumption) decreased from 5.50% to 5.25%, causing a larger increase in liabilities (the yellow bars). As of this valuation, the individual municipal reserves that make up the Actuarial Value of Assets are less than the Actuarial Liability. In addition, the funding ratio on a Market Value of Assets basis is important to understand the underlying System’s risks. The 2017 Market Value of Assets is less than the Actuarial Liability, such that on that basis, the funding ratio would be 93%.

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Pennsylvania Municipal Retirement System Participant Counts – end of year 2007 to 2016



The chart above shows a comparison of the demographic makeup of the System over the last ten years. The black line represents the active payroll and corresponds to the right-hand axis. The number above the bars represents the ratio of active to inactive participants which is decreasing steadily.

A retirement system has a life cycle, reaching maturity when as many or more of the covered participants are non-active (retirees and terminated vested participants). When this occurs, the ratio moves closer to and sometimes below 1.0. The System is maturing as indicated by the steadily declining ratio of active to inactive participants. The nature of the risk factors of a maturing fund is such that investment recovery takes more time and can be difficult to achieve without additional steps. This supports part of the rationale for further reduction in the interest rates. Prolonged recovery is primarily due to a decrease in net cash flows (occurring when benefit payments and expenses exceed contributions).

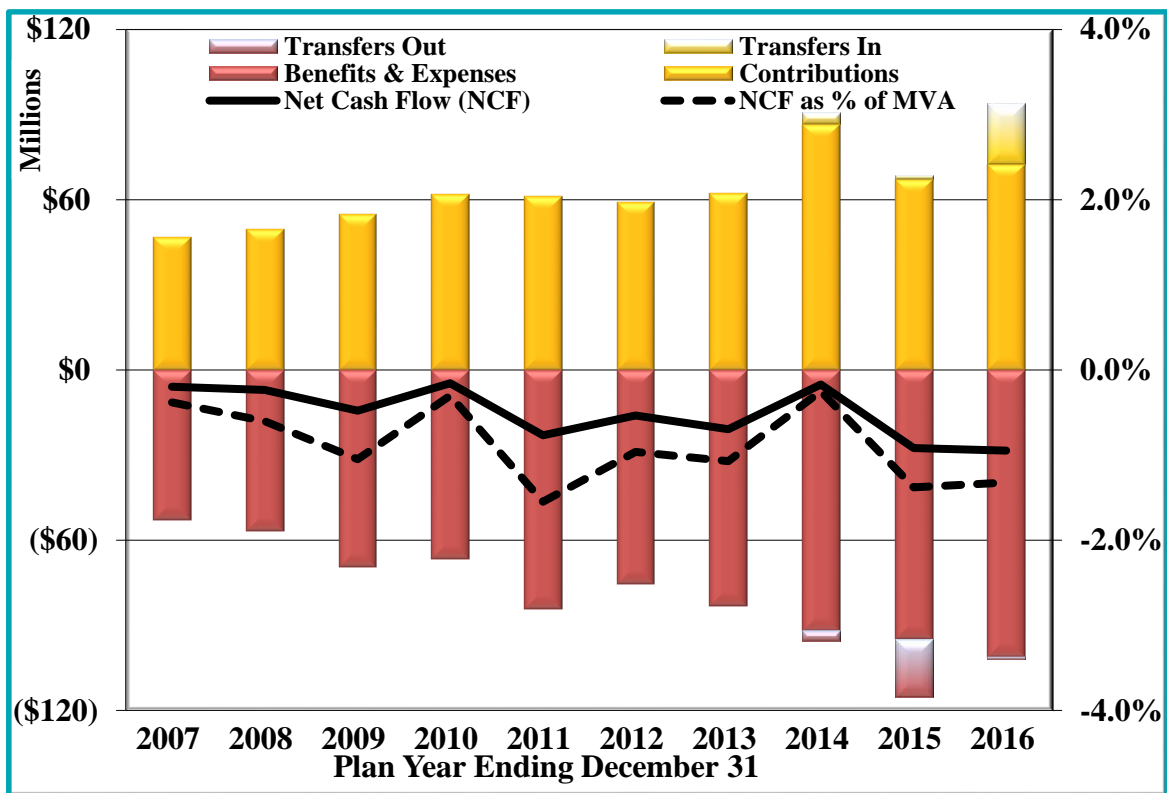
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SECTION I – BOARD SUMMARY

This next graph tracks the cash flow since 2007. An important risk element of a retirement system is the implication of cash flow (represented by the black line) and resources for paying benefits. If the level of benefit payments plus expenses exceeds expected contributions, the additional cash from existing assets are needed to make the benefit payments. This is referred to as negative cash flow which is typical among retirement systems where the number of retirees increase steadily compared to the number of active participants. The dashed black line (which corresponds to the right-hand axis) provides the net cash flow as a percent of the Market Value of Assets (MVA). As of December 31, 2016, this resulted in a \$28.4 million deficit excluding transfers into and out of the System which is the equivalent of 1.3% of MVA. As the graph below illustrates, the negative net cash flow falls within the range of 0.1% to 2.0% of total assets, averaging to negative 0.9% (-0.9%) over the ten-year period. This implies that along with proceeds from contributions, an additional amount of cash generated from asset investments must be used to pay benefits. Another way to consider this is that for the total value of assets to grow, the fund needs a minimum return equal to the net negative cash flow.

The volatility of the net cash flow is a function of contributions and benefit payments, and does not reflect a transfer of funds into the System from new participating municipalities and asset outflows to municipalities that choose to leave the System which can vary greatly from year to year. The incorporation of transfers into and out of the System can be found in Table II-2 and is shown below in the shaded bars dating back to 2014, the first year this information is available.

Pennsylvania Municipal Retirement System Cash Flows – 2007 through 2016



SECTION I – BOARD SUMMARY

D. Projected Financial Trends

Our analysis of the Pennsylvania Municipal Retirement System’s projected financial trends is an important part of this valuation. In this section, we present our assessment of the implications of the January 1, 2017 valuation results on the future outlook in terms of benefit security (assets sufficient to cover liabilities) and the System’s expected funding progression.

In the charts that follow, we project the Retirement System’s resources and obligations. We assume the Act 205 contributions are made each year. The projections are provided under four different assumptions:

- 1) Assuming 5.25% investment returns each and every year,
- 2) Assuming 7.50% investment returns each and every year,
- 3) Assuming average investment returns over 20 years equals 5.25% but vary annually based on the returns provided in Table I-5. We do this to demonstrate a more realistic projection because the System’s return will never be level from year to year,
- 4) Assuming 20 years of varied returns equal to an overall average 7.50% investment return based on Table I-6.

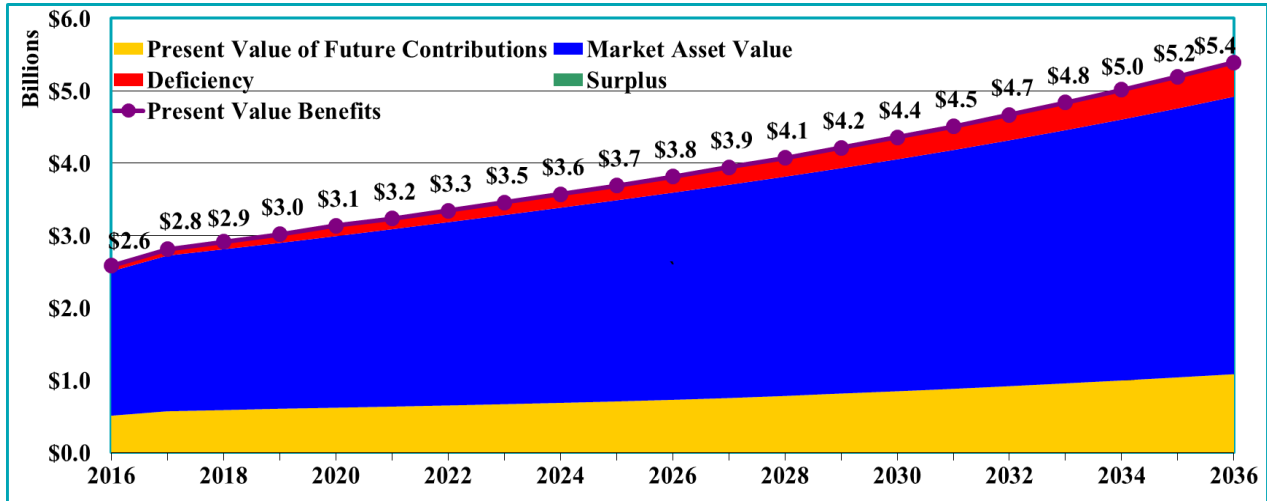
The projections that follow show how the total obligations (shown by the purple line) of the System, assuming the current active population, consistently increase. This is an open group projection which means when an active participant is expected to change status, they are assumed to be replaced. The area under the purple line represents the *Present Value of Benefits*. This amount takes into account the value of all benefits earned up to that point in time (Actuarial Liability) plus benefits assumed to be earned into the future. This amount represents the System’s total obligation over time.

To meet these obligations, the System has resources which include the Market Value of Assets (in blue) and the present value of future contributions (in gold). To the extent these two sources are insufficient to meet the obligations today or in the future, the result will be a deficit (in red). If the System’s resources exceed the obligations, the result will be a surplus (green). For this System, given that the investment Regular Interest Rate for all municipalities is currently at 5.25%, the only resource to cover a deficit or create a surplus is through average future investment returns at a System level that exceed the 5.25% rate.

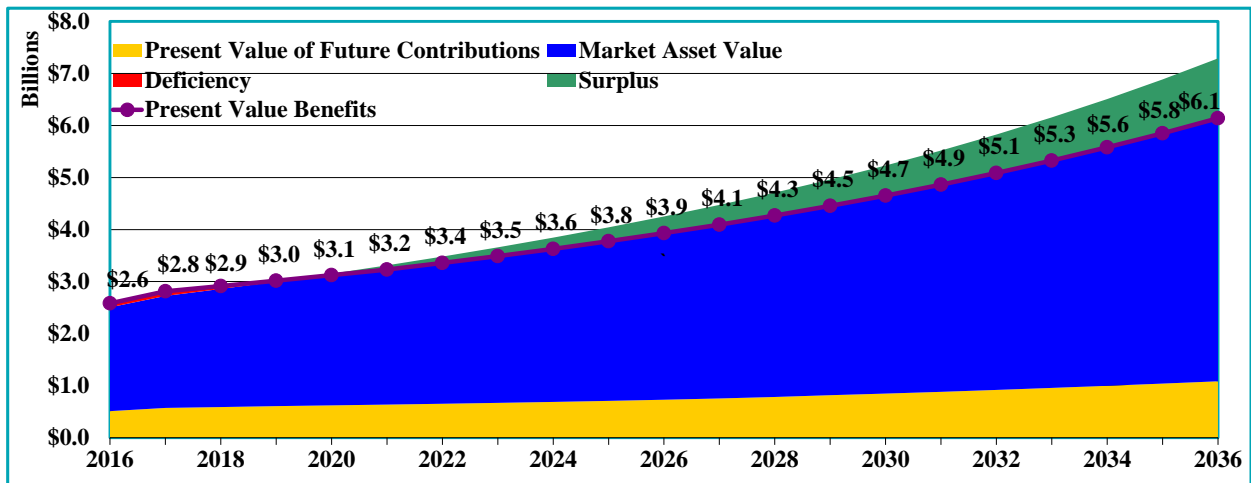
Under the following projection, the gap between the assets and the System’s obligations gradually increases throughout the projection. This occurs primarily because the MVA is originally less than the obligation and the AVA, and contributions are based on the underfunded AL when compared to the AVA, not the MVA. Therefore, without earnings in excess of the Regular Interest Rate, gap between the MVA and the obligations will grow over time.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
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SECTION I – BOARD SUMMARY



This next graph shows the implications if the assets are projected to grow at the rate of 7.5%.



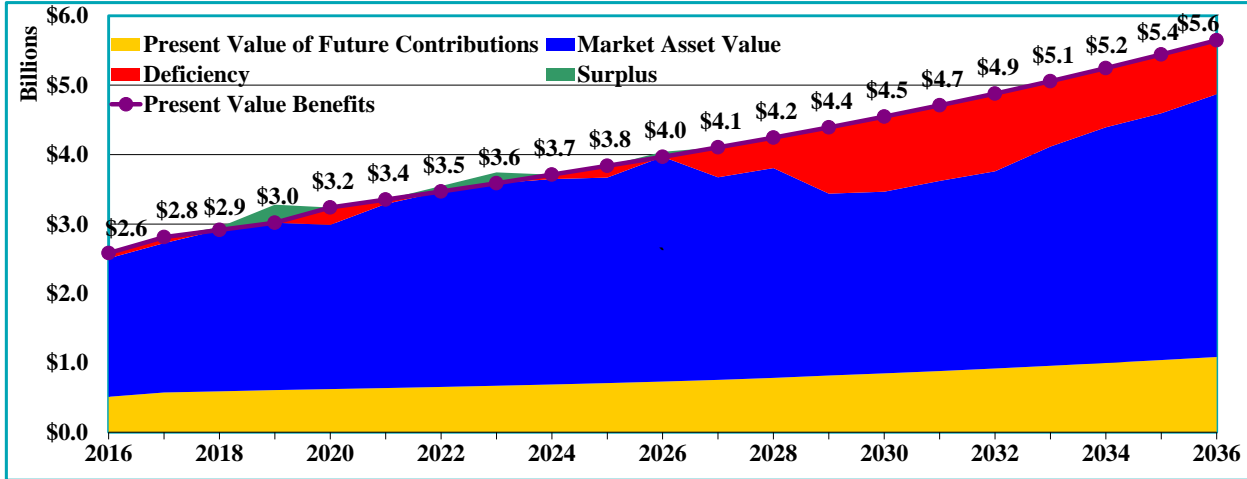
The surplus, shown by the green area in the second chart, displays the assets outpacing the obligations over the 20 year projection because the annual investment return is 225 basis points larger than the Regular Interest Rate. In addition, the projected present value of benefits increases under this scenario because excess interest is assumed to occur and increase benefits offered under individual pension plans. When excess interest is distributed, its use may be limited to pay down any unfunded liability instead of providing cost of living increases or benefit improvements based upon Pennsylvania Municipal Retirement Law until an individual municipality’s funded status is at least 95% funded.

The System’s return on assets each year will not equal 5.25% but will, over time, be volatile with returns above and below the assumption Based on the hypothetical future return rates in Table I-5 on the next page, which yield an average 5.25% rate of return over the projection period, the projected funded status will show higher and lower levels of funding based upon the market value of assets. This illustrates that as the System continues to mature some poor investment returns can materially impact the future funded status, again supporting the value of reduction in the Regular Interest Rate from 5.50% to 5.25%.

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SECTION I – BOARD SUMMARY

Table I-5 Projected Returns Equal to the Valuation Rate										
Fiscal Year	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Return	12.00%	15.00%	-10.00%	14.00%	11.00%	8.00%	-2.00%	2.00%	14.00%	-10.00%
Fiscal Year	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Return	6.00%	-11.00%	2.60%	7.50%	6.50%	14.00%	10.00%	7.00%	8.70%	6.00%



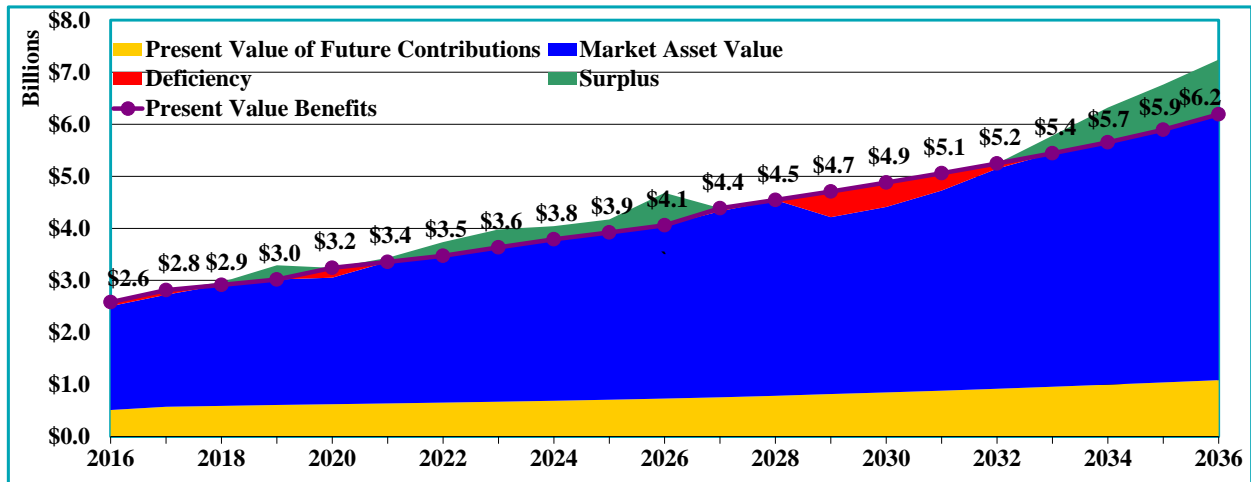
Based on this illustration, without returns averaging in excess of 5.25%, the fund will fluctuate from positions of surplus and deficit due to market volatility, anticipated negative cash flows, and additional liabilities paid to participants in the form of excess interest based on Board policy and final approval. This illustrates that there are still risks of material underfunding even if the System return rate of 5.25% is met.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
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SECTION I – BOARD SUMMARY

The potential volatility is equally apparent when we project investment returns that vary but now are expected to produce an average return over time of 7.50% as summarized in Table I-6. The fund could come out of deficit position at the end of the period.

Table I-6 Projected Returns Equal to 7.5%										
Fiscal Year	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Return	12.50%	15.00%	-8.00%	17.00%	12.00%	9.00%	3.00%	5.00%	16.00%	-8.00%
Fiscal Year	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
Return	7.50%	-8.00%	7.00%	10.00%	12.00%	16.00%	12.00%	9.00%	9.00%	7.50%



**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
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SECTION II – ASSETS

The System’s assets play a key role in the financial operation and in the decisions the Board may make with respect to future deployments. The level of assets, the allocation of assets among asset classes, and the methodology used to measure assets can impact benefit levels, Municipal and County contributions, and the ultimate security of participants’ benefits.

In this section, we present detailed information on total (county & non-county) System assets including:

- **Disclosure** of System assets at December 31, 2016 and December 31, 2015;
- Statement of the **changes** in market values during the year;
- Development of the **actuarial value of assets**; and
- Allocation of **excess interest**.

Disclosure

The market value of assets represents a “snap-shot” or “cash-out” value, which provides the principal basis for measuring financial performance from one year to the next. Market values, however, can fluctuate widely with corresponding swings in the marketplace.

The actuarial values are a reflection of the market values and the aggregate reserves being credited to each participating employer. They are used for evaluating the System’s ongoing liability to meet its obligations to pay benefits when due.

Table II-1 summarizes at the market value of assets by asset class.

Table II-1				
Statement of Assets at Market Value December 31 (\$ Thousands)				
	2016		2015	
Assets				
Equity Investments	\$	1,395,780	\$	1,271,596
Accounts Receivable		5,660		16,845
Fixed Income Investments		336,624		367,716
Real Estate Investments		424,342		357,871
Fixed Assets		93		121
Accounts Payable		(8,731)		(7,857)
Investment Purchases Payable		(3,331)		(12,252)
Net Deferred Outflow of Resources		941		451
Total Market Value of Assets	\$	2,151,378	\$	1,994,491

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2017**

SECTION II – ASSETS

Table II-2 summarizes the transaction of the assets during the year leading up to our valuation.

Table II-2 Changes in Market Value in (\$ Thousands)		
Market Value of Assets – January 1, 2016	\$	1,994,491
<u>Additions</u>		
Contributions:		
Municipal Employers	\$ 51,622	
Plan Members	20,777	
Transfers from other plan administrators	21,373	
Assessments	227	
Total Contributions	\$	93,999
Investment Income:		
Net Appreciation In Fair Value Of Investments	\$ 141,919	
Short-Term And Other Investments	356	
Common And Preferred Stock	10,535	
Real Estate Equity	15,058	
International Equities	5,202	
Less Investment Expenses	(9,127)	
Net Investment Income	\$	163,943
 Total Additions	\$	257,942
<u>Deductions</u>		
Annuity Benefits	\$ (94,334)	
Terminations	(679)	
Administrative Expenses	(6,042)	
 Total Deductions	\$	(101,055)
Market Value of Assets – January 1, 2017	\$	2,151,378

From Table II-2 it is important to recognize that annuity benefits, terminations and administrative expenses of \$101.1 million exceeds contribution income and transfers into the system of \$94.0 million for a net negative cash flow of \$7.1 million, which is approximately 0.3% of the Market Value of Assets. The net negative cash flow is approximately 1.3% of the Market Value of Assets if transfers are excluded from the calculation.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2017**

SECTION II – ASSETS

Actuarial Value of Assets

The Actuarial Value of Assets is based on the individual municipal account balances maintained by PMRS, also referred to as reserves.

This asset valuation method also takes into account the calculation of *excess interest* which is derived from income in excess of the long-term investment return assumption and when the Market Value of Assets exceed the Actuarial Value of Assets. The steps in the determination of the Actuarial Value of Assets as of December 31, 2016 are shown below. When the Market Value of Assets exceeds the Actuarial Value of Assets there is a surplus. However, the Market Value of Assets is less than the reserves by \$118.9 million as of December 31, 2016. This deficit represents 5.5% of the Market Value of Assets. Based on the funding structure of the System, it is currently anticipated that this difference will be made up by future investment returns in excess of the current crediting rate assumption of 5.25%.

Table II-3 Development of Actuarial Value of Assets (\$ Thousands)	
1. Prior Year Actuarial Value:	\$ 2,153,626
2. Total Audited Reserve Accounts:	\$ 2,264,464
3. Expected Administrative Expenses:	<u>5,814</u>
4. Preliminary Actuarial Value (2. + 3.):	\$ 2,270,278
5. Current Year Market Value of Assets:	2,151,378
6. Prior Year Market Value of Assets:	1,994,491
7. New Surplus {Minimum of [(5. - 4.) & (5. - 4.) - (6. - 1.)]}:	(118,900)
8. Percentage of New Surplus Credited as Excess Interest: ^a	0.000%
9. Excess Interest (Maximum of 0 and (7. x 8.)) available:	\$ 0
10. Excess Interest awarded	\$ 0
11. Current Year Actuarial Value of Assets (4. + 10.):	\$ 2,270,278

^a See Table II-4b

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2017**

SECTION II – ASSETS

Excess Interest Allocation

Each year, municipalities may be eligible to receive a supplemental allocation of investment monies beyond the regular 5.5% interest rate effective until December 31, 2016. This “excess interest” award is derived as a portion of “new surplus” created during the year. “Surplus” refers to the excess of Market Value of Assets over the Actuarial Value of Assets. Once the preliminary actuarial asset value has been determined, a formula is used to determine the new surplus. Depending on the relative size of surplus to market value “margin,” between 10% and 90% of new surplus will be designated as “excess interest.”

For the year ended December 31, 2016, there was no surplus because the Market Value of Assets is less than the Actuarial Value of Assets. The calculation in Table II-4a details the calculation that leads to no excess interest for this year.

Table II-4a	
Determination of Excess Interest (\$ Thousands)	
1. Assets	
a. Market value	\$ 2,151,378
b. Preliminary Actuarial Value	<u>2,270,278</u>
c. Available Surplus (1a. - 1b.)	\$ (118,900)
2. Reserves	
a. Members	\$ 451,613
b. Municipal	849,758
c. Disability	892
d. Retired	960,943
e. DROP Participant Reserve Account	<u>1,258</u>
f. Total (2a. + 2b. + 2c. + 2d. + 2e.)	\$ 2,264,464
3. Last year's surplus	\$ 0
4. New surplus (1c. - 3.)	\$ (118,900)
5. Excess percent of New Surplus (see Table II-4b)	0.000%
6. Excess Interest Awarded	\$ 0
7. Percent of reserve {6. / (2f. - 2c.)}	0.00%
8. Trial Surplus (1c. - 6.)	\$ (118,900)
9. Trial margin percent (8. / 1a.)	0.00%

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2017**

SECTION II – ASSETS

Table II-4b Determination of Excess Percent of New Surplus (\$ Thousands)	
1. Market Value of Assets	\$ 2,151,378
2. Available Surplus	\$ 0
3. Margin (2. / 1.)	0.00%
4. New Surplus	\$ 0
5. New Margin (4. / 1.)	0.00%
6. Excess Percent (10% + 800% x 3.) / (100% + 800% x 5.)	0.00%

As of the valuation date, the System has a net deficit. Therefore, no excess interest is awarded to participating municipalities and counties.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
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SECTION III – LIABILITIES

Disclosure

The present value of all benefits is the measure of the total expected obligations of the System reflecting the expected future benefit accruals of active participants and the payout stream of all benefits. When compared to the Market Value of Assets and present value of future contributions the balance (surplus)/deficit is a measure of the System’s risk in providing for these obligations.

The Actuarial Liability is used for funding calculations. The Actuarial Liability is calculated taking the present value of benefits less the present value of future normal costs under the **Entry Age Normal** funding method.

The following table presents the different liability measurements reflecting actual municipal liabilities and a roll-forward of County plan liabilities for the 2017 valuation. The Present Value of Future Contributions is based upon the Present Value of Future Normal Cost and future amortization of unfunded/(surplus) as of the January 1, 2017 valuation for the municipal defined benefit plans. This information for the County plans is based upon the prior year valuation results rolled forward one year.

Table III-1		
Obligation Deficit/(Surplus) Analysis of All PMRS Plans*		
	January 1, 2017	January 1, 2016
<u>Present Value of All Benefits - Total Obligation</u>		
Active Participant Benefits	\$ 1,697,656,933	\$ 1,581,929,109
Retiree and Inactive Benefits	<u>1,114,835,472</u>	<u>999,866,637</u>
Present Value of Benefits (PVB)	\$ 2,812,492,405	\$ 2,581,795,746
Present Value of Future Contributions	(564,877,774)	(473,633,595)
Municipal Market Value of Assets (MVA)	<u>(2,151,378,301)</u>	<u>(1,994,491,256)</u>
Net (Surplus)/Deficit of Resources to Obligation (PVB + PVFNC + MVA)	\$ 96,236,330	\$ 113,670,895
<u>Actuarial Liability</u>		
Present Value of Benefits (PVB)	\$ 2,812,492,405	\$ 2,581,795,746
Present Value of Future Normal Cost Contributions (PVFNC)	<u>(491,727,021)</u>	<u>(430,454,280)</u>
Actuarial Liability (AL = PVB + PVFNC)	\$ 2,320,765,384	\$ 2,151,341,466
Municipal Actuarial Value of Assets (AVA)	<u>(2,270,278,691)</u>	<u>(2,153,625,821)</u>
Net Unfunded/(Surplus) (AL + AVA)	\$ 50,486,693	\$ (2,284,355)

*Unrounded values may differ from the rounded values in other sections of report

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2017**

SECTION IV – CONTRIBUTIONS

In the process of evaluating the financial condition of any pension plan, the actuary analyzes the assets and liabilities to determine the contributions needed based upon the funding policy established for the plan. Typically, the actuarial process will use a funding technique that will result in a pattern of contributions that are both stable and predictable.

For each of the plans covered by the System, the funding cost method as stipulated by law to be applied in the determination of the liability is the **Entry Age Normal Actuarial Cost Method**. This method is also relevant for accounting standards, as it is an acceptable cost method for GASB 67/68. Incorporating this cost method results in four components used to determine the total contribution: the **normal cost**, the amortization of **initial unfunded actuarial liability**, any subsequent amortizations of **increases/decreases in the unfunded actuarial liability/or adjustment for surplus**, and **expenses** applied at the rate of \$20 per participant.

The statutory funding method requires that increases/decreases resulting from experience gains or losses by plan get amortized over the lesser of 20 years or the future working life of the active participants. Increases/decreases from assumption changes by the System are amortized over 15 years or the future working life of the active participants. Changes in liabilities as a result of changes in benefits by plan are amortized over 20 years if state mandated, otherwise over 10 years for active employees and 1 year for inactive employees. There are exceptions to some of these rules for plans in differing levels of “distress” as defined by under Act 205.

For plans with a surplus, the contribution rate is the normal cost offset by 10% of the surplus. This report provides an analysis of the aggregate assets and liabilities but not the aggregation of the Minimum Municipal Obligations (MMO) required for each participating municipality covered by the 2017 Act 205 forms for 2019 and 2020 MMO contributions. The combination of underfunded and surplus plans would not necessarily be informative in reviewing the overall funded status of the System.

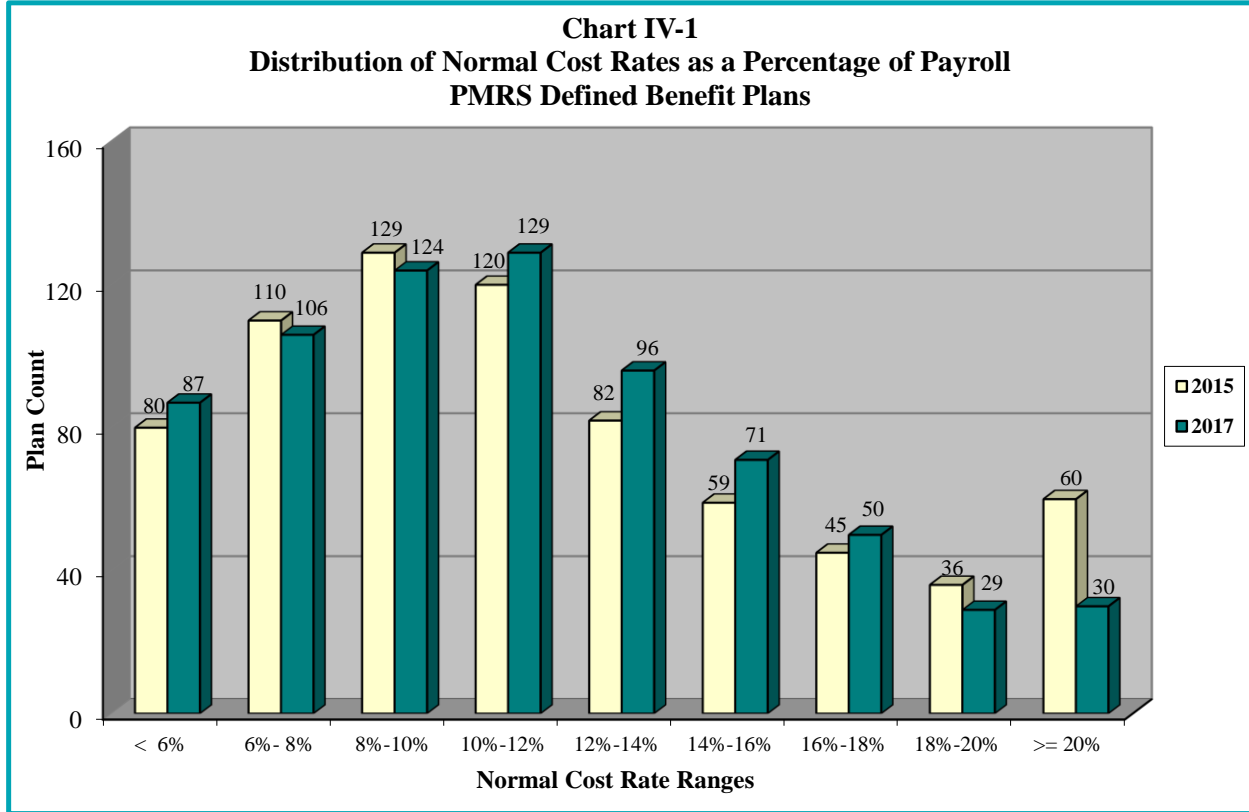
On the following pages, we describe the cost components and provide graphically the distribution of costs among the participating municipalities.

The normal cost rate (i.e., normal cost as a percent of payroll) is determined in the following steps. For a typical new entrant, an individual normal cost rate is determined by taking the present value of future normal costs as of entry age into the plan divided by that member’s present value of expected future salary during their working lifetime. The total normal cost rate is reduced by the member contribution rate to produce the employer normal cost rate. If a plan provides for a Separate Member Annuity through required member contributions, this contribution rate is then added to the total normal cost rate to determine the final total normal cost rate.

PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2017

SECTION IV – CONTRIBUTIONS

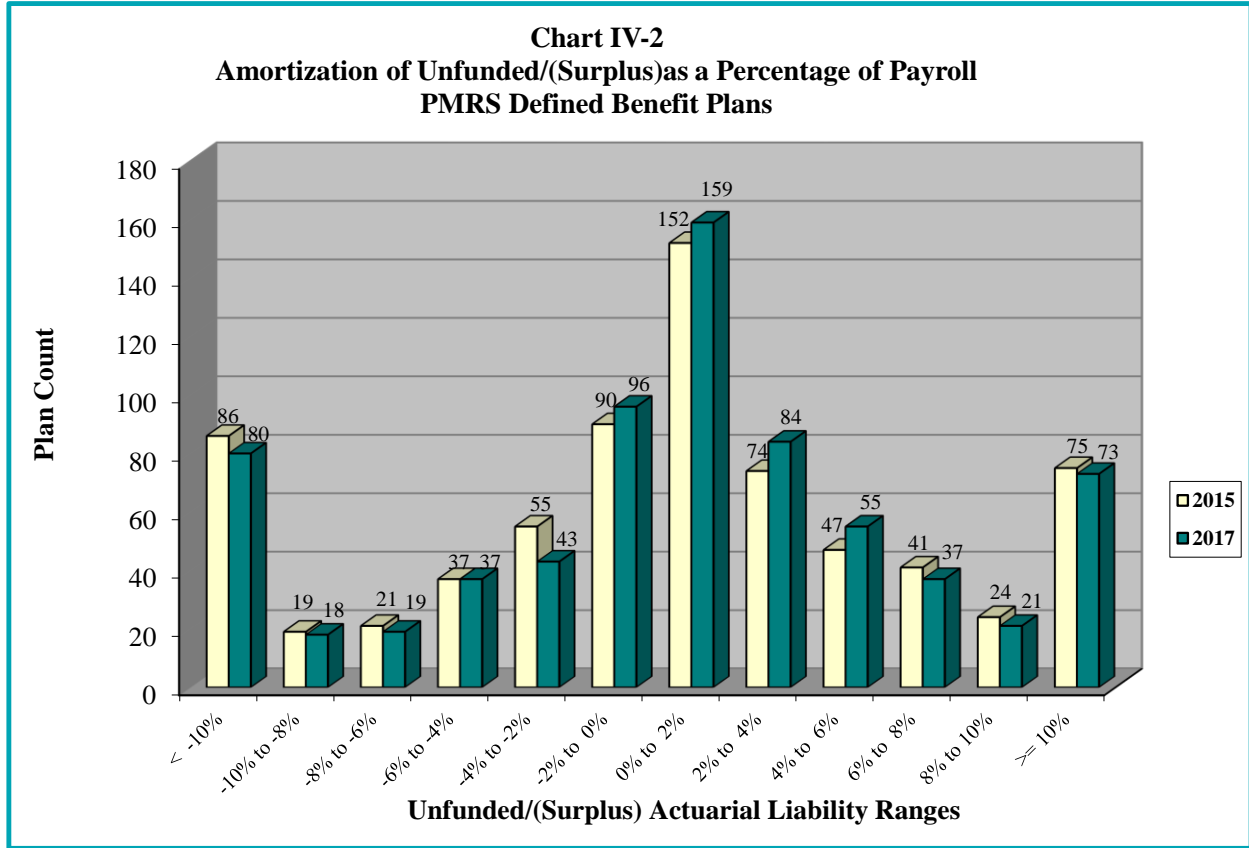
The following chart is a summary of the normal cost rates determined for the traditional defined benefit plans as of January 1, 2015 and January 1, 2017.



**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
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SECTION IV – CONTRIBUTIONS

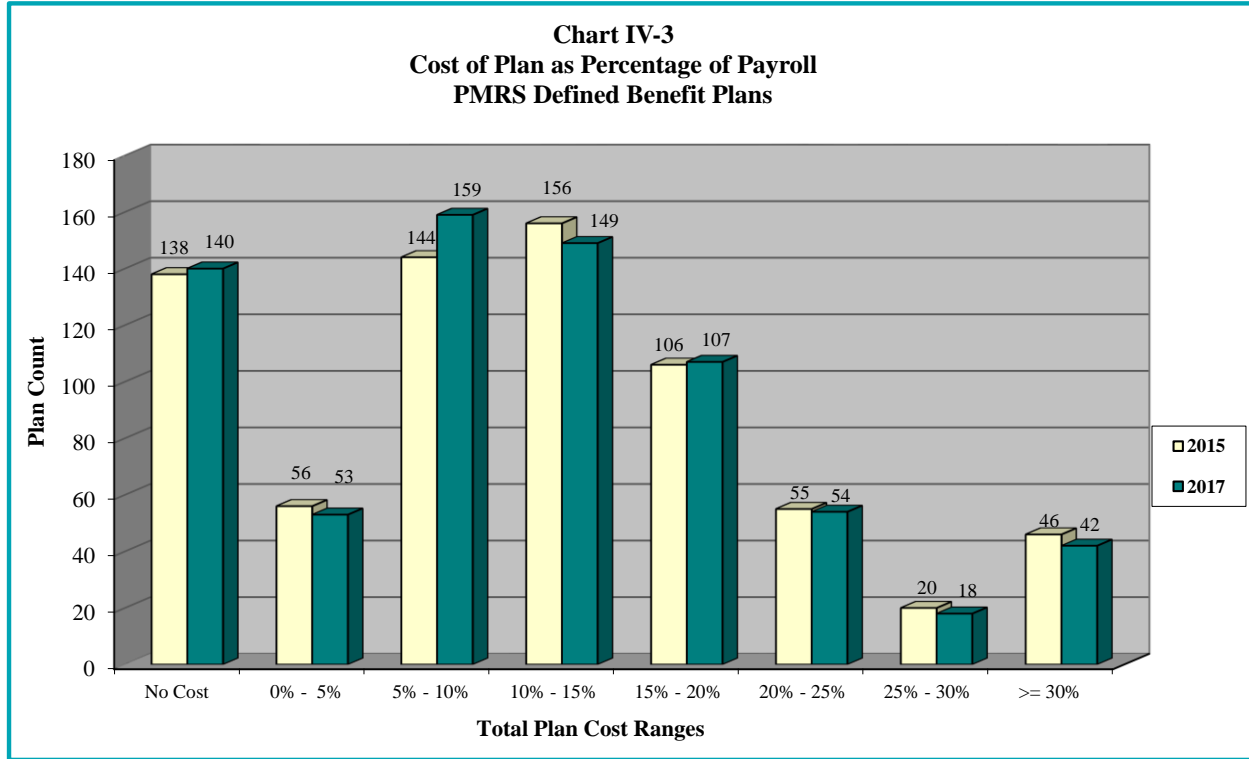
Chart IV-2 below is a summary of the unfunded/(surplus) actuarial liability amortization costs defined as a percent of covered payroll of each plan’s active members, determined for the traditional defined benefit plans as of January 1, 2015 and January 1, 2017.



**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
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SECTION IV – CONTRIBUTIONS

Chart IV-3 below is a summary of the total costs as a percentage of covered payroll, representing the sum of the normal cost and amortization of unfunded/(surplus) offset determined for the traditional defined benefit plans as of January 1, 2015 and January 1, 2017.



**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
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SECTION V – ACCOUNTING AND FINANCIAL STATEMENT INFORMATION

GASB Statements No. 67 (GASB 67) and No. 68 (GASB 68) established standards for disclosure of pension information by public employee retirement systems and governmental employers in notes to financial statements and supplementary information. The System is defined as an agent multiple-employer plan system under GASB 67. The assets of an agent multiple-employer plan system are pooled for investment purposes but separate accounts are maintained for each individual participating employer. As a result, each participating employer's share of the pooled assets is legally available to pay the pensions of only its retirees.

The actuarial liability is determined assuming that the System is on-going and participants continue to terminate employment, retire, etc., in accordance with the actuarial assumptions. Liabilities are discounted at the assumed valuation interest rate of 5.25% per annum.

Tables V-1 through V-6 provide the exhibits to be used with the System's Comprehensive Annual Financial Report based upon review of GASB 67 and input from PMRS:

- Table V-1 is the Note to Required Supplementary Information;
- Table V-2 is the Solvency Test which shows the portion of Actuarial Liability covered by Assets;
- Table V-3 is the Funded Status of Actuarial Liabilities;
- Table V-4 is the Schedule of Retirees and Beneficiaries;
- Table V-5 is the Schedule of Total Membership by Status with Six Year Trend; and
- Table V-6 is the Schedule of Total Membership and Salary.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2017**

SECTION V – ACCOUNTING AND FINANCIAL STATEMENT INFORMATION

**Table V-1
NOTE TO REQUIRED SUPPLEMENTARY INFORMATION**

The information presented in the required supplementary schedules was determined as part of the actuarial valuation at the date indicated. Additional information as of the latest actuarial valuation follows.

Valuation date	January 1, 2016 – County Plans January 1, 2017 – Cash Balance (CB) and Municipal plans that are not CB
Measurement date	January 1, 2017
Actuarial cost method	Entry Age Normal
Amortization method	Level dollar for Plan Bases and an average for Aggregate Gain/Loss, 10% of surplus is credited against aggregate cost where applicable
Actuarial assumptions:	
Investment rate of return*	5.25%
Projected salary increases*	2.8%-7.05%
*Includes inflation at	2.8%
Cost-of-living adjustments	ad hoc

The actuarial assumptions used have been adopted by the System’s Board based on the most recent review of the System’s experience for the period January 1, 2009 through December 31, 2013 and completed in 2015 and the updated investment rate of return assumption of 5.25% as of January 1, 2017 based on the Board’s review of this assumption during 2016.

The rate of employer contributions to the System is composed of the normal cost, amortization of the unfunded actuarial liability and an allowance for administrative expenses. The normal cost is a level percent of payroll cost which, along with member contributions, will pay for projected benefits at retirement for the average plan participant. The actuarial liability is that portion of the present value of projected benefits that will not be paid by future employer normal costs or member contributions. The difference between this liability and the funds accumulated as of the same date is the unfunded actuarial liability (or surplus if funds exceed the liabilities). The allowance for administrative expenses is based on the System’s actual administrative expenses.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2017**

SECTION V – ACCOUNTING AND FINANCIAL STATEMENT INFORMATION

**Table V-2
SOLVENCY TEST
Aggregate Accrued Liabilities for**

Valuation Date January 1,	Active Member Contributions (1)*	Retirees & Beneficiaries (2)	Active Member		Portion of Accrued Liabilities Covered by Reported Assets		
			Employer Financed Contributions (3)	Actuarial Value of Reported Assets	(1)	(2)	(3)
2017	\$451,613,188	\$1,114,835,472	\$754,316,724	\$2,270,278,691	100%	100%	93%
2016	435,834,498	999,866,637	715,640,331	2,153,625,821	100%	100%	100%
2015	427,736,008	938,380,470	701,148,372	2,081,439,591	100%	100%	102%
2014	416,472,872	881,502,593	707,246,642	1,972,273,674	100%	100%	95%
2013	418,163,830	812,688,102	672,720,129	1,886,703,664	100%	100%	97%
2012	407,199,633	639,260,852	680,756,784	1,792,809,433	100%	100%	110%

*Includes the sum of the active member employee contribution balances, the member separate annuity account balances, the municipal for member separate annuity account balances, and the excess interest allocations

**Table V-3
Funded Status of Actuarial Liabilities**

Valuation Date January 1,	Actuarial Value of Assets (A)	Actuarial Liability (AL) Entry Age (B)	Unfunded AL (Surplus) (B-A)	Funded Ratio (A/B)	Discount Rate
2017	\$2,270,278,691	\$2,320,765,384	\$50,486,693	97.8%	5.25%
2016	2,153,625,821	2,151,341,466	(2,284,355)	100.1%	5.50%
2015	2,081,439,591	2,067,264,850	(14,174,741)	100.7%	5.50%
2014	1,972,273,674	2,005,222,107	32,948,433	98.4%	5.50%
2013	1,886,703,664	1,903,572,061	16,868,397	99.1%	5.50%
2012	1,792,809,433	1,727,217,269	(65,592,164)	103.8%	6.00%

The actuarial assumptions as of January 1, 2017 are shown in the assumptions and methods section. The above information was derived from membership data, as provided by the System, regarding:

Valuation Date	Valuation of Defined Benefit Liabilities		
	Complete Valuation	Roll-Forward	Cash Balance Plans
January 1, 2017	718	4	311
January 1, 2016	4	718	294
January 1, 2015	717	4	286
January 1, 2014	4	712	268
January 1, 2013	710	4	251
January 1, 2012	4	705	240
January 1, 2011	702	5	229
January 1, 2010	5	691	202

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2017**

SECTION V – ACCOUNTING AND FINANCIAL STATEMENT INFORMATION

The table below is a schedule of the changes to the retiree and beneficiary rolls over the last six years.

Table V-4										
Schedule of Retirees and Beneficiaries - Added to and Removed from Rolls in Last Six Years										
Valuation Date	Average				Average				Percent	
	Added to roll	Annual Annuities Added	Annual Benefit Increase	Deleted from roll	Annual Annuities Removed	Number on roll	Annual Annuities	Percentage Increase in Annuities	Average Annual Annuities	Increase in Average Annuities
2017	447	\$18,744	490	108	\$8,174	5,699	\$88,360,677	9.5%	\$15,505	2.9%
2016	339	18,888	161	87	18,915	5,360	80,729,221	6.3%	15,061	1.3%
2015	392	17,908	185	227	10,494	5,108	75,936,364	6.6%	14,866	3.1%
2014	431	20,472	430	168	16,043	4,943	71,257,797	9.5%	14,416	3.7%
2013	391	16,440	443	105	8,288	4,680	65,046,544	9.5%	13,899	2.8%
2012	438	16,404	885	228	14,252	4,394	59,411,245	7.5%	13,521	2.4%

The table below is a summary of the total membership over the last six years.

Table V-5							
Schedule of Total Membership by Status							
Six Year Trend							
Valuation Date	Active Members:		Retirees	Beneficiaries	Deferred Pensions	Inactive Members*	Total
	Defined Benefit	Cash Balance					
2017	7,728	1,303	5,099	600	1,150	28	15,908
2016	7,698	1,274	4,784	576	1,173	7	15,512
2015	7,580	1,214	4,566	542	1,027	8	14,937
2014	7,676	1,185	4,423	520	1,044	14	14,862
2013	7,599	1,131	4,160	520	1,098	51	14,559
2012	7,836	1,158	3,899	495	952	21	14,361

* Inactive members represent inactive non-vested participants with employee contribution account balances.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2017**

SECTION V – ACCOUNTING AND FINANCIAL STATEMENT INFORMATION

The table below is a schedule of the total membership over the last four years.

Table V-6 Schedule of Total Membership and Salary				
	2017	As of January 1^a		2014
		2016	2015	
a. Retirees currently receiving benefits	5,099	4,784	4,566	4,423
b. Beneficiaries currently receiving benefits	600	576	542	520
c. Terminated vested employees entitled to future benefits from Defined Benefit Plans	834	872	779	753
d. Terminated non-vested employees entitled to contribution refunds from Defined Benefit Plan:	28	7	8	14
e. Active employees in defined benefit plans	7,728	7,698	7,580	7,676
i. Aggregate Salary ^b	\$422,621,214	\$394,133,120	\$384,270,155	\$389,410,214
ii. Vested ^c	4,573	4,676	4,726	4,881
iii. Non-vested	3,156	3,022	2,854	2,795
f. Participants in cash balance plans	1,619	1,575	1,462	1,476
i. Aggregate Salary	\$53,998,354	\$51,642,049	\$47,537,851	\$45,193,710
ii. Active	1,303	1,274	1,214	1,185
iii. Inactive	316	301	248	291

a Includes traditional defined benefit non-county plans, traditional defined benefit county plans, and cash balance plans

b Annualized salary paid during the prior plan year for Traditional Defined Benefit plan participants and actual salary for active cash balance participants

c Count of vested participants estimated based on service as of the valuation date

PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2017

APPENDIX A – MEMBERSHIP INFORMATION

**Distribution of All Active Members
by Age and Service as of January 1, 2017**

COUNTS BY AGE/SERVICE

Age	Service										Total
	1 year or less	1 to 2	2 to 3	3 to 5	5 to 10	10 to 15	15 to 20	20 to 25	25 to 30	30 & up	
Under 20	4	1	2	0	0	0	0	0	0	0	7
20 to 24	118	67	30	19	2	0	0	0	0	0	236
25 to 29	145	129	83	139	63	6	0	0	0	0	565
30 to 34	111	96	78	112	214	73	4	0	0	0	688
35 to 39	87	84	72	92	196	209	68	2	0	0	810
40 to 44	64	89	54	88	182	185	180	60	0	0	902
45 to 49	107	77	73	109	211	224	228	150	92	3	1,274
50 to 54	84	80	60	116	210	247	225	167	186	85	1,460
55 to 59	72	61	58	109	195	255	219	171	174	237	1,551
60 to 64	31	24	30	54	139	174	179	132	139	208	1,110
65 & up	27	3	16	31	59	65	57	51	49	70	428
Total	850	711	556	869	1,471	1,438	1,160	733	640	603	9,031

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
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APPENDIX A – MEMBERSHIP INFORMATION

**Distribution of Active Defined Benefit Members
by Age and Service as of January 1, 2017**

COUNTS BY AGE/SERVICE

Age	Service										Total
	1 year or less	1 to 2	2 to 3	3 to 5	5 to 10	10 to 15	15 to 20	20 to 25	25 to 30	30 & up	
Under 20	4	1	2	0	0	0	0	0	0	0	7
20 to 24	98	52	26	16	2	0	0	0	0	0	194
25 to 29	128	109	79	130	54	4	0	0	0	0	504
30 to 34	100	85	72	104	196	61	4	0	0	0	622
35 to 39	76	72	63	84	171	189	65	1	0	0	721
40 to 44	51	73	46	73	160	160	165	54	0	0	782
45 to 49	91	56	63	86	178	193	195	139	82	2	1,085
50 to 54	65	64	55	88	176	215	190	150	167	76	1,246
55 to 59	60	46	48	87	153	220	188	141	151	219	1,313
60 to 64	26	18	24	48	107	148	146	108	123	173	921
65 & up	24	3	12	25	48	47	48	39	36	51	333
Total	723	579	490	741	1,245	1,237	1,001	632	559	521	7,728

PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2017

APPENDIX A – MEMBERSHIP INFORMATION

**Distribution of Active Cash Balance Members
by Age and Service as of January 1, 2017**

COUNTS BY AGE/SERVICE

Age	Service										Total	
	1 year or less	1 to 2	2 to 3	3 to 5	5 to 10	10 to 15	15 to 20	20 to 25	25 to 30	30 & up		
Under 20	0	0	0	0	0	0	0	0	0	0	0	0
20 to 24	20	15	4	3	0	0	0	0	0	0	0	42
25 to 29	17	20	4	9	9	2	0	0	0	0	0	61
30 to 34	11	11	6	8	18	12	0	0	0	0	0	66
35 to 39	11	12	9	8	25	20	3	1	0	0	0	89
40 to 44	13	16	8	15	22	25	15	6	0	0	0	120
45 to 49	16	21	10	23	33	31	33	11	10	1	1	189
50 to 54	19	16	5	28	34	32	35	17	19	9	9	214
55 to 59	12	15	10	22	42	35	31	30	23	18	18	238
60 to 64	5	6	6	6	32	26	33	24	16	35	35	189
65 & up	3	0	4	6	11	18	9	12	13	19	19	95
Total	127	132	66	128	226	201	159	101	81	82	82	1,303

PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2017

APPENDIX A – MEMBERSHIP INFORMATION

**Pennsylvania Municipal Retirement System Distribution of All Active Members
by Age and Service as of January 1, 2017**

AVERAGE SALARY BY AGE/SERVICE

Age	Service										Total
	1 year or less	1 to 2	2 to 3	3 to 5	5 to 10	10 to 15	15 to 20	20 to 25	25 to 30	30 & up	
Under 20	\$32,029	\$59,121	\$56,116	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$42,781
20 to 24	\$34,580	\$36,603	\$42,725	\$48,099	\$50,209	\$0	\$0	\$0	\$0	\$0	\$37,411
25 to 29	\$36,446	\$42,384	\$50,342	\$49,725	\$49,467	\$49,165	\$0	\$0	\$0	\$0	\$44,697
30 to 34	\$38,303	\$45,864	\$50,423	\$49,581	\$55,254	\$60,395	\$67,462	\$0	\$0	\$0	\$50,354
35 to 39	\$39,480	\$42,437	\$44,268	\$49,967	\$56,018	\$63,902	\$60,780	\$59,691	\$0	\$0	\$53,545
40 to 44	\$39,382	\$44,604	\$44,249	\$50,110	\$52,935	\$60,107	\$65,848	\$62,906	\$0	\$0	\$55,067
45 to 49	\$38,961	\$41,562	\$48,632	\$47,092	\$50,715	\$59,058	\$61,261	\$63,910	\$70,215	\$63,169	\$55,090
50 to 54	\$35,490	\$46,046	\$46,608	\$51,050	\$51,405	\$51,721	\$56,940	\$60,889	\$66,331	\$62,498	\$54,509
55 to 59	\$41,959	\$46,396	\$50,269	\$48,503	\$48,593	\$51,841	\$55,839	\$58,396	\$60,634	\$62,707	\$54,400
60 to 64	\$44,347	\$45,248	\$46,035	\$50,969	\$47,307	\$48,716	\$53,734	\$52,739	\$57,364	\$60,443	\$52,948
65 & up	\$46,888	\$64,486	\$44,009	\$48,241	\$46,612	\$44,884	\$49,841	\$55,354	\$50,929	\$59,301	\$50,554
Total	\$38,249	\$43,474	\$47,535	\$49,453	\$51,633	\$55,491	\$58,381	\$59,235	\$62,214	\$61,503	\$52,776

PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2017

APPENDIX A – MEMBERSHIP INFORMATION

**Inactive Benefit Payment Distribution
as of January 1, 2017**

COUNTS BY BENEFIT/AGE: RECEIVING PAYMENTS

Age	Monthly Benefit	Count
x < 30	\$3,709	4
30 <= x < 35	\$2,453	2
35 <= x < 40	\$5,421	14
40 <= x < 45	\$8,392	21
45 <= x < 50	\$39,200	55
50 <= x < 55	\$209,055	133
55 <= x < 60	\$705,251	407
60 <= x < 65	\$1,729,062	1,046
65 <= x < 70	\$1,992,513	1,387
70 <= x < 75	\$1,246,393	1,071
75 <= x < 80	\$674,676	661
80 <= x < 85	\$441,257	473
85 <= x	\$306,007	425
<Total>	\$7,363,390	5,699

COUNTS BY BENEFIT/AGE: DEFERRED PAYMENTS

Age	Monthly Benefit	Count
x < 30	\$1,508	8
30 <= x < 35	\$10,403	27
35 <= x < 40	\$33,370	51
40 <= x < 45	\$61,339	78
45 <= x < 50	\$137,273	157
50 <= x < 55	\$187,542	206
55 <= x < 60	\$180,762	213
60 <= x < 65	\$61,443	86
65 <= x < 70	\$5,591	6
70 <= x < 75	\$230	1
75 <= x < 80	\$301	1
80 <= x < 85	\$0	0
85 <= x	\$0	0
<Total>	\$679,761	834

Deferred payments listed above are attributable to the non-cash balance defined benefit plans only. Deferred payments to the 316 cash balance participants will be determined upon their retirement.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2017**

APPENDIX B – ACTUARIAL ASSUMPTIONS AND METHODS

Actuarial Assumptions:

The PMRS demographic actuarial assumptions were revised by the Board effective January 1, 2016, while the Regular Interest Rate (investment return assumption) was approved by the Board effective January 1, 2017:

A. Healthy Life Mortality:

Rates of Pre-Retirement Mortality

Males: RP 2000 Non-Annuitant Male table projected 15 years with Scale AA
Females: RP 2000 Non-Annuitant Female table projected 15 years with Scale AA, setback five years

Rates of Post-Retirement Mortality

Males: RP2000 Annuitant Male table projected 5 years with Scale AA
Females: RP2000 Annuitant Female table projected 10 years with Scale AA

Based on the information provided by PMRS and review of the actual mortality experience over a five-year period, these mortality tables provide projected mortality improvements for the future. Given that experience analysis is required to be performed every four years the projection periods are sufficient to reflect anticipated improvements until the next study is performed.

Service Related Mortality: 15% for municipal plans and 50% for uniform plans

B. Disabled Life Mortality Rates:

Males and females: RP 2000 with 10 year set forward

C. Termination Rates Before Retirement

Rates based on the number of active members in the pension plan, years of service, and the type of plan participants (non-uniform or uniform).

Municipal Participants (Non-Uniform) Number of Active Members in Plan		
Service	<25	25+
<1	15.0%	18.0%
1	15.0%	18.0%
2	11.0%	14.0%
3	8.0%	12.0%
4	7.0%	9.0%
5	6.0%	9.0%
6	5.5%	8.0%
7	5.5%	7.5%
8	5.5%	6.5%
9	4.0%	5.0%
10+	2.5%	4.0%

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2017**

APPENDIX B – ACTUARIAL ASSUMPTIONS AND METHODS

Uniform Participants Number of Active Members in Plan		
Service	<25	25+
<1	12.0%	13.0%
1	12.0%	10.0%
2	12.0%	7.0%
3	9.0%	7.0%
4	7.0%	6.0%
5	5.0%	5.0%
6	5.0%	4.0%
7	5.0%	3.0%
8	4.5%	3.0%
9	4.0%	3.0%
10+	3.0%	3.0%

D. Disability Incidence Rates:

Municipal - 40% of 1964 OASDI (Social Security) Experience for Males with adjustments. Sample rates are:

Age	Rate
25	0.014%
35	0.029%
45	0.064%
55	0.134%
65	0.658%

Uniformed plans – 60% of 1964 OASDI (Social Security) Experience for Males with adjustments. Sample rates are:

Age	Rate
25	0.031%
35	0.058%
45	0.136%
55	0.335%
65	1.123%

Type of Disability:

- (a) 15% of disablements are assumed to be service related for municipal plans, and
- (b) 50% of disablements are assumed to be service related for uniform plans.

E. Workers Compensation: Service-related disability benefits payable from municipal plans are offset by 25% of final average salary.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2017**

APPENDIX B – ACTUARIAL ASSUMPTIONS AND METHODS

F. Salary Scale:

Age	Total Rate ¹ (including inflation)
25	7.05%
30	5.44%
35	4.55%
40	4.26%
45	3.97%
50	3.72%
55	3.44%
60	3.28%
65	2.80%

¹Add 2% for each of the first three years of service and additional 6% increase in year prior to normal retirement age

G. Rates of Retirement:

Municipal Members:

Members are assumed to retire over a range of ages as shown below.

Age	Rate ¹
<45	2%
45	8%
46	10%
47 – 50	15%
51 – 54	17%
55	22%
56 – 59	14%
60 – 64	18%
65	25%
66 – 74	20%
75	100%

¹ Rates indicated are adjusted by adding 5% (and 10% for ages 60-62 under current rate assumptions) for the year in which the member is first eligible for normal retirement.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
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APPENDIX B – ACTUARIAL ASSUMPTIONS AND METHODS

Uniform Members:

Members are assumed to retire over a range of ages as shown below.

Age	Rate
<49	0%
50	30%
51 – 54	10%
55	25%
56 – 58	20%
59 – 60	15%
61	20%
62	30%
63 – 64	20%
65	30%
66+	100%

H. Marital Status and Spouse’s Age (if applicable):

80% of active members are assumed to be married for retirees with the 50% Joint and Survivor form of payment. Male spouses are assumed to be three years older than female spouses.

I. Social Security Projections (if applicable):

- (a) The Social Security Taxable Wage Base will increase by 3.3% compounded annually;
- (b) The Consumer Price Index will increase 2.8% compounded annually; and
- (c) The Average Total Wages of All Workers will increase by 3.3% compounded annually.

J. Post-Retirement Cost of Living Increases (if applicable)/Inflation: 2.8% per year, subject to plan limitations.

K. Investment Return Assumption for municipal assets (Regular Interest Rate):

5.25% compounded annually (net of investment and certain administration expenses) for funding purposes.

L. Administrative Expenses

System-wide Actuarial Value of Assets: The expense assumption is based on the previous year’s actual expenses increased by 5%.

Municipalities: The expense assumption is based on the expected expenses for the current year, as reported on the Act 205 forms.

Rationale for Assumptions: An experience study is completed every four years for the System. The assumptions outlined above were reviewed and adopted by the Board based on the most recent experience study for the period covering January 1, 2009 – December 31, 2013.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2017**

APPENDIX B – ACTUARIAL ASSUMPTIONS AND METHODS

Actuarial Methods:

Contribution requirements are individually determined for each participating municipality, on an actuarial basis as described below in the Funding of the Unfunded Actuarial Liability section, at least biennially. The frequency of the actuarial valuation is determined by applicable Commonwealth statute (Act 205 of 1984 and Act 293 of 1972). The following actuarial methods were adopted effective January 1, 1985, unless indicated otherwise.

Actuarial Value of Assets:

Sum of all audited reserve accounts as of the valuation date, including Member, Municipal, Retired, Disability, and DROP Reserves, and a one-year administration expense reserve, plus the portion of any additional investment income to be distributed as “excess interest.” The actuarial value can never be less than 90 percent of fair market value.

Each year, municipalities may receive an excess interest allocation derived as a portion of new surplus created during the prior year based on the current financial standing of the System. “Surplus” refers to the excess of fair market value over the actuarial value of assets. Once the preliminary actuarial value of assets has been determined, a formula is used to allocate the new surplus. Generally, depending on the relative size of surplus to fair market value, between 10 percent and 90 percent of the new surplus will become excess interest.

The Actuarial Value of Assets are set equal to reserves under the System based on the unique legislative structure of PMRS, which are increased annually at a rate agreed on by the Board named “Regular Interest” as defined under the Pennsylvania Municipal Retirement Law. Therefore, these assets do not necessarily relate directly or indirectly with the current market value of assets as required under Actuarial Standard of Practice Statement No. 44 which states under Section 3.3:

“...the actuary should select an asset valuation method that is designed to produce actuarial values of assets that bear a reasonable relationship to the corresponding market values. The qualities of such an asset valuation method include the following:

- a. The asset valuation method is likely to produce actuarial values of assets that are sometimes greater than and sometimes less than the corresponding market values.*
- b. The asset valuation method is likely to produce actuarial values of assets that, in the actuary’s professional judgment, satisfy both of the following:*
 - 1. The asset values fall within a reasonable range around the corresponding market values. For example, there might be a corridor centered at market value, outside of which the actuarial value of assets may not fall, in order to assure that the difference from market value is not greater than the actuary deems reasonable.*
 - 2. Any differences between the actuarial value of assets and the market value are recognized within a reasonable period of time. For example, the actuary might use a method where the actuarial value of assets converges toward market value at a pace that the actuary deems reasonable, if the investment return assumption is realized in future periods.*

APPENDIX B – ACTUARIAL ASSUMPTIONS AND METHODS

In lieu of satisfying both (1) and (2) above, an asset valuation method could satisfy section 3.3(b) if, in the actuary's professional judgment, the asset valuation method either (i) produces values within a sufficiently narrow range around market value or (ii) recognizes differences from market value in a sufficiently short period."

The administrative rules adopted by the PMRS Board in conjunction with Pennsylvania Municipal Retirement Law, which are not subject to comply with Actuarial Standards of Practice (ASOP), when defining the Actuarial Value of Assets, does not necessarily meet the requirement of ASOP 44 Selection and Use of Asset Valuation Methods for Pension Valuations. The Actuarial Value of Assets provided within this report follow the Pennsylvania Municipal Retirement Law and the PMRS policy statement.

Actuarial Cost Method: Entry Age Normal Actuarial Cost Method.

The Entry Age Normal Actuarial Cost Method was used for active employees, whereby the normal cost is computed as the level annual percentage of pay required to fund the retirement benefits between each member's date of hire and assumed retirement. Entry age is defined as attained age less credited service. The normal cost is based on taking the value, as of entry age into the plan, of each member's projected future benefits. This value is then divided by the value, also at entry age, of each member's expected future salary producing a normal cost rate as a percent of salary. The normal cost rate is multiplied by current salary to determine each member's normal cost. If a plan provides for a Separate Member Annuity through required member contributions, this contribution rate is then added to the total normal cost rate to determine the final total normal cost rate. Within the MMO calculation, the normal cost is reduced by the member contribution to produce the employer normal cost to be paid.

The actuarial liability is the difference between the present value of future benefits and the present value of future normal cost. The unfunded actuarial liability is the difference between the actuarial liability and the actuarial value of assets.

Funding of the Unfunded Actuarial Liability:

Actuarial gains (or losses), including the effect of contributions greater or lesser than the previously determined actuarial level, are reflected by decreases (or increases) in the unfunded actuarial liability. Under Act 205 of 1984, and updated by Act 44, the unfunded actuarial liability for each plan is amortized as a level dollar amount over the lesser of:

- (a) (i) 30 years, with respect to the initial liability as of 1/1/85 (or first valuation);
- (ii) 20 years, with respect to actuarial gains and losses;
- (iii) 15 years, with respect to changes due to actuarial assumptions;
- (iv) 20 years, with respect to changes due to plan provisions (if state mandated);
- (v) 10 years, with respect to changes in benefits for currently active members and 1 year for retired members (if local benefit changes); or

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APPENDIX B – ACTUARIAL ASSUMPTIONS AND METHODS

- (b) The average assumed working lifetime of active employees as of the date the liability was established. If there are no active employees, the unfunded liability is amortized one year after the liability was established.

With the two exceptions which follow, the funding method is applied individually with respect to each municipality:

- 1) Retired and disabled members are paid monthly benefits from the System's Retired Reserve account, which at the time of retirement receives a transfer from the municipal and member accounts in an amount actuarially determined to be sufficient to pay all future benefits for the member (and, if applicable, a surviving beneficiary). Thus, post-retirement experience is pooled with the System.
- 2) A disabled member's pension is met in part from the amount that can be provided by the value of that portion of the member's accrued benefit attributable to municipal contributions, with the balance of the pension being provided by the appropriate transfer from the Disability Reserve Account. The amount of annual transfer from the accumulated municipal contributions to the Disability Reserve Account is determined on the one year term cost basis, i.e., the expected cost of disabilities in the coming year.

If a plan is in a surplus position, then 10% of the surplus is credited against the aggregate cost of the plan.

Method to Estimate Roll Forward Liabilities:

The defined benefit pension plans for municipalities are valued explicitly every odd calendar year. However, the liabilities for the County plans are explicitly valued every even calendar year. For the odd calendar years, we estimate the County Plan liabilities by rolling forward the prior year's liabilities. With the implementation of GASB 68, which required an individual report to be issued for each pension plan, the liabilities for the County defined benefit plans were rolled forward based on the actual benefit payments. These liabilities reflect the assumption changes and any material changes to the liabilities that may have occurred since the prior actuarial valuation. These rolled forward liabilities have been reflected in this report. The liabilities for all participants in pay status for these municipal pension plans are explicitly valued every year. The roll forward active and deferred vested liabilities were proportionally adjusted based on the prior year liabilities net of in pay status liabilities.

All other liabilities for the municipal and cash balance plans were explicitly valued as of January 1, 2017 based on the data, plan provisions, methods and assumptions.

Changes in Actuarial Assumptions and Methods:

As a response to the recession and slow recovery as well as a review of the System liabilities, annuity purchase rates, and the long term expected rate of return for the Market Value of Assets, the Regular Interest Rate was reduced by the Pennsylvania Municipal Retirement Board effective January 1, 2017 from 5.50% to 5.25%.