

Pennsylvania Municipal Retirement System

**Actuarial Valuation
as of January 1, 2020**

Produced by Cheiron

January 2022

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January 31, 2022

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 2020 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, 2020. The purpose of this report is to provide the aggregate valuation results of the participating employers for the System and analyze the System-wide asset and liability performance with projections. The report provides statistics on the 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.

This report reflects the actuarial liabilities for the county plans, which are explicitly calculated as of January 1, 2020. The liabilities for the cash balance plans are based on the member and municipal account balances as of December 31, 2019, as provided by PMRS, as well as the explicit liabilities associated with retirees for these plans. The liabilities for the municipal (i.e. non-county) defined benefit plans (i.e., municipal and authority defined benefit plans) are explicitly valued every odd calendar year and are based on the January 1, 2019 actuarial liabilities. These liabilities are rolled-forward in total, the explicit retiree liabilities are determined as of January 1, 2020, and the active and terminated vested liabilities are adjusted accordingly. Any material changes to the plan provisions are also reflected.

This report was prepared for the Board for the purposes described herein and for the use by the System 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 analyzes system-wide 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 Auditor General of the Commonwealth of Pennsylvania. We refer you to the Foreword and Board Summary which present the general approach used in the preparation of this report with a focus on key metrics of the System, historical trends, and stress testing of the System. The report also includes descriptions of the sources and reliability of the data and the actuarial assumptions upon which our findings are based.

This report and its contents have been prepared in accordance with generally recognized and accepted actuarial principles and practices and our understanding of the Code of Professional Conduct and applicable Actuarial Standards of Practice (ASOPs) set out by the Actuarial Standards Board as well as applicable laws and regulations. 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



Anthony Bucci, FCA, MAAA, EA
Consulting Actuary



Bonnie Rightnour, FSA, MAAA, EA
Consulting Actuary



Karen M. Zangara, FSA, MAAA, EA
Principal Consulting Actuary

cc: Cynthia Cranmer, CPA
Jonathan B. Chipko, Cheiron

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2020**

FOREWORD

Cheiron performed the actuarial valuation of the Pennsylvania Municipal Retirement System (System) as of January 1, 2020. 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) as well as additional information as requested by PMRS based on information provided by the Government Finance Officers Association (GFOA).

An actuarial valuation establishes and analyzes System assets and liabilities on a consistent basis and traces the progress 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 of our findings, disclosing important trends experienced by the System in recent years, and risks for consideration.

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

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

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

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

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 as provided by the System and submitted to the Commonwealth through the 2019 Act 205 filings and 2020 Act 293 filings.

We have rolled forward the total liabilities for the municipal defined benefit plans to January 1, 2020. These liabilities reflect material changes at the individual plan level (such as plan changes) if applicable. These liabilities are incorporated into all of the 2020 liability calculations to provide a reasonable estimate for the aggregate System's obligations. Further information on these techniques can be found in Appendix B under "Method to Estimate Rolled Forward Liabilities".

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
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FOREWORD

Liabilities for cash balance and county plans were determined using the demographic and financial data as of January 1, 2020 that was provided to us by the System for all participants.

Liabilities for all participants in pay status were determined based on the January 1, 2020 data sets.

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 both individually and in aggregate represent the best estimate for the future experience of the System as of January 1, 2020. They reflect the experience analysis completed in July 2015 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 Actuarial Assumptions and Methods Appendix of this report.

The results of this report are dependent upon future experience conforming to these assumptions. To the extent that plan experience differs from that anticipated by the assumptions, there are changes in assumptions or plan provisions, or changes to applicable law, the true cost for each of the plans could vary from our results. Future valuation reports may differ significantly from the current results presented in this document due to such factors as: 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, 2020**

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 county plans participating in the System and the full valuation of the cash balance plans,
- Roll-forward of municipal defined benefit plans,
- Past trends and expected future trends in the System’s financial condition,
- Potential risks to the System and individual plans, and
- Information required by the Governmental Accounting Standards Board (GASB) and the System’s Financial Statements.

In this Section, we present the principal valuation results. This includes the basis upon which the January 1, 2020 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.

Throughout our report, our discussion will address changes from January 1, 2018, the last time the county plans were explicitly valued, to January 1, 2020. We also address the overall status of the System comparing results from January 1, 2019 to January 1, 2020. The January 1, 2019 valuation results reflect the explicit valuation of the cash balance and municipal defined benefit pension plans, and a roll-forward of the county plan liabilities based upon the January 1, 2018 results.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2020**

SECTION I – BOARD SUMMARY

A. Valuation Basis

The January 1, 2020 valuation results are based on the actuarial assumptions approved by the Board effective January 1, 2016 and a 5.25% interest rate assumption, as adopted by the Board in November 2016, effective January 1, 2017. No assumption changes were effective with the January 1, 2020 valuation.

Below we identify key results of this valuation.

- *Transfer of Funds to the Retired Members' Reserve Account (Retiree Reserve):* As a result of the Asset Surplus (described below) as of December 31, 2019 and because the retiree liabilities exceeded the Retiree Reserve as of December 31, 2018 by \$6.5 million, the System transferred \$6.5 million from the Undistributed Earnings as outlined in the December 31, 2019 ACFR to the Retiree Reserve.
 - Consistent with past practice, this transfer amount is determined after the December 31, 2019 ACFR is published. The transfer will be reflected in the Retiree Reserve and Undistributed Earnings retroactive to January 1, 2020 in the December 31, 2020 ACFR.
 - The Retiree Reserve throughout this report reflects this transfer of funds.
- *Actuarial Value of Assets:* The Actuarial Value of Assets (AVA) of \$2.632 billion equals the sum of the reserve information provided in the System's December 31, 2019 ACFR and includes the transfer of \$6.5 million to the Retiree Reserve as described above. The return of the reserves for the past year was 5.25% based on the Regular Interest Rate determined by PMRS for the year. This transfer has no impact on the System Market Value of Assets (MVA) nor the individual plans' AVA but does result in a larger System AVA. The AVA increased from \$2.529 billion as of January 1, 2019 to \$2.632 billion as of January 1, 2020.
- *Market Value of Assets:* The Market Value of Assets (MVA) is \$2.792 billion as of December 31, 2019 and the money-weighted rate of return net of investment expense for the past year was 20.9% as published in the ACFR. The investment return for the year is the primary reason the results associated with the MVA as provided in this report improved over the prior year's results. The MVA increased from \$2.349 billion as of January 1, 2019 to \$2.792 billion as of January 1, 2020.
- *Asset Surplus:* The System's MVA exceeded the AVA by \$160 million. This created a Trial Excess Interest as defined in the Board Policy 05-2. The Board has elected to not award Excess Interest to the System's plans based on the Trial Excess Interest as of December 31, 2019.
- *Actuarial Liabilities:* The January 1, 2020 Actuarial Liabilities (AL) represent the explicit valuation of the cash balance and county plans, and a roll-forward of the liabilities for municipal defined benefit plans based on the January 1, 2019 results. The System's AL increased by \$81 million, from \$2.520 billion to \$2.601 billion, primarily due to additional accruals during the past year with interest, offset by benefit payments paid to retirees. There was an actuarial gain of \$2.2 million attributable to cash balance forfeitures, and for the county plans, lower salary increases and higher turnover than expected.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
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SECTION I – BOARD SUMMARY

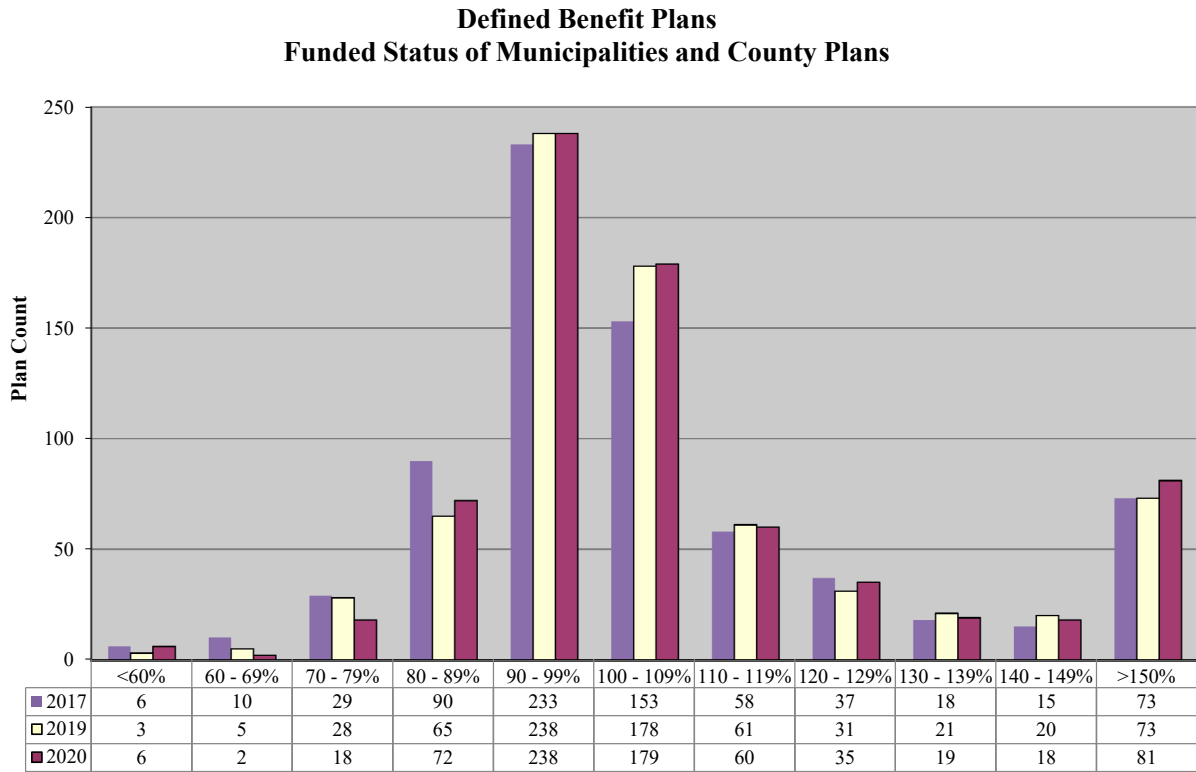
- *Unfunded Actuarial Liability (UAL)/Surplus Assets (SA):* The System is made up of many different retirement plans. Some plans have UAL, which occurs when the Actuarial Liability exceeds the Actuarial Value of Assets (AVA). Other plans have SA, which occurs when the AVA is greater than the AL. In aggregate, the System's surplus increased from \$8.8 million as of January 1, 2019 to \$30.4 million as of January 1, 2020.
- *Funded Ratio using Actuarial Value of Assets:* This is the ratio of the System's Actuarial Value of Assets to Actuarial Liability. The funded ratio increased from 100.4% as of January 1, 2019 to 101.2% as of January 1, 2020.
- *Funded Ratio using Market Value of Assets:* This is the ratio of the System's Market Value of Assets to Actuarial Liability. The funded ratio increased from 93.2% as of January 1, 2019 to 107.3% as of January 1, 2020. This change was primarily due to the market gains during the past year.

The numerical values provided above may not add due to rounding. Please refer to the detailed sections in this report for more information.

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SECTION I – BOARD SUMMARY

The following chart shows a distribution of the individual plans’ funded status for the defined benefit plans (both municipal and county plans) using AVA of the plans covered by the System in 2017, 2019 and 2020. Because the majority of the 2020 results are based on a roll forward of the 2019 AL, overall these bars are very similar but still tend toward improved funding, with more variability at the edges of the analysis due to unique circumstances attributable to some plans.



Number of Plans Based on Associated Funded Ratio

Under Act 205 as amended by Act 44, plans may be considered distressed if they are less than 90% funded. As of January 1, 2020, **about 13% of the defined benefit plans were less than 90% funded. This is an improvement compared to 14% and 19% as of January 1, 2019 and January 1, 2017, respectively.**

As of January 1, 2020, 54% of the defined benefit plans were at least 100% funded. This is an improvement compared to 53% and 49% as of January 1, 2019 and January 1, 2017, respectively. These overfunded plans can apply 10% of the excess assets (assets that exceed the liabilities) to reduce their Minimum Municipal Obligation (MMO). On this basis, it is not uncommon for the number of plans that have a funded status above 100% to decline as that surplus is used to offset contributions.

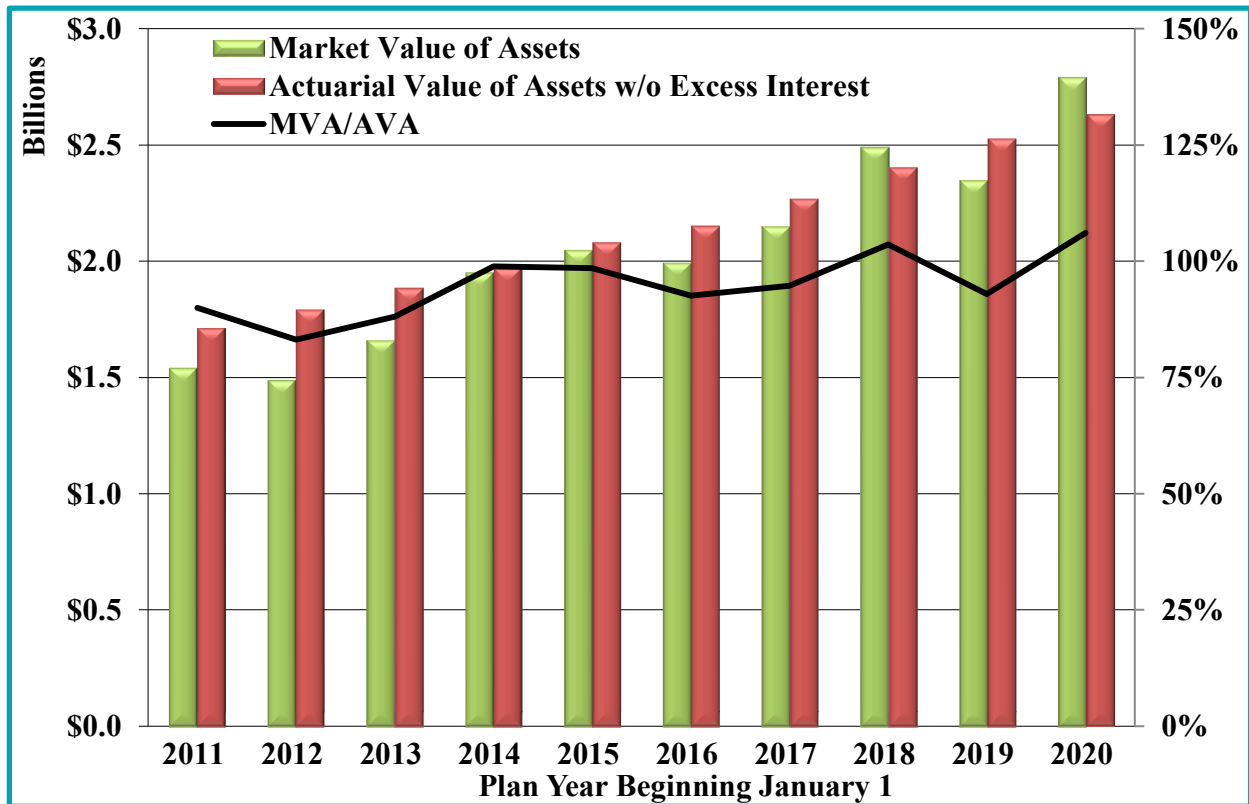
**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2020**

SECTION I – BOARD SUMMARY

In addition to the historical funded status ranges, another important relationship to review is that of 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 is the actual amount of money the system has as reported on the ACFR. The money-weighted returns net of investment expenses for the plan years ended 2018 and 2019 were -4.6% and 20.9%, respectively. Comparing the Market Value of Assets to the Actuarial Value of Assets provides a representation of the actual System assets to the System reserve accounts, which are used to determine the Actuarial Value of Assets. As of January 1, 2019, the Market Value of Assets was \$180 million less than the Actuarial Value of Assets, but as of January 1, 2020, the Market Value of Assets exceeded the Actuarial Value of Assets by \$160 million.

The following table shows the historical 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 and oriented with the right vertical axis) demonstrating the underlying risk of the System as addressed later in this report. Over this time period, the only Plan Years the MVA exceeded the AVA were 2018 and 2020.



When the ratio of Market Value of Assets (MVA) to Actuarial Value of Assets (AVA) is less than 100%, any shortfall between the AVA and MVA must come from future investment earnings in excess of the Regular Interest Rate. When the MVA exceeds the AVA, there is a potential for excess interest distributions to be awarded by the Board.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2020**

SECTION I – BOARD SUMMARY

B. Current Financial Condition

On the following pages, we summarize the key results of the January 1, 2020 valuation and how they compare to the results from the January 1, 2019 valuation.

1. System Membership:

Table I-1 shows that the total System membership increased by 2.2% from 2019 to 2020. The active participant counts reported for the Traditional Defined Benefit Plans increased by 0.3% while the active cash balance plan participation increased by 3.9%, showing a continued increased growth in the cash balance plans over the traditional defined benefit plan.

Table I-1			
Membership Total			
	January 1, 2020	January 1, 2019	% Change
Traditional Defined Benefit Actives	7,970	7,949	0.3%
Cash Balance Benefit Actives	1,502	1,446	3.9%
Terminated Vesteds	1,205	1,168	3.2%
Participants Receiving Benefit Payments	5,781	5,550	4.2%
Inactive Nonvested Participants with Balances	47	40	17.5%
Beneficiaries	654	639	2.3%
Total System Members	17,159	16,792	2.2%
Annual Salaries*	\$535,040,390	\$518,655,085	3.2%
Average Salary per Active Member	\$56,487	\$55,205	2.3%

* 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

Table I-2 summarizes 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, 2020	January 1, 2019	Change	
Number of plans:				
Traditional Defined Benefit Plans	728	723	0.69%	
Cash Balance Plans	<u>328</u>	<u>323</u>	1.55%	
Total	1,056	1,046	0.96%	
Active Employees in Traditional Defined Benefit Plans:				
Count	7,970	7,949	0.26%	
Average Age	47.8	47.8	-0.06%	
Average Service	11.7	11.8	-1.26%	
Total Payroll*	\$ 465,906,342	\$ 455,352,355	2.32%	
Average Pay	\$ 58,458	\$ 57,284	2.05%	
Active Employees in Cash Balance Plans:				
Count	1,502	1,446	3.87%	
Average Age	49.3	49.8	-0.96%	
Average Service	10.6	11.1	-4.02%	
Total Payroll*	\$ 69,134,048	\$ 63,302,730	9.21%	
Average Pay*	\$ 46,028	\$ 43,778	5.14%	
Total Active PMRS Participants	9,472	9,395	0.82%	
Inactive Nonvested Participants with account balances:				
	47	40		
Deferred Vested Participants:				
Traditional Defined Benefit Plans	882	853	3.40%	
Cash Balance Plans	323	315	2.54%	
Pensioners:				
Count	5,781	5,550	4.16%	
Average Age	70.3	70.1	0.32%	
Average Monthly Benefit	\$ 1,434	\$ 1,406	1.97%	
Number of New Awards	381	429	-11.19%	
Average New Monthly Benefit	\$ 1,638	\$ 1,631	0.43%	
Number Receiving Legislated COLA	293	284	3.17%	
Survivor Beneficiaries:				
Count	654	639	2.35%	
Average Age	74.6	74.4	0.24%	
Average Monthly Benefit	\$ 1,022	\$ 1,008	1.37%	
Total Inactive PMRS Participants	7,687	7,397	3.92%	

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

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
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SECTION I – BOARD SUMMARY

2. System Assets and Liabilities:

Table I-3 presents a comparison between the January 1, 2019 and January 1, 2020 System assets, liabilities, unfunded actuarial liability, and funded ratios for traditional defined benefit municipal, traditional defined benefit county, and municipal cash balance plans. The total in-pay liabilities, which include the DROP liabilities, are \$1.196 billion. This amount is less than the Retiree Reserve plus DROP Account which equals \$1.198 billion. Therefore, no transfer of funds will be needed to fully fund the Retiree Reserve Account as of December 31, 2020.

On an Actuarial Value of Asset basis, the funded ratio increased from 100.4% as of January 1, 2019 to 101.2% as of January 1, 2020. Similarly, the funded ratio based on the Market Value of Assets increased from 93.2% as of January 1, 2019 to 107.3% as of January 1, 2020.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
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SECTION I – BOARD SUMMARY

Table I-3 Total Plan Assets and Liabilities (\$ thousands)			
	January 1, 2020	January 1, 2019	% Change to Baseline
Traditional Defined Benefit (Non-county) Plans:			
Actives	\$ 1,119,823	\$ 1,102,156	1.6%
Terminated Vesteds	87,519	86,138	1.6%
In Pay Status	1,103,197	1,056,279	4.4%
Total Actuarial Liability ²	\$ 2,310,539	\$ 2,244,573	2.9%
Actuarial Value of Assets ¹	2,331,222	2,253,907	3.4%
Unfunded/(Surplus) of Actuarial Liability	\$ (20,683)	\$ (9,334)	121.6%
Traditional Defined Benefit (County) Plans:			
Actives	\$ 72,399	\$ 72,098	0.4%
Terminated Vesteds	13,432	12,883	4.3%
In Pay Status	52,593	49,562	6.1%
Total Actuarial Liability	\$ 138,424	\$ 134,543	2.9%
Actuarial Value of Assets ¹	139,730	133,858	4.4%
Unfunded/(Surplus) of Actuarial Liability	\$ (1,306)	\$ 685	-290.7%
Cash Balance Plans:			
Actives	\$ 93,400	\$ 87,345	6.9%
Terminated Vesteds	18,354	16,734	9.7%
In Pay Status	40,764	36,950	10.3%
Total Actuarial Liability	\$ 152,518	\$ 141,029	8.1%
Aggregate Actuarial Value of Assets ¹	153,843	141,882	8.4%
Unfunded/(Surplus) of Actuarial Liability	\$ (1,325)	\$ (853)	
Total of All Plans			
Actives	\$ 1,285,622	\$ 1,261,599	1.9%
Terminated Vesteds	119,305	115,755	3.1%
In Pay Status	1,196,554	1,142,791	4.7%
Total Actuarial Liability	\$ 2,601,481	\$ 2,520,144	3.2%
Market Value of Assets (MVA)	\$ 2,792,069	\$ 2,349,380	18.8%
Aggregate Actuarial Value of Assets (summation of above) ¹	\$ 2,624,795	\$ 2,529,647	3.8%
Expenses in Excess of Assessment	4,511	5,513	-18.2%
Actuarial Value of Asset Adjustment ³	2,543	(6,220)	-140.9%
Preliminary Actuarial Value of Assets ⁴	\$ 2,631,849	\$ 2,528,940	4.1%
Excess Interest Distribution	\$ 0	\$ 0	
Actuarial Value of Assets (Reflecting Excess Interest)	\$ 2,631,849	\$ 2,528,940	4.1%
Unfunded/(Surplus) using Actuarial Value of Assets	\$ (30,368)	\$ (8,796)	245.3%
Funded Ratio on Actuarial Value of Assets	101.2%	100.4%	0.8%
Unfunded/(Surplus) using Market Value of Assets	\$ (190,588)	\$ 170,764	-211.6%
Funded Ratio on Market Value of Assets	107.3%	93.2%	15.1%

1 Equals the Aggregate Actuarial Value of Assets for all plans.

2 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 municipal plan liabilities; numbers may not add due to rounding.

3 The Actuarial Value of Asset Adjustment reflects the net 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 and the disability reserve, which is not included in the AVA at the plan level.

4 The Actuarial Value of Assets is based on member, municipal, retiree, disability & DROP reserve accounts as approved by the Board including the \$6.5 million transfer to the Retiree Reserve effective December 31, 2019. This transfer will first be reflected retroactively as of December 31, 2019 in the System's Retiree Reserve in the December 31, 2020 ACFR.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2020**

SECTION I – BOARD SUMMARY

Table I-4 summarizes the January 1, 2020 County defined benefit plans separately for those that are in a surplus or underfunded position.

Table I-4		
Funded Status of County Plans		
	January 1, 2020	January 1, 2018
A. County Plans in a surplus position		
1. Number of plans with a surplus	2	2
2. Actuarial Value of Assets in plans with a surplus	\$124,047,962	\$112,416,606
3. Actuarial Liability in plans with a surplus	<u>120,408,952</u>	<u>111,260,249</u>
4. Amount of surplus (2. – 3.)	\$3,639,010	\$1,156,357
B. County Plans in an underfunded position		
1. Number of underfunded plans	2	2
2. Actuarial Value of Assets in underfunded plans	\$15,681,835	\$13,793,295
3. Actuarial Liability in underfunded plans	<u>18,015,462</u>	<u>16,187,124</u>
4. Amount of (unfunded) liability (2. – 3.)	(\$2,333,627)	(\$2,393,829)

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SECTION I – BOARD SUMMARY

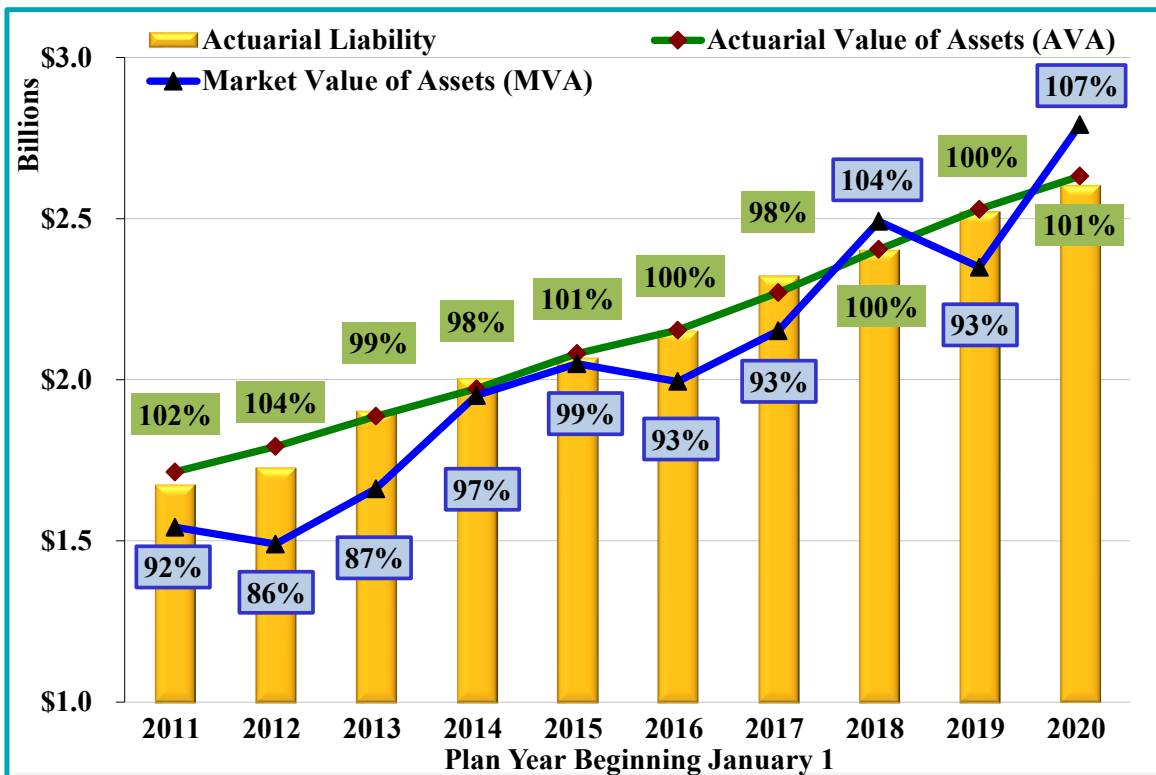
C. Historical Trends

Even though the attention given to the valuation reflects the most recently computed actuarial liability and funded 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 market and actuarial value of assets (blue and green lines) compared to the total System actuarial liabilities (yellow bars). We have included the funded ratio (Actuarial Value of Assets divided by the Actuarial Liability) across the top of each bar in green boxes to show the recent progress of the System. For 2020, this funded ratio is 101%. The Actuarial Value of Assets are based on the reserve accounts for the System. Due to the growth of the reserves as outlined with the Pennsylvania Municipal Retirement Law, the Actuarial Value of Assets is expected to grow linearly as seen by the green line and there is little variability in the historical funded ratio.

In addition, the funded ratio on a Market Value of Assets basis is important to understand the underlying System’s risks addressed later in this report. The market value funded ratios (Market Value of Assets divided by the Actuarial Liability) are provided within each bar in blue boxes. The 2020 Market Value of Assets is greater than the Actuarial Liability with a funded ratio of 107%. Due to the volatility of the Market Value of Assets, this ratio ranges from 86% up to 107% compared to the funded ratio based on the Actuarial Value of Assets, which ranges from 98% to 104%.

Pennsylvania Municipal Retirement System Assets and Liabilities



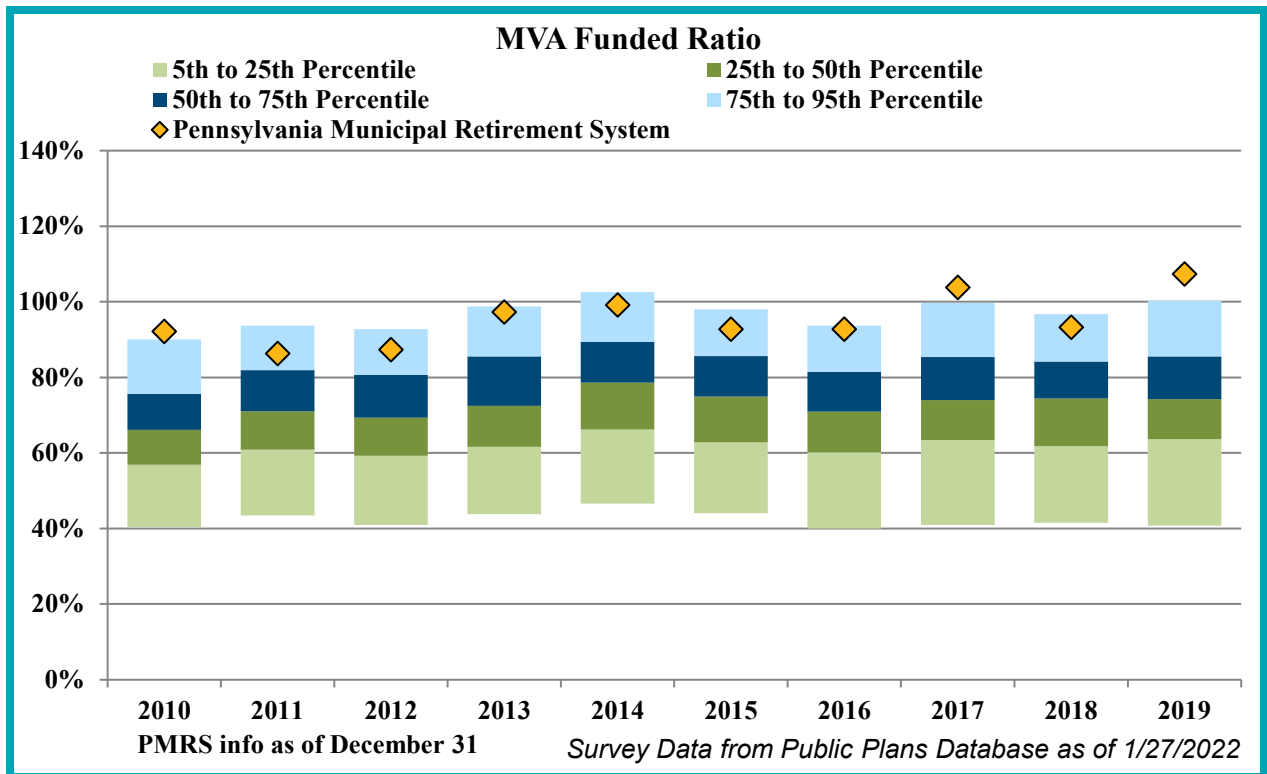
**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2020**

SECTION I – BOARD SUMMARY

The following chart compares PMRS to the distribution from the 5th to 95th percentile for the plans contained in the Public Plans Database, which is maintained by the Boston College’s Center for Retirement Research, the Center for State and Local Government Excellence, and the National Association of State Retirement Administrators. The number of plans in any given year range from about 150 up to almost 200.

The years in these types of charts represent plans with fiscal years ending during the year. Therefore, the results of PMRS as of this valuation are aligned to 2019 (December 31, 2019). The gold diamonds represent the System.

The funded ratio on a Market Value of Assets basis shown in the blue boxes in the prior chart are now represented by the yellow diamonds. Relative to this universe of plans, PMRS is always found in the top quartile.



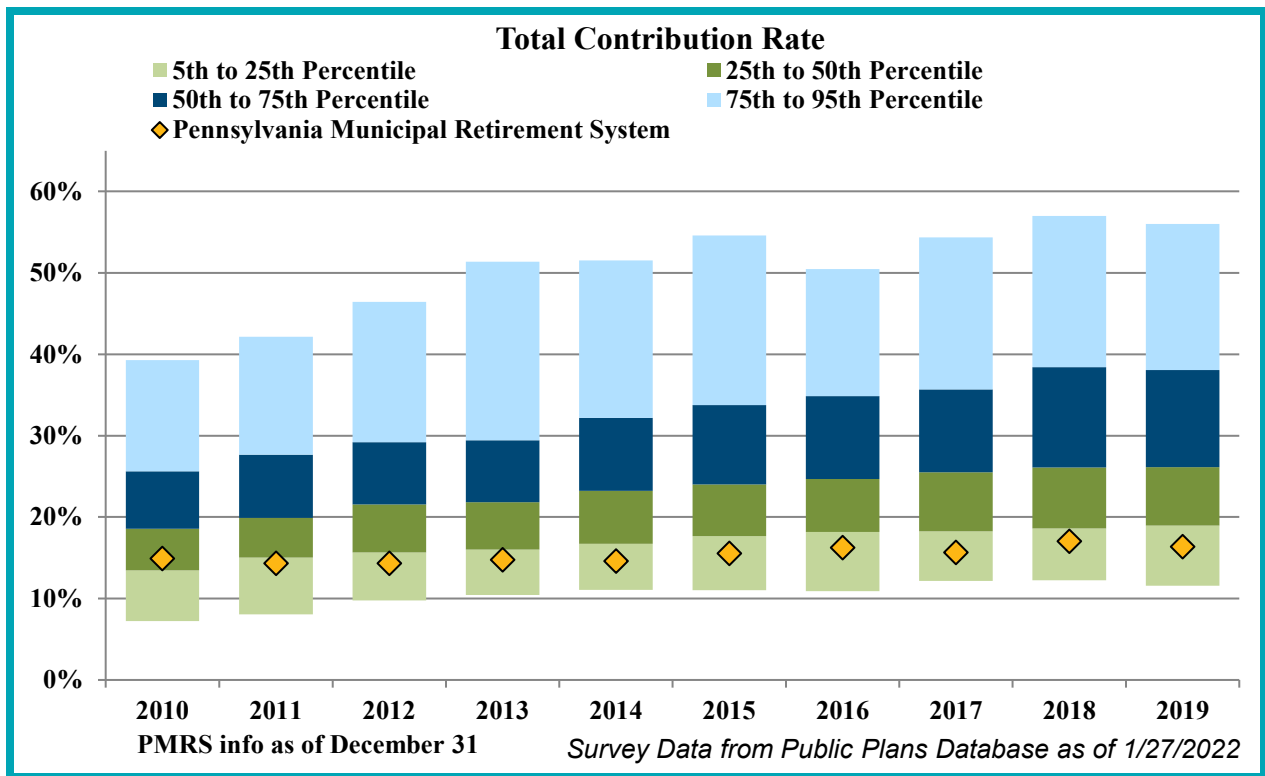
**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
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The Total Contribution Rate of pension plans is generally the sum of the following divided by the active payroll:

1. **Normal Cost**, the value of benefits accrued during the year for active participants
2. An **Amortization Payment** of the unfunded liability based on the funding method
3. **Annual Expenses** equal to \$20 per participant to assist in maintenance of the plan

The Total Contribution Rate for the System, shown by the yellow diamonds below, is substantially driven by the Normal Cost. The majority of plans are fully funded with no required Amortization Payment, however there are still many plans that are not fully funded. This has contributed to a lower Total Contribution Rate for PMRS plans as shown in the Public Plan Database.

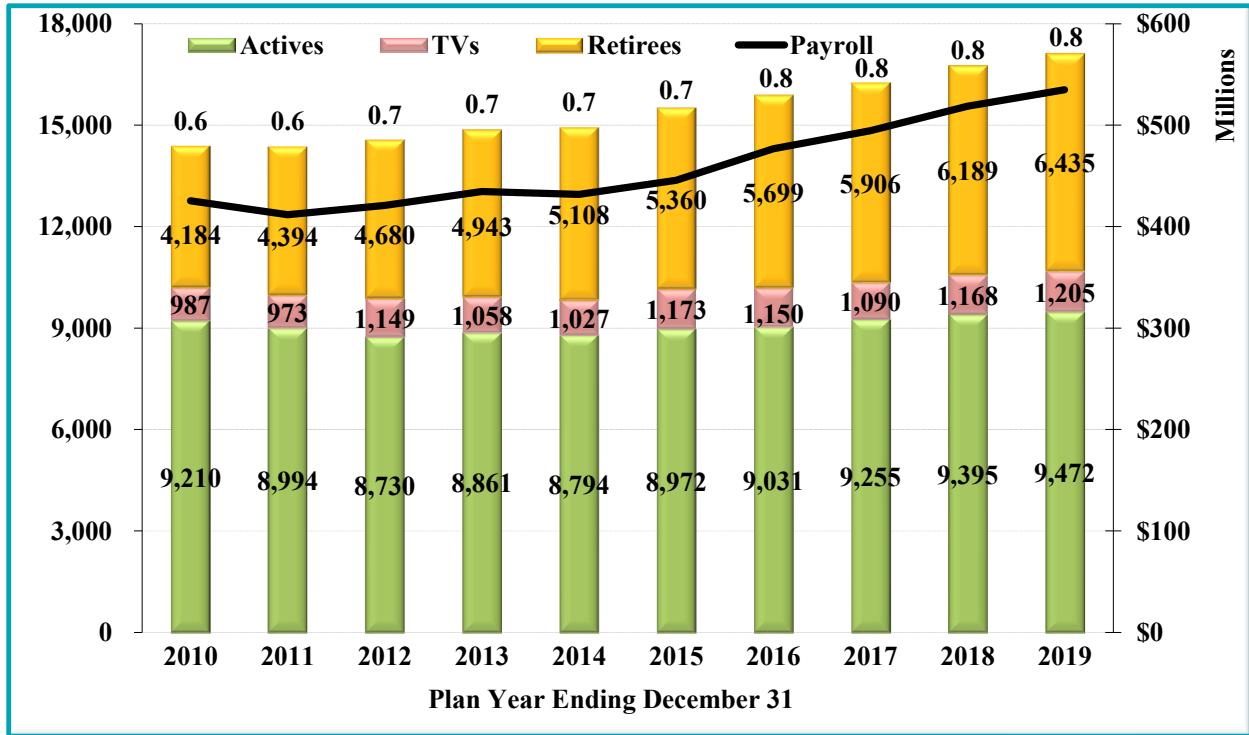


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Pennsylvania Municipal Retirement System Participant Counts – end of year

This chart shows a comparison of the demographic makeup of the System over the last ten years. The black line represents the active payroll and is oriented to the right-hand axis. The number above the bars represents the support ratio of vested inactive to active participants which is slowly increasing but is still under 1.



A retirement system has a life cycle, reaching maturity when there are more covered inactive participants (retirees and terminated vested participants) than those who are actively employed. When this occurs, the support ratio of inactive to active participants is above 1.0. The System is maturing as indicated by the steadily increasing ratio of inactive to active participants, currently at 0.8. A mature system is more sensitive to risk factors such as investment risk, such that investment recovery takes more time and can be difficult to achieve without additional measures such as higher contributions. Prolonged investment recovery is impacted by the net negative cash flows occurring when benefit payments and expenses exceed contributions. This measure is correlated with the support ratio. This is discussed in more detail in the risk section of this report.

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, 2020 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 in this section only consider what was known as of January 1, 2020 based on the assumptions listed in the back of this report. The experience study approved by the Board in July 2020 are expected to increase liabilities, but these assumption changes are not incorporated here. The projections are provided under four different investment return assumption scenarios:

- 1) Assuming 5.25% investment returns each and every year,
- 2) Assuming a 7.00% (net of investment fees) for each and every year based in part on the long-term expected return information provided by the investment consultant and prior review by the Board,
- 3) Assuming average investment returns over 20 years equal 5.25% but vary annually based on the returns provided in Table I-5. We do this to demonstrate a more realistic projection with varying returns 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 7.00% investment return based on the returns provided in Table I-6.

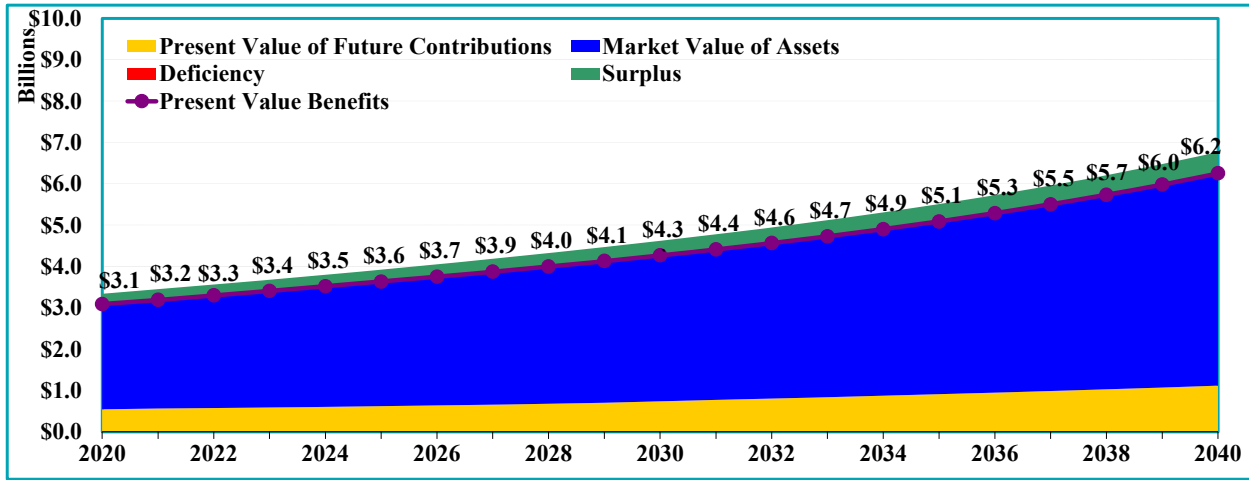
The projections that follow show how the total obligations (purple line) of the System consistently increase. This is an open group projection which means when an active participant is expected to change status, they are assumed to be replaced. The area under the purple line represents the *Present Value 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 5.25%, the key resource initially to cover a deficit or create a surplus is through average future investment returns at a System level that exceed the 5.25% rate. The Board can reduce future crediting rates which in turn should increase the likelihood that returns will exceed this rate. This would also result in increased future contributions.

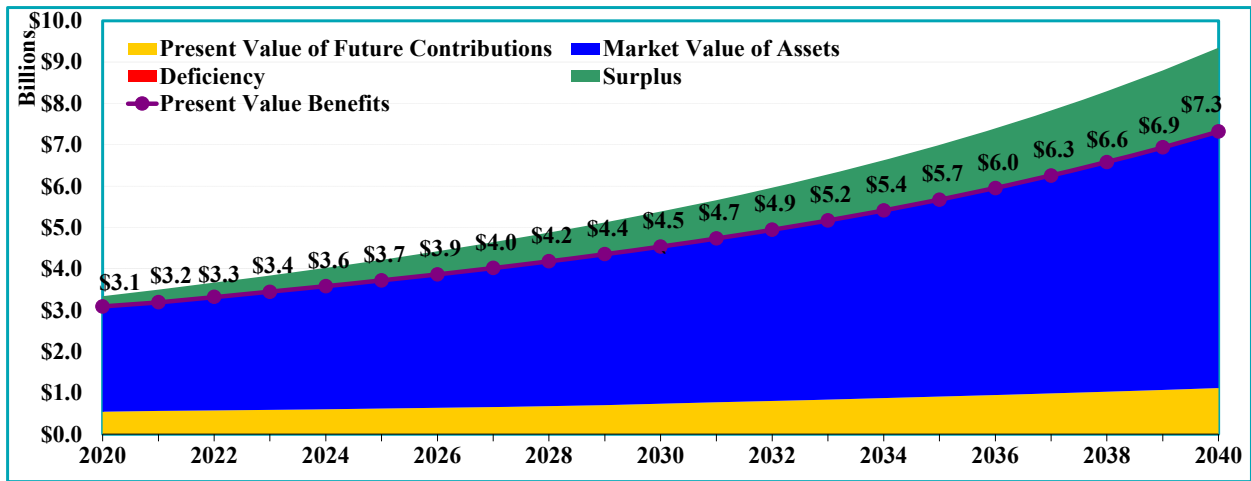
Under the following projections the gap between the assets and the System’s obligations gradually increases throughout the projection period. This occurs primarily because the MVA is originally greater than the obligation and the AVA, and contributions are based on the overfunded AL when compared to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

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This next graph shows the projection if the assets grow at a rate of 7.00% throughout the projection period.



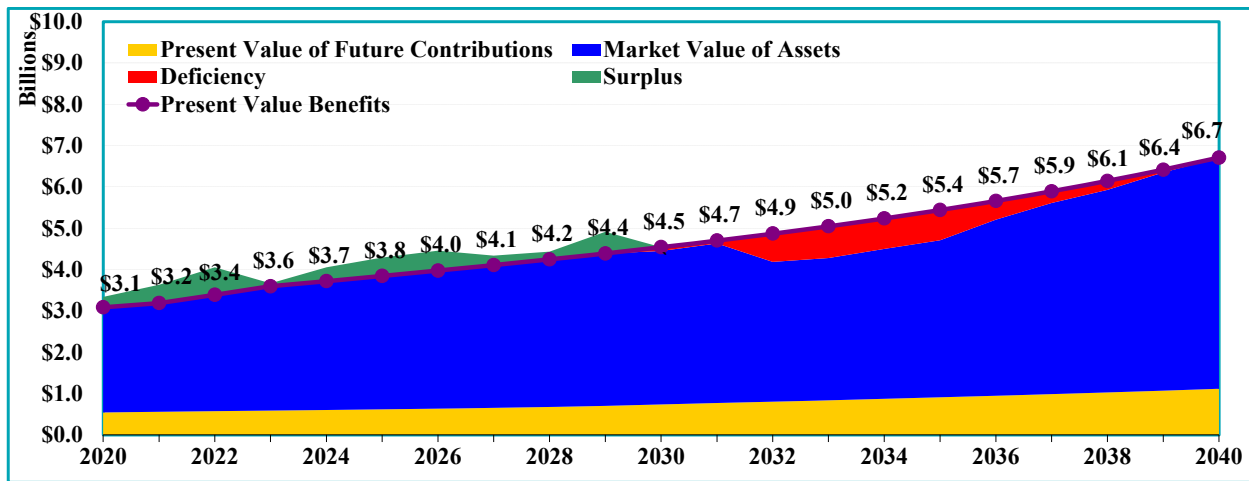
The surplus in this scenario grows much faster as the assets outpace the obligations over the 20-year projection because of the assumption that the annual investment return will be 175 basis points higher (7.0% compared to 5.25%). In addition, the projected present value of benefits increases even more under this scenario because excess interest is assumed to be awarded, which increases benefits offered under individual pension plans. Excess interest can be distributed to pay down unfunded liabilities 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 on an AVA basis. For these projections, we assumed that percentage of plans that have achieved the 95% funded status is gradually increased over time until 2031 at which point it is assumed that all plans in the System have met this threshold and any distribution of Excess Interest will also increase the AL.

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The System’s return on assets each year is assumed to be the Regular Interest Rate of 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 fluctuate based on the market value of assets.

Table I-5 Projected Returns Equal to the Valuation Rate										
Fiscal Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Return	12.00%	15.00%	-10.00%	14.00%	8.00%	5.75%	-2.00%	4.00%	14.00%	-10.00%
Fiscal Year	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
Return	6.00%	-10.50%	4.00%	7.50%	6.50%	14.00%	10.00%	7.00%	8.75%	7.00%



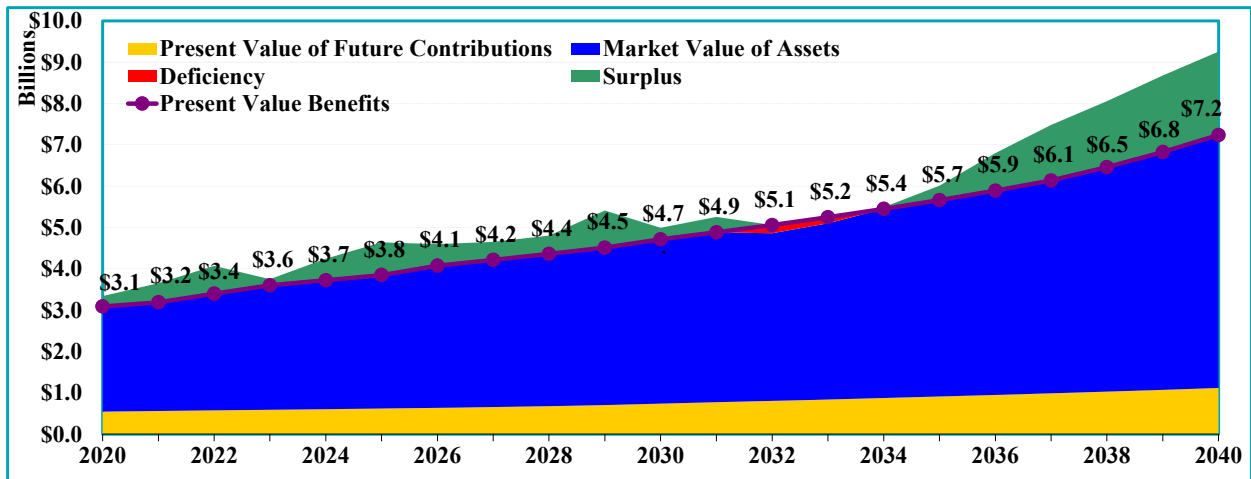
In this scenario, the negative net cash flow in conjunction with these volatile returns results in a worse funded position over time than the flat 5.25% projection. This is due in part to the projected distribution of more excess interest prior to 2030 where the early returns are higher than the assumption, which results in an increase in liabilities for plans that are at least 95% funded.

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The volatility is equally apparent when the projected investment returns vary but are expected to produce an average return over time of 7.00% as summarized in Table I-6.

Table I-6 Projected Returns Equal to 7.00%										
Fiscal Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Return	12.50%	15.00%	-8.00%	17.00%	12.00%	0.00%	2.50%	5.00%	16.00%	-8.00%
Fiscal Year	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
Return	7.25%	-8.00%	7.00%	10.00%	12.00%	16.00%	12.00%	9.00%	9.00%	7.50%



SECTION I – BOARD SUMMARY

E. Actuary’s Assessment of Risk

Actuarial Standards of Practice (ASOP) No. 51 is a requirement for all actuarial pension valuations completed after November 1, 2018. Actuarial valuations are based on a set of assumptions regarding future economic and demographic experience. These assumptions represent a reasonable estimate of long-term future experience, but actual future experience will undoubtedly be different. The purpose of this section of the actuarial report is to identify, in the actuaries’ professional judgment, the primary risks to the System, provide some background information about those risks, and provide an assessment of those risks in accordance with ASOP No. 51. According to the ASOP, the actuary should identify risks that, in the actuary’s professional judgment, may reasonably be anticipated to significantly affect the plan’s future financial condition.

The identification of risks for PMRS can be viewed in aggregate at a System level or at the individual plan level (Plan Risk). The individual plan level risks can vary greatly from plan to plan. The fundamental risk to the System is that the market value of assets could become insufficient to meet the benefit obligations of the individual plans, which could require increased contributions making the plans unaffordable. This section will attempt to address this fundamental risk by reviewing the Plan and System level risks for the following:

- 1) Investment Risk
- 2) Longevity and Other Demographic Risks
- 3) Withdrawal Risk

1) ***Investment Risk*** represents the risk associated with asset volatility (particularly losses) and exists for nearly all pension plans. Because the Pennsylvania Municipal Retirement Law defines the Regular Interest used in the funding valuation, the risk associated with the investment return for PMRS is unique.

Plan Level:

Participating plans within PMRS are not exposed to the same investment risk as typical pension plans. PMRS credits the municipal and member accounts at the Regular Interest Rate each year, regardless of the actual investment return on the market value of assets. Thus, the aggregation of the plans’ reserve accounts represent the Actuarial Value of Assets (AVA) and are used to determine the required plan contributions also known as the Minimum Municipal Obligation (MMO). If the system-wide MVA exceeds the plans’ AVA, then individual plans may receive a distribution of the surplus called Excess Interest. Therefore, plans participating in PMRS are not generally subject to the down-side risk of asset volatility, but they do have the opportunity to share in the up-side potential.

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System Level:

When the actual investment returns are less than the Regular Interest Rate (currently 5.25%), the Market Value of Assets (MVA) may drop below the system-wide reserve accounts. This gap would be closed by the accumulation of returns in excess of the Regular Interest Rate in the future. This scenario occurred during 2019. The System's asset allocation is selected such that the long-term return on assets is expected to exceed the Regular Interest Rate, which helps to mitigate this inherent System risk. For the January 1, 2020 valuation, the MVA exceeded the AVA because the excess asset returns exceeded the Regular Interest Rate and also were sufficient to fill the shortfall that existed at January 1, 2019. The current long-term expected return is above 7.00% (net of investment expenses) based on information provided by the investment consultant and reviewed by the Board.

If the actual investment returns are greater than the Regular Interest Rate and the system-wide reserve accounts are less than the market value of assets, then there is a surplus as defined in PMRS Policy Statement 05-2. This is the current status for the System with the MVA exceeding the AVA by \$160 million after reflecting the \$6.5 million transfer to the Retiree Reserve Account to ensure that the System level retiree liabilities (discussed more below) are fully funded. The Board decided not to distribute this surplus as of January 1, 2020.

The System level investment risk can be explored in more detail by reviewing the Net Cash Flow and the Maturity Level.

Net Cash Flow: Net cash flow (NCF) during a year equals the contributions into the System (inflows) minus the benefit payments and expenses (outflows) coming out of the System. If the level of outflows exceeds the inflows, the system has negative NCF. Mature plans generally have a negative NCF as the number of retirees increase. Additional cash from investment returns and existing assets are then needed to pay the pension benefits if a system has negative NCF.

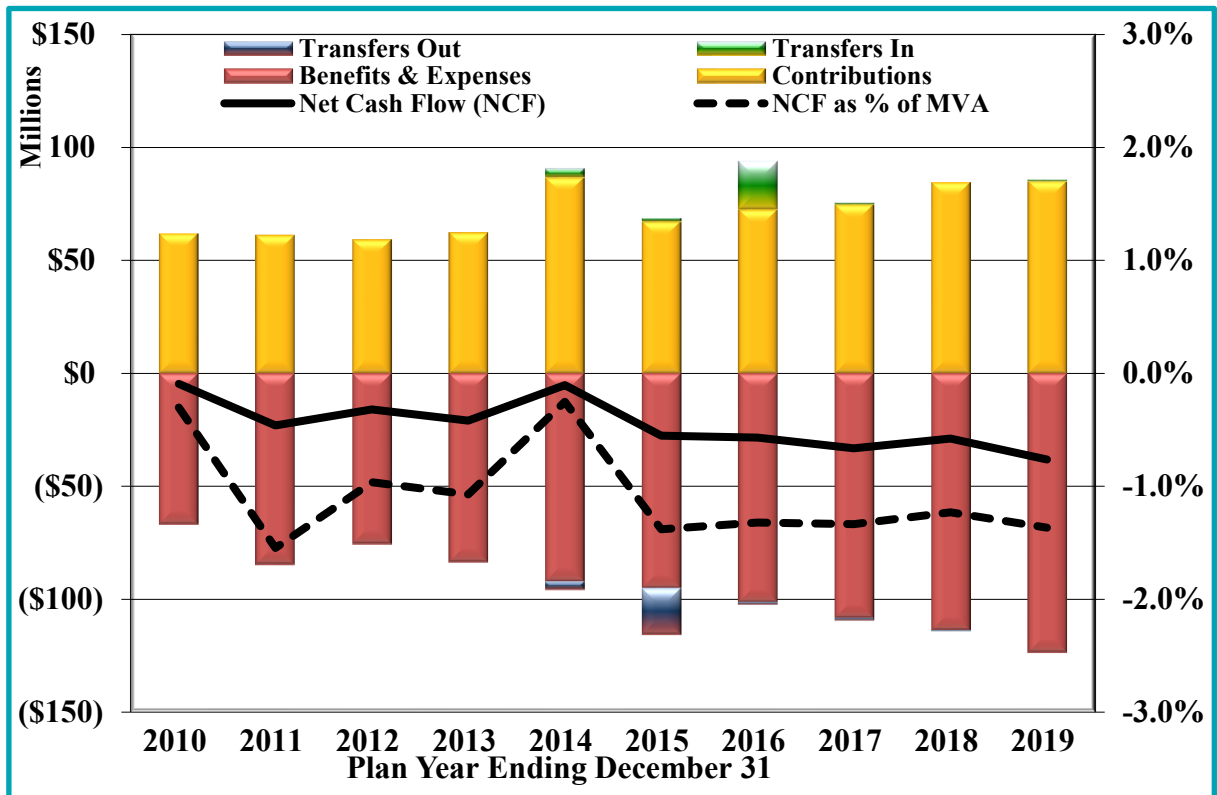
The System's recent NCF over a ten-year span is displayed in the next graph. The NCF is represented by the black line. The dashed black line (which is oriented to the right-hand axis) provides the NCF as a percent of the Market Value of Assets (MVA). As of December 31, 2019, this resulted in a \$38 million negative NCF, excluding transfers into and out of the System. This represents about -1.6% of the beginning of year MVA. The negative NCF falls within the range of -0.1% to -2.0% of total assets. This implies that in addition to contributions, current plan assets must be used to pay benefits. Another way to say this is that for the total value of assets to remain level or grow, the fund needs a minimum investment return at least equal to the negative NCF. Negative NCF can become less negative or even positive by decreasing the Regular Interest Rate (which results in an increase in contributions).

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The volatility of the NCF is largely a function of contributions and benefit payments. Beginning in 2014, the transfer of funds into and out of the System from new participating municipalities and exiting municipalities is excluded from the calculation of the NCF due to changes in the information provided on the ACFR. The incorporation of transfers into and out of the System can be found in Table II-2 for the past year and is shown below in the shaded bars dating back to 2014, the first year this information was available.

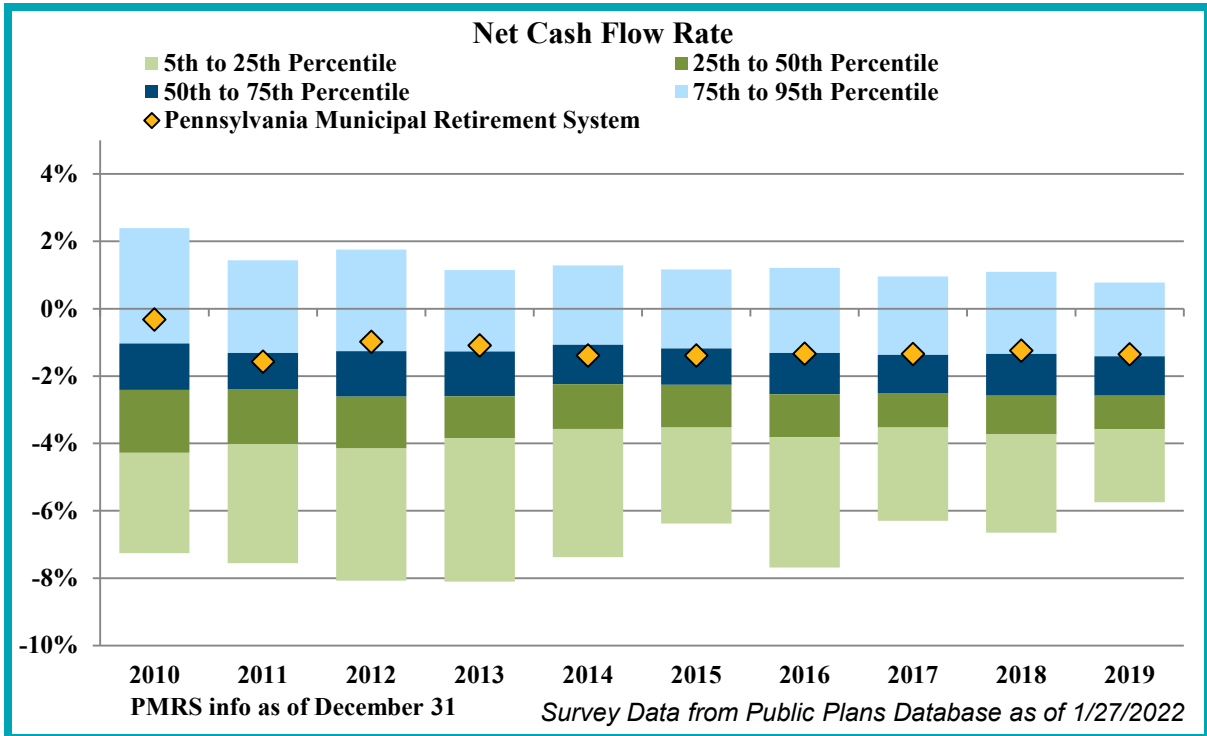
Pennsylvania Municipal Retirement System Cash Flows



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The following chart shows the distribution from the 5th to 95th percentile of NCF for the plans in the Public Plans Database. Similar to the prior charts like this, the years represent plans with fiscal years ending during the year. The gold diamonds represent the System. Relative to the universe of plans, PMRS is a younger plan, found in the top quartile of this group in recent years.

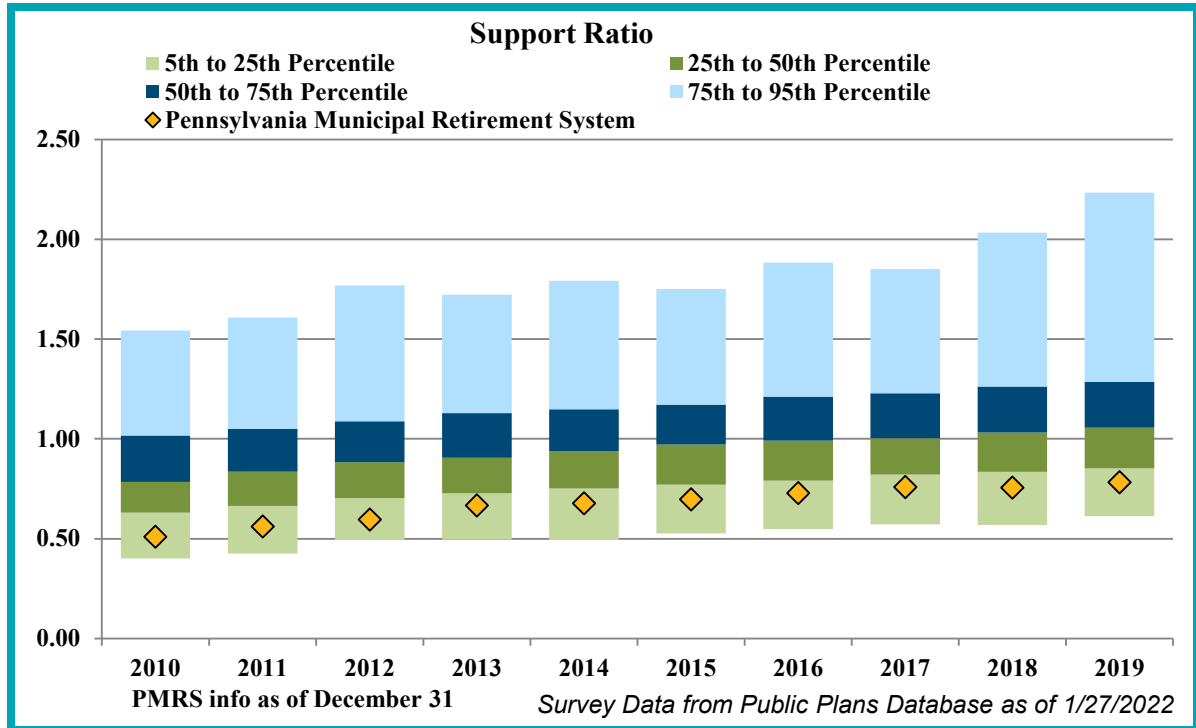


Maturity Level: Mature pension plans are plans that have more inactive participants than active participants. These plans tend to have negative NCF and are more sensitive to investment risks. Plan maturity can be measured in a variety of ways, but one simple measure of plan maturity is the ratio of the number of inactive participants (those receiving benefits or entitled to a deferred benefit) to the number of active participants. We refer to this as the support ratio. The revenue base supporting the plan is usually proportional to the number of active participants. A relatively high number of inactive participants compared to active participants may indicate a larger plan relative to its revenue base.

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The chart below shows the distribution from the 5th to 95th percentile of support ratios for the plans in the Public Plans Database. The lower the support ratio, the lower the maturity and the lower the sensitivity of the plan to risk. The gold diamonds represent the System. This shows that while the System is maturing, it is doing so at a very similar rate to the universe of plans and still remains relatively young.



For additional review of the risk of the System associated with the investment returns, please refer to the prior section to review the deterministic projections.

- 2) **Longevity and Other Demographic Risk** is the potential for retirees to live longer than expected or other demographic experience to differ from the assumptions. This has the potential to result in more benefits being paid than anticipated from the assets. This creates a financial risk that the plan will cost more than originally anticipated.

Plan Level:

PMRS is designed to transfer the longevity risk from individual plans to the System when participants retire. This is managed via a transfer of the present value of expected benefit payments from the member and municipal accounts to the Retiree Reserve. Once this transfer occurs, the individual plan no longer has risk associated with the retiree outliving their expected lifetime assumption as long as the plan remains in the System.

Plans in PMRS range in plan participant counts from 1 to nearly 1,000. There is always a risk that actual demographic experience will vary from the assumptions, but this is magnified when plans with smaller counts deviate from assumptions. This deviation can cause volatility in the liabilities and the associated MMO. The demographic experience of the System is reviewed every 5 years to ensure that assumptions reflect the experience of the plans of the System in aggregate.

SECTION I – BOARD SUMMARY

System Level:

All retirees are paid from the Retiree Reserve Account which is funded through transfers of member and municipal reserve accounts from the individual plans. In this way, mortality risk is pooled among all individual plans, reducing an individual plan's overall risk associated with mortality. Provided plans do not withdraw from PMRS, this retiree longevity risk stays within the System. Assumption changes that occur after the transfer to the Retiree Reserve Account that increase the retiree liabilities (such as mortality assumption changes or reductions in the discount rate) can cause a gap between the Retiree Reserve Account and the System's retiree liabilities. Ongoing, if retirees live longer than originally expected, more benefit payments will be paid out of the Retiree Reserve Account than expected, further increasing this gap. If the retiree liabilities are not fully funded by the Retiree Reserve Account and there are surplus assets available under PMRS Policy Statement 05-2, then according to general counsel's interpretation of PMRL, there will be a transfer of undistributed excess earnings to the Retiree Reserve Account to ensure these liabilities are fully funded.

- 3) **Withdrawal Risk** is the risk that plans withdraw from the System.

Plan Level:

If an individual plan withdraws from the System all future risks associated with longevity and market fluctuations will be passed onto the withdrawing plan, because the assets that are distributed to the plan on withdrawal are marked to the System's Market Value of Assets up to the plan's Actuarial Value of Assets.

System Level:

If a significant number of plans or plans representing a large percentage of assets withdraw from the System, there could be risk to the System because the economies of scale for services provided may be more difficult to provide. Further, the depletion in assets may greatly change the System's exposure to investment risk, longevity risk, and expense management. There have been relatively few plans that have withdrawn from PMRS in the past 10 years. In fact, the number of pension plans in total has increased from 697 defined benefit plans and 203 cash balance plans as of January 1, 2010 to 728 defined benefit plans and 328 cash balance plans as of January 1, 2020. The active participant count over that same time period has grown from 9,351 to 9,472 participants while participants receiving a benefit have increased from 3,909 to 6,435. When plans withdraw from PMRS, the Pennsylvania Municipal Retirement Law states that the assets distributed to the withdrawing plan cannot exceed the Plan's pro rata portion of the market value of assets "as of the date of receipt of the application for permission to withdraw to prevent plans from leaving with higher reserve accounts". This protects the System in part from anti-selection risk when a participating employer requests a withdrawal.

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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 funded status, 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, 2019 and December 31, 2018;
- 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 “snapshot” 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 the market value of assets by asset class as provided in the December 31, 2019 PMRS ACFR.

Table II-1				
Statement of Assets at Market Value December 31 (\$ Thousands)				
	2019		2018	
Assets				
Equity Investments	\$	1,856,004	\$	1,459,723
Accounts Receivable		6,946		4,243
Fixed Income Investments		446,610		416,101
Real Estate Investments		500,027		486,313
Fixed Assets		388		383
Accounts Payable		(5,299)		(4,810)
Net Pension Liability		(4,781)		(3,938)
Net OPEB Obligation Liability		(3,332)		(5,197)
Investment Purchases Payable		(2,409)		(1,860)
Net Deferred Outflow of Resources		(2,085)		(1,578)
Total Market Value of Assets	\$	2,792,069	\$	2,349,380

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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, 2019	\$ 2,349,380
<u>Additions</u>	
Contributions:	
Municipal Employers	\$ 60,450
Plan Members	24,332
Transfers from other plan administrators	544
Assessments	357
Total Contributions	\$ 85,683
Investment Income:	
Net Appreciation (Depreciation) In Fair Value Of Investments	\$ 454,527
Short-Term And Other Investments	1,198
Common And Preferred Stock	13,030
Real Estate	17,922
International Equities	5,905
Less Investment Expenses	(12,319)
Net Investment Income	\$ 480,263
Miscellaneous Income:	\$ 19
Total Additions	\$ 565,965
<u>Deductions</u>	
Annuity Benefits and terminations	\$ (118,409)
Transfers to other plan administrators	0
Administrative Expenses	(4,867)
Total Deductions	\$ (123,276)
Market Value of Assets – January 1, 2020	\$ 2,792,069

From Table II-2 the benefit payments, transfers out of the system, and administrative expenses of \$123.3 million exceeds contribution income and transfers into the system of \$85.7 million for a net negative cash flow of \$37.6 million, which is approximately negative 1.6% of the beginning of year Market Value of Assets.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
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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 exceeds the Actuarial Value of Assets. The steps in the determination of the Actuarial Value of Assets as of December 31, 2019 are shown below. When the Market Value of Assets exceeds the Actuarial Value of Assets there is an asset surplus. Because the Market Value of Assets exceeded the reserves by \$160.2 million as of December 31, 2019 after reflecting the \$6.5 million transfer from Undistributed Earnings to the Retiree Reserve, the excess interest was available to be distributed to the member plans in accordance with Policy Statement 05-2. However, as allowed by Policy Statement 05-2, the Board decided not to make this distribution.

Table II-3	
Development of Actuarial Value of Assets (\$ Thousands)	
1. Prior Year Actuarial Value	\$ 2,528,940
2. Total Audited Reserve Accounts ^a	\$ 2,627,338
3. Expected Administrative Expenses Net of Assessment	<u>4,511</u>
4. Preliminary Actuarial Value of Assets (2+3)	\$ 2,631,849
5. Current Year Market Value of Assets	2,792,069
6. Prior Year Market Value of Assets	2,349,380
7. New Surplus {Minimum of [(5-4)&(5-4)-(6-1)]}	160,220
8. Percentage of New Surplus Credited as Excess Interest	38.317%
9. Excess Interest (Maximum of 0 and (7x8)) available for distribution	\$ 61,391
10. Excess Interest awarded	\$ 0
11. Actuarial Value of Assets [(Reflecting Excess Interest); (4+10)]	\$ 2,631,849

^a See Table II-4a.

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SECTION II – ASSETS

Excess Interest Allocation

Each year the System’s funded status is evaluated in accordance with Board Policy 05-2 to determine if cumulative investment monies earned above the regular interest rate are available to be awarded to plans. 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 Value of Assets 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, 2019, there was a \$160.2 million surplus. This surplus represents the Market Value of Assets in excess of the Actuarial Value of Assets after reflecting the \$6.5 million transfer from Undistributed Earnings to the Retired Members’ Reserve Account. The calculation in Table II-4a details the available excess interest award for distribution. The Board did not approve a distribution this year.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
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SECTION II – ASSETS

**Table II-4a
Determination of Excess Interest (\$ Thousands)**

1. Assets		
a. Market value	\$	2,792,069
b. Preliminary Actuarial Value		<u>2,631,849</u>
c. Available Surplus (1a. - 1b.)	\$	160,220
2. Reserves		
a. Members' Reserve Account	\$	485,374
b. Municipal Accounts		942,893
c. Disability Reserve Account		688
d. Retired Members' Reserve Account ^a		1,197,510
e. DROP Participant Reserve Account		<u>873</u>
f. Total (2a. + 2b. + 2c. + 2d. + 2e.)	\$	2,627,338
3. Last year's surplus	\$	(179,560)
4. New surplus (1c. - 3. not greater than 1c.)	\$	160,220
5. Excess percent of New Surplus (see Table II-4b)		38.317%
6. Excess Interest Awarded	\$	0
7. Percent of reserve {6. / (2f. - 2c.)}		0.00%
8. Trial Surplus/(Deficit) (1c. - 6.)	\$	160,220
9. Trial margin percent {8. / 1a.}, not less than 0		5.74%

^a Reflects the \$6.5 million transfer from Undistributed Earnings.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
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SECTION II – ASSETS

Table II-4b Determination of Excess Percent of New Surplus (\$ Thousands)	
1. Market Value of Assets	\$ 2,792,069
2. Available Surplus	\$ 160,220
3. Margin (2. / 1.)	5.74%
4. Available Surplus/(Deficit) last year	\$ (179,560)
5. New Surplus (2. - 4., but not greater than 2.)	\$ 160,220
6. New Margin (5. / 1.)	5.74%
7. Excess Percent $(10\% + 8*3.) / (100\% + 8*6.)$	38.3169%

As of the valuation date, the System has a surplus in assets.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2020**

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 municipal plan liabilities for the 2020 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, 2020 valuation for the county plans. This information for the municipal plans is based on the prior year valuation results rolled forward one year. For the analysis of the deficit/surplus of the Present Value of Benefits (PVB) outlined below, the PVB of the cash balance plans equals the AL because for funding purposes these plans are by definition currently set to be fully funded due to their plan design.

Table III-1		
Obligation Deficit/(Surplus) Analysis of All PMRS Plans		
	January 1, 2020	January 1, 2019
<u>Present Value of All Benefits - Total Obligation</u>		
Active Participant Benefits	\$ 1,771,387,356	\$ 1,777,076,100
Retiree and Inactive Benefits	<u>1,315,859,327</u>	<u>1,258,545,895</u>
Present Value of Benefits (PVB)	\$ 3,087,246,683	\$ 3,035,621,995
Present Value of Future Contributions (PVFC)	(544,164,959)	(569,229,134)
Municipal Market Value of Assets (MVA)	<u>(2,792,069,139)</u>	<u>(2,349,379,775)</u>
Net (Surplus)/Deficit of Resources to Obligation (PVB + PVFC + MVA)	\$ (248,987,415)	\$ 117,013,086
<u>Actuarial Liability</u>		
Present Value of Benefits (PVB)	\$ 3,087,246,683	\$ 3,035,621,995
Present Value of Future Normal Cost (PVFNC)	<u>(485,765,469)</u>	<u>(515,477,681)</u>
Actuarial Liability (AL = PVB - PVFNC)	\$ 2,601,481,214	\$ 2,520,144,314
Actuarial Value of Assets (AVA)	<u>(2,631,849,434)</u>	<u>(2,528,939,742)</u>
Net Unfunded/(Surplus) (AL + AVA)	\$ (30,368,220)	\$ (8,795,428)

Unrounded values may differ from the rounded values in other sections of report. January 1, 2020 information reflects the present value of the cash balance contributions and Normal Cost.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2020**

SECTION III – LIABILITIES

Changes in Liabilities

The Actuarial Liabilities shown in the following table change with each valuation based on the experience of the Plan. As liabilities for the county plans are valued every other year, gains/losses shown below reflect a two-year period. The liability may change for any of several reasons, including:

- New hires since the last valuation
- Benefits accrued (normal cost) since the last valuation
- Plan amendments (benefit changes) including excess interest benefit improvements
- Interest on Actuarial Liability
- Benefits paid (benefit payments) to retirees and beneficiaries
- Participants leaving employment and dying at rates different than expected (gain/losses)
- Participants transferring to other Plans within the System
- Plans transferring into and out of the System
- Changes in actuarial assumptions
- Changes in actuarial methods

The following table shows the sources of the Actuarial Liability changes since the last valuation based on the GASB results determined for the individual plans and updated liabilities for the cash balance plans. The total benefit payments below represent the sum of those reported in the individual plans' GASB reports.

Table III-2 Actuarial Liability Reconciliation	
Actuarial Liability as of 1/1/2019	\$ 2,520,144,314
Actuarial Liability as of 1/1/2020	2,601,481,214
Liability Increase/(Decrease)	81,336,900
Changes due to	
Normal Cost	\$ 68,750,769
Interest	132,484,878
Benefit Changes	26,700
(Gains)/Losses	(2,205,294)
Benefit Payments	(118,264,305)
Transfers	544,152
Total	\$ 81,336,900

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2020**

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 the cost method required under 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 each plan are amortized over the lesser of 20 years or the future working life of the active participants in the plan. Increases/decreases from assumption changes by the System are amortized over the lesser of 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 Act 205.

In years where there are benefit improvements related to excess interest distributions, the impacted plans receive funds through their excess interest distribution to fully fund the excess interest benefit improvement. Therefore, there is no impact on the unfunded liabilities as a result of the excess interest benefit improvements.

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 2019 Act 205 forms for 2021 and 2022 MMO contributions and 2020 Act 293 forms for 2022 and 2023 employer contributions. The combination of underfunded and surplus plans would not necessarily be informative in reviewing the overall funded status of the System.

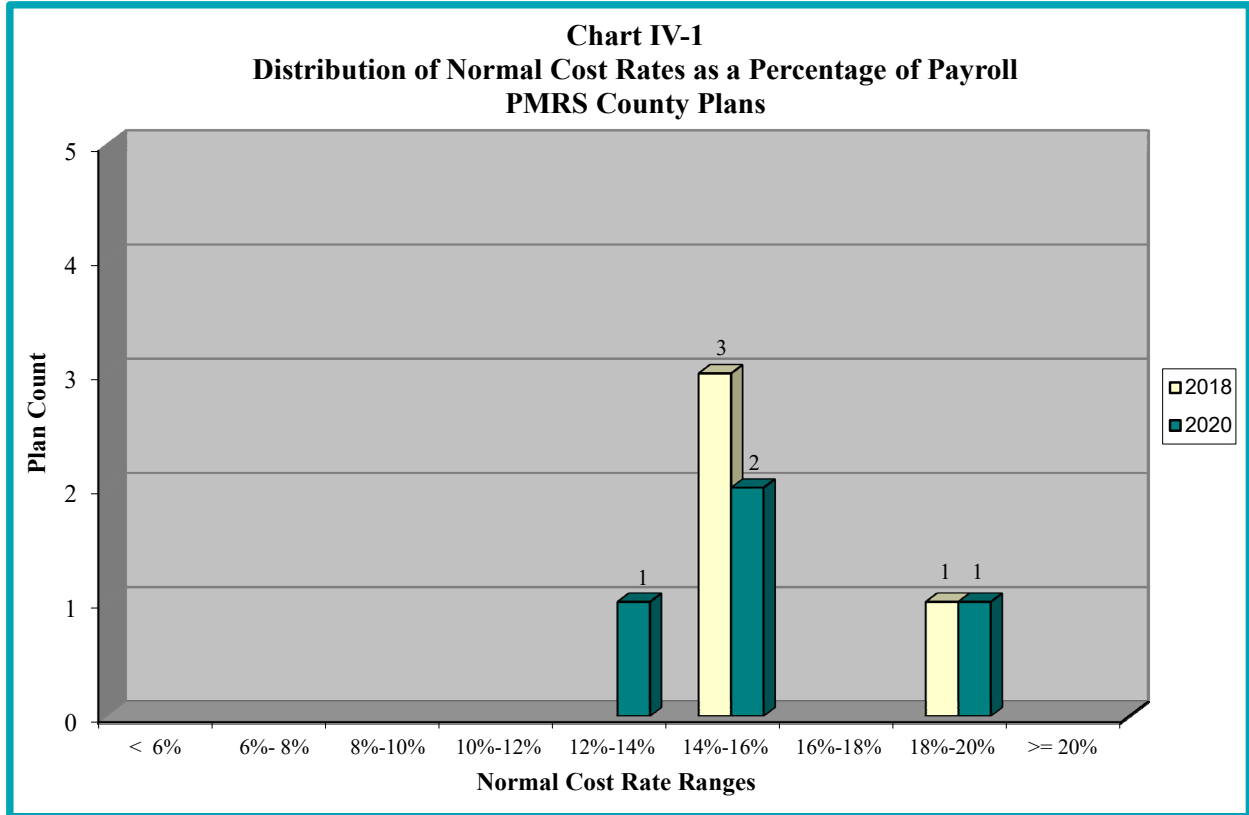
On the following pages, we describe the cost components and provide graphically the distribution of costs among the participating county plans.

The normal cost rate (i.e., normal cost as a percentage 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 net 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, 2020

SECTION IV – CONTRIBUTIONS

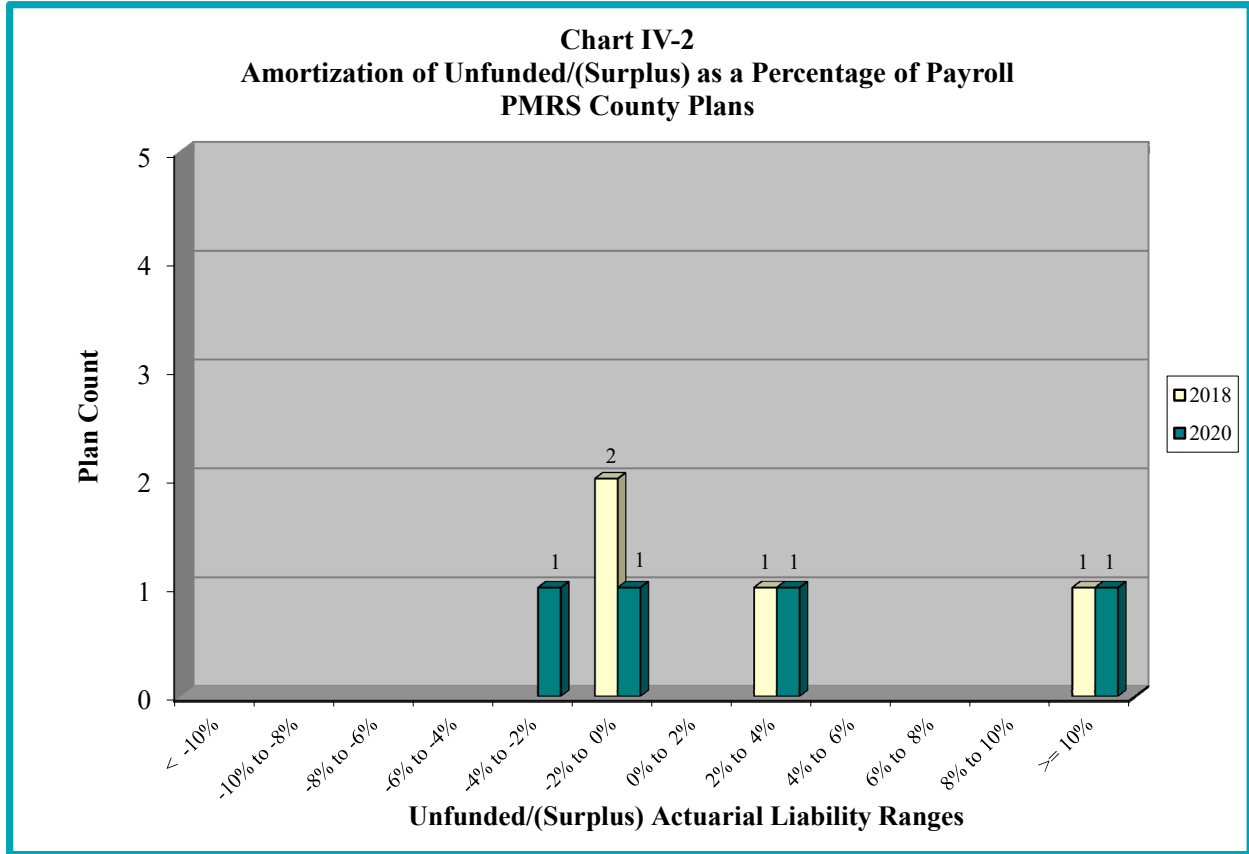
The following chart is a summary of the normal cost rates, which is the normal cost as a percentage of payroll, determined for the traditional defined benefit county plans as of January 1, 2018 and January 1, 2020.



**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2020**

SECTION IV – CONTRIBUTIONS

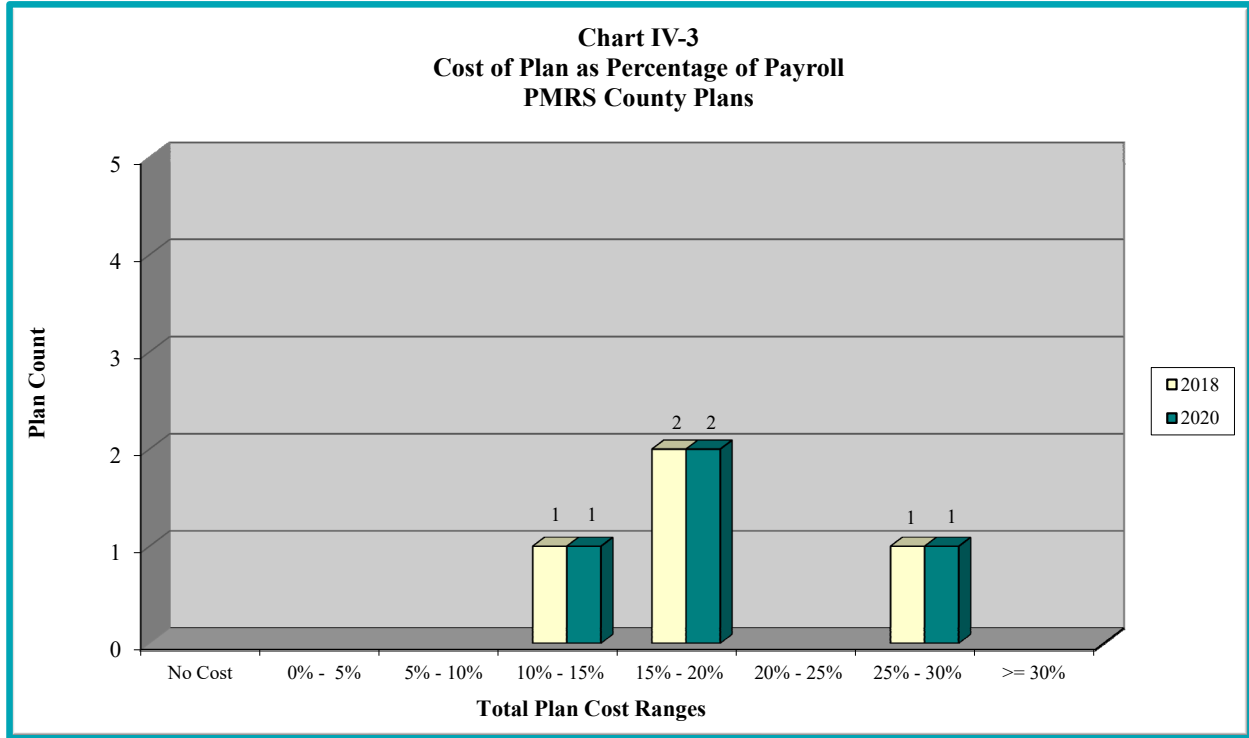
Chart IV-2 below is a summary of the unfunded/(surplus) actuarial liability amortization costs defined as a percentage of covered payroll of each plan’s active members, determined for the traditional defined benefit county plans as of January 1, 2018 and January 1, 2020.



PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2020

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 county plans as of January 1, 2018 and January 1, 2020.



**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2020**

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 ACFR 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; and
- Table V-6 is the Schedule of Total Membership and Salary.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2020**

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, 2020 – County Plans and Cash Balance (CB) Plans January 1, 2019 – Plans that are neither County nor CB plans
Measurement date	January 1, 2020
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 of 2.8%	
Cost-of-living adjustments (COLA)	2.8% per year up to plan maximum

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.

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 percentage of payroll 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 future member contributions. The difference between this liability and the Actuarial Value of Asset 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, 2020**

SECTION V – ACCOUNTING AND FINANCIAL STATEMENT INFORMATION

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

Valuation Date January 1,	Active Member (1)*	Retirees, Beneficiaries & Vested Terminated (2)	Active Member Employer Financed Contributions (3)	Actuarial Value of Reported Assets	Portion of Accrued Liabilities Covered by Reported Assets		
					(1)	(2)	(3)
2020	\$485,374,472	\$1,315,859,327	\$800,247,415	\$2,631,849,434	100%	100%	104%
2019	474,930,885	1,258,545,895	786,667,534	2,528,939,742	100%	100%	101%
2018	460,805,568	1,175,715,217	764,391,135	2,404,498,404	100%	100%	100%
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%

*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
GASB Statement No. 67 Disclosure**

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
2020	\$2,631,849,434	\$2,601,481,214	\$(30,368,220)	101.2%	5.25%
2019	2,528,939,742	2,520,144,314	(8,795,428)	100.4%	5.25%
2018	2,404,498,404	2,400,911,920	(3,586,484)	100.1%	5.25%
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%

The actuarial assumptions as of January 1, 2020 are shown in the assumptions and methods section which are used, along with the participant data and plan provisions provided by PMRS, to determine the liabilities above. The following table shows the number of pension plans valued at each year, and which plans have liabilities rolled-forward from the prior year.

Valuation Date	Valuation of Defined Benefit Liabilities		
	Complete Valuation	Roll-Forward	Cash Balance Plans
January 1, 2020	4	724	328
January 1, 2019	719	4	323
January 1, 2018	4	726	314
January 1, 2017	718	4	311
January 1, 2016	4	718	294
January 1, 2015	717	4	286

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2020**

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	Added to roll	Average Annual Annuities Added	Average Annual Benefit Increase	Deleted from roll	Average Annual Annuities Removed	Number on roll	Annual Annuities	Percentage Increase in Annuities	Average Annual Annuities	Percent Increase in Average Annuities
January 1, 2020	381	\$19,656	528	135	\$11,392	6,435	\$107,504,808	6.0%	\$16,706	2.0%
2019	429	19,572	419	146	8,147	6,189	101,399,088	7.8%	16,384	2.9%
2018	383	18,912	575	176	9,325	5,906	94,073,168	6.5%	15,928	2.7%
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%

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:		Deferred Retirees	Inactive Beneficiaries	Deferred Pensions	Inactive Members	Total
	Defined Benefit	Cash Balance					
January 1, 2020	7,970	1,502	5,781	654	1,205	47	17,159
2019	7,949	1,446	5,550	639	1,168	40	16,792
2018	7,868	1,387	5,307	599	1,090	35	16,286
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

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

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2020**

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				
	2020	As of January 1¹		2017
		2019	2018	
a. Retirees currently receiving benefits	5,781	5,550	5,307	5,099
b. Beneficiaries currently receiving benefits	654	639	599	600
c. Terminated vested employees entitled to future benefits from Defined Benefit Plans	882	853	797	834
d. Terminated non-vested employees entitled to contribution refunds from Defined Benefit Plans	47	40	35	28
e. Active employees in defined benefit plans	7,970	7,949	7,868	7,728
i. Aggregate Salary ²	\$465,906,342	\$455,352,355	\$434,554,380	\$422,621,214
ii. Vested ³	4,388	4,470	4,553	4,573
iii. Non-vested	3,582	3,479	3,315	3,156
f. Participants in cash balance plans	1,825	1,761	1,680	1,619
i. Aggregate Salary	\$69,134,048	\$63,302,730	\$60,013,152	\$53,998,354
ii. Active	1,502	1,446	1,387	1,303
iii. Inactive	323	315	293	316

¹ Represents entire System

² Annualized salary paid during the prior plan year for Traditional Defined Benefit plan participants and actual salary for active cash balance participants

³ Count of vested participants estimated based on service as of the valuation date

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2020**

APPENDIX A – MEMBERSHIP INFORMATION

This appendix provides various member information including age-service distribution tables for active members by count and salary, benefit distribution information for participants in pay status, including a break-down by pension type.

**Distribution of Active Defined Benefit Members
by Age and Service as of January 1, 2020**

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	8	2	0	0	0	0	0	0	0	0	10
20 to 24	110	62	26	21	6	0	0	0	0	0	225
25 to 29	150	120	105	119	76	4	0	0	0	0	574
30 to 34	115	117	80	133	199	63	2	0	0	0	709
35 to 39	87	87	72	122	198	167	51	4	0	0	788
40 to 44	97	63	55	107	146	143	176	43	1	0	831
45 to 49	62	66	55	98	161	166	171	121	63	9	972
50 to 54	77	76	48	105	189	169	184	169	114	72	1,203
55 to 59	50	51	53	96	163	168	191	141	135	205	1,253
60 to 64	26	38	31	58	125	146	161	126	91	174	976
65 & up	13	10	14	36	59	62	61	57	40	77	429
Total	795	692	539	895	1,322	1,088	997	661	444	537	7,970

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2020**

APPENDIX A – MEMBERSHIP INFORMATION

**Distribution of Active Cash Balance Members
by Age and Service as of January 1, 2020**

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	2	0	0	0	0	0	0	0	0	0	2
20 to 24	26	19	9	5	1	0	0	0	0	0	60
25 to 29	23	14	14	26	13	0	0	0	0	0	90
30 to 34	21	27	11	21	12	10	0	0	0	0	102
35 to 39	22	19	9	22	16	16	4	0	0	0	108
40 to 44	23	16	10	22	21	25	15	2	0	0	134
45 to 49	26	15	24	31	36	23	24	20	5	1	205
50 to 54	21	25	12	24	31	27	26	22	9	12	209
55 to 59	16	8	12	31	47	32	28	35	19	24	252
60 to 64	4	13	7	16	39	31	31	26	24	35	226
65 & up	1	2	5	4	20	18	17	11	12	24	114
Total	185	158	113	202	236	182	145	116	69	96	1,502

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2020**

APPENDIX A – MEMBERSHIP INFORMATION

**Distribution of Active Members
by Age and Service as of January 1, 2020**

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	\$22,844	\$36,147	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$25,061
20 to 24	\$32,566	\$45,789	\$42,633	\$51,043	\$64,821	\$0	\$0	\$0	\$0	\$0	\$0	\$40,038
25 to 29	\$39,574	\$46,271	\$48,067	\$50,872	\$58,385	\$64,021	\$0	\$0	\$0	\$0	\$0	\$47,583
30 to 34	\$37,303	\$46,314	\$53,998	\$57,728	\$59,233	\$56,995	\$79,181	\$0	\$0	\$0	\$0	\$52,236
35 to 39	\$37,193	\$51,005	\$51,617	\$56,090	\$60,825	\$67,211	\$68,607	\$72,210	\$0	\$0	\$0	\$57,028
40 to 44	\$35,731	\$49,354	\$49,495	\$52,838	\$58,772	\$65,482	\$72,702	\$72,897	\$42,682	\$0	\$0	\$58,285
45 to 49	\$33,792	\$49,550	\$49,236	\$55,833	\$56,880	\$61,227	\$70,299	\$71,197	\$74,777	\$74,332	\$0	\$59,840
50 to 54	\$38,998	\$45,041	\$54,346	\$47,589	\$55,507	\$57,396	\$62,988	\$67,081	\$73,535	\$73,975	\$0	\$58,449
55 to 59	\$40,245	\$47,031	\$53,068	\$56,182	\$56,316	\$58,658	\$57,621	\$61,030	\$69,676	\$68,429	\$0	\$59,358
60 to 64	\$43,627	\$49,905	\$46,026	\$57,637	\$56,539	\$54,450	\$60,866	\$59,647	\$62,244	\$64,242	\$0	\$58,332
65 & up	\$36,053	\$51,056	\$40,776	\$50,596	\$51,232	\$53,111	\$53,869	\$56,358	\$59,987	\$61,890	\$0	\$54,542
Total	\$36,922	\$47,590	\$50,073	\$54,013	\$57,473	\$59,966	\$64,151	\$64,428	\$68,577	\$66,832	\$0	\$56,487

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2020**

APPENDIX A – MEMBERSHIP INFORMATION

**Inactive Benefit Payment Distribution
as of January 1, 2020**

COUNTS BY BENEFIT/AGE: RECEIVING PAYMENTS

Age	Monthly Benefit	Count
x < 30	\$2,968	4
30 <= x < 35	\$5,566	7
35 <= x < 40	\$5,816	8
40 <= x < 45	\$12,837	21
45 <= x < 50	\$34,205	43
50 <= x < 55	\$175,502	127
55 <= x < 60	\$642,609	335
60 <= x < 65	\$1,835,973	1,076
65 <= x < 70	\$2,605,349	1,612
70 <= x < 75	\$1,772,014	1,346
75 <= x < 80	\$981,783	863
80 <= x < 85	\$515,250	538
85 <= x	\$368,862	455
<Total>	\$8,958,734	6,435

COUNTS BY BENEFIT/AGE: DEFERRED PAYMENTS¹

Age	Monthly Benefit	Count
x < 30	\$1,427	6
30 <= x < 35	\$15,938	42
35 <= x < 40	\$43,724	75
40 <= x < 45	\$89,769	119
45 <= x < 50	\$174,813	205
50 <= x < 55	\$240,425	295
55 <= x < 60	\$246,254	291
60 <= x < 65	\$82,461	142
65 <= x < 70	\$12,982	24
70 <= x < 75	\$330	4
75 <= x < 80	\$12	2
80 <= x < 85	\$0	0
85 <= x	\$0	0
<Total>	\$908,134	1,205

¹ Deferred payments listed above are attributable to the non-cash balance defined benefit plans only. Deferred payments to the 323 cash balance participants will be determined upon their retirement.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
ACTUARIAL VALUATION AS OF JANUARY 1, 2020**

APPENDIX A – MEMBERSHIP INFORMATION

Pensions in Payment on January 1, 2020 by Type and Amount						
Monthly Amount	Total	Pension Type				
		Normal	Involuntary early	Voluntary early	Service disability	Non-service disability
Total	6,435	5,423	226	668	53	65
Under \$100	286	247	19	18	1	1
\$ 100 - \$199	346	282	28	35	1	0
200 - 299	341	275	28	38	0	0
300 - 399	335	270	24	35	4	2
400 - 499	338	280	23	32	1	2
500 - 599	324	269	9	38	2	6
600 - 699	270	215	17	35	3	0
700 - 799	286	233	14	36	1	2
800 - 899	275	220	12	33	1	9
900 - 999	258	205	7	32	5	9
1,000 - 1,199	530	424	16	71	6	13
1,200 - 1,399	389	307	11	60	5	6
1,400 - 1,599	362	303	4	41	9	5
1,600 - 1,799	266	232	5	26	1	2
1,800 - 1,999	258	215	3	33	6	1
2,000 - 2,199	218	194	2	18	2	2
2,200 - 2,399	206	181	3	21	1	0
2,400 - 2,599	163	147	0	14	1	1
2,600 - 2,799	146	130	0	13	1	2
2,800 - 2,999	115	107	0	6	0	2
3,000 - 3,499	275	257	1	15	2	0
3,500 - 3,999	189	179	0	10	0	0
4,000 and over	259	251	0	8	0	0

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
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APPENDIX A – MEMBERSHIP INFORMATION

Pensions Awarded in Prior Ten Years, by Type and Monthly Amount										
Year Ended December 31:	Total		Normal		Involuntary early		Voluntary early		Disability	
	Number	Average Monthly Amount	Number	Average Monthly Amount	Number	Average Monthly Amount	Number	Average Monthly Amount	Number*	Average Monthly Amount
2010	396	1,552	341	1,632	13	364	37	1,250	5 (0)	1,407
2011	438	1,367	352	1,496	37	459	40	1,180	9 (3)	888
2012	390	1,370	341	1,421	20	520	22	1,614	7 (2)	709
2013	431	1,706	364	1,800	17	905	34	1,280	16 (2)	1,319
2014	392	1,492	341	1,524	14	825	29	1,575	8 (2)	1,022
2015	339	1,574	309	1,593	4	562	22	1,569	4 (2)	1,113
2016	447	1,562	397	1,600	11	627	28	1,428	11 (3)	1,485
2017	383	1,576	342	1,616	8	822	29	1,350	4 (1)	1,311
2018	429	1,631	382	1,651	9	963	33	1,475	5 (4)	2,277
2019	381	1,638	341	1,644	8	781	27	1,887	5 (5)	1,247

*Number of service-related disability pensions are shown in parentheses.

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APPENDIX B – ACTUARIAL ASSUMPTIONS AND METHODS

Actuarial Assumptions:

The PMRS demographic actuarial assumptions were most recently revised by the Board effective January 1, 2016, while the Regular Interest Rate (investment return assumption) was most recently approved by the Board effective January 1, 2017 with no changes for the January 1, 2020 valuation:

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
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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
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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
ACTUARIAL VALUATION AS OF JANUARY 1, 2020**

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.

M. 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. The new assumptions approved by the Trustees in July 2020 will first be incorporated in the January 1, 2021 valuation results and report.

**PENNSYLVANIA MUNICIPAL RETIREMENT SYSTEM
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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 (AVA):

The AVA is the sum of all audited reserve accounts as of the valuation date, including Member, Municipal, Retired, Disability, and DROP Reserves, as provided in the December 31, 2019 ACFR, and a one-year administration expense reserve, plus any additional adjustments as made during the year by the Board of Trustees without reflecting any Excess Interest. In years where an excess interest distribution occurs, the following year's valuation will incorporate the updated information once the type and amount of distribution to each plan has been determined.

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 AVA. Once the preliminary AVA 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 AVA is set equal to reserves under the System based on the unique legislative structure of PMRS. These reserves are increased annually at a set rate agreed on by the Board named "Regular Interest" as defined under the Pennsylvania Municipal Retirement Law. These assets do not 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.*

APPENDIX B – ACTUARIAL ASSUMPTIONS AND METHODS

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.*

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 required to comply with Actuarial Standards of Practice (ASOP) when defining the Actuarial Value of Assets, do 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:

The Entry Age Normal Actuarial Cost Method was used for active employees, whereby the normal cost is computed as the level annual percentage of salary 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 percentage 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.

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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
- (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 Roll Forward Liabilities:

The county defined benefit pension plans and cash balance plans are valued explicitly every even calendar year (cash balance plans are valued every year). However, the liabilities for those plans that are neither county nor cash balance are explicitly valued every odd calendar year. For the even calendar years, we estimate those Plan liabilities by rolling forward the prior year's liabilities. With the implementation of GASB 68, which required an individual report to be

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APPENDIX B – ACTUARIAL ASSUMPTIONS AND METHODS

issued for each pension plan, the liabilities for those plans that are neither county or cash balance (i.e., municipal or authority defined benefit plans) were rolled forward based on the actual benefit payments. These liabilities reflect 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 county and cash balance plans were explicitly valued as of January 1, 2020 based on the data, plan provisions, methods and assumptions.

Valuation Software:

Cheiron utilizes ProVal, an actuarial valuation software leased from Winklevoss Technologies (WinTech) to calculate liabilities and project benefit payments. We have relied on WinTech as the developer of ProVal. We have reviewed ProVal and have a basic understanding of it and have used ProVal in accordance with its original intended purpose. We have not identified any material inconsistencies in assumptions or output of ProVal that would affect this actuarial valuation.

Disclosures Regarding Models Used:

Cheiron utilizes ProVal, an actuarial valuation software leased from Winklevoss Technologies for the intended purpose of calculating liabilities and projected benefit payments. We have examined the reasonableness of the input data and assumptions, reviewed sample calculations for accuracy, reconciled the actuarial gain loss, and find the aggregate results reasonable and appropriate. We are not aware of any material inconsistencies, unreasonable output resulting from the aggregation of assumptions, material limitations or known weaknesses that would affect this actuarial valuation.

The deterministic projections are based on our propriety model P-Scan developed by our firm that utilize the results shown in this valuation report. The model is also used to stress test the impact of volatile asset returns over the projection period. The projections assume continuation of the plan provisions and actuarial assumptions (other than projected returns on MVA where noted in Section I) in effect as of the valuation date and do not reflect the impact of any changes in benefits or actuarial assumptions that may be adopted after the valuation date. While the assumptions individually are reasonable for the underlying valuation that supports the projections, specifically for projection purposes, they are also considered reasonable in the aggregate. Additional assumptions are disclosed in the Projected Financial Trends of Section I to provide scenarios related to projected returns and distribution of excess interest.

Changes in Actuarial Assumptions and Methods:

None.