

**TACOMA EMPLOYEES' RETIREMENT SYSTEM**

**STUDY OF MORTALITY EXPERIENCE**  
**January 1, 2002 – December 31, 2005**

by

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May 2, 2006

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Retirement Board  
Tacoma Employees' Retirement System  
1544 Tacoma Municipal Building  
747 Market Street  
Tacoma, WA 98402

Re: Tacoma Employees' Retirement System Study of Mortality Experience

Dear Members of the Board:

It is a pleasure to submit this study of the mortality experience of the Tacoma Employees' Retirement System from January 1, 2002 through December 31, 2005.

The results of this investigation are the basis for recommended changes in actuarial assumptions for the actuarial valuation to be performed as of January 1, 2007.

The purpose of this report is to communicate the results of our review of the mortality assumptions to be used in the completion of the upcoming valuation. Our recommendations are designed to anticipate the emerging experience of the System.

In preparing this report, we relied without audit on information supplied by the System's staff. In our examination, we have found the data to be reasonably consistent and comparable with data used for other purposes. It should be noted that if any data or other information is inaccurate or incomplete, our calculations might need to be revised.

We hereby certify that, to the best of our knowledge and belief, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices which are consistent with the principles prescribed by the Actuarial Standards Board (ASB) and the Code of Professional Conduct and Qualification Standards for Public Statements of Actuarial Opinion of the American Academy of Actuaries.

We further certify that the assumptions developed in this report satisfy ASB Standards of Practice, in particular, No. 35 (Selection of Demographic and Other Non-economic Assumptions for Measuring Pension Obligations).

Milliman's work product was prepared exclusively for the System for a specific and limited purpose. It is a complex, technical analysis that assumes a high level of knowledge concerning the System's operations, and uses the System's data, which Milliman has not audited. It is not for the use or benefit of any third party for any purpose. Any third party recipient of Milliman's work product who desires professional guidance should not rely upon Milliman's work product, but should engage qualified professionals for advice appropriate to its own specific needs. Any distribution of this report must be in its entirety including this cover letter, unless prior written consent from Milliman is obtained.



Retirement Board  
May 2, 2006  
Page Two

We would like to express our appreciation to Patricia F. Pabst, Retirement System Director, and the members of her staff, who gave substantial assistance in supplying the data on which this report is based.

I, Mark Olleman am a member of the American Academy of Actuaries, a Fellow of the Society of Actuaries, and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained herein.

I respectfully submit the following report, and look forward to discussing it with you,

Sincerely,

A handwritten signature in black ink that reads "Mark C. Olleman". The signature is fluid and cursive, with a long horizontal flourish at the end.

Mark C. Olleman, FSA, EA, MAAA  
Consulting Actuary  
MCO/kjk

cc: Ms. Karen Steffen

KIS/MCO/rsc

**TACOMA EMPLOYEES' RETIREMENT SYSTEM  
2002 - 2005 Mortality Study**

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# TACOMA EMPLOYEES' RETIREMENT SYSTEM 2002 - 2005 Mortality Study

## Section 1

### Executive Summary and Recommendations

This study analyzes the mortality assumptions to be used in the January 1, 2007 actuarial valuation of the Tacoma Employees' Retirement System (TERS).

#### Section 2 - Introduction

Just as certain investment choices have an associated "investment risk", choices in actuarial assumptions have an associated "actuarial risk." Determining the adequacy of the current contribution rates is dependent on the assumptions we use to project the future benefit payments and then to discount the value of future benefits to determine the present values. Thus, it is important that the Board understand the sensitivity of the actuarial calculations to the underlying assumptions.

Section 2 provides an introduction to the process of setting both demographic and economic actuarial assumptions. It discusses the following:

- The "actuarial risk" associated with setting actuarial assumptions.
- An overview of the process we follow in analyzing the retired mortality assumptions.
- Our philosophy in setting actuarial assumptions.
- Actuarial Standards of Practice No. 27 and No. 35.

#### Section 3 – Mortality Assumptions

Section 3 discusses the mortality assumptions. Our recommendations are to:

- Adopt new assumptions that are consistent with the most recent tables published by the Society of Actuaries and TERS mortality experience of the last 4 years.

Project mortality improvements using the standard RP-2000 scale (Scale AA) in one of the 2 following manners:

- Adopt a full generational mortality assumption where longevity is assumed to vary by year of birth.
- Project mortality improvements to 2015.

A full generational mortality assumption will produce somewhat higher costs, because it projects mortality past 2015. A full generational mortality assumption attempts to project all future mortality improvements now. This method is not yet commonly used by retirement systems, but we expect it to become common in the near future.

Projecting mortality to 2015 can be seen as a half way approach. Enough margin is provided so that experience losses are not expected to accumulate before 2015. If this approach is taken, we recommend a generational mortality assumption be carefully considered when the next mortality study is performed 4 years from now.

## Financial Impact

The 4 projections on the following pages show the impact on the January 31, 2006 Early Warning Calculations of the revised assumptions using both a static projection of mortality improvements to 2015 and a full generational mortality assumption. In both cases the January 1, 2007 contribution required by a 20 year amortization of the reserve is less than the current 14.00% contribution rate if experience follows the actuarial assumptions. If the "20 Year Amortization Rate" is larger than the current 14.00% contribution rate, then the Board's funding policy says the Board will "consider" recommending a contribution increase.

The impact of the revised assumptions is shown on Line E of each projection. It is important to remember that the actuarial assumptions will not change the actual rate at which members die or the System's actual costs. The actuarial assumptions will only anticipate the System's emerging costs to the extent that they correctly anticipate future experience.

- Projection 1: Mortality projected to 2015, 7.75% returns in all future years.  
The Normal Cost Rate increases from 16.25% to 16.87%. The 20 year amortization rate at January 1, 2007 is 12.44%.
- Projection 2: Generational mortality projection, 7.75% returns in all future years.  
The Normal Cost Rate increases from 16.25% to 17.25%. The 20 year amortization rate at January 1, 2007 is 13.46%.
- Projections 3 and 4: One year of -8.90% investment returns.  
Two of the largest risks facing the System's funding are the potentials of low asset returns, and contribution volatility. Projections 3 and 4 modify projections 1 and 2 by assuming the System earns a negative 8.9% asset return for one year followed by 7.75% in the next 3 years. Negative 8.9% was used as an example because it was the System's actual return in 2002. One year of negative 8.9% is not the worst possibility facing the System. For instance, an extended bear market could cause greater decreases in funding.

The asset losses shown in Projections 3 and 4 would be projected to result in: Funded Ratios below 100% and 20 Year Amortization Rates that grow to 20.21% of pay in Projection 3 or 21.41% of pay in Projection 4. This is significantly more than the current contribution rate of 14.00%.

General comments: These projections incorporate the System's final December 31, 2005 assets as provided by the Retirement System. A general wage increase of 2.3% is used on line D. Final wage increases have not yet been determined. Smaller wage increases would be more favorable to the System. The data and methods are the same as disclosed in our January 31, 2006 early warning letter except for the mortality assumptions and the December 31, 2005 assets.

## Projection 1: Mortality Improvements Projected to 2015, 7.75% Returns in All Future Years Tacoma City Employees' Retirement System

based on the current total contribution rate of 14.00%  
(all dollar amounts in millions)

	Actuarial Accrued Liability	Actuarial Assets	Actuarial Funded Ratio	Market Assets	Market Value Funded Ratio	Normal Cost Rate	Contribution Rate Minus Normal Cost Rate	Funding Reserve Amortization Period	20 Year Amortization Rate*	
<b>January 1, 2005 Valuation</b>										
<b>A. January 1, 2005 Valuation Results</b>	\$754.3	\$807.3	107.0%	\$889.9	118.0%	16.25%	-2.25%	18.6	14.14%	
<b>January 1, 2006 Estimates</b> (Based on January 1, 2005 Census Data)										
<b>B. Line A Projected to 1/1/2006</b> Expected 12/31/2005 assets assuming 7.75% market return in 2005	\$806.2	\$885.2	109.8%	\$948.1	117.6%	16.25%	-2.25%	33.3	12.94%	
<b>C. 12/31/2005 Assets (2005 Asset Gain/Loss added to Line B)</b> Final assets (provided by Retirement System)	\$805.0	\$886.3	110.1%	\$955.6	118.7%	16.25%	-2.25%	35.2	12.84%	
<b>D. 1/1/2006 Salary Gain added to Line C</b> Estimated Salary Gain (General Wage Increase for 2006 = 2.3%) with Approximate assets (provided by Retirement System)	\$797.5	\$886.3	111.1%	\$955.6	119.8%	16.25%	-2.25%	44.2	12.38%	
<b>E. Mortality assumption projected to 2015 added to Line D</b> Based on Static Projection of Mortality to 2015	\$832.8	\$886.3	106.4%	\$955.6	114.7%	16.87%	-2.87%	13.2	14.97%	
<b>F. 1/1/2006 with Optional Plan Changes added to Line E</b> Estimated Percent Increase in Actuarial Accrued Liability and Normal Cost Revised for Plan Changes	INPUT 0.0%	\$886.3	106.4%	\$955.6	114.7%	INPUT 16.87%	-2.87%	13.2	14.97%	
<b>Projections</b>										
<b>G. Line F Projected to January 1, 2007</b> Input Market Return on Assets for 2006 Expected 1/1/2007 given input market return for 2006				INPUT 7.75%	\$1,016.5	114.3%	16.87%	-2.87%	36.2	12.44%
<b>H. Line G Projected to January 1, 2008</b> Input Market Return on Assets for 2007 Expected 1/1/2008 given input market returns for 2006 & 2007				INPUT 7.75%	\$1,079.9	113.8%	16.87%	-2.87%	50.6	11.62%
<b>I. Line H Projected to January 1, 2009</b> Input Market Return on Assets for 2008 Expected 1/1/2009 given input market returns for 2006 to 2008				INPUT 7.75%	\$1,145.9	113.4%	16.87%	-2.87%	51.9	11.58%
<b>J. Line I Projected to January 1, 2010</b> Input Market Return on Assets for 2009 Expected 1/1/2010 given input market returns for 2006 to 2009				INPUT 7.75%	\$1,214.3	113.0%	16.87%	-2.87%	50.9	11.61%

\* The Board's funding policy states that if the amortization of the funding reserve (also called funding excess) is over a period shorter than 20 years the Retirement Board will consider an increase in the contribution rates. As an example, Line A, the January 1, 2005 valuation would amortize the funding reserve in 18.6 years. This is due to a current total contribution rate of 14.00% which is 2.25% of pay less than the normal cost rate of 16.25%. Based on line A, the total contribution rate would have to be increased by 0.14% to 14.14% starting January 1, 2006 to maintain an amortization of the funding reserve over the 20 year period January 1, 2005 to January 1, 2025.

**Projection 2: Generational Mortality Projections, 7.75% Returns in All Future Years  
Tacoma City Employees' Retirement System**  
based on the current total contribution rate of 14.00%  
(all dollar amounts in millions)

	Actuarial Accrued Liability	Actuarial Assets	Actuarial Funded Ratio	Market Assets	Market Value Funded Ratio	Normal Cost Rate	Contribution Rate Minus Normal Cost Rate	Funding Reserve Amortization Period	20 Year Amortization Rate*	
<b>January 1, 2005 Valuation</b>										
<b>A. January 1, 2005 Valuation Results</b>	\$754.3	\$807.3	107.0%	\$889.9	118.0%	16.25%	-2.25%	18.6	14.14%	
<b>January 1, 2006 Estimates</b> (Based on January 1, 2005 Census Data)										
<b>B. Line A Projected to 1/1/2006</b> Expected 12/31/2005 assets assuming 7.75% market return in 2005	\$806.2	\$885.2	109.8%	\$948.1	117.6%	16.25%	-2.25%	33.3	12.94%	
<b>C. 12/31/2005 Assets (2005 Asset Gain/Loss added to Line B)</b> Final assets (provided by Retirement System)	\$805.0	\$886.3	110.1%	\$955.6	118.7%	16.25%	-2.25%	35.2	12.84%	
<b>D. 1/1/2006 Salary Gain added to Line C</b> Estimated Salary Gain (General Wage Increase for 2006 = 2.3%) with Approximate assets (provided by Retirement System)	\$797.5	\$886.3	111.1%	\$955.6	119.8%	16.25%	-2.25%	44.2	12.38%	
<b>E. Generational Mortality added to Line D</b> Based on Generational Mortality	\$842.3	\$886.3	105.2%	\$955.6	113.5%	17.25%	-3.25%	8.9	15.94%	
<b>F. 1/1/2006 with Optional Plan Changes added to Line E</b> Estimated Percent Increase in Actuarial Accrued Liability and Normal Cost Revised for Plan Changes	INPUT 0.0%	\$886.3	105.2%	\$955.6	113.5%	INPUT 17.25%	-3.25%	8.9	15.94%	
<b>Projections</b>										
<b>G. Line F Projected to January 1, 2007</b> Input Market Return on Assets for 2006 Expected 1/1/2007 given input market return for 2006				INPUT 7.75%	\$1,016.5	112.9%	17.25%	-3.25%	24.0	13.46%
<b>H. Line G Projected to January 1, 2008</b> Input Market Return on Assets for 2007 Expected 1/1/2008 given input market returns for 2006 & 2007				INPUT 7.75%	\$1,079.9	112.3%	17.25%	-3.25%	30.8	12.72%
<b>I. Line H Projected to January 1, 2009</b> Input Market Return on Assets for 2008 Expected 1/1/2009 given input market returns for 2006 to 2008				INPUT 7.75%	\$1,145.9	111.8%	17.25%	-3.25%	30.8	12.70%
<b>J. Line I Projected to January 1, 2010</b> Input Market Return on Assets for 2009 Expected 1/1/2010 given input market returns for 2006 to 2009				INPUT 7.75%	\$1,214.3	111.3%	17.25%	-3.25%	29.8	12.81%

\* The Board's funding policy states that if the amortization of the funding reserve (also called funding excess) is over a period shorter than 20 years the Retirement Board will consider an increase in the contribution rates. As an example, Line A, the January 1, 2005 valuation would amortize the funding reserve in 18.6 years. This is due to a current total contribution rate of 14.00% which is 2.25% of pay less than the normal cost rate of 16.25%. Based on line A, the total contribution rate would have to be increased by 0.14% to 14.14% starting January 1, 2006 to maintain an amortization of the funding reserve over the 20 year period January 1, 2005 to January 1, 2025.

**Projection 3: Mortality Improvements Projected to 2015, One Year of -8.90% Return followed by 7.75% Returns in All Future Years  
Tacoma City Employees' Retirement System**

based on the current total contribution rate of 14.00%  
(all dollar amounts in millions)

	Actuarial Accrued Liability	Actuarial Assets	Actuarial Funded Ratio	Market Assets	Market Value Funded Ratio	Normal Cost Rate	Contribution Rate Minus Normal Cost Rate	Funding Reserve Amortization Period	20 Year Amortization Rate*
<b>January 1, 2005 Valuation</b>									
<b>A. January 1, 2005 Valuation Results</b>	\$754.3	\$807.3	107.0%	\$889.9	118.0%	16.25%	-2.25%	18.6	14.14%
<b>January 1, 2006 Estimates</b> (Based on January 1, 2005 Census Data)									
<b>B. Line A Projected to 1/1/2006</b>	\$806.2	\$885.2	109.8%	\$948.1	117.6%	16.25%	-2.25%	33.3	12.94%
Expected 12/31/2005 assets assuming 7.75% market return in 2005									
<b>C. 12/31/2005 Assets (2005 Asset Gain/Loss added to Line B)</b>	\$805.0	\$886.3	110.1%	\$955.6	118.7%	16.25%	-2.25%	35.2	12.84%
Final assets (provided by Retirement System)									
<b>D. 1/1/2006 Salary Gain added to Line C</b>	\$797.5	\$886.3	111.1%	\$955.6	119.8%	16.25%	-2.25%	44.2	12.38%
Estimated Salary Gain (General Wage Increase for 2006 = 2.3%) with Approximate assets (provided by Retirement System)									
<b>E. Mortality assumption projected to 2015 added to Line D</b>	\$832.8	\$886.3	106.4%	\$955.6	114.7%	16.87%	-2.87%	13.2	14.97%
Based on Static Projection of Mortality to 2015									
<b>F. 1/1/2006 with Optional Plan Changes added to Line E</b>	INPUT					INPUT			
Estimated Percent Increase in Actuarial Accrued Liability and Normal Cost Revised for Plan Changes	0.0%					0.0%			
	\$832.8	\$886.3	106.4%	\$955.6	114.7%	16.87%	-2.87%	13.2	14.97%
<b>Projections</b>									
<b>G. Line F Projected to January 1, 2007</b>				INPUT					
Input Market Return on Assets for 2006				-8.90%					
Expected 1/1/2007 given input market return for 2006	\$889.6	\$957.7	107.7%	\$858.4	96.5%	16.87%	-2.87%	17.2	14.37%
<b>H. Line G Projected to January 1, 2008</b>				INPUT					
Input Market Return on Assets for 2007				7.75%					
Expected 1/1/2008 given input market returns for 2006 & 2007	\$948.7	\$986.5	104.0%	\$909.6	95.9%	16.87%	-2.87%	7.9	15.92%
<b>I. Line H Projected to January 1, 2009</b>				INPUT					
Input Market Return on Assets for 2008				7.75%				Unfunded	
Expected 1/1/2009 given input market returns for 2006 to 2008	\$1,010.4	\$1,001.9	99.2%	\$962.4	95.2%	16.87%	-2.87%	Grows	18.08%
<b>J. Line I Projected to January 1, 2010</b>				INPUT					
Input Market Return on Assets for 2009				7.75%				Unfunded	
Expected 1/1/2010 given input market returns for 2006 to 2009	\$1,074.4	\$1,016.6	94.6%	\$1,016.6	94.6%	16.87%	-2.87%	Grows	20.21%

\* The Board's funding policy states that if the amortization of the funding reserve (also called funding excess) is over a period shorter than 20 years the Retirement Board will consider an increase in the contribution rates. As an example, Line A, the January 1, 2005 valuation would amortize the funding reserve in 18.6 years. This is due to a current total contribution rate of 14.00% which is 2.25% of pay less than the normal cost rate of 16.25%. Based on line A, the total contribution rate would have to be increased by 0.14% to 14.14% starting January 1, 2006 to maintain an amortization of the funding reserve over the 20 year period January 1, 2005 to January 1, 2025.

**Projection 4: Generational Mortality Projections, One Year of -8.90% Return followed by 7.75% Returns in All Future Years  
Tacoma City Employees' Retirement System**

based on the current total contribution rate of 14.00%  
(all dollar amounts in millions)

	Actuarial Accrued Liability	Actuarial Assets	Actuarial Funded Ratio	Market Assets	Market Value Funded Ratio	Normal Cost Rate	Contribution Rate Minus Normal Cost Rate	Funding Reserve Amortization Period	20 Year Amortization Rate*	
<b>January 1, 2005 Valuation</b>										
<b>A. January 1, 2005 Valuation Results</b>	\$754.3	\$807.3	107.0%	\$889.9	118.0%	16.25%	-2.25%	18.6	14.14%	
<b>January 1, 2006 Estimates</b> (Based on January 1, 2005 Census Data)										
<b>B. Line A Projected to 1/1/2006</b> Expected 12/31/2005 assets assuming 7.75% market return in 2005	\$806.2	\$885.2	109.8%	\$948.1	117.6%	16.25%	-2.25%	33.3	12.94%	
<b>C. 12/31/2005 Assets (2005 Asset Gain/Loss added to Line B)</b> Final assets (provided by Retirement System)	\$805.0	\$886.3	110.1%	\$955.6	118.7%	16.25%	-2.25%	35.2	12.84%	
<b>D. 1/1/2006 Salary Gain added to Line C</b> Estimated Salary Gain (General Wage Increase for 2006 = 2.3%) with Approximate assets (provided by Retirement System)	\$797.5	\$886.3	111.1%	\$955.6	119.8%	16.25%	-2.25%	44.2	12.38%	
<b>E. Generational Mortality added to Line D</b> Based on Generational Mortality	\$842.3	\$886.3	105.2%	\$955.6	113.5%	17.25%	-3.25%	8.9	15.94%	
<b>F. 1/1/2006 with Optional Plan Changes added to Line E</b> Estimated Percent Increase in Actuarial Accrued Liability and Normal Cost Revised for Plan Changes	INPUT 0.0%	\$886.3	105.2%	\$955.6	113.5%	INPUT 17.25%	-3.25%	8.9	15.94%	
<b>Projections</b>										
<b>G. Line F Projected to January 1, 2007</b> Input Market Return on Assets for 2006 Expected 1/1/2007 given input market return for 2006				INPUT -8.90%	\$858.4	95.3%	17.25%	-3.25%	11.7	15.39%
<b>H. Line G Projected to January 1, 2008</b> Input Market Return on Assets for 2007 Expected 1/1/2008 given input market returns for 2006 & 2007				INPUT 7.75%	\$909.6	94.6%	17.25%	-3.25%	4.4	17.01%
<b>I. Line H Projected to January 1, 2009</b> Input Market Return on Assets for 2008 Expected 1/1/2009 given input market returns for 2006 to 2008				INPUT 7.75%	\$962.4	93.9%	17.25%	-3.25%	Unfunded Grows	19.22%
<b>J. Line I Projected to January 1, 2010</b> Input Market Return on Assets for 2009 Expected 1/1/2010 given input market returns for 2006 to 2009				INPUT 7.75%	\$1,016.6	93.2%	17.25%	-3.25%	Unfunded Grows	21.41%

\* The Board's funding policy states that if the amortization of the funding reserve (also called funding excess) is over a period shorter than 20 years the Retirement Board will consider an increase in the contribution rates. As an example, Line A, the January 1, 2005 valuation would amortize the funding reserve in 18.6 years. This is due to a current total contribution rate of 14.00% which is 2.25% of pay less than the normal cost rate of 16.25%. Based on line A, the total contribution rate would have to be increased by 0.14% to 14.14% starting January 1, 2006 to maintain an amortization of the funding reserve over the 20 year period January 1, 2005 to January 1, 2025.

**TACOMA EMPLOYEES' RETIREMENT SYSTEM  
2002 - 2005 Mortality Study**

**Section 2**

**Introduction**

Actuarial assumptions can be broken into three broad groups:

- Active Demographic Assumptions
- Retired Mortality
- Economic Assumptions

The System's Assumptions are studied in even years and actuarial valuations are performed in odd years. The assumptions are studied on the following 4 year cycle:

<u>Year</u>	<u>Assumptions Studied</u>
2002	Retired Mortality Assumptions
2004	Active Demographic Assumptions and Economic Assumptions
2006	Retired Mortality Assumptions
2008	Active Demographic Assumptions and Economic Assumptions

The focus of this study is the Retired Mortality Assumptions. This section however encompasses all three groups, provides an overview of the process and importance of setting actuarial assumptions, and comments on the continued appropriateness of the economic assumptions. A full review of the economic assumptions will be performed in the 2008 assumption review.

**A. Funding and Valuation Principles**

Just as certain investment choices have an associated "investment risk," choices in actuarial assumptions have an associated "actuarial risk." Our responsibility is to always consider the impact our work will have on future taxpayers and the members of the Retirement System.

Determining the adequacy of the current contribution rates is dependent on the actuarial assumptions. Thus, it is important that the Board understand the sensitivity of the actuarial calculations to the underlying assumptions.

- If, as the retained actuary, we overestimate the true cost of the plan, justified benefit improvements to employees may be inappropriately denied.
- If, as the retained actuary, we underestimate true costs, inappropriate benefit increases may be enacted. Also, if our assumptions understate the true cost, future taxpayers may be required to bear a burden that rightfully belongs to the current taxpayers.

As an example consider the assumption for investment return. Since the actuarial assumptions are set for the long term, it is expected that in the short term there will be years in which the actual investment return will exceed the actuarial assumed rate, and there will be years when the actual experience will not meet the assumed rate. It is the expected long-term rate that is used to project and finance the retirement benefits.

It should be recognized that a higher investment return assumption will tend to lower required contributions in the short term, while a lower investment return assumption will tend to require higher contributions in the short term. However, the actuarial assumptions will not change the System's actual experience. If actual experience is less favorable than assumed, actuarial losses will develop requiring higher contributions in the long term. In addition, any move back from a more optimistic assumption to a less optimistic assumption will also tend to result in higher contribution rates and, thus, higher taxes. These concepts apply to the selection of all actuarial assumptions.

The question that needs to be asked in the public sector is: How great an actuarial risk is the Board, and thus the City of Tacoma, willing to accept in the actuarial assumptions? If actuarial experience gains materialize, the funded status will be better than expected. If actuarial experience losses materialize, what will be the consequences?

As stated above the actuarial assumptions can be divided into three groups: economic, active demographic, and retired mortality. The economic assumptions must not only reflect the System's actual experience but also give even greater consideration to the long-term expectation of future economic growth for the nation, as well as the global economy. By long term, we are looking at time periods of from 20 to 40, possibly to 60, years – a much longer time frame than any period investment managers or economists would be discussing with you.

The non-economic, or demographic assumptions including retired mortality, are based on the System's actual experience, adjusted to reflect trends and historical experience. Thus, the economic assumptions are much more subjective than the demographic assumptions, and the demographic assumptions are much more dependent on the results of the experience studies.

## **B. Overview**

This report presents the results of an investigation of the recent retired mortality experience of the System. We will refer to this investigation as an experience study.

Throughout this report, we refer to "expected" and "proposed" actuarial assumptions. The "expected" assumptions are those used in our last actuarial valuation. They may also be referred to as the "current" or "old" assumptions. The "proposed" or "recommended" assumptions are those we recommend for use in the valuation as of January 1, 2007 and for subsequent valuations until further changes are made. Note that the Retirement Board has the authority and responsibility to make the final decision regarding the appropriateness of the assumptions.

Economic assumptions are generally chosen on the basis of the actuary's expectations as to the effect of future economic conditions on the operation of the Retirement System. However, the setting of these assumptions is much more subjective than setting and recommending the demographic assumptions. This report briefly reviews the continued appropriateness of the economic assumptions.

Section 3 of this report shows the results of our study of retired member mortality. The exhibits are detailed comparisons between actual and expected experience on both the current and proposed bases. For each type of assumption, graphs show the actual, the expected (or old) and proposed rates. The exhibits also show the total numbers of actual and expected deaths.

For each exhibit, the actual decrement rates are shown as bar graphs on an age-by-age basis and a 5 year grouping of age basis. The current rates – also referred to as “expected” or “old” rates – used in the most recent actuarial valuation, are shown as well as the new proposed assumptions as line graphs. Therefore, the assumption changes we are proposing are illustrated by the difference between the two lines in each exhibit.

### C. Our Philosophy

Similar to an actuarial valuation, the calculation of actual and expected experience is a fairly mechanical process. From one actuary to another, you would expect to see very little difference. However, the setting of assumptions is a different story, as it is more art than science. In this report, we present alternative assumptions. To help you understand our thought process, here is a brief summary of our philosophy:

- **Don't overreact:** When we see significant changes in experience, we generally do not adjust our rates to reflect the entire difference. We will generally recommend rates somewhere between the old rates and the new experience. If the experience during the next study shows the same result, we will probably recognize this trend at that point. On the other hand, if the experience returns closer to its prior level, we will not have overreacted, possibly causing unnecessary volatility in contribution rates.
- **Anticipate Trends:** If there is an identified trend that is expected to continue, we believe that this should be recognized. An example of this is the retiree mortality assumption. It is an established trend that people are continuing to live longer; therefore, we build in a margin to reflect future decreases in mortality rates.
- **Simplify:** Where there is no material difference in results, we attempt to simplify our assumptions and methods. There is no point in complexity that does not improve accuracy.

### D. Actuarial Standard of Practice No. 27 – Selection of Economic Assumptions

The Actuarial Standards Board has adopted Actuarial Standard of Practice (ASOP) No. 27, *Selection of Economic Assumptions for Measuring Pension Obligations*. This standard provides guidance to actuaries giving advice on selecting economic assumptions for measuring obligations under defined benefit plans, such as TERS.

Because no one knows what the future holds, the best an actuary can do is to use professional judgment to estimate possible future economic outcomes. These estimates are based on a mixture of past experience, future expectations, and professional judgment. The actuary should consider a number of factors, including the purpose and nature of the measurement, and appropriate recent and long-term historical economic data. However, the standard explicitly advises the actuary not to give undue weight to recent experience.

Recognizing that there is not one “right answer”, the standard calls for the actuary to develop a best estimate range for each economic assumption, and then recommend a specific point within that range. Each economic assumption should individually satisfy this standard.

After completing the selection process, the actuary should review the set of economic assumptions for consistency. As an example, an inflation component used in both the investment return and wage growth assumptions should be consistent. If a change occurs in one assumption, the actuary needs to consider if the change should modify other economic assumptions as well.

An actuary’s best-estimate range with respect to a particular measurement of pension obligations may change from time to time due to changing conditions or emerging plan experiences. The actuary may change assumptions frequently in certain situations, even if the best-estimate range has not changed materially, and less frequently in other situations. Even if assumptions are not changed, the actuary needs to be satisfied that each of the economic assumptions selected for a particular measurement complies with Actuarial Standard of Practice No. 27 (ASOP No. 27).

The following section provides a brief review confirming that the System’s economic assumptions adopted 2 years ago remain reasonable. We will do a full review of the economic assumptions when we review the active demographic assumptions in two years.

## E. Economic Assumption Review

Two years ago the System adopted economic assumptions of 3.25% inflation and 4.50% real return for a total investment return assumption (net of investment expenses) of 7.75%. At the same time a real wage growth assumption of 0.75% was adopted which when added to the 3.25% inflation assumption provided a total wage growth assumption of 4.00%. Our analysis of the inflation and real wage growth assumptions is unchanged since our prior report. A full description is therefore provided in our 2004 experience study report. This report focuses on the investment real rate of return assumption using Wilshire's most recent assumptions. Our analysis confirms the current economic assumptions to be reasonable.

Wilshire provided us with their most recent capital market assumptions and the System's target asset allocation for this study. They are:

Asset Category	Target Asset Allocation	Expected Return	Standard Deviation
US Stocks	40%	8.25%	17.00%
International Equity	15	8.25%	19.00%
Core U.S. Bonds	20	5.00%	5.00%
High Yield	10	6.50%	10.00%
REITs	15	6.25%	16.00%
Total Portfolio	100%		

### Correlation Table

	US Stocks	Int. Equity	Core US Bond	High Yield	REITS
US Stocks	1.00				
International Equity	0.74	1.00			
Core US Bonds	0.29	0.11	1.00		
High Yield	0.48	0.28	0.39	1.00	
REITS	0.30	0.20	0.15	0.30	1.00

We applied Wilshire's assumptions and the target asset allocation to a model based on mathematical formulas from *The Long-Term Expected Rate of Return: Setting It Right* by Olivier de la Grandville as published in the *Financial Analysts Journal*, Nov/Dec 1998. The capital market assumptions were adjusted to remove Wilshire's inflation assumption of 2.25%. The model provides a guide to see what long term compounded returns are reasonable to expect. The results are summarized below, showing expected real rates of return up to 30 years.

HORIZON in Years	Mean	Std Dev	Percentile Results for Real Rate of Return				
			5 <sup>th</sup>	25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>	95 <sup>th</sup>
1	4.9%	10.9%	-12.0%	-2.7%	4.3%	11.9%	23.7%
5	4.4	4.8	-3.4	1.1	4.3	7.6	12.6
10	4.4	3.4	-1.2	2.0	4.3	6.6	10.1
20	4.3	2.4	0.4	2.7	4.3	6.0	8.4
30	4.3	2.0	1.1	3.0	4.3	5.7	7.6

The average real rate of return for one year is 4.88% (8.13% including an assumed inflation rate of 3.25%). However, the return is subject to significant year-to-year volatility as evidenced by the standard deviation. Volatility over time lowers the mean rate of return, resulting in a 30 year average real rate of return of 4.33% (7.58% including an assumed inflation rate of 3.25%).

Over a thirty-year time horizon, there is a 25% chance the real rate of return will be less than 3.0% and a 25% chance the return will be greater than 5.7%. Therefore, we can say the real return is just as likely to be within the range from 3.0% to 5.7% as not. The median real return over thirty years is expected to be 4.3%. Adding 3.25% for our inflation assumption, less 0.30% for investment expenses to 3.0% and 5.7% gives a reasonable range of 5.95% to 8.65%.

Based on the ASOP No. 27 guidelines and our comments above, we conclude that a reasonable range for the investment return assumption could be from 5.95% to 8.65% for an actuarial valuation of a retirement system with the current TERS asset allocation policy. The current 7.75% investment return assumption is inside this corridor.

Therefore, the current group of economic assumptions, as summarized in the following chart, remains reasonable.

<b><u>Current Economic Assumptions</u></b>	
Inflation	3.25%
Net Real Rate of Return	<u>4.50</u>
Investment Return <sup>(1)</sup>	7.75%
Inflation	3.25%
Real Wage Growth	<u>0.75</u>
Wage Growth	4.00%
Spread (Investment Return - Wage Growth)	3.75%

<sup>(1)</sup> Net of investment expenses.

## **G. Actuarial Standard of Practice No. 35: Selection of Demographic Assumptions**

Actuarial Standard of Practice No. 35 (ASOP No. 35) governs the selection of demographic and other noneconomic assumptions for measuring pension obligations. ASOP No. 35 states that the actuary should use professional judgment to estimate possible future outcomes based on past experience and future expectations, and select assumptions based upon application of that professional judgment. The actuary should select reasonable demographic assumptions in light of the particular characteristics of the defined benefit plan that is the subject of the measurement. A reasonable assumption is one that is expected to appropriately model the contingency being measured and is not anticipated to produce significant cumulative actuarial gains or losses over the measurement period.

### **ASOP No. 35 Steps**

The actuary should follow the following steps in selecting the demographic assumptions:

1. Identify the types of assumptions. Types of demographic assumptions include but are not limited to retirement, mortality, termination of employment, disability, election of optional forms of payment, administrative expenses, family composition, and treatment of missing or incomplete data. The actuary should consider the purpose and nature of the measurement, the materiality of each assumption, and the characteristics of the covered group in determining which types of assumptions should be incorporated into the actuarial model.
2. Consider the relevant assumption universe. The relevant assumption universe includes experience studies or published tables based on the experience of other representative populations, the experience of the plan sponsor, the effects of plan design, and general trends.
3. Consider the assumption format. The assumption format includes whether assumptions are based on parameters such as gender, age, service or calendar year. The actuary should consider the impact the format may have on the results, the availability of relevant information, the potential to model anticipated plan experience, and the size of the covered population.
4. Select the Specific Assumptions. In selecting an assumption the actuary should consider the potential impact of future plan design as well as the factors listed above.
5. Evaluate the Reasonableness of the Selected Assumption. The assumption should be expected to appropriately model the contingency being measured. The assumption should not be anticipated to produce significant actuarial gains or losses.

### **ASOP No. 35 General Considerations and Application**

Each individual demographic assumption should satisfy the criteria of ASOP No. 35. In selecting demographic assumptions the actuary should also consider: the internal consistency between the assumptions, materiality, cost effectiveness, and the combined effect of all assumptions. At each measurement date the actuary should consider whether the selected assumptions continue to be reasonable, but the actuary is not required to do a complete assumption study at each measurement date. In our opinion the demographic assumptions recommended in this report have been developed in accordance with ASOP No. 35.

**TACOMA EMPLOYEES' RETIREMENT SYSTEM  
2002 - 2005 Mortality Study**

**Section 3**

**Mortality Assumptions**

We studied rates of mortality among healthy and disabled retired members. Valuation mortality is a critical assumption, since if members live longer than expected, we will be understating the true cost of the future plan obligations.

**Results**

Overall, we found the actual number of deaths for healthy members (207) was close to what the current rates would have predicted (210). The following is a comparison of the actual-to-expected deaths of retired members by sex and type for the study period January 1, 2002 – December 31, 2005. The counts for proposed assumptions project future improvements in mortality to 2015.

Healthy Members					
Sex	Actual	Old Assumps	Actual / Expected	Proposed Assumps	Actual / Proposed
Male	160	155	103%	145	110%
Female	47	55	85	43	109
Total	207	210	99%	188	110%

Disabled Members					
Sex	Actual	Old Assumps	Actual / Expected	Proposed Assumps	Actual / Proposed
Both	13	9	144%	8	163%

Exhibits 1 - 3 show the results of the study graphically. The rates are currently based on three factors. We studied each of these factors to see if they were significant, and, if so, what the impact was. We found the System to have the same trends as are generally true for all mortality studies:

- **Age:** Members at older ages tend to have a greater probability of dying than younger members.
- **Sex:** Male members tend to have a greater probability of dying than females.
- **Retirement Type:** Healthy retirees live longer than disabled retirees.

**Mortality Improvement**

It is an established trend that people are living longer. We believe it is appropriate to reflect future mortality improvements. Our long standing method has been to include a “margin” in the rates (predicting fewer deaths in the future than are actually occurring in the present experience). This results in a ratio of actual to expected deaths over 100%.

Another way to account for trends in long term mortality is to use generational mortality improvements. This method is more sophisticated, but is now practical given improvements in technology. The “generational” mortality approach assumes mortality will improve very slightly each year. For example, a member turning 65 in 2007 is assumed to have a slightly smaller probability of dying while 65 than a member who turns 65 in 2006. The RP-2000 Mortality Table is the most recently published table; it was developed by the Society of Actuaries, and it includes a scale to project generational mortality (Scale AA).

## Recommendations

We recommend changing the mortality assumptions. We recommend using the RP-2000 Mortality Tables as the base table for all groups, adjusting the standard rates to be either lower or higher than these rates (an age set back or age set forward) to recognize the System’s experience over the last 4 years. We further recommend projecting mortality improvements using the standard RP-2000 scale (Scale AA) in one of the 2 following manners:

- Project mortality improvements to 2015. This will provide an actual death to expected deaths ratio of approximately 110%.
- Adopt a full generational mortality assumption where longevity is assumed to vary by year of birth.

The Society of Actuaries RP-2000 study indicates mortality is expected to continue improving past 2015. We expect future experience to confirm this. We further expect that using generational mortality assumptions, where mortality for each member is projected until the date of their death, is likely to become common. However, the use of generational mortality assumptions is still in the early stages among retirement systems. If a full generational assumption is not adopted now, we strongly recommend the System consider a full generational assumption when the next mortality study is performed in 4 years.

Exhibits 1 to 3 are based on a static projection of mortality improvement to 2015. If a full generational mortality assumption is adopted, it would extend the projections of mortality to individual members’ dates of death.

Our specific recommendations are as follows:

- **Healthy Male Mortality (Exhibit 1):** The actual experience is close to what the assumption predicted (actual deaths are 103% of expected). The recommended mortality rates projected to 2015 produce a 110% actual to expected ratio. Our recommendation is the RP2000 Combined Mortality Table for Males set forward 1 year with mortality improvements projected by Scale AA to 2015, or full generational mortality.
- **Healthy Female Mortality (Exhibit 2):** The actual experience is not close to what the assumption predicted (actual deaths are 85% of expected). We are recommending higher mortality rates which produce a 109% actual to expected ratio when projected to 2015. Our recommendation is the RP2000 Combined Mortality Table for Females set back 1 year with mortality improvements projected by Scale AA to 2015, or full generational mortality.

- **Disabled Mortality (Exhibit 3):** There have only been 13 deaths from this group in the last 4 years. 13 deaths during the study period is not a statistically valid sample size. Therefore, we recommend using a standard RP2000 disabled mortality table with no set forward or set back. Since there have been more deaths than expected, we recommend using the RP2000 male disabled mortality table instead of the female table. Our recommendation is therefore the RP2000 Disabled Mortality Table for Males with mortality improvements projected by Scale AA to 2015, or full generational mortality.
- **Beneficiary Mortality:** In previous actuarial valuations, we have used the same mortality assumptions for beneficiaries as for retirees. We recommend continuing this practice. It is impractical to study beneficiary mortality, because reliable data is only for beneficiaries who survive the related retiree, not for beneficiaries who predecease the related retiree. This results in an undercount of beneficiary deaths. A study using such incomplete data gives misleading results. Moreover, there is no reason to believe that the mortality of beneficiaries should be significantly different from that of service retirees of the same sex.
- **Active Member Mortality:** Active member mortality experience is often incomplete due to members who terminate employment before they die, and the possibility of deaths of members with low service being classified as terminations. The Study of Public Employee Retirement Systems released by the Society of Actuaries in 2002 states:

“Of all noneconomic assumptions reviewed in PERS experience studies, active mortality displayed the greatest overall variance from expectations. For all studies reporting numbers of actual and expected deaths, there were about 32,000 actual deaths compared with 45,000 expected occurrences, yielding an overall active mortality ratio of about 71%. Active mortality does not have a major impact on the calculation of plan liabilities and costs.”

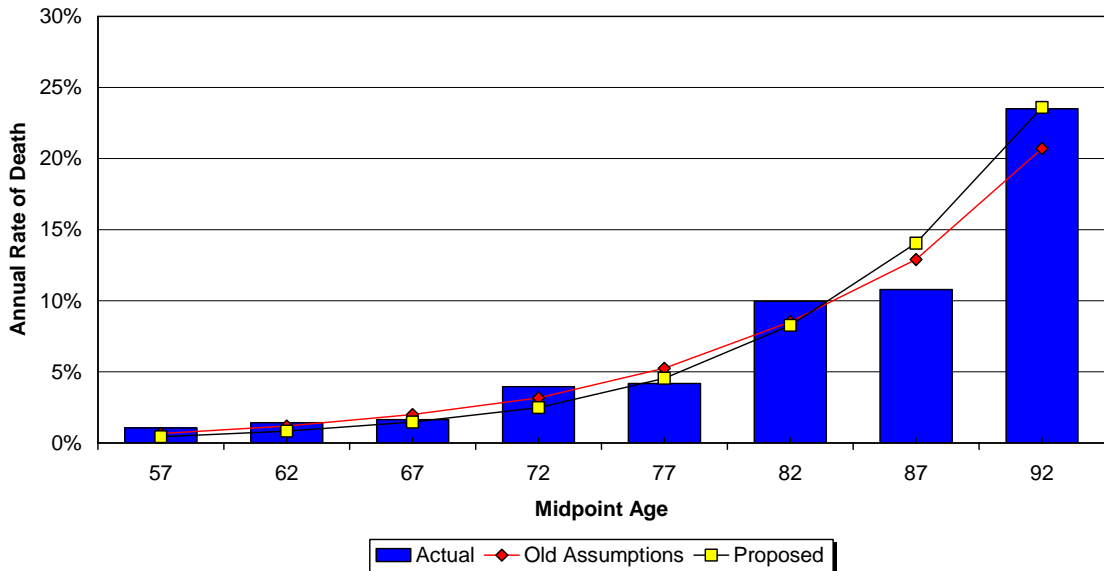
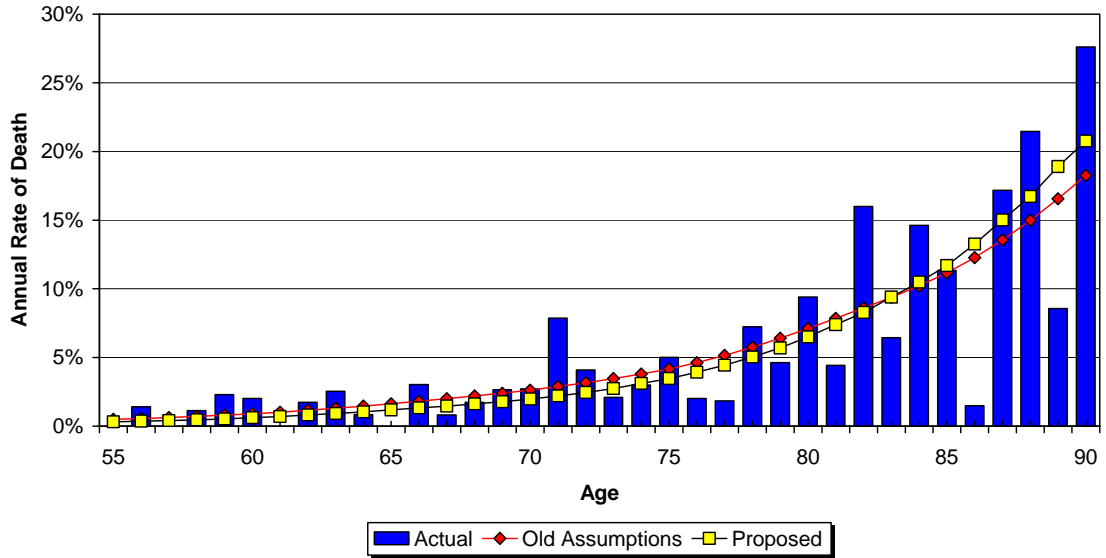
Therefore since the System has very few deaths of active members to use in forming an assumption, data on active mortality is not consistent, and the active mortality assumption does not have a major impact on costs, we recommend using the simplified method of adopting the new mortality assumptions for actives as well as retirees.

**TACOMA EMPLOYEES' RETIREMENT SYSTEM  
2002 - 2005 Mortality Study**

**Exhibit 1**

**Mortality Rates  
Service – Male**

**January 1, 2002 through December 31, 2005**



	Old Assumptions	Actual	Proposed
Total Count	155	160	145
Actual / Expected	103%		110%

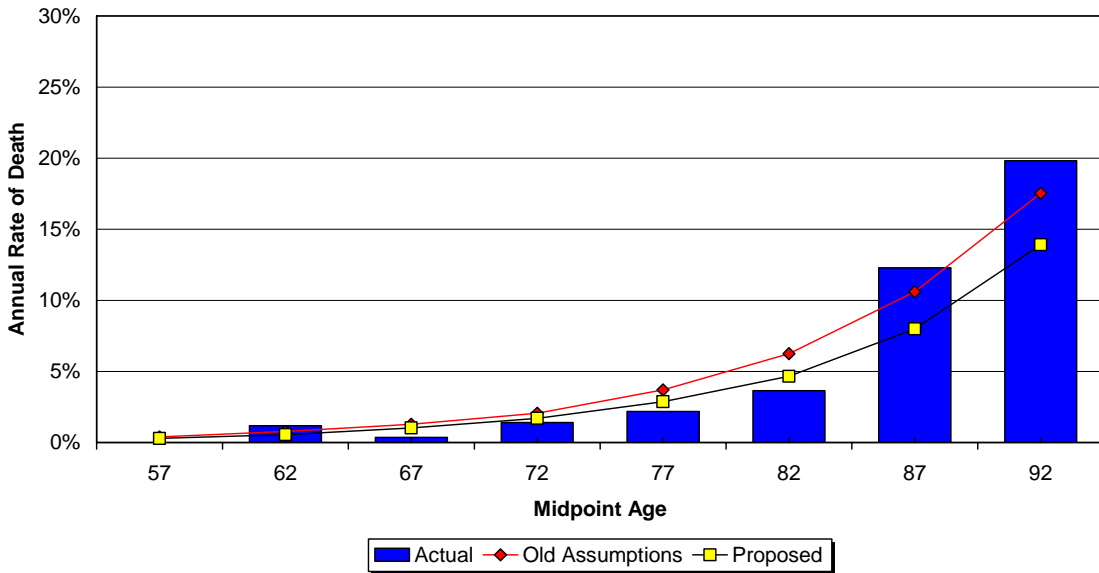
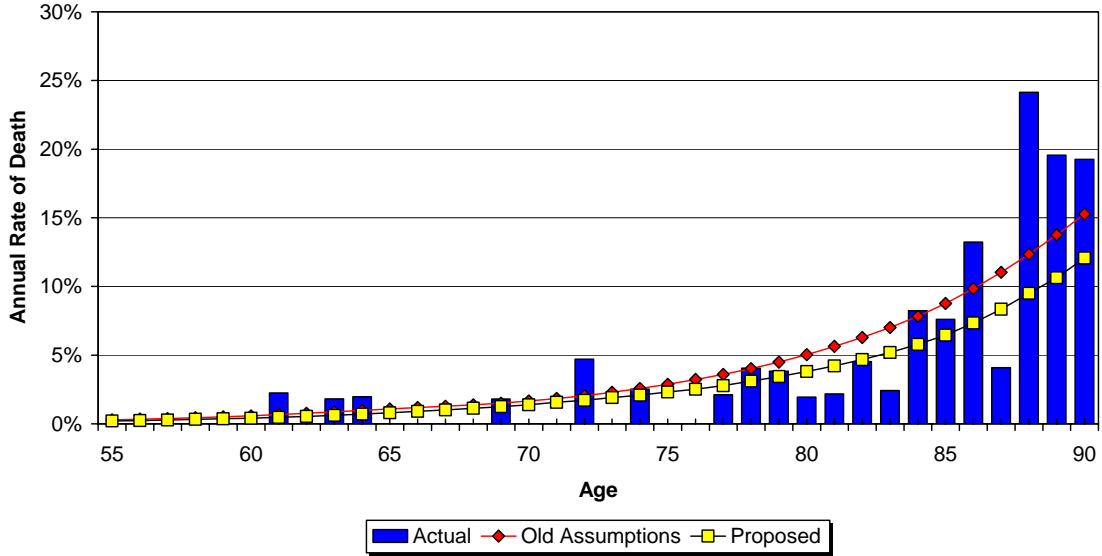
Expected Mortality = 1994 Group Annuity Mortality Table for Males set forward one year  
Proposed Mortality = RP 2000 Mortality Table for Males set forward one year and projected to 2015

**TACOMA EMPLOYEES' RETIREMENT SYSTEM  
2002 - 2005 Mortality Study**

**Exhibit 2**

**Mortality Rates  
Service – Female**

**January 1, 2002 through December 31, 2005**



	Old Assumptions	Actual	Proposed
Total Count	55	47	43
Actual / Expected	85%		109%

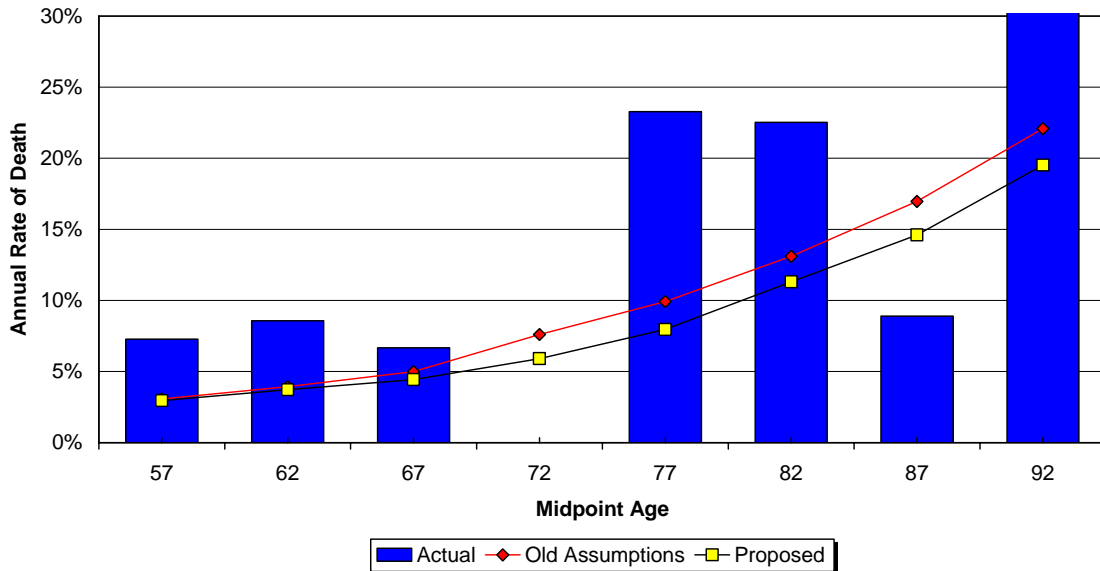
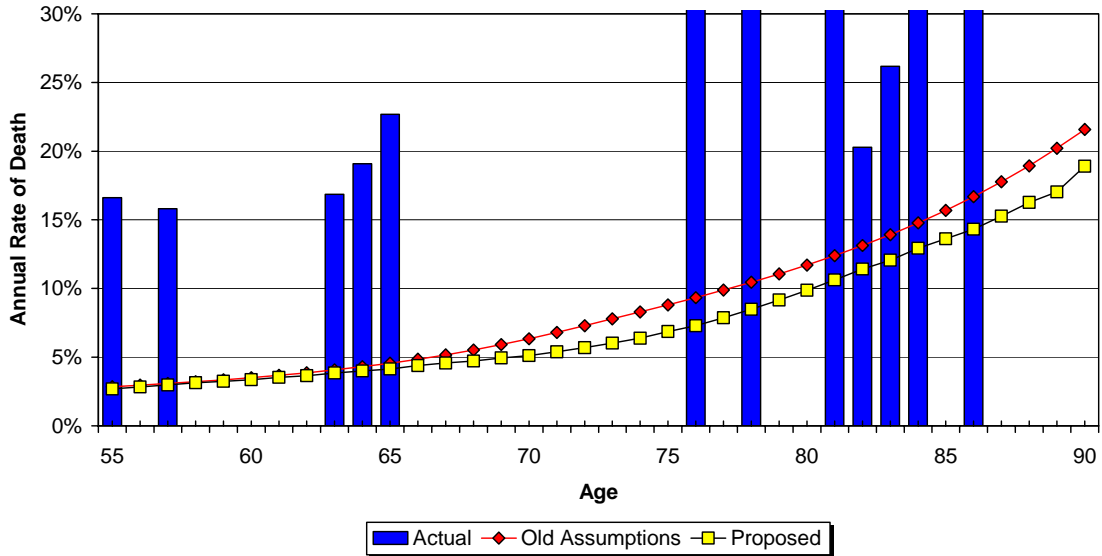
Expected Mortality = 1994 Group Annuity Mortality Table for Females set forward two years  
Proposed Mortality = RP 2000 Mortality Table for Females with one year set back and projected to 2015

**TACOMA EMPLOYEES' RETIREMENT SYSTEM  
2002 - 2005 Mortality Study**

**Exhibit 3**

**Mortality Rates  
Disability Retirement**

**January 1, 2002 through December 31, 2005**



	Old Assumptions	Actual	Proposed
Total Count	9	13	8
Actual / Expected	144%		163%

Expected Mortality = 1992 Railroad Board Disabled Annuity Mortality Table  
Proposed Mortality = RP 2000 Male Disabled Mortality Table with no set forward and projected to 2015