

**TEACHERS RETIREMENT ASSOCIATION FUND**

**Actuarial Experience Study for the period  
July 1, 2000 through June 30, 2004**

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February 2, 2006

Mr. Gary Austin  
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St. Paul, Minnesota 55103-1855

Dear Mr. Austin:

We are pleased to submit this report on the actuarial experience of the Teachers Retirement Association Fund for the period July 1, 2000 through June 30, 2004. This investigation is the basis for our recommendation of the assumptions and methods to be used for the July 1, 2006 actuarial valuation. In addition, we recommend a broader, more comprehensive study on the economic assumptions.

All current actuarial assumptions and methods were reviewed as part of this study. Some of our recommendations reflect changes to the assumptions and methods used in the July 1, 2004 actuarial valuation while other current assumptions and methods remain adequate.

Our analysis was conducted in accordance with generally accepted actuarial principles as prescribed by the Actuarial Standards Board (ASB) and the American Academy of Actuaries. Additionally, the development of all assumptions contained herein are in accordance with the ASB Actuarial Standard of Practice (ASOP) No. 27 (*Selection of Economic Assumptions for Measuring Pension Obligations*) and ASOP No. 35 (*Selection of Demographic and Other Non-Economic Assumptions for Measuring Pension Obligations*).

This study has found two areas of concern which require further discussions and analysis under a broader study. One of our findings was on the method of amortizing the Unfunded Accrued Liability. We believe that the method currently employed may create unstable contribution rates. A separate study should review all available methods and select an amortization method that best matches the long term nature of the stable benefit promise with a long term stable contribution rate.

Secondly, the economic assumptions reviewed here (investment return, inflation, salary increases and payroll growth) have been reviewed in an aggregate context, as is the prescribed method for experience studies. However, the structure of the fund may be exposing the Fund to risks that need to be more fully assessed with the cooperative efforts of PERA, SBI and all related parties. There are demographic risks that may be emerging in light of the "split" of the fund between retirees and actives, as well as other possible economic risks more fully explained later in this report.

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Thus, we recommend an "amortization method" study and an "economic forecast" study to be conducted before final recommendations can be issued on the matter of changing economic assumptions.

Demographic assumption changes, where applicable, are not a part of these future study recommendations, hence proposed recommendations and changes related to demographics are presented in this report.

The undersigned actuaries are experienced with performing experience studies for large public-sector pension plans and are qualified to render the opinions contained in this report.

Sincerely,



Leslie L. Thompson, FSA, MAAA, EA  
Senior Vice President and Consulting Actuary



Brad Ramirez, ASA, MAAA, EA  
Consulting Actuary

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## I. INTRODUCTION AND SUMMARY OF KEY FINDINGS

Actuarial valuations are prepared annually to determine whether the statutory contribution rates are sufficient to fund the Teachers Retirement Association Fund on an actuarial reserve basis. Each actuarial valuation involves a projection of the benefits expected to be paid in the future to all members of the Fund. The projection of expected future benefit payments is based on the characteristics of members as of the valuation date, the benefit provisions in effect on that date and assumptions of future events and conditions.

The assumptions used in actuarial valuations can be grouped in two categories: (1) economic assumptions - the assumed long-term rates of investment return, salary increases and payroll growth, and (2) non-economic or demographic assumptions - the assumed rates of withdrawal, disability, retirement, and mortality. Demographic assumptions are selected primarily on the basis of recent experience, while economic assumptions rely more on a long-term perspective of expected future trends.

If actual experience exactly matches the expected experience, the actual annual cost of the Fund will equal the annual cost determined by the actuarial valuation. However, this result is virtually never achieved, due to the long-term forecast of the benefit projections and the numerous assumptions used in actuarial valuations. The Fund recognizes actuarial gains or actuarial losses each year, reflecting the net difference between actual experience and anticipated experience. Determination of the funded status is updated in connection with each actuarial valuation to reflect the net gain or loss. A pattern of gains or losses to one or more assumptions is the basis for recommended changes to the assumptions. Each valuation measures the effectiveness of each assumption and allows for the monitoring of the assumptions.

We are providing to the Association a recommendation of the assumptions and methods used in the actuarial valuation. If the assumptions on an overall basis prove to be a good indicator of actual experience, the actuarially determined contribution rates for the current level of benefits will continue to be sufficient to meet the funding policy of the Fund. On the other hand, if the assumptions understate or overstate the actual cost of the Fund, the annual contribution rates will vary accordingly.

## I. INTRODUCTION AND SUMMARY OF KEY FINDINGS (continued)

Actuarial experience studies are undertaken periodically and serve as the basis for recommended changes in actuarial assumptions and methods. A change in assumptions is recommended when it is demonstrated that the current assumptions do not accurately reflect the current trend determined from analysis of the data or anticipated future trends based upon reasonable expectations. The data analyzed is actual experience for demographic assumptions and economic forecast for economic assumptions. The Actuarial Standards Board (ASB) provides actuaries with standards of practice that provides guidance and recommendations on acceptable methods and techniques to be used in developing both economic and demographic assumptions. Specifically, these are the ASB Actuarial Standard of Practice (ASOP) No. 27 (*Selection of Economic Assumptions for Measuring Pension Obligations*) and ASOP No. 35 (*Selection of Demographic and Other Non-Economic Assumptions for Measuring Pension Obligations*).

A change in actuarial methodology is recommended when such change adds stability to the actuarial valuation process or provides an approach that better fits the funding policy. The methods considered in this study include the actuarial cost method, the actuarial asset valuation method, and the amortization method.

This study reviews the actuarial experience of the Teachers Retirement Association Fund for the four-year period from July 1, 2000 through June 30, 2004, compares this experience to the current actuarial assumptions and recommends changes to the assumptions as necessary. The actuarial methods used in performing the valuation are also reviewed in this study and recommended changes are provided as necessary.

## I. INTRODUCTION AND SUMMARY OF KEY FINDINGS (continued)

We recommend changes to the following assumptions or methods:

### ECONOMIC ASSUMPTIONS

We conducted a review of all economic assumptions, including investment return, inflation, salary increases and payroll growth. While the short term four-year history does portray a story of lower salary increases and lower investment returns, we are not yet in a position to recommend a change without further analysis. The reasons for these concerns that reach beyond an experience study are:

- The internal transfer of assets to the post fund creates a possible exposure to demographic risk that can only be more fully assessed through a projection study. This generally is not an issue in plans where all assets remain aggregated and payable to all members. But with the Association and this design for the post fund, we recommend a further study of this demographic impact on the long term capital market expectations.
- We are recommending a change in the asset accounting method for the Post-Retirement Fund. We have come to understand through various discussions that all parties are aware of the anomalous form of accounting for the Post-Retirement Fund and how it may not pass the GASB requirement that assets must be “market-related”. (The method employed here has a portion of the assets as “liability-related”.) We would suggest that this is a higher priority for the Association to review. If accepted, we will assess the impact on the fund. Similar to the comments above, once the full impact of this accounting change is understood, SBI needs to be consulted for their assessment of any impact on the asset allocation and related long term capital market assumptions.
- Additionally, we recommend a more comprehensive study between the Association and SBI on the long term capital market assumptions. This is for two reasons: One, we found that the SBI assumptions are

on the optimistic side of average (and the Association should review the related risk so they can assess their long term optimal assumption for funding). Secondly, there have been recent, perhaps fundamental, changes in our economy that merit consideration of all parties (e.g., fuel prices, inflation).

In conclusion, this experience study presents the measurement of experience against assumptions, makes certain recommendations for change, but strongly recommends a more comprehensive study of the additional risks discussed above.

We recommend a review of these assumptions in their entirety, using the “building block” approach to ensure consistency between salaries, inflation and real rates of return. (See Actuarial Standard of Practice #27.)

***Inflation***

The current inflation assumption is 5.00% per annum. We recognize that SBI assumes 3.00% and historical inflation has been lower. However, this assumption requires further study and modeling, in light of the unique risks referenced above.

***Salary Increase***

The current salary increase is calculated using the reported salary for prior fiscal year, increased according to the assumed annual increase to current fiscal year and annually for each future year. During a ten-year select period,  $0.30\% \times (10-T)$  where T is completed years of service is added to the ultimate rate. When comparing experience against the assumptions we found that the assumed salary increases are higher than those actually paid during the study period. This assumptions also merits further study, in light of the risks referenced above.

***Payroll Growth***

The payroll growth assumption is 5.00% per annum and is higher than overall experience. We recommend that during the course of the broader study that this assumption be reviewed.



## **DEMOGRAPHIC ASSUMPTIONS**

***Withdrawal Rates*** Current withdrawal rates are based on the age and service of the member. During the three-year select period, the rates are 45% for the first year, 12% for the second year, and 6% for the third year for males, and 40% for the first year, 10% for the second year, and 8% for the third year for females. We recommend keeping the current select period assumptions.

***Disability Incidence Rates*** Disability incidence rates are currently age related, ending at age 64 to 65. We recommend keeping the current assumptions.

***Retirement Rates*** The study indicates that actual retirement rates under Rule of 90 are slightly higher than the current assumed rates and that actual retirement rates for all other retirements are slightly lower than the current assumed rates. We recommend changing these assumptions to better reflect anticipated future plan experience. We also recommend that the effects of the Combined Service Annuity provisions on retirement rates be examined further.

***Post-Retirement Mortality*** We recommend continued use of the current mortality table, the 1983 Group Annuity Mortality Table set back six years for males and set back three years for females.

***Pre-Retirement Mortality*** We recommend the continued use of the current mortality table, the 1983 Group Annuity Mortality Table set back twelve years for males and set back ten years for females.

***Disabled Mortality*** We recommend no change to the current tables.

## II. ECONOMIC ASSUMPTIONS

The economic assumptions have a significant impact on the development of plan liabilities. Changes to these assumptions can substantially alter the results determined by the actuary. The goal of our analysis is to produce a consistent set of economic assumptions that appropriately reflect expected future economic trends.

The primary economic assumptions that affect the Fund's funding are:

- Investment return
- Salary increases
- Payroll growth
- Inflation

The current economic assumptions used for the July 1, 2004 actuarial valuation for the Teachers Retirement Association Fund are as follows:

Investment return	-	Pre-retirement: 8.50% per annum Post-retirement: 6.00% per annum
Salary increases	-	Reported salary for prior fiscal year, with new hires annualized, increased according to the ultimate table shown in the rate table to current fiscal year and annually for each future year. During a ten-year select period, $0.30\% \times (10-T)$ where T is completed years of service is added to the ultimate rate.
Payroll growth	-	5.00% per annum
Inflation	-	5.00% per annum

The Actuarial Standards Board (ASB) has adopted Actuarial Standard of Practice No. 27 (ASOP 27), (Selection of Economic Assumptions for Measuring Pension Obligations) to provide actuaries guidance in developing economic assumptions. A key feature of the ASB's guidance is the "building block" approach in developing economic assumptions. This approach requires the actuary to consider the key component parts of major assumptions and determine reasonable best-estimates for each component.

Under this approach, we consider the investment rate of return assumption as the combination of an inflation component and a real rate of return component. The components of the salary increase assumption are inflation, productivity and merit. The inflation component is included in all economic assumptions, and therefore is key to developing a consistent set of actuarial assumptions. For this

reason we recommend that the comprehensive study look at long term inflation and its impact on the real and nominal rates of return, as well as the salary and payroll growth assumptions.

## II. ECONOMIC ASSUMPTIONS (continued)

### A. Inflation

In reviewing the assumed inflation component, we reviewed a commonly referenced historical measure of inflation, the Minneapolis-St. Paul, MN-WI and National Consumer Price Index for all urban consumers (CPI-U). The table below shows how recent inflation experience is well below the longer-term average rate.

#### Average Annual Change in CPI-U

	Minneapolis – St. Paul	National
Past 5 Years	2.94%	2.68%
Past 10 Years	2.73%	2.52%
Past 20 Years	3.06%	3.07%

The average annual rate of increase in the CPI-U over the five years ending June 30, 2004 is 2.94%. Historical trend is a less important consideration for the assumed rate of inflation, but assists in determining the reasonable bounds of expected inflation.

The typical range of expected inflation for actuarial assumptions in recent years is between 3.00% and 4.50%. Considering this trend, we have determined the current reasonable range to be between 2.75% and 3.50%.

As a check of the validity of this reasonable range, we reference the *2004 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Disability Insurance Trust Funds (2004 OASDI Trustees Report)*. The range of inflation rates in this report was 1.80% for low-cost projection and 3.80% for high-cost projection.

The current inflation assumption is 5.00% per annum. We recommend that this be reviewed in the broader study to take into account risk factors such as recent economic developments, changing work force demographics, as well as using the past as a marker for reasonableness.

## II. ECONOMIC ASSUMPTIONS (continued)

### B. Investment Rate of Return

The investment rate of return assumption is developed using the “building block” approach as outlined in the ASOP 27. Under this approach, the investment rate of return assumption is made up of two components, the inflation component and the real investment rate of return component.

In developing the reasonable range for the real rate of return, we considered the historical returns of the Fund’s two major asset classes, stocks and bonds. First, over the long term, U.S. Stocks (S&P 500) have averaged an annual rate of return of 10.20%, while U.S. Bonds have averaged a 5.70% annual rate of return according to Ibbotson Associates historical market data. Then we used the real rates as developed by SBI, and added the inflation component to develop the range.

The expected real rates of return as supplied by SBI are:

<u>Asset Class</u>	<u>Real Return</u>
<b>Equity</b>	
Domestic	6.25
International - unhedged	6.25
International - hedged	6.05
Emerging markets	8.50
<b>Alternative Assets</b>	
Private equity	10.00
Real assets	5.00
Yield oriented	5.50
<b>Fixed Income</b>	
Domestic bonds	3.50
Non dollar bonds - unhedged	3.50
Non dollar bonds - hedged	3.30
High Yield	4.50
Cash equivalents	1.00

Based on the Fund’s current target allocation and total return assumptions, the expected real rate of return is 5.62% as developed on the next page.

## II. ECONOMIC ASSUMPTIONS (continued)

### B. Investment Rate of Return (continued)

ASSET CLASS	TARGET ALLOCATION* (A)	EXPECTED REAL RATE OF RETURN** (B)	CONTRIBUTION TO TOTAL REAL RATE OF RETURN (A)*(B)
Domestic and International Equity:	60%	6.25%	3.75%
Bonds:	24%	3.50%	0.84%
Alternative Assets:	15%	6.80%***	1.02%
Cash:	1%	1.00%	0.01%
<b>Total Expected Real Rate of Return:</b>			<b>5.62%</b>
Assumed Rate of Inflation (using a range of conservative to SBI estimate):			2.50% - 3.00%
Expected Investment Return:			8.12% - 8.62%
Allowance for Investment Expense:			.20%
Range Estimate for Investment Rate of Return Assumption:			7.92% - 8.42%

\*Based on Investment Policy and Guidelines

\*\*Based on 3.00% Assumed Rate of Inflation and the real returns and inflation rate provided by the Minnesota State Board of Investment

\*\*\*Average of the returns of the three asset classes within alternative investments

These real rates of return and rates of inflation have been developed without further modeling of demographic risks to the plan (that may or may not play a role in changing asset allocations or return assumptions). This range development should be viewed as only a single point in the more broad study of long term economic forecasts.

The current assumption is 8.50%, which is slightly above the range developed for this assumption. The 8.50% appears optimistic, and we recommend a comprehensive review of all investment assumptions in the aggregate. Also, we recommend a more comprehensive study with SBI that could include a review of these real rate of return estimates in light of the very recent impacts in our economy.

A similar analysis of the Post-Retirement Fund also yields an expected net investment return range of 7.92% to 8.42% (the target allocation for the Post-Retirement Fund is nearly identical to the target allocation for the Basic Fund). The payment of earnings on retired reserves in excess of 6.00% is accounted for by a post-retirement rate of return assumption of 6.00%. In other words, the liabilities for

retired members are valued at 6.00% (not the assumed 8.50%) to “pay” for cost of living increases. With advancing baby boomer retirements, the economic forecast study will need to examine the impacts on the post as well as the active fund.

## II. ECONOMIC ASSUMPTIONS (continued)

### C. Salary Increase Assumption

Under the “building block” approach recommended in the ASOP 27, this assumption is composed of three components; inflation, productivity, and merit/promotion. The inflation and productivity components are combined to produce the assumed rate of wage inflation. This rate represents the “across the board” average annual increase in salaries shown in the experience data. The merit component includes the additional increases in salary due to performance, seniority, promotions, etc.

This component is typically more correlated to years of service than age, especially at lower years of service. Thus, we recommend the continued use of a select and ultimate salary scale. The current annual salary increase assumption ages at the ultimate rate is as follows:

Age	Rate
30	6.00%
35	6.00%
40	5.70%
45	5.20%
50	5.00%
55	5.00%
60	5.30%
65	5.70%

During the first ten years of employment, referred to as the select period, an amount equal to:

- $0.30 \times (10 - T)$ , where T is completed years of service is added to the ultimate rate.

The determination of the reasonable range for the productivity component considers the historical experience of the workforce, as well as national indicators of productivity growth.



## II. ECONOMIC ASSUMPTIONS (continued)

### C. Salary Increase Assumption (continued)

Below is a summary of the observed and assumed average annual increase during the ten-year select period.

<b>Service</b>	<b>Observed Average Annual Increase</b>	<b>Assumed Average Annual Increase</b>
1 – 2	6.64%	8.21%
2 – 3	6.62%	7.89%
3 – 4	6.35%	7.56%
4 – 5	6.41%	7.22%
5 – 6	6.34%	6.90%
6 – 7	6.13%	6.58%
7 – 8	5.88%	6.25%
8 – 9	5.95%	5.91%
Ultimate	3.73%	5.20%

Below is a summary of the observed and assumed average annual increases for all participants during both the select and ultimate periods.

<b>Age Group</b>	<b>Observed Average Annual Increase</b>	<b>Assumed Average Annual Increase</b>
20 – 25	7.88%	8.20%
25 – 30	7.16%	8.19%
30 – 35	6.21%	7.02%
35 – 40	5.89%	6.57%
40 – 45	4.56%	5.74%
45 – 50	4.29%	5.35%
50 – 55	3.52%	5.14%
55 – 60	3.44%	5.14%
60 – 65	3.86%	5.58%
65 – 70	4.51%	5.84%

## **II. ECONOMIC ASSUMPTIONS (continued)**

### **C. Salary Increase Assumption (continued)**

We recommend that further study be given to the overall salary increase assumptions as part of the broader economic forecast study.

We will closely monitor the experience in the upcoming actuarial valuations. When a trend of excessive gains or losses is apparent, we will alert the Association to these results.

## II. ECONOMIC ASSUMPTIONS (continued)

### D. Payroll Growth Assumption

Unlike the other economic assumptions, the payroll growth assumption plays no part in the calculation of the Fund's liabilities. It does, however, have a material impact upon the determination of the amortization of the unfunded actuarial accrued liability and the determination of contribution rates. Under the current funding method, the amortization of the unfunded actuarial accrued liability over the funding period is calculated to be level as a percent of payroll. This calculation requires an assumption of the future annual increase in total covered payroll over the funding period.

The average of the total active member payroll of the Fund has increased 2.5% annually since 2000. The average annual increase in the number of active members is 0.2% per year. This experience study shows that historically the payroll growth experience has been lower than assumed, but similar to other economic assumptions we recommend this assumption to be a part of the broader economic forecast study.

### **III. DEMOGRAPHIC ASSUMPTIONS**

The assumptions discussed in this section are demographic in nature, and rely heavily on the experience data and its credibility. The actuary often uses professional judgment in applying a level of credibility to experience data.

A primary analysis tool used in measuring the effectiveness of demographic assumptions is the actual to-expected ratio, or A/E ratio. This ratio is the number of actual occurrences divided by the assumed number of occurrences. An A/E ratio greater than 100% results from more actual occurrences than assumed, and an A/E ratio less than 100% results from less actual occurrences than assumed. An A/E ratio of 100% is not always the most desired result. For example, the trend of decreasing mortality rates is well documented, therefore the recommended mortality assumption should reflect the current mortality rates from the data with a margin to appropriately account for the expected trend of mortality improvement. Thus, an A/E ratio greater than 100% is typically desired for the recommended mortality assumption.

#### **A. Withdrawal Rates**

The withdrawal rates used in actuarial valuations project the percentage of employees who are expected to terminate employment each year before the first assumed retirement age.

#### **Current Actuarial Assumptions**

The current assumption utilizes a “select and ultimate” approach. The select rates are used to reflect the consistency of withdrawal rates among employees with the same years of service regardless of their age. After the three-year select period, age-related rates are used to approximate the employees’ withdrawal rates.

### III. DEMOGRAPHIC ASSUMPTIONS (continued)

#### A. Withdrawal Rates (continued)

The select withdrawal rates used for the July 1, 2004 actuarial valuation for the first three years of service are shown below:

Service	Male	Female
0 - 1	45.00%	40.00%
1 - 2	12.00%	10.00%
2 - 3	6.00%	8.00%

The ultimate withdrawal rates used for the July 1, 2004 actuarial valuation are shown below for certain ages:

Age	Male	Female
20	3.70%	4.50%
25	3.20%	4.50%
30	2.70%	4.50%
35	2.50%	3.90%
40	2.35%	2.75%
45	2.10%	2.10%
50	1.85%	1.85%

#### Membership Experience

A member withdraws from active employment when a termination from employment occurs prior to attaining the eligibility requirement for a retirement benefit. The current assumption utilizes an approach that accounts for a change in withdrawal rates at varying ages of employees with more than three years of service. It is reflected in the experience data that the change in these rates are more correlated to the change in years of service. It is apparent that after a certain "select" period, the rates of withdrawal for employees vary within a small range which can be approximated with a single "ultimate" rate.

### III. DEMOGRAPHIC ASSUMPTIONS (continued)

#### A. Withdrawal Rates (continued)

The tables below summarize the total number of withdrawals during the select period, the actual average number per year and the expected average number per year based on the assumed withdrawal rates for male and female participants.

#### Male

Years of Service	Number of Withdrawals Fiscal Year Ended June 30				Average Per Year		
	2001	2002	2003	2004	Actual	Expected	Ratio
0 – 1	945	987	873	944	937	923	1.02
1 – 2	100	117	116	107	110	133	0.83
2 – 3	64	78	87	79	77	57	1.35
<b>Total</b>	<b>1,109</b>	<b>1,182</b>	<b>1,076</b>	<b>1,103</b>	<b>1,124</b>	<b>1,113</b>	<b>1.01</b>

#### Female

Years of Service	Number of Withdrawals Fiscal Year Ended June 30				Average Per Year		
	2001	2002	2003	2004	Actual	Expected	Ratio
0 – 1	2,376	2,631	2,393	2,421	2,455	2,467	1.00
1 – 2	316	398	335	335	346	341	1.01
2 – 3	234	292	260	268	264	206	1.28
<b>Total</b>	<b>2,926</b>	<b>3,321</b>	<b>2,988</b>	<b>3,024</b>	<b>3,065</b>	<b>3,014</b>	<b>1.02</b>

### III. DEMOGRAPHIC ASSUMPTIONS (continued)

#### A. Withdrawal Rates (continued)

The tables below summarize the actual, expected, and recommended select withdrawal rates for male and female participants:

#### Male

Service	Actual	Expected	Ratio	Recommended
0 – 1	46%	45%	1.02	45%
1 – 2	10%	12%	0.83	12%
2 – 3	8%	6%	1.35	6%

#### Female

Service	Actual	Expected	Ratio	Recommended
0 – 1	40%	40%	1.00	40%
1 – 2	10%	10%	1.01	10%
2 – 3	10%	8%	1.28	8%

