Deloitte.

Minnesota Legislative Commission on Pensions and Retirement

Actuarial Review of Retirement Systems as of July 1, 2014

Prepared by Deloitte Consulting LLP

June 2015

Contents

Actuarial Opinion

This report presents the results of the actuarial review performed by Deloitte Consulting, LLP of the July 1, 2014 actuarial valuations of selected statewide and major local Minnesota public retirement plans in accordance with Minnesota Statutes, Section 356.214, Subdivision 4, as directed by the Minnesota Legislative Commission on Pensions and Retirement ("LCPR" or "the Commission").

Our review was based on participant data and financial information provided by the systems and their actuaries. We assumed the data to be complete and accurate. Any subsequent changes to the data could change the results of our review. We did not independently audit the data and other information provided.

In our opinion, the July 1, 2014 actuarial valuations of the plans included in our analysis were performed in compliance with Minnesota Statutes, Section 356.215, with the Standards for Actuarial Work of the Commission, and with the applicable actuarial standards of practice issued by the Actuarial Standards Board. It is also our opinion that the actuarial liabilities and contribution rates developed are reasonable and reliable.

Future actuarial measurements may differ significantly from current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operations 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.

Our scope for this actuarial review did not include analyzing the potential range of such future measurements, and we did not perform that analysis.

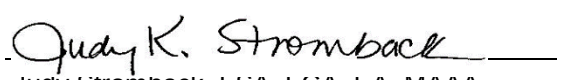
This report is prepared solely for the benefit and internal use of the LCPR and the State of Minnesota. This report is not intended for the benefit of any other party and may not be relied upon by any third party for any purpose. Deloitte Consulting accepts no responsibility or liability with respect to any party other than the LCPR and the State of Minnesota in accordance with its statutory and regulatory requirements.

The undersigned with actuarial credentials collectively meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein.

Any tax advice included in this written communication was not intended or written to be used, and it cannot be used by the taxpayer, for the purpose of avoiding any penalties that may be imposed by any governmental taxing authority or agency.

To the best of our knowledge, no employee of the Deloitte U.S. Firms is an officer or director of the systems. In addition, we are not aware of any relationship between the Deloitte U.S. Firms and the systems that may impair or appear to impair the objectivity of the work detailed in this report.

DELOITTE CONSULTING LLP



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Executive Summary

Intent

The intent of this report is to provide an assessment of the reasonableness and reliability of July 1, 2014 actuarial reports prepared by Minnesota retirement systems' retained actuaries and to review the compliance of those reports with Minnesota Statutes, Section 356.215, the Standards for Actuarial Work of the LCPR, and the applicable actuarial standards of practice.

Process

To achieve the above-stated goals, we have reviewed both system-provided and actuary-provided census data, high-level asset information, detailed sample life output from each actuary's valuation software and the July 1, 2014 actuarial reports themselves.

A detailed description of our process is contained in the Process Description section of our report.

Results and Recommendations

As stated in the previous section, it is our opinion that the July 1, 2014 actuarial valuations of the plans included in our analysis were performed in compliance with Minnesota Statutes, Section 356.215, with the Standards for Actuarial Work of the LCPR, and with the applicable actuarial standards of practice. It is also our opinion that the actuarial liabilities and contribution rates developed are reasonable and reliable.

We did not find any issues that rose to the level of serious concern; however, we have made recommendations that in our opinion may more accurately estimate the liabilities and appropriate contribution levels.

We have also noted potential changes to the reports that could be made to improve understanding of the actuarial work performed. In addition to clarifications for certain assumptions and plan provisions being valued, we recommend providing sensitivity analysis associated with certain assumptions.

These recommendations are discussed further in our Summary of Key Findings section as well as the detailed sections that follow.

Other Considerations

The following topics of significant importance to the Commission were not included in the scope of this review:

- Expected Return on Investments
- Mortality and Mortality Improvement Rates
- Funding Policy

While we touch briefly on these items in this report, we did not perform a detailed analysis of these issues. These topics will be included in the scope of future reports and presentations we will deliver to the Commission over the coming year. It is important to understand that while we state that it is our opinion that the valuation results are reasonable and reliable based on the statutory assumptions and funding policy, changes to those underlying items could significantly impact the funded status of the plans and projected contributions.

Summary of Key Findings and Recommendations by System

Deloitte Consulting performed an actuarial review of the July 1, 2014 actuarial valuation reports of the Minnesota State Retirement System (MSRS), the Minnesota Public Employees Retirement Association (PERA), the Minnesota Teachers Retirement Association (TRA), the St. Paul Teachers' Retirement Association (STPRFA), and the Duluth Teachers' Retirement Fund Association (DTRFA).

The plans reviewed within each system are summarized below. Please note that the General Plan within MSRS was excluded from this review because a separate replication valuation is being completed as of July 1, 2014 for that plan.

MSRS	PERA	TRA	SPTRFA	DTRFA
State Patrol	General	TRA	SPTRFA	DTRFA
Judges	Correctional			
Legislators	Police & Fire			
Correctional	MERF			

For all systems, we recommend the following changes be considered:

- We recommend the actuaries consider the likelihood that participants choose a refund of their employee contributions with interest, even when less than the present value of the annuity they are eligible to receive. Although not necessarily the participant's best financial decision, empirical evidence suggests this choice is not uncommon. We recognize the retained actuaries are correctly following the State of Minnesota Standards for Actuarial Work.
- The Combined Service Annuity scaling factors, which are used to reflect additional liabilities for participants who have transferred between systems, should be studied and confirmed. They have not been analyzed since 2002. Although we have no reason to believe the current factors are inaccurate, a significant change in these factors could change liability amounts by 1-2%.
- Over the past couple of years, several studies and papers have been published that draw focus to public plan funding methods. We recommend that the Commission review these studies and consider whether any changes should be made to the current funding policy.

The tables below summarize the key issues identified and estimated impact of any changes recommended for each specific system. In the sections that follow we provide the details supporting these findings and recommendations. Unless otherwise noted, the issue identified applies to all plans within the system noted.

Minnesota State Retirement System (MSRS)			
Area of Review	**Issues Identified**	**Impact of Change**	**Other Comments**
Actuarial Report	Because the Legislators plan is unfunded, we recommend disclosing undiscounted cash flows.	This information summarizes the outlay required by the plan, because it cannot rely on investment earnings.	Although not required, we believe this to be useful information in the case of an unfunded plan.

Public Employees Retirement Association (PERA)			
Area of Review	**Issues Identified**	**Impact of Change**	**Other Comments**
Compliance with State Statutes – Actuarial Assumptions	The Police & Fire plan is currently phasing-in early retirement factors (ERFs) for some participants based on valuation year instead of decrement year.	Because the changes in ERFs are not directionally consistent, liability differences are not easy to estimate but would be minimal.	Given that the phase-in schedule is known, it should be applied to all participants based on assumed decrement date.

Teachers Retirement Association (TRA)			
Area of Review	**Issues Identified**	**Impact of Change**	**Other Comments**
Overall	No recommendations outside of those noted above.		

St. Paul Teachers' Retirement Fund Association (SPTRFA)			
Area of Review	**Issues Identified**	**Impact of Change**	**Other Comments**
Data Validity	The system implemented new administration software and is reporting data to the actuary using that software for the first time as of this valuation.	Significant questions were posed by the actuary based on the prior year's valuation. The system relied on the actuary to identify inconsistencies between the 2014 and 2013 database, which we are unable to confirm.	After an administrative software replacement, this type of problem is difficult to avoid. It could be mitigated by additional checks during and after the actuarial valuation process, which we did not investigate as a part of this review.
Compliance with State Statutes – Actuarial Assumptions	84 deferred vested participants' liabilities are estimated based on employee contributions. Lack of salary history from the System prevents annuity valuation.	The liability for these participants is understated, but the impact on the plan's total liability is <1%.	Because the impact on liability is insignificant, we recommend disclosing the data assumption without adjusting the liability for these participants.

Duluth Teachers' Retirement Fund Association (DTRFA)			
Area of Review	**Issues Identified**	**Impact of Change**	**Other Comments**
Data Validity	Deferred vested participant benefits are being reported at earliest commencement age instead of Normal Retirement age.	The actuary does considerable work to back out outdated early retirement factors, and if necessary, re-apply current factors.	We have found no errors in this process in our review, but note the potential for errors due to the manual effort required.

Process Description

In accordance with Minnesota Statutes, Section 356.214, Subdivision 4(b), our role as the Commission's actuary is to "audit[1] 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."

Below is a description of the areas of review our analysis covered and the processes followed to achieve the directives set forth in the statute above.

- **Review of Census Data** – There are typical and anticipated adjustments made to census data in preparing an actuarial valuation. This section assesses the reasonableness of the retained actuary's reconciliation and data adjustment procedures, including their documentation in the valuation report. By comparing summary statistics from the valuation reports to our data analysis, we can highlight differences in the underlying processed data and the likely impact on cost. This section also determines the completeness, quality, and consistency of the data delivered by the system to the retained actuary, and aims to identify potential improvements in the current data collection process.

- **Review of Financial Data** - Adjustments are made to the systems' market value of assets to determine the actuarial value of assets. These adjustments impact valuation results and potential contribution rates. We reviewed the methods and calculations performed to determine the actuarial value of assets.

- **Review Compliance with State Statutes** – The plan provisions and some actuarial assumptions and methods are prescribed by State Statute. Our review identifies the applicable statutes, and compares their requirements against the provisions, assumptions, and methods valued and disclosed in the report by the systems' retained actuary. The applicable statutes are identified within our review of each component below.

- **Validation of Liabilities and Contribution Rates** – The liabilities reported in the actuarial valuations are an aggregation of the liability calculated for each individual participant. In this section, we review targeted Sample Lives to determine that the retained actuaries have reasonably calculated liabilities and contribution rates for each plan.

- **Review of Actuarial Report for completeness and correctness –** In this section, we review the content of the actuarial report for required disclosures and accuracy of information. We provide a summary of any inaccuracies contained within the report and areas of potential improvement.

These areas of review are conducted in accordance with applicable Actuarial Standards of Practice (ASOPs) and the Standards for Actuarial Work established by the State of Minnesota LCPR. The specific standards applicable to each review area are identified within each subsection.

[1] For purposes of this report, the term "audit" refers to an actuarial review of the work performed by the systems' actuaries. It does not refer to an audit under generally accepted government auditing standards.

Review of Census Data

Applicable ASOPs and State Statutes

Actuarial Standard of Practice No. 23, Data Quality, provides general guidance for determining if data is appropriate for its intended purpose and whether it is sufficiently reasonable, consistent, and comprehensive. The ASOP states:

> Data that are completely accurate, appropriate, and comprehensive are frequently not available. 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.

The purpose of this section is to determine the completeness, quality, and consistency of the data and the data transfer process from the system to the retained actuary.

This Standard also addresses the actuary's responsibilities in reviewing data upon which they rely and states that in such cases:

> …the actuary should review the data for reasonableness and consistency, unless, in the actuary's professional judgment, such review is not necessary or not practical. In exercising such professional judgment, the actuary should take into account the extent of any checking, verification, or auditing that has already been performed on the data, the purpose and nature of the assignment, and relevant constraints.

And:

> …judgmental adjustments or assumptions can be applied to the data that allow the actuary to perform the analysis.

Therefore, this section also assesses the reasonableness of the retained actuary's reconciliation and data adjustment procedures.

Minnesota State Retirement System (MSRS)

Quality of census data and the data transfer process by the system:
Census files provided to the retained actuary were reviewed to assess quality and consistency. The data counts and field values appear consistent, using prior valuations as a baseline. The data clearly identifies the applicable retirement plan and eligible benefits for each record. The method used by the actuary to obtain system data has been consistent over the last several years, and consists of the system providing a dataset containing all records in its data, which is processed by the actuary.

Records that were excluded were explainable. Thousands of participants from the system's data were excluded from the plan actuarial valuations, the majority of which are terminated Unclassified Participants. These participants may have been eligible to transfer to the MSRS General Plan while they were employed, depending on their date of hire and years of service, but are now certainly ineligible because they have terminated employment. Therefore, they have appropriately been excluded from any valuation. Exclusions were also made for participant records with certain status codes, indicating death and refund of employee contributions.

Overall, we believe the data received is of sufficient quality and completeness to perform the actuarial valuation. It contains both the information necessary to value benefits and exclude participants that are ineligible for benefits.

Data reconciliation and adjustment process performed by the actuary:
We have reviewed adjustments and assumptions that the actuary deemed necessary to create a valuation database for each plan. The actuary lists in their final reports the data adjustments and assumptions made in their data reconciliation. We have found the adjustments to be minimal, consistent, and reasonable.

The following tables provide a summary comparing the demographic statistics between the system (prior to adjustment) and the actuary's data for each plan. As illustrated, very few adjustments were required, and our review did not reveal any additional adjustments that we would recommend.

State Patrol

	System Data	Actuary Data	Difference
Active Members	858	858	-
Average Age	41.9	41.8	-0.2%
Average Service	12.4	12.4	-
Service Retirements	794	776	-2.3%
Average Age	68.6	68.4	-0.3%
Average Monthly Annuity	$ 4,875	$ 4,899	0.5%
Survivors	155	155	-
Average Monthly Annuity	$ 2,791	$ 2,791	-
Disability Retirements	36	54	50.0%
Average Monthly Annuity	$ 3,535	$ 3,643	3.1%
Deferred Retirements	44	44	-
Average Age	44.5	44.5	-
Average Monthly Annuity (at NRD)	$ 1,715	$ 1,715	-
Terminated Other Non-Vested	17	17	-
Total	1,904	1,904	-

Minnesota State Retirement System (Continued)

State Patrol (Continued)

The two items with differences greater than 1% are related to disabled individuals who reached full retirement age in FY 2014. The system classifies these individuals as part of the Service Retirement group. The actuary reclassified these individuals as disability retirements to accurately capture the increased mortality rates associated with this population. This is a new change for FY 2014 and will continue to improve the valuation analysis prospectively. We agree with the correction in status for these participants, and have confirmed that the number of people in the plan that moved from Service Retirement to Disability Retirement is appropriate.

All adjustments made by the actuary were replicated within a reasonable margin and we would suggest no changes to the adjustments being made. Very few gaps in data existed in the data provided by the system, and assumptions used to populate those gaps were reasonable.

Judges

	System Data	Actuary Data	Difference
Active Members	311	316	1.6%
Average Age	56.8	56.9	0.1%
Average Service	9.6	9.9	3.9%
Service Retirements	249	227	-8.8%
Average Age	59.3	74.6	25.8%
Average Monthly Annuity	$ 5,590	$ 5,509	-1.4%
Survivors	84	84	-
Average Monthly Annuity	$ 4,077	$ 4,077	-
Disability Retirements	2	24	1100.0%
Average Monthly Annuity	$ 4,194	$ 6,240	48.8%
Deferred Retirements	21	16	-23.8%
Average Age	59.3	57.3	-3.4%
Average Monthly Annuity (at NRD)	$ 4,285	$ 3,011	-29.7%
Terminated Other Non-Vested	-	-	-
Total	667	667	-

The adjustment in status code for participants previously coded as Service Retirements and corrected to be Disability Retirements applies to this group as well, but the impact as a percentage of counts and benefits is much greater due to the smaller size of the group and relatively large number of adjustments. In addition to that correction, five participants in the system data are being coded as Deferred Retirements because they reached a service cap. The actuary has correctly valued these participants as Actives.

All adjustments made by the actuary were replicated within a reasonable margin and we would suggest no changes to the adjustments being made. Very few gaps in data existed in the data provided by the system, and assumptions used to populate those gaps were reasonable.

Minnesota State Retirement System (Continued)

Legislators

	System Data	Actuary Data	Difference
Active Members	24	24	-
Average Age	66.7	66.6	-0.1%
Average Service	26.9	26.9	-
Service Retirements	301	301	-
Average Age	75.8	75.8	-
Average Monthly Annuity	$ 1,940	$ 1,940	-
Survivors	74	74	-
Average Monthly Annuity	$ 1,523	$ 1,523	-
Disability Retirements	-	-	-
Average Monthly Annuity	$ -	$ -	-
Deferred Retirements	63	63	-
Average Age	58.7	58.6	-0.2%
Average Monthly Annuity (at NRD)	$ 1,501	$ 1,501	-
Terminated Other Non-Vested	-	-	-
Total	462	462	-

No differences above necessitated further investigation.

All adjustments made by the actuary were replicated within a reasonable margin and we would suggest no changes in adjustments be made. Very few gaps in data existed in the data provided by the system, and assumptions used to populate those gaps were reasonable.

Correctional

	System Data	Actuary Data	Difference
Active Members	4,504	4,504	-
Average Age	41.5	41.5	-
Average Service	8.7	8.7	-
Service Retirements	2,115	2,075	-1.9%
Average Age	65.2	65.1	-0.2%
Average Monthly Annuity	$ 1,533	$ 1,532	-0.1%
Survivors	175	175	-
Average Monthly Annuity	$ 1,201	$ 1,201	-
Disability Retirements	228	268	17.5%
Average Monthly Annuity	$ 1,554	$ 1,563	0.6%
Deferred Retirements	1,232	1,232	-
Average Age	45.4	45.3	-0.2%
Average Monthly Annuity (at NRD)	$ 717	$ 717	-
Terminated Other Non-Vested	384	384	-
Total	8,638	8,638	-

Minnesota State Retirement System (Continued)

Correctional (Continued)

The two items with differences greater than 1% are related to disabled individuals who reached full retirement age in FY 2014. The system classifies these individuals as part of the Service Retirement group. The actuary reclassified these individuals as disability retirements to accurately capture the increased mortality rates associated with this population. This is a new change for FY 2014 and will continue to improve the valuation analysis prospectively. We agree with the correction in status for these participants, and have confirmed that the number of people in the plan that moved from Service Retirement to Disability Retirement is appropriate.

All adjustments made by the actuary were replicated within a reasonable margin and we would suggest no changes to the adjustments being made. Very few gaps in data existed in the data provided by the system, and assumptions used to populate those gaps were reasonable.

Public Employees Retirement Association of Minnesota (PERA)

Quality of census data and the data transfer process by the system:
Census files provided to the retained actuary were reviewed to assess quality and consistency. The data counts and field values appear consistent, using prior valuations as a baseline. The data clearly identifies the applicable retirement plan and eligible benefits for each record, with the exception of the MERF plan as noted below. The method used by the actuary to obtain system data has been consistent over the last several years, and consists of the system providing a dataset containing all records in its data, which is processed by the actuary.

Records that were excluded were explainable. Thousands of participants are excluded from the plans' actuarial valuations, primarily for participant records with certain status codes indicating death and refund of employee contributions. As noted in the report, all participants active on the day prior to an employer privatizing are eligible for a deferred vested benefit in PERA. Therefore, active records indicated as participating in a Privatized Plan were excluded, while their record reflecting prior vested service in the prior PERA Plan has been retained.

We also note that for this system, nearly all Vested Deferred participant benefits are calculated by the actuary based on earnings and salary information provided by the system. This is unlike other systems, which provide a benefit amount for Vested Deferred participants. There is a potential for individual participant benefit amounts to be calculated inaccurately; however, we have no reason to believe that this method would result in a conservative or aggressive bias in actuarial valuation results.

Overall, we believe the data received is of sufficient quality and completeness to perform the actuarial valuation. It contains both the information necessary to value benefits and exclude participants that are ineligible for benefits.

Data reconciliation and adjustment process performed by the actuary:
We have reviewed adjustments and assumptions that the actuary deemed necessary to create a valuation database for each plan. The actuary lists in their final reports the data adjustments and assumptions made in their data reconciliation. We have found the adjustments to be minimal, consistent, and reasonable.

The following tables provide a summary comparing the demographic statistics between the system (prior to adjustment) and the actuary's data for each plan. As illustrated, very few adjustments were required, and our review did not reveal any additional adjustments that we would recommend.

Public Employees Retirement Association of Minnesota (Continued)

General Employees Retirement Plan

	System Data	Actuary Data	Difference
Active Members	143,343	143,343	-
Average Age	47.0	47.0	-
Average Service	10.7	10.7	-
Service Retirements	73,552	71,740	-2.5%
Average Age	72.4	72.4	-
Average Monthly Annuity	$ 1,126	$ 1,126	-
Survivors	7,690	7,690	-
Average Monthly Annuity	$ 1,256	$ 1,256	-
Disability Retirements	1,892	3,704	95.8%
Average Monthly Annuity	$ 954	$ 1,046	9.6%
Deferred Retirements	48,540	48,505	-0.1%
Average Age	50.5	50.5	-
Average Monthly Annuity (at NRD)	N/A	N/A	N/A
Terminated Other Non-Vested	125,381	121,019	-3.5%
Total	400,398	396,001	-1.1%

The differences between the system and actuary counts for Deferred Retirements and Terminated Other Non-Vested are due to individuals who had received a refund according to system data but had not been reclassified as paid out. The actuary removed the participants who had received refunds from the valuation. We agree with this change.

Similar to MSRS, adjustments were made by the actuary for participants that the actuary knows to be Disability Retirements coded by the system as Service Retirements. We agree with the correction in status for these participants, and have confirmed that the number of people in the plan that moved from Service Retirement to Disability Retirement is appropriate.

Public Employees Retirement Association of Minnesota (Continued)

Police & Fire

	System Data	Actuary Data	Difference
Active Members	10,879	10,879	-
Average Age	40.4	40.4	-
Average Service	12.4	12.4	-
Service Retirements	7,165	7,002	-2.3%
Average Age	67.3	67.3	-
Average Monthly Annuity	$ 4,315	$ 4,326	0.3%
Survivors	1,886	1,886	-
Average Monthly Annuity	$ 2,435	$ 2,435	-
Disability Retirements	989	1,151	16.4%
Average Monthly Annuity	$ 3,768	$ 3,777	0.2%
Deferred Retirements	1,482	1,481	-0.1%
Average Age	46.1	46.1	-
Average Monthly Annuity (at NRD)	N/A	N/A	N/A
Terminated Other Non-Vested	1,025	975	-4.9%
Total	23,426	23,374	-0.2%

Consistent with the General Plan, we understand that the differences between the system and actuary counts for Deferred Retirements and Terminated Other Non-Vested are due to these individuals receiving a refund. Status corrections from Service Retirements to Disability Retirements were also made as noted above. We agree with the correction in status for these participants, and have confirmed that the number of people in the plan that moved from Service Retirement to Disability Retirement is appropriate.

Correctional

	System Data	Actuary Data	Difference
Active Members	3,604	3,603	-
Average Age	40.4	40.4	-
Average Service	7.6	7.7	0.7%
Service Retirements	606	571	-5.8%
Average Age	65.1	64.9	-0.3%
Average Monthly Annuity	$ 666	$ 625	-6.2%
Survivors	36	36	-
Average Monthly Annuity	$ 592	$ 592	-
Disability Retirements	126	162	28.6%
Average Monthly Annuity	$ 1,329	$ 1,325	-0.3%
Deferred Retirements	2,383	2,380	-0.1%
Average Age	40.8	40.8	-
Average Monthly Annuity (at NRD)	N/A	N/A	N/A
Terminated Other Non-Vested	2,043	1,936	-5.2%
Total	8,798	8,688	-1.3%

Public Employees Retirement Association of Minnesota (Continued)

Correctional (Continued)

Consistent with the General Plan, we understand that the differences between the system and actuary counts for Deferred Retirements and Terminated Other Non-Vested are due to these individuals receiving a refund. Status corrections from Service Retirements to Disability Retirements were also made as noted above. We agree with the correction in status for these participants, and have confirmed that the number of people in the plan that moved from Service Retirement to Disability Retirement is appropriate.

Minneapolis Employees Retirement Fund (MERF)

	System Data	Actuary Data	Difference
Active Members	42	42	-
Average Age	61.9	61.9	-
Average Service	36.1	39.6	9.7%
Service Retirements	3,034	2,929	-3.5%
Average Age	75.3	75.3	-
Average Monthly Annuity	$ 3,007	$ 3,038	1.0%
Survivors	740	740	-
Average Monthly Annuity	$ 2,657	$ 2,657	-
Disability Retirements	3	109	-
Average Monthly Annuity	$ 1,543	$ 2,116	-
Deferred Retirements	41	43	4.9%
Average Age	58.4	61.4	5.1%
Average Monthly Annuity (at NRD)	N/A	N/A	N/A
Terminated Other Non-Vested	2	-	-100.0%
Total	3,862	3,863	-

Consistent with the General Plan, we understand that the differences between the system and actuary counts for Deferred Retirements and Terminated Other Non-Vested are due to these individuals receiving a refund. Status corrections from Service Retirements to Disability Retirements were also made as noted above. We agree with the correction in status for these participants, and have confirmed that the number of people in the plan that moved from Service Retirement to Disability Retirement is appropriate.

The difference of approximately 10% for active members' average service is uniformly spread across active participants. Each active participant's attained service was 3.5 years greater in the actuary's data than the system's data. It was brought to our attention just prior to the release of this report that the system provided a subsequent data file to the retained actuary, which accounts for the difference in the service fields. We have not reviewed this subsequent dataset.

Teachers Retirement Association of Minnesota (TRA)

Quality of census data and the data transfer process by the system:
Census files provided to the retained actuary were reviewed to assess quality and consistency. The data counts and field values appear consistent, using prior valuations as a baseline. The data clearly identifies the applicable retirement plan and eligible benefits for each record. The method used by the actuary to obtain system data has been consistent over the last several years, and consists of the system providing a dataset containing all records in its data, which is processed by the actuary.

Overall, we believe the data received is of sufficient quality and completeness to perform the actuarial valuation. It contains both the information necessary to value benefits and exclude participants that are ineligible for benefits.

Data reconciliation and adjustment process performed by the actuary:
We have reviewed adjustments and assumptions that the actuary deemed necessary to create a valuation database for each plan. The actuary lists in their final reports the data adjustments and assumptions made in their data reconciliation. We have found the adjustments to be minimal, consistent, and reasonable.

The following table provides a summary comparing the demographic statistics between the system (prior to adjustment) and the actuary's data for each plan. As illustrated, very few adjustments were required, and our review did not reveal any additional adjustments that we would recommend.

	System Data	Actuary Data	Difference
Active Members	77,243	77,243	-
Average Age	43.4	43.4	-
Average Service	12.1	12.1	-
Service Retirements	53,774	53,774	-
Average Age	72.1	72.1	-
Average Monthly Annuity	$ 27,411	$ 27,411	-
Survivors	4,472	4,472	-
Average Monthly Annuity	$ 27,518	$ 27,518	-
Disability Retirements	563	563	-
Average Monthly Annuity	$ 19,393	$ 19,393	-
Deferred Retirements	12,911	12,907	-
Average Age	47.7	47.7	-
Average Monthly Annuity (at NRD)	N/A	$ 10,100	N/A
Terminated Other Non-Vested	29,980	29,984	-
Total	178,943	178,943	-

No differences above necessitated further investigation.

St. Paul Teachers' Retirement Fund Association (SPTRFA)

Quality of census data and the data transfer process by the system:
The July 1, 2014 actuarial valuation was the first one completed after the system implemented new administration software. Because of this change, data reported to the actuary was inconsistent with prior years. Through the actuary's data reconciliation, they asked a variety of clarifying questions to the system due to these inconsistencies. We were provided these questions and answers, and applied the corrections to the system data prior to comparison to the actuary data. While we can confirm that data was updated appropriately per this additional information from the system, we cannot confirm that all inconsistencies between the July 1, 2014 and July 1, 2013 datasets were identified.

One data element that is not provided by the system to the actuary that would ideally be reported is the accumulated earnings on Employee Contributions. Depending on the accuracy of historical salary information or the salary scale assumption in lieu of accurate historical salaries, this could be estimated fairly precisely. However, if historical salaries are unknown and sporadic, the actuary's assumption could vary significantly. The net impact on valuation results would be unlikely to be significant in total, but could shift liabilities from the Termination decrement to Refunds. There were 84 participants for whom no earnings information was provided; therefore, only estimated contributions were valued.

In spite of the potential shortcomings above, we believe the data received is of sufficient quality and completeness to perform the actuarial valuation. It contains both the information necessary to value benefits and exclude participants that are ineligible for benefits.

Data reconciliation and adjustment process performed by the actuary:
We have reviewed adjustments and assumptions that the actuary deemed necessary to create a valuation database for each plan. The actuary lists in their final reports the data adjustments and assumptions made in their data reconciliation. We have found the adjustments to be minimal, consistent, and reasonable.

The following table provides a summary comparing the demographic statistics between the system (prior to adjustment) and the actuary's data for each plan. As illustrated, very few adjustments were required, and our review did not reveal any additional adjustments that we would recommend.

	System Data	Actuary Data	Difference
Active Members	3,878	3,876	-0.1%
Average Age	44.7	44.7	-
Average Service	11.4	11.4	-
Leave of Absence Members	83	83	-
Service Retirements	3,157.0	3,156.0	-
Average Age	$ 72	$ 72	-
Average Monthly Annuity	2,580	2,580	-
Survivors	$ 339	$ 339	-
Average Monthly Annuity	2,572	2,571	-
Disability Retirements	$ 34	$ 34	-
Average Monthly Annuity	1,486	1,486	-
Deferred Retirements	1,830	1,829	-0.1%
Average Age	$ 48	$ 48	-
Average Monthly Annuity (at NRD)	N/A	N/A	N/A
Terminated Other Non-Vested	1,613	1,616	0.2%
Total	10,851	10,850	-

St. Paul Teachers' Retirement Fund Association (Continued)

No differences above necessitated further investigation. For 17 active teachers with salaries less than $100, including two participants with negative salaries, salary values were set equal to average salary amounts. We recommend no change to this assumption.

Duluth Teachers' Retirement Fund Association (DTRFA)

Quality of census data and the data transfer process by the system:
Census files provided to the retained actuary were reviewed to assess quality and consistency. The data counts and field values appear consistent, using prior valuations as a baseline. The data clearly identifies the applicable retirement plan and eligible benefits for each record. The method used by the actuary to obtain system data has been consistent over the last several years, and consists of the system providing a dataset containing all records in its data, which is processed by the actuary.

Overall, we believe the data received is of sufficient quality to perform the actuarial valuation. It contains both the information necessary to value benefits and exclude participants that are ineligible for benefits.

Data reconciliation and adjustment process performed by the actuary:
We have reviewed adjustments and assumptions that the actuary deemed necessary to create a valuation database for each plan. The actuary lists in their final reports the data adjustments and assumptions made in their data reconciliation. We have found the adjustments to be minimal, consistent, and reasonable.

The following table provides a summary comparing the demographic statistics between the system (prior to adjustment) and the actuary's data for each plan. As illustrated, very few adjustments were required, and our review did not reveal any additional adjustments that we would recommend.

	System Data	Actuary Data	Difference
Active Members	837	837	-
Average Age	47.6	47.6	-
Average Service	12.8	12.8	-
Service Retirements	1,365	1,353	-0.9%
Average Age	72.4	72.4	-
Average Monthly Annuity	$ 1,539	$ 1,539	-
Survivors	128	128	-
Average Monthly Annuity	$ 1,366	$ 1,366	-
Disability Retirements	9	21	133.3%
Average Monthly Annuity	$ 1,176	$ 1,190	1.2%
Deferred Retirements	253	253	-
Average Age	51.6	51.6	-
Average Monthly Annuity (at NRD)	$ 233	$ 233	-
Terminated Other Non-Vested	744	747	0.4%
Total	3,336	3,339	0.1%

The disability retirement count difference is due to the system considering individuals who were previously disabled to be retired upon reaching age 65, while the actuary categorized these individuals as disabled. We agree with the correction in status for these participants, and have confirmed that the number of people in the plan that moved from Service Retirement to Disability Retirement is appropriate.

Review of Financial Data

Applicable ASOPs and State Statutes

Actuarial Standard of Practice No. 44, Selection and Use of Asset Valuation Methods for Pension Valuations, governs the asset valuation method for pension valuations, which is used to develop the actuarial value of assets (AVA). In short, the Standard does not take issue with using Market Value of Assets (MVA) as a Plan's Actuarial Value of Assets (AVA).

When a plan opts to use a smoothing method, the ASOP provides that the actuary should select an asset valuation method that is designed to produce actuarial values of assets that bear a reasonable relationship to the corresponding market values. In making that determination, the Standard indicates that such a method would be likely to produce:

- AVAs that are sometimes greater than and sometimes less than the corresponding market values
- AVAs that fall within a reasonable range of market values
- Recognition of differences between a plan's AVA and MVA within a reasonable period of time

All three requirements above are considered to be met if in the actuary's professional judgment the asset valuation method:

- Produces AVAs within a sufficiently narrow range of market values; and/or
- Recognizes differences between AVA and MVA in a sufficiently short period

The intent of this section of our report is to identify the asset valuation method prescribed by State Statute, confirm it has been implemented correctly by the retained actuary, and identify whether it conforms to ASOP No. 44.

In accordance with Minnesota Statutes, Section 356.214, Subdivision 1(f), the actuarial value is calculated by adjusting the market value to remove 80% of the prior year's investment gain or loss, 60% of the gain or loss from two years ago, 40% of the gain or loss from three years ago, and 20% of the gain or loss from four years ago. The gain or loss is measured by comparing actual returns on a market value basis to those expected using the 8.00% assumption in 2014. The actuarial value of assets is not constrained by a range of the market value of assets.

We believe the statutory method results in an AVA that bears a reasonable relationship to MVA, although we note that the trend within the industry is toward shorter recognition periods and increased use of corridors, the latter of which is lacking from the current method.

Our match of each retained actuary's AVA calculation can be found in Appendix B. Below is a summary of our findings.

Minnesota State Retirement System (MSRS)

Based on our review the statutory method is being applied accurately, perhaps with the exception of the Legislators Plan as noted below.

State Patrol

Overall, we were able to replicate the retained actuary's calculation of the actuarial value of Assets.

Judges

Overall, we were able to replicate the retained actuary's calculation of the actuarial value of Assets.

Legislators

The Legislators plan is essentially funded on a pay-as-you-go basis. The plan's AVA is set equal to its MVA, which may technically be considered as inconsistent with Minnesota Statutes. Per the valuation report by the retained actuary, this has been the practice since the July 1, 2000 valuation. We view this difference in method to be insignificant because a change in the asset smoothing method would result in a minimal impact in the plan's unfunded liability. Based on recent historical asset returns, the AVA using the prescribed smoothing method would be approximately $0.8M less than MVA. The resulting $0.8M increase in UAAL is insignificant compared to the current UAAL of $242.6M.

Correctional

Overall, we were able to replicate the retained actuary's calculation of the actuarial value of Assets.

Public Employees Retirement Association of Minnesota (PERA)

Based on our review the statutory method is being applied accurately.

General Employees Retirement Plan

Overall, we were able to replicate the retained actuary's calculation of the actuarial value of Assets.

Police & Fire

Overall, we were able to replicate the retained actuary's calculation of the actuarial value of Assets.

Correctional

Overall, we were able to replicate the retained actuary's calculation of the actuarial value of Assets.

Minnesota Employees' Retirement Fund

The actuarial value of Assets is set equal to the market value to be consistent with the underlying basis of setting contributions under State Statute 353.50.

Teachers Retirement Association of Minnesota (TRA)

Based on our review the statutory method is being applied accurately. Overall, we were able to replicate the retained actuary's calculation of the actuarial value of Assets.

St. Paul Teachers' Retirement Fund Association (SPTRFA)

Based on our review the statutory method is being applied accurately. Overall, we were able to replicate the retained actuary's calculation of the actuarial value of Assets.

Duluth Teachers' Retirement Fund Association (DTRFA)

Based on our review the statutory method is being applied accurately. Overall, we were able to replicate the retained actuary's calculation of the actuarial value of Assets.

Compliance with State Statutes – Plan Provisions

Applicable ASOPs and State Statutes

Eligibility for and determination of retirement benefits payable from the reviewed systems are stipulated by Minnesota statutes. Benefit provisions are found primarily in Minnesota Statutes, Sections 352 (MSRS), 353 (PERA), 354 (TRA), and certain sections of 354A (DTRFA and SPTRFA).

MSRS, PERA, TRA, SPTRFA, and DTRFA

We have reviewed the sample life calculations noted in Appendix A for compliance with State Statute Sections referenced above. Participant benefit amounts were matched at every potential future decrement age and, if applicable, benefit amounts currently being paid were matched. No benefits provided by State Statute were identified as having been omitted from the valuation and the calculations reasonably reflect the benefits provided.

Additional details of the specific sample life calculations can be found in Appendix A.

Compliance with State Statutes – Actuarial Assumptions

Applicable ASOPs and State Statutes

Minnesota Statutes, Section 356.215 provides certain required actuarial assumptions that must be used in performing systems' annual valuations. The explicitly prescribed actuarial assumptions include:

- Discount rate
- Salary scale
- Payroll growth
- Projected changes in Cost of Living Adjustments (COLA)

Section 356.215 also stipulates that other assumptions must be set at levels consistent with those determined in the most recent quadrennial experience study completed, including:

- Mortality
- Disability
- Retirement
- Withdrawal
- Other relevant demographic and economic assumptions

The purpose of this section of our report is to review the assumptions as summarized in the actuarial valuations and applied in sample life calculations to confirm compliance with the above-referenced statutes. In addition, we reviewed the assumptions for general reasonableness. A more detailed analysis of these assumptions is outside the scope of this report. A more detailed analysis will be performed during our review of the quadrennial experience study.

To review the reasonableness of the assumptions, we relied on the actuarial standards below and addressed prescribed and non-prescribed assumptions individually.

Actuarial Standards of Practice No. 27, Selection of Economic Assumptions for Measuring Pension Obligations, provides guidance to actuaries in selecting economic assumptions. Generally stated, economic assumptions should be based on a combination of the actuary's professional judgment, past experience, and expected long-term future trends.

As applicable when the 2014 valuation reports were issued, the actuary should first develop a "best-estimate range", or the smallest expected range of actual outcomes, and then select a point within that range. Assumptions should be individually reasonable and reasonable in combination with others, and they should be consistent.

Importantly, ASOP No. 27 has been restated effective for any actuarial work product with a measurement date on or after September 30, 2014. The guidance regarding the reasonableness of an economic assumption has been changed to remove the "best-estimate range" standard. It recommends that a reasonable assumption reflect historical and current economic data, reflect the actuary's professional judgment, and be unbiased. While this revised standard is not applicable to the July 1, 2014 reports, we have considered the updated guidance in our review as a best practice.

Actuarial Standard of Practice No. 35, Selection of Demographic and other Noneconomic Assumptions for Measuring Pension Obligations, provides guidance to actuaries in selecting demographic and other assumptions not covered by ASOP No. 27.

The selection process is similar to ASOP No. 27, and has been similarly restated, but effective for actuarial work products with a measurement date on or after June 30, 2015. Therefore, both standards will apply in the systems' next valuation cycle.

We have reviewed the assumptions for reasonableness within the context of the standards and statutes above.

We have the following recommendations that apply to all systems:

- We recommend studying the load being applied to former and current participants allowing for Combined Service Annuities (CSAs). This load accounts for participants' prior service with other Minnesota retirement systems, and affects all vested terminated liabilities and some active liabilities. The magnitude of these factors was last studied in 2002 (2012 in the case of SPTRFA) and while they may not be inaccurate, their accuracy should be confirmed as a best practice.
- Participants are assumed to elect the greater of their Employee Contributions with interest or their deferred annuity upon termination. This is the most conservative valuation method of Employee Contributions, consistent with the State of Minnesota Standards for Actuarial Work and perhaps the most reasonable without information indicating otherwise. However, we recommend analyzing actual experience in the next Experience Study to determine if a significant portion of employees are electing a refund of contributions when it is not the greater benefit.

Minnesota State Retirement System (MSRS)

We have reviewed the sample lives noted in Appendix A for compliance with the state statutes listed above. Assumptions including decrement rates, early retirement adjustment factors and percent married were confirmed at each decrement age. Overall, we found the assumptions prescribed by statute and elected based on experience studies to be applied correctly.

Public Employees Retirement Association (PERA)

We have reviewed the sample lives noted in Appendix A for compliance with the state statutes listed above. Assumptions including decrement rates, early retirement adjustment factors and percent married were confirmed at each decrement age. Overall, we found the assumptions prescribed by statute and elected based on experience studies to be applied correctly. We did identify two topics that we believe the retained actuary should review during the next valuation cycle:

- In the Police and Fire Plan, the phase-in of early retirement factors appears to be based on valuation year, instead of decrement year, for at least some participants. The result is that the new early retirement factors remain only 10% phased in for this group of participants. The overall changes in early retirement factors are not large and the retained actuary indicated the affected participants were a subset of active employees. Therefore, while we recommend the error be corrected, we do not believe the result would significantly change the Plan's overall funding position.
- In the MERF Plan, two minor issues were identified related to the termination decrement. The termination decrement is being applied to actives under age 61, all of whom are eligible for Normal Retirement based on having 30 or more years of service. The termination decrement also contains an adjustment of approximately 0.98 that we were unable to validate. These issues primarily impact the termination liability, which is less than $250,000 in total. We wouldn't expect corrected programming to change that liability by more than 10%, or $25,000.

Teacher's Retirement Association (TRA)

We have reviewed the sample lives noted in Appendix A for compliance with the state statutes listed above. Assumptions including decrement rates, early retirement adjustment factors and percent married were confirmed at each decrement age. Overall, we found the assumptions prescribed by statute and elected based on experience study to be applied correctly.

St. Paul Teachers' Retirement Fund Association (SPTRFA)

We have reviewed the sample lives noted in Appendix A for compliance with the state statutes listed above. Assumptions including decrement rates, early retirement adjustment factors and percent married were confirmed at each decrement age. Overall, we found the assumptions prescribed by statute and elected based on experience study to be applied correctly.

While no errors were found during our review of the sample life calculations, we have identified the following suggestion for refinement in the retained actuary's valuation assumptions:

- A total of 84 deferred vested participant records contained no salary information and their liability is estimated based on actuarial assumptions. The retained actuary assumed that Employee Contributions with interest would approximate these participants' benefits. While this assumption may be the appropriate given the data provided to the actuary, it likely underestimates the liability of these participants. The accuracy of the estimates is complicated further because the system has asked the actuary to estimate accumulated interest on contributions. However, given the relatively small number of records impacted, we do not believe this is a significant concern.

Duluth Teachers' Retirement Fund Association (DTRFA)

We have reviewed the sample lives noted in Appendix A for compliance with the state statutes listed above. Assumptions including decrement rates, early retirement adjustment factors and percent married were confirmed at each decrement age. Overall, we found the assumptions prescribed by statute and elected based on experience study to be applied correctly.

While no errors were found during our review of the sample life calculations, we have identified the following suggestion for refinement in the retained actuary's valuation assumptions:

- Deferred Vested participant benefits are provided to the actuary in the form of a benefit payable at earliest commencement date, calculated under the plan provisions in effect at the time of termination. Because the actuary values Deferred Vested participants assuming retirement at Normal Retirement Age, they must back out the Early Retirement reduction in calculating the benefit payable at Normal Retirement Age. The implicit assumption made by the actuary about the Early Retirement factors applied to each participant may complicate liability calculations, particularly as early retirement reductions change over time. We'd recommend the system provide the actuary with benefit amounts payable at Normal Retirement Age to eliminate the need for this assumption.

Validation of Liabilities and Contribution Rates

Applicable State Statutes – Actuarial Methods

Actual employee and employer contribution rates are determined by the State of Minnesota Legislature, and fall outside the scope of this review. However, Minnesota Statutes, Section 356.215 requires that each plan's Normal Cost (NC), Actuarial Accrued Liability (AAL), and amortization of the Unfunded Actuarial Accrued Liability (UAAL) be calculated and disclosed using specified actuarial techniques. Additionally, it requires that the Annual Recommended Contribution (ARC) determined using this method be compared to required contribution rates to calculate the contribution sufficiency/(deficiency) that exists.

The components of a plan's Annual Required Contribution are its normal cost, and amortization of its UAAL. The amortization component is referred to as the Supplemental Contribution.

In order to determine a plan's normal cost, a replication valuation would be required. Matching Actuarial Accrued Liabilities and Normal Costs across plans also falls outside the scope of this review. However, representative sample lives have been selected and reviewed as summarized in Appendix A. By confirming decrement rates, benefit amounts, and select Present Value of Benefit calculations, we have determined the reasonableness of stated liabilities within each report.

Therefore, the intent of this portion of our review is to confirm the retained actuary's determination of the amortization of the Unfunded Actuarial Accrued Liability, or Supplemental Contribution as per State Statute. For each plan, we have summarized our verification below (in $000's), including the impact of any differences on funding sufficiency/(deficiency).

Minnesota State Retirement System (MSRS)

All calculations were matched within a reasonable threshold, as summarized below.

	Minnesota State Retirement System (MSRS)			
	State Patrol	Judges	Legislators	Correctional
Retained Actuary Supplemental Contribution	$ (13,875)	$ (10,098)	$ (20,217)	$ (22,746)
Deloitte Supplemental Contribution	$ (13,948)	$ (10,208)	$ (20,217)	$ (22,896)
Difference in ARC (as a % of payroll)	-0.11%	-0.25%	0.00%	-0.07%

The results above confirm that the actuary's calculation is consistent with the method described in the valuation report. For both the Judges and General Plan, the amortization period listed in state statute is slightly different than used by the retained actuary. We understand that the most recent statutes do not reflect the full funding periods developed in this valuation. We agree with the actuary's methodology.

Public Employees Retirement Association (PERA)

All calculations were matched within a reasonable threshold, as summarized below.

	Public Employees Retirement Association (PERA)			
	General	Correctional	Police & Fire	MERF
Retained Actuary Supplemental Contribution	$ (443,815)	$ (1,349)	$ (104,584)	$ (22,939)
Deloitte Supplemental Contribution	$ (447,382)	$ (1,369)	$ (105,157)	$ (22,968)
Difference in ARC (as a % of payroll)	-0.07%	-0.07%	-0.07%	-1.23%

The results above confirm that the actuary's calculation is consistent with the method described in the valuation report. For both the Police & Fire and General Plan, the amortization period listed in state statute is slightly different than used by the retained actuary. We understand that the most recent statutes do not reflect the full funding periods developed in this valuation. We agree with the actuary's methodology.

Teachers Retirement Association (TRA)

All calculations were matched within a reasonable threshold, as summarized below.

	TRA
Retained Actuary Supplemental Contribution	$ (445,413)
Deloitte Supplemental Contribution	$ (448,226)
Difference in ARC (as a % of payroll)	-0.06%

St. Paul Teachers' Retirement Fund Association (SPTRFA)

All calculations were matched within a reasonable threshold, as summarized below.

	SPTRFA
Retained Actuary Supplemental Contribution	$ (36,030)
Deloitte Supplemental Contribution	$ (36,087)
Difference in ARC (as a % of payroll)	-0.02%

Duluth Teachers' Retirement Fund Association (DTRFA)

All calculations were matched within a reasonable threshold, as summarized below.

	DTRFA
Retained Actuary Supplemental Contribution	$ (10,335)
Deloitte Supplemental Contribution	$ (10,374)
Difference in ARC (as a % of payroll)	-0.08%

Review of Actuarial Valuations

Applicable ASOPs and State Statutes

Actuarial Standard of Practice No. 4, Measuring Pension Obligations and Determining Pension Plan Costs or Contributions**,** provides guidance regarding nearly all aspects of the actuarial valuation method, including several cross-references to other ASOPs cited in this review.

Actuarial Standard of Practice No. 41, Actuarial Communications, provides guidance for any written, electronic, or oral communication issued by an actuary with respect to actuarial services. The standard specifically identifies disclosures that must be made within Actuarial Reports like the annual valuations provided by the retirement systems.

A general rule applied to pension valuations is to make disclosures necessary to allow a qualified actuary to approximate the results, if required data were provided.

Minnesota Statutes, Section 356.215 provides additional information that retained actuaries must disclose in their annual actuarial valuations specific to Minnesota Retirement Plans.

The standards and statutes above identify what must be reported within the reviewed valuations. We have recommended additional disclosure where we judged its value to be worth the effort of production.

MSRS, PERA, TRA, SPTRFA, and DTRFA

For all plans, we recommend demonstrating the sensitivity of the discount rate assumption by providing the following key metrics using a discount rate 1% higher and 1% lower than the prescribed rate:

- Actuarial Accrued Liability
- Unfunded Actuarial Accrued Liability
- Funded Ratio
- Contribution Sufficiency/Deficiency

We recommend also showing the sensitivity of the threshold year for higher post-retirement benefit increases by showing the same metrics listed above if the threshold was reached immediately and if the threshold was never reached.

Minnesota State Retirement System (MSRS)

Each plan's actuarial valuation was reviewed in its entirety, and we have found each report to satisfy the requirements of ASOP No. 41 and Minnesota Statutes, Section 356.215. The following minor corrections are recommended:

- In disclosure of the actuarial basis used to convert benefits between payment forms, we found that in all plans, the pre-decrement discount rate of 7.5% was omitted. This should be corrected, as the actuary does assume optional forms are elected in all plans and therefore the liabilities are affected by this assumption.

Along with the correction above, we recommend the system and actuary consider making the following additions to the report:

- For the Legislators Plan specifically, we believe disclosing undiscounted cash flows would be a beneficial tool for understanding the financial obligation presented by the plan.

Public Employees Retirement Association (PERA)

Each plan's actuarial valuation was reviewed in its entirety, and we have found each report to satisfy the requirements of ASOP No. 41 and Minnesota Statutes, Section 356.215.

Although no corrections are noted, we recommend the system and actuary consider making the following additions to the report:

- We recommend the five-year phase in of the revised Early Retirement reduction factors be summarized in the Police & Fire plan report.

Teachers Retirement Association (TRA)

The plan's actuarial valuation was reviewed in its entirety, and we have found it to satisfy the requirements of ASOP No. 41 and Minnesota Statutes, Section 356.215.

Although no corrections are noted, we recommend the system and actuary consider making the following additions to the report:

- The actuary references revised Early Retirement reduction factors that are applicable beginning July 1, 2015. These factors are phased-in over five years in the current valuation and we recommend the methodology used be summarized in the report.

St. Paul Teachers' Retirement Fund Association (SPTRFA)

The plan's actuarial valuation was reviewed in its entirety, and we have found it to satisfy the requirements of ASOP No. 41 and Minnesota Statutes, Section 356.215.

Duluth Teachers' Retirement Fund Association (DTRFA)

The plan's actuarial valuation was reviewed in its entirety, and we have found it to satisfy the requirements of ASOP No. 41 and Minnesota Statutes, Section 356.215.

Appendix A – Sample Lives Reviewed

Summary of Reviewed Sample Lives

Sample Life output is used by actuaries to confirm the actuarial assumptions, plan provisions, and actuarial methods used in actuarial valuations. The tables below summarize by system and plan the Sample Lives that Deloitte reviewed, as referenced throughout this report. While differences in actuarial valuation software prevent absolute matches of both liabilities and sample life output, we have reviewed representative participant sample lives and matched them within an acceptable threshold to confirm the reasonableness of stated liabilities within each report.

For all sample lives listed below, detailed output provided by the retained actuary was analyzed. Decrement rates for all benefits, early retirement adjustment factors, augmentation factors, monthly benefit amounts, optional form conversion rates and actuarial equivalence were tested and confirmed within a reasonable threshold. Participants were targeted to spread across benefit tiers to maximize the breadth of our review.

For select Plans, each of the components above along with survival and discount rates were compiled to match the present value of benefits for each participant, including decrement detail for active participants. Plans were selected based primarily on size. This method was chosen to maximize the percentage of the liability that has been validated more thoroughly.

Minnesota State Retirement System (MSRS)

	Minnesota State Retirement System (MSRS)			
	State Patrol	Judges	Legislators	Correctional
Active	5	4	2	4
Deferred Vested	2	2	2	2
Retired	2	3	3	3
Disabled	1	1	0	1
Survivor	1	1	1	1

Public Employees Retirement Association (PERA)

	Public Employees Retirement Association (PERA)			
	General	Police & Fire	Correctional	MERF
Active	5	4	2	3
Deferred Vested	2	3	1	1
Retired	3	2	2	5
Disabled	1	1	1	2
Survivor	1	1	1	1

Teacher Systems

	Teachers Retirement Association (TRA)	St. Paul Teachers' Retirement Fund Association (SPTRFA)	Duluth Teachers' Retirement Fund Association (DTRFA)
Active	7	5	6
Deferred Vested	2	3	2
Retired	4	2	2
Disabled	0	1	1
Survivor	0	1	1

Appendix B – Actuarial Value of Asset (AVA) Confirmations

Overall, we were able to replicate the retained actuary's calculation of the actuarial value of Assets as summarized below.

Minnesota State Retirement System (MSRS)

State Patrol

	(In thousands of $'s)	Retained Actuary		Deloitte	
		6/30/2014		**6/30/2014**	
1	**MVA**		667,340		667,340
2	**Avg. Bal. Calc.**				
	a Total assets, BOY		593,201		593,201
	b Total assets, EOY		667,340		667,340
	c Net Investment Income		107,187		107,187
	d Avg. Balance (a+b-c)/2		576,677		576,677
3	**Expected Return (8.0% * 2.d.)**		46,134		46,134
4	**Actual Return**		107,187		107,187
5	**Current Year G/(L) (4-3)**		61,053		61,053
6	**Unrecognized asset returns**	Unrecognized AMT		Unrecognized AMT	
	a FYE 2014	80%	48,842	80%	48,842
	b FYE 2013	60%	20,185	60%	20,185
	c FYE 2012	40%	(13,696)	40%	(13,696)
	d FYE 2011	20%	14,139	20%	14,139
	e FYE 2010	0%	-	0%	-
			69,470		69,470
7	**AVA at EOY**		597,870		597,870
8	**AVA / MVA =**		0.90		0.90

Minnesota State Retirement System (Continued)

Judges

	(*In thousands of $'s*)	Retained Actuary		Deloitte	
		6/30/2014		**6/30/2014**	
1	**MVA**		175,556		175,556
2	**Avg. Bal. Calc.**				
	a Total assets, BOY		155,398		155,398
	b Total assets, EOY		175,556		175,556
	c Net Investment Income		28,011		28,013
	d Avg. Balance (a+b-c)/2		151,472		151,471
3	**Expected Return (80% * 2.d.)**		12,118		12,118
4	**Actual Return**		28,011		28,013
5	**Current Year G/(L) (4-3)**		15,893		15,895
6	**Unrecognized asset returns**	Unrecognized AMT		Unrecognized AMT	
	a FYE 2014	80%	12,715	80%	12,716
	b FYE 2013	60%	5,257	60%	5,257
	c FYE 2012	40%	(3,581)	40%	(3,581)
	d FYE 2011	20%	3,637	20%	3,637
	e FYE 2010	0%	-	0%	-
			18,028		18,029
7	**AVA at EOY**		157,528		157,527
8	**AVA / MVA =**		0.90		0.90

Minnesota State Retirement System (Continued)

Correctional

	(In thousands of $'s)	Retained Actuary		Deloitte	
		6/30/2014		**6/30/2014**	
1	**MVA**		877,056		877,056
2	**Avg. Bal. Calc.**				
	a Total assets, BOY		747,157		747,157
	b Total assets, EOY		877,056		877,056
	c Net Investment Income		137,523		137,523
	d Avg. Balance (a+b-c)/2		743,345		743,345
3	**Expected Return (80% * 2.d.)**		59,468		59,468
4	**Actual Return**		137,523		137,523
5	**Current Year G/(L) (4-3)**		78,055		78,055
6	**Unrecognized asset returns**	Unrecognized AMT		Unrecognized AMT	
	a FYE 2014	80%	62,445	80%	62,444
	b FYE 2013	60%	24,516	60%	24,516
	c FYE 2012	40%	(15,563)	40%	(15,563)
	d FYE 2011	20%	15,354	20%	15,354
	e FYE 2010	0%	-	0%	-
			86,752		86,751
7	**AVA at EOY**		790,304		790,305
8	**AVA / MVA =**		0.90		0.90

Public Employees Retirement Association of Minnesota (PERA)

General Plan

	(*In thousands of $'s*)	Retained Actuary		Deloitte	
		6/30/2014		**6/30/2014**	
1	**MVA**		17,404,822		17,404,822
2	**Avg. Bal. Calc.**				
	a Total assets, BOY		15,084,608		15,084,608
	b Total assets, EOY		17,404,822		17,404,822
	c Net Investment Income		2,760,854		2,760,854
	d Avg. Balance (a+b-c)/2		14,864,288		14,864,288
3	**Expected Return (80% * 2.d.)**		1,189,143		1,189,143
4	**Actual Return**		2,760,854		2,760,854
5	**Current Year G/(L) (4-3)**		1,571,711		1,571,711
6	**Unrecognized asset returns**	Unrecognized AMT		Unrecognized AMT	
	a FYE 2014	80%	1,257,369	80%	1,257,369
	b FYE 2013	60%	500,043	60%	500,043
	c FYE 2012	40%	(328,689)	40%	(328,689)
	d FYE 2011	20%	331,559	20%	331,559
	e FYE 2010	0%	-	0%	-
			1,760,282		1,760,282
7	**AVA at EOY**		15,644,540		15,644,540
8	**AVA / MVA =**		0.90		0.90

Public Employees Retirement Association of Minnesota (Continued)

Police & Fire

	(In thousands of $'s)	Retained Actuary	Deloitte
		6/30/2014	**6/30/2014**
1	**MVA**	7,273,100	7,273,100
2	**Avg. Bal. Calc.**		
	a Total assets, BOY	6,346,741	6,346,741
	b Total assets, EOY	7,273,100	7,273,100
	c Net Investment Income	1,158,388	1,158,388
	d Avg. Balance (a+b-c)/2	6,230,727	6,230,727
3	**Expected Return (80% * 2.d.)**	498,458	498,458
4	**Actual Return**	1,158,388	1,158,388
5	**Current Year G/(L) (4-3)**	659,930	659,930
6	**Unrecognized asset returns**	Unrecognized AMT	Unrecognized AMT
	a FYE 2014	80% 527,944	80% 527,944
	b FYE 2013	60% 212,556	60% 212,556
	c FYE 2012	40% (123,076)	40% (123,076)
	d FYE 2011	20% 130,657	20% 130,657
	e FYE 2010	0% -	0% -
		748,081	748,081
7	**AVA at EOY**	6,525,019	6,525,019
8	**AVA / MVA =**	0.90	0.90

Public Employees Retirement Association of Minnesota (Continued)

Correctional

	(In thousands of $'s)	Retained Actuary	Deloitte
		6/30/2014	**6/30/2014**
1	**MVA**	453,232	453,232
2	**Avg. Bal. Calc.**		
	a Total assets, BOY	366,750	366,750
	b Total assets, EOY	453,232	453,232
	c Net Investment Income	69,451	69,450
	d Avg. Balance (a+b-c)/2	375,266	375,266
3	**Expected Return (80% * 2.d.)**	30,021	30,021
4	**Actual Return**	69,451	69,450
5	**Current Year G/(L) (4-3)**	39,430	39,429
6	**Unrecognized asset returns**	Unrecognized AMT	Unrecognized AMT
	a FYE 2014	80% 31,544	80% 31,543
	b FYE 2013	60% 11,560	60% 11,560
	c FYE 2012	40% (6,681)	40% (6,681)
	d FYE 2011	20% 6,320	20% 6,320
	e FYE 2010	0% -	0% -
		42,743	42,742
7	**AVA at EOY**	410,489	410,489
8	**AVA / MVA =**	0.91	0.91

Teachers Retirement Association of Minnesota (TRA)

	(In thousands of $'s)	Retained Actuary		Deloitte	
			6/30/2014		**6/30/2014**
1	**MVA**		20,289,594		20,289,594
2	**Avg. Bal. Calc.**				
	a Total assets, BOY		18,019,319		18,019,319
	b Total assets, EOY		20,293,684		20,293,684
	c Net Investment Income		3,257,693		3,257,693
	d Avg. Balance (a+b-c)/2		17,527,655		17,527,655
3	**Expected Return (80% * 2.d.)**		1,402,212		1,402,212
4	**Actual Return**		3,257,693		3,257,693
5	**Current Year G/(L) (4-3)**		1,855,481		1,855,481
6	**Unrecognized asset returns**	Unrecognized AMT		Unrecognized AMT	
	a FYE 2014	80%	1,484,385	80%	1,484,385
	b FYE 2013	60%	608,602	60%	608,602
	c FYE 2012	40%	(418,101)	40%	(418,101)
	d FYE 2011	20%	432,776	20%	432,776
	e FYE 2010	0%	-	0%	-
			2,107,662		2,107,662
7	**AVA at EOY**		18,181,932		18,181,932
8	**AVA / MVA =**		0.90		0.90

St. Paul Teachers' Retirement Fund Association (SPTRFA)

	(In thousands of $'s)	Retained Actuary		Deloitte	
		6/30/2014		**6/30/2014**	
1	**MVA**		1,045,435		1,045,435
2	**Avg. Bal. Calc.**				
	a Total assets, BOY		933,082		933,082
	b Total assets, EOY		1,045,435		1,045,435
	c Net Investment Income		168,176		168,177
	d Avg. Balance (a+b-c)/2		905,171		905,170
3	**Expected Return (80% * 2.d.)**		72,414		72,414
4	**Actual Return**		168,176		168,177
5	**Current Year G/(L) (4-3)**		95,762		95,763
6	**Unrecognized asset returns**	Unrecognized AMT		Unrecognized AMT	
	a FYE 2014	80%	76,609.60	80%	76,610
	b FYE 2013	60%	28,018.20	60%	28,018
	c FYE 2012	40%	(32,802.40)	40%	(32,802)
	d FYE 2011	20%	25,637.00	20%	25,637
	e FYE 2010	0%	-	0%	-
			97,462		97,463
7	**AVA at EOY**		947,972		947,972
8	**AVA / MVA =**		0.91		0.91

Duluth Teachers' Retirement Fund Association (DTRFA)

	(In thousands of $'s)	Retained Actuary	Deloitte
		6/30/2014	**6/30/2014**
1	**MVA**	226,071,060	226,071,060
2	**Avg. Bal. Calc.**		
	a Total assets, BOY	205,300,543	205,300,544
	b Total assets, EOY	226,071,060	226,071,060
	c Net Investment Income	35,460,477	35,460,477
	d Avg. Balance (a+b-c)/2	197,955,563	197,955,564
3	**Expected Return (80% * 2.d.)**	15,836,445	15,836,445
4	**Actual Return**	35,460,477	35,460,477
5	**Current Year G/(L) (4-3)**	19,624,032	19,624,032
6	**Unrecognized asset returns**	Unrecognized AMT	Unrecognized AMT
	a FYE 2014	80% 15,699,226	80% 15,699,226
	b FYE 2013	60% 9,478,782	60% 9,478,782
	c FYE 2012	40% (6,769,253)	40% (6,769,253)
	d FYE 2011	20% 4,787,728	20% 4,787,728
	e FYE 2010	0% -	0% -
		23,196,482	23,196,483
7	**AVA at EOY**	202,874,578	202,874,577
8	**AVA / MVA =**	0.90	0.90