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ACTUARIAL REVIEW REPORT FOR

THE NORTH DAKOTA TEACHERS' FUND FOR RETIREMENT

Prepared July 13, 2016

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CONSULTING, LLC
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July 13, 2016

Board of Trustees
North Dakota Teachers' Fund for Retirement
1930 Burnt Boat Drive
PO Box 7100
Bismarck, ND 58507

Dear Board of Trustees:

Cavanaugh Macdonald Consulting, LLC has performed an independent review of the July 1, 2015 actuarial valuation of the North Dakota Teachers' Fund for Retirement. As an independent reviewing or auditing actuary, we have been asked to express an opinion regarding the reasonableness and accuracy of the actuarial assumptions, actuarial cost methods, and valuation results.

Our analysis of the actuarial assumptions and methods was based largely on the most recent experience study prepared in April, 2015. Our opinion on the valuation results was based on a replication valuation of the July 1, 2015 actuarial valuation. The retained actuary for the System is Segal Consulting (Segal). We would like to thank Segal for their cooperation and assistance in providing the required information to us. **We generally find the actuarial valuation results to be reasonable and accurate based on the assumptions and methods used. The valuation was performed by qualified actuaries and was performed in accordance with the principles and practices prescribed by the Actuarial Standards Board.** This report documents the detailed results of our review.

If you need anything else, please do not hesitate to give us a call. The undersigned 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 in this report.

Sincerely,

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Chief Pension Actuary

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Principal and Consulting Actuary

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1. EXECUTIVE SUMMARY

As an independent auditing actuary, Cavanaugh Macdonald Consulting, LLC (CMC) has been tasked to provide a general overview and express an opinion of the reasonableness and soundness of the work performed by Segal Consulting (Segal) for the North Dakota Teachers' Fund for Retirement (NDTFFR). The work to be reviewed includes both the July 1, 2015 actuarial valuation and GASB reports, projection results prepared in conjunction with the valuation, and the most recent experience study dated April 30, 2015.

We requested full member and financial data from NDTFFR along with reports, plan descriptions and applicable statutes pertaining to the plans. We also requested member data, as reconciled for the 2015 valuation, from Segal as well as complete descriptions of assumptions, methods and valuation procedures.

It is our belief that an audit should not focus on finding trivial differences between actuarial processes, procedures, philosophies, and styles utilized by two different actuaries, but rather to verify there are no material errors, and to find improvements to the process and procedures utilized by the System's actuary. Because actuarial work draws on professional judgment, there is a subjective component that must be considered alongside the objective component of matching numerical results. In performing this audit, we attempt to limit discussions concerning stylistic preferences and focus more on the significant philosophical approaches, the accuracy of calculations, the completeness and reliability of reporting, and the compliance with generally acceptable actuarial practices and standards of practice in all of the work reviewed.

As described in our report, we have determined that the actuarial methods, assumptions, processes, and reports are consistent with the applicable Actuarial Standards of Practice and our understanding of GASB Statements 67 and 68. Throughout the report, we have noted a few issues where we believe there are opportunities for improvement.

In Section 2 of our report, we analyze the set of actuarial assumptions used by Segal. The actuarial assumptions are a critical component of the valuation process and, thus, were reviewed as part of the audit. While we offer some minor comments, we find the assumptions recommended by Segal and adopted by the NDTFFR Board to be reasonable and appropriate for their intended purposes.

In Section 3 of our report, we review the actuarial methods that are used to develop the actuarial contribution rate. We point out a concern we have with Segal's application of the Entry Age Normal cost method. As we note, however, this concern is not in conflict with Actuarial Standards of Practice, although we don't believe it follows common pension practice. The other methods are appropriate to help assess the funded status and contribution needs of the Fund.

In Section 4 of our report, we compare the data provided by NDTFFR with the data used by Segal. We find that the data is consistent and appropriate, and have no recommendations.

In Section 5 of our report, we show the results of our independently calculations of the liabilities of NDTFFR compared with the results prepared by Segal. We identified a minor issue with the

valuation of liabilities for deferred vested members and also made a recommendation as to how the normal cost rate should be developed. We provide a comparison of our calculations and note that generally our suggested changes have minimal impact on the measurements of funded status. While we would calculate the normal cost rate in a different way that results in a higher rate, this rate would not change the fact that the funded level is expected to improve under a range of scenarios. We note that the close match of the Present Value of Benefits calculation is an indication that the calculations are reliable.

In Section 6, we provide our analysis on the valuation report produced by Segal. We found it to be substantially in compliance with the ASOPs, but we offered some suggestions for improvement.

In Section 7, we discussed our review of the GASB reporting and found it to be reasonable.

In Section 8, we compared results of a model that we independently built to project future valuation results to the projections Segal provided to the NDTFFR. Our results exhibited substantially similar patterns under an array of investment return alternatives, indicating the reasonableness of Segal's approach.

Because of the complexity of actuarial work, we would not expect to match Segal's results exactly, nor would we necessarily expect our opinions regarding the selection of assumptions and methods to be the same as those of Segal. While we offer up a number of different ideas, we believe that Segal's work provides an appropriate assessment of the health and funding requirements of the NDTFFR.

The remainder of this report provides the basis for our findings for each of the requested tasks, including our recommendations.

2. ACTUARIAL ASSUMPTIONS

BACKGROUND ON ACTUARIAL ASSUMPTIONS

The actuarial assumptions form the basis of any actuarial valuation or cost study. Since it is not possible to know in advance how each member's career will evolve in terms of salary growth, future service and cause of termination, the actuary must develop assumptions in an attempt to estimate future patterns. These assumptions enable the actuary to value the amount of benefits earned and to reasonably estimate when and how long these benefits will be paid. Similarly, the actuary must make an assumption about future investment earnings of the trust fund. In developing the assumptions, the actuary examines the past experience and considers future expectations to make the best estimate of the anticipated experience under the plan.

There are two general types of actuarial assumptions:

- Economic assumptions – these include the valuation interest rate (expected return on plan assets), assumed rates of salary increase, price inflation, wage inflation, and increases in total payroll. The selection of economic assumptions should conform to ASOP No. 27 *"Selection of Economic Assumptions for Measuring Pension Obligations"*.

- Demographic assumptions – these include the assumed rates of retirement, mortality, termination, and disability. The selection of demographic assumptions should conform to ASOP No. 35 *"Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations"*.

Different actuaries have different philosophies when it comes to evaluating the experience study data and recommending changes to assumptions. Based on the recommendations in the NDTFFR Experience Study report, it appears that Segal's approach is to move partway from the prior assumption towards the recently observed experience. We generally operate under this philosophy as well. When we see significant changes in experience, we consider them carefully and try to discern why the dramatic change occurred. If we believe the observed data is not an aberration and should be seriously considered, we typically recommend rates somewhere between the old rates and the new experience. If experience during the next experience study period shows the same result, we will likely recognize the trend at that point in time or at least move further in the direction of the observed experience. On the other hand, if experience returns closer to its prior level, we will not have overacted, possibly causing unnecessary volatility in the actuarial contribution rates. We would encourage Segal to explicitly outline their philosophy in their report so as to help the readers understand the rationale behind their recommendations.

Segal presents the experience study results in a presentation rather than a formal report. The presentation does include an actuarial certification signed by the actuaries regarding compliance with Actuarial Standards of Practice and their qualifications to prepare the results. We recommend that when Segal prepares the next experience study, they produce a complete formal report as well as the presentation. Although not required by actuarial standards, we believe this is a "best practice", allowing for more complete explanation and justification as to why decisions were made

to keep or change a given assumption. It is possible that such reasons were mentioned when the presentation was delivered to the Board, but there is no remaining record of such comments. This is a deficiency that can be eliminated by preparing a formal, written report

ECONOMIC ASSUMPTIONS

Actuarial Standards of Practice (ASOPs) are issued by the Actuarial Standards Board to provide guidance to actuaries with respect to certain aspects of performing their work. As mentioned earlier, ASOP 27 is the standard that addresses the selection of or recommendations regarding economic assumptions for measuring pension obligations (liabilities) under defined benefit plans.

The prior and recommended economic assumptions in the Experience Study report were:

	Segal Recommendation	Prior Assumption
Price inflation	2.75%	3.00%
Real wage growth (productivity)	1.50%	1.50%
Total wage growth	4.25%	4.50%
Adjustment for conservatism	(1.00%)	(1.25%)
Total payroll growth	3.25%	3.25%
Price inflation	2.75%	3.00%
Real rate of return (net of expenses and adjustments)	5.00%	5.00%
Investment return	7.75%	8.00%

Each assumption is briefly discussed in the following narrative:

Price Inflation: Price inflation impacts both the assumption for the rates of salary increase (individual as well as total payroll) and the investment return assumption. The underlying price inflation component in both must be consistent in accordance with the guidance provided in ASOP 27.

Historical patterns of inflation show a long-term average of around 3%. Inflation has varied significantly over time, with some notably high periods in the 1970's influencing the average. In recent years, inflation has been consistently below the long-term average of 3% and the financial markets' pricing of inflation (comparing Treasuries and TIPS) suggests that trend is expected to continue for the next 30 years. However, these results may be partially driven by the recent actions of the Federal Reserve Bank and, therefore, may not be indicative of the long-term estimation that actuaries need for their work. For a longer time frame, actuaries often consider the expected increase in the CPI used by the Office of the Chief Actuary for the Social Security Administration. In the July 2014 report (the latest report as of Segal's experience study), the ultimate projected

annual increase in the CPI over the next 75 years was estimated to be 2.7%, under the intermediate cost assumptions. The lower cost assumption used a forecast of 2.0% and the high cost assumption was 3.4%. (For informational purposes, the 2015 Social Security report did not change any of these assumptions.)

While there can be arguments made for assuming inflation will remain low for a very long period of time, we note that inflation can be significantly affected by monetary and fiscal policy, and those policies may change dramatically and rapidly. Consequently, these are also some strong arguments for assuming that inflation could increase at some point in the future.

Segal cites the current market pricing and a comparison of peer retirement systems for their recommendation to lower the inflation assumption from 3.00% to 2.75%. We note that the market pricing can be somewhat volatile, but it is not unreasonable to consider that as a lower bound. We note that the current Social Security Administration estimate is very close to the 2.75% selected rate, adding further credibility. We find the selection of 2.75% for the inflation assumption to be reasonable.

Investment Return Assumption: The investment return assumption (also called the valuation interest rate) should represent the long-term rate of return expected on the plan assets, considering the asset allocation, the real rate of return on each asset class, and the underlying inflation rate, net of investment expenses required to earn that return.

The long-term relationship between price inflation and investment return has long been recognized by economists. The basic principle is that the investor demands a more or less level "real return" – the excess of actual investment return over price inflation. If inflation rates are expected to be high, investment return rates are also expected to be high, while low inflation rates will result in lower expected investment returns, at least in the long run.

The period considered for pension funding represents a very long time horizon. In reviewing this assumption, the actuary should consider asset allocation policy, historical returns, and expectations of future returns. Frequently, asset advisors focus on no more than the next 5 to 10 years since they are most concerned with how to invest the funds currently to maximize returns. The longer term is less relevant to them, but it is, of course, paramount to actuaries who are projecting benefits to be paid for the next 50 to 100 years. This difference in perspective can significantly influence how investment advisors and actuaries derive an investment return assumption.

A common practice, which was used by Segal, is to consider the various asset classes in the portfolio, and then find the expected return that would be anticipated using the target asset allocation. Returns by asset class are most often provided by the system's investment advisor. For their analysis, Segal looked to the expectations of Segal Rogerscasey, an affiliated company, and the average expectations tabulated in the Horizon Survey of Capital Market Assumptions. Both Segal Rogerscasey and Horizon have assumptions developed for a 20-year time frame, a comparatively long range for investment advisors, although still a somewhat short period from the

perspective of actuaries. Ultimately, Segal selected the Horizon Survey results because it represents a number of advisors and they prefer the aggregation of information over a single advisor. We note that they did not discuss the results using the capital market assumptions of Callan Associates, NDTFFR's investment advisor. While we find that unusual and believe that, in general, such analysis is performed and often assigned relatively high credibility, we understand that there was significant discussion between Segal and NDTFFR staff regarding the selection of appropriate capital market assumptions for the purposes involved.

Segal further adjusts the expected returns from the capital markets model for expected investment expenses. This adjustment is not typically made because capital market assumptions are generally based on a passive portfolio with virtually no fees (real estate and private equity are often exceptions since passive investment is not common). To the extent that a fund uses active management, it is assumed that investment returns will be sufficient to offset the additional fees – otherwise active management would not be used. Consequently, an adjustment for investment fees is not normally made to a return estimated from passive benchmarks. The impact of Segal's adjustment is an understatement of the real rate of return. However, this creates some conservatism and we are not opposed to allowing for additional margin for adverse deviation, which is permitted by ASOP 27.

After these adjustments, Segal's real rate of return assumption is 5.00%. We would point out that this is the same underlying real return assumption in the prior investment return assumption; i.e., the reduction in the investment return assumption from 8.00% to 7.75% is the same as the reduction in the assumed inflation rate. In our experience with systems around the country who have adjusted their rate of return assumptions, we have found that the change in inflation assumption is often the key driver of the change. We have no concerns with the ultimate selection of an investment return assumption of 7.75%.

Payroll Growth Assumption (Wage Inflation): The unfunded actuarial accrued liability (UAAL) is amortized as a level percentage of payroll over the amortization period. As a result, a payroll growth assumption is necessary to develop the UAAL contribution rate. The payroll growth assumption consists of price inflation and the real wage growth. In their analysis, Segal considered the change in the National Average Wage Index, as published by the Social Security Administration, a reasonable proxy for wage inflation, along with the actual NDTFFR experience over the past 20 years. They also state an expectation for slightly higher growth in North Dakota when compared to the nation as a whole because of the state's strong economy. Ultimately, they assume that productivity is 1.5%, so total wage inflation (real wage growth plus price inflation) is 4.25%. The payroll growth assumption, however, is set at 3.25%, reflecting a specific adjustment to be conservative.

While we recognize that the North Dakota state economy has been strong over the last few years, we are not convinced that it will be able to remain stronger than the United States over the entire long term (next 30 to 50 years). As a result, we would probably set the productivity assumption somewhat lower than 1.5% to be more in line with long-term national trends, or we might have

considered an assumption of 1.5% for, say, 10-15 years and a more moderate long-term assumption thereafter. However, we are not uncomfortable with the selection of 1.5% and find the wage growth assumption of 4.25% and payroll growth assumption of 3.25% to both be reasonable.

Salary Scale: There are several factors that generally affect individual salary increases and are typically reflected in the salary scale. The first of these is price inflation. As the price of goods and services increase, wages are expected to increase as well. The second component, productivity (sometimes called the real wage growth), is a measure of how much wages increase across the whole labor pool in excess of the rate of price inflation. The combination of price inflation and the productivity component is called wage inflation or the total wage growth assumption. The third component, frequently identified as merit, reflects the portion of salary increases provided at the individual level, including promotion, increased skills, longevity pay, and other similar items. The combination of these three components is reflected in the total salary scale.

In developing their recommendation for this assumption, Segal displayed a table showing the actual vs. expected salary increase for all years in the study, net of inflation, for five-year groupings of service. Based on this information, Segal determined that the merit scale was reasonable, and so the proposed total salary scale was the prior total salary scale reduced by 0.25% at all durations due to the reduction in the inflation assumption.

In discussions with Segal, they indicated that they actually based the rates of salary increase on duration from initial system entry date rather than years of completed service. Based on this, we believe that they should change their description of the basis to more accurately reflect the nature of the rates developed.

We acknowledge that the last few years have been a very challenging period in which to analyze salary experience. Many governmental entities have had budget constraints that have resulted in low salary increases. Inflation has also been very low, reducing the size of "across-the-board" increases. Nationally, unemployment and underemployment have likely resulted in downward pressure on wages. Meanwhile, the North Dakota economy has been comparatively strong. These factors all serve to complicate the analysis of salary growth for the study period. We would have expected some mention of some or all of these factors in Segal's analysis. Again, this might be the result of not preparing a formal report where more narrative and discussion can be included.

On the surface, the results displayed in the table do not make a compelling case for any change. Merit increases in the first 5 years of service were above the expected amount, while in all years after (at least as grouped), they were below expectation. We think it could have been useful to show the results separately for each fiscal year and/or a graph of increases by year of service for the complete 30 years of service over which the assumption is studied. Such analysis might have provided some insight into actual experience, although as noted in the prior paragraph, recent years have been influenced by a number of atypical factors that complicate analyzing and setting the merit scale. While we are comfortable with the recommendation to retain the merit scale, we urge the inclusion of additional analysis in the report the next time an experience study is performed.

The analysis of spiking included by Segal was a nice addition to report. We concur that these results would not indicate a widespread spiking problem. There may be individuals, however, who are able to find ways to substantially increase pay in their final years of employment, thus resulting in a higher benefit amount. The cost of this may be low (as suggested by Segal's analysis), but there may be a public policy issue as well. We would suggest an analysis to determine what portion of individuals had large increases in the final averaging period to see what issues may be arising, rather than simply looking at the average. Of course, the longer averaging period in Tier 2 means that the spiking issue eventually will have an even smaller impact than it currently has.

DEMOGRAPHIC ASSUMPTIONS

The major demographic assumptions are the assumed rates of retirement, withdrawal (with or without a vested benefit), disability, and mortality (death before or after retirement). In the following paragraphs, we make specific comments on the demographic assumptions.

Rates of Mortality: One of the most important demographic assumptions in the pension valuation is mortality because it projects how long benefit payments are expected to be made. The longer retirees live and receive benefits, the larger the liability of the system, thus increasing the contributions required to fund the system. In addition, if members live longer than expected based on the assumption, the true cost of future benefit obligations will be understated and contributions will increase as the unfavorable experience unfolds.

Because of potential differences in mortality, healthy retirees, disabled participants, and active members are usually studied separately. The mortality assumption applies to members both before and after retirement although the post-retirement mortality assumption has a far greater impact on valuation results. Most often, gender distinct rates are used since studies continually show that females live longer than males, although that gap has been shrinking according to recent mortality studies.

It is commonly recognized that rates of mortality have been declining, which means people, in general, are living longer. ASOP 35, "*Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations"*, requires the actuary to include an assumption as to expected mortality improvement (even if the improvement is assumed to be 0) after the measurement date. It further requires the actuary to disclose what, if any, future mortality improvements are assumed and how the improvements are reflected in the mortality assumption.

There are two approaches to anticipating future improvements in mortality:

(1) setting the mortality assumption so that it includes a "margin", and
(2) using the generational mortality improvements.

The first approach intentionally selects a mortality table with lower mortality rates than are currently being observed, thus providing room for mortality improvements in the future. Under this approach, the AE ratio is well over 100% initially because the actual deaths are higher than expected by the mortality table (creating margin). Under the second approach (generational mortality), the starting mortality rates are set close to the observed experience (with resulting AE ratios around 100%), and then future improvements are directly reflected by applying a mortality improvement scale to the mortality rates in each future year to reduce the probability of death. Under the generational approach, the greatest change in life expectancy is reflected for younger members who have more years of future mortality improvement.

For their analysis of mortality, Segal weighted the mortality experience by the amount of the benefit. Thus, an individual receiving a $1,500 monthly benefit has twice the influence on the study results that an individual with a $750 monthly benefit has. Because there tends to be a correlation between benefit size and longevity, weighting the analysis helps to ensure that the assumption is a good fit for measuring the retiree liability, and not simply estimate the number of retirees dying. The Society of Actuaries' tables (such as the RP-2014 table Segal recommended) are also developed this way so it is appropriate to analyze the actual experience on this basis. We commend Segal for using this approach.

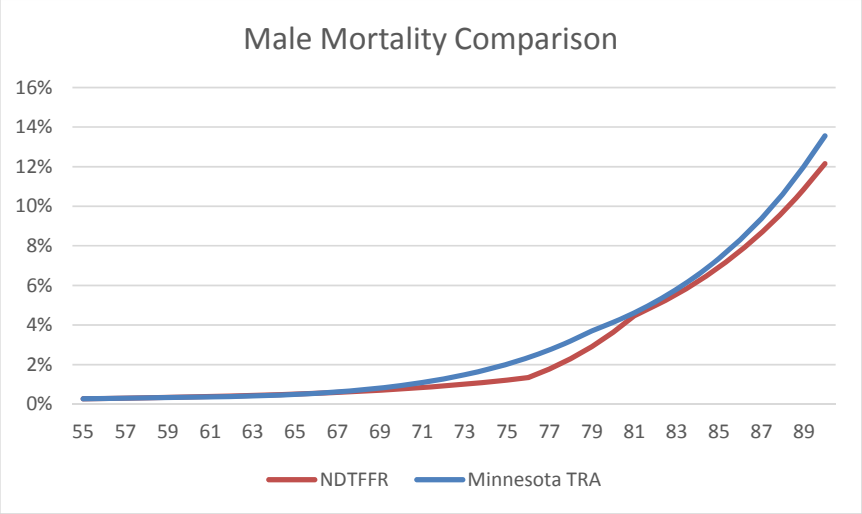
The presentation is lacking in providing a significant description of the process and contains only limited numerical or graphical information. We do believe additional detail, perhaps in a report appendix, would enhance the report particularly for a more technical audience. We would not, however, expect it to change Segal's recommendation.

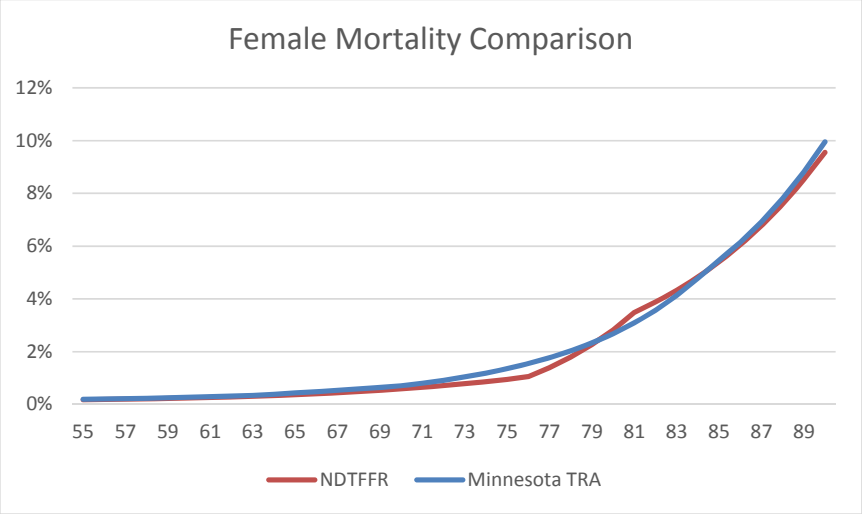
Segal proposes a variant of the RP-2014 table in which the rates of mortality at ages under 75 are multiplied by 50%, while ages over 80 are multiplied by 100% (i.e. left unchanged), with graded factors from 75 to 80. This approach of applying different scaling factors to different ranges of a mortality table has not been common practice by public plan actuaries. However, we have been using this approach for around 15 years and have found it to be a very useful and appropriate tool in developing mortality assumptions that accurately anticipate the experience of a given system. By using this approach, Segal can blend the general pattern of national mortality in corporate retirement plans with what has been observed in the North Dakota Teachers' Fund for Retirement. After applying the scaling factors, the resulting Actual/Expected (AE) ratios are over 100%, indicating some conservative in the resulting assumption. While we believe it would have been perfectly acceptable to use a slightly larger scaling factor to produce AE ratios closer to 100%, we do not have any concerns with the factors chosen and the resulting mortality assumption. Furthermore, we commend Segal on adopting this methodology for developing the mortality assumption.

We note that along with the RP-2014 table, the Society of Actuaries also produced a "white collar" and "blue collar" version of the table. We did some analysis with these tables which indicated that had Segal started with the white collar version of the RP-2014 table, less scaling would have been

required. Such an approach is largely a matter of preference, and Segal's selection of the regular table as a starting point is not inappropriate.

Finally, because of the comparatively small size of NDTFFR compared to other statewide teachers or school retirement systems, there is some value in comparing the results to nearby states. As the following graphs show, the rates proposed by Segal are not very different from those used by the Minnesota Teachers Retirement Association (one of our clients). This is further confirmation that the proposed mortality table is reasonable.





Rates of Retirement: A major factor in how members elect to retire is the set of eligibility conditions for reduced and unreduced retirement. The changes in retirement eligibility beginning

in 2008 for the new Tier 2 and many Tier 1 members (except those who were grandfathered) has resulted in a situation in which the retirement eligibility for those included in the study are not the same as the retirement eligibility for future retiring members. In their presentation, Segal notes that there is little experience for anything other than the Tier 1 grandfathered group. However, because approximately 70% of the active liability is due to Tier 1 grandfathered members, the use of rates that are influenced by Tier 1 grandfathered experience is appropriate. Over the next two experience studies, the patterns of the Tier 1 non-grandfathered group should emerge. Because the eligibility provisions for the Tier 1 non-grandfathered and Tier 2 groups are the same, it is likely that there will be similar retirement patterns unfolding.

Segal analyzes the actual retirement rates compared to the current unisex early retirement rates and the sex-distinct unreduced retirement rates. They also study the rates of retirement in the first year in which unreduced retirement benefits are available, recognizing that there are many individuals who elect to retire as soon as the criteria for unreduced retirement is met. Segal makes some updates to the rates of retirement, generally moving from the current rate toward the recently observed experience. This approach seems reasonable to us and we believe the proposed assumptions are reasonable.

As with other parts of the experience study, we believe it would be valuable to provide additional detail beyond the three graphs included in the presentation. In particular, an analysis by fiscal year could have been especially valuable to see if the first year or two of the study period showed lower actual rates of retirement following the market downturn of 2008.

We also believe that it could have been valuable to study the experience with results weighted in proportion to salary or approximate liability. This philosophy is similar to using benefit-weighted analysis in developing the mortality assumption. It has been our experience that frequently the earliest retirees are those with longer service and higher pay, and so larger assumed rates of retirement at younger ages may help minimize losses arising from high liability individuals retiring earlier than others. As a teacher system, NDTFFR is likely to have a more homogeneous population than a general statewide retirement system, and so this type of analysis may not produce markedly different results for NDTFFR, even though it might for a system composed of a wide range of employee types. Still, we would suggest that this type of analysis at least be considered in the next experience study.

Rates of Termination: The termination of employment (withdrawal) assumption is a service-based assumption which is the most commonly used format for termination assumptions in other public retirement systems. Segal recommended some modest adjustments to move part way from the current assumption toward the observed experience. The rates appear reasonable in light of the observed experience. As with retirement, we believe additional detail in the report could be helpful to the reader. We also frequently find that individuals with lower liability have greater termination rates than those with higher liability, and so a weighted analysis for this assumption could also be beneficial.

In discussions with Segal, they indicated that they actually based the rates of termination on duration from initial system entry date rather than years of completed service. Based on this, we believe that they should change their description of the basis to more accurately reflect the nature of the rates developed.

Rates of Disability: There were very few disabilities observed during the study period (46 in this study, 40 in the prior study), so this assumption is very difficult to evaluate, and Segal's election to retain the table certainly makes sense. A graph or table of results would be helpful to determine if the observed pattern roughly had the same shape as the assumption. We believe it might be of value to examine results by gender to determine if there are significant differences. We do not believe there would be much value added by using a weighted analysis, since disability may first manifest itself with a period of time of part time work and lower wages, thereby distorting the weighted analysis.

Rates of Death: Like disability, active death tends to be a rare event. We believe that Segal's decision to use the employee mortality table associated with the retiree mortality table is appropriate.

Miscellaneous Assumptions: In the valuation process, there are some assumptions that are required for programming purposes that are fairly minor in significance and often difficult to measure. In these cases, it is reasonable to use some rough analysis or even simply professional judgment. Segal's presentation identifies several of these assumptions related to spouses and proposes retaining the current assumption. We find their recommended assumptions to be reasonable.

There are some other minor assumptions that are not addressed in the Experience Study. One is the assumption that terminating employees elect the more valuable option (on a present value basis) of a deferred retirement benefit or a refund of member contributions. We suspect that many people do not make the optimal election, but this assumption is conservative. With the current high member contribution rates, this criteria will most often lead to the assumption that the member elects a refund. A second assumption that was not studied is that of the load applied to new retirees to reflect a possible benefit adjustment. It is common in many retirement systems, especially school and teacher systems with July 1 valuation dates, to have a preliminary retirement benefit calculated that is paid for the month of July. Then, when the school district provides final pay information, the benefit amount is revised, most often upward. While this assumption is reasonable, we believe it should be reviewed in each experience study, especially as the transition of the membership moves from Tier 1 to Tier 2 with their different definitions of final average pay.

3. ACTUARIAL METHODS

ACTUARIAL COST METHOD

For all pension plans, whether defined benefit or defined contribution, the basic retirement funding equation is:

$$C + I = B + E$$

Where:

- C = employer and member contributions
- I = investment income
- B = benefits paid
- E = expenses paid from the fund, if any.

As can be seen from the formula, for a given level of benefits and expenses the greater "I" is, the smaller "C" is. This is the underlying reason for advance funding a pension plan, and historically investment income pays for 60% to 70% of the benefit dollars received by plan members. In other words, for every dollar paid to a member only 30 to 40 cents comes from contributions.

Of course, the problem with the formula is that in order to figure out exactly how much to contribute, the plan would have to be closed to new members and allowed to operate until all retirees were deceased. At that point, the benefits and expenses actually paid out, and the investment income actually earned would be known and, using the equation above, the true cost could be determined. Since the vast majority of plans are ongoing and have no intention of closing, and since even with a closed plan it takes a very long time before all benefits are finally paid out, plan sponsors hire actuaries to estimate the cost of their plans and to create a budget for systematic contributions to meet that cost.

In order to determine the contributions needed, the actuary's first step is to estimate on a given date (the valuation date) the value of all benefits (and expenses) that will be paid to the existing active and retired membership over their remaining lifetimes based on the plan's current benefit structure. This estimation requires the use of assumptions regarding both future events (termination, disability, retirement, death, etc.) and future economic conditions (return on assets, inflation, salary growth, etc.). The NDTFFR assumptions were covered in the previous section.

By combining the assumptions for future events and the salary growth assumption, the actuary generates an expected benefit payment stream. In other words, a string of annual payments expected to be made to the current active and retired members from the valuation date until all members are no longer living. Then the actuary applies the investment return assumption to discount each year's payments to the valuation date, creating the present value of all future benefits or the total liability of the plan.

3. ACTUARIAL METHODS

The difference between the total liability and the current assets of the plan represents the present value of future contributions (PVFC) that have to be made by either members or the employers. Usually the members and employers cannot contribute the entire difference in one year, but rather desire a relatively smooth contribution pattern over time that also meets any external constraints. In order to budget for the PVFC, the actuary applies an actuarial cost method. There are several acceptable cost methods, but it's important to recognize that they are nothing more than budgeting tools.

Different actuarial cost methods can provide for faster funding earlier in a plan's existence, more level funding over time, or more flexibility in funding. The choice of an actuarial cost method will determine the pattern or pace of the funding and, therefore, should be linked to the long-term financing objectives of the system and benefit security considerations.

The actuarial cost method used by Segal for NDTFFR is the entry age normal method. This cost method determines the normal cost as a level percentage of pay which, if paid from entry into the plan to the last assumed retirement age, will accumulate to an amount sufficient to pay the expected benefit. Entry age normal tends to result in reasonably stable contribution rates, a feature that is desirable for many public plans. An additional cost is determined by amortizing the unfunded actuarial accrued liability (discussed later in this section). The entry age normal cost method is also the method specified by GASB for financial reporting under GASB Statements 67 and 68. Entry age normal is the most common cost method used by public plans and we completely agree with its use by NDTFFR.

In our review of Segal's work, we find that their application of some of the technical details of the entry age normal cost method are nonstandard in our experience, and note that this may lead to some distortion of the results. The remainder of this section on cost methods is to explain our concerns. The issues are highly technical in nature, but are presented here for completeness.

At the heart of the entry age normal cost method is the determination of the entry age. All of the cost allocation calculations – and therefore actuarial accrued liability and normal cost – hinge on this key data item (which is often derived from other data elements). Calculations start with current data (amount of service, salary, employee contribution account balance, etc.), and then build a hypothetical history (assuming all current assumptions have always been met) from the present age back to entry age. They also build an expectation for the future, again assuming all current assumptions will be met going forward. Then measuring from the entry age, the calculations determine the ratio of the present value of all benefits that are expected to be paid under the plan provisions over the present value of all future expected pay. This ratio, the normal cost rate, is used in the remaining calculations.

It is important to note that the history between the entry age and the present age is hypothetical. While some recent pay history may be reflected, the historical array of pay rates or amounts is based on the assumed salary growth assumption trended backward. The focus is on the current benefit provisions and assumed pay structure, not the actual history. This makes the normal cost

rate a reflection of the value of the plan benefits for a hypothetical individual who begins employment at a given entry age. If a 25-year old is hired this year and another 25-year old is hired in five years, they will have the same normal cost rate provided the benefit provisions and assumptions are unchanged (ignoring the small impact of generational mortality).

Just as historical pay is hypothetically developed, so is historical service. For those individuals who have an uninterrupted career of full time employment, this hypothetical service and the actual service line up exactly – one year of service was earned each year of employment. Roughly 75% of the NDTFFR active members have actual service that corresponds to the difference between the valuation date and the date of enrollment into NDTFFR. However, nearly 25% have less service than would be indicated by the enrollment date, reflecting some period in which there was a break in employment or employment that resulted in less than a full year of service in some years. Our concern is with Segal's approach for these individuals with a "gap". (Note: This gap can arise for a variety of reasons including when members work for a few years in other states or for private schools, when they takes a few years out of the profession for child-rearing or other employment, or in some cases because a refund of contributions was taken when there was a break in service of at least 120 days.)

Consider two individuals who are 45 years old with 15 years of service who have the same current job and pay. Member A initially joined the system at age 30 and has worked full time since then. Member B joined at age 25, worked for 5 years, then took a five year break from age 30 to 35, before returning to full time employment for the last 10 years. Under the most common approach for determining the entry age, the entry age is set as the current age minus the current service. Thus, both members A and B are assigned an entry age of 30 and the hypothetical service and salary array is built from age 30 to age 45 (the present). Future service and salary projections are the same for both members, so they both have the same actuarial accrued liability and normal cost. In all respects, both members are the same in the valuation.

In Segal's approach, however, members A and B are treated differently. This is illustrated in Chart 1. Segal treats member A equivalently to the common method, building a hypothetical service and salary array from age 30 forward. For member B, however, they begin building the array from age 25, the initial date of entry into the system. They assign service from the current age going back, so there are 14 years at age 44, 13 years at age 43, etc., on back to the first year of service being earned between ages 30 and 31. The service array is effectively filled with 0's between 25 and 30. The salary array is filled with hypothetical salaries from age 25 to age 45. Note that because the salary growth assumption is based on duration from entry, the assumed salaries in the past and in the future are different for the two members – only the current salary is the same.

Chart 1

Member A			Member B		
Age	Salary	Service	Age	Salary	Service
			25	$15,814	0
			26	$16,605	0
			27	$17,435	0
			28	$18,307	0
			29	$19,223	0
30	$19,241	0	30	$20,184	0
31	$20,203	1	31	$21,193	1
32	$21,213	2	32	$22,253	2
33	$22,273	3	33	$23,365	3
34	$23,387	4	34	$24,533	4
35	$24,557	5	35	$25,760	5
36	$25,784	6	36	$27,048	6
37	$27,074	7	37	$28,400	7
38	$28,427	8	38	$29,820	8
39	$29,849	9	39	$31,312	9
40	$31,341	10	40	$32,877	10
41	$32,908	11	41	$34,192	11
42	$34,554	12	42	$35,560	12
43	$36,281	13	43	$36,982	13
44	$38,095	14	44	$38,462	14
45	$40,000	15	45	$40,000	15
46	$41,600	16	46	$41,600	16
47	$43,264	17	47	$43,264	17
48	$44,995	18	48	$44,995	18
49	$46,794	19	49	$46,794	19
50	$48,666	20	50	$48,666	20
etc.			etc.		

Note: For simplification, salaries are assumed to grow at 5% for the first 15 years, and 4% thereafter.

When the normal cost rate is calculated for member B (at the age 25 entry age), the denominator includes the present value of future salaries from age 25 to age 75, including five years of salaries for years that were not actually worked. The present value of benefits reflects only benefits from age 30 forward because no service is considered before then. For member A, the present value of benefits at entry age also reflects benefits from age 30 forward (although slightly different benefits from member B because of the differing salary assumption), but the present value of future salaries includes only salaries from age 30 to age 75. Consequently, members A and B have different

normal cost rates, different actuarial accrued liabilities, and possibility different values for the present value of future benefits.

Member B has a lower normal cost rate because benefits are assumed to be funded over salary connected with years in which there was no employment. This means that there will be less funding for member B than for member A in the future, even though they have the same job, pay, and service. However, because less will be funded for member B in the future, a higher actuarial accrued liability is assigned to member B than member A. Of course, contributions were not collected on member B's pay from age 30 to 35 (when member B wasn't working), so there are no corresponding assets, resulting in a higher unfunded actuarial accrued liability for member B, and therefore higher UAAL amortization payments. A comparison of the numerical results in Section 5 shows that Segal's approach results in a lower normal cost rate, but a higher accrued liability, as would be expected.

While it might seem like trading off a lower normal cost amount for a higher amortization amount is simply a matter of timing, there is another implication of this approach that is not simply an allocation issue. Because member B was assumed to have started employment five years earlier, the duration based salary increases and termination rates being used are five years further along. This means that member B is expected to have lower future salaries, but also a lower likelihood of terminating employment in the future. These factors change the calculation of the Present Value of Benefits (PVB), although each factor works in a different direction: Lower future salaries means lower expected retirement benefits and PVB, while lower termination rates means a greater likelihood of retiring (rather than terminating and taking a refund of contributions) which results in a larger PVB. We estimate the combined impact is no more than 0.25% of active liability, so the net impact of the factors is small.

We wish to stress that this method is, in our opinion, not a common approach in the public sector. Actuarial Standards of Practice do not provide any precise requirements on how entry age is to be determined, nor do they even define specific cost methods. However, we believe most actuaries would agree that best practices would apply the entry age normal cost method as we recommend. While the approach used by Segal is not common and creates some odd results in certain situations, it is not inconsistent with governing actuarial standards. The main implication of the two different entry age methods is how the past and future pieces of the liability are allocated. The total expected payouts in the future are virtually unchanged, and thus the Present Value of Benefits is also virtually unchanged. Segal's approach, when compared to ours, will lead to a lower normal cost payment and a higher amortization payment.

3. ACTUARIAL METHODS

ASSET VALUATION METHOD

Since the purpose of actuarial funding is to build up an asset pool (remember the importance of "I" in "C + I = B + E") actuaries need to value the current asset pool on each valuation date. The market value could be used, but it would tend to create too much volatility from valuation date to valuation date, and a single day's measurement is not necessarily indicative of the true underlying value of the investments held by the plan. Thus, most actuaries use an asset valuation method which smoothes out these fluctuations in pursuit of achieving more stable funding measures and (when relevant) developing more level contributions. A good asset valuation method places values on a plan's assets which are related to current market value, but which will also produce a smooth pattern of costs. This is a question of balancing fit (measured against market value) and smoothness.

Neither book nor market value of assets is generally felt to be appropriate in determining the actuarial contribution rate for an ongoing pension plan. Book value produces smooth predictable employer contributions, but it ignores sizeable appreciation and is not a good measure of the fund's true value (i.e., a poor fit to market value). On the other hand, market value is a realistic current measure of the fund but, on a long-term basis, one day's market value may not be a very meaningful figure for a pension fund. Furthermore, sharp short-term swings in market value can result in large fluctuations in the computed employer contributions required to fund the plan (i.e., not very smooth).

The goal of the actuarial asset valuation method is to smooth or reduce investment market fluctuations. This is particularly important during periods of volatile capital markets in which abrupt changes in asset values, when factored into the funding valuation, produce sudden unnecessary changes in contribution levels. In this case, "unnecessary" implies that the change in asset values is not necessarily a true revaluing of the assets involved, but rather a fluctuation reflecting a current economic climate or a short-term reaction to specific news.

In our opinion, desirable characteristics of an actuarial asset valuation method include the following:

- The method should be simple to operate. It should be readily calculable from financial statements.
- The method should be easy to explain to all interested parties.
- The theoretical underpinnings should be solid and not produce a long-term lag to the fair value of assets. The value produced should account for market values.
- The method should smooth the effect of market fluctuations.

- Investment decisions should not be affected by the actuarial asset valuation method, and vice versa.

- The value produced should be realistic; the price tag placed on assets should be sensible and should not cause other variables to be adjusted to account for unrealistic asset values.

NDTFFR Asset Valuation Method: The asset valuation method used by Segal in the valuation is a method commonly used by other public sector retirement systems. The smoothing method finds the difference between the actual investment return and the expected investment return (using the actuarial assumed rate of return) on the market value of assets. This dollar amount of difference is then recognized 20% per year over five years. Additionally, there is a corridor applied to keep the actuarial value of assets within 20% of the market value of assets.

Compliance with ASOP 44

Actuarial Standard of Practice Number 44, "*Selection and Use of Asset Valuation Methods for Pension Valuations*", provides guidance to the actuary when selecting an asset valuation method for purposes of a defined benefit pension plan actuarial valuation. When considering the use of an asset valuation method other than market value, ASOP 44 states the actuary should select an asset valuation method that is designed to produce actuarial values of assets that bear a reasonable relationship to the corresponding market values. Further guidance states that the asset valuation method must satisfy both of the following criteria:

(a) The asset values fall within a reasonable range around the corresponding market value, AND
(b) Any differences between the actuarial value of assets and the market value of assets are recognized within a reasonable period of time.

In lieu of satisfying both (a) and (b) above, an asset valuation method meets ASOP 44 requirements if, in the actuary's professional judgment, the asset valuation method either:

(i) Produces values within a sufficiently narrow range around market value, OR
(ii) Recognizes differences from market value in a sufficiently short period.

Several of the terms in the criteria of ASOP 44 such as "reasonable" and "sufficiently narrow" are not well defined. As a result, actuaries can differ in their opinion on these matters. As we consider the current asset valuation method used by NDTFFR in light of ASOP 44, we believe it satisfies these requirements. The inclusion of the corridor by NDTFFR is not needed to comply with ASOP 44 in our opinion because of the five year recognition of gains and losses, and, in fact, could actually increase volatility. However, it is an acceptable and widely used feature and we are fine with its inclusion.

We find the asset valuation method to be reasonable and in accordance with actuarial standards.

3. ACTUARIAL METHODS

AMORTIZATION OF UNFUNDED ACTUARIAL ACCRUED LIABILITY METHOD

The unfunded actuarial accrued liability is amortized over a 30-year closed period effective July 1, 2013 as a level percentage of payroll. As of the July 1, 2015 valuation, 28 years remain. Each year, the gains or losses arising from liability and asset experience, along with any assumption or benefit provision changes are added to the existing base. This method has been widely used in the public sector, although in recent years there has been a movement toward using layers of bases. Under this approach, the initial UAAL is amortized over a closed period. Annual changes in the UAAL due to experience or assumption and benefit changes are amortized over a separate base (typically 15 or 20 years). Such an approach prevents volatility in the actuarially determined contribution rates that will arise when the amortization period becomes shorter. We believe this is something that NDTFFR may wish to consider at some point, but because the current period is still relatively long, there is no urgent need to act. ***We believe the NDTFFR amortization method is generally reasonable.***

4. DATA REVIEW

Segal and NDTFFR supplied CMC with active, terminated vested, retired member and beneficiary data as of June 30, 2015. We compared the records and generally agreed with the processing being performed by Segal. For those active members who earned less than one year of service credit in the year prior to the valuation, Segal annualizes the reported pay so that it reflects an annual rate of pay. Otherwise, Segal's processing remains fairly limited.

We tested the counts by status and the totals of selected fields to be sure they matched. We note that while the data files provided from NDTFFR to Segal require only minimal processing, Segal does retain several years of salary history that it uses to supplement the valuation calculations. We considered the data supplied by NDTFFR and did not identify any additional information that we believe would improve the ability of Segal to perform its work. ***Overall, we are comfortable that the data Segal uses to perform its valuation is consistent with the data supplied by NDTFFR.***

REASONABLENESS OF THE ACTUARIAL VALUATION RESULTS

This section of our review discusses the reasonableness and accuracy of the liabilities and costs developed in Segal's July 1, 2015 actuarial valuation.

Generally accepted actuarial standards and practices provide actuaries with the basic mathematics and the framework for calculating the actuarial results. When it comes to applying those actuarial standards to complex calculations, differences may exist due to individual opinion on the best way to perform those calculations. Differences may also arise from the actuarial software used to make these calculations, especially in the allocation of liabilities between past and future service for active members. Although these factors may lead to differences in the calculated results, these differences should not be material. Generally, differences in the present value of benefits of 1% to 2% or less and differences in the actuarial liabilities of 5% or less are considered reasonable. The normal cost rate should generally be within 5% as well.

As part of the actuarial audit, CMC used the data provided by Segal to reproduce the valuation liabilities thus ensuring that any differences were not due to data issues. A summary of results is included at the end of this section. While the aggregate results are generally very close, we also looked at some individual detailed sample lives. This allowed us to identify some minor issues that would not otherwise be apparent from the summarized results. However, the reasonable match of the summarized results emphasizes that the differences discussed in the remainder of this section are indeed minor. ***Based on the results of our review, overall, we find the actuarial liabilities, contribution rate calculations, and the GASB disclosures to be reasonable.*** As noted in the cost method section, we believe the application of the entry age cost method is atypical, but if we mirror that same approach, we arrive at similar liability measures.

One issue we noted is in the calculation of the liability for deferred vested members. Segal values the benefit by comparing, on an individual member basis, the present value of the member's deferred benefit and the value of the member's account balance with interest. To the greater of these two numbers, they also add a liability for death prior to benefit commencement. Because electing a refund of member contributions would eliminate the obligation for the pre-commencement death benefit, it would be more appropriate to first add the present value of the death benefit to the present value of the deferred benefit and compare that to the member's account balance with interest. Segal acknowledges that technically this approach is not correct, but they explained that the approach was taken because of programming simplicity. We agree with Segal that it has a minimal impact on results. ***We believe that Segal should review this item and make any needed correction in the next valuation.***

A second issue noted involves calculating the normal cost rate. For this calculation, Segal divides the dollar amount of normal cost, adjusted with interest, by the total annual pay for all active members at the start of the year. However, the dollar amount of normal cost is developed using assumptions which reflect a partial year's pay in the final (partial) year of employment. This leads to a mismatch in the conversion of the normal cost amount to the normal cost rate. Segal is essentially calculating the contribution rate for all members – both current members and those who will be hired in the current year - to pay the dollar amount of normal cost of those who were members at the start of the year. This means the contributions for new hires in their first year are not applied to fund their benefits, resulting in an actuarial loss at the year-end valuation. We prefer a normal cost rate that is developed by dividing the dollar amount of normal cost for the members at the start of the year by the pay expected during the year for those same members. This would result in a slightly higher normal cost rate, but would also mean that contributions on behalf of new hires are immediately being applied toward the new hire benefits, thereby eliminating the actuarial loss for new members. Because the contributions are set by statute, the only impact this difference has is to understate the contribution rate deficiency. ***We believe that Segal should review this and determine if any changes are appropriate.*** We have seen Segal's approach used by other systems, but believe our recommended approach is technically more appropriate.

A third issue, perhaps more theoretical than practical, involves the retrospective projections used in the entry age calculations. Segal uses actual historical salaries for the past six years, then assumed salaries from that point back to the assumed entry age. They also determine the member account balance with interest using these actual salaries (for the last six years) and the actual member contribution rates that were in effect at that time. We generally prefer to use the assumed prior salaries for all years and the current member contribution rates so as to get a normal cost rate that reflects the current plan provisions rather than being affected by past benefit structures or actual pay patterns. We do note that it is not uncommon in actuarial practice to use historical salaries. However, we do not often see a reflection of historical benefits reflected in the normal cost calculation. We believe the present value of benefits appropriately reflect actual history, and only propose changing the normal cost rate along with the corresponding impact on actuarial accrued liability. We wish to emphasize that our proposal is to value the current provisions that are applicable to each member, not the provisions applicable to new members. ***We would suggest Segal consider changing at least the method of calculating the retrospective member account balances to better measure the current benefit structure's underlying normal cost rate.***

Finally, there are several places in the report where intermediate asset or liability amounts are adjusted to the middle of the year. Segal performs these calculations by using simple interest, or 3.875%, for half a year. While this is reasonable, we note that many actuaries would use half a year reflecting compound interest of 7.75% per year and thus use an interest adjustment of 3.803%. In some cases, Segal has apparently reflected additional information regarding timing, but has not clearly explained the timing. This combination makes it difficult to replicate the interest, although we are very close. This is very minor and we point it out only for Segal's consideration.

5. ACTUARIAL VALUATION RESULTS REVIEW

The appendix includes key items for the individual calculation reviewed. On the following pages, we show summarized results for the entire replication. The first exhibit reflects our attempt to replicate Segal's results as closely as possible. To do so, we included the additional liability for deferred vesteds and used six years of historical pay. We also calculated the entry age based on the first enrollment date in the System. The second exhibit reflects our preferred approaches on these issues, as discussed earlier. The ratios indicate that we match reasonably well for the present value of benefits and actuarial accrued liability, but the normal cost rate is noticeably different, especially when our method for calculating entry age is used. As discussed earlier, our calculation of entry age essentially changes only the allocation of the liability to past and future service, so the increased normal cost rate also coincides with a decrease in actuarial accrued liability.

Comparison of June 30, 2015 Liability Measures

Matching Segal Methodology

	Segal	CMC	CMC/Segal
Present Value of Benefits			
Active Members			
Retirement	2,028,241,599	1,998,782,593	0.985
All other decrements	198,032,167	203,628,990	1.028
Total active	2,226,273,766	2,202,411,583	0.989
Retirees	1,874,669,272	1,876,824,197	1.001
Inactives	85,198,880	86,102,526	1.011
Total	4,186,141,918	4,165,338,306	0.995
Actuarial Accrued Liability			
Active Members	1,489,907,830	1,435,695,298	0.964
Retirees	1,874,669,272	1,876,824,197	1.001
Inactives	85,198,880	86,102,526	1.011
Total	3,449,775,982	3,398,622,021	0.985
Normal Cost Amount (No Interest Adjustment)			
Retirement	53,893,070	50,595,292	0.939
All other decrements	14,346,370	16,089,751	1.122
Total	68,239,440	66,685,043	0.977
Payroll for Normal Cost Rate	625,774,379	582,715,468	0.931
Normal Cost Rate (no expenses included)			
Retirement	8.94%	8.68%	0.971
All other decrements	2.37%	2.76%	1.165
Total	11.31%	11.44%	1.011

Includes using Segal's method for determining Entry Age, inclusion of historical salaries, and the inclusion of a death benefit for current deferred vested members who are expected to elect a lump sum.

Comparison of June 30, 2015 Liability Measures

CMC Preferred Methodology

	Segal	CMC	CMC/Segal
Present Value of Benefits			
Active Members			
Retirement	2,028,241,599	1,993,518,145	0.983
All other decrements	198,032,167	207,947,960	1.050
Total active	2,226,273,766	2,201,466,105	0.989
Retirees	1,874,669,272	1,876,824,197	1.001
Inactives	85,198,880	83,559,677	0.981
Total	4,186,141,918	4,161,849,979	0.994
Actuarial Accrued Liability			
Active Members	1,489,907,830	1,388,080,871	0.932
Retirees	1,874,669,272	1,876,824,197	1.001
Inactives	85,198,880	83,559,677	0.981
Total	3,449,775,982	3,348,464,745	0.971
Normal Cost Amount (No Interest Adjustment)			
Retirement	53,893,070	54,505,294	1.011
All other decrements	14,346,370	17,946,898	1.251
Total	68,239,440	72,452,192	1.062
Payroll for Normal Cost Rate	625,774,379	582,864,941	0.931
Normal Cost Rate (no expenses included)			
Retirement	8.94%	9.35%	1.046
All other decrements	2.37%	3.08%	1.300
Total	11.31%	12.43%	1.099

6. VALUATION REPORT REVIEW

CONTENT OF THE ACTUARIAL REPORTS

The American Academy of Actuaries has issued a number of Actuarial Standards of Practice which provide guidance on measuring pension obligations and communicating the results (ASOP No. 4, 23, 27, 35, 41 and 44). Those standards list specific elements to be included, either directly or by reference to other documents, in pension actuarial communications. Some of the elements would not be pertinent in all communications, but since an actuarial valuation report is the most complete picture of the actuarial status of the plan, all of the elements listed should be covered in the report, even if only briefly.

The July 1, 2015 actuarial valuation report for NDTFFR generally provides sufficient information for another actuary to understand the process and to assess the reasonableness of the results. We compared the contents of the report to over 30 specific items detailed for pension actuarial work in ASOPs 4 and 41. ***In our review of the report, we found it to be substantially in compliance with the applicable ASOPs***. We identified three items as areas where some clarification or enhancement might be helpful. These suggestions, admittedly very fine points, are made not to fix a problem, but to enhance the report and be sure that all ASOPs are fully met:

- ASOP 4, Paragraph 4.1.k requires disclosure of the outstanding amortization base(s), the amortization payment, and the years remaining. All of this information is included in the report, but it is not all provided in one place in the report. We suggest considering having all of this information presented together in one exhibit.
- ASOP 4, Paragraph 4.1.m calls for a qualitative assessment of the contribution policy and plan funding. While these concepts are commented on to some degree, we suggest adding a brief sentence or paragraph to directly discuss the issue.
- ASOP 4, Paragraph 4.1.q requires disclosure of information regarding the funded status. We did not find a clear discussion of whether the funded status can be used for contribution determination, so we suggest adding some clarifying language that this ratio will ultimately be used in lowering contribution rates.

As noted in the discussion on the experience study, because the salary increase and termination assumptions are based on duration from entry date rather than simply completed years of service, the description of how those rates are used in Section 4, Exhibit X should be modified.

In addition to the requirements of the ASOPs, we also reviewed the reports to determine if there are changes that might improve the communication of the results. We have tried to avoid suggestions that are merely stylistic, recognizing that the current report reflects the influences, over time, of the retained actuary, the NDTFFR staff, and the Board. Nonetheless, we have identified one item that we believe could enhance the report:

The asset gain or loss to be recognized (see page 6, item 2a) is not otherwise developed in the report. We were able to independently calculate the amount and concur with its accuracy, but we think the derivation of this amount could be useful in helping readers better understand the method.

7. GASB Reporting Review

With the recent implementation of GASB Statements 67 and 68, the complexity of reporting for accounting has increased for governmental retirement plans. The recent introduction also means that there are a range of approaches in providing the information. To evaluate the GASB section of the report, we first reviewed the development of the Single Effective Interest Rate (SEIR), then reviewed the calculations required to measure and allocate the pension liability and expense. Finally, we reviewed the presentation of these numbers.

SEIR Determination

One of the new concepts introduced in GASB 67 and 68 is the SEIR. The basic concept is that when a plan is funded, the assets can be presumed to earn investment return that helps pay benefits, and so future benefit payments are discounted to the present at the assumed investment return. If the plan has exhausted its assets, then the future benefit payments are discounted back at a municipal bond rate. GASB calls for finding a single rate that produces the same value for liabilities when applied to either the funded or unfunded periods of time and then using this rate for various calculations.

The development of the SEIR is not directly presented in any of Segal's reports (and is not required to be), but they provided us with a spreadsheet justifying the selected rate of 7.75%. The spreadsheet largely followed the model in the GASB 67 and 68 illustrations whereby projections of the Fiduciary Net Position (FNP) are made for the remaining life of all current members. Since the FNP is projected to be positive in all years, the long-term expected return on assets may be used as the SEIR. This development is largely a technical exercise and frequently does not reasonably illustrate future funding expectations. Consequently, the SEIR development is often not included in any formal reporting, but provided to the auditors to assist in their review.

Our review of the report indicated that the calculations were reasonable. We used our valuation results in some cases to confirm the reasonableness of the input items. Because NDTFFR is funded with statutory contribution rates and has a new, lower cost tier being implemented, we fully expected that the projections would show the FNP staying positive for all years, just as it did. As a minor observation, Segal indicated that had the FNP been exhausted, they would have discounted future cash flows at a high quality tax-exempt general obligation municipal bond rate of 3.73%. They did not indicate the source of this rate (there is not a unique source), but we found the rate plausible in light of rates published by the Federal Reserve Bank of St. Louis. We would suggest Segal include a source or derivation of this rate for completeness.

GASB 67 and 68 Calculations

We were generally able to verify all of the calculations presented in the GASB disclosure information, including a sampling of calculations related to the allocation of expense to individual employers. It should be noted that the liability amounts used for GASB calculations are the same as the liability amounts used in the funding calculations, so if minor changes are made to the

calculation of funding results in the future, there will be minor changes to the GASB numbers as well.

There were some cases in which we were not able to exactly match interest calculations made by Segal. We recognize that sometimes these calculations reflect the fact that the timing of certain cash flows is not the middle of the year, and so a different factor is used. The differences were all minor, however, and seem reasonable.

GASB DISCLOSURES

The GASB standards contains substantial detail that must be publicly disclosed by the System and/or the participating employers. Segal's report provides sufficient information for the interested parties to prepare the needed disclosures.

In Exhibit 4 of the GASB report, a historical schedule of employer contributions is provided. In the notes to Exhibit 4, the assumptions and methods disclosed are those used for the July 1, 2015 valuation. We believe it would be more appropriate to display the assumptions used for the July 1, 2014 valuation since that valuation developed the actuarial contribution shown in the Schedule for the 2015 fiscal year.

8. PROJECTION MODEL REVIEW

As part of their annual work, Segal prepares projections of future funding results under various market value return scenarios. To replicate these results, we used a hypothetical profile of new entrants provided to us by Segal. While not auditing this profile, we did review it to make sure that it appeared reasonable for NDTFFR.

We then independently projected future liabilities and other valuation results for 30 years into the future. With these, we built a model to provide results similar to what Segal provides in their projection work. Since we did not have Segal's model, our replication of the model results was developed in a completely independent manner. As a result, the threshold for the replication to be reasonable is broader than that of the actuarial valuation.

We compared funded ratios for 10 different investment scenarios at five-year intervals over the 30-year period and found our results to be comparable to Segal's. Because our starting valuation results were slightly different, we would expect differences to persist throughout the projection period. However, the proportionate difference did not materially change, indicating that the two models were predicting similar results. Because of the wide array of possible scenarios that can be modeled, we cannot comment on the accuracy or the reliability of the model in broad general terms, but we can verify that the projections provided in the presentation to the NDTFFR Board are reasonable.

APPENDIX

APPENDIX

Comparison of actives lives

	Segal Calculation			Replication of Segal's Method			CMC Preferred Method		
Sample Life	NC	AL	PVB	NC	AL	PVB	NC	AL	PVB
1	6,922	541,771	565,683	7,815	529,000	561,853	9,506	516,470	556,432
2	6,230	56,553	167,790	5,953	59,243	167,893	7,464	34,079	166,430
3	1,608	26,399	50,674	1,634	25,282	50,566	2,878	8,702	50,932
4	7,782	7,316	109,604	7,153	7,220	109,143	7,153	7,220	109,143
5	3,681	29,808	93,502	3,775	26,862	94,073	4,580	13,869	91,065
6	1,124	97,983	103,580	1,055	99,348	105,281	4,468	83,811	109,485
7	2,222	222,541	232,151	2,398	223,966	235,924	10,174	191,997	243,759
8	6,992	66,946	155,266	7,078	63,296	155,530	4,306	96,783	153,638

Note: These sample lives were selected to allow Cavanaugh Macdonald to test certain aspects of Segal's calculations and are not a representative sample of the actual membership.

Comparison of inactives lives

Sample Life	Status	Segal Calculation PVB	CMC Preferred Method PVB
1	Deferred	39,461	38,130
2	Deferred	73,286	71,133
3	Retiree	798,540	798,540
4	Retiree	196,134	196,134
5	Retiree	344,457	344,457
6	Retiree	546,802	546,802
7	Retiree	302,747	302,747
8	Beneficiary	41,808	41,808
9	Beneficiary	104,601	104,601

Note: These sample lives were selected to allow Cavanaugh Macdonald to test certain aspects of Segal's calculations and are not a representative sample of the actual membership.