Actuarial Review of the 2021 Accounting Disclosures for the North Carolina Office of the State Auditor

November 2021

Table of Contents

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November 19, 2021

Ms. Amy Senogles, CPA
Financial Audit Supervisor
Office of the State Auditor
2 S. Salisbury St.
20601 Mail Service Center
Raleigh, North Carolina 27699-0600

Re: North Carolina Actuarial Review of 2021 Accounting Disclosures

Dear Ms. Senogles:

Gabriel, Roeder, Smith & Company (GRS) is pleased to present this report of an Actuarial Review of the 2021 Accounting Disclosures related to the North Carolina Retirement System. We are grateful to the Office of the State Auditor for their responsiveness and assistance throughout the actuarial review process. In addition, we wish to thank the consultants of Cavanaugh Macdonald Consulting ("CMC") and Segal Consulting for their cooperation and assistance with this project.

This project is separated into two engagements. This is a report covering the work of the first engagement. A report covering the work of the second engagement will be issued in early 2022. The first engagement is described as follows:

> Evaluate the actuarial valuations of the following plans used in the State's financial statements for the period ended June 30, 2021:
>
> - The Teachers and State Employees Retirement System of North Carolina (TSERS);
> - The Local Governmental Employees Retirement System of North Carolina (LGERS);
> - The Register of Deeds Supplemental Pension Fund of North Carolina (RODSPF);
> - The North Carolina Retiree Health Benefits Plan (RHB); and
> - The Disability Income Plan of North Carolina (DIPNC).
>
> The Contractor will conduct a review of all assumptions, procedures, and methodology utilized by the actuary of the TSERS, LGERS, RODSPF, RHB and DIPNC plans. This review should include:
>
> 1. A review of the valuation report and results and how they comply with actuarial standards, and whether such valuation reflects appropriate disclosure information under required reporting.
> 2. An analysis and benchmarking of the actuarial assumptions, and a review of the actuarial methods used in determining the pension liability for compliance with generally accepted actuarial principles.
> 3. An analysis of the procedures used to validate the participant data, a test of select test lives from the membership group (active and retired) to validate key components, and a detailed review of the results.

The purpose of this report is to provide the results of our actuarial review, described on the previous page, including:

- An opinion regarding the reasonableness and accuracy of the actuarial assumptions, actuarial cost methods, procedures, and valuation results; and
- Certification that the plans' actuarial valuation was prepared in accordance with pronouncements issued by the Governmental Accounting Standards Board (GASB), principles and practices prescribed by the Actuarial Standards Board, and that the actuarial calculations were performed by qualified actuaries in accordance with accepted actuarial procedures.

This report was prepared at the request of the Office of the State Auditor of North Carolina (OSA) for the purposes stated above. It may not be suitable for other purposes. This report may be shared with parties other than the OSA, but only with the OSA's permission and only in its entirety. GRS is not responsible for unauthorized use of this report.

In our opinion, the assumptions and methods used in the 2020 valuations of the aforementioned plans are reasonable and comply with the Governmental Accounting Standards Board (GASB) Statement Nos. 67 and 74 and comply with practices promulgated by the Actuarial Standards. The intended audience is the OSA. The authors of this report are available to answer questions.

The signing actuaries are independent of the plan sponsor.

This report was prepared using our proprietary models (valuation model, capital markets model, etc.) and related software which, in our professional judgment, have the capabilities to provide results that are consistent with the purposes of the review and has no material limitations or known weaknesses. We performed tests to ensure that the models reasonably represent that which is intended to be modeled. We have also relied on the GRS actuaries and Internal Software, Training, and Processes Team who developed and maintain the model.

Abra D. Hill and Jeffrey T. Tebeau are Members of the American Academy of Actuaries (MAAA) as indicated, and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein.

Respectfully submitted,
Gabriel, Roeder, Smith & Company

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ADH/JTT:dj

EXECUTIVE SUMMARY

Executive Summary

Background

Gabriel, Roeder, Smith & Company (GRS) was engaged by the Office of the State Auditor to review calculations related to the 2021 disclosures the State will include in its Comprehensive Annual Financial Report.

This report covers the work of the first engagement. A report covering the work of the second engagement will be issued in early 2022. The first engagement is described as follows:

> Evaluate the actuarial valuations of the following plans used in the State's financial statements for the period ended June 30, 2021:
>
> - The Teachers and State Employees Retirement System of North Carolina (TSERS);
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> - The Register of Deeds Supplemental Pension Fund of North Carolina (RODSPF);
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> - The Disability Income Plan of North Carolina (DIPNC).
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> The Contractor will conduct a review of all assumptions, procedures, and methodology utilized by the actuary of the TSERS, LGERS, RODSPF, RHB and DIPNC plans. This review should include:
>
> 1. A review of the valuation report and results and how they comply with actuarial standards, and whether such valuation reflects appropriate disclosure information under required reporting.
> 2. An analysis and benchmarking of the actuarial assumptions, and a review of the actuarial methods used in determining the pension liability for compliance with generally accepted actuarial principles.
> 3. An analysis of the procedures used to validate the participant data, a test of select test lives from the membership group (active and retired) to validate key components, and a detailed review of the results.

The purpose of this report is to provide the results of our actuarial review, described above, including:

- An opinion regarding the reasonableness and accuracy of the actuarial assumptions, actuarial cost methods, procedures, and valuation results; and
- Certification that the plans' actuarial valuation was prepared in accordance with pronouncements issued by the Governmental Accounting Standards Board (GASB), principles and practices prescribed by the Actuarial Standards Board, and that the actuarial calculations were performed by qualified actuaries in accordance with accepted actuarial procedures.

The balance of this report is organized as follows:

Section 1 – Experience Study Review

- Review of Recommended Demographic Assumptions; and
- Review of Recommended Actuarial Methods.

Section 2 – Review of Economic Assumptions

Section 3 – Review of the Respective Valuation Reports Containing the Underlying Calculations for the GASB Valuations

- Test Lives Exhibits; and
- Comments Regarding Test Lives Review.

Section 4 – Review of the Respective GASB Reports

- Content Review; and
- Calculations Review.

Section 5 – Comments and Conclusions

- Comments;
- Prior Year's Recommendations;
- Conclusions; and
- Recommendations for future years.

Conclusion

In our opinion, the assumptions and methods used in the December 31, 2020 valuations of the aforementioned plans are reasonable and comply with the Governmental Accounting Standards Board (GASB) Statement Nos. 67 and 74 and comply with practices promulgated by the Actuarial Standards.

Based on our test lives review and our review of the funding and GASB reports, we certify that the plans' actuarial valuation was prepared in accordance with pronouncements issued by the Governmental Accounting Standards Board (GASB), principles and practices prescribed by the Actuarial Standards Board, and that the actuarial calculations were performed by qualified actuaries in accordance with accepted actuarial procedures.

SECTION 1

EXPERIENCE STUDY REVIEW

Experience Study

The Experience Studies appear to be on a five-year cycle and assumptions have changed since we reviewed them in our 2020 report. It is our understanding that both the demographic and economic assumptions were updated for the 2020 valuation report pursuant to the most recent experience study performed in 2020. This section reviews the demographic assumptions and actuarial methods, while the next section (II) contains the review of the economic assumptions.

Review of Recommended Demographic Assumptions

TSERS

The TSERS experience study appears to be on a five-year cycle with the next cycle expected to be January 1, 2020 through December 31, 2024. We were provided the most recently completed experience study, dated December 9, 2020, covering the period January 1, 2015 through December 31, 2019. We have reviewed the demographic assumptions recommended from this study that are currently in use for the funding and GASB valuations.

Non-Mortality Demographic Assumptions

The non-mortality demographic assumptions were reviewed in the experience study dated December 9, 2020, and covering the five-year period ending on December 31, 2019. We have reviewed that report and find that the recommended assumptions are reasonable, based on TSERS actual experience (as detailed in that report). When reviewing demographic experience, actuaries are guided by Actuarial Standards of Practice (ASOP) Statement No. 35. ASOP 35 provides that non-mortality demographic assumptions should take into consideration historical experience, future expectations, the actuary's professional judgement, the purpose of the measurement and should not result in significant bias (unless a bias is explicitly intended to cover adverse risk or plan provisions that are difficult to model). The experience study report reviewed demonstrates that these guidelines were followed in the development of the recommended assumptions. The proposed non-mortality demographic assumptions were generally set to reflect actual experience during the study period (i.e., the ratio of actual to expected decrements based on the proposed assumptions was very close 1.0).

We find the recommended assumptions (which were in use for the December 31, 2020 funding valuation) to be reasonable for use in the funding and GASB valuations.

Mortality Assumptions

ASOP 35 states that the actuary should generally consider at least the following when setting mortality assumptions: pre- and post-mortality; potentially different mortality for different employee classifications (if appropriate); adjustments for mortality improvement that occurs from the period studied (in the experience study) to the measurement period (the date of the valuation); and mortality improvements after the measurement date. The experience study started with nationally published mortality tables and were adjusted based on TSERS actual experience. The common industry convention is, that for any group's actual mortality experience to be given full credibility, there should be enough covered

participants to result in at least 1,000 actual deaths during the five-year period studied. The experience study demonstrates that certain groups/statuses (or a combination thereof) were analyzed together in order to increase credibility (e.g., beneficiaries, non-safety disabled retirees, safety disabled retirees). The report demonstrates that considerations for setting mortality assumptions promulgated in ASOP 35 were followed. We noted that for some groups various scaling factors were applied based on age (similar to the previous experience study). While we believe this to be a reasonable adjustment to reflect the System's experience, not enough detail was given to see how the adjustments for each age were calculated.

We find the recommended assumptions (which were in use for the December 31, 2020 funding valuation) to be reasonable for use in the funding and GASB valuations.

LGERS

The LGERS experience study appears to be on a five-year cycle with the next cycle expected to be January 1, 2020 through December 31, 2024. We were provided the most recently completed experience study, dated December 9, 2020, covering the period January 1, 2015 through December 31, 2019. We have reviewed the demographic assumptions recommended from this study that are currently in use for the funding and GASB valuations.

Non-Mortality Demographic Assumptions

The non-mortality demographic assumptions were reviewed in the experience study dated December 9, 2020, and covering the five-year period ending on December 31, 2019. We have reviewed that report and find that the recommended assumptions are reasonable, based on LGERS actual experience (as detailed in that report). The experience study report reviewed demonstrates that these guidelines were followed in the development of the recommended assumptions. The proposed non-mortality demographic assumptions were generally set to reflect actual experience during the study period (i.e., the ratio of actual to expected decrements based on the proposed assumptions was very close 1.0).

We find the recommended assumptions (which were in use for the December 31, 2020 funding valuation) to be reasonable for use in the funding and GASB valuations.

Mortality Assumptions

The experience study started with nationally published mortality tables and were adjusted based on LGERS actual experience. As noted under the TSERS section the report is silent as to the process used to adjust the rates for certain ages. For beneficiaries, the report indicates that beneficiaries from all the systems were combined to provide additional credibility. Non-safety disabled retirees were combined and safety disabled retirees were combined for the same reason. In general, the report demonstrates that considerations for setting mortality assumptions promulgated in ASOP 35 were followed.

We find the recommended assumptions (which were in use for the December 31, 2020 funding valuation) to be reasonable for use in the funding and GASB valuations.

RODSPF and DIPNC

The RODSPF and DIPNC experience study appears to be on a five-year cycle with the next cycle expected to be January 1, 2020 through December 31, 2024. We were provided the most recently completed experience study, dated December 9, 2020, covering the period January 1, 2015 through December 31, 2019. We have reviewed the demographic assumptions recommended from this study that are currently in use for the funding and GASB valuations.

The demographic experience for RODSPF is combined with the LGERS in the analysis. Therefore, the demographic assumptions for the RODSPF are the same as those for LGERS. Please see our aforementioned comments.

Except for rates of disability and recovery or death from disabled status, the demographic assumptions for the DIPNC are the same as those for TSERS. Please see our aforementioned comments.

The experience study report recommends updated disability and disability claim termination rates for DIPNC. The report provided to us for review showed neither the details of the current assumptions nor the actual experience. While the process to determine these proposed rates that was described is reasonable and in compliance with ASOPs, there is insufficient detail in the reports to determine if the recommended rates are reasonable. We recommend that future experience studies include the level of detail that compares actual, expected and proposed rates by age so that another actuary can opine on the reasonability of the recommendations.

In addition, for DIPNC, the experience study recommends projecting the valuation pay to the appropriate period rather than assuming that pay does not increase from disablement.

We find the recommended assumptions (which were in use for the December 31, 2020 funding valuation) to be reasonable for use in the funding and GASB valuations.

RHB

Non-health related demographic assumptions are the same as those used for the pension valuations. Specific health related demographic assumptions, such as participation, enrollment and migration assumptions are disclosed in the GASB Statement No. 74 reports. These assumptions are reported to be based on actual experience as well as future plan sponsor expectation as disclosed in the most recent financial report.

We find these assumptions to be reasonable for use in the GASB valuation. Currently, no funding valuation for the RHB is performed.

Review of Recommended Actuarial Methods

TSERS, LGERS, RODSPF

The funding and GASB valuations both use the Entry Age Actuarial Cost method. The asset method is a five-year smoothed market related value with a 20% corridor around the market for funding. The asset method for GASB is market value.

The most recent experience study proposed changes to some of the actuarial methods. The method for calculating the liability attributable to TSERS and LGERS terminated vested members is based on estimated benefits rather than 200% of each member's contribution balance. For RODSPF, the liability is based on each member's benefit provisions rather than the provisions for pre-2009 hires. In addition, the study recommends implementing direct rate smoothing over a five-year period to mitigate large contribution rate increases.

We find the methods used for the funding valuation to comply with the ASOPs and reasonable for funding. We find the methods used for the GASB valuation to those prescribed by the GASB pronouncements.

DIPNC

The funding uses the Aggregate Actuarial Cost method. The asset method is a five-year smoothed market related value with a 20% corridor around the market for funding. The funding method for GASB valuation is the Entry Age Actuarial Cost method. The asset method used for the GASB valuation is market value.

We find the methods used for the funding valuation comply with the ASOPs and reasonable for funding. We find the methods used for the GASB valuation to those prescribed by the GASB pronouncements.

RHB

The actuarial cost method for the GASB valuation is the Entry Age Actuarial Cost method. The asset method is the market value.

We find the methods used for the GASB valuation to be in accordance with those prescribed by the GASB pronouncements.

In summary, we find the demographic assumptions and actuarial methods used for the funding and GASB valuations to be reasonable.

SECTION 2

REVIEW OF ECONOMIC ASSUMPTIONS

Review of Economic Assumptions

The key economic assumptions are:

1. **Assumed Rate of Inflation** – The rate of price inflation (as measured by the Consumer Price Index for all Urban consumers) which underlies the remainder of the economic assumptions.
2. **Assumed Rate of Investment Return** – The expected annual rate of return on System assets, net of expenses, over a long-term period. This is also the rate at which projected future benefits under the system are discounted to the present.
3. **Assumed Rate of Increase in Compensation** – The rate at which a member's annual salary is assumed to increase each year, which impacts the level of member benefits.

ASOP No. 27

Actuarial Standards of Practice No. 27, Selection of Economic Assumptions for Measuring Pension Obligations, provides guidance on selection of economic assumptions for measuring obligations for defined benefit plans. The standard requires that the selected economic assumptions be consistent with each other. That is, the selection of the investment return assumption should be consistent with the selection of the wage inflation and price inflation assumptions.

ASOP No. 27 defines a reasonable economic assumption as an assumption that is:

1. Appropriate for the purpose of the measurement;
2. Reflects the actuary's professional judgment;
3. Takes into account historical and current economic data that is relevant as of the measurement date;
4. Is an estimate of future experience, an observation of the data inherent in market data or a combination thereof; and
5. Has no significant bias (i.e., it is not significantly optimistic or pessimistic) except when provisions for adverse deviation or other factors included and disclosed under Section 3.5.1, or when alternative assumptions are used for the assessment of risk.

However, the standard explicitly advises an actuary not to give undue weight to recent experience.

ASOP No. 27 acknowledges that for any given economic assumption, there is a reasonable range of opinions on that assumption.

Inflation

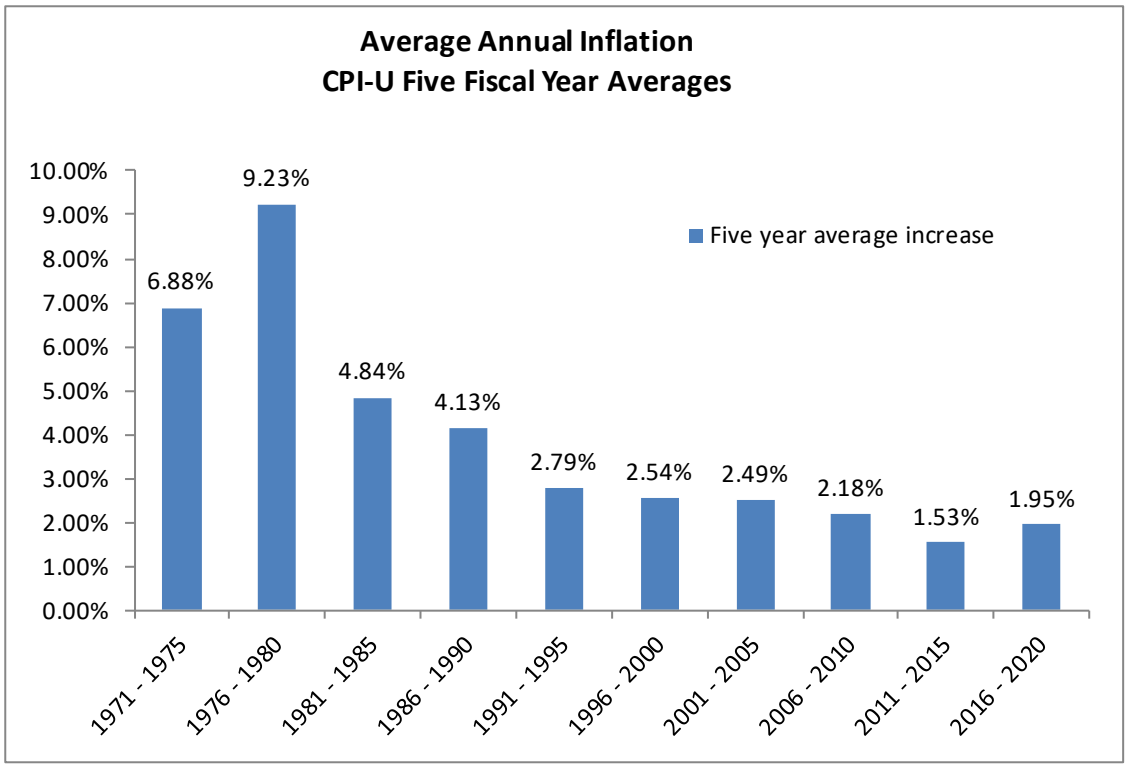
By "inflation," we mean price inflation, as measured by annual increases in the Consumer Price Index (CPI). This inflation assumption underlies all of the other economic assumptions. It not only impacts investment return, but also salary increases and other inflation linked benefits.

Over the five-year period from 2015 through 2020, the CPI-U has increased at an average rate of 1.95%.

The table on the following page shows the average inflation over various periods, ending December 31, 2020.

Fiscal Year	Annual Increase in CPI-U
2016	2.07%
2017	2.11%
2018	1.91%
2019	2.29%
2020	1.36%
3-Year Average	1.85%
5-Year Average	1.95%
10-Year Average	1.74%
20-Year Average	2.04%
25-Year Average	2.14%
30-Year Average	2.25%
40-Year Average	2.80%
50-Year Average	3.83%

The following graph shows the average inflation over five-year periods over the last 50 years:



As the above graph illustrates, the high inflation of the 1970s and 1980s is well in the past. The geometric average price inflation was 2.25% per year over the last 30 years, ending December 31, 2020; 2.04% over the last 20 years and 1.74% over the last 10 years.

Future Inflation Expectations

Since price inflation is relatively volatile and is subject to a number of influences not based on recent history, economic assumptions are less reliably based on recent past experience than are the demographic assumptions. Therefore, it is important not to give undue weight to recent experience. We must also consider future expectations for inflation as well.

We surveyed the inflation assumption used by twelve nationally recognized firms (investment consultants, asset managers, and insurance companies) across the country. In our sample of these firms, the short-term inflation assumption ranged from 1.92% to 3.10%, with an average of 2.19%; the long-term inflation assumptions ranged from 2.11% to 2.31%, with an average of 2.21%.

Another point of reference is the Social Security Administration's (SSA) 2020 Trustees Report, in which the Office of the Chief Actuary is projecting a long-term ultimate intermediate annual inflation rate assumption of 2.4%. The Social Security Trustees report uses the ultimate rates for their 75-year projections, much longer than the longest horizon we can discern from Treasuries and TIPS.

The table on the following page presents a summary of inflation rate forecasts from various professional experts.

Forward-Looking Annual Inflation Forecasts (From Professional Experts in the Field of Forecasting Inflation)[a]	
Congressional Budget Office[b]	
5-Year Annual Average	2.18%
10-Year Annual Average	2.29%
Federal Reserve Bank of Philadelphia[c]	
5-Year Annual Average	2.40%
10-Year Annual Average	2.30%
Federal Reserve Bank of Cleveland[d]	
10-Year Expectation	1.60%
20-Year Expectation	1.82%
30-Year Expectation	2.00%
Federal Reserve Bank of St. Louis[e]	
10-Year Breakeven Inflation	2.34%
20-Year Breakeven Inflation	2.43%
30-Year Breakeven Inflation	2.29%
U.S. Department of the Treasury[f]	
10-Year Breakeven Inflation	2.36%
20-Year Breakeven Inflation	2.39%
30-Year Breakeven Inflation	2.41%
50-Year Breakeven Inflation	2.45%
100-Year Breakeven Inflation	2.48%
Social Security Trustees[g]	
Ultimate Intermediate Assumption	2.40%

[a]End of the Second Quarter, 2021. Version 2021-08-11 by Gabriel, Roeder, Smith & Company.

[b]*The Budget and Economic Outlook: 2021 to 2031,* Release Date: February 2021, Consumer Price Index (CPI-U), Percentage Change from Year to Year, 5-Year Annual Average (2021 - 2025), 10-Year Annual Average (2021 - 2030).

[c]*First Quarter 2021 Survey of Professional Forecasters,* Release Date: May 14, 2021, Headline CPI, Annualized Percentage Points, 5-Year Annual Average (2021 - 2025), 10-Year Annual Average (2021 - 2030).

[d]Inflation Expectations, Model output date: June 1, 2021.

[e]The breakeven inflation rate represents a measure of expected inflation derived from X-Year Treasury Constant Maturity Securities and X-Year Treasury Inflation-Indexed Constant Maturity Securities. Observation date: June 1, 2021.

[f]*The Treasury Breakeven Inflation (TBI) Curve,* Monthly Average Rates, June, 2021.

[g]*The 2020 Annual Report of The Board of Trustees of The Federal Old-Age And Survivors Insurance and Federal Disability Insurance Trust Funds,* April 22, 2020, Long-range (75-year) assumptions, Intermediate, Consumer Price Index (CPI-W), for 2024 and later.

Taking all of this information into consideration, we believe that the 2.5% price inflation assumption currently used in the funding and GASB valuations is reasonable. We believe that a price inflation assumption in the range of 2.00% to 2.50% is supportable by historical experience and future expectations. That being said, price inflation is the starting point for the other economic assumptions, such as the investment rate of return, wage increases, and health trend rates. If a price inflation assumption is too high (low) and it results in an investment rate of return that is also too high (low), the resulting valuations can be too optimistic (pessimistic) and/or contributions that may be too low (high). However, if the investment rate of return assumption is not too high, then a price inflation that is higher than future expectations support can actually add a margin for adverse experience when measuring liabilities. In other words, it is important not to just look at this assumption in isolation.

Investment Return

The investment return assumption, also referred to as the valuation interest rate, is one of the principal assumptions in any actuarial valuation. It is used to discount future expected benefit payments back to the valuation date, which ultimately determines the liability (i.e., present value of benefits) of the retirement plan. Even a small change to this assumption can produce significant changes to the liabilities and contribution rates.

For TSERS, LGERS, RODSPF, and DIPNC this assumption was adjusted after the 2015-2019 experience study. For the RHB, this assumption is set by the State (and is currently the same as TSERS and LGERS). However, because the RHB is not a funded plan, this assumption is not the discount rate. Rather, the discount rate is based on the Bond Buyer 20-year GO index.

The assumed rate of investment return for TSERS and LGERS December 31, 2020 funding valuations was 6.5%. Based on the reported asset allocation (and the target allocation shown in the CAFR) and a 2.50% price inflation assumption, we believe this assumption is reasonable for use as the assumed rate of return for the funding valuations and the expected long-term rate of return for the GASB valuations, based on the information provided for this review. It is important to note that for both LGERS and TSERS, a large portion (approximately 25%, each) of their asset allocation (as reported in the December 31, 2020 valuations) is in the "other" category. This category is footnoted to indicate it covers real estate, alternatives, inflation and credit. We recommend this category be further subdivided since these categories do not all have the same future expectations. Subdividing this category would allow an auditor (or other user of the report) to perform a more robust analysis to determine if the assumption continues to be appropriate. RODSPF and DIPNC use an assumed of investment return of 3.00%. Since these funds are primarily invested in fixed income vehicles, we believe this is a reasonable assumption for funding and for the long expected rated of return for GASB, based on a 2.50% inflation assumption.

We have tested this assumption using our 2021 Capital Markets Assumption Model and the reported asset allocation in the December 31, 2020 reports. In 2021, the capital market assumptions used by the consultants who provide that information to us have continued a pattern of decreasing, even a more precipitous decrease in 2021. Based on our 2021 model, the 6.5% assumption is near the top of the range, we would consider to be reasonable using the current NCRS asset allocation. While the investment return assumption was reduced by 0.50% since the last valuation, the average expected returns produced by the 2021 capital market assumptions also decreased by approximately 0.50%.

Wage inflation, Payroll Growth and Pay Increases

These items were studied as part of the most recent experience study. These respective experience studies provide enough detail to demonstrate that the recommended assumptions (which were used in the December 31, 2020 funding valuations) are reasonable.

RHB Trend Rates

The trend rates used for the GASB valuation of the RHB are similar to the trend rates that GRS currently uses, but end in an ultimate rate higher than what GRS currently uses. However, we believe they are reasonable. We note the trend rates for are consistent with the rates used in the previous valuation.

Summary

In summary, we find the economic assumptions to be reasonable for funding and GASB.

SECTION 3

A REVIEW OF THE RESPECTIVE VALUATION REPORTS CONTAINING THE UNDERLYING CALCULATIONS FOR THE GASB VALUATIONS

Test Lives Review

TSERS

Actives

GRS requested test life information on 11 active cases. Three cases were listed as terminated (one vested) members and another case was listed as disabled (valued with active). The active cases are shown below:

Test Case	Age	Service	Reported Pay	Sex	Valuation Result	GRS	CMC	% Diff
1	40.3267	9.5378	$ 43,774.98	F	**EAAL**	$ 66,614	$ 70,764	-5.86%
Teacher					**PVB**	135,733	133,991	1.30%
					NC	5,860	5,130	14.23%
					PVFS	550,425	540,645	1.81%
2	55.1107	3.6667	1,114,166.61	M	**EAAL**	220,535	202,445	8.94%
General					**PVB**	501,778	537,627	-6.67%
					NC	41,357	39,305	5.22%
					PVFS	7,698,643	9,242,476	-16.70%
3	60.1189	5.1667	102,765.35	M	**EAAL**	103,749	105,684	-1.83%
General					**PVB**	192,669	196,631	-2.01%
					NC	16,771	15,465	8.45%
					PVFS	562,249	587,390	-4.28%
4	41.6831	18.8333	68,172.54	F	**EAAL**	256,232	256,905	-0.26%
General					**PVB**	292,562	303,317	-3.55%
					NC	4,987	5,584	-10.69%
					PVFS	511,730	553,224	-7.50%
5	57.7746	19.0000	44,664.37	M	**EAAL**	159,084	155,842	2.08%
Teacher					**PVB**	185,307	185,852	-0.29%
					NC	5,546	5,555	-0.17%
					PVFS	218,185	238,670	-8.58%
6	67.2077	15.5000	20,462.28	F	**EAAL**	55,496	56,093	-1.06%
General					**PVB**	65,990	67,096	-1.65%
					NC	3,055	3,012	1.42%
					PVFS	65,994	66,174	-0.27%
7	34.0821	1.9167	34,094.18	M	**EAAL**	8,978	8,376	7.19%
General					**PVB**	49,357	46,985	5.05%
					NC	3,955	3,513	12.58%
					PVFS	351,635	355,311	-1.03%
Total Test Cases					**EAAL**	870,688	856,108	1.70%
					PVB	1,423,396	1,471,499	-3.27%
					NC	81,531	77,564	5.11%
					PVFS	9,958,861	11,583,890	-14.03%

We were not able to replicate the active TSERS calculation for the case that was reported as currently receiving DIPNC benefits, since the underlying salary information was not available on the data file. We have therefore excluded that case.

TSERS

Retirees

GRS requested test life information on 14 retiree cases. The retiree cases are shown below:

Test Case	Age	Option Code	Current Monthly Benefit	Sex	Valuation Result	GRS	CMC	% Diff
1 - Law Enforcement	84.71	OPT3	$1,051.79	M	**EAAL/PVB**	$ 79,397	$ 77,871	1.96%
2 - General	75.04	MAX	281.00	F	**EAAL/PVB**	30,311	30,253	0.19%
3 - General	83.54	OPT63	1,610.64	F	**EAAL/PVB**	134,182	133,929	0.19%
4 - Teacher	63.46	MAX	3,499.43	F	**EAAL/PVB**	515,455	518,594	-0.61%
5 - General	77.62	OPT62	718.35	F	**EAAL/PVB**	88,903	87,287	1.85%
6 - General	66.88	MAX	365.78	F	**EAAL/PVB**	49,270	49,198	0.15%
7 - General (beneficiary)	56.62	OPT62	1,621.65	F	**EAAL/PVB**	246,704	236,293	4.41%
8 - Teacher	69.38	MAX	1,476.94	M	**EAAL/PVB**	182,598	175,119	4.27%
9 - Teacher	67.29	OPT62	1,795.69	M	**EAAL/PVB**	270,813	264,387	2.43%
10 - Teacher (disabled)	60.88	OPT2	1,656.99	F	**EAAL/PVB**	259,220	256,017	1.25%
11 - Teacher (disabled)	68.04	OPT62	1,231.57	M	**EAAL/PVB**	172,731	170,502	1.31%
12 - Teacher (disabled)	57.79	MAX	1,349.73	M	**EAAL/PVB**	158,610	159,351	-0.47%
13 - General	57.79	MAX	778.77	F	**EAAL/PVB**	121,045	121,105	-0.05%
14 - General	67.96	OPT62	2,966.47	F	**EAAL/PVB**	538,770	528,001	2.04%
Total Test Cases					**EAAL/PVB**	2,848,009	2,807,911	1.43%

TSERS

Terminated Vested

GRS requested test life information on 11 terminated vested cases. CMC indicated that one of those members was retired. The remaining terminated vested cases, and three terminated cases originally requested with the actives (one vested and two non-vested), are shown below:

Test Case	Age	Service	Accumulated Contributions	Sex	Valuation Result	GRS	CMC	% Diff
1	62.2159	14.1667	$ 38,940.86	M	**EAAL/PVB**	$ 72,408	$ 76,082	-4.83%
2 **	39.3470	9.7727	32,193.72	M	**EAAL/PVB**	32,194	32,720	-1.61%
3	49.1886	8.9166	40,207.08	F	**EAAL/PVB**	48,675	48,201	0.98%
4	58.4906	11.5833	69,694.51	M	**EAAL/PVB**	108,418	106,944	1.38%
5	52.649	5.8636	11,414.06	F	**EAAL/PVB**	14,603	15,205	-3.96%
6	52.1831	16.2500	64,135.72	M	**EAAL/PVB**	64,192	66,642	-3.68%
7	45.5246	16.000	114,684.33	F	**EAAL/PVB**	116,303	152,549	-23.76%
8 **	40.1381	11.8455	36,550.79	F	**EAAL/PVB**	36,551	36,998	-1.21%
9 **	39.1995	5.0122	14,324.45	F	**EAAL/PVB**	14,324	14,493	-1.17%
10 #	61.3157	2.2727	1,892.20	F	**EAAL/PVB**	1,892	3,784	-50.01%
11*#	32.8415	1.4167	4,770.83	M	**EAAL/PVB**	4,771	9,542	-50.00%
12 **	32.4045	5.0000	13,856.72	F	**EAAL/PVB**	13,857	13,980	-0.88%
13 #	23.7555	3.0000	3,835.36	F	**EAAL/PVB**	3,835	7,671	-50.00%
Total Test Cases					**EAAL/PVB**	532,023	584,811	-9.03%

** Non-vested termination with TSERS, but also valued as active with LGERS.*

*** PV of deferred benefits were lower than the contribution balances.*

 # GRS values are equal to contribution balances; CMC values are two times the balance. *See page 27 for comments.*

Total TSERS

(Actives, Retirees, and Terminated Vested)

Valuation Result	GRS	CMC	% Diff
EAAL	$4,250,720	$4,248,829	0.04%
PVB	4,803,428	4,864,220	-1.25%

LGERS

Actives

GRS requested test life information on 10 active cases. The 10 active cases are shown below:

Test Case	Age	Service	Reported Pay	Sex	Valuation Result	GRS	CMC	% Diff
1	34.7132	13.4167	$66,908.84	M	**EAAL**	$ 169,403	$ 167,104	1.38%
Law Enforcement					**PVB**	249,378	259,521	-3.91%
					NC	8,052	8,705	-7.50%
					PVFS	691,446	699,446	-1.14%
2	93.1627	24.5833	47,126.61	M	**EAAL**	102,721	83,781	22.61%
Law Enforcement					**PVB**	102,721	83,781	22.61%
					NC	0	0	
					PVFS	0	0	
3	45.2214	21.5000	73,932.41	M	**EAAL**	343,595	353,961	-2.93%
Law Enforcement					**PVB**	415,307	415,767	-0.11%
					NC	10,670	9,721	9.77%
					PVFS	519,563	466,969	11.26%
4	32.8415	6.4165	52,724.78	M	**EAAL**	35,461	45,632	-22.29%
General					**PVB**	85,034	112,826	-24.63%
					NC	4,301	5,634	-23.65%
					PVFS	643,075	621,573	3.46%
5	40.3854	14.7500	68,309.09	F	**EAAL**	175,626	189,170	-7.16%
Fire & Rescue					**PVB**	264,936	273,812	-3.24%
					NC	9,025	8,480	6.43%
					PVFS	706,420	674,766	4.69%
6	46.4127	26.4167	60,605.97	M	**EAAL**	359,265	427,766	-16.01%
Fire & Rescue					**PVB**	381,939	461,411	-17.22%
					NC	6,002	8,375	-28.34%
					PVFS	236,304	240,042	-1.56%
7	55.8321	21.0833	55,593.69	M	**EAAL**	232,948	225,835	3.15%
Fire & Rescue					**PVB**	272,178	265,755	2.42%
					NC	7,537	7,799	-3.36%
					PVFS	301,399	279,881	7.69%
8	36.3799	10.6667	74,098.07	M	**EAAL**	123,423	136,027	-9.27%
Fire & Rescue					**PVB**	228,741	231,169	-1.05%
					NC	9,426	8,592	9.71%
					PVFS	869,866	812,746	7.03%
9	60.7187	15.4167	31,514.12	F	**EAAL**	97,772	93,352	4.73%
General					**PVB**	116,636	115,969	0.58%
					NC	4,434	5,095	-12.98%
					PVFS	137,662	136,218	1.06%
10	33.2077	12.3334	31,859.85	M	**EAAL**	61,671	60,853	1.34%
Fire & Rescue					**PVB**	96,410	108,325	-11.00%
					NC	3,358	4,504	-25.45%
					PVFS	344,034	330,684	4.04%
Total Test Cases					**EAAL**	1,701,885	1,783,482	-4.58%
					PVB	2,213,280	2,328,335	-4.94%
					NC	62,805	66,905	-6.13%
					PVFS	4,449,769	4,262,326	4.40%

LGERS

Retirees

GRS requested test life information on 12 retiree cases. Those 12 retiree cases are shown below:

Test Case	Age	Option Code	Current Monthly Benefit	Sex	Valuation Result	GRS	CavMac	% Diff
1 - Law Enforcement	70.62	MAX	$1,129.62	M	**EAAL/PVB**	$ 125,091	$ 123,461	1.32%
2 - General	73.04	OPT62	2,451.86	F	**EAAL/PVB**	341,399	340,652	0.22%
3 - General	71.21	MAX	1,279.95	F	**EAAL/PVB**	155,697	156,526	-0.53%
4 - General	73.88	OPT62	861.66	F	**EAAL/PVB**	111,400	110,562	0.76%
5 - General	82.79	MAX	1,943.90	F	**EAAL/PVB**	151,817	149,808	1.34%
6 - General	67.12	MAX	360.39	F	**EAAL/PVB**	48,353	48,470	-0.24%
7 - Law Enforcement	59.38	OPT63	2,943.97	M	**EAAL/PVB**	462,354	461,232	0.24%
8 - General	70.96	MAX	1,101.97	F	**EAAL/PVB**	135,161	134,766	0.29%
9 - General	57.21	OPT4	3,029.60	M	**EAAL/PVB**	321,190	324,322	-0.97%
10 - Law Enforcement	55.12	OPT62	4,792.63	M	**EAAL/PVB**	818,385	813,967	0.54%
11 - Fire	74.46	OPT2	1,319.25	M	**EAAL/PVB**	190,984	186,677	2.31%
12 - General	75.12	MAX	1,442.55	F	**EAAL/PVB**	155,618	156,781	-0.74%
Total Test Cases					**EAAL/PVB**	3,017,449	3,007,222	0.34%

Terminated Vested

GRS requested test life information on 10 Terminated Vested cases. Those 10 cases are shown below:

Test Case	Age	Service	Accumulated Contributions	Sex	Valuation Result	GRS	CMC	% Diff
1 - Fire & Rescue	59.2719	18.4166	$91,267.21	M	**EAAL/PVB**	$ 199,028	$ 208,782	-4.67%
2 - Fire & Rescue	40.4605	7.7500	22,778.15	M	**EAAL/PVB**	22,778	21,577	5.57%
3 - Fire & Rescue	37.2801	8.3333	32,705.50	M	**EAAL/PVB**	32,706	30,962	5.63%
4 - Fire & Rescue	39.4127	7.4166	26,912.60	F	**EAAL/PVB**	26,913	25,334	6.23%
5 - Fire & Rescue	66.0411	10.5000	35,255.31	M	**EAAL/PVB**	54,773	66,579	-17.73%
6 - General	43.1025	7.4167	16,933.64	F	**EAAL/PVB**	16,934	16,333	3.68%
7 - General	53.3799	10.3332	36,368.82	F	**EAAL/PVB**	49,137	56,700	-13.34%
8 - General	61.3580	8.2500	34,123.34	M	**EAAL/PVB**	34,123	36,219	-5.79%
9 - General	54.7351	12.0000	54,513.22	F	**EAAL/PVB**	74,961	88,747	-15.53%
10 - General*	65.0602	0.4166	962.40	M	**EAAL/PVB**	962	1,925	-50.02%
Total Test Cases					**EAAL/PVB**	512,315	553,158	-7.38%

** Non-vested termination with LGERS, but also valued as active with TSERS (disability case). GRS values are equal to contribution balances; CMC values are two times the balance. See page 27 for comments.*

Total LGERS

(Actives, Retirees, and Terminated Vested)

Valuation Result	GRS	CMC	% Diff
EAAL	$5,231,649	$5,343,862	-2.10%
PVB	5,743,044	5,888,715	-2.47%

RODSPF

Actives

GRS requested test life information on 10 active cases. CMC indicated that one of the cases was not on the RODSPF file and one was terminated. The remaining active cases are shown below:

Test Case	Age	Service	Reported Pay	Sex	Valuation Result	GRS	CMC	% Diff
1	79.7050	34.2500	$61,142.59	F	**EAAL**	$ 163,924	$ 163,591	0.20%
					PVB	163,924	163,591	0.20%
					NC	0	0	
					PVFS	0	0	
2	42.9659	15.9167	62,773.14	F	**EAAL**	27,751	44,802	-38.06%
					PVB	106,856	163,348	-34.58%
					NC	5,249	9,831	-46.61%
					PVFS	958,353	754,247	27.06%
3	57.3212	20.5833	88,195.44	F	**EAAL**	193,186	190,934	1.18%
					PVB	259,639	271,014	-4.20%
					NC	11,809	14,160	-16.60%
					PVFS	509,926	496,609	2.68%
4	39.0548	4.0833	49,192.36	F	**EAAL**	28,591	28,618	-0.09%
					PVB	111,422	112,780	-1.20%
					NC	5,427	5,350	1.44%
					PVFS	761,348	766,152	-0.63%
5	66.0329	16.0833	51,396.74	M	**EAAL**	67,738	82,618	-18.01%
					PVB	120,722	142,375	-15.21%
					NC	8,335	10,169	-18.04%
					PVFS	340,646	303,197	12.35%
6	63.9495	13.1667	44,849.04	F	**EAAL**	126,793	103,131	22.94%
					PVB	197,117	180,710	9.08%
					NC	13,496	12,870	4.86%
					PVFS	244,433	271,794	-10.07%
7	37.6831	9.4167	103,209.76	M	**EAAL**	71,486	78,222	-8.61%
					PVB	149,911	165,228	-9.27%
					NC	5,247	5,545	-5.37%
					PVFS	1,599,516	1,633,173	-2.06%
8	56.6804	2.0833	60,133.29	F	**EAAL**	23,289	21,032	10.73%
					PVB	99,728	95,338	4.60%
					NC	9,588	8,593	11.58%
					PVFS	481,007	505,900	-4.92%
Total Test Cases					**EAAL**	702,758	712,948	-1.43%
					PVB	1,209,319	1,294,384	-6.57%
					NC	59,151	66,518	-11.08%
					PVFS	4,895,229	4,731,072	3.47%

RODSPF

Retirees

GRS requested test life information on 11 retiree cases. CMC indicated that one of the individuals was deceased and one was not receiving RODSPF benefits. The remaining retiree cases are shown below:

						GRS		CMC	% Diff	
Test Case	Age	Option Code*	Current** Monthly Benefit	Sex	Valuation Result #	Exact Fract. Age	Nearest Integer Age		Exact Fract. Age	Nearest Integer Age
1	75.12	OPT62	$1,903.46	F	**EAAL/PVB**	$ 207,677	$ 208,722	$ 208,644	-0.46%	0.04%
2	67.29	MAX	5,145.26	M	**EAAL/PVB**	239,806	242,094	242,045	-0.93%	0.02%
3	73.46	MAX	3,994.53	F	**EAAL/PVB**	222,996	226,820	226,802	-1.68%	0.01%
4	72.54	OPT63	1,645.20	F	**EAAL/PVB**	231,315	226,820	226,802	1.99%	0.01%
5	66.88	MAX	794.63	F	**EAAL/PVB**	280,970	279,411	279,498	0.53%	-0.03%
6	78.71	MAX	4,357.65	M	**EAAL/PVB**	142,706	139,877	138,881	2.75%	0.72%
7	62.71	OPT63	3,954.55	F	**EAAL/PVB**	314,513	311,853	311,973	0.81%	-0.04%
8	62.29	MAX	1,129.01	M	**EAAL/PVB**	280,992	283,138	283,230	-0.79%	-0.03%
9	54.12	OPT4	3,516.69	F	**EAAL/PVB**	375,030	375,770	375,910	-0.23%	-0.04%
Total Test Cases					**EAAL/PVB**	2,296,005	2,294,505	2,293,785	0.10%	0.03%

** ROD benefits are paid for the life of the member only (MAX), regardless of beneficiary/option election for benefits paid from other plans.*

*** Benefit listed is LGERS benefit; ROD benefits are valued at $1,500 monthly.*

 # See page 28 regarding ages used for valuation results.

Terminated Vested

GRS requested test life information for two terminated vested cases. CMC indicated that they were terminated vested in LGERS.

Total RODSPF

(Actives and Retirees)

Valuation Result	GRS	CMC	% Diff
EAAL	$2,998,763	$3,006,733	-0.27%
PVB	3,505,324	3,588,169	-2.31%

DIPNC

Actives

GRS requested test life information on 10 active cases. One of these cases moved to retiree status. The remaining active cases are shown below:

Test Case	Age	Service	Reported Pay	Sex	Valuation Result	GRS	CMC	% Diff
1	67.9906	n/a	$185,824.33	M	**EAAL**	$ (72)	$ (560)	-87.14%
					PVB	332	431	-22.97%
					NC	95	275	-65.45%
					PVFS	658,064	615,802	6.86%
2	49.2159	21.3000	19,617.10	F	**EAAL**	53	215	-75.35%
					PVB	319	554	-42.42%
					NC	30	36	-16.67%
					PVFS	180,297	225,028	-19.88%
3	39.3267	9.5378	43,774.98	F	**EAAL**	456	273	67.03%
					PVB	1,596	1,295	23.24%
					NC	71	58	22.41%
					PVFS	748,164	783,900	-4.56%
4	26.0861	4.0000	23,031.69	F	**EAAL**	83	47	76.60%
					PVB	346	251	37.85%
					NC	18	15	20.00%
					PVFS	349,351	500,602	-30.21%
5	53.3157	15.5556	37,705.71	F	**EAAL**	89	275	-67.64%
					PVB	882	1,222	-27.82%
					NC	83	98	-15.31%
					PVFS	373,098	361,887	3.10%
6	35.7406	11.8484	51,433.45	F	**EAAL**	429	270	58.89%
					PVB	1,072	769	39.40%
					NC	43	33	30.30%
					PVFS	805,371	698,856	15.24%
7	24.5465	3.2727	39,393.50	F	**EAAL**	99	41	141.46%
					PVB	280	158	77.22%
					NC	18	12	50.00%
					PVFS	412,808	376,959	9.51%
8	47.9550	18.4545	76,519.74	M	**EAAL**	236	530	-55.47%
					PVB	1,166	1,414	-17.54%
					NC	87	79	10.13%
					PVFS	854,764	776,478	10.08%
9	67.2433	10.9167	29,086.67	M	**EAAL**	(64)	(94)	-31.91%
					PVB	0	216	-100.00%
					NC	19	85	-77.65%
					PVFS	90,793	95,841	-5.27%
Total Test Cases					**EAAL**	1,309	997	31.29%
					PVB	5,993	6,310	-5.02%
					NC	464	691	-32.85%
					PVFS	4,472,710	4,435,353	0.84%

DIPNC

Retirees

GRS requested test life information on 10 retiree cases. Those 10 retiree cases are shown below:

Test Case	Age	Disability Start Date	Current Monthly Benefit	Sex	Valuation Result	GRS	CMC	% Diff
1	60.99	11/2003	1,258.07	F	**EAAL/PVB**	$ 0	$ 639	-100.00%
2	62.44	4/2008	2,734.17	M	**EAAL/PVB**	0	0	n/a
3	60.61	8/2009	2,661.25	F	**EAAL/PVB**	5,875	6,888	-14.71%
4	52.35	11/2012	1,840.77	F	**EAAL/PVB**	55,377	55,878	-0.90%
5	50.35	2/2018	2,171.35	F	**EAAL/PVB**	51,088	34,122	49.72%
6	68.54	4/1981	702.90	F	**EAAL/PVB**	97,456	109,377	-10.90%
7	53.54	1/2011	3,172.86	F	**EAAL/PVB**	142,575	142,436	0.10%
8	60.27	6/2007	1,197.37	F	**EAAL/PVB**	12,678	24,141	-47.48%
9	53.10	11/1999	1,970.44	M	**EAAL/PVB**	21,290	21,822	-2.44%
10	60.19	8/2019	1,342.25	F	**EAAL/PVB**	9,374	9,032	3.79%
Total Test Cases					**EAAL/PVB**	395,713	404,335	-2.13%

Terminated Vested

Terminated vested members of TSERS are not eligible for DIPNC benefits, therefore none were requested.

Total DIPNC

(Actives and Retirees)

Valuation Result	GRS	CMC	% Diff
EAAL	$397,022	$405,332	-2.05%
PVB	401,706	410,645	-2.18%

RHB

GRS requested test life information on 10 active, 12 retiree and 10 terminated vested cases. Segal previously indicated that they do not run valuations seriatim. Instead, they group the data into smaller categories, run each group as if it was an individual record, and then gross the results up by the number in the group. Segal was very helpful and worked with us to identify testing that GRS would be comfortable in using instead of individual records when we first began reviewing these reports (in 2018). Each test record in the following displays actually represents a group of members.

Actives

Test Case	Age	Service	Reported Pay	Sex	Valuation Result	GRS	Segal	% Diff
1	40.33	9.54	$ 43,775	F	EAAL	$ 48,588	$ 52,389	-7.26%
Teachers					PVB	199,060	202,259	-1.58%
					NC	8,983	8,814	1.92%
					PVFS	759,159	744,337	1.99%
2	59.46	24.58	$ 55,000	F	EAAL	79,813	72,734	9.73%
Teachers					PVB	95,449	95,278	0.18%
					NC	5,743	6,087	-5.65%
					PVFS	134,991	203,698	-33.73%
3	36.39	15.90	$ 52,017	M	EAAL	105,143	141,018	-25.44%
General					PVB	304,562	338,901	-10.13%
					NC	14,066	16,638	-15.46%
					PVFS	736,607	618,643	19.07%
4	55.69	15.00	$ 31,953	M	EAAL	42,919	45,946	-6.59%
General					PVB	86,108	85,658	0.53%
					NC	5,351	4,669	14.61%
					PVFS	261,854	271,786	-3.65%
5	34.08	1.92	$ 34,094	M	EAAL	13,999	14,297	-2.08%
General					PVB	110,458	110,731	-0.25%
					NC	5,828	5,964	-2.28%
					PVFS	551,944	551,290	0.12%
6	67.21	15.50	$ 20,462	F	EAAL	12,310	16,844	-26.92%
Other					PVB	32,653	36,829	-11.34%
					NC	5,177	5,072	2.07%
					PVFS	74,528	80,628	-7.57%
7	56.26	17.30	$ 18,764	F	EAAL	45,512	45,442	0.15%
Other					PVB	83,299	86,329	-3.51%
					NC	5,523	4,990	10.68%
					PVFS	131,337	153,748	-14.58%
8	34.68	10.25	$ 64,020	F	EAAL	122,007	116,493	4.73%
Other					PVB	231,288	221,593	4.38%
					NC	7,321	6,873	6.52%
					PVFS	965,437	979,007	-1.39%
9	50.99	5.04	$ 28,755	F	EAAL	17,578	17,970	-2.18%
Other					PVB	54,216	53,469	1.40%
					NC	2,846	2,636	7.97%
					PVFS	382,554	387,310	-1.23%
Total Test Cases					EAAL	487,869	523,133	-6.74%
					PVB	1,197,093	1,231,047	-2.76%
					NC	60,838	61,743	-1.47%
					PVFS	3,998,411	3,990,447	0.20%

RHB

Retirees

	Test Case	Age	Sex	Valuation Result	GRS	Segal	% Diff
1	General	91.59	F	EAAL/PVB	$ 4,973	$ 5,183	-4.05%
2	General	84.02	F	EAAL/PVB	10,219	10,696	-4.46%
3	General	76.76	M	EAAL/PVB	20,346	20,434	-0.43%
4	General	72.04	F	EAAL/PVB	26,605	27,190	-2.15%
5	General	72.29	M	EAAL/PVB	27,932	28,992	-3.66%
6	General	66.62	F	EAAL/PVB	36,701	36,441	0.71%
7	General (disabled)	67.09	F	EAAL/PVB	28,754	29,403	-2.21%
8	General (disabled)	50.34	F	EAAL/PVB	155,941	161,058	-3.18%
9	General	61.26	M	EAAL/PVB	101,782	106,161	-4.12%
10	General (disabled)	63.01	M	EAAL/PVB	29,301	30,320	-3.36%
11	Teachers/Other	74.20	M	EAAL/PVB	26,779	27,692	-3.30%
12	General	68.54	F	EAAL/PVB	512	2,097	-75.58%
	Total Test Cases			EAAL/PVB	469,845	485,667	-3.26%

Terminated Vested

	Test Case	Age	Service	Sex	Valuation Result	GRS	Segal	% Diff
1	Teacher	47.61	18.4	F	EAAL/PVB	$ 112,538	$ 114,426	-1.65%
2	Teacher	51.81	7.9	F	EAAL/PVB	7,274	19,105	-61.93%
3	Teacher	36.17	7.6	F	EAAL/PVB	8,945	28,376	-68.48%
4	Teacher	42.27	8.0	F	EAAL/PVB	131,330	136,317	-3.66%
5	Law Enforcement	46.70	18.4	M	EAAL/PVB	121,021	126,156	-4.07%
6	General	63.61	6.2	F	EAAL/PVB	59,764	54,972	8.72%
	Total Test Cases				EAAL/PVB	440,872	479,352	-8.03%

Total RHB

(Actives, Retirees, and Terminated Vested)

Valuation Result	GRS	Segal	% Diff
EAAL	$1,398,586	$1,488,152	-6.02%
PVB	2,107,810	2,196,066	-4.02%

Test Lives Comments

We believe that the test lives are close enough to state that the liabilities shown in the funding valuations are reasonable and an appropriate representation of the liabilities, based on the current assumptions. When performing a full replication valuation, we generally consider replication a successful match if the replication is within the following tolerances (in plan total):

Total Present Value of Benefits	2%
Total Accrued Liability	5%
Normal Cost	5%
Present Value of Future Pay	2%

When looking at individual test life cases, differences may be much larger due to differences in rounding between actuarial software. For this reason, it is also important to consider the variance between the sums of the test cases, which will generally dampen the effect of differences due to rounding. However, the smaller the group of test cases, the larger the acceptable tolerances should be. We have found that the sums of the test cases (actives, retirees and terminated vested) for each of the plans we have reviewed are all within or acceptably close to the tolerance we would have applied to the plan totals when performing a full replication. We therefore believe the plan total results for TSERS, LGERS, RODSPF, DIPNC and RHB are reasonable.

This is our fourth year performing this analysis. As such, we attempted to request some of the same test life cases this year as we did in previous years, so we could review how the results changed from year-to-year. The results of our test life comparisons are generally consistent with the analysis performed in past years.

We have the following comments regarding the valuation reports and the current actuaries' calculations:

- The most recent 2015-2019 Experience Study noted that NCRS is working to provide CMC with more complete information regarding terminated vested members. The experience study recommended a change in the method for valuing inactive members. The method was changed from setting liabilities to 200% of the member's accumulated contributions, to using actual data (where possible) and estimating earnings where actual data isn't available for members with five or more years of service. For members with less than five years of service, 100% of the member's accumulated contributions are used.
- In relation to the previous point, we noted that members with less than five years of service were reported to have liabilities equal to 200% of their accumulated contributions (see TSERS test cases 10, 11, and 13, and LGERS test case 10). We recommend CMC reevaluate their calculation and/or disclosures in their report for consistency.
- Several of the terminated vested test cases showed greater discrepancies than others. GRS was not provided with the estimated benefits for the vested terminated members and therefore attempted to estimate the members' benefits using methods and assumptions described in the CMC reports. It may be that test cases where the difference is greater is attributable to using actual available data versus an estimation. In addition, we could not locate an assumption detailing when a terminated vested member would commence benefits. We assumed these members would commence receipt of benefits at earliest eligibility for reduced retirement benefits.

- For RODSPF retired test lives, two of the retirees had the same present value. Upon inspection, it was noted that the two retirees were within one year in age. It was further noted that for RODSPF retirees with birthdays closer to the valuation date (December 31), GRS values were closer to CMC's values, while for those with birthdays in the summer months the differences between GRS' and CMC's values were greater. This observation led us to evaluate/test the present values based on the retirees' nearest integer age at the valuation date, instead of exact fractional age as used with the other groups; this additional comparison is shown on page 21. Using nearest integer age yields results that are much closer to CMC's results, and would explain why two members with different ages could have the same present value. We recommend that CMC either reevaluate their calculation procedure for RODSPF retirees, or disclose the method used to calculate ages when valuing retirees.
- We continue to recommend a description concerning how RODSPF service is determined and/or maintained (see comment below).
- We noted that there exists retired DIPNC members who, based on the raw data provided to us, should have stopped receiving benefits prior the valuation date. However, looking at their liability figures, it appears these members are projected to receive benefits after the valuation date.
- The 2015-2019 Experience Study recommended updating the disability claim termination assumptions, from the 2012 GLTD table to 2019 GLTD table. However, the disability claim termination rates shown in Appendix D of the 2020 valuation report are the same as the 2019 valuation. We recommend CMC review their assumptions and/or disclosures in their report for consistency.
- We recommend Segal review the disability rates used in their actuarial valuation for consistency with the rates disclosed by CMC in the DIPNC valuation. We noted that the rates for males aged 20 to 24 were inconsistent with CMC's report.
- We recommend Segal review the spouse age difference assumption used in their report, which was four years. Pursuant to their Experience Study, CMC changed this assumption to three years. While we do not believe it absolutely necessary to use the same assumption is in both valuations, the demographic assumptions among the two valuations have been consistent historically.

We have the following comments regarding future audits:

- In reviewing the RODSPF actives, it became clear that the reported service on the file was not RODSPF service in all cases (it was most likely total LGERS service). We were able to find RODSPF start dates based on internet searches of public data to better match calculations. We suspect that CMC must have had additional data regarding RODSPF service for active members (as searching public databases would not be practical for the entire RODSPF active population). We recommend that such additional information be included in data provided to the auditor.
- As discussed previously, provide the estimated benefits for terminated vested members to the auditor.

SECTION 4

A REVIEW OF THE RESPECTIVE GASB REPORTS

Content Review

The GASB Statement Nos. 67 and 74 letters combined with the schedules in the funding valuation appear to have all of the actuarial schedules required by GASB Statement Nos. 67 and 74.

For the reports prepared by CMC, there are separate GASB letters issued with the main results. However, the information in these letters appears to be replicated in the funding valuation with additional GASB schedules. We believe that all of the actuarial schedules and actuarial disclosures required by GASB Statement Nos. 67 and 74 are detailed in the funding valuation report.

For the report prepared by Segal, there is no funding valuation (in accordance with the plan sponsor's decisions). The report that Segal provided for the GASB Statement No. 74 results contained the underlying valuation results as of December 31, 2020. We believe that the Segal GASB Statement No. 74 report contains all the actuarial schedules and disclosures required by GASB Statement No. 74.

Calculations Review

While our review affirmed the December 31, 2020 calculations of liabilities, the following chart shows our attempt at replicating the roll forward to June 30, 2021. Since the exact calculations were not provided and certain elements had to be estimated, we did not expect to exactly reproduce the June 30, 2021 numbers. As the schedules show, our estimates were extremely close.

		TSERS	LGERS	RODSPF	DIPNC	RHB
	Data					
1	December 31, 2020 AAL	$89,809,074,074	$33,485,232,590	$33,840,219	$323,115,513	$32,426,167,000
2	Employee Contribs during 12 months, ending 6/30/21	981,051,000	453,112,000	-	-	-
3	Employer Normal Cost Rate (Excl Admin Exp) as of 1/1/21	6.29%	7.23%	17.17%	23,010,000	2,131,391,000
4	Payroll as of 12/31/20	15,287,665,011	6,486,115,903	6,950,372		
5	Benefits Paid during 12 months ending 6/30/21	5,055,075,000	1,630,148,000	1,802,000	47,453,000	1,100,633,000
	GRS' approximation of numbers needed for roll forward					
	Change in Benefit Terms (not already included in					
6	12/31/2020 AAL)	-	-	-	-	-
7	Service Cost from 12/31/20 to 6/30/21: (3)*(4)/2	480,797,065	234,369,544	596,615	11,505,000	1,065,695,500
8	Benefit Payments from 12/31/20 to 6/30/21: (5)/2	2,527,537,500	815,074,000	901,000	23,726,500	550,316,500
	GRS' approximation of 6/30/21 TPL/OBEP Liab (roll forward)					
9	12/31/20 TPL: (1)+(6)	89,809,074,074	33,485,232,590	33,840,219	323,115,513	32,426,167,000
10	Service Cost: (2)/2 + (7)	971,322,565	460,925,544	596,615	11,505,000	1,065,695,500
11	Benefit Payments	2,527,537,500	815,074,000	901,000	23,726,500	550,316,500
12	Interest: (1)*6.5%/2 + [(10)-(11)]*6.5%/4[#]	2,893,506,415	1,082,515,147	505,320	4,755,071	352,985,650
13	TPL/OPEB Liab 6/30/21: (9) + (10) - (11) + (12)	91,146,365,553	34,213,599,281	34,041,155	315,649,084	33,294,531,650
14	TPL/OPEB Liab 6/30/21 developed by CavMac/Segal	91,073,632,000	34,180,463,000	33,990,000	315,388,000	33,500,219,000
15	Ratio of GRS approximation to CavMac/Segal Calculation	100.1%	100.1%	100.2%	100.1%	99.4%

[#] *For RODSPF and DIPNC, 6.5% is replaced with 3.00%; 2.16% for RHB.*

SECTION 5

COMMENTS AND CONCLUSIONS

Comments

We would like to thank Segal and CMC for their cooperation in the completion of this review. However, we would like to specifically recognize Segal for going above and beyond expectations in their efforts to ensure that we had the information necessary to complete our assignment.

While we have indicated we believe the assumed rate of return of 6.50% was reasonable for TSERS and LGERS (based on the information provided for this review). However, capital market expectations have continued to decrease. If this trend continues, it's possible this assumption may need to be lowered for future valuations (assuming no change in the asset allocation).

Prior Year's Recommendations

We have reviewed the reports with regard to our recommendations from last year (and the prior years) and have found implementation of most of our recommendations.

Conclusions

We believe the actuarial assumptions, actuarial cost methods, procedures, and valuation results are reasonable and based on our test life review, the valuation results are of reasonable accuracy.

We certify that the plans' actuarial valuation was prepared in accordance with pronouncements issued by the Governmental Accounting Standards Board (GASB), principles and practices prescribed by the Actuarial Standards Board, and that the actuarial calculations were performed by qualified actuaries in accordance with accepted actuarial procedures.

Recommendations for Future Years

We have the following recommendations for future valuations:

- We recommend the North Carolina Retirement Systems continue working to provide their actuary with more complete information regarding terminated vested members.
- We recommend that CMC increase the documentation regarding their data processing. Specifically, we suggest that documentation/commentary include:
    - How RODSPF service is determined/maintained
- We recommend CMC and Segal review their calculations, assumptions, and/or disclosures with regard to the following:
    - Liability calculations for non-vested terminated members
    - Assumed commencement age for vested terminated members
    - Age rounding methods (where applicable)
    - Disability claim termination rates (DIPNC)
    - Disability rates (RHB/DIPNC)
    - Spousal age difference (RHB)
- Providing additional data used in the valuation to the actuarial auditor:
    - RODSPF service for active members
    - Estimated benefits for terminated vested members