UNITED STATES GOVERNMENT

# MEMORANDUM

FORM G-115f (1-92)

RAILROAD RETIREMENT BOARD

March 27, 2024

TO: Actuarial Advisory Committee

FROM: Keith T. Sartain
Chief Actuary

KEITH SARTAIN

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Date: 2024.03.27 16:42:01 -04'00'

SUBJECT: Economic assumptions

This memorandum and accompanying exhibits detail the results of our studies and recommendations for the following items:

1. Ultimate cost-of-living adjustment (COLA) assumption,
2. Ultimate base wage increase assumption,
3. Investment return,
4. Salary Scale, and
5. Select period mortality load.

## Economic Assumptions

The employment and economic assumptions used in the 2023 Section 502 Report are shown in table 1 on the following page. The ultimate economic assumptions used in the 16th through the 28th Valuation are shown below.

| | *Wage Increase* | *COLA* | *Investment Return* |
|---|---|---|---|
| 16th Valuation | 4.00% | 3.50% | 6.00% |
| 17th Valuation | 3.75% | 3.50% | 6.00% |
| 18th Valuation | 4.50% | 4.00% | 6.50% |
| 19th Valuation | 4.00% | 3.50% | 6.00% |
| 20th Valuation | 4.00% | 3.50% | 6.00% |
| 21st Valuation | 4.00% | 3.20% | 6.00% |
| 22nd Valuation | 4.00% | 3.00% | 8.00% |
| 23rd Valuation | 4.00% | 3.00% | 7.50% |
| 24th Valuation | 4.00% | 3.00% | 7.50% |
| 25th Valuation | 3.80% | 2.80% | 7.00% |
| 26th Valuation | 3.70% | 2.70% | 7.00% |
| 27th Valuation | 3.60% | 2.60% | 7.00% |
| 28th Valuation | 3.40% | 2.40% | 6.50% |

The 29th Valuation has a measurement date of December 31, 2022; three years after the prior full valuation. It will reflect actual experience through 2023. It will be issued in June 2024.

Table 1. Employment and economic assumptions

| Calendar year | Average employment (thousands) | | | Percentage increase over prior year | | Investment return |
|---|---|---|---|---|---|---|
| | I | II | III | Earnings | Cost of living [a] | |
| 2022 | 189.7 | 189.7 | 189.7 | 6.1% [b] | 5.9% [b] | -10.8% [b] |
| 2023 | 195.2 | 193.3 | 190.8 | 10.0 | 8.7 [b] | 6.5 |
| 2024 | 194.9 | 191.0 | 186.2 | 2.0 | 3.3 | 6.5 |
| 2025 | 194.6 | 188.8 | 181.7 | 3.4 | 2.9 | 6.5 |
| 2026 | 194.3 | 186.6 | 177.3 | 3.4 | 2.4 | 6.5 |
| 2027 | 194.0 | 184.5 | 173.0 | 3.4 | 2.4 | 6.5 |
| 2028 | 193.7 | 182.4 | 168.8 | 3.4 | 2.4 | 6.5 |
| 2029 | 193.4 | 180.3 | 164.7 | 3.4 | 2.4 | 6.5 |
| 2030 | 193.1 | 178.3 | 160.7 | 3.4 | 2.4 | 6.5 |
| 2031 | 192.8 | 176.3 | 156.9 | 3.4 | 2.4 | 6.5 |
| 2032 | 192.5 | 174.3 | 153.1 | 3.4 | 2.4 | 6.5 |
| 2033 | 192.2 | 172.3 | 149.4 | 3.4 | 2.4 | 6.5 |
| 2034 | 191.9 | 170.4 | 145.8 | 3.4 | 2.4 | 6.5 |
| 2035 | 191.6 | 168.5 | 142.3 | 3.4 | 2.4 | 6.5 |
| 2036 | 191.3 | 166.6 | 138.8 | 3.4 | 2.4 | 6.5 |
| 2037 | 191.0 | 164.8 | 135.5 | 3.4 | 2.4 | 6.5 |
| 2038 | 190.8 | 163.0 | 132.2 | 3.4 | 2.4 | 6.5 |
| 2039 | 190.5 | 161.2 | 129.5 | 3.4 | 2.4 | 6.5 |
| 2040 | 190.2 | 159.4 | 126.9 | 3.4 | 2.4 | 6.5 |
| 2041 | 189.9 | 157.7 | 124.3 | 3.4 | 2.4 | 6.5 |
| 2042 | 189.6 | 156.0 | 121.9 | 3.4 | 2.4 | 6.5 |
| 2043 | 189.3 | 154.3 | 119.5 | 3.4 | 2.4 | 6.5 |
| 2044 | 189.0 | 152.7 | 117.1 | 3.4 | 2.4 | 6.5 |
| 2045 | 188.7 | 151.0 | 114.9 | 3.4 | 2.4 | 6.5 |
| 2046 | 188.4 | 149.4 | 112.6 | 3.4 | 2.4 | 6.5 |
| 2047 | 188.1 | 147.8 | 110.5 | 3.4 | 2.4 | 6.5 |

[a] Cost-of-living adjustments are effective January 1 of each year. Actual Tier 1 COLA is the same as the actual social security increase. Tier 2 COLA is 32.5% of the Tier 1 COLA.

[b] Actual.

## 1. COLA Assumption

The cost-of-living adjustment (COLA) increases tier 1 and tier 2 benefits and is based on changes in the CPI-W.

- The COLA for benefits to be paid in 2025 (i.e. the December 2024 COLA) will be based on the increase in the average CPI-W from the period July-September 2024 over the prior year's period July-September 2023.
- The COLA for benefits being paid in 2024 was 3.2% (i.e. the December 2023 COLA).
- The CPI-W for February 2024 showed a 3.1% increase year-over-year but has increased less than 1% since September 2023.

The current level of CPI inflation is above the Federal Reserve's long-term target, but the financial markets are anticipating rate cuts starting this year as inflation has dropped. We will wait until more data becomes available before setting the select COLA rates for the 29th Valuation. We will reference the latest available market rates when selecting the COLA for 2025, and likely grade down over a few years to the ultimate rate to assume through the 75-year projections.

In setting the ultimate COLA rate, we consider many items. Past inflation levels are not necessarily a good predictor of future experience however historical patterns and long-term trends are considered:

- For the 10-year period 2013 through 2023, the average annual increase in CPI-W was 2.64%.
- For the 20-year period 2003 through 2023, the average annual increase in CPI-W was 2.56%.
- For the 30-year period 1993 through 2023, the average annual increase in CPI-W was 2.51%.

It is also useful to examine and compare inflation assumptions used by peer systems and expectations from investment professionals:

- The Public Plans Database (PPD) *https://publicplansdata.org/public-plans-database/* contains plan-level data for 229 pension plans which covers 95 percent of public pension membership and assets nationwide. The most recent survey shows an average inflation assumption of 2.53%.
- Horizon Actuarial Services, LLC performs a survey each year of capital market assumptions from the investment advisory community. *https://www.horizonactuarial.com/survey-of-capital-market-assumptions*. The 2023 survey published last August had 42 investment advisors provide future capital market expectations. The average longer-term 20+ year expectation for inflation is 2.46%.
- The 2024 edition of J.P. Morgan Long-Term Capital Market Assumptions, *https://am.jpmorgan.com/us/en/asset-management/institutional/insights/portfolio-insights/ltcma/*, has a long-term inflation expectation of 2.50%.

- The future CPI increase used by the Social Security Administration over the next 75 years, contained in the 2023 OASDI Trustees Report *https://www.ssa.gov/oact/TR/2023/index.html*, is 2.4% under the intermediate cost scenario. This is unchanged from the 2022 OASDI Trustees Report. The 2024 OASDI Trustees Report is not yet available.

Considering the CPI-W historical experience, surveys of inflation assumptions used by pension plans, expectations of investment advisors, as well as SSA's COLA assumptions, we propose to slightly increase the ultimate COLA assumption from 2.4% to 2.5% for the 29th Valuation.

## 2. Base Wage Increase Assumption

The Tier 2 wage increase experience from 2000 to 2023 are shown in Table 2.1 and Chart 2.1. As might be expected, 2020 through 2023 is a somewhat unusual period given the pandemic shutdown, associated turnover, and recalls from furlough. We have decided to continue basing the long-term ultimate wage increase assumption on the experience of the prior two decades 2000-2019 while giving less weight to the most recent years.

For the 10-year period 2010 through 2019, the average annual rate of increase in tier 2 compensation per service month was 3.12% with real wage growth of 1.35%. When you include the next 4 years, the real wage growth drops to 1.02% per year. For the 20-year period 2000 through 2019, the average annual rate of increase was 3.19% with real growth of 1.03%. When you include the next 4 years, the real wage growth drops to 0.89% per year.

The wage increase assumptions used by Social Security, which appear in the 2023 OASDI Trustees Report, are shown in Table 2.2. SSA's ultimate wage increase assumptions are 4.79%, 3.56% and 2.35%, for the low-cost, intermediate, and high-cost scenarios, respectively. When compared against the intermediate scenario's 2.4% ultimate inflation assumption, the ultimate real wage growth is about 1.14% per year.

Considering our experience as well as SSA's assumptions, we propose maintaining a 1% real wage growth over our proposed COLA assumption and slightly raising the ultimate wage increase assumption from 3.4% to 3.5% for the 29th Valuation.

Please note RRB's wage model includes salary scales by service, which are discussed in section 4.

## Tier 2 Compensation Increase Experience

| CY | Nominal Tier 2 Comp Growth | Real Tier 2 Comp Growth | CPI |
|---|---|---|---|
| **1999** | | | |
| 2000 | 4.3% | 0.8% | 3.5% |
| 2001 | 3.0% | 0.3% | 2.7% |
| 2002 | 3.5% | 2.1% | 1.4% |
| 2003 | 3.3% | 1.1% | 2.2% |
| 2004 | 3.7% | 1.1% | 2.6% |
| 2005 | 3.8% | 0.3% | 3.5% |
| 2006 | 2.3% | -0.9% | 3.2% |
| 2007 | 3.9% | 1.0% | 2.9% |
| 2008 | 4.9% | 0.8% | 4.1% |
| 2009 | 0.0% | 0.7% | -0.7% |
| 2010 | 2.4% | 0.3% | 2.1% |
| 2011 | 3.6% | 0.0% | 3.6% |
| 2012 | 3.8% | 1.7% | 2.1% |
| 2013 | 2.5% | 1.1% | 1.4% |
| 2014 | 5.8% | 4.2% | 1.5% |
| 2015 | 2.7% | 3.1% | -0.4% |
| 2016 | -2.4% | -3.3% | 1.0% |
| 2017 | 4.5% | 2.3% | 2.1% |
| 2018 | 7.6% | 4.9% | 2.5% |
| 2019 | 1.0% | -0.7% | 1.7% |
| 2020 | 0.3% | -0.9% | 1.2% |
| 2021 | 2.6% | -2.5% | 5.3% |
| 2022 | 7.1% | -1.3% | 8.5% |
| 2023 | 9.8% | 5.8% | 3.8% |
| **10-Year Avg(2000-2009)** | **3.26%** | **0.71%** | **2.54%** |
| **10-Year Avg(2010-2019)** | **3.12%** | **1.35%** | **1.75%** |
| **20-Year Avg(2000-2019)** | **3.19%** | **1.03%** | **2.14%** |
| **4-Year Avg(2020-2023)** | **4.88%** | **0.22%** | **4.66%** |

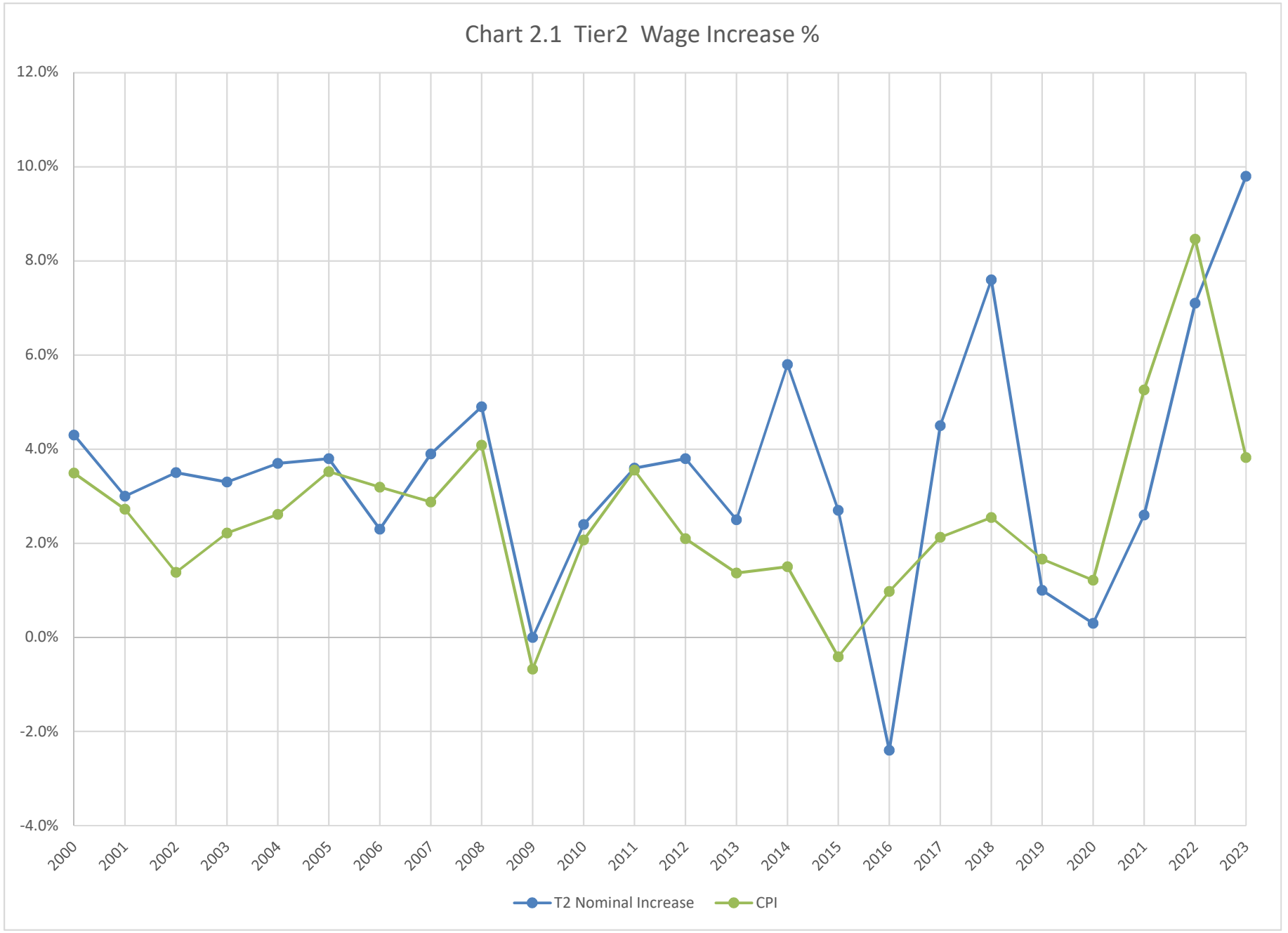


Chart 2.1 Tier2 Wage Increase %
12.0%
10.0%
8.0%
6.0%
4.0%
2.0%
0.0%
-2.0%
-4.0%
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
T2 Nominal Increase
CPI

Table 2.2 Social Security Principal Economic Assumptions

| Calendar year | Annual percentage change[a] in— Productivity (Total U.S. economy) | GDP price index | Average hours worked per week | Earnings as a percent of total labor compensation | Average annual wage in covered employment Nominal | Average annual wage in covered employment Real | Consumer price index |
|---|---|---|---|---|---|---|---|
| **Historical data:** | | | | | | | |
| **5-year periods:** | | | | | | | |
| 1960 to 1965 ... | 3.23 | 1.36 | 0.19 | -0.18 | 3.22 | 1.95 | 1.24 |
| 1965 to 1970 ... | 2.04 | 4.02 | -.66 | -.30 | 5.84 | 1.55 | 4.23 |
| 1970 to 1975 ... | 2.07 | 6.61 | -.87 | -.49 | 6.58 | -.17 | 6.76 |
| 1975 to 1980 ... | .94 | 7.21 | -.16 | -.33 | 8.88 | -.02 | 8.91 |
| 1980 to 1985 ... | 1.71 | 5.24 | .03 | -.36 | 6.52 | 1.24 | 5.22 |
| 1985 to 1990 ... | 1.33 | 3.14 | -.06 | -.20 | 4.79 | .93 | 3.83 |
| 1990 to 1995 ... | 1.30 | 2.45 | .34 | -.11 | 3.54 | .49 | 3.03 |
| 1995 to 2000 ... | 2.31 | 1.67 | .15 | .28 | 5.31 | 2.81 | 2.43 |
| 2000 to 2005 ... | 2.63 | 2.32 | -.79 | -.38 | 2.69 | .19 | 2.49 |
| 2005 to 2010 ... | 1.88 | 1.91 | -.51 | -.03 | 2.51 | .21 | 2.30 |
| 2010 to 2015 ... | .35 | 1.71 | .45 | .16 | 2.93 | 1.30 | 1.61 |
| 2015 to 2020 ... | 1.58 | 1.69 | -.16 | .10 | 2.95 | 1.23 | 1.70 |
| **Economic cycles:**[b] | | | | | | | |
| 1969 to 1973 ... | 2.64 | 5.04 | -.87 | -.34 | 5.94 | .98 | 4.91 |
| 1973 to 1979 ... | 1.06 | 7.54 | -.53 | -.43 | 8.58 | .03 | 8.54 |
| 1979 to 1990 ... | 1.39 | 4.61 | -.09 | -.29 | 5.78 | .46 | 5.30 |
| 1990 to 2001 ... | 1.84 | 2.08 | .11 | .05 | 4.19 | 1.42 | 2.73 |
| 2001 to 2007 ... | 2.15 | 2.52 | -.47 | -.18 | 3.45 | .80 | 2.63 |
| 2007 to 2019 ... | 1.09 | 1.62 | -.05 | .04 | 2.50 | .76 | 1.73 |
| 2019 to 2022[c] .. | 1.52 | 4.26 | -.03 | .33 | 5.60 | .61 | 4.95 |
| **Single years:** | | | | | | | |
| 2012..... | .34 | 1.88 | .13 | .47 | 3.33 | 1.20 | 2.10 |
| 2013..... | .52 | 1.77 | .33 | -.33 | 1.23 | -.14 | 1.37 |
| 2014..... | .31 | 1.86 | .36 | .27 | 3.60 | 2.07 | 1.50 |
| 2015..... | .61 | .96 | .41 | .05 | 3.38 | 3.81 | -.41 |
| 2016..... | .45 | 1.00 | -.50 | .10 | 1.29 | .31 | .98 |
| 2017..... | 1.04 | 1.93 | -.05 | .14 | 3.47 | 1.32 | 2.13 |
| 2018..... | 1.03 | 2.41 | .32 | -.10 | 3.65 | 1.08 | 2.55 |
| 2019..... | 1.32 | 1.78 | -.15 | .19 | 3.62 | 1.92 | 1.66 |
| 2020..... | 4.11 | 1.35 | -.43 | .17 | 2.76 | 1.52 | 1.21 |
| 2021..... | 1.49 | 4.49 | 1.11 | .48 | 9.36 | 3.89 | 5.26 |
| 2022[c]..... | -.99 | 7.03 | -.77 | .34 | 4.79 | -3.43 | 8.51 |
| **Intermediate:** | | | | | | | |
| 2023..... | .18 | 3.89 | .30 | -.16 | 4.15 | .15 | 4.00 |
| 2024..... | 1.11 | 2.17 | -.04 | -.13 | 3.76 | 1.20 | 2.53 |
| 2025..... | 1.40 | 2.05 | -.04 | -.04 | 4.06 | 1.62 | 2.40 |
| 2026..... | 1.44 | 2.05 | -.03 | [d] | 4.10 | 1.66 | 2.40 |
| 2027..... | 1.47 | 2.05 | -.04 | [d] | 4.08 | 1.64 | 2.40 |
| 2028..... | 1.56 | 2.05 | -.05 | -.03 | 4.01 | 1.57 | 2.40 |
| 2029..... | 1.63 | 2.05 | -.05 | -.05 | 4.03 | 1.60 | 2.40 |
| 2030..... | 1.63 | 2.05 | -.05 | -.07 | 4.01 | 1.57 | 2.40 |
| 2031..... | 1.63 | 2.05 | -.05 | -.07 | 3.98 | 1.54 | 2.40 |
| 2032..... | 1.63 | 2.05 | -.05 | -.07 | 3.76 | 1.33 | 2.40 |
| 2032 to 2097 ... | 1.63 | 2.05 | -.05 | -.08 | 3.56 | 1.14 | 2.40 |
| **Low-cost:** | | | | | | | |
| 2023..... | 0.87 | 3.86 | 0.36 | -0.14 | 4.73 | 0.79 | 3.90 |
| 2024..... | 1.95 | 2.79 | .07 | -.11 | 5.82 | 2.71 | 3.02 |
| 2025..... | 2.16 | 2.75 | .09 | -.01 | 6.17 | 3.08 | 3.00 |
| 2026..... | 1.96 | 2.75 | .06 | .03 | 5.61 | 2.53 | 3.00 |
| 2027..... | 1.94 | 2.75 | .05 | .04 | 5.34 | 2.27 | 3.00 |
| 2028..... | 1.93 | 2.75 | .05 | .02 | 5.29 | 2.22 | 3.00 |
| 2029..... | 1.93 | 2.75 | .05 | .01 | 5.26 | 2.20 | 3.00 |
| 2030..... | 1.93 | 2.75 | .05 | [d] | 5.25 | 2.19 | 3.00 |
| 2031..... | 1.93 | 2.75 | .05 | .01 | 5.24 | 2.18 | 3.00 |
| 2032..... | 1.93 | 2.75 | .05 | .01 | 5.04 | 1.98 | 3.00 |
| 2032 to 2097 ... | 1.93 | 2.75 | .05 | [d] | 4.79 | 1.74 | 3.00 |
| **High-cost:** | | | | | | | |
| 2023..... | -1.71 | 4.16 | .20 | -.16 | 1.86 | -2.58 | 4.56 |
| 2024..... | 1.53 | 2.28 | -.12 | -.13 | 3.63 | .70 | 2.92 |
| 2025..... | 1.50 | 1.41 | -.12 | -.06 | 3.71 | 1.81 | 1.86 |
| 2026..... | 1.41 | 1.35 | -.14 | -.04 | 3.44 | 1.61 | 1.80 |
| 2027..... | 1.51 | 1.35 | -.15 | -.05 | 3.43 | 1.60 | 1.80 |
| 2028..... | 1.28 | 1.35 | -.15 | -.09 | 2.92 | 1.10 | 1.80 |
| 2029..... | 1.26 | 1.35 | -.15 | -.11 | 2.74 | .92 | 1.80 |
| 2030..... | 1.30 | 1.35 | -.15 | -.14 | 2.72 | .91 | 1.80 |
| 2031..... | 1.33 | 1.35 | -.15 | -.14 | 2.72 | .90 | 1.80 |
| 2032..... | 1.33 | 1.35 | -.15 | -.16 | 2.50 | .69 | 1.80 |
| 2032 to 2097 ... | 1.33 | 1.35 | -.15 | -.17 | 2.35 | .54 | 1.80 |

[a] For rows with a single year listed, the value is the annual percentage change from the prior year. For rows with a range of years listed, the value is the compound average annual percentage change.
[b] Economic cycles are shown from peak to peak, except for the last cycle, which is not yet complete.
[c] Estimated values for 2022 vary slightly by alternative and are shown for the intermediate assumptions.
[d] Greater than -0.005 and less than 0.005 percent.

## 3. Investment Return

Railroad retirement investments are currently held in three accounts: the National Railroad Retirement Investment Trust (NRRIT), the Railroad Retirement Account (RRA), and the Social Security Equivalent Benefit Account (SSEBA). The NRRIT may invest in non-governmental assets, such as equity and debt securities, as well as governmental securities as stated in their Annual Management Report:

> Over the past twenty years, the Trust has deployed assets received from the Treasury into a diversified portfolio of US and non-US equity, as well as US and global fixed income, securities. Over time, the Trust has furthered that diversification by allocating a percentage of the portfolio to private equity, private debt, real assets, absolute return, and opportunistic investments. As mandated by its statute, the Trust has avoided undue concentration of investment in any asset class, type of security, or market sector.

The NRRIT investment policy target allocation is 60% global equity (including private equity), 21% global fixed income (including private debt), 10% real estate, and 9% other (including opportunistic investments).

Whereas the RRA and SSEBA are currently invested only in special issue Treasury obligations. The portion of the RRA not needed to pay current administrative expenses and the portion of the SSEBA not needed to pay current benefits and administrative expenses may be transferred from time to time to the NRRIT in such a manner as to maximize investment return to the Railroad Retirement system; however, only transfers from NRRIT have occurred in recent years.

**Historical Investment Returns and Valuation Assumption**

| Year Ending | NRRIT Alone | Combined Accounts | Valuation Assumption Year Ending | Valuation Assumption Ultimate Rate |
|---|---|---|---|---|
| 12/31/2015 | 0.1% | 0.2% | 7.0% | 7.0% |
| 12/31/2016 | 7.2% | 7.0% | 7.0% | 7.0% |
| 12/31/2017 | 17.3% | 16.7% | 7.0% | 7.0% |
| 12/31/2018 | -4.3% | -3.9% | 7.0% | 7.0% |
| 12/31/2019 | 17.6% | 16.8% | 7.0% | 7.0% |
| 12/31/2020 | 13.3% | 13.0% | 0.0%* | 7.0% |
| 12/31/2021 | 20.1% | 19.3% | 6.5% | 6.5% |
| 12/31/2022 | -11.4% | -10.8% | 6.5% | 6.5% |
| 12/31/2023 | 13.3% | 12.8% | 6.5% | 6.5% |

* Given the market reaction to the COVID-19 pandemic in 2020, we decided to assume a lower investment return for that year and then return to 7.0% thereafter. Actual return was much better as the equity markets recovered in the second half of the 2020 calendar year.

The actual NRRIT return and Combined Accounts return over the 21-year period since 1/1/2003 is 7.7% and 7.5% respectively.

**Future Investment Return Expectations**

In setting the rate that the Railroad Retirement accounts are projected to earn over the long term, we examined and considered many items not limited to the following:

- Survey of capital market assumptions from the investment advisory community,
- Capital market assumptions published by investment professionals,
- NRRIT investment guidelines effective October 1, 2023, and
- Proportion of the Railroad retirement investments held in RRA and SSEBA.

*Capital Market Assumptions*

Actuarial Standard of Practice No. 27 "Selection of Economic Assumptions for Measuring Pension Obligations" states that "The investment return assumption reflects the anticipated returns on the plan's current and, if appropriate for measurement, future assets" and "An assumption based on estimates of future experience is reasonable if it is not anticipated to produce significant cumulative gains or losses over the measurement period. An assumption based on market observations is reasonable if it fairly reflects current financial market data." Further, "In developing a reasonable assumption for these factors and in combining the factors to develop the investment return assumption, the actuary may consider a broad range of data and other inputs, including the judgment of investment professionals."

Recent published papers by industry experts predict higher-than-historical portfolio returns over the long term based on increases in interest rates, forecasts of inflation, and higher expectations across asset classes. The capital market assumptions used by investment advisors vary, however, and lead to a range of expected returns when applied to the Railroad Retirement accounts.

Horizon Actuarial Services, LLC performs a survey each year of capital market assumptions from the investment advisory community. *https://www.horizonactuarial.com/survey-of-capital-market-assumptions*. The 2023 survey was published last August and had 42 investment advisors provide expectations for future risk and returns for different asset classes in which pension plans commonly invest. We focus on the longer-term 20+ year expectations. The 2020 survey was available for consideration when the rate for the 28th Valuation was determined.

- Compared to the 2020 survey, future equity return expectations are somewhat higher. Fixed income classes are showing over 1% increases. This increase in less risky asset expected returns should increase expected returns across other more risky asset classes where investors will continue to expect a suitable risk premium.
- Inflation expectations have increased to 2.46% on average from 2.16% in the 2020 survey.
- Combining the capital market assumptions with equal weighting for all survey participants, and the NRRIT target asset allocation yields an expected return of approximately 8%.

The 2023 calendar year resulted in very good investment returns across asset classes. At the current elevated stock prices, we think part of the equity return expectations from the Horizon 2023 survey has been realized and expected returns in the 2024 survey may be tempered down somewhat. Therefore, we also looked at more recent capital market assumption forecasts that already incorporate the 2023 returns.

For example, the expectations for future risk and returns published in the 2024 edition of J.P. Morgan Long-Term Capital Market Assumptions reflects the 2023 calendar year market experience. *https://am.jpmorgan.com/us/en/asset-management/institutional/insights/portfolio-insights/ltcma/*. Consistent with our expectation, applying the capital market assumptions from the 2024 J.P. Morgan analysis to the NRRIT target asset allocation yields an expected return of approximately 7.75%.

As of December 31, 2023, $25,930 million was invested in the NRRIT, $488 million was invested in the RRA, and $1,083 million was invested in the SSEBA. The RRA and SSEBA accounts, which constitute around 6% of total assets, are invested strictly in government bonds with a minimum 3% return. We anticipate a long-term 3.5% return on these government bonds. Including these assets with the NRRIT assets, therefore, lowers the expected investment return for the combined accounts to approximately 7.5%.

Based on the on-going nature of the RRB system, the 75-year open group projection, the current surplus position, the investment advisors' expectations of future returns of asset classes, NRRIT's updated investment guidelines, and the small portion of assets held in the RRA and SSEBA, we recommend increasing the annual investment return assumption to 7.5% for the 29th Valuation.

## 4. Salary Scale Assumption

The valuation projections are performed with covered employee data grouped by age and service. An employee group's taxable earnings increase with the preceding Base Wage Increase Assumption plus an additional Tier 1 or Tier 2 salary scale based on an employee group's years of service. The calculation of an employee group's monthly salary for the next projection year is a 2-steps process:

EE's salary at (CY + 1) = EE's salary at CY times (1 + base wage increase%)
times (1 + increase from salary scale%)

We examined the change in monthly salary by service levels using data from 2013 through 2022. Following the formula above, we calculated the change in monthly salary in excess of the change in base wage increase for each progression in year of service and then calculated a weighted average for the nine years of experience. For years of service (YOS) 1 through 4 and at 30, factors are equal to the actual weighted averages. For YOS 30, we consistently saw a bump in the average pay. For YOS 5 through 29, the actual weighted averages are graduated using power functions to smooth out the variations. For YOS 31 and above, their experience has been combined; the factor is equal to the actual weighted average of the combined experience.

The crude experience data and graduated lines are shown in Chart 4.1 for Tier 1 and Chart 4.2 for Tier 2.

Table 4.1 shows the salary scales from the 28th Valuation. The proposed salary scales for the 29th Valuation are shown in Table 4.2.

We continue to see a significant increase in wages from year 0 to year 1. We believe this increase for new entrants is mostly due to earning a full month of covered service for short periods of employment as well as promotion increases and bonuses for completing training. The development of the salary scale factors also reflects the impact of employment changes due to withdrawal, retirement, and death, especially for the initial few durations when withdrawals are high. There may be similar fluctuations around other years when there is not a full 12 months of railroad service. Two individual example is shown below:

***Hired June 1994***

| Year | Service Months in the year | Monthly T2 Pay | Increase % |
|---|---|---|---|
| 0 | 7 | 2,186 | n/a |
| 1 | 12 | 2,997 | 37% |
| 2 | 12 | 3,272 | 9% |

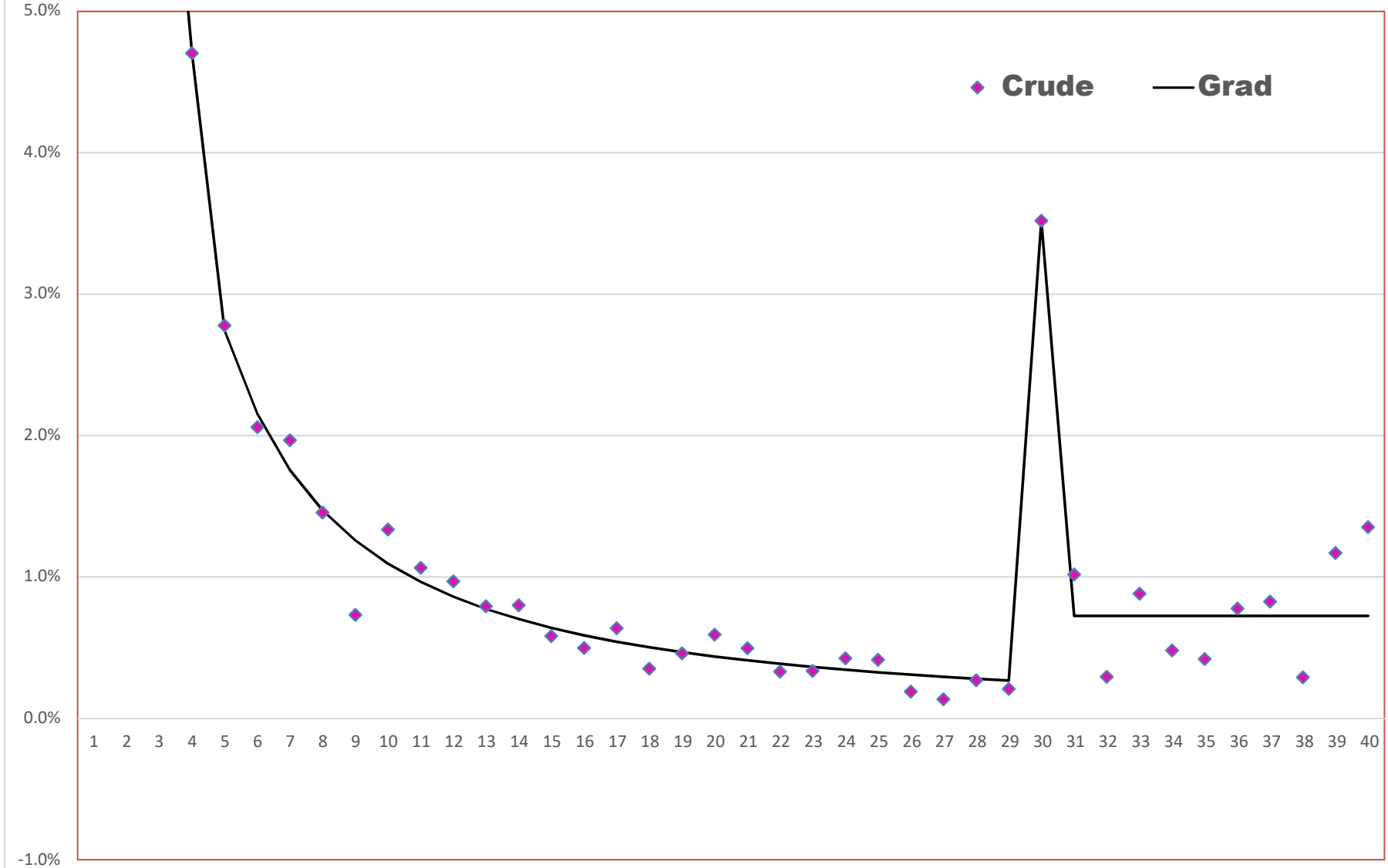
***Hired January 2016***

| Year | Service Months in the year | Monthly T2 Pay | Increase % |
|---|---|---|---|
| 0 | 12 | 6,676 | n/a |
| 1 | 12 | 7,733 | 16% |
| 2 | 12 | 7,950 | 3% |

Table 4.3, Chart 4.3, and Chart 4.4 show an example of the assumed wage patterns and the wage progressions to the next year in the valuation model assuming actual 2022 new entrant salaries with a 3.5% base wage increase and the proposed 29th Valuation salary scales. The salary scale establishes the shape of the wages across years of service and the base wage increase moves it forward to the next projection year.

Chart 4.5 compares the Tier 2 salary pattern based on the proposed salary scale for the 29th Valuation with the actual 2022 wage data. The red "Salary in the year" line is the assumed Tier 2 salary pattern in a calendar year generated starting from the 2022 actual Tier 2 salary at YOS = 0 and extending to other years of service (YOS > 0) using the Tier 2 salary scale. Its shape is close to the actual wage distribution for 2022, which demonstrates its effectiveness in projecting future wages for the valuation model.

## Chart 4.1 Tier 1 Salary Scale



## Chart 4.2 Tier 2 Salary Scale

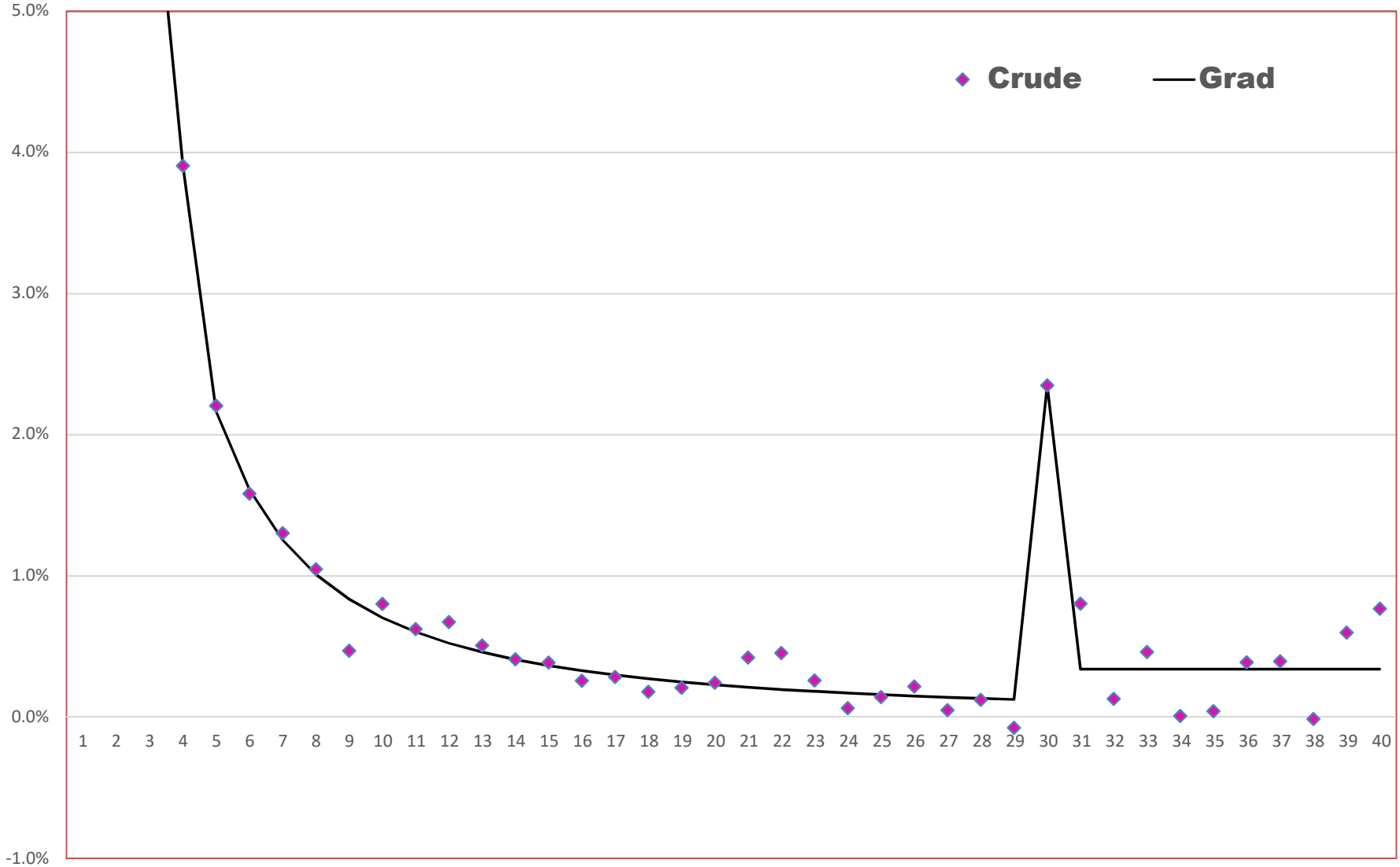


Table 4.1 Salary Scales for 28th Valuation

| Years of service [a] | Increase in average monthly salary from prior service level | |
|---|---|---|
| | Tier 1 | Tier 2 |
| 0 | | |
| 1 | 23.5% | 21.7% |
| 2 | 9.5% | 8.4% |
| 3 | 6.5% | 5.9% |
| 4 | 4.5% | 3.9% |
| 5 | 3.2% | 2.7% |
| 6 | 2.4% | 1.9% |
| 7 | 2.0% | 1.5% |
| 8 | 1.6% | 0.9% |
| 9 | 1.4% | 0.7% |
| 10 | 1.2% | 0.6% |
| 11 | 1.0% | 0.5% |
| 12 | 0.9% | 0.5% |
| 13 | 0.8% | 0.4% |
| 14 | 0.7% | 0.4% |
| 15 | 0.7% | 0.3% |
| 16 | 0.6% | 0.3% |
| 17 | 0.6% | 0.3% |
| 18 | 0.5% | 0.2% |
| 19 | 0.5% | 0.2% |
| 20 | 0.4% | 0.2% |
| 21 | 0.4% | 0.2% |
| 22 | 0.4% | 0.2% |
| 23 | 0.4% | 0.2% |
| 24 | 0.3% | 0.1% |
| 25 | 0.3% | 0.1% |
| 26 | 0.3% | 0.1% |
| 27 | 0.3% | 0.1% |
| 28 | 0.3% | 0.1% |
| 29 | 0.3% | 0.1% |
| 30 | 2.9% | 1.8% |
| 31 | 0.5% | 0.1% |
| 32 | 0.5% | 0.1% |
| 33 | 0.5% | 0.1% |
| 34 | 0.5% | 0.1% |
| 35 | 0.5% | 0.1% |
| 36 | 0.5% | 0.1% |
| 37 | 0.5% | 0.1% |
| 38 | 0.5% | 0.1% |
| 39 | 0.5% | 0.1% |
| 40 | 0.5% | 0.1% |
| 41 | 0.5% | 0.1% |
| 42 | 0.5% | 0.1% |
| 43 | 0.5% | 0.1% |
| 44 | 0.5% | 0.1% |
| 45 & over | 0.5% | 0.1% |

[a] Rounded up to nearest whole year.

Table 4.2 Proposed Salary Scales for 29th Valuation

| Years of service [a] | Increase in average monthly salary from prior service level | |
|---|---|---|
| | Tier 1 | Tier 2 |
| 0 | | |
| 1 | 24.4% | 22.3% |
| 2 | 9.1% | 8.1% |
| 3 | 7.3% | 6.3% |
| 4 | 4.7% | 3.9% |
| 5 | 2.7% | 2.2% |
| 6 | 2.2% | 1.6% |
| 7 | 1.8% | 1.3% |
| 8 | 1.5% | 1.0% |
| 9 | 1.3% | 0.8% |
| 10 | 1.1% | 0.7% |
| 11 | 1.0% | 0.6% |
| 12 | 0.9% | 0.5% |
| 13 | 0.8% | 0.5% |
| 14 | 0.7% | 0.4% |
| 15 | 0.6% | 0.4% |
| 16 | 0.6% | 0.3% |
| 17 | 0.5% | 0.3% |
| 18 | 0.5% | 0.3% |
| 19 | 0.5% | 0.2% |
| 20 | 0.4% | 0.2% |
| 21 | 0.4% | 0.2% |
| 22 | 0.4% | 0.2% |
| 23 | 0.4% | 0.2% |
| 24 | 0.3% | 0.2% |
| 25 | 0.3% | 0.2% |
| 26 | 0.3% | 0.2% |
| 27 | 0.3% | 0.1% |
| 28 | 0.3% | 0.1% |
| 29 | 0.3% | 0.1% |
| 30 | 3.5% | 2.4% |
| 31 | 0.7% | 0.3% |
| 32 | 0.7% | 0.3% |
| 33 | 0.7% | 0.3% |
| 34 | 0.7% | 0.3% |
| 35 | 0.7% | 0.3% |
| 36 | 0.7% | 0.3% |
| 37 | 0.7% | 0.3% |
| 38 | 0.7% | 0.3% |
| 39 | 0.7% | 0.3% |
| 40 | 0.7% | 0.3% |
| 41 | 0.7% | 0.3% |
| 42 | 0.7% | 0.3% |
| 43 | 0.7% | 0.3% |
| 44 | 0.7% | 0.3% |
| 45 & over | 0.7% | 0.3% |

[a] Rounded up to nearest whole year.

Table 4.3 An Illustration of Assumed Wage progression In Valuation Formulas

| Year1 YOS | Year1 Tier 1 | Year1 Tier 2 | Year1+ 1 YOS | Year1 +1 Tier 1 | Year2 + 1 Tier 2 |
|---|---|---|---|---|---|
| 0 | $ 4,862.88 | $4,821.20 | 0 | | |
| 1 | $ 6,049.42 | $5,896.33 | 1 | $ 6,261.15 | $6,102.70 |
| 2 | $ 6,599.92 | $6,373.93 | 2 | $ 6,830.92 | $6,597.02 |
| 3 | $ 7,081.71 | $6,775.49 | 3 | $ 7,329.57 | $7,012.63 |
| 4 | $ 7,414.55 | $7,039.73 | 4 | $ 7,674.06 | $7,286.12 |
| 5 | $ 7,614.75 | $7,194.60 | 5 | $ 7,881.26 | $7,446.42 |
| 6 | $ 7,782.27 | $7,309.72 | 6 | $ 8,054.65 | $7,565.56 |
| 7 | $ 7,922.35 | $7,404.74 | 7 | $ 8,199.63 | $7,663.91 |
| 8 | $ 8,041.19 | $7,478.79 | 8 | $ 8,322.63 | $7,740.55 |
| 9 | $ 8,145.72 | $7,538.62 | 9 | $ 8,430.82 | $7,802.47 |
| 10 | $ 8,235.32 | $7,591.39 | 10 | $ 8,523.56 | $7,857.09 |
| 11 | $ 8,317.68 | $7,636.94 | 11 | $ 8,608.80 | $7,904.23 |
| 12 | $ 8,392.54 | $7,675.13 | 12 | $ 8,686.28 | $7,943.76 |
| 13 | $ 8,459.68 | $7,713.50 | 13 | $ 8,755.77 | $7,983.47 |
| 14 | $ 8,518.89 | $7,744.36 | 14 | $ 8,817.06 | $8,015.41 |
| 15 | $ 8,570.01 | $7,775.33 | 15 | $ 8,869.96 | $8,047.47 |
| 16 | $ 8,621.43 | $7,798.66 | 16 | $ 8,923.18 | $8,071.61 |
| 17 | $ 8,664.54 | $7,822.06 | 17 | $ 8,967.79 | $8,095.83 |
| 18 | $ 8,707.86 | $7,845.52 | 18 | $ 9,012.63 | $8,120.11 |
| 19 | $ 8,751.40 | $7,861.21 | 19 | $ 9,057.70 | $8,136.35 |
| 20 | $ 8,786.40 | $7,876.93 | 20 | $ 9,093.93 | $8,152.63 |
| 21 | $ 8,821.55 | $7,892.69 | 21 | $ 9,130.30 | $8,168.93 |
| 22 | $ 8,856.83 | $7,908.47 | 22 | $ 9,166.82 | $8,185.27 |
| 23 | $ 8,892.26 | $7,924.29 | 23 | $ 9,203.49 | $8,201.64 |
| 24 | $ 8,918.94 | $7,940.14 | 24 | $ 9,231.10 | $8,218.04 |
| 25 | $ 8,945.70 | $7,956.02 | 25 | $ 9,258.79 | $8,234.48 |
| 26 | $ 8,972.53 | $7,971.93 | 26 | $ 9,286.57 | $8,250.95 |
| 27 | $ 8,999.45 | $7,979.90 | 27 | $ 9,314.43 | $8,259.20 |
| 28 | $ 9,026.45 | $7,987.88 | 28 | $ 9,342.37 | $8,267.46 |
| 29 | $ 9,053.53 | $7,995.87 | 29 | $ 9,370.40 | $8,275.73 |
| 30 | $ 9,370.40 | $8,187.77 | 30 | $ 9,698.37 | $8,474.34 |
| 31 | $ 9,435.99 | $8,212.34 | 31 | $ 9,766.25 | $8,499.77 |
| 32 | $ 9,502.05 | $8,236.97 | 32 | $ 9,834.62 | $8,525.27 |
| 33 | $ 9,568.56 | $8,261.68 | 33 | $ 9,903.46 | $8,550.84 |
| 34 | $ 9,635.54 | $8,286.47 | 34 | $ 9,972.78 | $8,576.50 |
| 35 | $ 9,702.99 | $8,311.33 | 35 | $ 10,042.59 | $8,602.22 |
| 36 | $ 9,770.91 | $8,336.26 | 36 | $ 10,112.89 | $8,628.03 |
| 37 | $ 9,839.31 | $8,361.27 | 37 | $ 10,183.68 | $8,653.92 |
| 38 | $ 9,908.18 | $8,386.35 | 38 | $ 10,254.97 | $8,679.88 |
| 39 | $ 9,977.54 | $8,411.51 | 39 | $ 10,326.75 | $8,705.92 |
| 40 | $ 10,047.38 | $8,436.75 | 40 | $ 10,399.04 | $8,732.03 |
| 41 | $ 10,117.71 | $8,462.06 | 41 | $ 10,471.83 | $8,758.23 |
| 42 | $ 10,188.54 | $8,487.44 | 42 | $ 10,545.14 | $8,784.51 |
| 43 | $ 10,259.86 | $8,512.91 | 43 | $ 10,618.95 | $8,810.86 |
| 44 | $ 10,331.68 | $8,538.45 | 44 | $ 10,693.28 | $8,837.29 |
| 45 & over | $ 10,404.00 | $8,564.06 | 45 & over | $ 10,768.14 | $8,863.80 |

**Assume Actual 2022 New Entrant Salaries**

$6,261.15 = 4,862.88 * 1.035 * (1 + 24.4%)

$7,674.06 = $7,081.71 * 1.035 * (1 + 4.7%)

$7,663.91 = $7,309.72 * 1.035 * (1 + 1.3%)

For simplicity and easier to understand, assume all EE works 12 months per year
In actual valuation, number of month worked is based on the "Service Month" table, which is a slightly less than 12 months.

Assume +3.5% wage increase for (year1 + 1) .

Based on actual 2022 new entrants salaries and the proposed 29th Valuation Salary Scales.

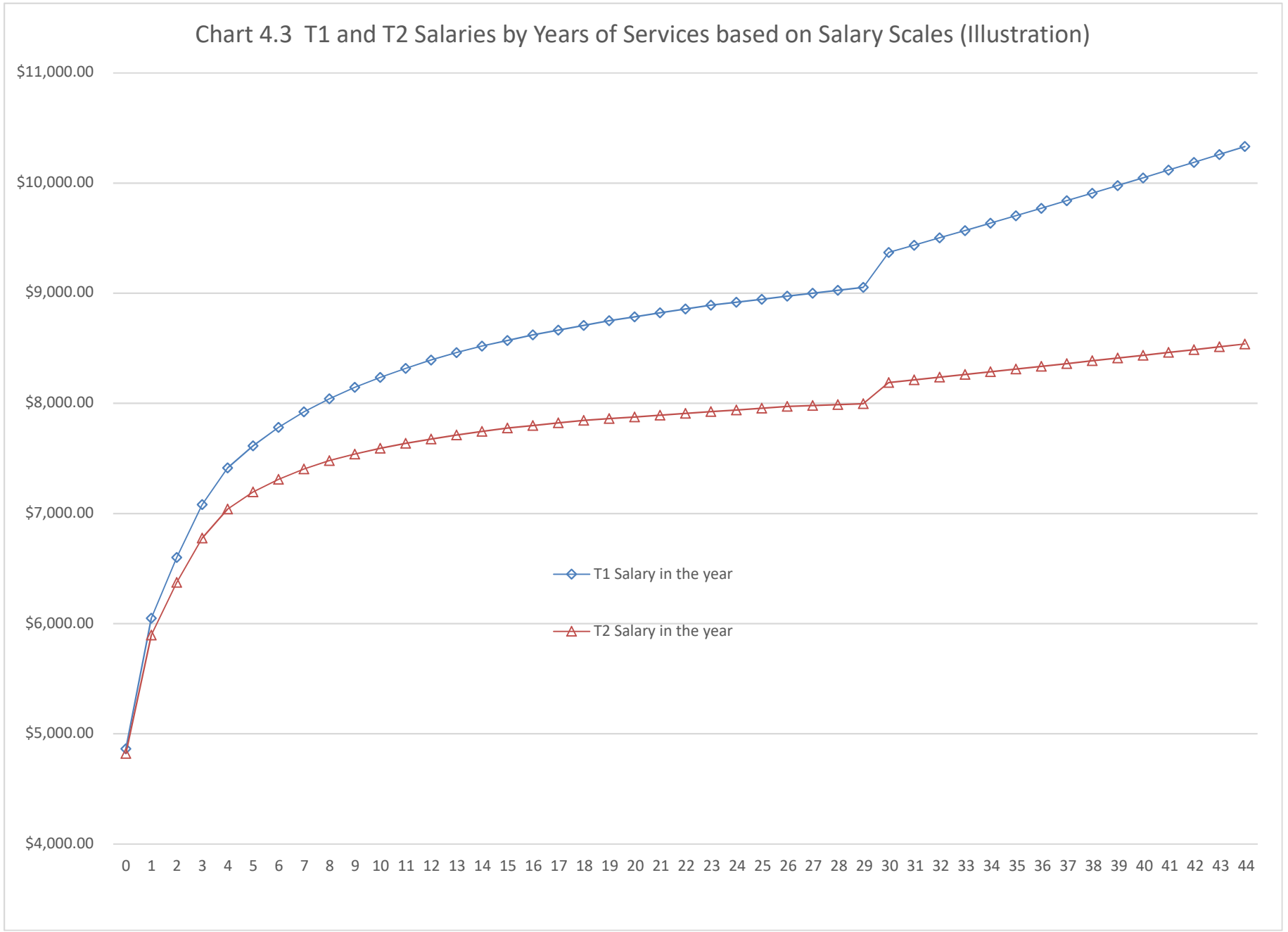


Chart 4.3 T1 and T2 Salaries by Years of Services based on Salary Scales (Illustration)
$11,000.00
$10,000.00
$9,000.00
$8,000.00
$7,000.00
$6,000.00
$5,000.00
$4,000.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44
T1 Salary in the year
T2 Salary in the year

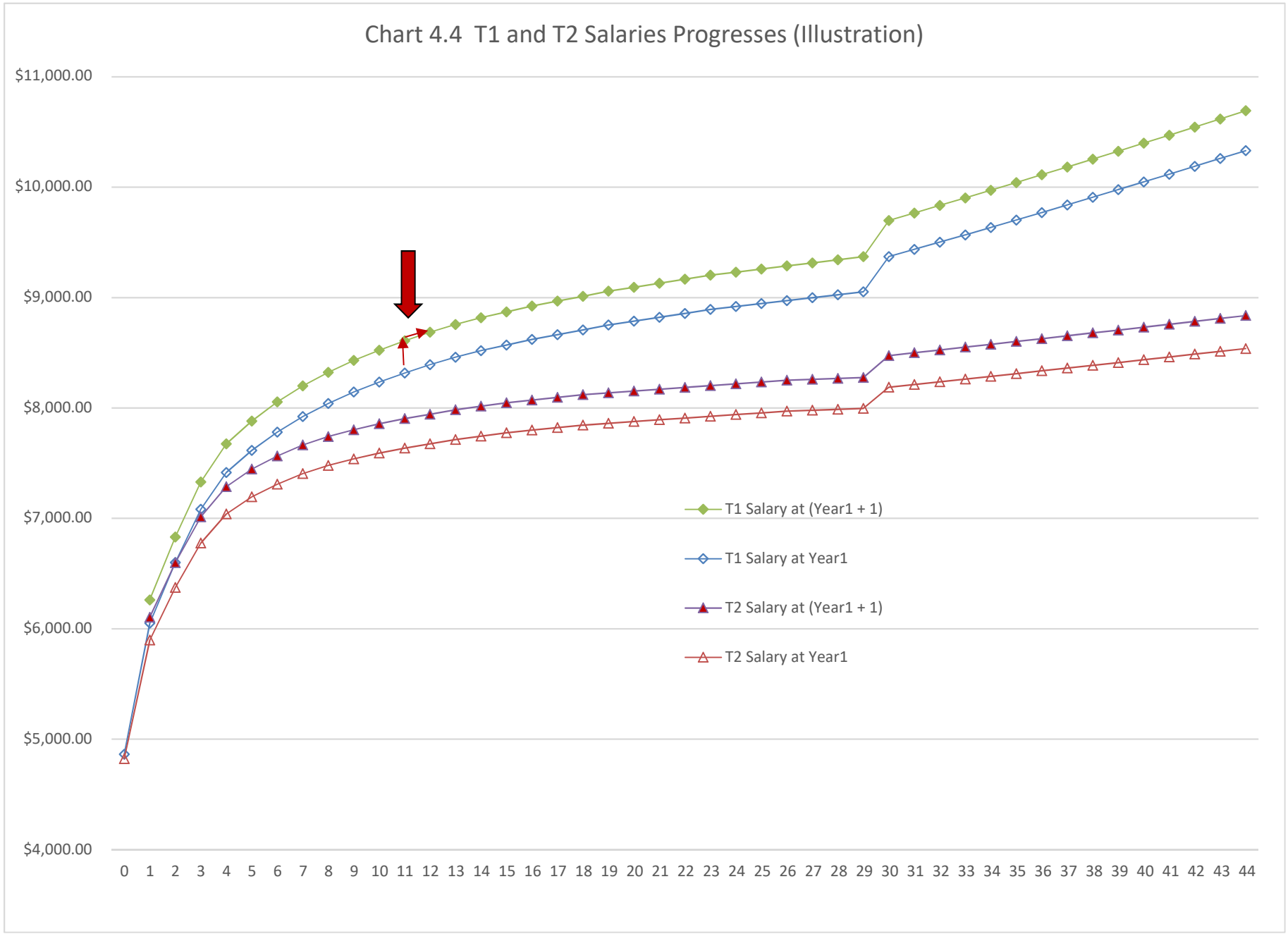


Chart 4.4 T1 and T2 Salaries Progresses (Illustration)
$11,000.00
$10,000.00
$9,000.00
$8,000.00
$7,000.00
$6,000.00
$5,000.00
$4,000.00
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44
T1 Salary at (Year1 + 1)
T1 Salary at Year1
T2 Salary at (Year1 + 1)
T2 Salary at Year1

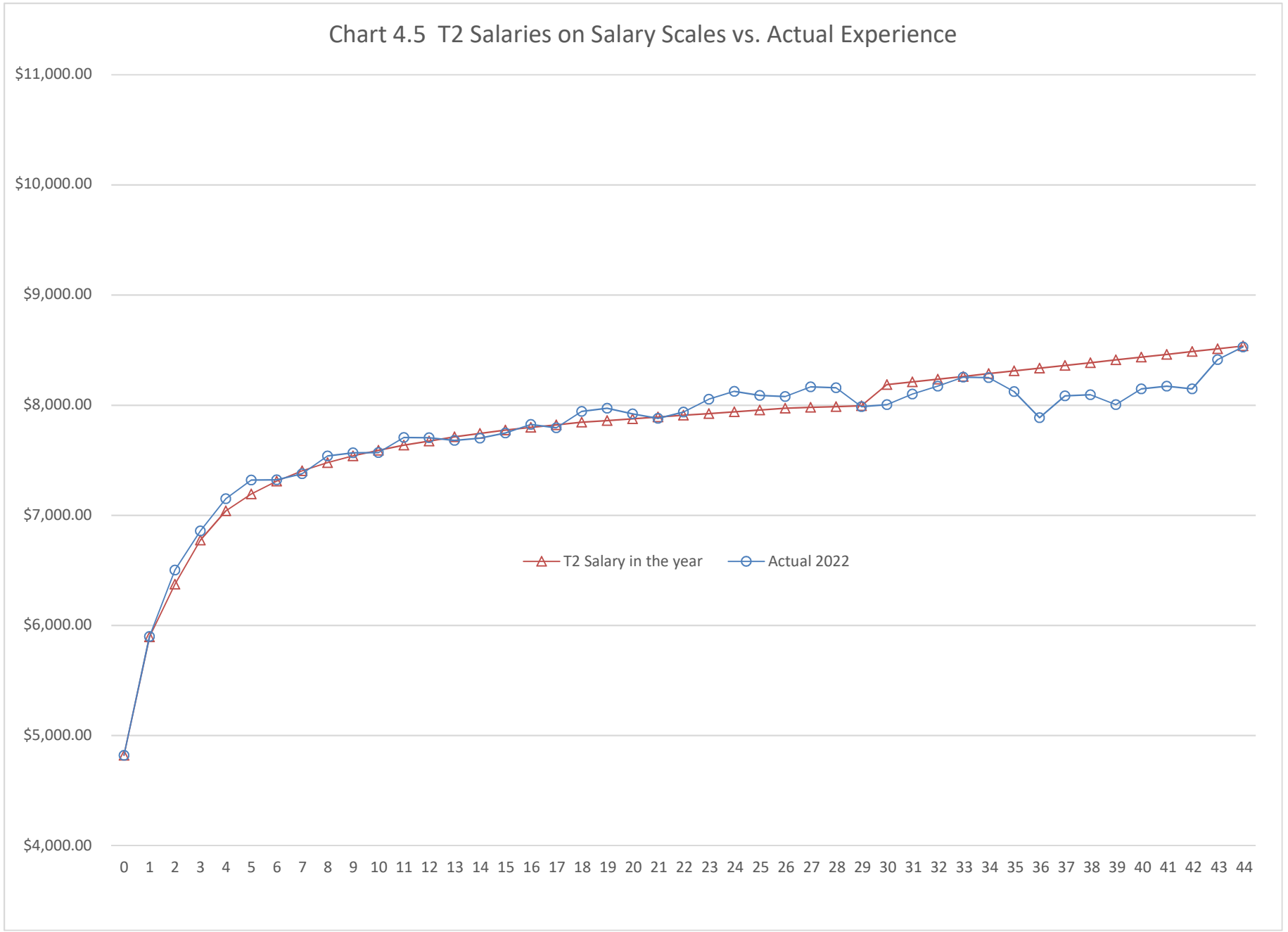


Chart 4.5 T2 Salaries on Salary Scales vs. Actual Experience
$11,000.00
$10,000.00
$9,000.00
$8,000.00
$7,000.00
$6,000.00
$5,000.00
$4,000.00
T2 Salary in the year
Actual 2022
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44

## 5. Select Period Mortality Load

For the calendar years 2020 through 2022, the RRB annuitants on the rolls have shown increases in deaths over expected, most likely due to COVID-19 pandemic. To recognize this increase, a select mortality load was introduced for the first three projection years of the valuation. For the 2023 Section 502 Report, the mortality loading factors were 111% for 2022, 106% for 2023 and 101% for 2024.

As part of our preparation for the 29th Valuation, we reviewed the actual deaths compared to expected deaths for age retirements and disability retirements. Mortality rate and improvement scale assumptions approved for the 29th Valuation were used for this review. One year of the mortality improvement scale was applied to derive the expected deaths for 2023. Based on the 2023 experience of these annuitants, there were no excess deaths. The actual to expected ratio of deaths for 2023 was 96%. Based on this review and the introduction of updated mortality rates and improvement scale for the 29th Valuation, no select mortality load will be applied for the 29th Valuation.