Michigan Public School Employees' Retirement System

Annual Actuarial Valuation Report

September 30, 2020

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March 12, 2021

Mr. Anthony Estell
Director, Office of Retirement Services
530 W. Allegan
Lansing, Michigan 48933

Re: Michigan Public School Employees' Retirement System - Actuarial Valuation as of September 30, 2020

Dear Mr. Estell:

The results of the September 30, 2020 annual actuarial valuation of the Michigan Public School Employees' Retirement System (MPSERS) pension benefits are presented in this report. The purpose of the valuation was to measure the System's funding progress, to determine the employer contribution for the 2022-2023 fiscal year, and to provide actuarial information for the System's financial report. The report should not be relied upon for any other purpose. This report may be provided to parties other than the Office of Retirement Services only in its entirety and only with the permission of the Office of Retirement Services. GRS is not responsible for unauthorized use of this report.

The valuation was based upon information furnished by the Office of Retirement Services concerning Retirement System benefits, financial transactions, and active members, terminated members, retirees and beneficiaries. Data was checked for internal and year-to-year consistency, but was not audited by us. As a result, we are unable to assume responsibility for the accuracy or completeness of the data provided. Year 2005 and prior years' valuation results back to 1993 were not prepared by GRS and are presented for comparison with the current year's results.

The valuation summarized in this report involves actuarial calculations that require making assumptions about future events. We believe that the assumptions and methods used in this report are reasonable and appropriate. However, other assumptions and methods could also be reasonable and could result in materially different results. Some of the numbers in this report are rounded. The use of the rounded numbers for plan liabilities should not imply a lack of precision. In addition, because it is not possible or practical to consider every possible contingency, we may use summary information, estimates or simplifications or calculations to facilitate the modeling of future events. We may also exclude factors or data that we deem to be immaterial.

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Future actuarial measurements may differ significantly from those presented in this report due to such factors as experience differing from that anticipated by actuarial assumptions, changes in plan provisions, actuarial assumptions/methods or applicable law. Due to the limited scope of this assignment, we did not perform an analysis of the potential range of future measurements. This valuation was based on the assumption that the plan sponsor will continue to be able to make any contribution necessary to fund the plan in the future. A determination of the plan sponsor's ability to make the necessary contributions in the future is beyond the scope of our expertise and was not performed by us.

This report was prepared using our proprietary valuation model and related software which in our professional judgment has the capability to provide results that are consistent with the purposes of the valuation and has no material limitations or known weaknesses. We performed tests to ensure that the model reasonably represents that which is intended to be modeled.

To the best of our knowledge, this report is accurate and fairly presents the actuarial position of the Retirement System. The valuation was conducted in accordance with standards of practice prescribed by the Actuarial Standards Board and in compliance with the applicable State statutes. Mita D. Drazilov and Louise M. Gates are independent of the plan sponsor and are Members of the American Academy of Actuaries (MAAA) who meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. It is our opinion that the actuarial assumptions used for the valuation produce results which are reasonable.

Sincerely,

Mita Drazilov

Mita D. Drazilov, ASA, FCA, MAAA

Louise Gates

Louise M. Gates, ASA, FCA, MAAA

MDD/LMG:rmn

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Executive Summary/Board Summary

1. Required Employer Contributions to Support Retirement Benefits

The computed employer contribution for fiscal year 2023 is shown below. Computed contributions are shown as a percentage of active member payroll and as the projected fiscal year 2023 dollar amount.

	Total Computed Employer Contribution			
		Hybrid Members		
	Non-Hybrid Members	Pension Plus Plan (PPP)	Pension Plus 2 Plan (PPP2)	Weighted Average
As a Percentage of Active Member Payroll				
Normal Cost	6.41 %	3.49 %	6.20 %	5.93 %
UAAL Amortization Payment	30.14	30.14	30.14	30.14
As an Annual Dollar Amount				
Normal Cost	$ 386,946,434	$ 44,524,357	$ 40,387,836	$ 471,858,627
UAAL Amortization Payment	2,845,971,132	(227,598)	(264,331)	2,845,479,203
Total	$ 3,232,917,566	$ 44,296,759	$ 40,123,505	$ 3,317,337,830

This valuation report establishes the employer contribution for fiscal year 2023. As a result of Public Act 300 of 2012 and the introduction of the defined contribution (DC) plan option, the employer normal cost rate (i.e., 5.93%) is expressed as a percentage of the defined benefit (DB) plan payroll, while the Unfunded Actuarial Accrued Liability (UAAL) amortization payment rate (i.e., 30.14%) is expressed as a percentage of total payroll (i.e., including both DB and DC plan active member payroll).

2. Budgeting Process and Reconciliation Process

For the September 30, 2011 valuation and prior valuations, an Annual Required Contribution (ARC) for Governmental Accounting Standards Board (GASB) accounting purposes and the required employer contribution for funding purposes were established for the fiscal year following the valuation date. For example, the September 30, 2011 valuation established an ARC and the required employer contribution for funding purposes for fiscal year 2012. However, the 2011 valuation was used for fiscal year 2014 budgeting purposes. Any differences between the required and budgeted employer contribution were handled through a reconciliation process, as established through subsection 41(9) of the MPSERS statute.

Beginning with the September 30, 2012 valuation, it was reported to the actuary that the reconciliation process had been suspended. The September 30, 2012 valuation determined the required contribution for fiscal year 2015 for funding and accounting purposes. For the September 30, 2015 valuation, it was reported to the actuary that the reconciliation process had been reinstated with reconciliation payments beginning in fiscal year 2016. The September 30, 2020 valuation determines the required employer contribution for fiscal year 2023 for both funding and accounting purposes.

The contribution requirements calculated in this report are in addition to any reconciliation payments as required by subsection 41(9) of the MPSERS statute.

3. Dedicated Gains Policy

In 2017, the Board adopted a Dedicated Gains Policy. The purpose of the Policy is to reduce the investment return assumption for actuarial valuation purposes if the fiscal year's market value rate of return exceeds a certain amount. The immediate recognition of the market value return is expected to offset the increase in the computed employer contribution from where it otherwise would have been.

For MPSERS, the following is applicable:

(1) The amount of excess investment return for MPSERS does not cover the increase in the normal cost contribution for any year.
(2) It was assumed that the reduction in the investment return assumption would be applicable to the Non-Hybrid and PPP portions of the pension plan only.

For fiscal year 2020, the actual return on the market value of assets was not high enough to trigger the provisions of the Dedicated Gains Policy. Therefore, for the September 30, 2020 valuation, the investment return assumption for the Non-Hybrid portion of the pension plan and the PPP portion of the pension plan remained 6.80%. Please see pages C-3 and C-5 for additional detail.

4. Contribution Comparison

The chart below compares the results of this valuation of the Retirement System with the results of the prior year's valuation:

Valuation Date	**9/30/2019**	**9/30/2020**
Contribution Percentage		
Normal Cost	5.94 %	5.93 %
UAAL Amortization Payment	28.29	30.14
Total	N/A	N/A
As an Annual Dollar Amount		
Normal Cost	$ 473,915,267	$ 471,858,627
UAAL Amortization Payment	2,661,767,658	2,845,479,203
Total	$ 3,135,682,925	$ 3,317,337,830
Fiscal Year Computed For	2022	2023
Fiscal Year Budgeted For	2022	2023

The computed employer contribution rates presented throughout this report do not reflect the normal cost or UAAL "floor" provisions described in bullet (5) of Public Act (PA) 92 of 2017 on page 3 of the Appendix or bullet (4) of PA 181 of 2018 on page 4 of the Appendix.

5. Determination of Pension Plus 2 Plan Contribution Rates

The September 30, 2018 actuarial valuation was the first valuation that included members participating in the PPP2. Given that limited experience is available for PPP2, it is our understanding that the 6.20% employer and member normal cost contribution rates will remain in effect until the next completed 5-year Experience Study. In addition, based upon the results of the September 30, 2020 valuation, no contribution is required to finance a UAAL for PPP2.

6. Reasons for Change

There are three general reasons why contribution rates change from one valuation to the next. The first is a change in the benefits or eligibility conditions of the plan. The second is a change in the valuation assumptions used to predict future occurrences and/or a change to the valuation methods. The third is the difference during the year between the plan's actual experience and what the assumptions predicted.

There were no benefit changes reported to the actuary for the year ended September 30, 2020.

In accordance with Public Act 181 of 2018, the payroll growth assumption for amortization purposes used in determining the fiscal year 2023 employer contributions decreased from 3.00% to 2.50%. While this assumption change had no impact on the Actuarial Accrued Liability, it did result in an increase in employer contribution requirements.

Plan experience for the year ended September 30, 2020 was less favorable than assumed and is described in more detail in Section B of this report.

SECTION A

INTRODUCTION

Contribution Requirements

Development of Employer Contributions for the Indicated Valuation Date

	Contributions for	September 30 2019 Total	2020 Non-Hybrid	2020 Hybrid Pension Plus (PPP)	2020 Hybrid Pension Plus 2 (PPP2)	2020 Total
(1)	Fiscal Year Ending September 30,	2022	2023	2023	2023	2023
(2)	Total Normal Cost of Benefits (as a % of member pay)	10.88%	11.23%	8.75%	12.40%	10.93%
(3)	Member Contribution % (weighted average)	4.94%	4.82%	5.26%	6.20%	5.00%
(4)	Employer Normal Cost % = (2) - (3)	5.94%	6.41%	3.49%	6.20%	5.93%
(5)	Projected Active Member Payroll for Fiscal Year - Normal Cost $	$ 7,973,776,301	$ 6,036,605,837	$ 1,275,769,553	$ 651,416,709	$ 7,963,792,099
(6)	Employer Normal Cost $ = (4) x (5)	473,915,267	386,946,434	44,524,357	40,387,836	471,858,627
(7)	Total Actuarial Accrued Liability	85,201,719,662	85,493,831,208	798,169,897	45,688,758	86,337,689,863
(8)	Funding Value of Assets	51,421,988,660	51,738,405,932	800,373,912	48,565,425	52,587,345,269
(9)	Unfunded Actuarial Accrued Liabilities (UAAL) = (7) - (8)	$ 33,779,731,002	$ 33,755,425,276	$ (2,204,015)	$ (2,876,667)	$ 33,750,344,594
	a. Present Value of Budgeted Early Retirement Incentive Payments	117,486,431	-	-	-	-
	b. Present Value of Remaining Early Retirement Incentive Payments	-	-	-	-	-
	c. Present Value of Future Reconciliation Payments	327,358,705	187,357,583	-	-	187,357,583
	d. Net UAAL to be Amortized = (9) - (9a) - (9b) - (9c)	$ 33,334,885,866	$ 33,568,067,693	$ (2,204,015)	$ (2,876,667)	$ 33,562,987,011
(10)	Amortization Period (years)	17	16	16	16	16
(11)	Amortization Factor (level percent of payroll payments)		11.58302731	11.58302731	12.22793403	
(12)	Amortization Payment $ [(1)]	$ 2,661,767,658	$ 2,845,971,132	$ (227,598)	$ (264,331)	$ 2,845,479,203
(13)	Projected Active Member Payroll for Fiscal Year - Amortization $ [(2)]	$ 9,409,381,509				$ 9,441,678,376
(14)	Amortization Payment % = (12) / (13) [(1),(3)]	28.29%				30.14%
(15)	Total Computed Employer Contribution $ = (6) + (12) [(4)]	**$ 3,135,682,925**	**$ 3,232,917,566**	**$ 44,296,759**	**$ 40,123,505**	**$ 3,317,337,830**

(1) *See page A-3 for a description of how to allocate the actual Amortization Payment dollar amounts amongst the Non-Hybrid, the PPP, and the PPP2 groups.*

(2) *The Non-Hybrid and PPP projected amortization payrolls include projected payroll for those members with a Non-Hybrid and PPP liability respectively, regardless of whether the active member is continuing to accrue benefits in the defined benefit plan. The PPP2 projected amortization payroll includes projected payroll for all PPP2 (i.e., $651.4 million) and "pure" DC members (i.e., $1,371.7 million).*

(3) *Consistent with MPSERS policy, the Amortization Payment is expressed as a percentage of total payroll (i.e., including both DB and DC active member payroll).*

(4) *The contribution requirements above are in addition to any reconciliation payments as required by subsection 41(9) of MPSERS statute and do not reflect any normal cost or UAAL floors as described in Public Act 92 and Public Act 181.*

Contribution Requirements

Computed Employer Contributions

Based on the assumptions outlined in Section E, as more of the active membership becomes Pension Plus 2 Plan members and the System pays off its unfunded actuarial accrued liability (UAAL), the long-term employer contribution rate for the Michigan Public School Employees' Retirement System is expected to be the long-term employer normal cost rate for the Pension Plus 2 Plan. However, for the current total defined benefit MPSERS active member population, the weighted average normal cost rate is 5.93%. Also, for the current year, there is a contribution needed to fund the UAAL. As the normal cost rate and the UAAL amortization payment rate are applied to different payrolls, the two contribution rates cannot be summed to get a total computed employer contribution rate.

Determining Employer Dollar Contributions

For any period of time, the percent-of-payroll contribution rate needs to be converted to dollars, then promptly contributed to the System. Please note, the normal cost rates and the UAAL amortization payment rates apply to two different types of payroll. The normal cost rates should be applied to the fiscal year 2023 payroll for those active employees who elected to maintain future benefit accruals in the defined benefit plan, while the UAAL amortization payment rates should be applied to the fiscal year 2023 payroll for the entire MPSERS active employee group.

For the Non-Hybrid Plan members, the employer normal cost rate (expressed as a % of Non-Hybrid payroll) is 6.41%. Applying the employer normal cost rate of 6.41% to the projected payroll for MPSERS active employees participating in the Non-Hybrid portion of the defined benefit plan for fiscal year 2023 produces annual employer normal cost contributions of $386,946,434.

For the PPP members, the employer normal cost rate (expressed as a % of PPP payroll) is 3.49%. Applying the employer normal cost rate of 3.49% to the projected payroll for MPSERS active employees participating in the PPP portion of the defined benefit plan for fiscal year 2023 produces annual employer normal cost contributions of $44,524,357.

For the PPP2 members, the employer normal cost rate (expressed as a % of PPP2 payroll) is 6.20%. Applying the employer normal cost rate of 6.20% to the projected payroll for MPSERS active employees participating in the PPP2 portion of the defined benefit plan for fiscal year 2023 produces annual employer normal cost contributions of $40,387,836.

The amortization payment for funding the UAAL (expressed as a % of the total MPSERS active member payroll) is 30.14%. Applying the amortization payment rate of 30.14% to the projected payroll for the total MPSERS active employees for fiscal year 2023 produces an annual amortization payment of $2,845,479,203.

Contribution Requirements

The sum of the three normal cost contributions and the amortization payment yields an expected total employer contribution of $3,317,337,830 for fiscal year 2023. Currently, the non-investment cash flow is tracked separately in the assets for the Non-Hybrid, PPP, and PPP2 groups. The normal cost contributions should be allocated to each of the respective groups as expected, based on the actual payroll amounts. For the amortization payment of the UAAL, ($227,598) should be allocated to the PPP group, ($264,331) should be allocated to the PPP2 group, and the remainder should be allocated to the Non-Hybrid group.

Reconciliation Payments

Starting with the September 30, 2015 valuation, it was reported to the actuary that the reconciliation process has been reinstated. The contribution requirements shown on page A-1 for fiscal year 2023 are needed in addition to the reconciliation payments required by subsection 41(9) of the MPSERS statute. The scheduled reconciliation payments were prepared and reported by the Office of Retirement Services (ORS) and are presented on page E-14.

Discussion of Changes

Revisions in Benefits

There have been no material revisions in benefits since the last annual actuarial valuation.

Revisions in Actuarial Assumptions or Methods

In accordance with Public Act 181 of 2018, the payroll growth assumption for amortization purposes used in determining the fiscal year 2023 employer contributions decreased from 3.00% to 2.50%. While this assumption change had no impact on the Actuarial Accrued Liability, it did result in an increase in employer contribution requirements of $91 million.

Actuarial Experience

Actuarial Experience was less favorable than that anticipated by the actuarial assumptions. The total actuarial loss was $66.9 million. The loss was due primarily to unfavorable investment experience.

Comment on the Investment Markets

Investment markets continue to be volatile. The actuarial value of assets (funding value), used to determine both the funded status and the required employer contribution, is based on a 5-year smoothed value of assets. This reduces the volatility of the valuation results.

As of September 30, 2020, the actuarial value of assets was 102% of market value. This means that meeting the actuarial investment return assumption in the next few years will require average future market returns which exceed the 6.80% investment return assumption.

If the September 30, 2020 valuation results were based on the market value of assets instead of the actuarial value of assets, the funded percent of the plan would be 59.6% (instead of 60.9%), and the UAAL amortization payment would be 31.32% of payroll (instead of 30.14%).

Measures of Financial Soundness

The purpose of this section of the report is to provide certain measures which indicate the financial soundness of the program. These measures relate to long term solvency and level funding.

The various percentages listed in this section as of a single valuation date are not overly significant standing alone. What is more significant is the trend of the rates over a period of years. It is also important to keep in mind that each time benefits or assumptions are revised, actuarial liabilities are created or diminished. Any newly created liabilities are financed systematically over a period of future years. All actuarially computed values in this analysis are based on the actuarial assumptions utilized in the respective years' actuarial valuations.

Long Term Solvency

Over the longer term, the solvency of an ongoing plan can be measured by comparing the actuarial value of assets to an amount known as the Actuarial Accrued Liability (AAL) under the Entry-Age actuarial cost method. This item has often been called the "past service liability." The AAL is affected immediately by any revisions in benefits or assumptions. The accumulation of assets to equal the AAL can be considered a long-range funding goal. Largely because of periodic benefit increases and poor investment experience since the early 2000's, very few retirement programs have attained this goal.

Valuation Date	Actuarial Value of Assets	Actuarial Accrued Liability	% of AAL Covered by Assets
9/30/2020	$52,587,345,269	$86,337,689,863	60.9 %
9/30/2019	51,421,988,660	85,201,719,662	60.4

The chart above illustrates the change in the total System funding percent since the prior year. Page B-7 shows the funded percent in greater detail and for a longer period of time. In particular, the funded percent for current benefit recipients is 75.4% as of September 30, 2020.

Measures of Financial Soundness

Level Contributions

The actuarial assumptions and cost method have been chosen with the intent of producing required total contributions which are expected to remain fairly level as a percentage of active member payroll. The following chart shows a brief history of contribution rates:

Valuation Date	Fiscal Year Budgeted For	Normal Cost [2]	Amortization Payment	Total Contribution
9/30/2020	2023	5.93 %	30.14 %	N/A [1]
9/30/2019	2022	5.94	28.29	N/A [1]

[1] Effective with Public Act 300 of 2012, the normal cost rate and the amortization payment rate are applied to different payrolls and can no longer be added together for a total contribution rate.
[2] Normal cost is a weighted average rate of the Non-Hybrid, PPP, and PPP2 normal cost rates.

A major factor affecting the stability of the contribution requirements just shown is how well the actual plan experience compares to the actuarial assumptions. The value of the difference between what actually occurred and what was assumed to occur is called the actuarial gain or loss. Gains tend to lower the subsequent contribution requirements of the program while losses tend to cause subsequent contribution requirements to rise.

Year Ending	Actuarial Gain/(Loss)	G/(L) Percent
9/30/2020	$ (66,857,690)	(0.08)%
9/30/2019	(1,101,348,790)	(1.32)%

G/(L) percent represents actuarial gain/(loss) calculated as a percentage of the beginning of year actuarial accrued liability.

Analysis of all the benchmarks noted, over a period of years, will provide an indication of whether the program is becoming financially stronger or weaker.

Other Observations

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

Given the plan's contribution allocation procedure, if all actuarial assumptions are met (including the assumption of the plan earning 6.80% on the Non-Hybrid and PPP actuarial values of assets and 6.00% on the PPP2 actuarial value of assets), it is expected that:

(1) The employer normal cost as a percentage of pay will trend to the level of the PPP2 normal cost rate as the Non-Hybrid and PPP populations decline and are replaced by PPP2 members,
(2) In the absence of any applicable payroll growth floor, the amortization payments are expected to increase as the amortization payroll growth assumption declines to 0% by the September 30, 2025 valuation,
(3) The unfunded actuarial accrued liability is expected to be fully amortized no later than the end of fiscal year 2038, and
(4) The funded status of the plan will generally increase gradually towards a 100% funded ratio.

When selecting a contribution allocation procedure, the following three items should be considered, including the balance amongst the three items:

(1) Benefit security,
(2) Intergenerational equity, and
(3) Contribution stability and predictability.

Generally, given the nature of public employee retirement systems (e.g., level contribution financing objective and perceived ongoing nature of the plan or plan sponsor), intergenerational equity and contribution stability and predictability have received more consideration than benefit security when contribution allocation procedures are selected. However, given the importance of benefit security to any retirement system, we suggest that contributions to the System in excess of those presented in this report be considered.

Other Observations (Concluded)

Limitations of Funded Status Measurements

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

(1) The measurement is inappropriate for assessing the sufficiency of plan assets to cover the estimated cost of settling the plan's benefit obligations. In addition, the measurement is inappropriate for assessing benefit security for the membership.
(2) The measurement is dependent upon the actuarial cost method which, in combination with the plan's amortization policy and asset valuation method, affects the timing and amounts of future contributions. The amounts of future contributions will most certainly differ from those assumed in this report due to future actual experience differing from assumed experience based upon the actuarial assumptions. A funded status measurement in this report of 100% is not synonymous with no required future contributions. If the funded status were 100%, the plan would still require future normal cost contributions (i.e., contributions to cover the cost of the active membership accruing an additional year of service credit).
(3) The measurement would produce a different result if the market value of assets were used instead of the actuarial value of assets, unless the market value of assets is used in the measurement.

Risks Associated with Measuring the Actuarial Accrued Liability and the Total Computed Employer Contribution

The determination of the actuarial accrued liability and the total computed employer contribution requires the use of assumptions regarding future economic and demographic experience. Risk measures, as illustrated in this report, are intended to aid in the understanding of the effects of future experience differing from the assumptions used in the course of the actuarial valuation. Risk measures may also help with illustrating the potential volatility in the actuarial accrued liability and the total computed employer contribution that result from the differences between actual experience and the actuarial assumptions.

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

Examples of risk that may reasonably be anticipated to significantly affect the plan's future financial condition include:

1. **Investment risk** – actual investment returns may differ from the expected returns;
2. **Asset/Liability mismatch** – changes in asset values may not match changes in liabilities, thereby altering the gap between the accrued liability and assets and consequently altering the funded status and contribution requirements;
3. **Contribution risk** – actual contributions may differ from expected future contributions. For example, actual contributions may not be made in accordance with the plan's funding policy or material changes may occur in the anticipated number of covered employees, covered payroll, or other relevant contribution base;
4. **Salary and Payroll risk** – actual salaries and total payroll may differ from expected, resulting in actual future accrued liability and contributions differing from expected;
5. **Longevity risk** – members may live longer or shorter than expected and receive pensions for a period of time other than assumed; and
6. **Other demographic risks** – members may terminate, retire or become disabled at times or with benefits other than assumed resulting in actual future accrued liability and contributions differing from expected.

The effects of certain trends in experience can generally be anticipated. For example, if the investment return since the most recent actuarial valuation is less (or more) than the assumed rate, the cost of the plan can be expected to increase (or decrease). Likewise, if longevity is improving (or worsening), increases (or decreases) in cost can be anticipated.

Additional risk assessment is outside the scope of the annual actuarial valuation. Additional assessment may include scenario tests, sensitivity tests, stochastic modeling, stress tests, and a comparison of the present value of accrued benefits at low-risk discount rates with the actuarial accrued liability.

Plan Maturity Measures

Risks facing a pension plan evolve over time. A young plan with virtually no investments and paying few benefits may experience little investment risk. An older plan with a large number of members in pay status and a significant trust may be much more exposed to investment risk. Generally accepted plan maturity measures include the following:

	September 30,		
	2020	**2019**	**2018**
Ratio of actives to retirees and beneficiaries	0.7	0.8	0.8
Ratio of net cash flow to market value of assets	(3.9)%	(3.9)%	(3.5)%
Duration of the actuarial accrued liability	11.35	11.41	11.29

Ratio of Actives to Retirees and Beneficiaries

A young plan with many active members and few retirees will have a high ratio of actives to retirees. A mature open plan may have close to the same number of actives to retirees resulting in a ratio near 1.0. A super-mature or closed plan may have significantly more retirees than actives resulting in a ratio below 1.0.

Ratio of Net Cash Flow to Market Value of Assets

A positive net cash flow means contributions exceed benefits and expenses. A negative cash flow means existing funds are being used to make payments. A certain amount of negative net cash flow is generally expected to occur when benefits are prefunded through a qualified trust. Large negative net cash flows as a percent of assets may indicate a super-mature plan or a need for additional contributions.

Duration of the Actuarial Accrued Liability

The duration of the actuarial accrued liability may be used to approximate the sensitivity to a 1% change in the assumed rate of return. For example, a duration of 10 indicates that the actuarial accrued liability would increase approximately 10% if the assumed rate of return were lowered 1%.

Summary of Other Risk Metrics

Valuation Date September 30,	Funded Ratio Based on AVA	Funded Ratio Based on MVA	UAAL Amortization Period	Total UAAL / Total Payroll[3]	Total Funding Value of Assets / Total Payroll[3]	Total AAL / Total Payroll[3]	Standard Deviation of Investment Return / Total Payroll[3]
2012 [1,2]	61 %	60 %	24	2.8	4.4	7.3	n/a
2013 [1]	60	63	23	3.1	4.6	7.7	n/a
2014 [1]	60	66	22	3.2	4.9	8.1	n/a
2015	61	63	21	3.2	5.0	8.2	n/a
2016 [1]	60	60	20	3.5	5.3	8.8	n/a
2017 [1]	62	61	19	3.6	5.7	9.3	n/a
2018 [1]	61	60	18	3.9	6.1	10.0	80 %
2019	60	60	17	3.9	5.9	9.8	77
2020	61	60	16	3.9	6.0	9.9	78

[1] *After changes in actuarial assumptions.*
[2] *After changes in plan provisions.*
[3] *Payroll for UAAL purposes (Total MPSERS Payroll).*

An explanation of the significance of the risk metrics presented above follows:

(1) **Funded Ratio (Funding Value of Assets basis)** – This is the most widely known measure of a plan's financial strength. The trend in the funded ratio and the actual funded ratio are both important metrics. A trend approaching 100% is desirable.

(2) **Funded Ratio (Market Value of Assets basis)** – This is similar to the above, except that the asset value used is the market value.

(3) **UAAL Amortization Period** – Periods above about 17 to 23 years generally indicate that the UAAL payment is less than the interest on the UAAL. This situation is referred to as "negative amortization." Negative amortization is increasingly viewed as undesirable.

(4) **Total UAAL / Total Payroll** – The ratio of UAAL to payroll gives an indication of the plan sponsor's ability to pay off the UAAL. A declining ratio is desirable. A ratio above approximately 3.0 to 4.0 may indicate difficulty in discharging the unfunded liability in some circumstances.

(5) **Total Funding Value of Assets / Total Payroll** – The ratio of assets to payroll gives an indication of both maturity and volatility. Many systems have ratios between 5.0 and 7.0. Social Security Replacement Plans may fall above that range. A high ratio can indicate volatility of contribution rates and amortization period.

(6) **Total AAL / Total Payroll** – This is similar to (5). It illustrates the expected ratio of assets to payroll when the plan has a funded ratio of 100%.

(7) **Standard Deviation of Investment Return / Total Payroll** – The portfolio standard deviation measures the volatility of investment return. When divided by payroll, it gives the effect of a one standard deviation asset gain or loss as a percent of payroll. This theoretically may happen once every 6 years.

SECTION B

FUNDING RESULTS

Present Value of Future Benefits and Accrued Liability

Determination of Unfunded Accrued Liability
as of September 30, 2020

	Non-Hybrid	PPP	PPP2	Total
A. Accrued Liability				
1. For retirees and beneficiaries	$ 58,698,202,335	$ 734,070	$ 0	$ 58,698,936,405
2. For vested and other terminated members [1]	2,419,209,481	76,007,052	472,574	2,495,689,107
3. For other inactive members [2]	106,252,214	0	0	106,252,214
4. For present active members				
a. Value of expected future benefit payments	29,761,357,180	2,204,637,695	575,894,403	32,541,889,278
b. Value of future normal costs	5,491,190,002	1,483,208,920	530,678,219	7,505,077,141
c. Active member accrued liability: (a) - (b)	24,270,167,178	721,428,775	45,216,184	25,036,812,137
5. Total accrued liability	85,493,831,208	798,169,897	45,688,758	86,337,689,863
B. Present Valuation Assets (Funding Value)	51,738,405,932	800,373,912	48,565,425	52,587,345,269
C. Unfunded Accrued Liability: (A.5) - (B)	33,755,425,276	(2,204,015)	(2,876,667)	33,750,344,594
D. Funding Ratio: (B) / (A.5)	60.5%	100.3%	106.3%	60.9%

[1] *Starting with the September 30, 2015 valuation, pending refunds of employee contributions for former employees who terminated without a vested benefit will be summarized with the vested and other terminated members. Prior to the September 30, 2015 valuation, these liabilities were summarized with the active liability.*

[2] *Includes liabilities for employees who transferred to the DC pension plan in connection with PA 300.*

Experience Gain/(Loss)

A. Derivation of Actuarial Gain/(Loss):	
1. Unfunded Actuarial Accrued Liability (UAAL) - Previous Valuation	$ 33,779,731,002
2. Total Normal Cost (employer plus member) for Year Ending 9/30/2020	895,885,193
3. Total Contributions (employer plus member) for Year Ending 9/30/2020	3,210,465,700
4. Interest on:	
a. UAAL: Discount Rate* x (1)	2,297,032,368
b. Normal Cost and Contributions: Discount Rate* / 2 x [(2) - (3)]	(78,695,959)
c. Net Total: (a) + (b)	2,218,336,409
5. Change in UAAL due to Benefit Changes	-
6. Change in UAAL due to Assumption Changes	-
7. Expected UAAL Current Year: (1) + (2) - (3) + (4c) + (5) + (6)	33,683,486,904
8. Actual UAAL Current Year	33,750,344,594
9. Experience Gain/(Loss): (7) - (8)	(66,857,690)
B. Approximate Portion of Gain/(Loss) due to Investments	(321,371,403)
C. Approximate Portion of Gain/(Loss) due to Liabilities: (A.9) - (B)	254,513,713

* *Discount rate is 6.80% for Non-Hybrid group, 6.80% for the PPP group, and 6.00% for the PPP2 group.*

The schedule above shows the net, aggregate experience for the System. The next page shows this experience in detail. Please note that row B above includes the accelerated recognition of investment gains associated with the Dedicated Gains Policy, if applicable.

Detailed Experience Gain/(Loss)

Gains/(Losses) During the Year Ended September 30, 2020
Resulting from Differences Between Assumed and Actual Experience

Type of Activity	Gain/(Loss)
1. **Retirements** (including disability retirement). If members retire at older ages or with lower final average pay than assumed, there is a gain. If younger ages or higher average pays, a loss.	$ 18,613,167
2. **Withdrawal from Employment** (including death-in-service). If more liabilities are released by withdrawals and deaths than assumed, there is a gain. If smaller releases, a loss.	(26,096,131)
3. **Pay Increases.** If there are smaller pay increases than assumed, there is a gain. If greater increases, a loss.	72,334,357
4. **Investment Income.** If there is greater investment income than assumed, there is a gain. If less income, a loss.	(321,371,403)
5. **Death After Retirement.** If retirants and inactive vested members live longer than assumed, there is a loss. If not as long, a gain.	109,103,020
6. **Rehires.**	(1,804,388)
7. **Other.** Miscellaneous gains and losses resulting from data adjustments, timing of financial transactions, etc.	82,363,688
8. **Composite Gain/(Loss) During Year.**	$ (66,857,690)

Experience Gain/(Loss)

Five-Year History
(Amounts Shown in Millions)

Plan Year Ending September 30 [1]	Experience Gain/(Loss)	Gain/(Loss) Due to Investments	Actuarial Value of Investments	Investment Gain/(Loss) as % of Assets
2020	$ (67)	$ (321)	$ 52,587	(0.61)%
2019	(1,101)	(577)	51,422	(1.12)
2018	1,863	1,885	50,630	3.72
2017	3,077	2,894	47,255	6.12
2016	1,108	989	43,204	2.29

Plan Year Ending September 30	Gain/(Loss) Due to Liabilities	Actuarial Accrued Liability	Liability Gain/(Loss) as % of Accrued Liability
2020	$ 254	$ 86,338	0.29%
2019	(524)	85,202	(0.61)
2018	(22)	83,375	(0.03)
2017	183	76,693	0.24
2016 [2]	119	72,310	0.16

[1] *Starting with the plan year ending September 30, 2017, the gain/(loss) due to investments includes the accelerated recognition of investment gains associated with the Dedicated Gains Policy.*

[2] *For the plan year ending September 30, 2016, the gain/(loss) due to liabilities includes a refund of University employer contributions totaling $2,478,596.*

Historical Funding Levels for Actuarial Accrued Liabilities

(Amounts Shown in Millions)

Valuation Date September 30	Actuarial Accrued Liability	Actuarial Value of Assets	Funded Ratio	Unfunded/(Overfunded) Accrued Liability	Active [3] Member Reported Payroll	Unfunded/(Overfunded) As % of Active Payroll
2009	$ 56,685	$ 44,703	78.9 %	$ 11,982	$ 9,884	121.2%
2010	58,543	43,294	74.0	15,250	8,845	172.4
2010 [1]	59,877	43,294	72.3	16,583	8,845	187.5
2010 [2]	60,927	43,294	71.1	17,633	8,845	199.4
2011	63,427	41,038	64.7	22,389	9,156	244.5
2012	64,281	38,450	59.8	25,831	8,649	298.7
2012 [1]	63,277	38,450	60.8	24,827	8,649	287.1
2012 [2]	62,716	38,450	61.3	24,266	8,649	280.6
2013 [1]	63,840	38,044	59.6	25,796	8,273	311.8
2014	65,050	39,626	60.9	25,424	8,167	311.3
2014 [1]	66,105	39,626	59.9	26,479	8,167	324.2
2015	67,728	41,006	60.5	26,721	8,264	323.3
2016	68,858	43,204	62.7	25,654	8,206	312.6
2016 [1]	72,310	43,204	59.7	29,107	8,206	354.7
2017	73,327	45,397	61.9	27,930	8,221	339.7
2017 [1]	76,693	47,255	61.6	29,438	8,221	358.1
2018	77,865	49,313	63.3	28,552	8,300	344.0
2018 [1]	83,375	50,630	60.7	32,745	8,300	394.5
2019	85,202	51,422	60.4	33,780	8,691	388.7
2020	86,338	52,587	60.9	33,750	8,716	387.2

[1] *Revised actuarial assumptions and/or methods.*

[2] *Change in plan provisions.*

[3] *Payroll for UAAL purposes (Total MPSERS Payroll).*

Computed and Actual Employer Contributions
Historical Comparison

(Amounts Shown in Millions)

Fiscal Year Ending September 30 [5]	Valuation Date September 30	Contribution Rates As Percents of Valuation Payroll				Actual Payroll	Employer Contribution for Fiscal Year	
							Computed [7]	Actual
	2011	20.90%				$ 9,064.2	$ 1,894.4	-
2012	2011 [3]	18.24				9,064.2	1,653.3	$ 1,454.4
2013	2011 [4]	19.60				8,793.2	1,723.5	1,364.1
	2012	26.00				8,895.1	2,312.7	-
	2012 [1]	25.49				8,895.1	2,267.4	-
		Non-Hybrid Normal Cost	PPP Normal Cost	PPP2 Normal Cost	Amortization Payment			
2014	2012 [2,4]	4.31 %	3.23 %		18.76 %	8,895.1	2,004.8	1,600.4
2015	2012 [2,4]	4.31	3.23		18.76	8,426.8	1,917.9	1,967.6
2016	2013 [1]	4.39	3.17		21.18	8,510.2	2,156.3	2,308.7
	2014	4.41	3.13		21.32	8,453.0	2,149.3	-
2017	2014 [1]	3.76	3.13		22.30	8,453.0	2,185.5	2,399.0
2018	2015	3.75	3.07	6.20 %	22.18	8,583.7	2,204.6	2,791.5
	2016	3.75	3.05	6.20	21.91	8,801.1	2,233.5	-
2019	2016 [1]	4.86	3.05	6.20	24.01	8,801.1	2,495.5	2,706.7
	2017	4.85	3.06	6.20	23.67	8,916.3	2,492.0	-
	2017 [1]	6.02	3.06	6.20	24.07	8,916.3	2,607.2	-
2020	2017 [2]	6.02	3.06	6.20	24.07	8,916.3	2,607.2	2,808.8
	2018	6.03	3.09	6.20	22.77			
2021 [6]	2018 [1]	6.39	3.43	6.20	26.70			
2022 [6]	2019	6.41	3.49	6.20	28.29			
2023 [6]	2020	6.41	3.49	6.20	30.14			

1 *Revised actuarial assumptions and/or methods.*

2 *Change in plan provisions.*

3 *Does not include UAAL amortization payment for ERI.*

4 *Incorporates re-amortization of ERI over a 10-year period, rather than a 5-year period.*

5 *Effective with fiscal year 2014, the normal cost rate and the amortization payment rate are applied to different payrolls and cannot be added.*

6 *For the fiscal years ending September 30, 2020 and beyond, the actual payroll and actual contribution are not yet known.*

7 *Computed amounts do not include reconciliation payments required by subsection 41(9) of the MPSERS Statute.*

Historical Funding Levels for Prioritized Actuarial Accrued Liability

Valuation Date September 30	Actuarial Accrued Liability ($ in Millions) (1) Active Member Contributions	(2) Retirants and Beneficiaries	(3) Active and Inactive Members (Employer Financed Portion)	Valuation Assets ($ in Millions)	Portion of Actuarial Accrued Liability Covered by Assets (1)	(2)	(3)	(4) [3]
2009	$ 5,449	$ 34,159	$ 17,077	$ 44,703	100.0%	100.0%	29.8%	78.9%
2010	5,055	38,315	15,173	43,294	100.0	99.8	0.0	74.0
2010 [1]	5,055	38,589	16,233	43,294	100.0	99.1	0.0	72.3
2010 [2]	5,055	39,639	16,233	43,294	100.0	96.5	0.0	71.1
2011	5,217	41,043	17,167	41,038	100.0	87.3	0.0	64.7
2012	5,296	42,076	16,909	38,450	100.0	78.8	0.0	59.8
2012 [1]	5,296	42,076	15,905	38,450	100.0	78.8	0.0	60.8
2012 [2]	5,296	42,076	15,344	38,450	100.0	78.8	0.0	61.3
2013 [1]	4,909	43,198	15,733	38,044	100.0	76.7	0.0	59.6
2014	5,225	44,126	15,699	39,626	100.0	78.0	0.0	60.9
2014 [1]	5,225	45,545	15,335	39,626	100.0	75.5	0.0	59.9
2015	5,738	46,538	15,452	41,006	100.0	75.8	0.0	60.5
2016	6,189	47,431	15,238	43,204	100.0	78.0	0.0	62.7
2016 [1]	6,189	49,299	16,822	43,204	100.0	75.1	0.0	59.7
2017	6,730	50,069	16,528	45,397	100.0	77.2	0.0	61.9
2017 [1]	6,730	51,878	18,085	47,255	100.0	78.1	0.0	61.6
2018	7,479	52,633	17,753	49,313	100.0	79.5	0.0	63.3
2018 [1]	7,479	56,834	19,062	50,630	100.0	75.9	0.0	60.7
2019	8,106	57,716	19,380	51,422	100.0	75.1	0.0	60.4
2020	8,329	58,699	19,310	52,587	100.0	75.4	0.0	60.9

[1] *Revised actuarial assumptions and/or methods.*
[2] *Change in plan provisions.*
[3] *Percent funded on a total valuation asset and total actuarial accrued liability basis.*

Financial Objective Achievement Indicators – Historical Comparison

(Dollar Amounts in Millions)

Valuation September 30	Valuation Assets	Termination Indicator [3]: Actuarial Present Value of Vested Benefits	Termination Indicator [3]: Funded Ratio	Experience Indicator: Actuarial Gain/(Loss)
2009	$ 44,703	$ 51,936	86.1 %	$ (2,719)
2010	43,294	52,901	81.8	(2,727)
2010 [1]	43,294	53,454	81.0	(2,727)
2010 [2]	43,294	54,505	79.4	(2,727)
2011	41,038	56,446	72.7	(3,981)
2012	38,450	57,372	67.0	(2,673)
2012 [1]	38,450	57,372	67.0	(2,673)
2012 [2]	38,450	57,369	67.0	(2,673)
2013 [1]	38,044	58,395	65.1	(399)
2014	39,626	59,505	66.6	1,084
2014 [1]	39,626	61,254	64.7	1,084
2015	41,006	62,735	65.4	111
2016	43,204	63,865	67.6	1,108
2016 [1]	43,204	66,777	64.7	1,108
2017	45,397	67,815	66.9	3,077
2017 [1]	47,255	70,701	66.8	3,077
2018	49,313	71,937	68.6	1,863
2018 [1]	50,630	77,740	65.1	1,863
2019	51,422	79,612	64.6	(1,101)
2020	52,587	80,838	65.1	(67)

[1] *Revised actuarial assumptions and/or methods.*

[2] *Change in plan provisions.*

[3] *Based upon the actuarial assumptions used for funding purposes, including the assumed rate of investment return.*

SECTION C

FUND ASSETS

Statement of Plan Net Assets (Assets at Market or Fair Value)

	September 30	
	2019	2020
Equity in Common Cash	$ 115,594,708	$ 125,372,155
Total Receivables	196,896,145	230,557,586
Short Term Investment Pools	1,681,333,494	2,274,661,628
Fixed Income Pools	6,895,680,256	6,337,047,275
Domestic Equity Pools	11,383,189,295	11,060,949,005
Real Estate Pool	4,822,926,464	4,145,113,732
Alternative Investment Pools	9,419,839,399	10,199,012,185
International Equity Pools	8,087,453,952	8,259,404,296
Absolute Return Pools	8,258,379,998	2,487,236,739
Real Return and Opportunistic Pools	0	6,342,139,827
Securities Lending Collateral less Obligations	231,542	0
Total Assets	50,861,525,253	51,461,494,428
Other Liabilities	(4,355,158)	(5,265,873)
Net Assets Held in Trust for Pension Benefits	$50,857,170,095	$51,456,228,555

Note: Asset amounts exclude assets held for health benefits.

Reconciliation of Plan Assets

	September 30, 2020			
	Non-Hybrid	PPP	PPP2	Total
Market Value, Beginning of Year	$ 50,193,099,454	$ 646,368,116	$ 17,702,525	$ 50,857,170,095
Additions				
Member Contributions	324,476,861	62,566,214	14,583,213	401,626,288
Employer Contributions	2,746,627,196	47,786,982	14,425,234	2,808,839,412
Net Investment Income[1]	2,507,842,222	35,747,815	1,641,252	2,545,231,289
Audit Adjustment[2]	76,441,034	984,379	26,960	77,452,373
Other Additions	73,860	0	0	73,860
Total Additions	5,655,461,173	147,085,390	30,676,659	5,833,223,222
Deductions				
Benefit Payments	5,183,108,849	20,457	0	5,183,129,306
Contribution Refunds/Transfers	25,468,541	2,379,689	68,631	27,916,861
Administrative Expenses[1]	22,778,986	324,701	14,908	23,118,595
Total Deductions	5,231,356,376	2,724,847	83,539	5,234,164,762
Market Value, End of Year	$ 50,617,204,251	$ 790,728,659	$ 48,295,645	$ 51,456,228,555

	September 30, 2019			
	Non-Hybrid	PPP	PPP2	Total
Market Value, Beginning of Year	$ 49,825,244,512	$ 515,794,960	$ 2,458,933	$ 50,343,498,405
Additions				
Member Contributions	334,818,461	60,839,621	7,488,483	403,146,565
Employer Contributions	2,656,469,201	42,961,053	7,282,283	2,706,712,537
Net Investment Income[1]	2,489,886,860	28,931,239	501,905	2,519,320,004
Audit Adjustment	0	0	0	0
Other Additions	202,305	0	0	202,305
Total Additions	5,481,376,827	132,731,913	15,272,671	5,629,381,411
Deductions				
Benefit Payments	5,058,614,101	9,996	0	5,058,624,097
Contribution Refunds/Transfers	27,490,889	1,830,190	23,552	29,344,631
Administrative Expenses[1]	27,416,895	318,571	5,527	27,740,993
Total Deductions	5,113,521,885	2,158,757	29,079	5,115,709,721
Market Value, End of Year	$ 50,193,099,454	$ 646,368,116	$ 17,702,525	$ 50,857,170,095

1 *Net investment income and administrative expenses are allocated amongst Non-Hybrid, PPP, and PPP2 assets, since this information was not provided.*

2 *Includes an adjustment for the difference between the amount submitted as Net Position Beginning of Year for the current report and the amount submitted as Net Position End of Year for the prior report. The adjustment was allocated amongst Non-Hybrid, PPP, and PPP2 in proportion to prior year's end of year market values.*

Development of Valuation Assets – Non-Hybrid

Year Ended September 30	2020	2021	2022	2023	2024
A. Funding Value Beginning of Year	$ 50,760,412,779				
B. Market Value					
B1. Market Value End of Year	50,617,204,251				
B2. Market Value Beginning of Year	50,193,099,454				
B3. Audit Adjustment	76,441,034				
C. Non-Investment Net Cash Flow					
C1. Member Contributions	324,476,861				
C2. Employer Contributions	2,746,627,196				
C3. Benefit Payments	(5,183,108,849)				
C4. Contribution Refunds / Transfers	(25,468,541)				
C5. Administrative Expenses	(22,778,986)				
C6. University Employer Contribution Refund	-				
C7. Other	73,860				
C8. Total Net Cash Flow: C1 + C2 + C3 + C4 + C5 + C6 + C7	(2,160,178,459)				
D. Investment Return					
D1. Market Return Total: B1 - B2 - B3 - C8	2,507,842,222				
D2. Assumed Rate of Return	6.80%	6.80%			
D3. Market Rate of Return	5.10%				
D4. Dedicated Gains Policy Trigger (Excess Return %)	0.00%				
D5. Market Return for Immediate Recognition: D4 x (B2 + B3 + C8/2)	-				
D6. Assumed Amount of Return: D2 x (A + B3 + C8/2)	3,383,459,992				
D7. Amount Subject to Phase-In: D1 - D5 - D6	(875,617,770)				
E. Phased-In Recognition of Investment Return					
E1. Current Year: 0.20 x D7	(175,123,554)				
E2. First Prior Year	(169,289,974)	$ (175,123,554)			
E3. Second Prior Year	38,321,874	(169,289,974)	$ (175,123,554)		
E4. Third Prior Year	10,518,708	38,321,874	(169,289,974)	$ (175,123,554)	
E5. Fourth Prior Year	(26,156,468)	10,518,706	38,321,875	(169,289,972)	$ (175,123,554)
E6. Total Phase-Ins	(321,729,414)	(295,572,948)	(306,091,653)	(344,413,526)	(175,123,554)
F. Funding Value End of Year					
F1. Preliminary Funding Value End of Year: A + B3 + C8 + D5 + D6 + E6	$ 51,738,405,932				
F2. Corridor Percent	30%				
F3. Upper Corridor Limit: (100% + F2) x B1	65,802,365,526				
F4. Lower Corridor Limit: (100% - F2) x B1	35,432,042,976				
F5. Funding Value End of Year	$ 51,738,405,932				
G. Difference Between Market and Funding Value	(1,121,201,681)				
H. Recognized Rate of Return	6.15 %				
I. Market Rate of Return	5.10 %				
J. Ratio of Funding Value to Market Value	1.0222				

Development of Valuation Assets – Non-Hybrid (Concluded)

Year Ended September 30	2015	2016	2017	2018	2019
A. Funding Value Beginning of Year	$ 39,500,051,337	$ 40,829,364,640	$ 42,944,352,572	$ 46,891,221,716	$ 50,124,791,376
B. Market Value					
B1. Market Value End of Year	42,204,073,869	43,200,578,786	46,633,503,623	49,825,244,512	50,193,099,454
B2. Market Value Beginning of Year	43,638,174,660	42,204,073,869	43,200,578,786	46,633,503,623	49,825,244,512
B3. Audit Adjustment	-	-	-	-	-
C. Non-Investment Net Cash Flow					
C1. Member Contributions	365,145,605	360,789,568	380,883,623	334,921,638	334,818,461
C2. Employer Contributions	1,957,258,280	2,279,403,758	2,365,264,891	2,754,634,743	2,656,469,201
C3. Benefit Payments	(4,530,914,738)	(4,671,295,533)	(4,806,948,758)	(4,934,628,372)	(5,058,614,101)
C4. Contribution Refunds / Transfers	(23,459,269)	(23,209,491)	(24,404,240)	(26,587,845)	(27,490,889)
C5. Administrative Expenses	Included in D1	Included in D1	Included in D1	Included in D1	(27,416,895)
C6. University Employer Contribution Refund [1]	(112,468,242)	(2,478,596)	-	-	-
C7. Other	-	-	-	502,593	202,305
C8. Total Net Cash Flow: C1 + C2 + C3 + C4 + C5 + C6 + C7	(2,344,438,364)	(2,056,790,294)	(2,085,204,484)	(1,871,157,243)	(2,122,031,918)
D. Investment Return					
D1. Market Return Total: B1 - B2 - B3 - C8	910,337,573	3,053,295,211	5,518,129,321	5,062,898,132	2,489,886,860
D2. Assumed Rate of Return	8.00%	8.00%	7.50%	7.05%	6.80%
D3. Market Rate of Return	2.14%	7.42%	13.09%	11.08%	5.11%
D4. Dedicated Gains Policy Trigger (Excess Return %)	0.00%	0.00%	5.51%	3.57%	0.00%
D5. Market Return for Immediate Recognition: D4 x (B2 + B3 + C8/2)	-	-	2,322,904,508	1,631,415,923	-
D6. Assumed Amount of Return: D2 x (A + B3 + C8/2)	3,070,725,302	3,184,077,559	3,142,631,275	3,239,872,838	3,336,336,728
D7. Amount Subject to Phase-In: D1 - D5 - D6	(2,160,387,729)	(130,782,348)	52,593,538	191,609,371	(846,449,868)
E. Phased-In Recognition of Investment Return					
E1. Current Year: 0.20 x D7	(432,077,546)	(26,156,470)	10,518,708	38,321,874	(169,289,974)
E2. First Prior Year	642,831,577	(432,077,546)	(26,156,470)	10,518,708	38,321,874
E3. Second Prior Year	371,421,574	642,831,577	(432,077,546)	(26,156,470)	10,518,708
E4. Third Prior Year	431,681,532	371,421,574	642,831,577	(432,077,546)	(26,156,470)
E5. Fourth Prior Year	(410,830,772)	431,681,532	371,421,576	642,831,576	(432,077,545)
E6. Total Phase-Ins	603,026,365	987,700,667	566,537,845	233,438,142	(578,683,407)
F. Funding Value End of Year					
F1. Preliminary Funding Value End of Year: A + B3 + C8 + D5 + D6 + E6	$ 40,829,364,640	$ 42,944,352,572	$ 46,891,221,716	$ 50,124,791,376	$ 50,760,412,779
F2. Corridor Percent	30%	30%	30%	30%	30%
F3. Upper Corridor Limit: (100% + F2) x B1	54,865,296,030	56,160,752,422	60,623,554,710	64,772,817,866	65,251,029,290
F4. Lower Corridor Limit: (100% - F2) x B1	29,542,851,708	30,240,405,150	32,643,452,536	34,877,671,158	35,135,169,618
F5. Funding Value End of Year	$ 40,829,364,640	$ 42,944,352,572	$ 46,891,221,716	$ 50,124,791,376	$ 50,760,412,779
G. Difference Between Market and Funding Value	1,374,709,229	256,226,214	(257,718,093)	(299,546,864)	(567,313,325)
H. Recognized Rate of Return	9.57 %	10.48 %	14.40 %	11.11 %	5.62 %
I. Market Rate of Return	2.14 %	7.42 %	13.09 %	11.08 %	5.11 %
J. Ratio of Funding Value to Market Value	0.9674	0.9941	1.0055	1.0060	1.0113

[1] *The University Employer Contribution Refund was assumed to occur at the end of the year for fiscal year 2015 and in the middle of the year for fiscal year 2016.*

Development of Valuation Assets – PPP

Year Ended September 30	2020	2021	2022	2023	2024
A. Funding Value Beginning of Year	$ 643,828,805				
B. Market Value					
B1. Market Value End of Year	790,728,659				
B2. Market Value Beginning of Year	646,368,116				
B3. Audit Adjustment	984,379				
C. Non-Investment Net Cash Flow					
C1. Member Contributions	62,566,214				
C2. Employer Contributions	47,786,982				
C3. Benefit Payments	(20,457)				
C4. Contribution Refunds / Transfers	(2,379,689)				
C5. Administrative Expenses	(324,701)				
C6. University Employer Contribution Refund	-				
C7. Other	-				
C8. Total Net Cash Flow: C1 + C2 + C3 + C4 + C5 + C6 + C7	107,628,349				
D. Investment Return					
D1. Market Return Total: B1 - B2 - B3 - C8	35,747,815				
D2. Assumed Rate of Return	6.80%	6.80%			
D3. Market Rate of Return	5.10%				
D4. Dedicated Gains Policy Trigger (Excess Return %)	0.00%				
D5. Market Return for Immediate Recognition: D4 x (B2 + B3 + C8/2)	-				
D6. Assumed Amount of Return: D2 x (A + B3 + C8/2)	47,506,660				
D7. Amount Subject to Phase-In: D1 - D5 - D6	(11,758,845)				
E. Phased-In Recognition of Investment Return					
E1. Current Year: 0.20 x D7	(2,351,769)				
E2. First Prior Year	(1,747,290)	$ (2,351,769)			
E3. Second Prior Year	672,606	(1,747,290)	$ (2,351,769)		
E4. Third Prior Year	3,658,484	672,606	(1,747,290)	$ (2,351,769)	
E5. Fourth Prior Year	193,688	3,658,483	672,605	(1,747,291)	$ (2,351,769)
E6. Total Phase-Ins	425,719	232,030	(3,426,454)	(4,099,060)	(2,351,769)
F. Funding Value End of Year					
F1. Preliminary Funding Value End of Year: A + B3 + C8 + D5 + D6 + E6	$ 800,373,912				
F2. Corridor Percent	30%				
F3. Upper Corridor Limit: (100% + F2) x B1	1,027,947,257				
F4. Lower Corridor Limit: (100% - F2) x B1	553,510,061				
F5. Funding Value End of Year	$ 800,373,912				
G. Difference Between Market and Funding Value	(9,645,253)				
H. Recognized Rate of Return	6.86 %				
I. Market Rate of Return	5.10 %				
J. Ratio of Funding Value to Market Value	1.0122				

Development of Valuation Assets – PPP (Concluded)

Year Ended September 30	2015	2016	2017	2018	2019
A. Funding Value Beginning of Year	$ 125,564,156	$ 176,988,329	$ 259,240,768	$ 364,064,848	$ 503,115,658
B. Market Value					
B1. Market Value End of Year	178,287,003	259,999,962	378,279,448	515,794,960	646,368,116
B2. Market Value Beginning of Year	135,014,304	178,287,003	259,999,962	378,279,448	515,794,960
B3. Audit Adjustment	-	-	-	-	-
C. Non-Investment Net Cash Flow					
C1. Member Contributions	30,576,687	38,103,570	47,104,615	56,952,770	60,839,621
C2. Employer Contributions	10,352,416	29,253,272	33,685,215	35,687,730	42,961,053
C3. Benefit Payments	-	(4,165)	(9,996)	(9,996)	(9,996)
C4. Contribution Refunds / Transfers	(974,546)	(1,308,882)	(1,707,164)	(2,044,166)	(1,830,190)
C5. Administrative Expenses	Included in D1	Included in D1	Included in D1	Included in D1	(318,571)
C6. University Employer Contribution Refund	-	-	-	-	-
C7. Other	-	-	-	1,262	-
C8. Total Net Cash Flow: C1 + C2 + C3 + C4 + C5 + C6 + C7	39,954,557	66,043,795	79,072,670	90,587,600	101,641,917
D. Investment Return					
D1. Market Return Total: B1 - B2 - B3 - C8	3,318,142	15,669,164	39,206,816	46,927,912	28,931,239
D2. Assumed Rate of Return	7.00%	7.00%	7.00%	7.00%	6.80%
D3. Market Rate of Return	2.14%	7.42%	13.09%	11.08%	5.11%
D4. Dedicated Gains Policy Trigger (Excess Return %)	0.00%	0.00%	0.00%	3.52%	0.00%
D5. Market Return for Immediate Recognition: D4 x (B2 + B3 + C8/2)	-	-	-	14,909,778	-
D6. Assumed Amount of Return: D2 x (A + B3 + C8/2)	10,187,900	14,700,716	20,914,397	28,655,105	37,667,690
D7. Amount Subject to Phase-In: D1 - D5 - D6	(6,869,758)	968,448	18,292,419	3,363,029	(8,736,451)
E. Phased-In Recognition of Investment Return					
E1. Current Year: 0.20 x D7	(1,373,952)	193,690	3,658,484	672,606	(1,747,290)
E2. First Prior Year	1,747,501	(1,373,952)	193,690	3,658,484	672,606
E3. Second Prior Year	611,291	1,747,501	(1,373,952)	193,690	3,658,484
E4. Third Prior Year	329,396	611,291	1,747,501	(1,373,952)	193,690
E5. Fourth Prior Year	(32,520)	329,398	611,290	1,747,499	(1,373,950)
E6. Total Phase-Ins	1,281,716	1,507,928	4,837,013	4,898,327	1,403,540
F. Funding Value End of Year					
F1. Preliminary Funding Value End of Year: A + B3 + C8 + D5 + D6 + E6	$ 176,988,329	$ 259,240,768	$ 364,064,848	$ 503,115,658	$ 643,828,805
F2. Corridor Percent	30%	30%	30%	30%	30%
F3. Upper Corridor Limit: (100% + F2) x B1	231,773,104	337,999,951	491,763,282	670,533,448	840,278,551
F4. Lower Corridor Limit: (100% - F2) x B1	124,800,902	181,999,973	264,795,614	361,056,472	452,457,681
F5. Funding Value End of Year	$ 176,988,329	$ 259,240,768	$ 364,064,848	$ 503,115,658	$ 643,828,805
G. Difference Between Market and Funding Value	1,298,674	759,194	14,214,600	12,679,302	2,539,311
H. Recognized Rate of Return	7.88 %	7.72 %	8.62 %	11.84 %	7.05 %
I. Market Rate of Return	2.14 %	7.42 %	13.09 %	11.08 %	5.11 %
J. Ratio of Funding Value to Market Value	0.9927	0.9971	0.9624	0.9754	0.9961

Development of Valuation Assets – PPP2

Year Ended September 30	2020	2021	2022	2023	2024
A. Funding Value Beginning of Year	$ 17,747,076				
B. Market Value					
B1. Market Value End of Year	48,295,645				
B2. Market Value Beginning of Year	17,702,525				
B3. Audit Adjustment	26,960				
C. Non-Investment Net Cash Flow					
C1. Member Contributions	14,583,213				
C2. Employer Contributions	14,425,234				
C3. Benefit Payments	-				
C4. Contribution Refunds / Transfers	(68,631)				
C5. Administrative Expenses	(14,908)				
C6. University Employer Contribution Refund	-				
C7. Other	-				
C8. Total Net Cash Flow: C1 + C2 + C3 + C4 + C5 + C6 + C7	28,924,908				
D. Investment Return					
D1. Market Return Total: B1 - B2 - B3 - C8	1,641,252				
D2. Assumed Rate of Return	6.00%	6.00%			
D3. Market Rate of Return	5.10%				
D4. Dedicated Gains Policy Trigger (Excess Return %)	0.00%				
D5. Market Return for Immediate Recognition: D4 x (B2 + B3 + C8/2)	-				
D6. Assumed Amount of Return: D2 x (A + B3 + C8/2)	1,934,189				
D7. Amount Subject to Phase-In: D1 - D5 - D6	(292,937)				
E. Phased-In Recognition of Investment Return					
E1. Current Year: 0.20 x D7	(58,587)				
E2. First Prior Year	(17,189)	$ (58,587)			
E3. Second Prior Year	8,068	(17,189)	$ (58,587)		
E4. Third Prior Year	-	8,068	(17,189)	$ (58,587)	
E5. Fourth Prior Year	-	-	8,069	(17,189)	$ (58,589)
E6. Total Phase-Ins	(67,708)	(67,708)	(67,707)	(75,776)	(58,589)
F. Funding Value End of Year					
F1. Preliminary Funding Value End of Year: A + B3 + C8 + D5 + D6 + E6	$ 48,565,425				
F2. Corridor Percent	30%				
F3. Upper Corridor Limit: (100% + F2) x B1	62,784,339				
F4. Lower Corridor Limit: (100% - F2) x B1	33,806,952				
F5. Funding Value End of Year	$ 48,565,425				
G. Difference Between Market and Funding Value	(269,780)				
H. Recognized Rate of Return	5.79 %				
I. Market Rate of Return	5.10 %				
J. Ratio of Funding Value to Market Value	1.0056				

Development of Valuation Assets – PPP2 [1] (Concluded)

Year Ended September 30	2018	2019
A. Funding Value Beginning of Year	$ 0	$ 2,426,660
B. Market Value		
B1. Market Value End of Year	2,458,933	17,702,525
B2. Market Value Beginning of Year	-	2,458,933
B3. Audit Adjustment	-	-
C. Non-Investment Net Cash Flow		
C1. Member Contributions	1,184,765	7,488,483
C2. Employer Contributions	1,186,390	7,282,283
C3. Benefit Payments	-	-
C4. Contribution Refunds / Transfers	(219)	(23,552)
C5. Administrative Expenses	Included in D1	(5,527)
C6. University Employer Contribution Refund	-	-
C7. Other	-	-
C8. Total Net Cash Flow: C1 + C2 + C3 + C4 + C5 + C6 + C7	2,370,936	14,741,687
D. Investment Return		
D1. Market Return Total: B1 - B2 - B3 - C8	87,997	501,905
D2. Assumed Rate of Return	6.00%	6.00%
D3. Market Rate of Return	11.08%	5.11%
D4. Dedicated Gains Policy Trigger (Excess Return %)	0.00%	0.00%
D5. Market Return for Immediate Recognition: D4 x (B2 + B3 + C8/2)	-	-
D6. Assumed Amount of Return: D2 x (A + B3 + C8/2)	47,656	587,850
D7. Amount Subject to Phase-In: D1 - D5 - D6	40,341	(85,945)
E. Phased-In Recognition of Investment Return		
E1. Current Year: 0.20 x D7	8,068	(17,189)
E2. First Prior Year	-	8,068
E3. Second Prior Year	-	-
E4. Third Prior Year	-	-
E5. Fourth Prior Year	-	-
E6. Total Phase-Ins	8,068	(9,121)
F. Funding Value End of Year		
F1. Preliminary Funding Value End of Year: A + B3 + C8 + D5 + D6 + E6	$ 2,426,660	$ 17,747,076
F2. Corridor Percent	30%	30%
F3. Upper Corridor Limit: (100% + F2) x B1	3,196,613	23,013,283
F4. Lower Corridor Limit: (100% - F2) x B1	1,721,253	12,391,768
F5. Funding Value End of Year	$ 2,426,660	$ 17,747,076
G. Difference Between Market and Funding Value	32,273	(44,551)
H. Recognized Rate of Return	7.02 %	5.91 %
I. Market Rate of Return	11.08 %	5.11 %
J. Ratio of Funding Value to Market Value	0.9869	1.0025

[1] *In fiscal year 2018, the formulas have been adjusted to account for the PPP2 beginning February 1, 2018.*

History of Approximate Investment Return Rates

Plan Year Ending September 30	Approximate Rate of Return [1] Market Value	Actuarial Value Non-Hybrid	Actuarial Value PPP	Actuarial Value PPP2
2011	3.78 %	0.56 %	6.37 %	
2012	15.96	(0.67)	8.60	
2013	13.27	5.68	8.97	
2014	15.90	10.84	9.88	
2015	2.14	9.57	7.88	
2016	7.42	10.48	7.72	
2017	13.09	14.40	8.62	
2018	11.08	11.11	11.84	7.02 %
2019	5.11	5.62	7.05	5.91
2020	5.10	6.15	6.86	5.79
Average Returns:				
Last five years:	8.31 %	9.50 %	8.40 %	6.24 %
Last ten years:	9.17 %	7.28 %	8.37 %	6.24 %

[1] *Approximate return based on ratio of total investment return to average asset value, using an assumed beginning-of-year timing of audit adjustments (if any) and an assumed mid-year timing of other asset flows, unless otherwise noted.*

Please note, starting in fiscal year 2017, the return on the actuarial value of assets may be impacted by the accelerated recognition of investment return under the Dedicated Gains Policy.

Historical Growth of Assets at Market Value

Fiscal Year Ended September 30	Revenues by Source: Member Contributions	Employer Contributions	Net Investment Income [1]	Expenses by Type: Retirement Benefits	Return of Contributions and Transfers	Administrative Expenses	Market Value of Assets
2001	$ 371,548,016	$ 629,924,827	$(4,575,630,855)	$ 1,890,812,400	$ 19,835,729	$ 17,312,250	$ 34,810,222,493
2002	413,163,871	603,949,327	(3,733,441,844)	2,041,439,863	20,813,845	23,610,482	30,008,029,657
2003	379,084,549	697,906,265	4,532,071,835	2,180,574,193	13,642,300	23,016,963	33,399,858,850
2004	456,352,606	697,647,338	4,130,642,038	2,358,216,073	18,403,233	19,374,673	36,288,506,853
2005	368,240,837	774,277,778	4,530,606,037	2,558,017,710	22,166,261	19,997,954	39,361,449,580
2006	518,599,720	995,932,425	4,927,177,496	2,761,292,217	24,024,234	22,501,098	42,995,341,672
2007	356,761,212	835,366,382	7,177,114,740	2,944,920,179	32,241,730	24,489,202	48,362,932,895
2008	399,256,616	999,374,879	(7,398,629,969)	3,117,434,847	32,720,146	24,740,628	39,188,038,800
2009	357,249,466	1,000,375,355	(2,712,429,401)	3,278,118,116	33,943,530	22,793,011	34,498,379,563
2010	377,748,755	1,001,251,673	3,563,025,960	3,525,020,341	33,907,066	26,000,699	35,855,477,845
2011	332,209,134	1,156,060,903	1,332,447,630	3,942,027,101	36,588,623	22,926,393	34,674,653,395
2012	335,470,879	1,454,438,907	5,387,076,055	4,082,242,506	31,865,139	37,119,630	37,700,411,961
2013	385,007,587	1,364,136,462	4,859,910,264	4,238,482,066	30,442,439	25,002,153	40,015,539,616
2014	405,443,772	1,600,375,132	6,192,710,860	4,388,328,518	28,840,649	23,711,249	43,773,188,964
2015	395,722,292	1,967,610,696	938,143,040	4,530,914,738	136,902,057 [2]	24,487,325	42,382,360,872
2016	398,893,138	2,308,657,030	3,095,177,500	4,671,299,698	26,996,969 [2]	26,213,125	43,460,578,748
2017	427,988,238	2,398,950,106	5,583,469,496	4,806,958,754	26,111,404	26,133,359	47,011,783,071
2018	393,059,173	2,791,508,863	5,136,369,857	4,934,638,368	28,632,230	25,951,961	50,343,498,405
2019	403,146,565	2,706,712,537	2,519,522,309	5,058,624,097	29,344,631	27,740,993	50,857,170,095
2020	401,626,288	2,808,839,412	2,622,757,522	5,183,129,306	27,916,861	23,118,595	51,456,228,555

[1] *Includes miscellaneous income and other changes in net assets/reserves/fund balances and net of investment expenses.*
[2] *Includes University employer contribution refund.*

Note: Data for the year 2005 and prior years was provided by the State of Michigan Department of Technology, Management and Budget - Financial Services.

SECTION D

CENSUS DATA

Summary of Participant Data by Category

	As of September 30	
	2019	**2020**
Retirees and beneficiaries currently receiving benefits:		
Regular benefits	194,374	196,604
Survivor benefits	18,588	19,018
Disability benefits	5,975	5,856
Total	218,937	221,478
Current Employees:		
Vested	94,621	92,006
Non-Vested	79,568	73,009
Total	174,189	165,015
Inactive employees entitled to benefits and not yet receiving them:	21,771	20,241
Total Participants	414,897	406,734

The September 30, 2019 inactive counts include 3,492 people who elected not to continue future accruals (after the transition date of February 1, 2013) in the defined benefit plan as a result of PA 300. All counts exclude 26,190 people hired after PA 300 who elected to participate in the pure defined contribution plan and 5,232 active records (5,109 reported with a DB plan code and 123 reported with a DC plan code) with both $0 salary and 0 service provided in the September 30, 2019 valuation data. It is our understanding that active records with both $0 salary and 0 service correspond to recently hired members who are still within the PPP2/DC election window.

The September 30, 2020 inactive counts include 3,187 people who elected not to continue future accruals (after the transition date of February 1, 2013) in the defined benefit plan as a result of PA 300. All counts exclude 30,681 people hired after PA 300 who elected to participate in the pure defined contribution plan and 3,028 active records (2,868 reported with a DB plan code and 160 reported with a DC plan code) with both $0 salary and 0 service provided in the September 30, 2020 valuation data. It is our understanding that active records with both $0 salary and 0 service correspond to recently hired members who are still within the PPP2/DC election window.

UAAL contributions are expected to continue to be collected on the payroll of these members in the future.

Retirees and Beneficiaries – Historical Comparison

Year Ended September 30	Rolls End of Year Number	Rolls End of Year Annual Benefit[1]	Annual % Increase Number	Annual % Increase Benefits	Average Annual Benefit
2001	130,790	$ 1,943,444	3.7%	8.1%	$ 14,859
2002	135,277	2,094,382	3.4	7.8	15,482
2003	139,814	2,251,766	3.4	7.5	16,105
2004	145,378	2,431,636	4.0	8.0	16,726
2005	151,706	2,644,700	4.4	8.8	17,433
2006	157,163	2,828,460	3.6	6.9	17,997
2007	162,844	3,013,075	3.6	6.5	18,503
2008	167,265	3,171,261	2.7	5.3	18,960
2009	171,922	3,336,165	2.8	5.2	19,405
2010	187,722	3,814,755	9.2	14.3	20,321
2011	192,435	3,987,227	2.5	4.5	20,720
2012	196,661	4,134,218	2.2	3.7	21,022
2013	200,952	4,289,281	2.2	3.8	21,345
2014	204,512	4,431,065	1.8	3.3	21,667
2015	207,651	4,568,852	1.5	3.1	22,003
2016	211,007	4,709,668	1.6	3.1	22,320
2017	213,989	4,839,414	1.4	2.8	22,615
2018	216,618	4,967,055	1.2	2.6	22,930
2019	218,937	5,087,367	1.1	2.4	23,237
2020	221,478	5,212,106	1.2	2.5	23,533

[1] *In thousands of dollars.*

Retirees and Beneficiaries
as of September 30, 2020
By Type of Retirement and Selected Option

Amount of Monthly Benefit	Number of Retirees	Type of Retirement*						Selected Option**				
		1	2	3	4	5	6	Opt. 1	Opt. 2	Opt. 3	Opt. 4	Opt 1E 2E,3E,4E
$ 1 - 400	34,096	29,777	2,588	140	1,224	5	362	17,985	8,208	5,356	861	1,686
401 - 800	32,912	28,015	2,104	151	2,018	3	621	16,786	7,094	6,163	1,251	1,618
801 - 1,200	22,281	18,731	1,625	74	1,294	2	555	10,378	4,749	4,604	1,098	1,452
1,201 - 1,600	17,498	14,440	1,744	26	858	3	427	7,315	3,881	3,563	1,091	1,648
1,601 - 2,000	15,774	13,315	1,536	15	552	0	356	6,093	3,442	3,225	1,092	1,922
2,001 - 2,400	16,634	14,690	1,210	1	454	3	276	6,106	3,730	3,274	1,285	2,239
2,401 - 2,800	17,544	16,082	969	6	246	0	241	6,522	3,967	3,518	1,482	2,055
2,801 - 3,200	17,165	16,021	879	2	138	0	125	6,949	3,652	3,500	1,472	1,592
3,201 - 3,600	14,893	14,108	623	1	57	1	103	6,521	2,970	3,164	1,273	965
3,601 - 4,000	11,234	10,731	428	0	16	0	59	5,363	2,066	2,254	967	584
Over 4,000	21,447	20,694	652	0	6	0	95	11,658	3,256	4,006	1,839	688
Totals	221,478	196,604	14,358	416	6,863	17	3,220	101,676	47,015	42,627	13,711	16,449

*** Type of Retirement**

1 – Normal retirement for age & service
2 – Survivor payment – normal retirement
3 – Duty disability retirement (including survivors)
4 – Non-duty disability retirement (including survivors)
5 – Survivor payment – duty death in service
6 – Survivor payment – non-duty death in service

**** Selected Option**

Opt. 1 – Straight life allowance
Opt. 2 – 100% survivor option
Opt. 3 – 50% survivor option
Opt. 4 – 75% survivor option
Opt. 1E, 2E, 3E, 4E – equated retirement plans

Active Members by Classification (Defined Benefit Only)

	September 30, 2019	September 30, 2020
Basic Members		
Number	10,827	9,257
Average Age	57.5 years	58.1 years
Average Service	25.8 years	26.0 years
Reported Payroll	$ 621,194,018	$ 541,329,320
Average Annual Pay	$ 57,375	$ 58,478
MIP Members		
Number	116,075	109,354
Average Age	49.4 years	49.8 years
Average Service	16.6 years	17.2 years
Reported Payroll	$ 6,070,584,864	$ 5,974,976,206
Average Annual Pay	$ 52,299	$ 54,639
PPP Members		
Number	41,796	37,718
Average Age	39.2 years	40.2 years
Average Service	3.8 years	4.7 years
Reported Payroll	$ 1,194,602,616	$ 1,211,312,993
Average Annual Pay	$ 28,582	$ 32,115
PPP2 Members		
Number	5,491	8,686
Average Age	34.5 years	35.1 years
Average Service	0.8 years	1.3 years
Reported Payroll	$ 153,096,332	$ 251,641,687
Average Annual Pay	$ 27,881	$ 28,971
Total		
Number	174,189	165,015
Average Age	47.0 years	47.3 years
Average Service	13.6 years	14.0 years
Reported Payroll	$ 8,039,477,830	$ 7,979,260,206
Average Annual Pay	$ 46,154	$ 48,355

The above active statistics exclude the following records:

- Active members hired after PA 300 who elected the pure defined contribution plan (26,190 as of September 30, 2019 and 30,681 as of September 30, 2020).
- Active members who elected not to continue future accruals (after the transition date of February 1, 2013) in the defined benefit plan as a result of PA 300 (3,492 as of September 30, 2019 and 3,187 as of September 30, 2020).
- Active records provided in the valuation with both $0 salary and 0 service (5,232 as of September 30, 2019 and 3,028 as of September 30, 2020). It is our understanding that active records with both $0 salary and 0 service correspond to recently hired members who are still within the PPP2/DC election window.

The total annual payroll reported in the valuation data (including payroll for those employees excluded from the active statistics above) is $8,716.3 million as of September 30, 2020 ($8,690.8 million as of September 30, 2019). UAAL contributions are expected to continue to be collected on the payroll of all MPSERS active members in the future.

Active Members (Defined Benefit Only)

Members in Active Service as of September 30, 2020
by Age and Years of Service

Age	Years of Service 0 - 4	5 - 9	10 - 14	15 - 19	20 - 24	25 - 29	30 & up	Total Count	Total Pay	Average Pay
Under 20	22							22	$ 329,704	$ 14,987
20 - 24	1,890	18						1,908	35,763,521	18,744
25 - 29	6,783	1,139	4					7,926	269,428,931	33,993
30 - 34	5,922	5,796	955	24				12,697	511,749,634	40,305
35 - 39	6,286	4,832	4,589	2,194	749			18,650	875,930,385	46,967
40 - 44	6,230	3,816	2,843	4,208	6,010	1,175		24,282	1,323,009,796	54,485
45 - 49	5,214	3,709	2,497	2,760	6,127	5,772	480	26,559	1,513,815,207	56,998
50 - 54	4,413	3,414	2,915	2,937	4,169	6,544	3,080	27,472	1,505,187,465	54,790
55 - 59	3,214	2,695	2,924	3,160	3,828	3,571	3,716	23,108	1,092,967,635	47,298
60 - 64	2,275	1,855	1,744	2,026	2,607	2,051	2,318	14,876	613,865,167	41,265
65 - 69	1,274	806	521	532	593	530	838	5,094	179,046,210	35,148
70 & Over	925	481	265	187	147	134	282	2,421	58,166,551	24,026
Total	44,448	28,561	19,257	18,028	24,230	19,777	10,714	165,015	$ 7,979,260,206	$ 48,355

The September 30, 2020 active statistics exclude: (1) 3,187 people who elected not to continue future accruals (after the transition date of February 1, 2013) in the defined benefit plan as a result PA 300, (2) 30,681 people hired after PA 300 who elected the pure defined contribution plan, and (3) 3,028 people provided in the valuation with both $0 salary and 0 service. It is our understanding that active records with both $0 salary and 0 service correspond to recently hired members who are still within the PPP2/DC election window.

The total annual payroll reported in the valuation data (including payroll for those employees excluded from the active statistics above) is $8,716.3 million as of September 30, 2020. UAAL contributions are expected to continue to be collected on the payroll of all MPSERS active members in the future.

Active and Inactive Members Reported for Valuation
Historical Comparison

Valuation Date September 30	Number of Inactive Vested Members	Active Members [2]					
				Average			
		Number	Reported Payroll[1]	Annual Pay	% Increase	Age	Years of Service
2001	*	318,538	$ 9,264,183	$ 29,083	1.2 %	43.6	9.6
2002	14,403	326,350	9,707,281	29,745	2.3	43.6	9.5
2003	14,247	326,938	10,043,862	30,721	3.3	43.8	9.7
2004	15,756	322,494	10,407,072	32,271	5.0	43.8	9.7
2005	16,806	316,151	10,205,972	32,282	0.0	43.7	9.7
2006	15,679	308,233	9,806,452	31,815	(1.4)	44.1	9.9
2007	14,999	295,984	9,851,471	33,284	4.6	44.5	10.3
2008	14,312	278,642	9,958,132	35,738	7.4	44.9	10.8
2009	14,454	268,208	9,883,674	36,851	3.1	45.4	11.4
2010	15,026	242,568	8,845,019	36,464	(1.1)	45.2	11.1
2011	15,090	236,660	9,155,691	38,687	6.1	45.3	11.3
2012	16,167	223,769	8,649,029	38,652	(0.1)	45.7	11.9
2013	16,235	212,525	8,225,140	38,702	0.1	46.0	12.3
2014	23,140	199,674	7,943,922	39,784	2.8	46.1	12.7
2015	22,717	194,957	8,005,009	41,060	3.2	46.1	12.8
2016	22,508	189,761	7,912,565	41,698	1.6	46.2	13.0
2017	22,234	187,735	7,880,041	41,974	0.7	46.2	13.0
2018	22,447	182,930	7,884,550	43,101	2.7	46.4	13.1
2019	21,771	174,189	8,039,478	46,154	7.1	47.0	13.6
2020 [3]	20,241	165,015	7,979,260	48,355	4.8	47.3	14.0

* *Not available.*

1 *Reported payroll in thousands. Beginning with the September 30, 2006 valuation, the payroll is no longer adjusted, and the payroll is the sum of the actual pays reported for each active member.*

2 *Active members hired after PA 300 who elected the pure defined contribution plan are excluded from the statistics above. Beginning with the September 30, 2014 valuation, active members who elected not to continue future accruals in the defined benefit plan as a result of PA 300 are included in the number of inactive vested members.*

3 *The September 30, 2020 inactive vested statistic includes 3,187 people who elected not to continue future accruals (after the transition date of February 1, 2013) in the defined benefit plan as a result PA 300. The September 30, 2020 active statistics exclude these members as well as 30,681 people hired after PA 300 who elected the pure defined contribution plan and 3,028 people provided in the valuation with both $0 salary and 0 service. It is our understanding that active records with both $0 salary and 0 service correspond to recently hired members who are still within the PPP2/DC election window. The total annual payroll reported in the valuation data (including payroll for those employees excluded from the active statistics above) is $8,716.3 million as of September 30, 2020. UAAL contributions are expected to continue to be collected on the payroll of all MPSERS active members in the future.*

SECTION E

METHODS AND ASSUMPTIONS

Valuation Methods

Actuarial Cost Method - Normal cost and the allocation of benefit values between service rendered before and after the valuation date was determined using an Individual Entry-Age Actuarial Cost Method having the following characteristics:

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

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

Actuarial gains (losses), as they occur, reduce (increase) the Unfunded Actuarial Accrued Liability (UAAL).

Financing of Unfunded Actuarial Accrued Liabilities - Unfunded actuarial accrued liabilities (full funding credit if assets exceed liabilities) were amortized by level (principal and interest combined) percent-of-payroll contributions over a reasonable period of future years. It is expected that the unfunded actuarial accrued liabilities will be fully amortized by the end of fiscal year 2038. For amortization purposes only, the payroll growth assumption is based upon the following schedule outlined in Public Act 181 of 2018 (PA 181): 3.50% for the September 30, 2017 and 2018 valuations, dropping 0.50% each subsequent year starting with the September 30, 2019 valuation, until an ultimate payroll growth assumption of 0.00% is reached beginning with the September 30, 2025 valuation.

Valuation Methods

Present value of future reconciliation payments – Subsection 41(9) of the MPSERS statute provides for a process to reconcile actual employer contributions to the actuarially computed contribution requirements. In order to avoid duplication of the employer contributions, the present value of future reconciliation payments is subtracted from the unfunded actuarial accrued liability (UAAL) to determine the remaining UAAL contribution. Please refer to pages A-1 and E-14.

Amortization of UAAL resulting from the Early Retirement Incentive (ERI) program of 2010 – It has been reported that 1.36% of payroll will be contributed beginning in fiscal year 2013 for a 10-year period to amortize the UAAL associated with the ERI program of 2010. In order to avoid duplication of the employer contributions, the present value of future ERI amortization payments is subtracted from the unfunded actuarial accrued liability (UAAL) to determine the remaining UAAL contribution. Please refer to page A-1. The September 30, 2017 valuation reflected that the employer contributed $200 million in October 2017 to eliminate the fiscal year 2021 and fiscal year 2022 scheduled ERI payments.

Actuarial Value of System Assets - The actuarial value of assets recognizes assumed investment income fully each year. Differences between actual and assumed investment income are phased in over a closed five-year period. During periods when investment performance exceeds the assumed rate, actuarial value of assets will tend to be less than market value. During periods when investment performance is less than the assumed rate, actuarial value of assets will tend to be greater than market value. The actuarial value of assets was reset to market value as of September 30, 2006, with five-year smoothing restarted at that time. The actuarial value of assets is developed separately for the Non-Hybrid, the PPP, and the PPP2 portions of the System. The total actuarial value of assets is the sum of these three components. The actuarial value of assets is not permitted to deviate from the market value of assets by more than 30%.

Valuation Assumptions

In accordance with Section 41(1) of the MPSERS statute (Act 300 of the Public Acts of 1980, as amended), the actuarial assumptions are adopted by the Retirement Board and the Department of Technology, Management and Budget after consultation with the actuary and the State Treasurer. The actuarial assumptions were based upon the results of an Experience Study for MPSERS covering the period October 1, 2012 through September 30, 2017. A report dated May 15, 2018 presented the results of the Experience Study. The investment return assumptions for the Non-Hybrid and PPP groups were updated beginning with the September 30, 2018 valuation in accordance with the Dedicated Gains Policy adopted by the Board of Trustees. The actuarial assumptions represent estimates of future experience.

The rate of investment return was 6.80% a year, compounded annually net of investment expenses for the Non-Hybrid and PPP groups (6.00% for the PPP2 group). This assumption was first used for the September 30, 2018 funding valuation of the System.

The assumed real rate of investment return is the rate of investment return in excess of either wage inflation or price inflation. Considering a wage inflation assumption of 2.75% and a price inflation assumption of 2.25%, the 6.80% nominal rate of investment return translates into a real rate of investment return of 4.05% over wage inflation and 4.55% over price inflation for the Non-Hybrid and PPP groups. Considering a wage inflation assumption of 2.75% and a price inflation assumption of 2.25%, the 6.00% nominal rate of investment return translates into a real rate of investment return of 3.25% over wage inflation and 3.75% over price inflation for the PPP2 group.

Valuation Assumptions

The rates of salary increase used for individual members are in accordance with the table below. This assumption is used to project a member's current pay to the pay upon which System benefits will be based. The current assumption was first used for the September 30, 2018 valuation of the System.

Sample Ages	Salary Increase Assumptions For an Individual Member Merit & Seniority	Base (Economy)	Increase Next Year
20	8.80 %	2.75 %	11.55 %
25	8.80	2.75	11.55
30	4.96	2.75	7.71
35	3.10	2.75	5.85
40	1.90	2.75	4.65
45	1.14	2.75	3.89
50	0.54	2.75	3.29
55	0.18	2.75	2.93
60	0.00	2.75	2.75
65	0.00	2.75	2.75
Ref	510		

The charts shown in this section may include a reference number (for example, 510 is used above). These reference numbers are used by GRS to track and identify assumption tables.

Valuation Assumptions

The healthy life post-retirement mortality table is used to measure the probabilities of each benefit payment being made after retirement for healthy lives.

Healthy Male Retirees:	RP-2014 Male Healthy Annuitant Mortality Table scaled by 82% and adjusted for mortality improvements using projection scale MP-2017 from 2006.
Healthy Female Retirees:	RP-2014 Female Healthy Annuitant Mortality Table scaled by 78% and adjusted for mortality improvements using projection scale MP-2017 from 2006.

This assumption was first used for the September 30, 2018 valuation of the System. Sample rates of mortality and years of life expectancy are shown below.

Sample Attained Ages	Probability of Dying Next Year		Future Life Expectancy (years)	
	Men	Women	Men	Women
50	0.33 %	0.21 %	36.55	39.55
55	0.47	0.30	31.71	34.54
60	0.66	0.45	27.04	29.66
65	0.95	0.66	22.58	24.99
70	1.41	1.01	18.36	20.51
75	2.23	1.65	14.42	16.29
80	3.76	2.83	10.87	12.44

Applicable to calendar year 2020. Rates and life expectancies in future years are determined by the fully generational MP-2017 projection scale.

For active members, the probabilities of dying before retirement (i.e., pre-retirement mortality) are as follows:

Male Active Members:	RP-2014 Male Employee Mortality Table scaled by 100% and adjusted for mortality improvements using projection scale MP-2017 from 2006.
Female Active Members:	RP-2014 Female Employee Mortality Table scaled by 100% and adjusted for mortality improvements using projection scale MP-2017 from 2006.

This assumption was first used for the September 30, 2018 valuation of the System. Sample rates of mortality and years of life expectancy are shown on the next page.

Sample Attained Ages	Probability of Dying Next Year		Future Life Expectancy (years)	
	Men	Women	Men	Women
20	0.04 %	0.02 %	68.11	72.32
25	0.05	0.02	62.78	66.99
30	0.05	0.02	57.45	61.66
35	0.06	0.03	52.14	56.35
40	0.07	0.05	46.84	51.07
45	0.10	0.07	41.56	45.81
50	0.17	0.11	36.35	40.61
55	0.28	0.18	31.25	35.49
60	0.49	0.27	26.32	30.47
65	0.88	0.39	21.68	25.58

Applicable to calendar year 2020. Rates and life expectancies in future years are determined by the fully generational MP-2017 projection scale. Active member deaths are assumed to be non-duty related.

The disabled life mortality table is used to measure the probabilities of each benefit payment being made after retirement to disabled lives.

Disabled Male Retirees: RP-2014 Male Disabled Annuitant Mortality Table scaled by 100% and adjusted for mortality improvements using projection scale MP-2017 from 2006.

Disabled Female Retirees: RP-2014 Female Disabled Annuitant Mortality Table scaled by 100% and adjusted for mortality improvements using projection scale MP-2017 from 2006.

This assumption was first used for the September 30, 2018 valuation of the System. Sample rates of mortality and years of life expectancy are shown below.

Sample Attained Ages	Probability of Dying Next Year		Future Life Expectancy (years)	
	Men	Women	Men	Women
50	2.00 %	1.16 %	24.48	28.90
55	2.33	1.52	21.35	25.08
60	2.77	1.88	18.30	21.53
65	3.35	2.19	15.43	18.11
70	4.14	2.83	12.68	14.74
75	5.51	4.14	10.05	11.57
80	7.86	6.35	7.66	8.82

Applicable to calendar year 2020. Rates and life expectancies in future years are determined by the fully generational MP-2017 projection scale.

Valuation Assumptions

The rates of retirement used to measure the probability of eligible members retiring during the next year are shown below. These assumptions were first used for the September 30, 2018 valuation of the System.

A Basic member is eligible for normal retirement after attaining age 55 with 30 or more years of credited service, or after attaining age 60 with 10 or more years of credited service.

A MIP member is eligible for normal retirement after 30 years of service, or after attaining age 60 with 5 or more years of service.

A Basic or MIP member is eligible for early retirement after attaining age 55 with 15 but less than 30 years of credited service.

A Pension Plus member is eligible for normal retirement after attaining age 60 with 10 or more years of credited service. Pension Plus members are not eligible for early retirement. Currently, Pension Plus 2 members have the same retirement eligibility and retirement rates as Pension Plus members.

Normal Retirement

Retirement	Percent of Eligible Members Retiring			
	Basic Members		MIP# and Pension Plus Members	
Ages	Teachers	Non-Teachers	Teachers	Non-Teachers
55	25 %	20 %		
56	21	20		
57	16	18		
58	16	18		
59	18	18		
60	20	18	20 %	17 %
61	20	18	20	17
62	29	29	23	24
63	29	29	23	24
64	25	24	23	20
65	25	24	25	20
66	30	30	30	26
67	25	28	25	20
68	25	23	25	16
69	25	20	25	16
70	25	20	25	16
71	21	20	25	16
72	21	20	25	16
73	21	20	20	16
74	21	20	20	16
75 & Over	100	100	100	100
Ref	2835	2836	2837	2838

 # Applies to MIP members with fewer than 30 years of service.

Normal Retirement

Years of Service	Percent of Eligible Members Retiring — MIP Members with 30+ Years of Service: Teachers	Non-Teachers
30	25 %	25 %
31	20	25
32	20	20
33	18	20
34	19	20
35	19	20
36	21	20
37	24	20
38	24	20
39	27	25
40	30	25
41	30	25
42	30	30
43	30	30
44	30	30
45	30	30
46	30	30
47	30	30
48	30	30
49	30	30
50	100	100
Ref	2833	2834

Early Retirement

Retirement Ages	Percent of Eligible Members Retiring: Basic Members	MIP Members
55	4.0 %	4.0 %
56	5.0	5.0
57	5.5	5.5
58	5.5	5.5
59	6.0	6.0
Ref	2832	2832

Valuation Assumptions

Rates of separation from active membership used in the valuation are shown below (rates do not apply to members eligible to retire and do not include separation on account of death or disability). This assumption measures the probabilities of members remaining in employment, and was first used for the September 30, 2018 valuation of the System.

Sample Ages	Years of Service	Percent Separating Within Next Year			
		Pay More Than $20,000		Pay Less Than $20,000	
		Teachers	Non-Teachers	Teachers	Non-Teachers
All	0	15.00 %	35.00 %	30.00 %	40.00 %
	1	10.00	14.00	25.00	26.00
	2	6.50	8.20	22.00	19.00
	3	6.00	6.80	22.00	16.00
	4	4.50	5.70	22.00	14.00
20	5 & over	3.00	5.00	22.00	14.00
25		3.00	4.76	22.00	14.00
30		2.58	3.76	22.00	14.00
35		1.82	2.78	20.80	13.40
40		1.32	2.20	18.20	11.80
45		1.08	1.88	16.40	9.80
50		1.00	1.80	16.00	8.40
55		1.00	1.80	16.00	8.00
60		1.00	1.80	16.00	8.00
Svc Ref		1136	877	1135	1137
Age Ref		1453	1454	1450	1451

Pension Plus 2 members are assumed to experience 50% of the assumed withdrawal rates above.

Valuation Assumptions

Rates of disability among active members used in the valuation are shown below, and were first used in the September 30, 2010 valuation of the System. Disabilities are assumed to be non-duty related.

Sample Ages	Percent Becoming Disabled Within Next Year
20	0.00 %
25	0.01
30	0.01
35	0.02
40	0.05
45	0.10
50	0.18
55	0.26
60	0.36
Ref.	393 x 0.80

Service Credit Accrual Rates: Members were assumed to accrue service credit each year as described in the table below:

	Assumed Average Service Credit Accrued Each Year
Teachers with Pay Over $20,000	0.93 years
Non-Teachers with Pay Over $20,000	0.93
Teachers with Pay Under $20,000	0.60
Non-Teachers with Pay Under $20,000	0.65

These accrual rates were first used for the September 30, 2014 valuation of the System.

Valuation Assumptions

Unknown Data:

- Members with unknown gender were assumed to be female.

- Members with unknown dates of birth were assumed to have an entry-age equal to 32 for Basic members, 33 for MIP members, 35 for PPP members, and 33 for PPP2 members.

- Active members with non-zero service who were reported without any annual pay were assumed to have pay equal to the average pay of the corresponding active group.

- Retired members with unknown benefit plan codes were assumed to be MIP.

- Active members with unknown pre-PA 300 benefit plan codes were assumed to be MIP Graded.

- Allocations of total credited service before and after the PA 300 transition date were approximated when not supplied.

- Frozen defined benefit amounts were estimated for active members who elected to participate in the DC Plan prospectively as a result of PA 300, when not supplied.

- Accrued benefits were estimated for inactive participants based upon the service and final average compensation provided in the data.

Miscellaneous and Technical Assumptions

Administrative Expenses	The normal cost contribution includes 0.30% payroll load for administrative expenses.
Benefit Service	Exact fractional service is used to determine the amount of benefit payable.
Cost-of-Living Assumption	MIP members are assumed to receive 3.0% cost-of-living increases. Basic members who retired on or before January 1, 1987 are assumed to receive 3.8% cost-of-living increases. All other members are assumed not to receive cost-of-living increases.
Decrement Operation	Disability and withdrawal decrements do not operate during retirement eligibility.
Decrement Timing	Retirement decrements are assumed to occur on July 1. All other decrements are assumed to occur mid-year.
Eligibility Testing	Eligibility for benefits is determined based upon the age nearest birthday and service nearest whole year on the date the decrement is assumed to occur.
Employee Contribution Interest Crediting	Employee contributions to the pension plan are assumed to be credited at the investment return assumption for each group.
Forfeitures	For vested separations from service, it is assumed that 0% of members separating will withdraw their contributions and forfeit an employer financed benefit. It was further assumed that the liability at termination is the greater of the vested deferred benefit (if any) or the member's accumulated contributions.
Incidence of Contributions	Contributions are assumed to be received continuously throughout the year.
Liability Adjustments	Inactive vested member liabilities were increased by 2% to reflect the value of the death benefit provision.
Marriage Assumption	75% of males and 65% of females are assumed to be married for purposes of death-in-service benefits. Male spouses are assumed to be three years older than female spouses for active member valuation purposes.
Normal Form of Benefit	A straight life benefit is the normal form of benefit.

Miscellaneous and Technical Assumptions

OPEB Contribution Refunds	For purposes of valuing the liabilities associated with OPEB contribution refunds (that are paid out of the pension plan), the Non-Hybrid investment return is used for Non-Hybrid members and the PPP investment return assumption is used for PPP members.
PPP2 Accrued Liability Load	The PPP2 accrued liability includes $0.6 million for employee and employer contribution amounts collected and included in the plan's reported assets attributable to participants not yet included in the pension valuation due to PPP2/DC election waiting periods. ORS reported that contributions (12.4% of payroll) had been collected on payroll totaling approximately $4.9 million.
PPP/PPP2 Normal Cost Load	We anticipate that as the PPP and PPP2 populations mature, they will take on a pay structure (i.e., an evolution of full-time / part-time membership composition) similar to the current Non-Hybrid population. We have developed a load of 0.35% of payroll for the PPP group and 1.78% of payroll for the PPP2 group to be applied to their respective normal costs to account for this expectation.
Procedure for Estimating Fiscal Year Employer Dollar Contributions	For purposes of determining the dollar contribution amounts, it is assumed that the total payroll will increase by 2.75% per year through fiscal year 2023. For purposes of amortizing the UAAL, a 2.50% payroll growth assumption is used, consistent with the payroll growth schedule as outlined in Public Act 181 of 2018. For people active as of September 30, 2020, projected payroll through fiscal year 2023 is based upon valuation demographic and salary increase assumptions. The remainder of the projected payroll in fiscal year 2023 (due to new hires after September 30, 2020) is allocated as follows: 33% to PPP2 members and 67% to DC members. The allocation of new entrants between PPP2 members and DC members was supplied by ORS in conjunction with the 30-year contribution projection for MPSERS as of September 30, 2019 and issued in July 2020.

Miscellaneous and Technical Assumptions

Reconciliation Payments

ORS provided the following schedule of reconciliation payments. For purposes of determining the present value of the reconciliation payments, it was assumed that payments occur in the middle of the fiscal period.

Fiscal Year	Reconciliation Payment
2021	$ 107,414,750
2022	45,833,222
2023	24,136,959
2024	22,627,568
2025	4,628,054
2026	0

Salary Increase Timing

Salary increases were assumed to be at the beginning of the fiscal year. This is equivalent to assuming that reported pays represent amounts paid to members during the year ended on the valuation date.

Service Purchase Loads

The following two loads have been included in the accrued liability to account for service purchases:

$45.3 million for amounts included in the plan's reported assets for purchased service that has not been paid for yet by the members. This amount is provided by ORS for each valuation.

$10.7 million estimated for purchased service paid for, but not reported in the valuation. We have estimated this amount based on supplemental data reported for the September 30, 2020 valuation.

SECTION F

PLAN PROVISIONS

Plan Provisions as of September 30, 2020

Our actuarial valuation of the System is based on the present provisions of the Public School Employees' Retirement Act (Act 300 of 1980, as amended).

Regular Retirement (no reduction factor for age):

Eligibility – For Basic members, age 55 with 30 years of credited service; or age 60 with 10 years credited service. For Member Investment Plan (MIP) members, any age with 30 years of credited service; or age 60 with 10 years credited service; or age 60 with 5 years of credited service provided member worked through 60th birthday and has credited service in each of the last 5 years. For Pension Plus Plan (PPP) and Pension Plus 2 Plan (PPP2) members, age 60 with 10 years of credited service.

Mandatory Retirement Age - None.

Annual Amount

Basic and MIP – Credited Service as of the Transition Date (i.e., February 1, 2013) times 1.5% times Final Average Compensation (FAC),

Plus

An amount determined by the member's election of Option 1, 2, 3 or 4 described below:

Option 1 – Credited Service after the Transition Date times 1.5% times FAC.

Option 2 – Credited Service after the Transition Date (until total service reaches 30 years) times 1.5% times FAC, PLUS Credited Service after the Transition Date and over 30 years times 1.25% times FAC.

Option 3 – Credited Service after the Transition Date times 1.25% times FAC.

Option 4 – None (Member will receive a benefit through a Defined Contribution plan).

PPP and PPP2 – Credited Service times 1.5% times FAC.

Final Average Compensation (FAC) - Average of highest 60 consecutive months. (36 months for MIP members). FAC is calculated as of the last day worked unless the member elected Option 4, in which case FAC is calculated as of the Transition Date.

Plan Provisions as of September 30, 2020

Early Retirement (age reduction factor used):

Eligibility - Age 55 with 15 or more (but less than 30) years of credited service and earned credited service in each of the last 5 years. At least 10 of the 15 years of credited service has to be earned service. PPP and PPP2 members are not eligible for early retirement benefits.

Annual Amount - Regular retirement benefit, reduced by 1/2% for each month by which the commencement age is less than 60.

Deferred Retirement (vested benefit):

Eligibility - 10 years of credited service. Benefit commences at the time age qualification is met.

Annual Amount - Regular retirement benefit based on service and final average compensation at time of termination.

Duty Disability Retirement:

Eligibility - No age or service requirement; in receipt of workers' disability compensation.

Annual Amount - Computed as regular retirement benefit with minimum benefit based on 10 years of credited service. Additional limitation such that disability benefits plus authorized outside earnings limited to 100% of final average compensation (increased by 2% each year retired).

Non-Duty Disability Retirement:

Eligibility - 10 years of credited service.

Annual Amount - Computed as regular retirement benefit based on credited service and final average compensation at time of disability. Additional limitation such that disability benefits plus authorized outside earnings limited to 100% of final average compensation (increased by 2% each year retired).

Duty Death Before Retirement:

Eligibility – No age or service requirement. Beneficiary is in receipt of workers' compensation. Also applies to "duty disability" retirees during first three years of disability.

Annual Amount – Spouse benefit computed as regular retirement benefit with minimum benefit based on 10 years of credited service, reduced for 100% Survivor election. If no surviving spouse, children under 18 share in benefit; if no spouse or children, a disabled and dependent parent is eligible.

Plan Provisions as of September 30, 2020

Non-Duty Death Before Retirement:

Eligibility – For Basic members, 15 years of credited service, or age 60 and 10 years of credited service. For MIP members, 10 years of credited service, or age 60 and 5 years of credited service. For PPP members, 10 years of credited service.

Annual Amount - Computed as regular retirement benefit, reduced in accordance with a 100% Survivor election, with payments commencing the first of month following death. For the beneficiary of a deferred member, benefit commences at time member would have attained the minimum age qualification.

Member Contributions:

Basic and MIP Members

Before Transition Date (February 1, 2013)

Basic members – None.

MIP members hired before January 1, 1990 - 3.9% of pay.

MIP members hired on or after January 1, 1990 and before July 1, 2008 - 3.0% of first $5,000 of pay, plus 3.6% of next $10,000 of pay, plus 4.3% of pay in excess of $15,000.

MIP members hired on or after July 1, 2008 - 3.0% of first $5,000 of pay, plus 3.6% of next $10,000 of pay, plus 6.4% of pay in excess of $15,000.

On or After Transition Date (February 1, 2013)

Contributions depend on member election of Option 1, 2, 3, or 4.

Option 1 – Basic Members – 4%
All MIP Members – 7%

Option 2 – Contribution as in Option 1 until member reaches 30 years of service. At 30 years of service, contribution reverts to pre-transition date level.

Option 3 – Post transition date contribution is the same as the pre-transition date contribution.

Option 4 – None (Member will receive a benefit through a Defined Contribution plan).

PPP Members – 3.0% of first $5,000 of pay, plus 3.6% of next $10,000 of pay, plus 6.4% of pay in excess of $15,000.

PPP2 Members – The member contribution rate will be based upon a 50/50 cost sharing arrangement with the employer with respect to the normal cost and the financing of any unfunded actuarial accrued liabilities associated with PPP2 participants.

Post-Retirement Cost-of-Living Adjustments:

One-time upward adjustments have been made in 1972, 1974, 1976, and 1977 for members retired on or after July 1, 1956 and prior to July 1, 1976 for members who were eligible for Social Security benefits. For members who retired prior to July 1, 1956 and were not eligible for Social Security benefits based upon membership service, the minimum base pension was increased in 1965, 1971, 1972, 1974, and 1981, and in 1976 and 1977 one-time upward adjustments were made.

Beginning in 1983 some benefit recipients received an annual distribution of investment earnings in excess of 8% (supplemental payment). On January 1, 1986, all members who retired prior to January 1, 1986 were given a permanent 8% increase. On January 1, 1990 a one-time upward adjustment for members who retired prior to October 1, 1981 was made.

Currently members receive annual increases based on the following schedule:

Retired before January 1, 1987 - Greater of supplemental payment or automatic 3% increases.
Retired on or after January 1, 1987 under MIP - Automatic 3% increases only.
Retired on or after January 1, 1987 under Basic plan - Supplemental payment only.
Retired under PPP or PPP2 – No increases.

Optional Forms of Payment:

The normal form of payment for a member who retires is a straight life annuity.

Section 85 of the MPSERS statute allows the member to choose from the following optional forms of payment: 100% joint and survivor annuity with pop-up, 75% joint and survivor annuity with pop-up, or 50% joint and survivor annuity with pop-up. Additionally, the straight life benefit and the joint and survivor optional forms can be paired with a Social Security equated option at age 62.

The optional forms of payment are actuarially equivalent to the straight life annuity. Option factors are based upon the following: (1) investment return assumption of 6.75%, (2) valuation mortality assumptions for healthy retirees, (3) unisex percent of 30% and (4) calculation year of 2021. The pop-up provision and any applicable COLA are reflected in the factors.

Plan Provisions as of September 30, 2020

<u>Member Contributions Attributable to the Retiree Health Plan:</u>

Under Public Act 300 of 2012, members were given the choice between i. and ii. below:

i. Maintaining eligibility for premium subsidy retiree medical coverage, and contributing 3% of their compensation while still working, or
ii. Entering the Personal Healthcare Fund (PHF).

Members not making an election will default into the premium subsidy arrangement.

If a member who elected the subsidy terminates prior to becoming eligible for the subsidy, dies before the total value of the subsidy received equals the total value of contributions made, or retires and declines coverage, the member or beneficiary may request a refund of unused funds. Refunds of member contributions to the healthcare funding account are issued as a supplemental pension benefit (payable at age 60 and payable from the pension plan) paid out over a 60-month period.

SECTION G

GLOSSARY

Glossary

Actuarial Accrued Liability	The difference between (i) the actuarial present value of future plan benefits, and (ii) the actuarial present value of future normal cost. Sometimes referred to as "accrued liability" or "past service liability."
Accrued Service	The service credited under the plan which was rendered before the date of the actuarial valuation.
Actuarial Assumptions	Estimates of future plan experience with respect to rates of mortality, disability, turnover, retirement, rate or rates of investment income and salary increases. Decrement assumptions (rates of mortality, disability, turnover and retirement) are generally based on past experience, often modified for projected changes in conditions. Economic assumptions (salary increases and investment income) consist of an underlying rate in an inflation-free environment plus a provision for a long-term average rate of inflation.
Actuarial Cost Method	A mathematical budgeting procedure for allocating the dollar amount of the "actuarial present value of future plan benefits" between the actuarial present value of future normal cost and the actuarial accrued liability. Sometimes referred to as the "actuarial funding method."
Actuarial Equivalent	A single amount or series of amounts of equal value to another single amount or series of amounts, computed on the basis of the rate(s) of interest and mortality tables used by the plan.
Actuarial Present Value	The amount of funds presently required to provide a payment or series of payments in the future. It is determined by discounting the future payments at a predetermined rate of interest, taking into account the probability of payment.
Amortization	Paying off an interest-bearing liability by means of periodic payments of interest and principal, as opposed to paying it off with a lump sum payment.
Experience Gain/(Loss)	A measure of the difference between actual experience and that expected based upon a set of actuarial assumptions during the period between two actuarial valuation dates, in accordance with the actuarial cost method being used.

Glossary

Normal Cost	The annual cost assigned, under the actuarial funding method, to current and subsequent plan years. Sometimes referred to as "current service cost." Any payment toward the unfunded actuarial accrued liability is not part of the normal cost.
Reserve Account	An account used to indicate that funds have been set aside for a specific purpose and is not generally available for other uses.
Unfunded Actuarial Accrued Liability	The difference between the actuarial accrued liability and valuation assets. Sometimes referred to as "unfunded accrued liability."
Valuation Assets	The value of current plan assets recognized for valuation purposes. Generally based on market value plus a portion of unrealized appreciation or depreciation.

APPENDIX

PUBLIC ACT SUMMARY OF PLAN CHANGES

Public Act 300 of 2012

A brief summary of the plan changes resulting from Public Act 300 of 2012 follows:

Basic and MIP active members were given the following options to increase, maintain, or cease their contributions to the pension plan:

(1) Increase their member contribution rate to the pension fund and maintain the 1.5% benefit multiplier in their pension formula for service accrued after the transition date (i.e., February 1, 2013). Basic member contributions increased to 4% (from 0%). MIP member contributions increased to a flat 7% (from 3.9% for MIP-Fixed, from a graded percentage up to 4.3% for MIP-Graded, and from a graded percentage up to 6.4% for MIP-Plus).
(2) Increase their member contribution rate (as noted above) and maintain the 1.5% benefit multiplier in their pension formula for service accrued after the transition date until they reach 30 years of service. Upon reaching 30 years of service, their member contribution rate would return to their current level (pre-Public Act 300 of 2012), and their pension formula for service in excess of 30 years would be based upon a 1.25% benefit multiplier.
(3) Maintain their current member contribution rate to the pension fund. The pension formula for years of service before the transition date is based upon a 1.5% benefit multiplier, while the pension formula for years of service after the transition date is based upon a 1.25% benefit multiplier.
(4) Cease member contributions to the DB portion of the pension fund. In this circumstance, the member would no longer receive future benefit accruals in the DB plan and would become a participant in the DC plan. The pension formula for years of service before the transition date is based upon a 1.5% benefit multiplier. The member's final average compensation would be frozen as of the transition date.

Members who did not make an election before the deadline were deemed to have elected Option (3), maintain their current member contribution rate and receive future accruals based upon a 1.25% benefit multiplier. There was no change in pension benefits to Pension Plus Plan (PPP) members. New members were given the option of electing between the PPP and the DC plan.

An additional provision of Public Act 300 of 2012 is that the impact of the Early Retirement Incentive (ERI) program of 2010 was re-amortized over a 10-year period, rather than a 5-year period. It is our understanding that the plan changes first affected the fiscal year 2014 budgeted employer contribution rates.

Public Act 300 of 2012 (Concluded)

Members who did not make an election before the deadline were deemed to have elected Option (3), maintain their current member contribution rate and receive future accruals based upon a 1.25% benefit multiplier. There was no change in pension benefits to Pension Plus Plan (PPP) members. As a result of Public Act 300 of 2012, new members were given the option of electing between the PPP and the DC plan. With the adoption of Public Act 92 of 2017, new members were given the option of electing between the Pension Plus 2 Plan (PPP2) and the DC plan. The current distribution of option elections for the total active membership (DB plus DC) as of September 30, 2020 is presented below:

Option 1 - Increase member contributions / 1.5% benefit multiplier after transition date	16 %
Option 2 - Increase member contributions and 1.5% benefit multiplier until 30 years of service	2
Option 3 - Current member contributions / 1.25% benefit multiplier after transition date	42
Option 4 - Cease DB member contributions / DC benefit after transition date	2
Option 5 - Not eligible to make an election or elected PPP	19
Option 6 - New hire who elected pure DC plan	15
Option 7 - New hire who elected PPP2	4

An additional provision of Public Act 300 of 2012 is that the impact of the Early Retirement Incentive (ERI) program of 2010 was re-amortized over a 10-year period, rather than a 5-year period.

It is our understanding that the plan changes first affected the fiscal year 2014 budgeted employer contribution rates.

Public Act 92 of 2017

A brief summary of the plan changes resulting from Public Act 92 of 2017 follows:

(1) Individuals that become members of MPSERS on or after February 1, 2018 (sometimes referred to as new hires) have the one-time choice between a Defined Contribution (DC) plan and a new Hybrid plan referred to as the Pension Plus 2 Plan (PPP2). The DC plan has an employer contribution of 4% of pay plus a 100% employer matching provision up to an additional 3% of a member's pay. The PPP2 is similar in nature to the Pension Plus Plan (PPP), with the following exceptions:
   a. The employer and member normal cost contribution rates are based upon a 50/50 cost sharing arrangement.
   b. The employer and member contribution rates associated with financing any unfunded actuarial accrued liabilities (UAAL) are based upon a 50/50 cost sharing arrangement.
   c. The MPSERS Board of Trustees has the ability to raise the normal retirement age (currently age 60) for active members if the life expectancy for a 65-year-old (based upon a unisex blend of 50/50) increases by a certain amount. The review of the age 65 life expectancy is based upon the mortality tables adopted as part of the normal 5-year Experience Study process. If a change to the normal retirement age is adopted, certain members who are near the then current retirement age would not be subject to the updated normal retirement age.
   d. Changes to the UAAL are amortized over a 10-year period using level dollar amortization.
   e. The discount rate for actuarial valuation purposes is 6%.

(2) The default election for a new hire is the DC plan.

(3) If the actuarial funded ratio of the PPP2 falls below 85% for two consecutive actuarial valuations, the PPP2 has the potential of being closed to new hires going forward. The actuarial funded ratio is based upon the actuarial value of assets (i.e., 5-year smoothing of investment returns).

(4) Members hired on or after February 1, 2013 who selected the DC plan receive the enhanced employer contribution structure of the new DC plan. Members hired before February 1, 2013 who selected the DC plan as part of the Public Act 300 (PA 300) reform do not receive the enhanced employer contribution rate structure. (Public Act 169 of 2018 later extended the enhanced DC structure to members hired before February 1, 2013 who selected the DC plan as part of PA 300.)

(5) Beginning with the State's fiscal year ending September 30, 2018 (applicable to Non-Hybrid and PPP only):
   a. The normal cost contribution rate must not be less than the normal cost contribution rate in the immediately preceding State fiscal year.
   b. The contribution rate associated with financing the UAAL must not be less than the contribution rate associated with financing the UAAL in the immediately preceding State fiscal year. This provision is applicable until such time as the UAAL is "paid off."

The normal cost and UAAL floors described in bullet (5) are not reflected in the contribution requirements shown in this valuation report.

Public Act 181 of 2018

A brief summary of the plan changes resulting from Public Act 181 of 2018 follows:

(1) For purposes of amortizing the UAAL, the legislation requires a transition from level percentage of payroll amortization to level dollar amortization by reducing the payroll growth assumption for amortization purposes according to the following schedule: 3.50% for the September 30, 2017 and 2018 valuations, dropping 0.50% each subsequent year starting with the September 30, 2019 valuation, until an ultimate payroll growth assumption for amortization purposes of 0.00% is reached beginning with the September 30, 2025 valuation.
(2) Starting with the determination of the fiscal year 2025 employer contribution requirements, ORS is allowed to reduce the payroll growth assumption in 25 basis point increments, rather than in 50 basis point increments, if the cost of reducing the payroll growth assumption by 50 basis points would increase the amortization payment by more than 7% of the prior year's UAAL payment.
(3) The basis over which the UAAL contribution rate will be applied is changing to payroll adjusted by the growth rate of "payroll plus purchased services." (Public Act 512 of 2018 later reversed this provision.)
(4) The UAAL contribution floor is changing from a rate floor to a dollar floor starting with the employer contributions in fiscal year 2022.