VIA ACTUARIAL SOLUTIONS

Minnesota Legislative Commission on Pensions and Retirement

Replication of July 1, 2024 Teachers Retirement Association of Minnesota Actuarial Valuation Report

June 30, 2025




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Minnesota Legislative Commission on Pensions and Retirement
Centennial Office Building, 1st floor
658 Cedar St.
St. Paul, MN 55155

Attn: Susan Lenczewski, Executive Director

Re: Replication of July 1, 2024 Teachers Retirement Association of Minnesota Actuarial Valuation Report

This report presents our replication of the July 1, 2024 actuarial valuation report for the Teachers Retirement Association of Minnesota (TRA or Plan). It provides various exhibits illustrating the degree to which we were able to replicate both (1) the retained actuary's liability calculations and (2) their use of those liabilities to determine contribution rates and sufficiency.

> **In our professional opinion, we were able to reasonably match the retained actuary's data inputs, liability calculations, and contribution determinations. We did not find any meaningful differences or deficiencies in their calculations, and we provide commentary on the few areas where subsets of our results diverged from the retained actuary. In general, these instances were very limited.**

Purpose of the Study

This study was prepared at the request of the Legislative Commission on Pensions and Retirement (LCPR). Its sole purpose is to replicate the July 1, 2024 TRA actuarial valuation calculations for reasonability, accuracy, and compliance with applicable Minnesota Statutes; LCPR standards for actuarial work; and relevant Actuarial Standards of Practice (ASOPs).

The report is intended to comply with Minnesota Statute 356.214 Subd. 4(b) which states that the auditing actuary shall:

> **"audit the valuation reports submitted by the actuary retained by each governing or managing board or administrative official, and provide an assessment of the reasonableness, reliability, and areas of concern or potential improvement in the specific reports reviewed, the procedures utilized by any particular reporting actuary, or general modifications to standards, procedures, or assumptions that the commission may wish to consider."**

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Data Used in the Analysis

The results in this report are based on the following data sources:

- July 1, 2024 actuarial valuation report prepared by TRA's retained actuary;
- July 1, 2024 census data files provided by TRA, and "scrubbed" census files provided by the retained actuary; and
- July 1, 2024 asset and financial data found in TRA's audited financial statements.

Although we reviewed all data sources for reasonability, we have not audited the underlying data and are relying on its substantial accuracy. If any data supplied is not accurate and complete, then our conclusions in this actuarial valuation replication may differ significantly.

We wish to thank all the parties involved for providing information in a timely manner and for answering our questions. We are particularly grateful to the staff at Cavanaugh Macdonald Consulting, LLC for their help answering questions about their valuation system's technical calculations.

Actuarial Certification

To the best of our knowledge, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices.

Upon receipt of the report, the LCPR should notify us if you disagree with any information contained in the report or if you are aware of any information that would affect the results that has not been communicated to us. The report will be deemed final and acceptable to the LCPR unless you immediately notify us otherwise.

The undersigned credentialed actuaries are members of the American Academy of Actuaries and meet the Academy's Qualification Standards to render the actuarial opinion contained herein. We are available to answer questions on the material contained in the report or to provide explanations or further detail, as may be appropriate. We are not aware of any financial interest or relationship that could create a conflict of interest or impair the objectivity of our work.

Signature redacted Signature redacted

Mark W. Schulte, FSA, EA, MAAA
Consulting Actuary

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Consulting Actuary

L/D/C/R:5/lml/mjc/emk/mws

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Executive Summary

This report summarizes our replication of the July 1, 2024 TRA actuarial valuation report. We conclude that the retained actuary reasonably determined the Plan's July 1, 2024 actuarial liabilities and contribution sufficiency/(deficiency).

We did not find any meaningful differences or deficiencies in the retained actuary's data or calculations. Overall liabilities and contributions were matched with sufficient accuracy, and we provide commentary on the few areas where subsets of our results diverged from the retained actuary. In general, these instances were very limited.

There is one technical note on page 5 regarding the valuation of liabilities for former members with non-vested benefits. We believe the retained actuary's calculations are reasonable, but they are slightly different than the methods used to value similar benefits for non-vested members in the other statewide pension systems.

	TRA Actuarial Valuation	VIA Replication	Difference[1]
Participant data			
Active members	85,962	85,962	0.0%
Service retirements	63,128	63,133	0.0%
Survivors	6,920	6,918	0.0%
Disability retirements	432	428	-0.9%
Deferred retirements	20,606	20,605	0.0%
Other non-vested terminations	41,476	41,477	0.0%
Total	**218,524**	**218,523**	0.0%
System assets *($1,000's)*			
Market value of assets	$ 29,092,479	$ 29,092,479	0.0%
Actuarial Value of Assets	28,322,800	28,322,800	0.0%
System liabilities *($1,000's)*			
Present Value of Future Benefits (PFVB)	43,471,130	43,030,360	-1.0%
Present Value of Future Normal Costs (PVFNC)	8,024,330	7,865,935	-2.0%
Actuarial Accrued Liability (AAL)	35,446,800	35,164,425	-0.8%
Normal Cost (NC)	720,328	697,777	-3.1%
System contributions *(% of payroll)*			
Normal cost rate	11.08%	10.76%	-0.32%
UAAL amortization payment	7.09%	6.82%	-0.27%
Expenses	0.29%	0.29%	0.00%
Total required contribution (Chapter 356)	18.46%	17.87%	-0.59%
Statutory contribution rate (Chapter 354)	17.21%	17.21%	0.00%
Contribution sufficiency/(deficiency)	-1.25%	-0.66%	0.59%

[1] The TRA contribution comparisons are absolute differences presented as a percent of payroll. All other comparisons are the relative differences between our replication results and the retained actuary.

Process Overview

The purpose of this report is to replicate (1) the technical calculation of the Plan's actuarial liabilities and (2) the contribution rates and sufficiency results based on those liabilities.

Our report focuses on replicating the following items:

1. Census data summaries;
2. Market asset data and Actuarial Value of Assets calculations;
3. Calculation of Plan liabilities;
4. Calculation of contribution sufficiency/(deficiency);
5. Confirmation of actuarial assumptions, methods, and plan provisions; and
6. Review of additional compliance items.

The table below summarizes how our valuation replication report incorporates each of these items.

Census data	▪ Compare participant category counts and summary statistics for the retained actuary vs. system census data files ▪ Compare detailed participant distributions for the retained actuary's census file vs. the valuation report summaries
Plan assets	▪ Compare market asset values in the valuation report to those in TRA's audited financial statements ▪ Replicate retained actuary's Actuarial Value of Assets calculations
Plan liabilities	▪ Replicate technical liability calculations, including Present Value of Future Benefits (PVFB), Present Value of Future Normal Costs (PVFNC), Actuarial Accrued Liability (AAL), and Normal Cost (NC) ▪ Compare liability calculations for various member status groups
Contribution sufficiency/(deficiency)	▪ Replicate the required normal cost and supplemental contribution rate calculations ▪ Replicate retained actuary's contribution sufficiency/(deficiency) determination
Assumptions, methods, and plan provisions	Verify that the actuarial assumptions, methods, and plan provisions used in the July 1, 2024 actuarial valuation are consistent with applicable Minnesota Statutes and TRA's recent actuarial experience studies.
Additional compliance requirements	Confirm that other aspects of the valuation report comply with applicable Minnesota Statutes, the LCPR's Standards for Actuarial Work, and relevant actuarial standards of practice (ASOPs).

Census Data

Census data is a foundational input for actuarial calculations. While it is not practical for data to be perfect, it should be reviewed for overall accuracy and reasonability.

Guidance on actuarial data is provided by Actuarial Standard of Practice No. 23, Data Quality (ASOP 23). It provides, in summary, that "The actuary should use available data that, in the actuary's professional judgment, allow the actuary to perform the desired analysis. However, if material data limitations are known to the actuary, the actuary should disclose those limitations and their implications".

To validate the census data used in the July 1, 2024 actuarial valuation report, we used the following process:

- Request separate census files from the retained actuary and TRA;
- Compare overall census counts and summary statistics for various member classes (e.g., active members, service retirements, etc.); and
- Prepare detailed participant statistical distribution tables and compare them to those found in the retained actuary's July 1, 2024 actuarial valuation report.

Overall, we found that the census data used by the retained actuary was consistent with the census data provided by TRA. Our census data comparisons and tables can be found in **Appendix A**. These exhibits are described below, along with some brief commentary.

Summary of participant statistics: This table summarizes and compares participant counts and high-level participant category statistics for the retained actuary and TRA census files. It shows that the two files were very closely aligned.
Distribution of active members: This table summarizes the retained actuary's active member data by classifying them in various age/service categories, along with the average pay for each classification. We found that this data was consistent with a similar summary table on page 54 of the July 1, 2024 actuarial valuation report.
Distributions of service retirements, survivors, and disability retirements: These tables summarize the retained actuary's inactive member data by classifying them by age and service since retirement/death/disability, along with the average annual benefit for each classification. We found that the data in each of these tables was consistent with similar tables found on pages 55-61 of the July 1, 2024 actuarial valuation report.

Plan Assets

Asset data is another of the foundational inputs for actuarial calculations. In addition to the Market Value of Assets, many public sector pension plans also use a smoothed Actuarial Value of Assets (AVA). The purpose of AVA methods is to stabilize contribution rates by smoothing investment returns – generally over a five-year period.

Guidance on asset smoothing methods is provided by Actuarial Standard of Practice No. 44, Selection and Use of Asset Valuation Methods for Pension Plans (ASOP 44). It provides considerations for selecting an actuarial asset method, including:

- Purpose of the measurement;
- Objectives of the employer and/or retirement system;
- Use of different methods/assumptions and adjustment for timing differences; and
- Other considerations such as the plan's expected future cash flows and liquidity needs.

Actuarial Standard of Practice No. 4, Measuring Pension Obligations and Determining Pension Plan Costs or Contributions (ASOP 4) also provides guidance, but generally defers to ASOP 44. The specific methodology for determining the AVA is prescribed in Minnesota Statutes, Section 356.215, Subd.1(f).

To validate the asset data and AVA calculations used in the July 1, 2024 actuarial valuation report, we used the following process:

- Review audited financial data and compare it to the information disclosed in the actuarial valuation report; and
- Replicate the AVA calculations shown in the July 1, 2024 actuarial valuation report.

We found that the asset data used by the retained actuary was consistent with TRA's audited asset information. We were also able to replicate the AVA calculation prepared by the retained actuary and confirm it follows the methods prescribed in Minnesota Statutes. Our asset data comparison can be found in Appendix B, and the AVA replication can be found in Appendix C.

Plan Liabilities

Actuarial liabilities are calculated by programming actuarial software with a retirement system's data, assumptions, methods, and plan provisions. This is a complex process which involves substantial effort and actuarial programming experience.

For the replication, we independently programmed our valuation software based on our understanding of the data, assumptions, methods, and plan provisions used in the July 1, 2024 actuarial valuation report, Minnesota Statutes, and the LCPR's standards for actuarial work. The primary results we replicated are:

- **Present Value of Future Benefits (PVFB):** plan liability equal to the discounted value of all projected future benefit payments (based on current participant group with projected compensation and service accruals).
- **Normal Cost (NC):** the portion of the PVFB attributed to the valuation year based on current compensation levels.
- **Present Value of Future Normal Costs (PVFNC):** the portion of the PVFB attributed to future years based on the present value of projected participant compensation.
- **Actuarial Accrued Liability (AAL):** the portion of the PFVB attributed to prior years based on each participant's historical and projected compensation.

We expect some liability calculation differences even if we used the exact same inputs as the retained actuary. This is because each actuarial software program may have slightly different ways of applying actuarial formulas. As a general rule, we would like to match the overall PVFB and AAL within 2% and PVFNC and Normal Cost within 5% of the retained actuary's results.

Results for member subgroups or split by benefit source may differ by larger magnitudes depending on how each actuary interprets and programs their actuarial software. We believe these differences are acceptable as long as they are small relative to the overall plan.

We matched the liability for former members without vested rights by using the same methodology as the retained actuary – the liability is equal to the total of all member's accumulated contributions with interest as of the valuation date. This methodology is different than what is currently used for the other Minnesota statewide retirement plans. The liability for this group in other plans is the present value of the projected account balance at retirement. Either methodology may be acceptable; we are simply noting the distinction since TRA uses a different method than the other pension systems.

The tables in **Appendix D** summarize and compare the liability measurements for different membership groups. **Our overall results are very close to those presented in the July 1, 2024 actuarial valuation, and we believe that the retained actuary is reasonably calculating plan liabilities.**

Contribution Sufficiency/(Deficiency)

TRA's statutory pension contribution rates are defined in Chapter 354 of Minnesota Statues, but the retained actuary is also required to calculate "required contributions" per Chapter 356.215 of Minnesota Statutes. The required contribution rates are those which are expected to fully fund the pension plan by the statutory full funding date.

We replicated the contribution sufficiency/(deficiency) calculations as follows:

- **Statutory contributions:** We calculated the estimated dollar value of the statutory normal cost contributions based on the retained actuary's blended statutory normal cost contribution rates applied to our replication of projected payroll. These amounts are added to the statutory supplemental contribution rates to determine the total statutory contribution rate.
- **Required contributions:** We calculated the estimated "percent of payroll" and dollar value of the contributions required to fully fund the plan based on the Chapter 356.215 required contribution rates. These consist of normal cost contributions plus the required supplemental contribution rate. The normal cost and supplemental components of the required contributions were based on our replication of TRA's normal cost, Unfunded Actuarial Accrued Liability, and projected payroll through the statutory June 30, 2048 full funding date.
- **Contribution sufficiency/(deficiency):** We compare our contribution sufficiency calculation (i.e., difference between the statutory and required contributions) to those determined by the retained actuary in the July 1, 2024 actuarial valuation report.

The tables in **Appendix E** summarize and compare our calculations. **Our overall results are close to those calculated by the retained actuary, and we believe that the retained actuary is reasonably calculating the contribution sufficiency/(deficiency).**

Assumptions, Methods, and Plan Provisions

The retained actuary's July 1, 2024 actuarial valuation report contains a detailed description of the actuarial assumptions, methods, and plan provisions used to prepare their results. These items are summarized in their report on pages 63 through 88. We do not reprint all the assumptions, methods, and plan provisions in this replication report, but we do provide a high-level commentary below.

Actuarial Methods
Actuarial Cost Method: Minnesota Statutes, Section 356.215 Subd.1(b) and (d) require that TRA use the Entry Age Normal level percent of pay actuarial cost method. In this method, the actuarial Present Value of Future Benefits (PVFB) for each individual is allocated as a level percent of pay from entry age (hire age, for most employees) to decrement age (e.g., expected age at termination or retirement). The portion of the PVFB allocated to the valuation year is called the Normal Cost (NC). The portion of the PVFB allocated to past years is called the Actuarial Accrued Liability (AAL). The retained actuary documents using this cost method in their report, and the closeness of our replication liabilities (Appendix D) indicate that it was applied appropriately.
Asset valuation method: The asset valuation method is used to smooth market fluctuations over time to create contribution stability. Minnesota Statutes, Section 356.215 Subd.1(f) requires using an Actuarial Value of Assets that smooths investment gains and losses over a five-year period. We confirmed that the retained actuary described and used the statutory asset smoothing method, and our replication calculations can be found in Appendix C of this report.
Contribution method: The contribution method specifies a process for funding the current year incurred liabilities (the Normal Cost) plus paying down/amortizing a portion of unfunded past liabilities (the Unfunded Actuarial Accrued Liability, or UAAL amortization). These contribution parameters are defined in Minnesota Statutes, Section 356.215 Subd.5 and Subd.11. They specify that (1) the Normal Cost must be expressed as a level percent of payroll and (2) the required supplemental contribution must be calculated by amortizing the UAAL as a level percent of projected payroll over the closed period ending June 30, 2048. Minnesota Statutes, Section 356.215 Subd. 11, paragraph (b) also contains a provision for adjusting the target amortization date if there has been a change in actuarial assumptions, methods, or plan provisions. Our understanding is that the assumption and plan changes valued in the July 1, 2024 report produced a net UAAL reduction, so these changes did not affect the statutory amortization end date (2048). We confirmed that pages 27-34 of the July 1, 2024 actuarial valuation report describes the correct contribution calculation process, and our replication calculations (Appendix E of this report) indicate that the retained actuary applied the methods and assumptions appropriately.

Actuarial Assumptions

Demographic assumptions: We verified that the demographic assumptions described in the July 1, 2024 actuarial valuation report were based on those developed in the 2018-2022 actuarial experience study dated August 2, 2023. The allowance for Combined Service Annuity assumptions are based on the LCPR prior actuary's report dated October 2016.

Economic assumptions: We verified that the economic assumptions described in the July 1, 2024 actuarial valuation report were based on those developed in the 2018-2022 experience study, and an investment return assumption and discount rate per Minnesota Statute, Section 356.215 Subd.8(a). They also include the COLA, salary scale, payroll growth, and other assumptions described in 356.215 Subd.8(b)-(d) and Subd.9

We also confirmed that demographic and economic assumptions used in the valuation are consistent with those described in Appendix A (effective July 1, 2024) to the LCPR's Standards for Actuarial Work. These assumptions include 2.5% price inflation, 3.00% payroll growth, service-based salary increase table, and PUB-2010 mortality tables.

Plan Provisions

Minnesota Statutes, Chapter 354 describes the retirement benefits provided to TRA members, and the primary service annuity formulas. We reviewed the plan provisions summarized in the July 1, 2024 actuarial valuation report and believe they are consistent with our understanding of the benefits described in Minnesota Statutes.

Additional Compliance Requirements

In addition to correctly summarizing and applying the assumptions, methods, and plan provisions, the actuarial valuation report must comply with other statutory requirements and professional standards. We reviewed the July 1, 2024 TRA actuarial valuation report for compliance with applicable Minnesota Statutes, LCPR Actuarial Standards, and relevant Actuarial Standards of Practice. We found that the report complied with all major guidance in these sources. The primary items we reviewed, along with any relevant observations, are summarized in the tables below.

Minnesota Statute Compliance

The applicable Minnesota Statutes include Sections 356.214 (actuarial valuation preparation) and 356.215 (actuarial valuations and experience studies). We confirmed compliance with the following requirements as described below.

Normal cost	Calculated as a level percentage of payroll per 356.215 Subd.5
Amortization of unfunded liabilities	Amortized as a level percent of payroll ending June 30, 2048 per 356.215 Subd.11
Measurement of actuarial gains and losses	Required gain/loss items measured per 356.215 Subd.12
Report contents	Consistent with the remaining requirements of 356.215 Subd.4 through 18. These include presentation of the accrued liability, membership tabulations, and summary of plan provisions.

LCPR Actuarial Standards Compliance

In addition to specific actuarial assumptions (described earlier in this report), the LCPR's Standards for Actuarial Work and its Appendix A specify actuarial cost methods and detailed report contents. We confirmed compliance with these requirements as described below.

Actuarial cost methods	Entry age cost method, benefits recognized, and contribution rates calculated per Standards, Section III
Report contents	All required elements included per Standards, Section IV

Actuarial Standards of Practice Compliance

Actuarial Standards of Practice (ASOPs) provide broad standards that all actuaries must follow as part of our professional standards. The relevant ASOPs for pension actuarial reports include:

- ASOP 4, Measuring Pension Obligations and Determining Pension Plan Costs or Contributions
- ASOP 23, Data Quality
- ASOP 27, Selection of Economic Assumptions for Measuring Pension Obligations
- ASOP 35, Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations[2]
- ASOP 41, Actuarial Communications
- ASOP 44, Selection and Use of Asset Valuation Methods for Pension Valuations
- ASOP 51, Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions
- ASOP 56, Modeling

We reviewed the report and believe that it adequately complies with all relevant Actuarial Standards of Practice, including ASOPs 4, 23, 27, 35, 41, 44, 51, and 56.

We specifically note CavMac's compliance with revised ASOP 4 which is effective for actuarial reports with measurement dates on or after February 15, 2023. ASOP 4 requires presentation and discussion of additional pension risk information. This includes disclosure of a Low-Default-Risk Obligation Measure (LDROM) and commentary about any concerns with the Actuarially Determined Contribution (ADC) or funding policy. The actuarial valuation report includes an LDROM analysis on page 39, and addresses implications of the contribution allocation procedures and funding policy on page 29.

[2] Note that ASOP 35 was recently repealed and its guidance was combined with a revised ASOP 27. This change does not affect the conclusions of our review.

Appendix A – Census Data Comparisons

The exhibits below compare the participant counts and certain data statistics between the "raw" TRA data and the "scrubbed" actuarial data.

Summary of Participant Statistics

	Retained Actuary	System Data	Difference
Active members	**85,962**	**85,962**	**0**
Average age	43.7	43.7	0.0%
Average service	12.4	12.4	0.0%
Average salary	$ 71,119	$ 71,119	0.0%
Service retirements	**63,128**	**63,133**	**5**
Average age	75.3	75.3	0.0%
Average annual annuity	$ 28,917	$ 28,916	0.0%
Survivors	**6,920**	**6,918**	**(2)**
Average age	82.9	82.9	0.0%
Average annual annuity	$ 28,209	$ 28,215	0.0%
Disability retirements	**432**	**428**	**(4)**
Average age	58.2	58.2	0.0%
Average annual annuity	$ 24,546	$ 24,656	0.4%
Deferred retirements	**20,606**	**20,605**	**(1)**
Average age	48.6	48.6	0.0%
Other non-vested terminations	**41,476**	**41,477**	**1**
Average refund	**$** 2,732	**$** 2,732	0.0%
Total	**218,524**	**218,523**	**(**1)

Note that the average refund amount for other non-vested terminations in the valuation report has been adjusted for the CSA load and does not match these results.

Distribution of Active Member Data

The table below summarizes our review of the retained actuary's active member data by age and years of service, and it also includes the average earnings for each grouping. It can be compared to the similar summary table on page 54 from the July 1, 2024 actuarial report. We find that the entries compare well to those in the actuarial valuation report.

Years of Service as of July 1, 2024

Age	<3	3-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40+	Total
<25	2,778	99									**2,877**
Avg pay	37,659	53,949									**38,219**
25-29	3,757	2,947	2,127								**8,831**
Avg pay	42,316	53,952	60,392								**50,552**
30-34	2,106	1,342	5,131	1,563							**10,142**
Avg pay	42,198	56,886	64,748	74,886							**60,587**
35-39	1,839	932	3,001	4,591	1,046						**11,409**
Avg pay	39,542	59,023	68,309	78,096	87,231						**68,587**
40-44	1,888	808	2,249	2,594	4,315	1,205					**13,059**
Avg pay	38,109	59,440	70,003	79,547	89,169	96,622					**75,423**
45-49	1,415	589	1,661	1,594	2,165	3,939	1,232				**12,595**
Avg pay	36,515	58,697	70,203	79,913	87,073	96,082	100,137				**81,031**
50-54	1,023	435	1,126	1,188	1,285	1,961	3,757	832			**11,607**
Avg pay	35,404	54,370	67,882	77,700	85,417	92,204	97,615	101,058			**83,571**
55-59	773	318	761	786	925	1,091	1,926	2,576	205		**9,361**
Avg pay	33,383	57,117	66,883	77,955	81,289	88,821	94,490	97,312	101,171		**83,500**
60-64	593	181	397	417	500	617	728	630	287	27	**4,377**
Avg pay	24,539	44,583	61,604	71,518	78,774	84,607	91,390	95,784	97,894	97,403	**74,501**
65-69	389	69	146	119	121	105	93	47	32	31	**1,152**
Avg pay	14,802	41,588	49,494	67,939	80,590	89,955	91,612	88,809	102,556	100,997	**54,029**
70+	343	48	57	24	17	18	13	8	6	18	**552**
Avg pay	9,333	23,354	32,779	45,637	69,781	92,529	97,606	75,432	111,942	109,027	**26,529**
Total	**16,904**	**7,768**	**16,656**	**12,876**	**10,374**	**8,936**	**7,749**	**4,093**	**530**	**76**	**85,962**
Avg pay	**37,526**	**55,634**	**66,078**	**77,811**	**86,736**	**93,546**	**96,583**	**97,698**	**99,602**	**101,622**	**71,119**

Distribution of Service Retirements

The table below summarizes our review of the retained actuary's service retirement data by age and years since retirement, and it also includes the average annual pension benefit for each grouping. It can be compared to the similar summary table on page 55 from the July 1, 2024 actuarial report. We find that the entries compare well to those in the actuarial valuation report.

Years Since Retirement as of July 1, 2024

Age	<1	1-4	5-9	10-14	15-19	20-24	25+	Total
<55								
Avg benefit								
55-59	216	793	3					**1,012**
Avg benefit	41,078	39,761	29,996					**40,013**
60-64	577	3,345	1,563	3				**5,488**
Avg benefit	39,661	40,462	31,940	31,610				**37,946**
65-69	504	3,607	4,590	1,859	9			**10,569**
Avg benefit	23,734	26,135	29,286	25,899	32,618			**27,353**
70-74	57	859	4,790	5,774	3,038	68	1	**14,587**
Avg benefit	25,327	21,401	24,273	28,014	27,035	37,764	1,797	**26,225**
75-79	11	123	900	3,953	5,114	3,925	395	**14,421**
Avg benefit	50,536	22,274	21,489	24,868	28,331	26,702	34,092	**26,634**
80-84	2	18	75	535	1,912	3,738	3,066	**9,346**
Avg benefit	153,644	43,759	24,545	22,097	23,998	26,615	30,508	**27,142**
85-89	1	5	11	50	205	1,052	3,722	**5,046**
Avg benefit	864	56,660	23,558	16,605	19,117	24,291	36,289	**32,880**
90+		2	1	10	23	75	2,548	**2,659**
Avg benefit		30,510	7,970	17,633	17,445	25,217	38,810	**38,144**
Total	**1,368**	**8,752**	**11,933**	**12,184**	**10,301**	**8,858**	**9,732**	**63,128**
Avg benefit	**33,645**	**32,381**	**26,997**	**26,356**	**26,941**	**26,451**	**35,035**	**28,917**

Distribution of Survivors

The table below summarizes our review of the retained actuary's survivor data by age and years since death, and it also includes the average annual pension benefit for each grouping. It can be compared to the similar summary table on page 58 of the July 1, 2024 actuarial report. We find that the entries compare well to those in the actuarial valuation report.

Years Since Death as of July 1, 2024

Age	<1	1-4	5-9	10-14	15-19	20-24	25+	Total
<45	12	70	49	28	8	1	1	**169**
Avg benefit	13,723	20,993	18,592	12,807	16,574	510	1,233	**17,977**
45-49	10	36	10	4	3	1	2	**66**
Avg benefit	18,142	18,359	16,749	16,354	20,423	6,291	17,937	**17,859**
50-54	12	49	22	11	12	5	4	**115**
Avg benefit	30,443	20,022	16,447	22,894	11,023	7,715	28,489	**19,521**
55-59	8	41	55	23	10	5	6	**148**
Avg benefit	30,076	22,371	19,423	11,389	20,049	16,670	33,385	**20,082**
60-64	17	81	63	32	11	6	5	**215**
Avg benefit	26,096	25,433	21,640	17,697	11,813	21,800	21,992	**22,344**
65-69	34	124	121	49	41	15	11	**395**
Avg benefit	24,175	24,423	21,451	18,740	16,708	19,778	15,658	**21,565**
70-74	71	242	204	109	53	18	20	**717**
Avg benefit	25,137	22,781	22,751	23,490	21,451	15,754	15,775	**22,643**
75-79	92	463	343	206	111	55	38	**1,308**
Avg benefit	25,710	24,788	24,474	24,200	24,635	21,192	19,823	**24,369**
80-84	127	491	364	213	147	82	92	**1,516**
Avg benefit	26,305	27,669	28,660	29,137	28,898	27,475	25,836	**27,996**
85-89	88	398	337	182	119	85	104	**1,313**
Avg benefit	34,089	33,030	34,027	36,960	35,016	33,523	30,240	**33,892**
90+	39	219	221	169	105	73	132	**958**
Avg benefit	37,284	35,161	39,523	40,794	42,177	44,868	37,173	**39,033**
Total	**510**	**2,214**	**1,789**	**1,026**	**620**	**346**	**415**	**6,920**
Avg benefit	**27,769**	**27,344**	**28,025**	**29,040**	**29,123**	**30,009**	**29,232**	**28,209**

Distribution of Disability Retirements

The table below summarizes our review of the retained actuary's disability retirement data by age and years since disability retirement, and it also includes the average annual pension benefit for each grouping. It can be compared to the similar summary table on page 61 of the July 1, 2024 actuarial report. We find that the entries compare well to those in the actuarial valuation report.

Years Disabled as of July 1, 2024

Age	<1	1-4	5-9	10-14	15-19	20-24	25+	Total
<45		11	8	1				**20**
Avg benefit		12,631	11,191	7,157				**11,781**
45-49	3	7	6	5	1			**22**
Avg benefit	26,033	22,317	11,521	11,452	2,850			**16,525**
50-54	2	22	21	11	5	2		**63**
Avg benefit	42,071	28,542	23,477	13,452	6,269	5,097		**22,136**
55-59	8	53	38	14	7	5	3	**128**
Avg benefit	40,001	36,089	25,816	15,201	10,807	7,586	7,141	**27,824**
60-64	5	48	55	37	17	3	3	**168**
Avg benefit	46,328	31,373	28,157	22,338	15,492	14,967	3,894	**26,385**
65+	1	9	13	5	1	2		**31**
Avg benefit	10,181	27,259	22,021	12,804	6,900	1,680		**19,873**
Total	**19**	**150**	**141**	**73**	**31**	**12**	**6**	**432**
Avg benefit	**38,109**	**30,580**	**24,593**	**18,024**	**12,262**	**8,032**	**5,517**	**24,546**

Appendix B – Market Value of Assets Comparison

The exhibit below compares the market value of assets from the system's annual financial report to the amounts used by the retained actuary (see pages 16 and 17 in the July 1, 2024 valuation report). We find that the entries compare well, which indicates that the market asset data used in the valuation report was correct. All amounts shown are in $1,000's.

	Retained Actuary	System Financials
Assets in Trust		
Cash, equivalents, short term securities	568,701	568,701
Fixed income	6,817,675	6,817,675
Equity and private equity	14,642,149	14,642,149
Other	8,309,555	8,309,555
Total Assets in Trust	**30,338,080**	**30,338,080**
Assets Receivable	30,644	30,644
Amounts Payable	(1,276,245)	(1,276,245)
Net Assets Held in Trust for Pension Benefits	**29,092,479**	**29,092,479**

Appendix C – Actuarial Value of Assets Replication

The exhibit below compares the retained actuary's July 1, 2024 AVA calculation (see page 19 in the July 1, 2024 valuation report) to our replication. The calculations match and are consistent with relevant Minnesota Statutes, Section 356.215, Subd.1(f) so we believe they were prepared correctly. All amounts shown are in $1,000's.

		Retained Actuary	VIA Match
1.	**Market value of assets available for benefits**	**29,092,479**	**29,092,479**
2.	Determination of average asset balance		
	a. Total assets at beginning of year	26,754,503	26,754,503
	b. Total assets at end of year	29,092,479	29,092,479
	c. Net investment income for fiscal year	3,199,055	3,199,055
	d. Average balance (a. + b. - c.)/2	26,323,964	26,323,964
3.	Expected return (7.0% x 2.d.)	1,842,677	1,842,677
4.	Actual return	3,199,055	3,199,055
5.	Current year asset gain/(loss) (4. - 3.)	1,356,378	1,356,378
6.	Unrecognized asset returns: Original Amount x Unrecognized %		
	a. FYE 2024: $1,356,378 x 80%	1,085,102	1,085,102
	b. FYE 2023: $333,761 x 60%	200,257	200,257
	c. FYE 2022: ($3,798,328) x 40%	(1,519,331)	(1,519,331)
	d. FYE 2021: $5,018,257 x 20%	1,003,651	1,003,651
	e. Total unrecognized amount	769,679	769,679
7.	**AVA at end of year (1. - 6.e.)**	**28,322,800**	**28,322,800**

Appendix D – Plan Liability Replications

The exhibits below compare our replication of the plan liabilities to those calculated by the retained actuary. We believe that the overall closeness of the results indicates the July 1, 2024 actuarial valuation report liabilities are reasonable. There are a couple of small benefit subclasses with larger differences (e.g., deferred retirements and refunds for active members) but these are very small relative to the overall plan. All amounts shown are in $1,000's.

Present Value of Benefits (PVB) Liability	Retained Actuary	VIA Replication	$ Difference	% Difference
Active members				
Retirement annuities	$ 20,893,229	$ 20,353,636	$ (539,593)	-2.6%
Disability benefits	425,247	422,390	(2,857)	-0.7%
Survivor benefits	195,106	198,860	3,754	1.9%
Deferred retirements	596,624	642,639	46,015	7.7%
Refunds	15,424	15,928	504	3.3%
Subtotal	$ 22,125,630	$ 21,633,453	$ (492,177)	-2.2%
Deferred retirements	1,076,989	1,069,998	(6,991)	-0.6%
Former members without vested rights	123,485	123,485	-	0.0%
Benefit recipients	20,145,026	20,203,424	58,398	0.3%
Total	**$ 43,471,130**	**$ 43,030,360**	**$ (440,770)**	**-1.0%**

Present Value of Future Normal Costs (PVFNC)	Retained Actuary	VIA Replication	$ Difference	% Difference
Active members				
Retirement annuities	$ 6,959,858	$ 6,727,532	$ (232,326)	-3.3%
Disability benefits	189,684	187,713	(1,971)	-1.0%
Survivor benefits	73,348	73,055	(293)	-0.4%
Deferred retirements	649,584	725,036	75,452	11.6%
Refunds	151,856	152,599	743	0.5%
Total	**$ 8,024,330**	**$ 7,865,935**	**$ (158,395)**	**-2.0%**

Actuarial Accrued Liability (AAL)	Retained Actuary	VIA Replication	$ Difference	% Difference
Active members				
Retirement annuities	$ 13,933,371	$ 13,626,104	$ (307,267)	-2.2%
Disability benefits	235,563	234,677	(886)	-0.4%
Survivor benefits	121,758	125,805	4,047	3.3%
Deferred retirements	(52,960)	(82,397)	(29,437)	55.6%
Refunds	(136,432)	(136,671)	(239)	0.2%
Subtotal	$ 14,101,300	$ 13,767,518	$ (333,782)	-2.4%
Deferred retirements	1,076,989	1,069,998	(6,991)	-0.6%
Former members without vested rights	123,485	123,485	-	0.0%
Benefit recipients	20,145,026	20,203,424	58,398	0.3%
Total	**$ 35,446,800**	**$ 35,164,425**	**$ (282,375)**	**-0.8%**

Normal Cost	Retained Actuary	VIA Replication	$ Difference	% Difference
Active members				
Retirement annuities	$ 627,363	$ 600,320	$ (27,043)	-4.3%
Disability benefits	16,253	15,694	(559)	-3.4%
Survivor benefits	6,501	6,604	103	1.6%
Deferred retirements	55,909	61,012	5,103	9.1%
Refunds	14,302	14,147	(155)	-1.1%
Total	**$ 720,328**	**$ 697,777**	**$ (22,551)**	**-3.1%**

Appendix E – Contribution Sufficiency/(Deficiency) Replication

The exhibit below compares our replication of the contribution calculations to the retained actuary's results. We begin by replicating the Supplemental Contribution Rate and then determine the Contribution Sufficiency/(Deficiency). We believe that the overall closeness of the results indicates the July 1, 2024 actuarial valuation report calculations are reasonable. All amounts shown are in $1,000's.

Supplemental Contribution Rate	Retained Actuary	VIA Replication	$ Difference	% Difference
1. Determination of Unfunded Actuarial Accrued Liability (UAAL)				
a. Actuarial accrued liability	$ 35,446,800	$ 35,164,425	$ (282,375)	-0.8%
b. Current assets (AVA)	28,322,800	28,322,800	-	0.0%
c. Unfunded actuarial accrued liability	$ 7,124,000	$ 6,841,625	$ (282,375)	-4.0%
2. Determination of Supplemental Contribution Rate				
a. Present value of future payrolls through the amortization date of June 30, 2048	$ 100,458,706	$ 100,255,400	$(203,306)	-0.2%
b. Supplemental contribution rate: (1.c. / 2.a.)	7.09%	6.82%		

	Retained Actuary	VIA Replication	$ Difference
Projected annual payroll for FY2024-2025	$ 6,501,070	$ 6,487,914	$ (13,156)

	Retained Actuary % of Payroll	Retained Actuary $ Amount	VIA Replication % of Payroll	VIA Replication $ Amount	% of Payroll Difference
1. Statutory Contributions - Chapter 354					
a. Employee contributions	7.75%	$ 503,836	7.75%	$ 502,813	0.00%
b. Employer contributions	8.91%	579,254	8.91%	578,073	0.00%
c. Supplemental Contributions					
i. 1993	0.08%	5,000	0.08%	5,000	0.00%
ii. 1996	0.05%	3,256	0.05%	3,256	0.00%
iii. 1997	0.20%	12,954	0.20%	12,954	0.00%
iv. 2014	0.22%	14,377	0.22%	14,377	0.00%
d. Total	17.21%	$ 1,118,677	17.21%	$ 1,116,473	0.00%
2. Required Contributions - Chapter 356					
a. Normal cost					
i. Retirement	9.65%	$ 627,363	9.26%	$ 600,320	-0.39%
ii. Disability	0.25%	16,253	0.24%	15,694	-0.01%
iii. Survivors	0.10%	6,501	0.10%	6,604	0.00%
iv. Deferred retirement	0.86%	55,909	0.94%	61,012	0.08%
v. Refunds	0.22%	14,302	0.22%	14,147	0.00%
vi. Total	11.08%	$ 720,328	10.76%	$ 697,777	-0.32%
b. Supplemental Contribution Amortization of UAAL	7.09%	$ 460,926	6.82%	$ 442,476	-0.27%
c. Allowance for Expenses	0.29%	18,853	0.29%	18,815	0.00%
d. Total	18.46%	$ 1,200,107	17.87%	$ 1,159,068	-0.59%
3. Contribution Sufficiency/(Deficiency)	-1.25%	$ (81,430)	-0.66%	$ (42,595)	0.59%