

Commonwealth of Virginia Joint Legislative Audit and Review Commission

2022 Quadrennial Actuarial Audit of the
Virginia Retirement System



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Actuarial Standard of Practice No. 41

TRANSMITTAL LETTER



May 18, 2022

Mr. Hal Greer
Director
Commonwealth of Virginia
Joint Legislative Audit and Review Commission
919 E. Main Street, Suite 2101
Richmond, Virginia 23219

Re: 2022 Quadrennial Actuarial Audit of the Virginia Retirement System

Dear Mr. Greer:

Presented in this report are the results of the 2022 Quadrennial Actuarial Audit of the Virginia Retirement System ("VRS"). This report has been prepared in order for the Joint Legislative Audit and Review Commission, herein referred to as JLARC, to meet its statutory responsibility, mandated by the Virginia Retirement System Oversight Act (§30-78 – §30-84 of the Code of Virginia), for publishing an actuarial report concerning the VRS. This 2022 Quadrennial Actuarial Audit is intended to provide the General Assembly with a comprehensive overview of the actuarial soundness of the VRS. Although the term "actuarial soundness" is not specifically defined, the primary purpose of the 2022 Quadrennial Actuarial Audit of VRS is to evaluate the financial status of the VRS as of June 30, 2021.

This 2022 Quadrennial Actuarial Audit consists of a non-replication actuarial audit of the assumptions, methods, procedures and conclusions used in the June 30, 2021, actuarial valuations prepared by VRS' consulting actuary, Cavanaugh Macdonald Consulting, LLC ("CMC").

The results of the audit are presented in the following format:

- I. Executive Summary
- II. General Audit Approach
- III. Reasonableness of Actuarial Assumptions
- IV. Reasonableness of Actuarial Methods and Funding Policy
- V. Application of Actuarial Assumptions, Methods and Benefit Plan Provisions
- VI. Actuarial Report Content, Detail, Format and Clarity
- VII. Review of Contribution Rates and Funded Ratios
- VIII. Actuarial Principles and Practices Employed by the Actuary
- IX. Comments and Considerations from the 2018 Quadrennial Audit
- X. Virginia Retirement System Response

This study was performed at the request of the JLARC and may be shared with other interested parties only with the permission of the JLARC. If shared with other parties, it should be shared in its entirety.

We would like to thank the staff at the VRS as well as CMC for their cooperation and assistance in providing the requested information as well as their thoughtful responses to our questions and inquiries.

Please understand that the primary purpose of our recommendations provided throughout this audit report is to improve the actuarial valuation process. We trust that CMC and VRS will find these recommendations to be helpful.

It is important to remember that actuarial calculations are based on assumptions regarding future events. Future actuarial measurements may differ significantly from the current measurements 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 operation of the methodology used for these measurements (such as the end of an amortization period or additional cost or contribution requirements based on the plan's funded status); and changes in plan provisions or applicable law.

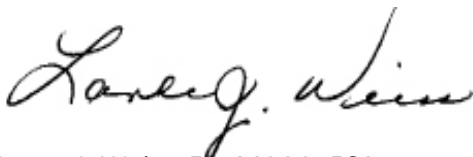
This audit was performed by actuaries experienced with public sector retirement systems. The actuaries signing this report, Lance J. Weiss and Amy Williams, are Members of the American Academy of Actuaries and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

GRS is independent of VRS, JLARC and CMC.

If you have any questions on this report or need additional information, please feel free to contact us.

Respectfully submitted,

Gabriel, Roeder, Smith & Company



Lance J. Weiss, EA, MAAA, FCA
Senior Consultant and Team Leader



Amy Williams, ASA, MAAA, FCA
Senior Consultant



SECTION I.

EXECUTIVE SUMMARY

Executive Summary

In accordance with the Virginia Retirement System Oversight Act (§30-78 – §30-84 of the Code of Virginia), Gabriel, Roeder, Smith & Company (“GRS”) was hired by the Joint Legislative Audit and Review Commission (“JLARC”) to conduct the 2022 Quadrennial Actuarial Audit of the Virginia Retirement System (“VRS”).

The purpose of this audit is to provide the General Assembly with a comprehensive overview of the actuarial soundness of the VRS. This audit consisted of a non-replication actuarial audit of the actuarial assumptions, methods and procedures used in, and the resulting conclusions from, the June 30, 2021, actuarial valuations prepared by VRS’ consulting actuary, Cavanaugh Macdonald Consulting, LLC (“CMC”).

Note that a full replication of the June 30, 2021, actuarial valuation results was not covered under the scope of this engagement. The actuarial audit consisted of a review of the key components in the actuarial valuations as well as a review of 94 test life cases in order to opine on the correct application of the actuarial assumptions, methods and benefit plan provisions (including the calculation of the normal cost and actuarial accrued liability).

The actuarial audit of the VRS included a review of the following VRS programs:

- VRS State Plans covering the following divisions: State Employees, Teachers, State Police (SPORS), Judges (JRS) and Virginia Law Officers (VaLORS);
- Six select political subdivisions participating in the VRS;
- Group Life Insurance Program (“GLI”);
- Health Insurance Credit Program (“HIC”);
- Line of Duty Act Program (“LODA”);
- Virginia Sickness and Disability Program (“VSDP”); and
- Virginia Local Disability Program (“VLDP”).

Based on the results of our audit, we believe that:

- VRS is actuarially sound;
- The actuarial assumptions used for the June 30, 2021, actuarial valuations of all plans are generally reasonable;
- The funding ratio of the VRS plans are generally improving and moving towards a 100 percent funded ratio goal; and
- The actuarial valuations prepared by Cavanaugh Macdonald Consulting, LLC, VRS’ Consulting Actuary, are reasonable and generally comply with the Actuarial Standards of Practice.

This audit report contains a number of recommendations resulting from our review. However, we do not consider these recommendations to be the result of material deficiencies; rather, these recommendations are intended to improve the measurement and communication of future actuarial valuations.

Executive Summary

Below is a **high level** summary of the areas addressed in the audit and our associated findings and recommendations:

- Actuarial Assumptions
 - Findings
 - We believe the actuarial assumptions used in the actuarial valuations for all the defined benefit plans, including the economic assumptions (inflation, investment return, wage inflation, payroll growth, salary increases) and the demographic assumptions (retirement, withdrawal, disability, mortality) are generally reasonable. The assumptions for the Other Postemployment Benefit (OPEB) programs are generally reasonable as well.
 - Recommendations
 - In order to improve the measurement of the actuarial valuation results, we have included a number of recommendations related to several of the actuarial assumptions which we believe VRS and CMC should implement when the actuarial assumptions are next reviewed. (Note that GRS is not recommending that any changes in assumptions need to be immediately.)
- Actuarial Cost Method and Actuarial Asset Valuation Method
 - Findings
 - The actuarial cost method and actuarial asset valuation method are reasonable for the actuarial valuation of the benefit plans. The entry age normal cost method and the 5-year asset smoothing method are appropriate and key components to satisfying VRS' financing objectives.
 - Recommendations
 - None
- Actuarial Funding Policy
 - Findings
 - We believe that the VRS funding policy represents an appropriate balance between cost stability and the goal of maintaining intergenerational equity. In addition, this funding policy is consistent with the model practices represented by the Conference of Consulting Actuaries White Paper as well as by the Government Finance Officers Association.
 - Recommendations
 - To better meet the plan's funding policy objectives, we recommend that CMC provide more details in the VRS funding actuarial report including the implications of having separate unfunded liability amortization bases and the magnitude of the expected change in future contribution rates as a result of the separate amortization bases.
(Page 32)

Executive Summary

- Application of Actuarial Assumptions, Methods and Benefit Plan Provisions
 - Findings
 - Based on our review of the individual test lives, we conclude that CMC appears to be consistently applying the actuarial assumptions, methods and plan provisions with the assumptions, methods and plan provisions as stated in the actuarial valuation reports. We have also reviewed CMC's calculation of the present value of future benefits, normal cost and employer contribution rates and believe they are reasonable. (Page 36)
 - Recommendations
 - We recommend treating transfers similarly to terminated vested members (for members with a payment form of deferred annuity, assume that the more valuable of a return of member contributions and a deferred annuity is elected). (Page 37)
- Actuarial Report Content, Detail, Format and Clarity
 - Findings
 - We have reviewed the actuarial valuation reports prepared by CMC for all the VRS benefit plans, including actuarial valuation reports provided for six political subdivisions, and find them to generally be in compliance with the Actuarial Standards of Practice with regard to content, detail, format and clarity. The gain/loss analysis disclosed in the actuarial valuation report for the VRS State Plans is useful in explaining the change in the unfunded actuarial accrued liability. (Page 39)
 - Recommendations
 - In order to ensure that another actuary qualified in the same practice area could make an objective appraisal of the reasonableness of the CMC's work as presented in the VRS actuarial reports, we have included a number of other recommendations regarding enhanced disclosures in future actuarial valuation reports. (Page 38)
- Contribution Rates and Funded Ratios
 - Findings
 - We believe that the employer contribution rates are reasonable.
 - VRS is actuarially sound. We believe that the funding ratios of the VRS plans are generally improving and moving towards a 100 percent funded ratio goal. The VRS funding policy should help accomplish this goal. (Page 52)
 - Recommendations
 - We recommend continued analysis be performed for the Health Insurance Credit Program in order to evaluate the objectives and adequacy of the contribution policy. In general, for OPEB programs with low funded ratios, contributions should be sufficient to cover at least benefits, normal costs, interest costs, plus a margin for potential losses. (Page 49)
 - We recommend providing more details in the actuarial report describing the reasons why the VSDP is so well funded. (Page 49)

The following sections of this report provide a more detailed discussion of our review of CMC's actuarial work for VRS, including additional findings and recommendations.

SECTION II.

GENERAL AUDIT APPROACH

General Audit Approach

In accordance with the Virginia Retirement System Oversight Act (§30-78 – §30-84 of the Code of Virginia), Gabriel, Roeder, Smith & Company (“GRS”) was hired by the Joint Legislative Audit and Review Commission (“JLARC”) to conduct the 2022 Quadrennial Actuarial Audit of the Virginia Retirement System (“VRS”).

The purpose of this audit is to provide the General Assembly with a comprehensive overview of the actuarial soundness of the VRS. This audit consisted of a non-replication actuarial audit of the actuarial assumptions, methods and procedures used in, and the resulting conclusions from, the June 30, 2021, actuarial valuations prepared by VRS’ consulting actuary, Cavanaugh Macdonald Consulting, LLC (“CMC”).

In accordance with the Statement of Needs agreed to between GRS and JLARC, this actuarial audit addresses the following areas:

- Reasonableness of Actuarial Assumptions;
- Reasonableness of Actuarial Methods and Funding Policy;
- Application of Actuarial Assumptions and Benefit Plan Provisions;
- Actuarial Report Content, Detail, Format and Clarity;
- Review of Contribution Rates and Funded Ratios; and
- Actuarial Principles and Practices Employed by the Actuary.

Plans included in the scope of this audit include the following VRS programs:

- VRS State Plans covering the following divisions: State Employees, Teachers, State Police (SPORS), Judges and Virginia Law Officers (VaLORS);
- Group Life Insurance Program (“GLI”);
- Health Insurance Credit Program (“HIC”);
- Line of Duty Act program (“LODA”)
- Virginia Sickness and Disability Program (“VSDP”);
- Virginia Local Disability Program (“VLDP”); and
- Six political subdivision plans (selected by JLARC and referred to as Plans A through F in this report).

In performing our review, we:

- Reviewed the VRS benefit handbooks and applicable statutes to understand the benefits provided by VRS;
- Reviewed the appropriateness of the actuarial assumptions;
- Reviewed the actuarial valuation reports; and
- Reviewed the detailed liability calculation of the sample lives to ensure that the calculations were consistent with the stated plan provisions, actuarial methods and assumptions.

The audit findings, which follow, are based on our review of this information and subsequent correspondence with VRS and the retained actuary for clarification and further documentation.

General Audit Approach

The following table presents a summary of the approach and steps GRS completed on behalf of the 2022 Quadrennial Actuarial Audit of the VRS:

WORK PLAN FOR THE 2022 ACTUARIAL AUDIT OF VRS

TASK DESCRIPTION		RESPONSIBILITY			
		GRS	JLARC	VRS AND/OR CavMac	DUE DATE
PROJECT PLANNING	1 Project Planning with Client and Team				
	a.) Finalize Statement of Work with JLARC	X	X		12/02/2021
DATA	2 Census Data, Financial Data, Actuarial Reports and Assumption Tables				
	a.) Send information/data request to CavMac and VRS	X			01/10/2022
	b.) Entrance video conference with JLARC, VRS and CavMac	X	X	X	01/17/2022
	c.) Provide GRS with certain plan data and information				
	- Valuation ready data used by CavMac to prepare the 6/30/2021 valuations			X	01/31/2022
	- Electronic copy of complete assumption tables				
	- VRS investment policy				
	d.) Copy of the June 30, 2021 actuarial valuation report(s) (all plans)			X	01/31/2022
	e.) Request test lives data	X			02/11/2022
ASSUMPTIONS AND METHODS	f.) Complete review of the valuation ready data files utilized by CavMac	X			02/21/2022
	g.) Scheduled status call with GRS and JLARC	X	X		03/04/2022
	3 Actuarial Assumptions and Methods				
	a.) Complete review of the economic actuarial assumptions	X			02/28/2022
ACTUARIAL LIABILITIES	b.) Complete review of the actuarial valuation methods	X			03/07/2022
	c.) Complete review of the demographic actuarial assumptions	X			03/14/2022
	4 Actuarial Liabilities				
ACTUARIAL VALUATION AND REPORT	a.) CavMac provides test lives data (request made on Feb 11)			X	03/02/2022
	c.) Complete test live review	X			03/30/2022
	b.) Scheduled status call with GRS and JLARC	X	X		04/01/2022
	5 Actuarial Valuation and Report				
REPORT AND BRIEFINGS	a.) Review CavMac actuarial reports				
	- Review for content, clarity, and accuracy				
	- Compliance with relevant Actuarial Standards of Practice (ASOPs)				
	- Reasonableness and completeness of results	X			04/18/2022
	- Examination of funded ratios				
	- Reasonableness of contribution rates				
	- Review local plan actuarial valuations				
REPORT AND BRIEFINGS	b.) Scheduled status call with GRS and JLARC	X	X		04/29/2022
	6 Deliverable Schedule				
	a.) Draft report to JLARC	X			04/22/2022
	b.) First Exit Video Conference	X	X		04/29/2022
	c.) Receive comments from JLARC		X		05/04/2022
	d.) Second draft report to JLARC (copies provided to VRS and CavMac)	X			05/18/2022
	e.) Second Exit Conference (by video conference or in-person)	X	X	X	05/25/2022
	f.) Receive comments from VRS and CavMac			X	06/03/2022
	g.) Draft of briefing slides to JLARC	X			06/14/2022
	h.) Receive comments from JLARC		X		06/17/2022
	i.) Final report copies to JLARC	X			06/22/2022
	j.) Final briefing packets	X			06/23/2022
	k.) Briefing to JLARC	X	X	X	TBD

Source: GRS Work Product

SECTION III.

REASONABLENESS OF ACTUARIAL ASSUMPTIONS

Reasonableness of Actuarial Assumptions

VRS Experience Study July 1, 2016 to June 30, 2020

CMC conducted an experience study in order to evaluate the continued appropriateness of the actuarial assumptions used in the annual actuarial valuation by comparing actual experience to expected experience. CMC made recommendations for updates to a number of the actuarial assumptions and the VRS Board of Trustees approved such changes at its April 20, 2021 meeting. All of the recommended and adopted assumptions were used in the June 30, 2021 VRS actuarial valuations.

Overview

For any pension plan, actuarial assumptions are selected that are intended to provide reasonable estimates of future expected events, such as Fund investment returns, interest crediting, and patterns of retirement, turnover and mortality. These assumptions, along with an actuarial cost method, an asset valuation method, the employee census data and the plan's provisions are used to determine the actuarial liabilities and overall actuarially determined funding requirements for the plan.

A single set of assumptions is typically not expected to be suitable forever. As the actual experience unfolds or the future expectations change, the assumptions should be reviewed and adjusted accordingly. Use of outdated or inappropriate assumptions can result in understated costs which will lead to higher future contribution requirements or perhaps an inability to pay benefits when due; or, on the other hand, produce overstated costs which place an unnecessarily large burden on the current generation of members, employers, and taxpayers.

The purpose of an experience study is to evaluate the continued appropriateness of the actuarial assumptions used in the annual actuarial valuation by comparing actual experience to expected experience. Understanding that recent prior experience tends to be a good indicator of future experience, we generally recommend an experience study be performed every three to five years, or sooner, if warranted.

The Code of Virginia sets forth requirements under which VRS is administered. In particular § 51.1 – 124.22(A)(4) requires an experience study once every four years. The retained actuary completed an analysis of the experience of the system from July 1, 2016, to June 30, 2020, covering the following divisions of VRS:

- State Employees;
- Teachers;
- State Police (SPORS);
- Virginia Law Officers (VaLORS);
- Judicial (JRS);
- Political Subdivisions;
- Group Life Insurance Program (GLI);
- Line of Duty Act Fund (LODA Fund);
- Health Insurance Credit Program (HIC);
- Virginia Sickness and Disability Program (VSDP); and
- Virginia Local Disability Program (VLDP).

Reasonableness of Actuarial Assumptions

We have reviewed CMC's experience study report dated September 10, 2021, in detail in order to assess the reasonableness of the assumptions used in the actuarial valuation.

It is important to understand the nature of the retirement plan and the plan sponsor when assessing the reasonableness of the actuarial assumptions. No projection of future events can be labeled as "correct" or "incorrect." Setting actuarial assumptions involves professional judgment that is both an art and a science.

The Actuarial Standards Board ("ASB") provides guidance on measuring the costs of financing a retirement program through the following Actuarial Standards of Practices ("ASOPs"):

- (1) ASOP No. 4, *Measuring Pension Obligations and Determining Pension Plan Costs or Contributions*;
- (2) ASOP No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations*;
- (3) ASOP No. 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*;
- (4) ASOP No. 44, *Selection and Use of Asset Valuation Methods for Pension Valuations*; and
- (5) ASOP No. 51, *Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions*.

Actuarial assumptions for the valuation of retirement plans are generally classified within two major categories: (i) economic assumptions (the money assumptions), and (ii) demographic assumptions (the people assumptions). We have assessed the reasonableness of both categories of actuarial assumptions as part of this actuarial audit.

Economic Assumptions

These assumptions simulate the impact of economic forces on the amounts and values of future benefits. Key economic assumptions include inflation, investment return, and rates of future salary increases.

Inflation

Inflation refers to price inflation as measured by annual increases in the Consumer Price Index (CPI). This assumption underlies and is the building block for most of the other economic assumptions, including the investment return assumption and assumed rate of salary increases.

Also, because VRS provides retirees a cost of living adjustment (COLA) that is based on the annual increase in CPI, future increases in CPI have a direct result on the actuarial valuation and future benefit payments.

The current inflation assumption is 2.50 percent. Over the five-year period from June 2016 through June 2021, the CPI-U has increased at an average rate of 2.43 percent.

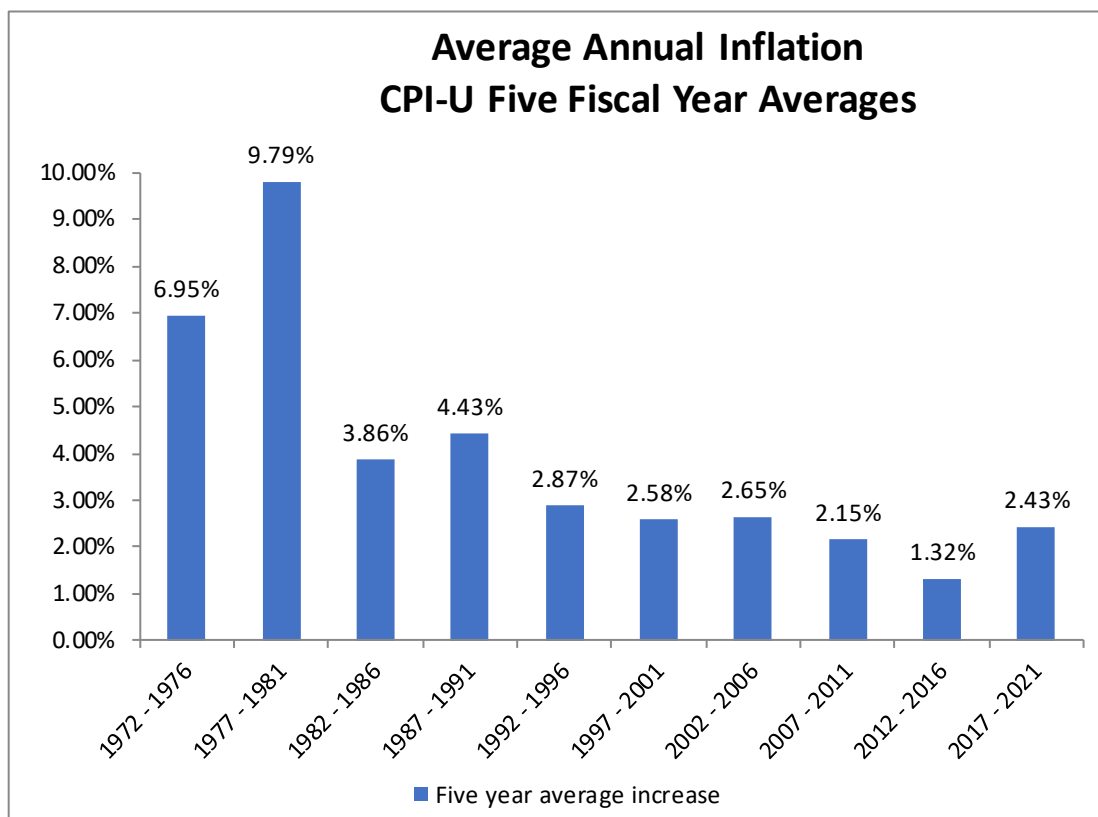
The table on the following page shows the average inflation over various periods, ending June 2021.

Reasonableness of Actuarial Assumptions

Fiscal Year	Annual Increase in CPI-U
2016-17	1.63%
2017-18	2.87%
2018-19	1.65%
2019-20	0.65%
2020-21	5.39%
3-Year Average	2.54%
5-Year Average	2.43%
10-Year Average	1.87%
20-Year Average	2.14%
25-Year Average	2.23%
30-Year Average	2.33%
40-Year Average	2.78%
50-Year Average	3.88%

Source: U.S. Bureau of Labor Statistics

The following chart shows the average annual inflation, as measured by the increase in CPI-U, in each of the 10 consecutive 5-year periods over the last 50 years.

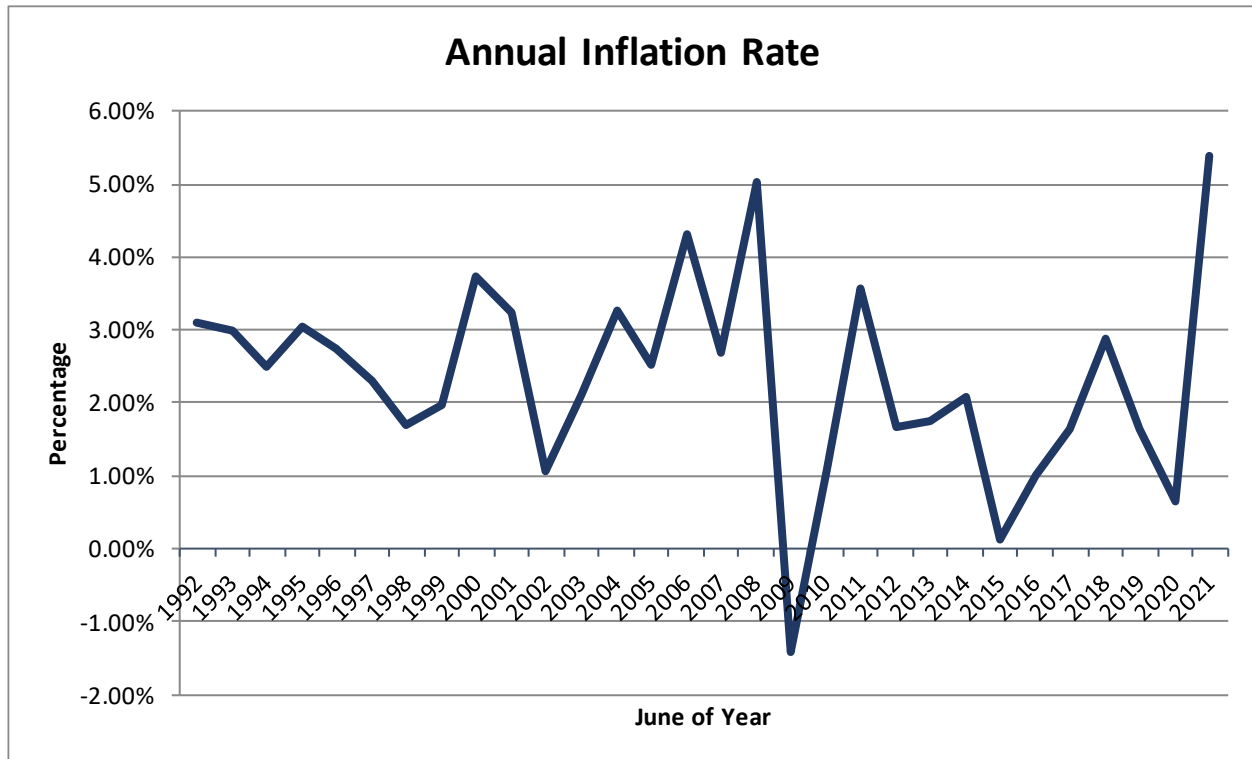


Source: U.S. Bureau of Labor Statistics

Reasonableness of Actuarial Assumptions

The geometric average annual increase in price inflation was 2.33 percent per year over the last 30 years, 2.14 percent over the last 20 years and 1.87 percent over the last 10 years.

The following graph illustrates the rate of inflation on a year by year basis over the last 30 years.



Source: U.S. Bureau of Labor Statistics

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 as well.

We surveyed the inflation assumption used by nationally recognized financial firms (investment consultants, asset managers and insurance companies) across the country. In our sample of these firms, the inflation assumption ranged from 1.92 percent to 3.10 percent, with an average of 2.19 percent.

Another point of reference is the Social Security Administration's (SSA) 2021 Trustees Report, in which the Office of the Chief Actuary is projecting a long-term average ultimate annual inflation rate of 1.80 percent in the high-cost projection scenario, 2.40 percent under the intermediate (best estimate) cost projection scenario and 3.00 percent in the low-cost projection scenario. 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 Treasury Inflation-Protected Securities (TIPS).

Reasonableness of Actuarial Assumptions

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

Forward-Looking Annual Inflation Forecasts ^a (From Professional Experts in the Field of Forecasting Inflation)	
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 2021 Annual Report of The Board of Trustees of The Federal Old-Age And Survivors Insurance and Federal Disability Insurance Trust Funds, August 31, 2021.

Reasonableness of Actuarial Assumptions

The annual inflation rate for the United States rose from a low of 1.4 percent in January of 2021 to a high of 8.5 percent in March of 2022, the highest since December 1981, according to U.S. Labor Department data published April 12.

The U.S. Federal Reserve System's monetary policymaking body (the Federal Open Market Committee) at its latest meeting on March 16, 2022, forecasted that the Personal Consumption Expenditures (PCE) inflation rate in the U.S. will average 4.3 percent in 2022 and then decline to a rate of 2.7 percent in 2023.

As previously stated, VRS provides retirees a cost of living adjustment (COLA) that is based on the annual increase in CPI. Therefore, future increases in CPI have a direct result on the actuarial valuation and future benefit payments. However, there is a risk of setting the inflation assumption too low such that plan benefits and cost will increase faster than expected if actual inflation is higher than assumed. (However, this risk has been somewhat mitigated with the COLA design. Specifically, Plan 1 retirees receive a COLA equal to the first 3 percent increase in CPI, plus 50 percent of any additional increase (up to an additional 4 percent of the increase in CPI), for a maximum annual COLA of 5 percent. Retirees in Plan 2 and the Hybrid Plan receive a slightly smaller COLA that is equal to the first 2 percent increase in CPI plus 50 percent of any additional increase (up to an additional 2 percent of the increase in CPI), for a maximum annual COLA of 3 percent.)

Taking all of this information into consideration, including the COLA design, **we believe the current 2.50 percent price inflation assumption is a reasonable expectation of future inflation.**

Investment Return

The investment return assumption (also referred to as the actuarial 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.

It is important to note that an actuarial investment return assumption based on expected future experience is a single estimate for all years and therefore implicitly assumes that returns above and below expectations will "average out" over time. In other words, the expected risk premium is reflected in the assumed rate of investment return in advance of being earned, while investment gains/losses are not reflected until actual experience emerges with each actuarial valuation.

Reasonableness of Actuarial Assumptions

CMC Analysis Using VRS Capital Market Assumptions

CMC states the following on page 25 of their experience study report:

Many investment firms and investment consulting firms produce estimates of future asset returns. While it might seem desirable to directly compare these estimates, asset class expectations are dependent on the construction of the portfolio. Other investment consultants may have in mind a different blend of large versus small stocks or growth versus value equities. There are also comparison challenges in certain asset classes such as international stock (emerging or developed markets), bonds (duration and credit quality), and alternatives (a very broadly interpreted category). For this reason, we believe trying to compare the expected return developed by VRS with the assumptions of another group of investment professionals may lead to an invalid comparison. Since VRS has qualified professionals on its staff and is in the best position to understand its own portfolio and the reasonable expectations given their investment style, we prefer to rely heavily on their analysis.

Based on 10-year forward returns from VRS investment staff and adjusting for an inflation assumption of 2.50 percent, the CMC experience study report estimates the 50th percentile real rate return to be 4.30 percent. This compares to VRS' long term real rate of return assumption of 4.25 percent, and a nominal return assumption of 6.75 percent, including 2.50 percent inflation.

GRS Analysis

In order to assess the reasonability of the current VRS investment return assumptions, we have performed an independent analysis which considers forward-looking measures of likely investment return outcomes for the asset classes in the current VRS investment policy. Because GRS is a benefits consulting firm and does not develop or maintain our own capital market expectations, we request and monitor forward-looking capital market expectations developed by a number of well-known major investment consulting firms. For purposes of this analysis, we have analyzed the VRS investment policy in conjunction with the capital market assumptions from 12 nationally recognized investment consultants. We do recognize that there are shortcomings in this analysis (as explained by CMC in their experience study report) and we also agree with the CMC suggestion to rely more heavily on the analysis of the VRS investment staff (or a System's own investment consultant).

Our analysis is performed using the GRS Capital Market Assumption Modeler (CMAM) tool. We update our CMAM on an annual basis. The capital market assumptions in the 2021 CMAM are from the following 12 firms (in alphabetical order): Aon Hewitt, Blackrock, BNY Mellon, Callan, Cambridge, JPMorgan, Meketa, Mercer, NEPC, RVK, Verus, and Wilshire. We believe that the benefit of using capital market expectations from multiple firms is that we can identify the uncertain nature of the items affecting the selection of the investment return assumption. While there may be differences in asset classes, investment horizons, inflation assumptions, treatment of investment expenses, excess manager performance (i.e., alpha), etc., we align the various capital market assumption sets from the 12 different firms in our model to best fit the Fund's investment policy (i.e., target asset allocation) as consistently as possible.

Reasonableness of Actuarial Assumptions

Each of the 12 firms provided capital market assumptions over an investment horizon of approximately 10 years. Although investment firms often refer to this period as “short-term” it is important to remember that 10 years is actually a very long time. In fact, the duration of the liabilities of the Fund is about 15 years. Therefore, returns during the next ten years will affect the plan’s funding materially. A subset of six investment firms provided capital market expectations over a longer horizon, varying between 20 and 30 years. For purposes of this report, however, the analysis is generally based on the 10-year expectations provided by the investment firms.

In general, our understanding is that the methodology used by the investment firms for developing these capital market expectations is forward-looking, not purely backward-looking. Over the years, we have observed a general decreasing trend in capital market expectations. However, we have also observed that some of the investment firms’ assumption sets are dependent on the market conditions at the time they are developed and consequently may be sensitive to short-term market fluctuations. Some expectations are contrarian – meaning that when the market is high, future expectations are lowered and when the market is low, future expectations are raised. The amount of these fluctuations as they appear in the year-to-year capital market assumptions varies between the various investment firms.

The GRS CMAM reflects the most up-to-date information at the time the data was collected (typically reflecting the investment firms’ expectations at the beginning of the calendar year). The results of the 2021 survey were generally lower capital market assumptions than 2020 for most asset classes, in some cases substantially lower. This is perhaps due in part to the decrease in bond yields in 2020 to record lows and the high stock market at the end of 2020 (resulting in the contrarian expectation of lower future stock market returns). Looking back to 2019, return expectations were somewhat higher than prior years for some survey participants, perhaps in part due to an increase in bond yields and a decrease in the stock market at the end of 2018. If we consider the three-year average of return expectations, the general decreasing trend is more apparent and the short-term fluctuations are diminished.

In the charts on the following pages, all returns are net of investment expenses and do not consider excess manager performance (alpha). Importantly, the information in this report is not intended to be construed as investment advice.

Real Return

The allocation of assets within the universe of investment options will significantly impact the overall performance. Therefore, it is meaningful to identify the range of expected returns based on each fund’s targeted allocation of investments and an overall set of capital market assumptions.

Our analysis was based on the target asset allocation from the Strategic Asset Allocation Implementation Schedule and Allowable Ranges document, which was approved by the VRS Board of Trustees on October 10, 2019, as disclosed on page 111 of the June 30, 2021, Annual Comprehensive Financial Report (ACFR). VRS’ forward looking investment policy is summarized on the following page.

Reasonableness of Actuarial Assumptions

Asset Class	Target Allocation
Public Equity	34%
Fixed Income	15%
Credit Strategies	14%
Real Assets	14%
Private Equity	14%
MAPS – Multi-Asset Public Strategies	6%
PIP – Private Investment Partnerships	3%
Total	100%

Source: 2021 VRS ACFR

Given VRS's current target asset allocation and the capital market assumptions from the 12 firms in our survey, the development of the average nominal return, net of investment expenses, is developed in the following manner and shown in the tables on the following pages.

Based on each firm's capital market assumptions, we estimated the expected nominal return of VRS's portfolio (column 2). We then took out each firm's price inflation assumption (column 3) to arrive at the real return (column 4). We then incorporate the price inflation assumption of 2.50 percent (column 5) to get the nominal return or the one-year arithmetic return (column 6). We have shown the standard deviation of returns as the investment risk in column 9. As the table shows in column 8, the average one-year nominal return (net of expenses) is 7.16 percent for the 12 firms included in our 2021 CMAM tool.

Development of the Average One-Year Nominal Return

GRS 2021 CMAM								
Capital Market Assumption Set (CMA)	CMA Expected Nominal Return	CMA Inflation Assumption	Expected Real Return (2)-(3)	Actuary Inflation Assumption	Expected Nominal Return (4)+(5)	Investment Expenses	Expected Nominal Return Net of Expenses (6)-(7)	Standard Deviation of Expected Return (1-Year)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	5.72%	2.01%	3.71%	2.50%	6.21%	0.00%	6.21%	10.33%
2	5.96%	2.00%	3.96%	2.50%	6.46%	0.00%	6.46%	11.23%
3	6.42%	2.15%	4.27%	2.50%	6.77%	0.00%	6.77%	12.71%
4	6.84%	2.34%	4.50%	2.50%	7.00%	0.00%	7.00%	13.19%
5	6.45%	2.00%	4.45%	2.50%	6.95%	0.00%	6.95%	12.45%
6	6.87%	2.21%	4.66%	2.50%	7.16%	0.00%	7.16%	13.70%
7	7.07%	2.40%	4.67%	2.50%	7.17%	0.00%	7.17%	13.10%
8	6.86%	2.11%	4.75%	2.50%	7.25%	0.00%	7.25%	11.89%
9	7.07%	2.00%	5.07%	2.50%	7.57%	0.00%	7.57%	13.32%
10	6.96%	1.92%	5.04%	2.50%	7.54%	0.00%	7.54%	12.63%
11	8.32%	3.10%	5.22%	2.50%	7.72%	0.00%	7.72%	13.71%
12	7.59%	2.01%	5.58%	2.50%	8.08%	0.00%	8.08%	15.67%
Average	6.84%	2.19%	4.66%	2.50%	7.16%	0.00%	7.16%	12.83%

Source: GRS Analysis

Reasonableness of Actuarial Assumptions

Note that the arithmetic rates of return represent the average future expected return which is higher than the median future expected return. Setting the actuarial valuation assumption at the arithmetic expected return ignores the downward effect of volatility on the accumulation of assets. Consequently, the probability of actually achieving the actuarial assumption compounded over time is less than 50 percent if it is set at the arithmetic expectation. Therefore, in addition to examining the expected one-year arithmetic return, it is important to review anticipated volatility of the investment portfolio and understand the range of long-term net returns that could be expected to be produced by the investment portfolio.

The next step in our analysis is to compare the probabilities of achieving returns over a 10-year horizon. The following table illustrates the 40th, 50th and 60th percentiles of returns as well as the probability of achieving the current assumption of 6.75, based on a price inflation assumption of 2.50 percent over a 10-year horizon. Note that the investment horizon for the capital market assumption sets used in this analysis is 10 years.

Distribution of 10-Year Average Returns and Probability of Exceeding 6.75%

GRS 2021 CMAM				
Capital Market Assumption Set (CMA)	Distribution of 10-Year Average Geometric Net Nominal Return			Probability of exceeding 6.75%
	40th	50th	60th	
(1)	(2)	(3)	(4)	(5)
1	4.89%	5.71%	6.54%	37.49%
2	4.99%	5.88%	6.77%	40.24%
3	5.01%	6.02%	7.03%	42.71%
4	5.16%	6.20%	7.25%	44.71%
5	5.25%	6.24%	7.23%	44.76%
6	5.22%	6.30%	7.39%	45.81%
7	5.35%	6.38%	7.43%	46.43%
8	5.66%	6.60%	7.55%	48.40%
9	5.70%	6.75%	7.82%	50.05%
10	5.81%	6.80%	7.81%	50.52%
11	5.78%	6.86%	7.95%	51.04%
12	5.73%	6.96%	8.20%	51.72%
Average	5.38%	6.39%	7.41%	46.16%

Source: GRS Analysis

The 50th percentile return is also related to the geometric average return. The geometric average of a sequence of returns over a number of years is the compound average of those returns over the number of years compounded. As the number of years in the geometric average increase and if the distributions of returns each year are independent and identically distributed, then the geometric average will converge to the median return. The median return is also a reasonable rate of return for purposes of the actuarial

Reasonableness of Actuarial Assumptions

valuation. The average of 50th percentile returns (based on the price inflation assumption of 2.50 percent) is 6.39 percent.

Column 5 of the preceding table shows the estimated probability of achieving the current assumed rate of return of 6.75 percent over a 10-year period (based on the price inflation assumption of 2.50 percent and the capital market assumptions from the firms in our survey, with a time horizon of about 10 years). The average probability of achieving 6.75 percent over 10 years based on these assumptions is about 46.16 percent.

An important fact to consider when deciding what weight to put on shorter term results or longer term results is the amount of benefits for current members that are projected to be paid over the shorter term (for example, the next 10 years). As shown in the solvency test on page 39 of the actuarial valuation report, over 60 percent of the actuarial accrued liability as of June 30, 2021, is attributable to benefits for current retired and inactive members (and a large percentage of these benefits are likely payable over the shorter term). Therefore, it is important to consider shorter-term expectations in addition to longer-term expectations in setting the economic assumptions.

In the VRS Experience Study Report for the Four-Year Period July 1, 2016 to June 30, 2020, CMC states “Due to the uncertainty surrounding the potential for and timing, length, or severity of a near-term recession, a discount rate based on a blend of short- and long-term expectations warranted a lowering of the plans’ long-term investment rate of return assumption. Historically, investment return assumptions have targeted the median of the expected range of outcomes. However, reflecting a blended discount rate to incorporate near-term uncertainty in the markets required selecting a discount rate below the median expected long-term rate. VRS selected a discount rate closer to the 40th percentile of future returns, providing approximately a 60% chance of achieving the long-term rate of return over time. We think that the current assumption gives due consideration to the short-term.”

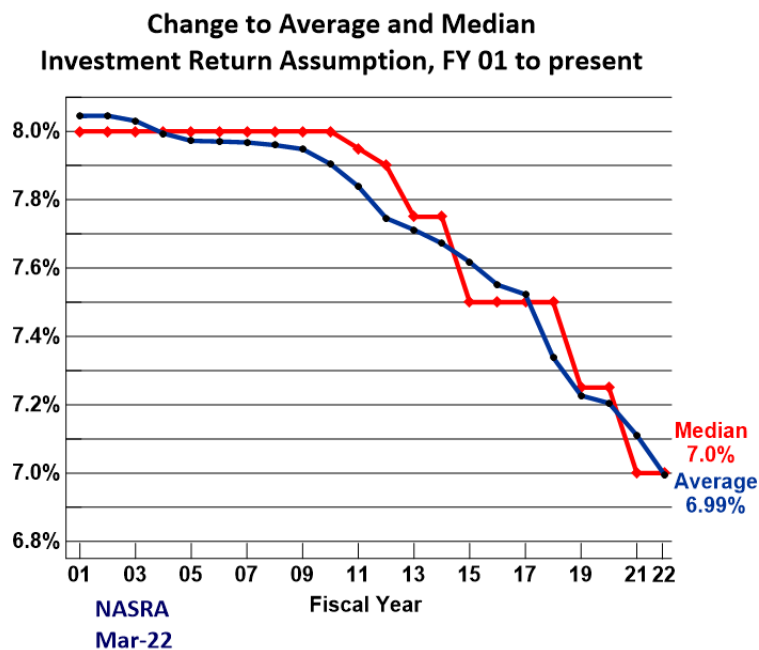
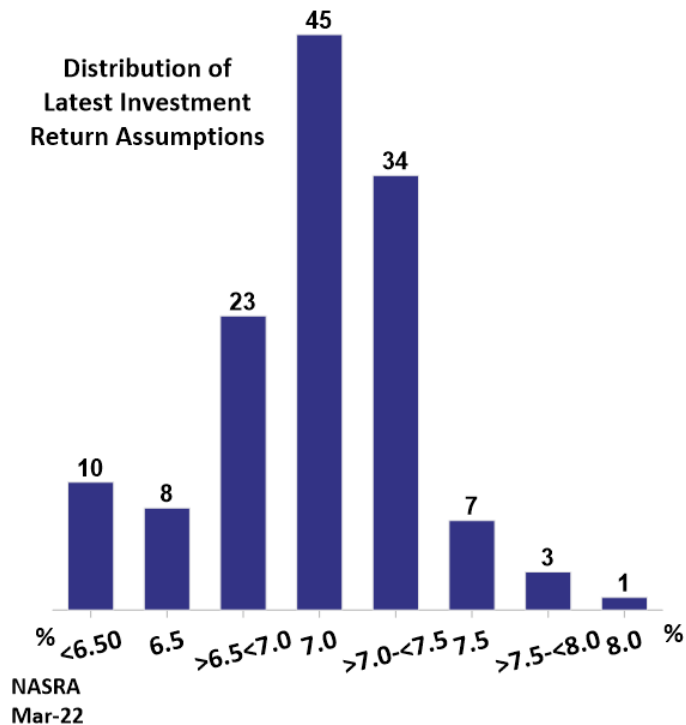
In fact, the analysis of the investment return assumption completed by CMC in the experience study utilizes short term (10 year) capital market assumptions developed by VRS investment staff.

Based on GRS’s analysis, the average probability of achieving the 6.75 percent investment return assumption over 10 years is about 46.16 percent. Generally speaking, GRS would like to see a probability of at least 50 percent. However, we recognize that there is no one right investment return assumption; instead there is a range of reasonable assumptions. Therefore, as long as the probability of achieving the 6.75 percent investment return assumption is at least 40 percent, we believe the 6.75 percent assumption is reasonable for use with the June 30, 2021 VRS actuarial valuation.

Although the investment return assumption for VRS should be selected based on VRS specific data, it is interesting to see what other plans use as the investment return assumptions — just to see if the VRS assumption is in the “ballpark”. Following is survey information on the investment return assumptions used by public pension plans that is published by NASRA (National Association of State Retirement Administrators). The current investment return assumption of 6.75 percent is below the median assumption of 7.00 percent.

Reasonableness of Actuarial Assumptions

Distribution of Latest Investment Return Assumptions Across Public Pension Plans



Source: NASRA website

Considering all of these facts, we believe that the current 6.75 percent investment return assumption is reasonable for use with the June 30, 2021, VRS funding actuarial valuation.

Reasonableness of Actuarial Assumptions

Reducing/increasing the investment return assumption will reduce/increase the funded ratio, increase/decrease the contribution requirements and increase/decrease the probability that the investment return assumption is achieved.

Since the LODA Fund is invested in the same as the pension funds, the LODA investment return assumption used in the funding actuarial valuation was increased from 4.75 percent to 6.75 percent. **We believe that the 6.75 percent investment return assumption is reasonable for the LODA June 30, 2021, funding actuarial valuation.**

Wage Inflation Assumption

The wage inflation assumption is 3.50 percent for all employee groups, comprised of 2.50 percent for price inflation and 1.00 percent for real wage inflation, i.e., assumed economic productivity increases.

The apparent real wage inflation is the ultimate rate of average annual salary increase for members with 20 or more years of service minus the actual annualized price inflation over the experience study period. CMC's calculation of the apparent real wage inflation is shown on page 33 of the CMC experience study report covering the period July 1, 2016, to June 30, 2020 and is summarized below along with the averages from the two prior experience studies.

Experience Study Period	Apparent Real Wage Inflation						
	State	Teachers	SPORS	VaLORS	JRS	Locals - Non LEOs	Locals - LEOs
7/1/2016-6/30/2020	1.11%	1.39%	3.71%	1.62%	-0.10%	1.57%	2.51%
7/1/2012-6/30/2016	1.88%	1.90%	2.82%	2.16%			
7/1/2008-6/30/2012	0.17%	0.67%	0.91%	0.53%			

Based on statistics from the Social Security System on the National Average Wage and shown on page 31 of the experience study report, the real wage growth was 1.15 percent during the last 10 years, 0.73 percent over the last 20 years and 0.91 percent over the last 30 years.

Given the national statistics and VRS statistics presented in the experience study report, **GRS believes the current wage inflation assumption of 3.50 percent (comprised of 2.50 percent for price inflation and 1.00 percent for assumed economic productivity increases) is reasonable for all employee groups.** However, for the next experience study we recommend CMC review whether increases in excess of wage inflation (merit, promotion and longevity increases) are provided for employees of certain employee groups with more than 20 years of service (in particular, SPORS). This would affect the member salary increase assumption for years in excess of 20 and the apparent real wage inflation statistics summarized above. (If the ultimate salary increase is attained at 25 years of service, for example, this may reduce the rates shown above and provide better support for the 1.00 percent wage inflation assumption.)

Reasonableness of Actuarial Assumptions

Payroll Growth Assumption

The assumed rate of total payroll growth is used in the calculation of the amortization of the unfunded actuarial accrued liability as a level percentage of payroll. The current assumption is 3.00 percent for all divisions comprised of the 2.5 percent assumption for price inflation plus an additional .5 percent.

If total payroll increases by less than the payroll growth assumption, the System will receive less contributions to finance the unfunded liability which will result in an increase in the actuarial determined contribution rate in future years in order to finance the unfunded liability over the same time period.

Following is a summary of the average annualized increase in total payroll for State Employees, Teachers, SPORS, VaLORS and JRS. The total payroll increases were calculated based on history included on pages 128 and 129 of the June 30, 2021, VRS ACFR.

	Average Annualized Increases in Total Payroll (through 2021)		Average Annualized Increases in Total Payroll in Excess of Inflation	
	9 Years	5 Years	9 Years	5 Years
State	2.06%	2.04%	0.19%	-0.39%
Teachers	2.63%	3.01%	0.76%	0.59%
SPORS	2.50%	2.31%	0.63%	-0.11%
VaLORS	0.05%	0.18%	-1.82%	-2.24%
JRS	2.63%	2.29%	0.76%	-0.14%
Average Inflation	1.87%	2.43%		

Source: GRS Analysis

Total payroll has increased on average by less than the current assumption of 3.00 percent for the nine-year period from 2012-2021 and for the five-year period from 2016-2021. The increase in total payroll in excess of inflation has increased on average by less than the .5 percent assumption. However, increases in total payroll are affected by both pay increases and changes in the number of active members. There have been fluctuations in the number of active members over the five and nine-year periods and most recently a decrease in the total number of active members between June 30, 2020 and June 30, 2021.

GRS believes the total payroll growth assumption of 3.00 percent (0.50 percent higher than the inflation assumption of 2.50 percent) is reasonable. We recommend that VRS/CMC continue to annually review the payroll growth assumptions between experience studies to ensure the assumption remains appropriate given changes in total payroll and the number of active members.

Reasonableness of Actuarial Assumptions

Salary Increase Assumptions

Generally, assumed rates of pay increase are constructed as the total of two main components:

- Wage Inflation – currently 3.50 percent (comprised of 2.50 percent for price inflation and 1.00 percent for real wage increases); and
- Merit, Promotion and Longevity – This portion of the salary increase assumption reflects components such as promotional increases as well as “step” increases and longevity pay. This portion of the assumption is not related to inflation.

In the context of a typical employer pay scale, pay levels are set for various employment grades, or “steps.” In general, this pay scale is adjusted as follows:

- The inflation and economic productivity assumptions, collectively referred to as wage inflation, reflect the overall increases of the entire pay scale; and
- The Merit, Promotion and Longevity increase assumption reflects movement of members through the pay scale.

The experience study reports provide documentation of the salary increase experience for State Employees, Teachers, State Police, Judges, Virginia Law Officers (VaLORS) and Top 10 and Non-Top 10 of the political subdivisions (separately for employees in hazardous duty and non-hazardous duty occupations).

There were no changes to the salary increase assumption, except for a decrease in the assumption from 4.50 percent to 4.00 percent for Judges.

Salary experience is shown on pages 248 through 265 of the experience study report. The salary experience data tables combine experience for employees with 20 or more years of service (for whom no merit, promotion and longevity increase in excess of inflation is assumed). However, the salary experience graphs show salary increases by year for all years of service. Based on the graphs, it appears that for some plans merit, promotion and longevity increases are granted to employees with more than 20 years of service.

GRS believes the current salary increase assumptions for all groups are reasonable based on the salary experience illustrated in the CMC experience study report.

During the next experience study:

- **We recommend that the salary data tables show experience for each year of service through 25 or 30 years in order to analyze whether merit, promotion and longevity increases are granted to employees with more than 20 years of service.**
- **Actual rates of salary increase for Judges were significantly lower than the assumed rate. We recommend that VRS continue to review whether a further decrease in the increase assumption of 4.00 percent (1.50 percent in excess of price inflation and 0.50 percent in excess of wage inflation) is appropriate for the Judges.**

Reasonableness of Actuarial Assumptions

Demographic Assumptions

ASOP 35, Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations, applies to actuaries when they are selecting demographic and all other assumptions not covered by ASOP No. 27 to measure obligations under any defined benefit pension plan that is not a social insurance program as described in Section 1.2, Scope, of ASOP No. 32, Social Insurance.

In accordance with ASOP 35, an actuary should identify the types of demographic assumptions to use for a specific measurement. In doing so, the actuary should determine the following:

- (a) The purpose and nature of the measurement;
- (b) The plan provisions or benefits and factors that will affect the timing and value of any potential benefit payments;
- (c) The characteristics of the obligation to be measured (such as measurement period, pattern of plan payments over time, open or closed group, and volatility);
- (d) The contingencies that give rise to benefits or result in loss of benefits;
- (e) The significance of each assumption; and
- (f) The characteristics of the covered group.

Not every contingency requires a separate assumption. For example, for a plan that is expected to provide benefits of equal value to employees who voluntarily terminate employment or become disabled, retire, or die, the actuary may use an assumption that reflects some or all of the above contingencies in combination rather than selecting a separate assumption for each.

Retirement

The retirement assumption is used to model the likelihood that a member retires from employment and immediately commences their VRS retirement benefit. CMC uses different retirement assumptions based on age, gender, employee type, plan and whether the employee is eligible for a reduced or unreduced retirement benefit. Utilizing different retirement assumptions like this is common for performing actuarial valuations for large retirement systems.

The number of members who actually retired during the observation period was generally less than expected. VRS' retirement experience during the observation period is similar to what we have observed with other statewide retirement systems. Generally, members have been working to later ages before retiring.

As a result, based on the results from the Experience Study for the Period July 1, 2016 to June 30, 2020, CMC recommended adjustments to the retirement assumption to better match actual experience. In addition, CMC recommended the age at which 100 percent retirement is assumed be increased to age 70 for hazardous duty, to age 80 for non-hazardous duty and to age 73 for Judges. A comparison of the actual to expected and actual to proposed retirements was summarized for each plan. The ratio of actual to proposed retirements was in general closer to 1.0 than the ratio of actual to expected retirements and indicates that the proposed rates more closely follow actual experience.

Reasonableness of Actuarial Assumptions

We believe the retirement assumptions documented in the experience study are reasonable.

Withdrawal

Not all active members of VRS are expected to continue employment with a participating employer of VRS during their entire career and make it to retirement. The purpose of the withdrawal assumption is to model the likelihood that an active member will continue to work for the employer to their retirement. Employee turnover behavior can be influenced by many factors, including external effects such as the economy. Therefore, it is important for the actuary to consider these factors when determining how much credibility to assign the experience when adjusting the current assumption to better model expected future experience.

CMC uses withdrawal rate assumptions based on age, gender, service and employee type. For the first 10 years, the rates vary by both age and service, and once a member attains 10 years of service, the rates vary solely by age.

We believe the withdrawal assumptions recommended in the experience study report are reasonable. Based on GRS' recommendation in the last audit, CMC reviewed whether the current complex structure of withdrawal rates is needed and concluded it is merited.

Disability Incidence

The disability incidence assumption models the number of members who will become disabled each year. Disabilities can occur due to service related or non-service related incidences.

CMC recommended changes in the disability rates in the previous Experience Study for the Period July 1, 2012, to June 30, 2016, such that the ratio of actual disabilities to the expected number of disabilities under the proposed assumptions was approximately 1.00. In the Experience Study for the Period July 1, 2016, to June 30, 2020, CMC stated "Using experience over the current and prior periods indicates there were fewer disabilities than expected, creating margin in the rates. The current rates are based on the prior experience study. We recommend retaining the current rates because we prefer maintaining a margin since the number of incidences is small, but the liability associated with an occurrence can be large. In addition, we removed the disability assumption for JRS in the last experience study and still consider this to be the appropriate assumption since JRS has not experienced a disability in several years."

We agree that considering disability experience over a longer period of time (eight years based on the current and prior experience studies) is appropriate given that the number of incidences is relatively small.

Based on the small number of incidences, we believe maintaining the disability rates from the prior experience study (for the Period July 1, 2012, to June 30, 2016) is reasonable for the June 30, 2021 actuarial valuation. However, during the next experience study, we recommend applying partial credibility (i.e., giving some degree of credibility) to more recent disability experience and adjusting

Reasonableness of Actuarial Assumptions

rates, as appropriate, (Especially for the rates applicable to ages 45 through 65, where more of the disability experience occurs.)

Mortality

The post-retirement mortality assumption is one of the most important demographic assumptions used in the actuarial valuation of a pension plan because it models how long benefit payments are expected to be paid to retirees. The longer retirees live, the larger VRS' liability, thus requiring more contributions to fund VRS.

Pre-retirement mortality and disabled mortality have a less significant impact on the actuarial valuation.

Because of potential differences in expected mortality experience, it is common to use different mortality assumptions for disabled and non-disabled retirees. It is also common to use gender distinct assumptions and different assumptions for certain membership groups that are expected to have different mortality patterns, such as teachers.

The mortality assumptions used in the actuarial valuation of the VRS plans (before and after the assumption changes recommended in the Experience Study for the period July 1, 2016, to June 30, 2020) are based on standard mortality tables published by the Society of Actuaries, adjusted using various techniques to provide a better fit to the expected mortality for the retirees covered by the benefit plan and to reflect expected future mortality improvements.

GRS had the following recommendations in the 2018 actuarial audit:

- Continue to consider if a generational mortality improvement assumption is appropriate;
- Analyze mortality experience on a benefits weighted or liability weighted basis; and
- Review the credibility of the experience in adjusting the standard base mortality tables (especially for smaller plans such as SPORS/VaLORS and pre-retirement and disabled mortality).

CMC recommended and VRS adopted mortality assumptions with a generational mortality improvement assumption and CMC analyzed mortality experience on a benefits weighted basis in the Experience Study for the period July 1, 2016, to June 30, 2020 (GRS recommendations 1 and 2).

CMC does mention the credibility of the mortality experience in the report. It appears that partial credibility may have been given to some of the experience in setting the mortality assumptions for the smaller plans and pre-retirement and disabled mortality.

The generational mortality improvement assumption that was recommended and adopted is 75% of the MP-2020 improvement scale. Following is the CMC rationale provided for using an adjusted mortality improvement scale.

“Beginning in 2014, the SOA has released an updated mortality improvement scale every year. We are proposing using the most recently released scale, MP-2020, adjusted to 75% of the standard rates. This adjustment results in improvements that are less than those suggested by the MP-2020 scale. We have

Reasonableness of Actuarial Assumptions

suggested this adjustment because each year since 2014 the SOA has scaled back the amount of mortality improvement in subsequent Mortality Projection Scales.”

Basically, the mortality assumptions recommended in the CMC Experience Study for the period July 1, 2016 to June 30, 2020, and used in the June 30, 2021, actuarial valuations are based on the PUB-2010 public sector mortality tables published by the Society of Actuaries.

Following is a comparison of the life expectancies using the Teachers’ mortality assumption with the adjusted MP-2020 mortality improvement scale and the MP-2020 mortality improvement scale.

Age	Post-retirement Future Life Expectancy (years)				Increase in Life Expectancy	
	Adjusted MP-2020 (75%)		MP-2020		Diff MP-2020 and Adj MP-2020	
	Male	Female	Male	Female	Male	Female
50	36.11	38.90	36.69	39.44	0.58	0.54
55	31.10	33.85	31.58	34.31	0.48	0.46
60	26.25	28.98	26.65	29.37	0.40	0.39
65	21.59	24.25	21.93	24.57	0.33	0.33
70	17.20	19.65	17.47	19.90	0.27	0.26
75	13.16	15.31	13.36	15.49	0.21	0.18
80	9.61	11.42	9.75	11.53	0.14	0.12
85	6.70	8.13	6.79	8.21	0.09	0.07
90	4.53	5.55	4.59	5.60	0.06	0.05

Source: GRS Analysis

We believe the current mortality assumptions are reasonable. However, we have the following recommendations when the next experience study is prepared:

Document how the adjustments to the standard base mortality tables were developed for the assumptions where the experience was not fully credible (the smaller plans such as SPORS/VaLORS and pre-retirement and disabled mortality).

Other Assumptions

The normal form of payment for retirement benefits is a life annuity, with a cash refund feature that guarantees that if a member dies before receiving benefits paid at least equal to contributions plus interest at retirement, the balance will be paid as a lump sum to the member’s beneficiary.

CMC has the following description of the assumed payment form in their report:

Modified cash refund annuity; in which the total benefit received by a member and his or her estate cannot be less than the total contributions made by the member while he or she was an active participant plus interest. For members in pay status, the modified cash refund was estimated to be in effect for two years after retirement for Judicial members and three years for all others.

Reasonableness of Actuarial Assumptions

Effective with the June 30, 2021 actuarial valuation, CMC assumes that decrements (i.e., events such as retirements, terminations, deaths, etc.) occur in the middle of the year, except for Teachers.

We believe that these assumptions are reasonable.

Assumptions Specific for OPEB Plans

Because there is significant overlap in the employee group covered by the pension and OPEB plans (i.e., Group Life Insurance Program (GLI), Line of Duty Act Program (LODA), Health Insurance Credit Program (HIC), Voluntary Sickness and Disability Program (VSDP) and Voluntary Local Disability Program (VLDP), the actuarial valuation of the OPEB plans utilize many of the same assumptions used in the actuarial valuation of the pension plan, including rates of termination, retirement and mortality.

As part of the Experience Study for the Period July 1, 2016, to June 30, 2020, CMC reviewed the following OPEB specific assumptions:

OPEB Specific Assumptions Reviewed by CMC

System	Assumption	Description
GLI	1. Pension economic and demographic assumptions	Adjusted in the same manner as the pension plans
	2. Retiree liability estimation for Life Only	Adjusted to estimate based on actual benefit payments for this group compared to actual benefit payments for total group
HIC	1. Pension economic and demographic assumptions	Adjusted in the same manner as the pension plan
	2. Benefit election (from deferred vested)	Adjusted election from deferred vested status to a flat 95% for State & Teachers and a flat 85% for Locals & Special Coverage Codes
	3. Benefit election (from disability)	Adjusted election to 80% for SPORS/ValORS and 50% for Locals and Special Coverage Codes
	4. Benefit utilization	Increase in utilization for all groups
	5. Percentage of deferred vested members electing to withdraw from VRS	Bifurcated assumption for above or below 50 years of age; in general, withdrawal rate increased for those below 50 and decreased for those over 50
	6. Benefit increase in the first year for those not using the maximum benefit	Reduction to 4.50% for all groups
VSDP / VLDP LTD	1. Pension economic and demographic assumptions	Adjusted in the same manner as the pension plans
	2. Rates of disability claim termination	Adjusted for credible VSDP experience
	3. Benefit offsets	Increased and extended period in which offset may be received based on available experience
	4. Catastrophic claims	Increased based on available experience
	5. Percentage eligible for additional 1% defined contribution	Reduction in number assumed to meet Social Security definition of disability and receive the additional 1% defined contribution
	*Until adequate experience emerges, VLDP calculations are based upon the data, actuarial assumptions and methods used in the actuarial valuation of the VSDP benefit.	

In addition, decrements are assumed to occur at mid-year (which is an approximation for throughout the year) rather than beginning of year for all plans except Teachers.

CMC recommended a change to the benefit utilization rates for members who elect HIC but do not receive the maximum benefit amount. Approximately 5% to 15% of all members are expected to select less than the full benefit election rate. These members are expected to utilize approximately 70% of the maximum benefit.

Reasonableness of Actuarial Assumptions

CMC recommended that many of the other rates remain unchanged. The experience study document did not include a comparison of the proposed assumption to the plan's actual experience for some of the rates, so we are unable to provide an opinion with certainty that the recommended assumptions are reasonable. For example, a table showing the number of eligible members who elected benefits, and received full or partial benefits, during the experience period could be used to evaluate the assumption. However, overall the assumptions appear to be reasonable.

The assumptions used for the VSDP/VLDP programs include: (i) probability of receiving a benefit offset, (ii) percentage of full benefits after offsets and (iii) rates of disability claim termination due to death or recovery. It would be useful if the experience study provided more detailed experience statistics supporting the development of these assumptions. With respect to the VSDP/VLDP LTC program, the morbidity, claim incidence and porting rates appear to be reasonable.

We believe the other OPEB assumptions are generally reasonable. We recommend that sufficient documentation be included in the next experience study report comparing the OPEB proposed assumptions to the plan's actual experience in order to assess the reasonability of the assumptions.

Summary of Recommendations on Actuarial Assumptions

We have the following recommendations between experience studies:

- We recommend that VRS/CMC review the payroll growth assumptions between experience studies to ensure the assumption remains appropriate given changes in total payroll and the number of active members. (Page 19)

When the next experience study is conducted, (which based on § 51.1–124.22(A)(4) would cover experience for the four-year period July 1, 2020, to June 30, 2024), GRS recommends that CMC and VRS consider the following:

- Whether increases in excess of wage inflation (merit, promotion and longevity increases) are provided for employees of certain employee groups with more than 20 years of service (in particular, SPORS). (Page 18)
- Whether merit, promotion and longevity increases are granted to employees with more than 20 years of service (by showing salary experience for each year of service through 25 or 30 years) (Page 20)
- Whether a further decrease in the salary increase assumption of 4.00 percent (1.50 percent in excess of price inflation and 0.50 percent in excess of wage inflation) is appropriate for the Judges. (Page 20)
- Applying partial credibility to the recent disability experience and adjusting rates, as appropriate. (Especially for the rates applicable to ages 45 through 65, where more of the disability experience occurs.) (Page 22)
- Document how the adjustments to the standard base mortality tables were developed for the assumptions where the experience was not fully credible (the smaller plans such as SPORS/VaLORS and pre-retirement and disabled mortality). (Page 24)

Reasonableness of Actuarial Assumptions

- Include sufficient documentation in the next experience study report comparing the OPEB proposed assumptions to the plan's actual experience in order to assess the reasonability of the assumptions. (Page 26)

Based on past history, revised actuarial assumptions based on the results of the next experience study (covering the four-year period July 1, 2020, to June 30, 2024) will likely first be reflected in the June 30, 2025 actuarial valuation. As such, they will first affect employer contribution rates for fiscal years ending 2027 and 2028.

SECTION IV.

REASONABLENESS OF ACTUARIAL METHODS AND FUNDING POLICY

Reasonableness of Actuarial Methods and Funding Policy

VRS Funding Policy Statement

According to the VRS Funding Policy Statement, the principal goal of the funding policy is to ensure that future contributions along with current plan assets are sufficient to provide for all benefits expected to be paid to members and beneficiaries when due, to seek to manage and control future contribution volatility to the extent reasonably possible and to calculate contributions in a manner that fully funds the long-term costs of promised benefits, while balancing the goals of 1) keeping contributions relatively stable and 2) equitably allocating the costs over the employees' period of active service.

The current funding policy used by the VRS Board sets contribution rates using:

- the Entry Age Normal cost method,
- a five-year asset smoothing method, and
- a closed 20-year amortization period for unfunded liabilities (Legacy unfunded liabilities as of 6/30/13 are amortized over a closed 30-year amortization period.)

VRS employs the same principles adopted for the funding of pensions to the funding of OPEB plans. As of the most recent actuarial valuation date of June 30, 2021, the VRS programs are funded as follows:

Funded Ratio Pension and OPEB Plans		
System	6/30/2021	6/30/2020
State	77.1%	75.1%
Teachers	77.2%	73.9%
SPORS	70.7%	73.0%
VaLORS	69.3%	68.5%
JRS	81.9%	83.5%
Locals	87.2%	86.4%
HIC State	18.4%	12.7%
HIC Teachers	12.1%	10.5%
VLDP-Teachers	98.6%	89.2%
VLDP-Locals	112.0%	91.3%
VSDP	218.9%	203.0%
Group Life	60.6%	53.2%
LODA	3.0%	1.5%

The sponsor may want to evaluate the current funding goals and policies for HIC since the funded ratio is significantly lower when compared to the other programs. Also, the sponsor may want to evaluate factors causing the significant growth in the state LTD and LTC programs.

The Line of Duty Act Program ("LODA") is an exception. The LODA is currently not pre-funded and employer contributions are determined by the Board on a current disbursement or pay-as-you-go basis. As such, the target funding level for all ongoing employers for LODA is at or near 0% of its accrued liabilities.

Reasonableness of Actuarial Methods and Funding Policy

Actuarial Cost Method – Entry Age Normal

The ultimate cost of VRS is equal to the actual benefits paid plus the expenses related to operating the plans. This cost is pre-funded through annual contributions to VRS plus the investment return on accumulated contributions. The projected level and timing of the contributions needed to fund the ultimate cost are determined by the actuarial assumptions, plan provisions, participant characteristics, investment and demographic experience and the actuarial cost method.

An actuarial cost method is a mathematical process for allocating the dollar amount of the total present value of plan benefits (TPV) between future normal costs and actuarial accrued liability (AAL). According to the VRS Funding Policy Statement, the VRS Board has adopted the Entry Age Normal cost method for all defined benefit and OPEB plans. Accordingly, this is the actuarial cost method used by CMC.

The Entry Age Normal actuarial cost method is characterized by:

- (1) Normal Cost – the level percent of payroll contribution, paid from each participant’s date of hire to date of retirement, which will accumulate enough assets at retirement to fund the participant’s projected benefits from retirement to death.
- (2) Actuarial Accrued Liability – the assets which would have accumulated to date had contributions been made at the level of the normal cost since the date of the first benefit accrual, if all actuarial assumptions had been exactly realized, and there had been no benefit changes.

The Entry Age Normal actuarial cost method is the most common funding method in the public sector. We believe that it is appropriate for the public sector because it produces costs that remain stable as a percentage of payroll over time, resulting in intergenerational equity for taxpayers. It is also the cost method required to be used by GASB for financial reporting.

We have reviewed CMC’s application of the Entry Age Normal actuarial cost method by comparing the test life results calculated by GRS and provided by CMC, and we believe that the method is applied correctly.

Asset Valuation Method – 5-Year Asset Smoothing

Market value of assets can experience significant short-term swings, which can cause large fluctuations in the development of the actuarially determined contributions required to fund retirement systems. As a result, many public pension systems use an asset valuation method which dampens these short-term volatilities and therefore achieves more stability in the employer contribution.

ASOP No. 44, Selection and Use of Asset Valuation Methods for Pension Valuations, provides a framework for the determination of the actuarial value of assets (AVA), emphasizing that the method should: (1) bear a reasonable relationship to the market value of assets (MVA), (2) recognize investment gains and losses over an appropriate time period and (3) avoid systematic bias that would overstate or understate the AVA in comparison to MVA.

Reasonableness of Actuarial Methods and Funding Policy

In accordance with the VRS Funding Policy Statement, the asset valuation method used by the systems in VRS, including the OPEB plans (except for the LODA, which does not pre-fund benefits), is a five-year smoothing method that recognizes the difference between the actual return (net of investment and administrative expenses) and the expected return based on the market asset value for each fiscal year at the rate of 20 percent each year. This method is the most common asset valuation method used by other large public employee retirement systems and **we believe it is appropriate to use for the VRS plans.** VRS also applies a 20 percent corridor around the MVA that restricts the degree which the AVA can vary from the MVA. **We believe the use of a corridor is also reasonable.**

We also verified the calculation of the actuarial value of assets as of June 30, 2021, for each benefit plan.

VRS Funding Policy

As previously stated, the VRS Funding Policy Statement addresses the following general policy objectives:

- Ensure funding of plans is based on actuarially determined contributions;
- Build funding discipline into the policy to ensure promised benefits can be paid;
- Maintain intergenerational equity so the cost of employee benefits is financed by the generation of taxpayers who receives services;
- Make employer costs a consistent percentage of payroll; and
- Require clear reporting to show how and when pension plans will be adequately funded.

VRS operates the same target funding level for all the benefit plans (pension and OPEB, except for the LODA) with the intent of ultimately attaining a 100 percent funded ratio.

The VRS Board has elected to calculate the actuarially determined contribution using the Entry Age Normal cost method (as a level percentage of payroll), a five-year asset smoothing method with a 20 percent corridor, and amortization rates that, with exception of recognition of the deferred contributions from the 2010-2012 biennium, are determined as a level percentage of payroll. The following components of the unfunded liability will be amortized as follows:

- The deferred contributions of the 2010-2012 biennium will be amortized as a level dollar amount over a closed, 10-year period beginning June 30, 2011. These deferred contributions, as defined under the 2011 Appropriations Act, Item 469(I)(6), have been paid off as of June 30, 2021 for all plans.
- The legacy unfunded liability as of June 30, 2013, that is not attributable to the deferred contributions of the 2010-2012 biennium will be amortized as a level percentage of payroll over a closed 30-year period beginning June 30, 2013 (22 years remaining as of June 30, 2021).
- All new sources of unfunded liability incurred in future years will be separately amortized as a level percentage of payroll over individual closed 20-year periods.

Effective November 20, 2019, the Board amended this policy to clarify that amortization periods of explicit bases may be shortened in an effort to pay off unfunded liabilities of either pensions or OPEBs earlier than originally scheduled.

Reasonableness of Actuarial Methods and Funding Policy

If the participating employers of VRS, including the State, adhere to this funding policy, then the funded ratio is expected to gradually improve and eventually attain a 100 percent funded ratio within a reasonable period.

The Conference of Consulting Actuaries (“CCA”) Public Plans Community in October 2014 issued a White Paper entitled *Actuarial Funding Policies and Practices for Public Pension Plans*. This CCA White Paper provides the following model practice for amortization periods and components:

- Layered fixed period amortization by source of UAAL;
- Level percent of pay amortization; and
- Amortization periods.

Source	Period
Active Plan Amendments	Lesser of active demographics, or 15 years
Inactive Plan Amendments	Lesser of inactive demographics, or 10 years
Experience Gain/Loss	15 to 20 years
Assumption or Method Changes	15 to 25 years
Early Retirement Incentives	5 years or less

According to CCA White Paper “Plans with layered amortization of an unfunded liability should consider actions to achieve a minimum net amortization charge that is not less than the payment required under a single 25-year amortization layer. This may be accomplished through active management of the amortization layers or through other means.” The net amortization payment (i.e., the sum of the layered amortization payments) for the State, Teachers and JRS plans is lower than a single 25-year payment of the outstanding unfunded liability.

Source: CCA White Paper

The Government Finance Officers Association (GFOA) has recommended that every state and local government that offers defined benefit pensions formally adopt a funding policy that provides reasonable assurance that the cost of those benefits will be funded in an equitable and sustainable manner. In particular, the GFOA recommends that amortization of the unfunded actuarial accrued liability should:

- 1) Use fixed (closed) periods that:
 - Are selected so as to balance the twin goals of demographic matching (equitable allocation of cost among generations) and volatility management (funding at a level percentage of payroll).
 - Never exceed 25 years, but ideally fall in the 15-20-year range.

Reasonableness of Actuarial Methods and Funding Policy

- 2) Use a layered approach for the various components to be amortized (that is, an approach that separately tracks the different components to be amortized); and emerge as a level percentage of member compensation or as a level dollar amount.

In general, we believe that the VRS funding policy represents an appropriate balance between cost stability and the goal of maintaining intergenerational equity. In addition, this funding policy is generally consistent with the model practices recommended by CCA White Paper, as well as by the GFOA. As discussed in the CCA White Paper, however, **we recommend that VRS consider actions to achieve a minimum net amortization charge that is not less than the payment required under a single 25 or 20 year amortization layer.**

In Schedule D of the June 30, 2021 actuarial valuation report, there is an amortization schedule for each plan showing the separate amortization bases. There is also a projection of the unfunded liability through June 30, 2024 and the projected unfunded liability of \$0 as of June 30, 2043 (after the original June 30, 2013 amortization base is fully amortized). The remaining amortization period as of June 30, 2021, for the outstanding balance of the unfunded liability as of June 30, 2013, is 22 years and new sources of unfunded liability are amortized over separate 20-year closed periods each year.

However, because unfunded liability gains subsequent to June 30, 2013, are being amortized over shorter periods than the remaining unfunded liability from June 30, 2013, there may be significant volatility of future contributions as some of these gains are fully amortized.

In the 2018 Quadrennial Audit report, GRS recommended that CMC provide more details in the VRS funding actuarial report, including (1) the effective amortization period and the definition of an “effective amortization period”, (2) a description of the implications of having separate unfunded liability amortization bases and an effective amortization period in excess of 22 years (the number of years remaining until VRS is expected to be fully funded) and (3) the magnitude of the expected change in future contribution rates as a result of the separate amortization bases.

CMC in their response to this comment, indicated that they *“will work with VRS to explore additional methods for adjusting the amortization of the legacy unfunded liabilities without having to aggregate bases.”*

Although VRS confirmed that such discussions have occurred, there is no mention of these considerations in the June 30, 2021 actuarial reports. Accordingly, **GRS continues to recommend that CMC provide more details in the VRS funding actuarial report regarding the implications of having separate unfunded liability amortization bases and the magnitude of the expected change in future contribution rates as a result of the separate amortization bases.**

Specifically, for the LODA plan, by Statute, employer contributions are calculated as the amount that would allow assets to be sufficient to pay costs for each two-year period and be depleted as the end of each two-year period.

Reasonableness of Actuarial Methods and Funding Policy

VRS Funding Policy for At-Risk Political Subdivision Plans

According to the VRS funding policy, CMC identified several potential at-risk Political Subdivision plans with funding ratios below 50 percent. Therefore, the VRS Board approved an amendment, effective November 14, 2013, to the VRS funding policy to address potential at-risk Political subdivision plans, including, but not limited to, those with 50 percent or lower funding. The amendment allows the Board to certify alternative contribution rates that would maintain a plan's solvency while also meeting the other objectives as stated in the Board's funding policy. Further, effective November 20, 2019, the VRS Board approved an amendment that provides for alternative funding requirements designed to allow additional payments toward unfunded liabilities and to ensure that benefits for employees, retirees and beneficiaries continue to be funded in a prudent manner.

According to information provided to us by VRS, there are 10 Political Subdivision defined benefit plans that require an at-risk surcharge. At-risk surcharges are applied to plans with low funded levels in an effort to bring the funded level up to a more sustainable level. The Political Subdivision actuarial reports state "For example, as part of the 2021 rate setting valuation, political subdivisions with a funded ratio of less than 75% were charged an additional contribution equal to the amount needed to maintain the total employer contribution at the same level as the previous rate setting actuarial valuation."

According to information provided to us by VRS, there are no Political Subdivision defined benefit plans that require an additional funding contribution in order to avoid needing a GASB blended discount rate.

We reviewed the six June 30, 2021 Political Subdivision plan actuarial reports provided to us by CMC and VRS. Plan F is the only one of the six plans that we reviewed that included a "Plan Surcharge."

Section IV of the Political Subdivision actuarial reports provides the following explanation of the additional funding charge and the plan surcharge:

The Additional Funding Charge is the contribution rate needed, if necessary, to allow the local system to use the Investment Return Rate as its Single Equivalent Interest Rate (SEIR) under GASB Statement No. 67. To determine the SEIR, the Fiduciary Net Position (FNP) must be projected into the future for as long as there are anticipated benefits payable under the plan's provision applicable to the membership and beneficiaries of the system on the Measurement Date. If the FNP is projected to not be depleted at any point in the future, the long term expected rate of return on plan investments expected to be used to finance the benefit payments may be used as the SEIR. If the FNP is projected to be depleted, an Additional Funding Charge is developed to avoid depletion.

The Plan Surcharge is the additional contribution rate applied to plans with low funding levels to bring the plan to a more sustainable funding position as determined by the Plan Actuary. For example, as part of the 2021 rate setting valuation, political subdivisions with a funded ratio of less than 75% were charged an additional contribution rate equal to the amount needed to maintain the total employer contribution at the same level as the previous rate-setting actuarial valuation.

In general, we believe that the VRS funding policy for Political Subdivision plans is reasonable.

Reasonableness of Actuarial Methods and Funding Policy

Summary of Recommendations on Reasonableness of Actuarial Methods and Funding Policy

- We recommend that CMC provide more details in the VRS funding actuarial report regarding the implications of having separate unfunded liability amortization bases and the magnitude of the expected change in future contribution rates as a result of the separate amortization bases. (Page 31)
- We recommend that VRS consider actions to achieve a minimum net amortization charge for each plan that is not less than the payment required under a single 25 or 20 year amortization layer. (Page 31)

SECTION V.

APPLICATION OF ACTUARIAL ASSUMPTIONS, METHODS AND BENEFIT PLAN PROVISIONS

Application of Actuarial Assumptions, Methods and Benefit Plan Provisions

Review of Test Life Calculations for Accuracy

In order to determine if the June 30, 2021, actuarial valuations completed by CMC for the VRS plans (1) are calculated based on the benefit provisions specified in Title 51.1 of State Code and (2) use the actuarial assumptions and actuarial methods disclosed in the experience study and the June 30, 2021, actuarial valuation reports, GRS requested sample participant calculations (i.e., test lives) from the retained actuary.

GRS requested that CMC provide sample participant calculations for the sample lives requested. For each active member sample life, CMC provided the following by decrement (retirement, termination, disability, death): present value of future benefits (PVB), present value of future salaries (PVFS), actuarial accrued liability (AAL) and normal cost (NC). The test life detail provided to us does not show probabilities of decrement by age, estimated pay and benefits by age or decrement, or present value of benefits by age for each decrement. Therefore, while we were able to compare the final results that GRS independently calculated against the results provided by CMC, we could not verify whether there were issues or inconsistencies in the calculations or application of assumptions for an individual age or year of service or if the differences were due to nuances in the valuation software programming.

Based on the most recent experience study, CMC changed their decrement timing assumption from beginning of year to middle of year for all systems except Teachers. (Decrement timing refers to the assumed timing of when members will retire, terminate employment, become disabled and die. Middle of year decrement timing is an approximation for members exiting uniformly throughout the year.) The GRS valuation system and the CMC valuation system seem to differ in how they calculate results based on middle of year decrement timing (in particular for the calculation of present value of future salaries), which is resulting in significantly more discrepancies in the test life results compared to the 2018 audit. **However, since the results calculated by GRS are close to those calculated by CMC (generally within 3 percent to 5 percent), we conclude that any inconsistencies that may be present in the CMC calculations are not material to the actuarial results.**

Calculation of the Actuarial Liability Information for Active Members:

Following are our comments based on calculating results for the 46 active member VRS pension test lives:

- 1) For 45 of the 46 test lives, the present value of future salaries (PVFS) calculated by GRS was within 3 percent of the amount calculated by CMC ***based on beginning of year decrement timing***. (One test life was slightly more than 3 percent higher.) In most of the cases, the amounts calculated by GRS were lower than those calculated by CMC. However, ***based on middle of year decrement timing*** for all systems except Teachers (which is the assumption CMC is using), there is a difference of more than 5 percent for 16 out of the 37 non-Teachers test lives. GRS is using the same salary increase and decrement rates (retirement rates, termination rates, etc.) for both the beginning of year and middle of year decrement timing results based on age and service at the beginning of the year (based on additional information from CMC). **Based on these results, we conclude that CMC seems to be applying the pay increase assumptions and the other decrement assumptions in a manner that is consistent with the stated actuarial assumptions (and application of rates based on age and service**

Application of Actuarial Assumptions, Methods and Benefit Plan Provisions

at the beginning of the year). However, the present value of future salaries results differ with how the GRS valuation system calculates results based on middle of year decrement timing, which affects the allocation of costs over a member's career (and the resulting actuarial accrued liability and normal cost). Because a member is assumed to work an additional half year before exiting active membership, we believe the higher present value of future salaries results that GRS has calculated for the middle of year decrement timing results are more appropriate.

- 2) For 37 of the 46 test lives, the present value of future benefits (PVFB) calculated by GRS was within 5 percent of the amount calculated by CMC (and 22 were within 3 percent). For 9 of the test lives, the PVFB difference was more than 5 percent.
 - a. There are 9 test lives with a difference in PVFB of more than 5 percent. (The differences are within 11 percent.) Four are State system members (out of 11 total active test lives), four are VaLORS members (out of eight total active test lives) and one is a Local member test life (out of six total active test lives). GRS recently received some additional feedback on certain test lives from CMC that may help explain the differences.
 - b. **Based on these results, we conclude that CMC seems to be applying the assumptions and benefit provisions in a manner that is consistent with the stated assumptions and benefit provisions in the actuarial report. We recommend that the additional clarification on the application of certain assumptions that was provided to GRS be disclosed in the actuarial valuation report.**
- 3) The normal cost (NC) calculation is based on a normal cost rate (based on a calculation of PVFB and PVFS at the member's entry age) and the member's expected pay in the upcoming year. The actuarial accrued liability (AAL) calculation is based on the PVFB and PVFS at the member's current age and the normal cost rate. Because there are more calculations performed for the AAL and NC than for the PVFS and PVFB, there is more room for differences in calculation methodologies between the two firms. Therefore, there were larger differences in the actuarial accrued liability (AAL) and normal cost calculated by GRS and CMC than for the PVFS and PVFB for the 46 individual test lives. **However, the combined AAL and NC calculation by GRS for the 46 test lives was about 3.50 percent lower for AAL and about 2.20 percent higher for NC, which we believe is a reasonable difference.**
 - a. The expected PVFB to be paid by VRS calculated by GRS for each active test life was relatively close to the expected PVFB for each test life calculated by CMC, which means that although the recognition of costs over the members' careers may differ significantly, the ultimate cost to VRS does not.

Calculation of the Actuarial Liability Information for Inactive and Retired Members:

For each inactive/retired member sample life, CMC provided the actuarial accrued liability (which is equal to the present value of future benefits for inactive/retired members).

Based on calculating results for the 48 terminated and retired member VRS pension test lives, GRS can closely match the actuarial accrued liabilities (within 5 percent) for 42 of the 48 test lives. For two of the six test lives with a larger discrepancy, the difference is attributable to GRS using the accumulated contribution balance as a minimum PVFB. For terminated vested members, CMC assumes that the more

Application of Actuarial Assumptions, Methods and Benefit Plan Provisions

valuable of a return of member contributions and a deferred annuity is elected. For the transfers (with a payment form of deferred annuity), the liability seems to be based on the value of a deferred annuity (even if it is lower than a return of member contributions). We recommend treating transfers similarly to terminated vested members. For three of the test lives, the payment form is a deferred annuity. There may be differences in the COLA commencement date and pre-commencement death benefits (for those with a status of LTD Dis). These are minor discrepancies which we do not believe would result in a significant difference in the total plan liabilities. The final larger discrepancy is for a VaLORS test life with status RetELW. GRS is including the liability for the temporary supplement in the liability, which is the source of the discrepancy.

Detailed Test Life Results

Tables 1 and 2 in the Appendix present results for the 46 active and 48 inactive (retired and terminated) members for whom we received test life results.

Summary of Recommendations on Application of Actuarial Assumptions, Methods and Plan Provisions

- We recommend that the additional clarification on the application of certain assumptions that was provided to GRS be disclosed in the actuarial valuation report. (Page 36)
- We recommend that CMC use the same assumption for current terminated vested members as is used for future terminated vested members which is to assume that the more valuable of a return of contributions and a deferred annuity is elected. (Page 37)

SECTION VI.

ACTUARIAL REPORT CONTENT, DETAIL, FORMAT AND CLARITY

Actuarial Report Content, Detail, Format and Clarity

Actuarial Standards of Practice

The Actuarial Standards Board (ASB) promulgates actuarial standards of practice (ASOPs) for use by actuaries when rendering actuarial services in the United States. A summary of the specific ASOPs that provide guidance with respect to report content and clarity (ASOP Nos. 4 and 41) can be found in the Appendix.

Findings and Recommendations

Our review of the June 30, 2021, actuarial valuation reports includes the following plans:

- Virginia Retirement System (i.e., actuarial valuation of the State Employees, Teachers, State Police, VaLORS and JRS);
- Six political subdivision plans participating in the VRS; and
- OPEB programs (i.e., the Group Life Insurance Program, Health Insurance Credit Program, the Virginia Sickness and Disability Program, the Virginia Local Disability Program and the Line of Duty Act Fund).

In the plan provisions section of the report, **we recommend the following clarifications:**

- **Description of the early retirement reduction**
 - The State Employees Plan 1 early retirement reduction is described as follows
 - *For members at least age 55, the reduction is 0.5% per month for the first 60 months and 0.4% per month for the next 60 months. This reduction is applied for each month that the retirement age precedes 65, or if more favorable, for each month the service at retirement is less than 30.*
 - The Plan 2 and Hybrid Plan early retirement reduction is described as follows
 - *Calculated the same as the normal retirement benefit, using actual service at retirement and multiplied by a reduction factor similar to Plan 1. No reduction is applied if the sum of the member's age and service is equal to 90.*
 - We do not see the Plan 1 early retirement reduction factors (0.5% and 0.4%) described in the Virginia Code. We recommend that VRS/CMC update the actuarial valuation report with additional information on the basis of the factors.
 - We recommend that CMC more clearly describes "a reduction factor similar to Plan 1" for the Plan 2/Hybrid Plan early retirement reduction.

In the actuarial assumptions and methods section of the report, **we recommend the following clarifications:**

- **Include a description of the technical assumptions (for example, decrement timing – assumed timing of retirements, terminations, disabilities and deaths and pay increase timing – at the beginning of the year, at the valuation date or at the end of the year and 12 months after the valuation date).**

Actuarial Report Content, Detail, Format and Clarity

In general, we believe that the actuarial reports we reviewed are in compliance with the applicable ASOPs regarding report content, detail, format and clarity.

Summary of Recommendations for Actuarial Report Content, Detail, Format and Clarity

Following is a summary of the recommendations discussed in this section of the report:

- We recommend that VRS/CMC update the actuarial valuation report with additional information on the basis of the early retirement reduction factors. (Page 38)
- We recommend that CMC more clearly describes “a reduction factor similar to Plan 1” for the Plan 2/Hybrid Plan early retirement reduction. (Page 38)
- We recommend CMC include a description of the technical assumptions (for example, decrement timing and pay increase timing). (Page 38)

SECTION VII.

REVIEW OF CONTRIBUTION RATES AND FUNDED RATIOS

Review of Contribution Rates and Funded Ratios

Calculation of the Employer Contribution Rate

Contribution rates for VRS employees are established every two years. The June 30, 2021 actuarial valuation reports that we reviewed during this quadrennial audit develop the employer contribution rates for fiscal years 2023 and 2024. The June 30, 2019 actuarial valuations developed the employer contribution rates for fiscal years 2021 and 2022. The results of the June 30, 2020 actuarial valuation are for informational purposes only.

The employer contribution rate is comprised of four components, an employer normal cost rate, an estimate of administrative expenses, an amortization percentage and a DC contribution for Hybrid Members. The normal cost rate is the theoretical percentage of pay that would be required to fund the member's benefits if this amount had been contributed from each member's entry date and if the fund's experience exactly followed the actuarial assumptions. For VRS, the normal cost will gradually decrease in future years as the number of active members earning the relatively more valuable Plan 1 benefits decrease and the number of members in Plan 2 and the new Hybrid plan (for applicable employee groups) increase.

The unfunded actuarial accrued liability amortization payment percentage is the cost of financing the difference between the actuarial accrued liability and the actuarial value of assets. The methods for determining the amortization percentage, such as the funding period, are dictated by the Board's funding policy.

Following are the components of the unfunded liability and the method for amortizing those components of the unfunded liability:

- The legacy unfunded liability as of June 30, 2013, that is not attributable to the deferred contributions of the 2010-2012 biennium, will be amortized as a level percentage of payroll over a closed 30-year period beginning June 30, 2013 (22 years remaining as of June 30, 2021).
- All new sources of unfunded liability incurred in future years will be separately amortized as a level percentage of payroll over individual closed 20-year periods.

The employer contribution rate as a percentage of payroll are illustrated on pages 6 through 11 in the VRS actuarial report. The following table summarizes the contribution rates for State Employees, Teachers, SPORS, VaLORS, JRS and Political Subdivisions.

Review of Contribution Rates and Funded Ratios

Components of Contribution Rate Based on June 30, 2021 Rate Setting Valuation	State Employees	Teachers	State Police (SPORS)	Judicial (JRS)	Virginia Law Officers (VaLORS)	Average of Political Subdivisions
Employer Contribution Rate for Defined Benefit Plan						
Employer Normal Cost Rate	4.76%	5.63%	13.05%	20.23%	11.11%	
Administrative Expense	0.29%	0.28%	0.38%	0.44%	0.27%	
Amortization of Unfunded Actuarial Accrued Liability	8.02%	8.04%	16.55%	8.14%	13.22%	
Annual Recommended Contribution	13.07%	13.95%	29.98%	28.81%	24.60%	7.97%
DC Contribution for Hybrid Members	1.06%	0.81%		1.86%		0.82%
Total Employer Contribution Rate	14.13%	14.76%	29.98%	30.67%	24.60%	8.79%
Total Contribution Rate Based on Prior June 30, 2020 valuation	14.57%	16.65%	26.72%	29.24%	22.13%	8.42%

The employer contribution rate as a percentage of payroll for the six Political Subdivision Plans that we reviewed is illustrated on page 4 of each respective Political Subdivision Plan actuarial report and summarized in the following table.

Components of Contribution Rate Based on June 30, 2021 Rate Setting Valuation	Plan A	Plan B	Plan C	Plan D	Plan E	Plan F
Employer Contribution Rate for Defined Benefit Plan						
Employer Normal Cost Rate	9.74%	8.38%	10.91%	8.78%	9.07%	4.39%
Amortization of Unfunded Actuarial Accrued Liability	6.43%	0.53%	1.77%	1.83%	0.66%	25.47%
Administrative Expense	0.30%	0.24%	0.31%	0.33%	0.30%	0.38%
Additional Funding Contribution	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Plan Surcharge	0.00%	0.00%	0.00%	0.00%	0.00%	0.08%
Annual Recommended Contribution	16.47%	9.15%	12.99%	10.94%	10.03%	30.32%
DC Contribution for Hybrid Members	0.65%	0.82%	0.53%	0.79%	0.63%	0.63%
Total Employer Contribution Rate	17.12%	9.97%	13.52%	11.73%	10.66%	30.95%
Total Contribution Rate Based on Prior June 30, 2020 valuation	15.06%	7.81%	12.57%	11.55%	10.50%	32.18%

The change in the employer contribution rate from the prior valuation is primarily the result of the changes in actuarial assumptions offset by investment gains.

Following is a summary of the contributions rates for the OPEB plans.

Review of Contribution Rates and Funded Ratios

OPEB Plan	Fiscal Years 2021/2022	Informational Only	Fiscal Years 2023/2024
	Board & General Assembly Approved		Board & General Assembly Approved
	2019 Valuation	2020 Valuation	2021 Valuation
GLI*	1.34%	1.36%	1.19%
HIC - State Employees	1.12%	1.08%	1.04%
HIC - Teachers	1.21%	1.18%	1.21%
HIC - Participating Political Subdivisions**	0.59%	0.64%	0.70%
HIC - Constitutional Officers	0.36%	0.35%	0.36%
HIC - Social Service Employees	0.38%	0.39%	0.37%
HIC - Registrars	0.39%	0.37%	0.32%
VSDP	0.61%	0.56%	0.56%
VLDP-Teachers	0.47%	0.45%	0.47%
VLDP-Political Subdivisions	0.83%	0.82%	0.85%

Source: CMC OPEB Plan Actuarial Report as of June 30, 2021

Based on the information provided in the actuarial valuation reports, **we believe that the employer contribution rates are reasonable.** Long term projections could help evaluate the sufficiency of the contribution rates and the growth in the funded ratio.

Review of VRS' Funded Ratio

The following table below provides the schedule of funding progress for all systems as of June 30, 2021 on a combined basis.

Schedule of Funding Progress (All Systems Combined) (Dollars in Thousands)

Funded Ratio for VRS Pension Plans					
June 30th Year End	Actuarial Value of Assets	Actuarial Accrued Liability	Unfunded Actuarial Accrued Liability	VRS Total Funded Ratio	
2021	\$ 88,234,769	\$ 111,110,589	22,875,820	79.4%	
2020	81,753,323	106,036,105	24,282,782	77.1%	
2019	79,140,911	103,196,070	24,055,159	76.7%	
2018	75,985,671	96,990,877	21,005,206	78.3%	
2017	71,833,935	93,501,215	21,667,280	76.8%	
2016	67,660,203	90,793,027	23,132,824	74.5%	
2015	64,392,482	88,268,952	23,876,470	73.0%	
2014	59,270,874	85,540,753	26,269,879	69.3%	
2013	54,027,168	82,407,017	28,379,849	65.6%	
2012	53,069,571	81,207,604	28,138,033	65.4%	
2011	54,472,733	78,423,149	23,950,416	69.5%	

Source: June 30, 2021, actuarial valuation report issued by CMC and the June 30, 2021 Annual Comprehensive Financial Report

Review of Contribution Rates and Funded Ratios

The following table illustrates the funded ratio for individual plans as of June 30, 2021 and June 30, 2020.

Funded Ratio Pension and OPEB Plans		
System	6/30/2021	6/30/2020
State	77.1%	75.1%
Teachers	77.2%	73.9%
SPORS	70.7%	73.0%
ValORS	69.3%	68.5%
JRS	81.9%	83.5%
Locals	87.2%	86.4%
HIC State	18.4%	12.7%
HIC Teachers	12.1%	10.5%
VLDP-Teachers	98.6%	89.2%
VLDP-Locals	112.0%	91.3%
VSDP	218.9%	203.0%
Group Life	60.6%	53.2%
LODA	3.0%	1.5%

Funded ratio based on actuarial value of assets.

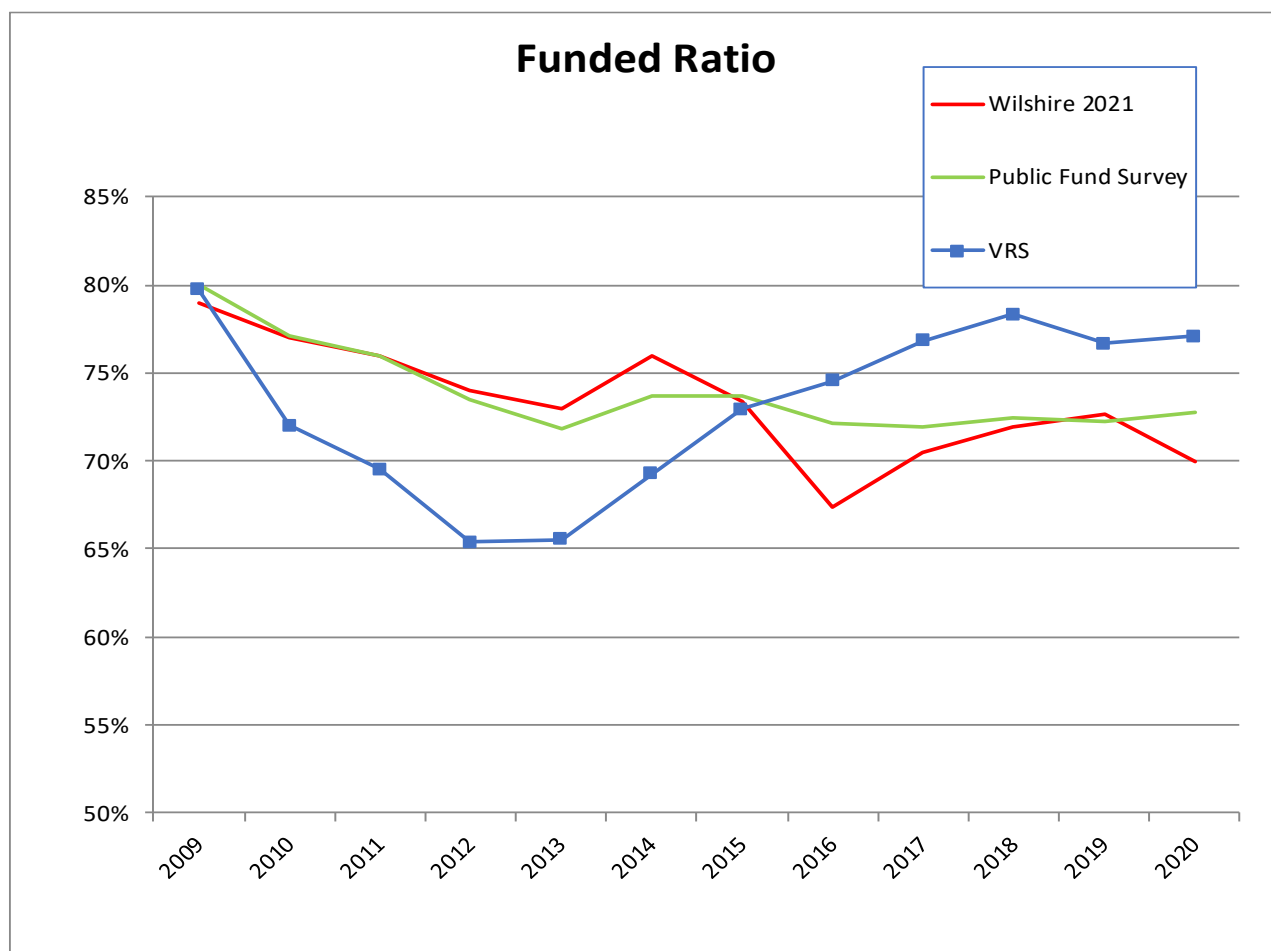
Source: CMC PowerPoint Presentation Deck dated October 18, 2021 and CMC OPEB Plan Actuarial Report as of June 30, 2021

VRS' combined funding ratio of 77.1 percent as of June 30, 2020 compares to an average of 72.8 percent for the 119 large public retirement systems included in the FY 2020 Public Fund Survey. The Public Fund Survey, which is sponsored by the National Association of State Retirement Administrators, is an online compendium of key characteristics of most of the nation's largest public retirement systems. Of the 119 systems reported in the latest FY 2020 survey, the funding ratio ranges from a high of approximately 116 percent to a low of about 17 percent. Note the VRS combined funding ratio increased to 79.4 percent as of June 30, 2021.

VRS' ranking in the range is somewhat misleading because other systems use different actuarial assumptions for determining their actuarial accrued liability. For example, the median return assumption for the 119 systems reported in the latest FY 2020 Public Fund survey is 7.25 percent, much higher than the 6.75 percent assumption used for VRS. If these other retirement systems calculated their liability, and corresponding funded ratio, using a 6.75 percent discount rate, then VRS would compare even more favorably to other statewide retirement systems.

The following table compares historical funding ratios among the VRS combined plans, the Public Fund survey and the Wilshire Consulting 2021 Report on State Retirement Systems Funding Levels.

Review of Contribution Rates and Funded Ratios



Wilshire Consulting 2021 Report on State Retirement Systems: Funding Levels and Asset Allocation

Public Fund Survey Summary of Finding for FY2020 Dated November 2021 (sponsored by the National Association of State Retirement Administrators)

The VRS funded ratio was about equal to the average from the Public Fund Survey and Wilshire Consulting report in 2009, was significantly lower until 2015 and has been higher since 2016. In addition, the assumptions used by VRS, specifically the investment return assumption, are reasonable, whereas some plans included in the Public Fund Survey and the Wilshire Report may be using more aggressive assumptions (for example, an investment return assumption with a low probability of being achieved).

Review of Political Subdivision Plans Funded Ratio

Following is a summary of the funded ratio as of June 30, 2021 and June 30, 2020 (prepared by GRS) for the six political subdivisions plans that we reviewed:

Review of Contribution Rates and Funded Ratios

Political Subdivision Plan	Plan A	Plan B	Plan C	Plan D	Plan E	Plan F
Actuarial Accrued Liability	\$ 1,311,092,323	\$ 20,411,949	\$ 407,668,345	\$ 29,330,144	\$ 12,432,861	\$ 18,634,367
Actuarial Value of Assets	1,066,728,827	19,317,692	377,327,820	26,723,012	11,869,332	10,895,130
Unfunded Actuarial Accrued Liability	244,363,496	1,094,257	30,340,525	2,607,132	563,529	7,739,237
Funded Ratio as of June 30, 2021	81.36%	94.64%	92.56%	91.11%	95.47%	58.47%
Funded Ratio as of June 30, 2020	82.55%	95.12%	91.32%	87.96%	92.09%	55.29%

Source: GRS Analysis of Select Political Subdivision Plan Actuarial Reports

With the exception of Plan F which is 58 percent funded, all of the other plans are at, or over, 80 percent funded (on an actuarial value of assets basis). These funded ratios compare to an average funding ratio of 71 percent according to the *Wilshire 2021 Report on City & County Retirement Systems: Funding Levels and Asset Allocation*. The average funded ratio as of June 30, 2021 for all of the Political Subdivisions plans with no enhanced hazardous duty is 95.6 percent and the average funded ratio for all plans with enhanced hazardous duty is 85.1 percent. This compares to an average funded ratio as of June 30, 2020 for all of the Political Subdivisions plans with no enhanced hazardous duty of 93.9 percent and the average funded ratio for all plans with enhanced hazardous duty of 84.6 percent.

As previously indicated, Plan F is the only one of the six plans that we reviewed that was identified as a plan that required an at-risk surcharge. According to information provided to us by VRS, there are 10 political subdivision defined benefit plans who require an at-risk surcharge. At-risk surcharges are applied to plans with low funded levels in an effort to bring the funded level up to a more sustainable level. The Plan F actuarial report states “For example, as part of the 2021 rate setting valuation, political subdivisions with a funded ratio of less than 75% were charged an additional contribution equal to the amount needed to maintain the total employer contribution at the same level as the previous rate setting actuarial valuation.”

According to information provided to us by VRS, there are no political subdivision defined benefit plans that require an additional funding contribution in order to avoid needing a GASB blended discount rate.

OPEB Plans Funding

The funding policy for the OPEB plans is to contribute normal cost plus amortization of the unfunded liability using the Entry-Age Normal actuarial cost method, a level percent of pay amortization method and an actuarial value of assets based on a five-year smoothing period with a 20 percent corridor around market value. The unfunded liability as of June 30, 2013 (legacy unfunded liability) is amortized over a 30-year closed period as a level percentage of payroll; subsequent gains and losses arising from future actuarial valuations are amortized over separate 20-year closed periods as a level percentage of payroll. (Note the actuarial value of assets for the (1) HIC Constitutional Officers, (2) Social Service Employees and (3) Registrars is equal to the market value.)

For the LODA, employer contributions are set such that assets are expected to be sufficient to cover pay-as-you-go costs for a two-year period but will be depleted at the end of the two-year period. LODA contributions are expected to increase annually.

Review of Contribution Rates and Funded Ratios

According to the CMC June 30, 2021 OPEB Actuarial Valuation Report, following are the changes experienced by the OPEB plans since the prior year valuation:

- The funded ratio, which compares assets to liabilities, increased for all plans.
- All plans had greater than expected investment return for the year due to the market value return of 27.5% versus the assumed rate of 6.75% which created actuarial gains.
- In all plans except HIC Political Subdivisions there were greater than expected contributions either because the employer contributions from the June 30, 2019 rate setting valuation were greater than those expected based on the prior valuation, or because the payroll upon which the rate was applied was greater than expected. The HIC Political Subdivisions had employer contributions slightly less than expected due mainly due to assumed contribution timing.
- The State HIC plan received an additional ad-hoc contribution of \$38.7 million in June 2021 which reduced the unfunded actuarial liability.
- GLI had gains due to the post-retirement mortality assumption change which assumes longer life expectancy and therefore later deaths. The GLI also had a small gain due to demographic experience.
- The HIC plans all had losses due the assumption changes, primarily due to the post-retirement mortality assumption which assumes longer life expectancy. Since the HIC pays lifetime benefits, longer than expected post-retirement life expectancy causes actuarial losses. In addition, the HIC plans had small gains or losses from demographic experience, none of which caused significant changes to the unfunded actuarial liability.
- The employer contribution rate for the HIC teachers was expected to decrease due to the experience study and investment gain, but instead increased slightly due to payroll remaining flat since the prior valuation rather than increasing as expected.
- The VSDP and VLDP Political Subdivisions had gains from the experience study change to assume that decrements such as disabilities, retirements, terminations, and deaths occur in the middle of the year instead of the beginning of the year. Since benefits are only payable from time of disability to retirement eligibility, the delay of a half year in the assumed onset of benefits caused an actuarial gain. This did not occur for VLDP teachers because the decrement timing assumption for teachers remained at the beginning of the year because of the timing pattern of teacher contracts.
- For all three disability plans, the inactive data is received from a third party and the data quality has been improving over the last few years leading to experience adjustments. It must also be noted that disability and termination from disability are low frequency/high volatility occurrences and, even for a System as large as VRS, experience is expected to be volatile. It is expected that the disability plans will continue to see experience gains and losses that are more volatile than

Review of Contribution Rates and Funded Ratios

the other OPEB plans due to the nature of the benefit as a salary replacement to a disability occurrence rather than an earned retirement benefit.

There is a general lack of background information on the historical funding of the OPEB plans in the VRS Report on the Actuarial Valuation of Other Postemployment Benefits report produced by CMC. As such, **we recommend that additional background information on the historical funding of the OPEB plans be added to the actuarial valuation report.**

Group Life Insurance Program

The VRS Report on the Actuarial Valuation of Other Postemployment Benefits (“VRS OPEB Report”) includes the following chart showing a progression of the funded status for the Group Life Insurance Program from 2016 to 2021.

SCHEDULE OF FUNDING PROGRESS GROUP LIFE INSURANCE PROGRAM
(\$ IN THOUSANDS)

Actuarial Valuation Date	Actuarial Value of Plan Assets (a)	Actuarial Accrued Liability (AAL) Entry Age (b)	Unfunded AAL (UAAL) (b - a)	Funded Ratio (a / b)	Covered Payroll (c)	UAAL as a Percentage of Covered Payroll ((b - a) / c)
6/30/2021	\$2,135,187	\$3,524,464	\$1,389,277	60.58%	\$21,052,089	6.60%
6/30/2020	1,905,233	3,583,131	1,677,898	53.17%	20,456,977	8.20%
6/30/2019	1,741,406	3,414,322	1,672,916	51.00%	20,498,084	8.16%
6/30/2018	1,574,017	3,166,533	1,592,516	49.71%	19,783,323	8.05%
6/30/2017	1,410,087	3,024,718	1,614,631	46.62%	19,222,759	8.40%
6/30/2016	1,247,564	2,974,468	1,726,904	41.94%	18,321,880	9.43%

Source: June 30, 2021, actuarial valuation report issued by CMC

- The funded ratio has increased from 42 percent at 2016 to 61 percent at 2021. This implies that the plan sponsor is making progress towards the financing of unfunded liabilities.
- The VRS ACFR includes a comparison of the historical actuarially determined contribution (ADC) to actual contributions. In general, over the past five years the plan sponsor has made contributions that are approximately 100 percent of the targeted annual required contributions (ARC).
- Based on the growth in funded ratio and the historical contribution patterns, if the plan sponsor continues to contribute 100 percent of the ARC, the funded ratio is expected to increase in the future.

Review of Contribution Rates and Funded Ratios

Health Insurance Credit Program

The VRS OPEB Actuarial Report includes the following chart showing a progression of the funded status for the Health Insurance Credit Program (for State Employers and Teachers) from 2016 to 2021.

SCHEDULE OF FUNDING PROGRESS HEALTH INSURANCE CREDIT PROGRAM (\$ IN THOUSANDS)

Actuarial Valuation Date	Actuarial Value of Plan Assets (a)	Actuarial Accrued Liability (AAL) Entry Age (b)	Unfunded AAL (UAAL) (b - a)	Funded Ratio (a / b)	Covered Payroll (c)	UAAL as a Percentage of Covered Payroll ((b - a) / c)
State Employees						
6/30/2021	\$191,829	\$1,044,663	\$852,834	18.36%	\$7,442,699	11.46%
6/30/2020	129,901	1,024,443	894,542	12.68%	7,221,134	12.39%
6/30/2019	109,417	1,026,752	917,335	10.66%	6,907,506	13.28%
6/30/2018	96,294	995,659	899,365	9.67%	6,635,983	13.55%
6/30/2017	79,451	990,724	911,273	8.02%	6,480,712	14.06%
6/30/2016	70,798	987,641	916,843	7.17%	6,319,509	14.51%
Teachers						
6/30/2021	\$177,304	\$1,471,397	\$1,294,093	12.05%	\$8,971,605	14.42%
6/30/2020	149,949	1,430,538	1,280,589	10.48%	8,911,307	14.37%
6/30/2019	130,043	1,425,883	1,295,840	9.12%	8,608,489	15.05%
6/30/2018	113,136	1,379,073	1,265,937	8.20%	8,479,023	14.93%
6/30/2017	96,987	1,357,921	1,260,934	7.14%	8,303,502	15.19%
6/30/2016	86,701	1,351,203	1,264,502	6.42%	7,666,824	16.49%

Source: June 30, 2021, OPEB actuarial valuation report issued by CMC.

The preceding table shows somewhat slow growth in the funded ratio. Recent investment gains are a primary reason for the increase in the funded ratio. The sponsor may want to consider strengthening the funding policy.

The OPEB Actuarial Report includes a reconciliation of assets for the Health Insurance Credit Program during 2021, which is summarized as follows:

Review of Contribution Rates and Funded Ratios

Health Insurance Credit Program Liquidity Ratio (\$ in Thousands)							
	State		Political	Constitutional	Social Service		Total
Market Value of Assets	Employees	Teachers	Subdivisions	Officers	Employees	Registrars	
Assets at June 30, 2020	\$ 125,377	\$ 144,158	\$ 24,468	\$ 5,114	\$ 1,934	\$ 126	\$ 301,177
Contributions	119,817	107,159	5,242	2,664	1,160	54	236,096
Benefits/Expenses	72,129	94,200	3,088	2,063	1,084	35	172,599
Investment Income	34,790	37,093	6,711	954	335	24	79,907
Assets at June 30, 2021	207,855	194,210	33,333	6,669	2,345	169	444,581
Liquidity Ratio	1.7	1.5	7.9	2.5	1.8	3.6	1.7

Source: June 30, 2021, OPEB actuarial valuation report issued by CMC

The preceding table shows that the ratio of assets to benefits and expenses, or liquidity ratio, is less than 2.00 for most plans. This is another indicator that the funding policy may not adequately finance plan benefits. In general, for OPEB programs with low funded ratios, contributions should be sufficient to cover at least benefits, normal costs, interest costs, plus a margin for potential losses.

Based on these facts, we recommend continued analysis be performed for the Health Insurance Credit Program in order to evaluate the adequacy of the contribution policy.

Virginia Sickness and Disability Program (VSDP) and Virginia Local Disability Program (VLDP)

The VRS OPEB Actuarial Report includes two charts showing a progression of the funded status from 2016 to 2021 for the VSDP and VLDP, which is summarized below:

Virginia Sickness and Disability Program (VSDP) and Virginia Local Disability Program (VLDP)

Historical Funded Status for FYE 6/30	VSDP State Employees	VLDP Teachers	VLDP Political Subdivisions
2016	173%	13%	14%
2017	193%	40%	50%
2018	174%	49%	31%
2019	195%	64%	70%
2020	203%	89%	91%
2021	219%	99%	112%

Source: June 30, 2021, OPEB actuarial valuation report issued by CMC

- The preceding table shows that the VSDP program is very well funded. The VLDP program is experiencing exceptional growth in the funded ratio.

We recommend providing more details in the actuarial report describing the reasons why the VSDP is so well funded and the reasons for the significant growth in the funded ratio for the VLDP.

Review of Contribution Rates and Funded Ratios

Virginia Line of Duty Act Fund

As previously stated, the LODA is currently not pre-funded and employer contributions are determined by the Board on a current disbursement or pay-as-you-go basis. As such, the target funding level for all ongoing employers for LODA is at or near 0% of its accrued liabilities.

The Virginia Line of Duty Program (LODA Program) provides health benefits and death benefits for various segments of participants involved in disabilities and death due to line of duty incidents. The program was enacted in 1972.

The VRS Line of Duty Act Fund Actuarial Valuation Report develops two Employer Contribution Rates:

- Pay-As-You-Go Funding develops LODA Fund Employer Costs Per Full Time Employee (FTE)
- Actuarially Determined Employer Contribution Rate (ADEC) developed for GASB 74 purposes

For LODA, employer contributions are set such that assets are expected to be sufficient to cover pay-as-you-go costs for a two-year period but will be depleted at the end of this period. LODA contribution rates are expected to increase annually. The promised death benefits and postemployment healthcare benefits provided through the Plan are included in all of the actuarially estimated contribution rates. The Plan is a cost-sharing, multiple employer plan. The actuarially determined employer contribution rates were developed using the entry age normal cost method with projected benefits. As the LODA Fund is invested in the same manner as the pension funds, the valuation results provided reflect the same discount rate of 6.75% as used in the pension valuations. The unfunded accrued liability is being amortized by regular annual contributions as a level percentage of payroll within a 30-year period with a payroll increase assumption of 3.00% annually. The medical premium rates are developed using trend rates for pre-65 participants starting at 7.0% reducing over 10 years to 4.75%; the post 65 trend rates start at 5.25% also reducing to 4.75% over 4 years. The initial health care costs are based upon premium amounts provided by DHRM which used experience of the LODA members currently receiving benefits.

The actuarial cost method and the other assumptions are appropriate for the purpose of providing these contribution rates and other liabilities. From the report, however, it is unclear what, if any, reasonableness checks were done on the initial premium amounts provided by DHRM. **We recommend that the actuarial valuation include additional details on the development per capita and disclose any reliance on information provided by DHRM's healthcare consultant.**

Virginia Line of Duty Program Funding and Cash Flow Projections

The following table demonstrates reasonable patterns for contribution rates and cash flows expected under the LODA program.

Review of Contribution Rates and Funded Ratios

CASH FLOW PROJECTIONS Based on Actual and Projected Board Approved Rates in Odd Rate Setting Years (Actual Cash Flow Projection)

All Participating Employer Groups - June 30, 2021 Valuation Basis								
	Actual	Projected						
	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028
FTE Employees	19,989.05	19,087.20	19,087.20	19,087.20	19,087.20	19,087.20	19,087.20	19,087.20
Cash Flow (Per FTE Employee)								
Employer Contribution Rate	\$717.31	\$722.55	\$681.84	\$681.84	\$1,057.92	\$1,057.92	\$1,228.64	\$1,228.64
Benefit Costs	(655.11)	(738.42)	(840.46)	(935.31)	(1,018.65)	(1,103.43)	(1,194.65)	(1,275.85)
Administrative Expenses	(49.00)	(29.60)	(30.49)	(31.38)	(32.33)	(33.32)	(34.32)	(35.36)
Investment Income and Misc. Rev	183.14	49.56	43.62	30.56	35.94	35.94	41.46	41.46
Net Cash Flow	196.34	4.09	(145.49)	(254.29)	42.88	(42.89)	41.13	(41.11)
Cash Flow								
Employer Contributions	\$13,632,927	\$13,791,456	\$13,014,453	\$13,014,453	\$20,192,792	\$20,192,792	\$23,451,235	\$23,451,235
Benefit Costs	(13,094,992)	(14,094,421)	(16,041,981)	(17,852,481)	(19,443,202)	(21,061,347)	(22,802,536)	(24,352,467)
Administrative Expenses	(979,427)	(565,000)	(582,000)	(599,000)	(617,000)	(636,000)	(655,000)	(675,000)
Investment Income and Misc. Rev	3,660,865	945,975	832,489	583,360	685,982	685,983	791,267	791,266
Net Cash Flow	\$3,219,373	\$78,010	(\$2,777,039)	(\$4,853,668)	\$818,572	(\$818,572)	\$784,966	(\$784,966)
End of Year Net Position	\$7,552,697	\$7,630,707	\$4,853,668	\$0	\$818,572	\$0	\$784,966	\$0

Source: June 30, 2021 VRS LODA Actuarial Valuation Report

The following table illustrates the pay-as-you-go funding status of the LODA:

(\$ IN THOUSANDS)

Actuarial Valuation Date	Actuarial Value of Assets (a)	Actuarial Accrued Liability (AAL)* (b)	Unfunded AAL (UAAL) (b - a)	Funded Ratio (a / b)
6/30/2021	\$7,553	\$255,265	\$247,712	2.96%
6/30/2020	4,333	295,455	291,122	1.47
6/30/2019	2,839	285,185	282,346	1.00
6/30/2018	1,889	293,842	291,953	0.64
6/30/2017	3,461	270,379	266,918	1.28
6/30/2016	2,708	224,683	221,975	1.21
6/30/2015	728	245,808	245,080	0.30
6/30/2014	0	225,816	225,816	0.00
6/30/2013	0	204,084	204,084	0.00
6/30/2012	0	226,174	226,174	0.00
6/30/2011	0	398,956	398,956	0.00

Source: June 30, 2021 VRS LODA Actuarial Report

Review of Contribution Rates and Funded Ratios

Funded Ratio Conclusions

VRS is actuarially sound. The funding ratio of the VRS plans are generally improving and moving towards a 100 percent funded ratio goal.

- The funded ratio for the VRS pension plans has increased from about 74.5 percent in 2016 to 79.4 percent in 2021.
- The average funded ratio as of June 30, 2021 for all of the Political Subdivisions plans with no enhanced hazardous duty is 95.6 percent and the average funded ratio for all plans with enhanced hazardous duty is 85.1 percent.
- The funded ratio for the Group Life Insurance Program is increasing and if the plan sponsor continues to contribute 100 percent of the ARC, the funded ratio is expected to increase in the future.

Summary of Recommendations for Review of Contributions Rates and Funded Ratios

- We recommend that background information on the historical funding of the OPEB plans be added to the actuarial valuation report. (Page 47)
- We recommend continued analysis be performed for the Health Insurance Credit Program in order to evaluate the adequacy of the contribution policy. (Page 49)
- We recommend providing more details in the actuarial report describing the reasons why the VSDP and the VLDP programs are so well funded. (Page 49)
- We recommend that the LODA report include additional details on the development of per capita costs. (Page 50)

SECTION VIII.

ACTUARIAL PRINCIPLES AND PRACTICES EMPLOYED BY THE ACTUARY

Actuarial Principles and Practices Employed by the Actuary

Actuarial Standards of Practice

The Actuarial Standards Board (ASB) promulgates actuarial standards of practice (ASOPs) for use by actuaries when rendering actuarial services in the United States. Although the Board of VRS is the ultimate decision-making body with regard to approval of the actuarial assumptions used in the annual actuarial valuations, CMC must still comply with the Actuarial Standards of Practice when providing advice or recommendations to the Board on the selection of actuarial assumptions.

The following Actuarial Standards of Practice are applicable to the retirement and OPEB plans sponsored by VRS:

- ASOP No. 4, *Measuring Pension Obligations and Determining Pension Plan Costs or Contributions*;
- ASOP No. 5, *Incurred Health and Disability Claims*;
- ASOP No. 6, *Measuring Retiree Group Benefits Obligations and Determining Retiree Group Benefits Program Periodic Costs or Actuarially Determined Contributions*;
- ASOP No. 18, *Long Term Care Insurance*;
- ASOP No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations*;
- ASOP No. 35, *Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations*;
- ASOP No. 41, *Actuarial Communications*;
- ASOP No. 44, *Selection and Use of Asset Valuation Methods for Pension Valuations*; and
- ASOP No. 51, *Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions (Effective for any actuarial work product with a measurement date on or after November 1, 2018)*.

In general, we find that CMC followed the appropriate ASOPs.

Summary of Recommendations for Actuarial Principles and Practices Employed by the Actuary

None.

SECTION IX.

COMMENTS AND CONSIDERATIONS FROM THE 2018 QUADRENNIAL AUDIT

Comments and Considerations from GRS from the 2018 Audit

The 2018 Quadrennial Actuarial Audit of the Virginia Retirement System conducted by Gabriel, Roeder, Smith & Company included a number of recommendations. Note that these recommendations were not intended to correct any material deficiencies but rather to improve the quality of future actuarial valuations.

Conclusions

VRS provided a response to our recommendations in a letter from Ms. Patricia Bishop addressed to Mr. Hal Greer dated June 25, 2018. CMC provided a response to our recommendations in a letter from Mr. Larry Langer addressed to Ms. Cynthia Wilkinson dated June 25, 2018.

After completing a quadrennial actuarial experience study covering fiscal years 2016 through 2020, and as requested by JLARC, VRS provided further comments related to GRS' recommendations in a letter from Ms. Patricia Bishop addressed to Mr. Hal Greer dated June 10, 2021. In this letter, VRS provided additional comments related to some of the more prominent recommendations made by GRS in the 2018 Quadrennial Actuarial Audit report.

To the best of our knowledge, based on the responses in these letters, the VRS actuarial reports and presentations and the test life detail received from CMC and VRS for this year's audit, **we believe that these recommendations were generally considered and appropriately reflected.**

SECTION X.

VIRGINIA RETIREMENT SYSTEM RESPONSE



Virginia
Retirement
System

Patricia S. Bishop
Director

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P.O. Box 2500
Richmond, Virginia 23218-2500
Toll free: 1-888-VARETIR (827-3847)
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June 17, 2022

Mr. Hal E. Greer
Director
Joint Legislative Audit and Review Commission
919 East Main Street
Suite 2101
Richmond, Virginia 23219

Dear Hal:

Thank you for the opportunity to review the exposure draft of the 2022 Quadrennial Actuarial Audit of the Virginia Retirement System ("VRS"). We appreciate the thorough approach and attention to detail that Gabriel, Roeder, Smith & Company ("GRS") exhibited during the audit process and the chance to discuss the report's findings in the meeting between our respective actuaries on June 2, 2022, during which the actuaries reached substantial agreement on the report's findings. Further, we appreciate the efforts of the JLARC staff in coordinating and overseeing this review.

We are pleased that GRS found no material deficiencies and found the work of Cavanaugh MacDonald Consulting, LLC ("CMC") to be performed according to generally accepted actuarial standards and principles using reasonable assumptions and methods.

The actuarial audit process is an important element in the governance of a plan and provides an opportunity to further refine the assumptions and methods being used to perform the annual valuations. It also provides an opportunity to enhance documentation in the reports which provides more clarity and transparency related to the valuation process. While this positive report helps demonstrate the commitment of our team and plan actuaries, we appreciate the opportunity for ongoing review and will consider the recommendations offered by GRS in upcoming valuations or analysis as applicable.

Conclusion

We would again like to express our appreciation to the actuaries of GRS and to the JLARC staff for the professional, courteous and cooperative manner in which this actuarial audit was conducted. Actuarial valuations and experience studies are critical in the rate setting process, including valuing and documenting the plan's assets and liabilities. Accordingly, VRS remains keenly focused on adhering to the highest standards of professional and actuarial practice as well as other industry best practices related to this

Mr. Hal E. Greer

June 17, 2022

Page 2

essential duty. VRS and its actuaries from CMC concur with the report's conclusions and find the Quadrennial Audit conducted by JLARC and its actuary to be a valuable tool for validating and fine-tuning VRS' valuation and rate setting processes.

Sincerely,

A handwritten signature in black ink, reading "Patricia S. Bishop". The signature is written in a cursive style with a large, stylized initial "P".

Patricia S. Bishop
Director



Cavanaugh Macdonald

CONSULTING, LLC

The experience and dedication you deserve

June 16, 2022

Ms. Cynthia D. Wilkinson
Policy, Planning and Compliance Director
Virginia Retirement System
1200 E. Main Street
Richmond, VA 23219

RE: ACTUARIAL REVIEW RESULTS

Dear Ms. Wilkinson:

We have received a copy of the 2022 Quadrennial Actuarial Audit of the Virginia Retirement System which was produced by Gabriel, Roeder, Smith & Company (GRS) to detail their findings of the review of our June 30, 2021 valuations, as well as our latest experience study report.

We are, of course, pleased that GRS's overall findings conclude that the actuarial valuations we prepared and the actuarial assumptions upon which they are based are reasonable and comply with Actuarial Standards of Practice.

While there were no material findings, GRS has detailed a number of items that will allow fine-tuning future valuations and experience studies.

We want to thank GRS and the JLARC staff for the professional and courteous manner in which they conducted their review.

Sincerely,

Larry Langer, ASA, FCA, EA, MAAA
Principal and Consulting Actuary

S:\2022\Virginia Retirement System\GRS External Audit\6-16-22 CAV MAC RESPONSE to Actuarial Audit.docx

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APPENDIX

Appendix

Table 1: VRS Pension Plan Active Member Test Cases – Beg of Year Dec Timing

Active Members							GRS				CMC				% Difference - GRS to CMC			
System	Plan	Age	Salary	Cred Svc	Vest Svc	Sex	PVFB	AL	NC	PVFS	PVFB	AL	NC	PVFS	PVFS	PVFB	AL	NC
State	0: Plan1 Vested	36.0	\$ 84,000	13.92	13.92	F	\$ 227,612	\$ 154,912	\$ 6,641	\$ 865,306	\$ 230,663	\$ 153,380	\$ 6,842	\$ 879,774	-1.64%	-1.32%	1.00%	-2.94%
State	0: Plan1 Vested	56.2	179,817	29.25	29.25	F	1,196,139	1,108,739	16,227	920,933	1,231,363	1,153,790	13,941	936,793	-1.69%	-2.86%	-3.90%	16.40%
State	0: Plan1 Vested	56.6	52,757	0.50	20.50	M	68,029	0	9,642	354,180	73,325	0	10,082	362,412	-2.27%	-7.22%		-4.36%
State	2: Plan 2	33.9	34,228	1.58	9.33	M	42,641	3,606	3,073	404,938	45,134	3,230	3,255	407,650	-0.67%	-5.52%	11.64%	-5.59%
State	2: Plan 2	43.9	74,550	8.08	8.08	F	117,114	59,832	6,014	656,906	119,816	62,142	5,875	669,076	-1.82%	-2.26%	-3.72%	2.37%
State	2: Plan 2	60.9	113,905	8.83	8.83	M	220,210	130,758	17,237	540,595	233,732	139,282	17,703	548,552	-1.45%	-5.79%	-6.12%	-2.63%
State	1: Plan 1 NonVested	46.0	50,835	1.92	11.58	F	79,380	4,599	7,853	461,417	81,765	6,611	7,751	466,748	-1.14%	-2.92%	-30.43%	1.32%
State	1: Plan 1 NonVested	60.1	43,155	2.75	2.75	F	51,217	14,014	6,551	218,356	49,078	12,783	6,249	221,213	-1.29%	4.36%	9.63%	4.83%
State	4: Hybrid	30.8	35,325	2.67	2.67	F	15,194	2,798	1,425	250,830	15,953	3,163	1,444	252,933	-0.83%	-4.76%	-11.54%	-1.32%
State	4: Hybrid	49.5	52,229	18.00	18.00	M	114,236	87,087	3,125	433,529	115,555	86,725	3,214	441,134	-1.72%	-1.14%	0.42%	-2.77%
State	4: Hybrid	59.8	211,735	5.50	5.50	M	217,580	85,746	23,347	1,087,782	202,978	101,100	17,491	1,109,859	-1.99%	7.19%	-15.19%	33.48%
Teachers	0: Plan1 Vested	49.1	77,116	24.92	24.92	F	515,789	449,214	9,267	558,048	507,921	439,212	9,257	558,046	0.00%	1.55%	2.28%	0.11%
Teachers	0: Plan1 Vested	41.0	35,397	5.50	13.50	M	110,222	32,256	6,152	459,318	113,259	32,938	6,049	465,784	-1.39%	-2.68%	-2.07%	1.70%
Teachers	0: Plan1 Vested	52.0	68,170	6.67	6.67	F	172,235	79,928	11,329	543,738	171,953	78,007	11,110	546,701	-0.54%	0.16%	2.46%	1.97%
Teachers	2: Plan 2	53.8	139,925	27.00	27.00	M	730,617	629,617	12,678	1,123,128	765,150	663,337	12,213	1,137,535	-1.27%	-4.51%	-5.08%	3.81%
Teachers	2: Plan 2	55.8	51,248	7.33	7.33	F	102,812	54,481	6,887	353,387	107,496	55,175	7,187	355,123	-0.49%	-4.36%	-1.26%	-4.17%
Teachers	1: Plan 1 NonVested	40.0	108,928	11.92	11.92	M	307,671	160,203	10,720	1,523,663	314,945	160,996	10,617	1,554,423	-1.98%	-2.31%	-0.49%	0.97%
Teachers	1: Plan 1 NonVested	37.5	48,452	4.75	7.50	F	101,567	25,474	5,446	655,319	105,490	25,796	5,475	660,758	-0.82%	-3.72%	-1.25%	-0.53%
Teachers	4: Hybrid	22.5	23,019	0.58	0.58	M	11,083	393	1,089	191,022	11,029	0	1,072	193,773	-1.42%	0.49%		1.59%
Teachers	4: Hybrid	53.7	81,899	34.42	34.42	F	534,179	496,442	5,743	541,332	542,461	506,339	5,321	541,295	0.01%	-1.53%	-1.95%	7.93%
SPORS	0: Plan1 Vested	37.3	84,017	14.50	14.50	M	434,668	259,614	14,166	1,017,392	446,477	270,402	13,815	1,035,674	-1.77%	-2.64%	-3.99%	2.54%
SPORS	0: Plan1 Vested	43.4	72,019	6.00	19.33	F	305,155	118,128	18,966	695,872	308,250	125,295	18,641	683,615	1.79%	-1.00%	-5.72%	1.74%
SPORS	0: Plan1 Vested	59.7	203,758	31.50	36.42	M	1,523,325	1,402,350	36,622	577,804	1,544,402	1,460,104	24,701	587,758	-1.69%	-1.36%	-3.96%	48.26%
SPORS	2: Plan 2	21.2	47,833	0.00	0.67	F	100,070	0	7,108	618,320	101,834	0	7,020	630,908	-2.00%	-1.73%		1.25%
SPORS	2: Plan 2	28.5	55,163	5.83	6.25	M	185,796	50,342	8,913	786,013	191,640	52,894	8,919	795,610	-1.21%	-3.05%	-4.82%	-0.07%
SPORS	2: Plan 2	42.0	83,057	8.67	8.67	F	274,704	121,125	13,189	935,576	280,208	127,617	12,712	953,792	-1.91%	-1.96%	-5.09%	3.75%
SPORS	2: Plan 2	43.0	62,943	10.25	10.25	M	235,402	121,256	10,202	690,026	240,834	125,130	10,017	703,091	-1.86%	-2.26%	-3.10%	1.85%
SPORS	1: Plan 1 NonVested	47.3	65,250	8.42	12.17	F	216,451	102,978	12,125	597,539	217,972	107,031	11,604	602,542	-0.83%	-0.70%	-3.79%	4.49%
JRS	0: Plan1 Vested	49.4	212,365	9.83	23.83	M	1,167,952	493,550	51,161	2,795,023	1,153,860	495,734	48,323	2,850,384	-1.94%	1.22%	-0.44%	5.87%
JRS	2: Plan 2	50.8	166,164	8.00	8.00	M	743,526	281,473	33,287	2,302,347	746,184	296,671	32,971	2,232,098	3.15%	-0.36%	-5.12%	0.96%
JRS	4: Hybrid	36.8	166,164	2.00	8.00	M	441,755	40,141	20,522	3,249,213	437,809	40,750	19,649	3,311,266	-1.87%	0.90%	-1.49%	4.44%
JRS	4: Hybrid	60.5	184,617	6.58	6.58	F	536,752	236,273	37,752	1,466,568	540,972	240,501	36,537	1,495,586	-1.94%	-0.78%	-1.76%	3.33%
VaLORS	0: Plan1 Vested	37.3	41,761	13.75	13.75	F	143,370	112,162	4,032	291,891	155,179	113,888	5,179	296,781	-1.65%	-7.61%	-1.52%	-22.15%
VaLORS	0: Plan1 Vested*	44.9	46,669	23.33	23.33	F	399,543	361,094	7,043	239,586	407,988	357,458	8,958	243,748	-1.71%	-2.07%	1.02%	-21.38%
VaLORS	0: Plan1 Vested*	51.3	48,396	24.17	24.17	M	424,490	398,499	8,025	142,095	416,144	385,097	9,278	144,567	-1.71%	2.01%	3.48%	-13.51%
VaLORS	2: Plan 2	33.7	40,086	10.08	10.08	M	103,766	71,304	3,808	309,728	113,843	76,299	4,267	315,512	-1.83%	-8.85%	-6.55%	-10.76%
VaLORS	2: Plan 2	42.4	63,957	11.67	11.67	F	210,694	146,527	7,891	479,432	215,789	123,428	11,013	488,031	-1.76%	-2.36%	18.71%	-28.35%
VaLORS	2: Plan 2	53.2	156,375	6.00	6.00	M	396,556	186,879	36,408	815,001	429,715	217,381	35,716	832,032	-2.05%	-7.72%	-14.03%	1.94%
VaLORS	1: Plan 1 NonVested	55.0	40,174	5.67	5.67	M	84,944	46,804	7,525	179,876	90,644	49,253	7,933	183,109	-1.77%	-6.29%	-4.97%	-5.14%
VaLORS	1: Plan 1 NonVested	55.0	38,214	0.08	12.92	F	37,805	-38	8,269	154,904	42,210	0	8,930	158,473	-2.25%	-10.44%		-7.40%
Local	0: Plan1 Vested	49.2	60,672	21.50	21.58	M	471,424	406,182	12,106	318,790	477,695	408,995	12,338	324,335	-1.71%	-1.31%	-0.69%	-1.88%
Local	1: Plan 1 NonVested	42.6	52,646	7.08	9.00	M	168,316	72,303	9,433	512,484	175,289	75,378	9,518	522,671	-1.95%	-3.98%	-4.08%	-0.89%
Local	2: Plan 2	45.1	287,411	4.00	4.00	F	352,971	119,105	27,723	2,156,768	318,156	100,109	25,069	2,199,652	-1.95%	10.94%	18.98%	10.59%
Local	2: Plan 2	68.4	15,868	7.83	7.83	F	26,735	17,461	2,228	48,822	27,066	17,256	2,294	49,586	-1.54%	-1.22%	1.19%	-2.88%
Local	0: Plan1 Vested	60.4	32,730	32.08	32.08	M	218,102	210,013	2,039	112,895	218,323	208,476	2,403	114,828	-1.68%	-0.10%	0.74%	-15.15%
Local	4: Hybrid	22.4	30,111	1.50	1.50	F	5,165	1,766	779	88,153	5,578	886	1,045	90,162	-2.23%	-7.40%	99.32%	-25.45%

Source: GRS Analysis. Highlighted cells indicate a difference of more than 5%. Results are based on assumed beginning of year decrement timing for all systems.

*Eligible for temporary supplement.



Appendix

Table 1: VRS Pension Plan Active Member Test Cases – Middle of Year Dec Timing

Active Members							GRS				CMC				% Difference - GRS to CMC			
System	Plan	Age	Salary	Cred Svc	Vest Svc	Sex	PVFB	AL	NC	PVFS	PVFB	AL	NC	PVFS	PVFS	PVFB	AL	NC
State	0: Plan1 Vested	36.0	\$ 84,000	13.92	13.92	F	\$ 223,949	\$ 154,042	\$ 6,386	\$ 892,878	\$ 230,663	\$ 153,380	\$ 6,842	\$ 879,774	1.49%	-2.91%	0.43%	-6.66%
State	0: Plan1 Vested	56.2	179,817	29.25	29.25	F	1,175,851	1,086,644	15,730	995,136	1,231,363	1,153,790	13,941	936,793	6.23%	-4.51%	-5.82%	12.83%
State	0: Plan1 Vested	56.6	52,757	0.50	20.50	M	69,122	-47	9,510	374,441	73,325	0	10,082	362,412	3.32%	-5.73%		-5.67%
State	2: Plan 2	33.9	34,228	1.58	9.33	M	43,624	3,679	3,174	416,210	45,134	3,230	3,255	407,650	2.10%	-3.35%	13.90%	-2.49%
State	2: Plan 2	43.9	74,550	8.08	8.08	F	115,861	59,129	5,954	684,172	119,816	62,142	5,875	669,076	2.26%	-3.30%	-4.85%	1.34%
State	2: Plan 2	60.9	113,905	8.83	8.83	M	219,023	127,034	17,101	586,955	233,732	139,282	17,703	548,552	7.00%	-6.29%	-8.79%	-3.40%
State	1: Plan 1 NonVested	46.0	50,835	1.92	11.58	F	78,253	4,422	7,692	476,702	81,765	6,611	7,751	466,748	2.13%	-4.30%	-33.11%	-0.76%
State	1: Plan 1 NonVested	60.1	43,155	2.75	2.75	F	51,366	13,926	6,498	235,315	49,078	12,783	6,249	221,213	6.37%	4.66%	8.94%	3.98%
State	4: Hybrid	30.8	35,325	2.67	2.67	F	15,137	2,759	1,517	262,222	15,953	3,163	1,444	252,933	3.67%	-5.12%	-12.77%	5.06%
State	4: Hybrid	49.5	52,229	18.00	18.00	M	112,011	85,008	3,048	452,579	115,555	86,725	3,214	441,134	2.59%	-3.07%	-1.98%	-5.16%
State	4: Hybrid	59.8	211,735	5.50	5.50	M	216,985	82,935	23,091	1,174,677	202,978	101,100	17,491	1,109,859	5.84%	6.90%	-17.97%	32.02%
Teachers	0: Plan1 Vested	49.1	77,116	24.92	24.92	F	515,789	449,214	9,267	558,048	507,921	439,212	9,257	558,046	0.00%	1.55%	2.28%	0.11%
Teachers	0: Plan1 Vested	41.0	35,397	5.50	13.50	M	110,222	32,256	6,152	459,318	113,259	32,938	6,049	465,784	-1.39%	-2.68%	-2.07%	1.70%
Teachers	0: Plan1 Vested	52.0	68,170	6.67	6.67	F	172,235	79,928	11,329	543,738	171,953	78,007	11,110	546,701	-0.54%	0.16%	2.46%	1.97%
Teachers	2: Plan 2	53.8	139,925	27.00	27.00	M	730,617	629,617	12,678	1,123,128	765,150	663,337	12,213	1,137,535	-1.27%	-4.51%	-5.08%	3.81%
Teachers	2: Plan 2	55.8	51,248	7.33	7.33	F	102,812	54,481	6,887	353,387	107,496	55,175	7,187	355,123	-0.49%	-4.36%	-1.26%	-4.17%
Teachers	1: Plan 1 NonVested	40.0	108,928	11.92	11.92	M	307,671	160,203	10,720	1,523,663	314,945	160,996	10,617	1,554,423	-1.98%	-2.31%	-0.49%	0.97%
Teachers	1: Plan 1 NonVested	37.5	48,452	4.75	7.50	F	101,567	25,474	5,446	655,319	105,490	25,796	5,475	660,758	-0.82%	-3.72%	-1.25%	-0.53%
Teachers	4: Hybrid	22.5	23,019	0.58	0.58	M	11,083	393	1,089	191,022	11,029	0	1,072	193,773	-1.42%	0.49%		1.59%
Teachers	4: Hybrid	53.7	81,899	34.42	34.42	F	534,179	496,442	5,743	541,332	542,461	506,339	5,321	541,295	0.01%	-1.53%	-1.95%	7.93%
SPORS	0: Plan1 Vested	37.3	84,017	14.50	14.50	M	425,317	254,144	13,678	1,041,050	446,477	270,402	13,815	1,035,674	0.52%	-4.74%	-6.01%	-0.99%
SPORS	0: Plan1 Vested	43.4	72,019	6.00	19.33	F	305,560	116,177	18,690	722,526	308,250	125,295	18,641	683,615	5.69%	-0.87%	-7.28%	0.26%
SPORS	0: Plan1 Vested	59.7	203,758	31.50	36.42	M	1,495,082	1,358,760	38,624	669,092	1,544,402	1,460,104	24,701	587,758	13.84%	-3.19%	-6.94%	56.37%
SPORS	2: Plan 2	21.2	47,833	0.00	0.67	F	97,763	-18	7,113	630,981	101,834	0	7,020	630,908	0.01%	-4.00%		1.32%
SPORS	2: Plan 2	28.5	55,163	5.83	6.25	M	185,033	50,316	8,973	802,774	191,640	52,894	8,919	795,610	0.90%	-3.45%	-4.87%	0.61%
SPORS	2: Plan 2	42.0	83,057	8.67	8.67	F	273,138	120,406	13,007	959,631	280,208	127,617	12,712	953,792	0.61%	-2.52%	-5.65%	2.32%
SPORS	2: Plan 2	43.0	62,943	10.25	10.25	M	234,264	120,169	9,994	711,440	240,834	125,130	10,017	703,091	1.19%	-2.73%	-3.96%	-0.23%
SPORS	1: Plan 1 NonVested	47.3	65,250	8.42	12.17	F	216,585	101,745	11,923	621,842	217,972	107,031	11,604	602,542	3.20%	-0.64%	-4.94%	2.75%
JRS	0: Plan1 Vested	49.4	212,365	9.83	23.83	M	1,148,413	478,380	49,664	2,862,891	1,153,860	495,734	48,323	2,850,384	0.44%	-0.47%	-3.50%	2.78%
JRS	2: Plan 2	50.8	166,164	8.00	8.00	M	734,217	274,124	32,449	2,353,940	746,184	296,671	32,971	2,232,098	5.46%	-1.60%	-7.60%	-1.58%
JRS	4: Hybrid	36.8	166,164	2.00	8.00	M	434,908	39,088	19,993	3,288,408	437,809	40,750	19,649	3,311,266	-0.69%	-0.66%	-4.08%	1.75%
JRS	4: Hybrid	60.5	184,617	6.58	6.58	F	536,305	229,888	36,742	1,538,180	540,972	240,501	36,537	1,495,586	2.85%	-0.86%	-4.41%	0.56%
ValORS	0: Plan1 Vested	37.3	41,761	13.75	13.75	F	140,856	112,050	3,722	307,810	155,179	113,888	5,179	296,781	3.72%	-9.23%	-1.61%	-28.13%
ValORS	0: Plan1 Vested*	44.9	46,669	23.33	23.33	F	406,595	371,600	6,125	258,835	407,988	357,458	8,958	243,748	6.19%	-0.34%	3.96%	-31.63%
ValORS	0: Plan1 Vested*	51.3	48,396	24.17	24.17	M	417,070	390,528	7,486	163,703	416,144	385,097	9,278	144,567	13.24%	0.22%	1.41%	-19.31%
ValORS	2: Plan 2	33.7	40,086	10.08	10.08	M	104,288	73,001	3,679	325,200	113,843	76,299	4,267	315,512	3.07%	-8.39%	-4.32%	-13.78%
ValORS	2: Plan 2	42.4	63,957	11.67	11.67	F	209,760	149,742	7,327	503,762	215,789	123,428	11,013	488,031	3.22%	-2.79%	21.32%	-33.47%
ValORS	2: Plan 2	53.2	156,375	6.00	6.00	M	395,903	189,691	34,848	882,108	429,715	217,381	35,716	832,032	6.02%	-7.87%	-12.74%	-2.43%
ValORS	1: Plan 1 NonVested	55.0	40,174	5.67	5.67	M	85,667	47,136	7,408	196,970	90,644	49,253	7,933	183,109	7.57%	-5.49%	-4.30%	-6.62%
ValORS	1: Plan 1 NonVested	55.0	38,214	0.08	12.92	F	40,270	-53	8,453	172,049	42,210	0	8,930	158,473	8.57%	-4.60%		-5.34%
Local	0: Plan1 Vested	49.2	60,672	21.50	21.58	M	464,766	397,942	11,651	343,702	477,695	408,995	12,338	324,335	5.97%	-2.71%	-2.70%	-5.57%
Local	1: Plan 1 NonVested	42.6	52,646	7.08	9.00	M	168,706	72,206	9,349	331,757	175,289	75,378	9,518	522,671	1.74%	-3.76%	-4.21%	-1.78%
Local	2: Plan 2	45.1	287,411	4.00	4.00	F	351,993	119,341	27,856	2,270,074	318,156	100,109	25,069	2,199,652	3.20%	10.64%	19.21%	11.12%
Local	2: Plan 2	68.4	15,868	7.83	7.83	F	26,969	17,113	2,443	55,807	27,066	17,256	2,294	49,586	12.55%	-0.36%	-0.83%	6.50%
Local	0: Plan1 Vested	60.4	32,730	32.08	32.08	M	214,070	205,484	2,067	127,248	218,323	208,476	2,403	114,828	10.82%	-1.95%	-1.44%	-13.98%
Local	4: Hybrid	22.4	30,111	1.50	1.50	F	5,484	1,691	944	101,417	5,578	886	1,045	90,162	12.48%	-1.69%	90.86%	-9.67%

Source: GRS Analysis. Highlighted cells indicate a difference of more than 5%. Results are based on assumed beginning of year decrement timing for Teachers and middle of year decrement timing for all other systems.

*Eligible for temporary supplement.



Appendix

Table 2: VRS Pension Plan Terminated and Retired Member Test Cases

Deferred/Retired Members							GRS	CMC	% Difference PVB	GRS PVFB with	% Difference PVB
System	Plan	Status	Age	Benefit Amount	Payment Form	Sex	PVFB*	PVFB	GRS to CMC	Contrib Minimum	GRS to CMC
State	Plan 1 Vested	VT	40.3	\$5,149.99	Deferred Life Annuity	F	\$14,429	\$22,783	-36.67%	\$22,783	0.00%
State	Plan 1 Vested	Ret	52.9	34,677.24	100% Joint & Survivor	F	662,368	664,674	-0.35%	662,368	-0.35%
State	Plan 1 Vested	Ret	66.0	21,381.96	Leveling Option	F	92,378	93,404	-1.10%	92,378	-1.10%
State	Plan 1 Vested	Ret	80.3	13,439.16	50% Joint & Survivor	M	128,701	131,797	-2.35%	128,701	-2.35%
State	Plan 1 Vested	Dis Ret	76.1	34,785.12	80% Joint & Survivor	M	353,839	356,147	-0.65%	353,839	-0.65%
State	Plan 2	LTD Dis	35.8	49,309.99	Deferred Life Annuity	M	78,778	74,366	5.93%	78,778	5.93%
State	Plan 2	VT	42.1	5,362.50	Deferred Life Annuity	M	12,837	16,858	-23.85%	16,858	0.00%
State	Plan 2	BFRC	51.8	9,567.84	Life Annuity	F	41,535	41,647	-0.27%	41,535	-0.27%
State	Hybrid	VT	51.7	3,906.37	Deferred Life Annuity	F	18,421	20,180	-8.72%	20,180	0.00%
Teachers	Plan 1 Vested	VT	57.8	14,424.23	Deferred Life Annuity	M	119,186	124,149	-4.00%	119,186	-4.00%
Teachers	Plan 1 Vested	Ret	97.1	66,087.60	Life Annuity	F	134,506	138,576	-2.94%	134,506	-2.94%
Teachers	Plan 1 Vested	Dis Ret	61.1	18,197.88	72% Joint & Survivor	F	345,963	354,394	-2.38%	345,963	-2.38%
Teachers	Plan 1 Vested	NVT	74.3	25,746.03	Lump Sum	M	0	25,746	-100.00%	25,746	0.00%
Teachers	Plan 1 Vested	RetELW	65.4	12,346.80	Life Annuity	M	81,731	83,392	-1.99%	81,731	-1.99%
Teachers	Plan 1 Vested	DisRetELW	69.5	20,298.60	100% Joint & Survivor	F	19,759	20,290	-2.62%	19,759	-2.62%
Teachers	Plan 2	Ret	68.6	4,492.32	75% Joint & Survivor	F	67,055	66,912	0.21%	67,055	0.21%
Teachers	Plan 2	BenefELW	51.8	9,567.84	Life Annuity	F	120,308	120,636	-0.27%	120,308	-0.27%
Teachers	Hybrid	LTD Dis	47.2	20,802.22	Deferred Life Annuity	F	63,458	67,526	-6.03%	63,458	-6.03%
Teachers	Hybrid	BFRC	55.8	1,266.12	Life Annuity	M	18,848	18,880	-0.17%	18,848	-0.17%
Teachers	Hybrid	TransOut	27.8	663.88	Deferred Life Annuity	M	650	685	-5.09%	1,556	127.13%
Teachers	Hybrid	TransOut	28.4	2,010.00	Deferred Life Annuity	F	2,234	2,349	-4.89%	6,057	157.85%
SPORS	Plan 1 Vested	Ret	58.9	30,963.12	Leveling Option	M	311,721	314,711	-0.95%	311,721	-0.95%
SPORS	Plan 1 Vested	Ret	66.9	56,265.24	Life Annuity	F	668,177	675,021	-1.01%	668,177	-1.01%
SPORS	Plan 1 Vested	Dis Ret	68.8	34,830.96	100% Joint & Survivor	M	489,473	495,105	-1.14%	489,473	-1.14%
SPORS	Plan 1 Vested	BenefELW	87.7	28,946.28	Life Annuity	F	114,606	114,295	0.27%	114,606	0.27%
SPORS	Plan 1 Vested	TransOut	60.4	4,278.40	Deferred Life Annuity	F	61,118	61,870	-1.22%	61,118	-1.22%
SPORS	Plan 1 Non-Vested	RetELW	64.9	3,592.80	Life Annuity	M	985	991	-0.65%	985	-0.65%
SPORS	Plan 2	LTD Dis	38.8	47,337.37	Deferred Life Annuity	M	142,597	148,385	-3.90%	142,597	-3.90%
SPORS	Plan 2	VT	47.0	4,886.76	Deferred Life Annuity	M	29,403	30,356	-3.14%	29,403	-3.14%
SPORS	Plan 2	BFRC	37.4	3,376.56	Life Annuity	F	28,084	28,362	-0.98%	28,084	-0.98%
VaLORS	Plan 1 Vested	LTD Dis	49.5	30,728.20	Deferred Life Annuity	M	182,109	189,988	-4.15%	182,109	-4.15%
VaLORS	Plan 1 Vested	Ret	60.6	9,391.92	35% Joint & Survivor	F	131,864	131,870	0.00%	131,864	0.00%
VaLORS	Plan 1 Vested	Dis Ret	47.0	11,867.52	Life Annuity	M	187,879	188,681	-0.43%	187,879	-0.43%
VaLORS	Plan 1 Non-Vested	VT	37.0	8,611.81	Deferred Life Annuity	M	27,164	28,127	-3.42%	27,164	-3.42%
VaLORS	Plan 2	Ret	58.9	8,717.64	Leveling Option	M	51,014	50,914	0.20%	51,014	0.20%
VaLORS	Plan 2	Ret	72.5	2,527.56	100% Joint & Survivor	M	36,038	36,310	-0.75%	36,038	-0.75%
VaLORS	Plan 2	BFRC	59.1	2,695.80	Life Annuity	F	38,915	39,205	-0.74%	38,915	-0.74%
VaLORS	Plan 2	RetELW	60.8	23,956.32	Life Annuity	M	333,292	287,332	16.00%	333,292	16.00%
VaLORS	Plan 2	TransOut	56.9	7,901.25	Deferred Life Annuity	F	87,477	91,670	-4.57%	87,477	-4.57%
JRS	Plan 1 Vested	Ret	55.9	76,959.48	Leveling Option	M	923,650	946,318	-2.40%	923,650	-2.40%
JRS	Plan 2	Ret	67.9	27,789.96	50% Joint & Survivor	M	313,197	323,359	-3.14%	313,197	-3.14%
JRS	Hybrid	BFRC	67.7	10,259.28	Life Annuity	F	130,338	130,521	-0.14%	130,338	-0.14%
Locals	Plan 1 Vested	Ret	64.6	25,418.04	100% Joint & Survivor	M	383,777	398,819	-3.77%	383,777	-3.77%
Locals	Plan 2	VT	36.5	5,068.24	Deferred Life Annuity	M	15,433	16,459	-6.23%	15,433	-6.23%
Locals	Plan 2	Dis Ret	57.1	8,900.16	Life Annuity	F	127,193	128,045	-0.67%	127,193	-0.67%
Locals	Plan 2	Dis Ret	58.1	15,820.44	Life Annuity	M	204,294	206,731	-1.18%	204,294	-1.18%
Locals	Hybrid	BFRC	52.0	930.00	Life Annuity	F	15,760	15,829	-0.44%	15,760	-0.44%
Locals	Hybrid	RetELW	67.1	3,349.08	Life Annuity	F	16,800	16,985	-1.09%	16,800	-1.09%
Total Test Lives							7,429,341	7,541,650	-1.49%	7,473,950	-0.90%
Total by Status											
Status											
BFRC							273,479	274,444	-0.35%	273,479	-0.35%
Dis Ret							1,708,640	1,729,103	-1.18%	1,708,640	-1.18%
DisRetELW							19,759	20,290	-2.62%	19,759	-2.62%
LTD Dis							466,942	480,265	-2.77%	466,942	-2.77%
NVT							0	25,746	-100.00%	25,746	0.00%
Ret							3,904,447	3,972,685	-1.72%	3,904,447	-1.72%
RetELW							432,808	388,700	11.35%	432,808	11.35%
TransOut							151,479	156,574	-3.25%	156,208	-0.23%
VT							236,873	258,912	-8.51%	251,007	-3.05%

Source: GRS Analysis. Highlighted cells indicate a difference of more than 5%.

*Before applying return of employee accumulated contributions with interest as minimum value.



Appendix

Actuarial Standard of Practice No. 4

ASOP No. 4, Measuring Pension Obligations and Determining Pension Plan Costs, provides guidance for measuring pension obligations and communicating the results. The Standard lists specific elements to be included, either directly or by references to prior communication, in pension actuarial communications. The pertinent items that should be included in an actuarial valuation report for a pension plan should include:

- a) a statement of the intended purpose of the measurement and a statement to the effect that the measurement may not be applicable for other purposes;
- b) the measurement date;
- c) a description of adjustments made for events after the measurement date under section 3.4.2;
- d) an outline or summary of the plan provisions included in the actuarial valuation, a description of known changes in significant plan provisions included in the actuarial valuation from those used in the immediately preceding measurement prepared for a similar purpose, and a description of any significant plan provisions not included in the actuarial valuation, along with the rationale for not including such significant plan provisions;
- e) the date(s) as of which the participant and financial information were compiled;
- f) a summary of the participant information;
- g) if hypothetical data is used, a description of the data;
- h) a description of any accounting policies or funding elections made by the principal that are pertinent to the measurement;
- i) a description of the methods used to value any significant benefit provisions described in section 3.5.3 such that another actuary qualified in the same practice area could make an objective appraisal of the reasonableness of the actuary's work as presented in the actuarial report;
- j) a description of the actuarial cost method and the manner in which normal costs are allocated, in sufficient detail to permit another actuary qualified in the same practice area to assess the significant characteristics of the method (for example, how the actuarial cost method is applied to multiple benefit formulas, compound benefit formulas, or benefit formula changes, where such plan provisions are significant);
- k) a description of the cost allocation procedure or contribution allocation procedure including a description of amortization methods and any pay-as-you-go funding (i.e., the intended payment by the plan sponsor of some or all benefits when due). The actuary should disclose the outstanding amortization balance, the amortization payment included in the periodic cost or actuarially determined contribution, and the remaining amortization period for each amortization base along with a disclosure if the unfunded actuarial accrued liability is not expected to be fully amortized. For purposes of this section, the actuary should assume that all actuarial assumptions will be realized and actuarially determined contributions will be made when due;
- l) a statement indicating that the contribution allocation procedure is significantly inconsistent with the plan accumulating adequate assets to make benefit payments when due, if applicable in accordance with section 3.14.1;
- m) a qualitative description of the implications of the contribution allocation procedure or plan sponsor's funding policy on future expected plan contributions and funded status in accordance with section 3.14.2. The actuary should disclose the significant characteristics of the contribution allocation procedure or plan sponsor's funding policy, and the significant assumptions used in the assessment;

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- n) a description of the types of benefits regarded as accrued or vested if the actuary measured the value of accrued or vested benefits, and, to the extent the attribution pattern of accrued benefits differs from or is not described by the plan provisions, a description of the attribution pattern;
- o) a description of whether and how benefit payment default risk or the financial health of the plan sponsor was included, if a market-consistent present value measurement was performed;
- p) funded status based on an immediate gain actuarial cost method if the actuary discloses a funded status based on a spread gain actuarial cost method. The immediate gain actuarial cost method used for this purpose should be disclosed in accordance with section 4.1(j);
- q) if applicable, a description of the particular measures of plan assets and plan obligations that are included in the actuary's disclosure of the plan's funded status. For funded status measurements that are not prescribed by federal law or regulation, the actuary should accompany this description with each of the following additional disclosures:
 - 1. whether the funded status measure is appropriate for assessing the sufficiency of plan assets to cover the estimated cost of settling the plan's benefit obligations;
 - 2. whether the funded status measure is appropriate for assessing the need for or the amount of future contributions; and
 - 3. if applicable, a statement that the funded status measure would be different if the measure reflected the market value of assets rather than the actuarial value of assets.
- r) a statement, appropriate for the intended users, indicating that future measurements (for example, of pension obligations, periodic costs, actuarially determined contributions or funded status as applicable) may differ significantly from the current measurement. For example, a statement such as the following could be applicable: "Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period or additional cost or contribution requirements based on the plan's funded status); and changes in plan provisions or applicable law."

In addition, the actuarial communication should include one of the following:

- i. if the scope of the actuary's assignment included an analysis of the range of such future measurements, disclosure of the results of such analysis together with a description of the factors considered in determining such range; or
- ii. a statement indicating that, due to the limited scope of the actuary's assignment, the actuary did not perform an analysis of the potential range of such future measurements;
- s) description of known changes in assumptions and methods from those used in the immediately preceding measurement prepared for a similar purpose. For assumption and method changes that are not the result of a prescribed assumption or method set by another party or a prescribed assumption or method set by law, the actuary should include an explanation of the information and analysis that led to those changes. The explanation may be brief but should be pertinent to the plan's circumstances;

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- t) description of all changes in cost allocation procedures or contribution allocation procedures that are not a result of a prescribed assumption or method set by law, including the resetting of an actuarial asset value. The actuary should disclose the reason for the change and the general effects of the change on relevant periodic cost, actuarially determined contribution, funded status, or other measures, by words or numerical data, as appropriate. The disclosure of the reason for the change and the general effects of the change may be brief but should be pertinent to the plan's circumstances;
- u) a description of adjustments of prior measurements used under section 3.4.3; and
- v) if, in the actuary's professional judgment, the actuary's use of approximations and estimates could produce results that differ materially from results based on a detailed calculation, a statement to this effect.

Appendix

Actuarial Standard of Practice No. 41

ASOP No. 41, Actuarial Communications, provides guidance to actuaries with respect to actuarial communications.

The requirements for actuarial communications are as follows:

- The actuary should take appropriate steps to ensure that the form and content of each actuarial communication are appropriate to the particular circumstances, taking into account the intended users.
- The actuary should take appropriate steps to ensure that each actuarial communication is clear and uses language appropriate to the particular circumstances, taking into account the intended users.
- The actuary should issue each actuarial communication within a reasonable time period, unless other arrangements as to timing have been made. In setting the timing of the communication, the needs of the intended users should be considered.
- An actuarial communication should clearly identify the actuary responsible for it. When two or more individuals jointly issue a communication (at least some of which is actuarial in nature), the communication should identify all responsible actuaries, unless the actuaries judge it inappropriate to do so. The name of an organization with which each actuary is affiliated also may be included in the communication, but the actuary's responsibilities are not affected by such identification. Unless the actuary judges it inappropriate, the actuary issuing an actuarial communication should also indicate the extent to which the actuary is available to provide supplementary information and explanation.
- An actuarial report may comprise one or several documents. The report may be in several different formats (such as formal documents produced on word processing, presentation or publishing software, e-mail, paper or websites). Where an actuarial report for a specific intended user comprises multiple documents, the actuary should communicate which documents comprise the report.
- An actuarial communication should identify the party responsible for each material assumption and method. Where the communication is silent about such responsibility, the actuary who issued the communication will be assumed to have taken responsibility for that assumption or method. The actuary's obligation when identifying the other party who selected the assumption or method depends upon how the assumption or method was selected.