

▶ TENNESSEE CONSOLIDATED RETIREMENT SYSTEM

Experience Study

July 1, 2012 – June 30, 2016

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► Experience Study Purpose

- Statutory requirement at least every 6 years
TCA Section 8-34-503(b)
- Verify accuracy of valuation assumptions
- Modify assumptions if needed

► Actuarial Assumption Overview

- Plan costs are determined by actual experience of the plan

Benefits paid

+ Expenses

- Investment return

Plan Costs

- Role of actuarial assumptions
 - present value determination of estimated future plan costs
 - timing of contributions to fund estimated future plan costs

▶ Actuarial Assumption Overview

- Demographic Assumptions
 - Post-retirement mortality
 - Pre-retirement mortality
 - Rate of disability
 - Turnover/Withdrawal
 - Retirement
- Economic Assumptions
 - Inflation
 - Cost of living adjustments
 - Investment return/Discount rate
 - Compensation increases
 - Social Security wage base growth

► Experience Study Process

- Data Collection
 - Provided by TCRS
 - 4-year period ending June 30, 2016
- Expected Incidence/Exposure/Assumed Rate
 - Apply existing assumptions
 - Determine expected outcomes
- Actual Incidence
 - Compare to actual outcomes
 - Analyze and adjust if appropriate reflection of the future

► Data Groupings

- Teachers Group
 - Teachers
 - UT-TIAA with guarantees
 - Local Teachers
 - “Aged” Teachers
 - Group III
- General State Group
 - General State
 - Political Subdivisions
 - Group II

▶ System Overview – Legacy Plans (as of June 30, 2016)

- Defined Benefit System
 - State employees, higher education and K-12 teachers hired prior to July 1, 2014
 - 528 local governments (participation is optional and costs are valued individually)
- Demographic Data
 - 191,000 Active Participants
 - 149,000 Retired Participants
(\$2.4 Billion in annual payments)
- Market Value of Assets -- \$43.2 Billion

System Overview – Hybrid Plans (as of June 30, 2016)

- Defined Benefit System
 - State employees, higher education and K-12 teachers hired on or after July 1, 2014
 - 21 local governments (participation is optional and costs are valued individually)
- Demographic Data
 - 22,000 Active Participants
 - 3 Retired Participants
- Market Value of Assets -- \$95.3 Million

▶ Demographic Assumption Principles

- Match experience
- Credibility
- Conform to industry standards
- Continuity
- Liability weighted results
 - Results not just based on number of participants
 - Results weighted by benefit liability

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► Post-retirement Mortality

- Observations (2016 vs. 2012 experience study results)
 - Teachers
 - Male mortality – no mortality changes since 2012
 - Female mortality – 8% more deaths in 2016
 - **Overall Average – 5% more deaths in 2016**
 - General State/Political Subdivisions
 - Male mortality – 3% fewer deaths in 2016
 - Female mortality – 3% more deaths in 2016
 - **Overall Average – no mortality changes since 2012**

► Post-retirement Mortality

- 2016 TCRS Experience vs. Industry Standard Mortality
 - Teachers
 - Male mortality – 111% of RP-2014 White Collar Table
 - Female mortality – 98% of RP-2014 White Collar Table
 - **Overall Average – 103% of RP-2014 White Collar Table**
 - General State/Political Subdivisions
 - Male mortality – 102% of RP-2014 Blue Collar Table
 - Female mortality – 97% of RP-2014 Blue Collar Table
 - **Overall Average – 100% of RP-2014 Blue Collar Table**

► Post-retirement Mortality

- Current Assumption
 - Base Table: 2008-2012 TCRS Experience
 - Improvement Scale: Scale AA
 - Projection Period:
 - Legacy Plan - 2 years
 - Hybrid Plan - Generational
- Recommended Assumption
 - Base Table: RP-2014 Annuitants adjusted for 2012-2016 TCRS Experience
 - Teachers - RP-2014 White Collar (111% - Male; 98% - Female)
 - General State/PoliSubs - RP-2014 Blue Collar (102% - Male; 97% - Female)
 - Improvement Scale: MP-2016 (most current available each year)
 - Projection Period:
 - Legacy Plan - 6 years beyond each valuation date
 - Hybrid Plan - Generational

► Post-retirement Mortality (Disabled Lives)

- Current Assumption (All groups)
 - 110% of standard IRS disabled mortality table
(Sex-distinct disability mortality table per RR 96-7)
- Observations
 - 2016 study observed more deaths than expected
 - Other industry tables would expect fewer deaths
 - Relatively small amount of data to be credible
- Recommended Assumption (All groups)
 - No change (continue to monitor in future studies)

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► Pre-retirement Mortality

- Current Assumption
 - Base Table: 2012 IRS Table
 - Improvement Scale: Scale AA
 - Projection Period:
 - Legacy Plan - 15 years
 - Hybrid Plan - Generational
- Recommended Assumption
 - Base Table: RP-2014 Nonannuitants (Total dataset)
 - Improvement Scale: MP-2016 (most current available each year)
 - Projection Period:
 - Legacy Plan - 15 years beyond each valuation date
 - Hybrid Plan - Generational

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► Other Active Demographic Assumptions

- In general, participants chose to work longer during the 2008-2012 period than assumed (lower termination and retirement rates)
- Difficult economic environment between 2008 and 2012
- Economy likely impacted participant behaviors
- 2012 study recommended no changes to the assumptions related to participant choice

► Other Active Demographic Assumptions

- “There is nothing more deceptive than an obvious fact.”
- Arthur Conan Doyle
- 2012-2016 period observed possibly a reversal of this trend (higher termination and retirement rates than assumed), but what is best long-term assumption?
- Recommendation: maintain disability / turnover / retirement assumptions as-is and monitor again in 2020 to identify a more stable pattern

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► Inflation

- Component in all economic assumptions
- Current assumption is 3.0%
- Background
 - 15 year average 2.1%
 - 25 year average 2.3%
 - 30 year average 2.6%
 - 50 year average 4.1%
 - OASDI Trustees 2.0% - 3.2%
- Recommended assumption is 2.5%

► Cost of Living Adjustments (COLA)

- Annual TCRS COLA limited to 3.0%
- Long-term inflation assumption of 2.5% is an average (some years higher, some years lower)
- TCRS COLA will be less than the 3.0% cap when inflation is low but will not exceed 3.0% when inflation is high
- Long-term COLA average with cap will be less than the long-term assumed rate of inflation
- Inflation History (capped at 3.0% annually)
 - 15 year average 2.0% (uncapped = 2.1%)
 - 25 year average 2.2% (uncapped = 2.3%)
 - 30 year average 2.3% (uncapped = 2.6%)
 - 50 year average 2.5% (uncapped = 4.1%)
- Recommended assumption is 2.25% (0.25% reduction)

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► TCRS Investment Return History

Asset Class	Rate of Return During Year	30-Year Average Annualized Rate of Return Through Given Year
2015-2016	2.8%	7.7%
2014-2015	3.3	8.5
2013-2014	16.7	9.3
2012-2013	9.9	8.6
2011-2012	5.6	9.4
2010-2011	19.6	9.4
2009-2010	10.2	8.8
2008-2009	(15.3)	8.8
2007-2008	(1.2)	9.7
2006-2007	13.2	10.0

► TCRS Investment Policy

Asset Class	Long-term Target Allocation
Domestic Equity	31%
International Equity	14
Emerging Markets	4
Domestic Fixed Income	20
Private Equity – Traditional	10
Private Equity – Strategic Lending	10
Real Estate	10
Cash and Cash Equivalents	1
TOTAL	100

► Capital Market Projection

Horizon	Real Rate of Return	Assumed Inflation	Total Rate of Return
20-Year Projection*	4.68%	2.50%	7.18%

* Based on 20-year capital market projections published by Horizon Actuarial Services, LLC, which compiled information from 12 different investment organizations

► Investment Return/Discount Rate

- Current assumption is 7.50%
- 30-year historical TCRS return = 7.74%
- 20-year capital market projection = 7.18%
- Future time horizon of the actuarial valuation is longer than 20-years and should reflect a long-term expectation
- Look beyond current economic cycle (history is a good indicator of multiple economic cycles)
- 7.18% to 7.74% is a reasonable range to select an assumption
- Recommended assumption is 7.25%
 - Lower end of reasonable range to reflect conservatism
 - Reflects lower inflation expectation
 - Consistent with recent industry trends of lowering expected return assumption (represents a 0.25% decrease)

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► Compensation Increases

- Pattern of compensation change declines by age
- Related to inflation and market influences
- Components:
 - Inflation + Merit Increase + National Productivity Increase
- Current assumption:
 - 8.97% at age 20 graded to 3.69% at age 70 (4.25% weighted average)

► Compensation Increases

- Observations between 2012 and 2016
 - Average raises for all groups during the period were approx. 3.5% (inflation during the period was 1.3%)
 - Somewhat overstated due to one-time compensation policies and adjustments
 - Continued market pressure limiting compensation increases
- Recommended assumption:
 - 8.72% at age 20 graded to 3.44% at age 70 (4.00% weighted average)
 - Inflation (2.5%) + Merit Increase (1.0%) + National Productivity Increase (0.5%) = 4.0% Total Average Increase

► Social Security Wage Base Growth

- Related to inflation
- Include national productivity increase
- Generally 0.5% greater than inflation
- Current assumption: 3.5%
- Recommended assumption: 3.0%
 - Inflation (2.5%) + National Productivity Increase (0.5%)

► TCRS Option Factors

- Factors related to survivorship options at retirement, early retirement reduction, actuarial equivalence, etc.
- Update to be performed based on new assumptions
- Impacted by discount rate, mortality and COLA
- Applicable to Legacy Plan and Hybrid Plan