

# Actuarial

Madisonville



Kenedy



Brownsville





May 25, 2018

Board of Trustees  
Texas Municipal Retirement System ("TMRS" or the "System")  
Austin, Texas

Dear Trustees:

In accordance with the Texas Municipal Retirement System ("TMRS") Act, the annual actuarial valuation of the assets and liabilities of the TMRS Pension Trust Fund was completed as of December 31, 2017.

Except for healthy post-retirement mortality and the mortality assumption used to develop the Annuity Purchase Rates (APRs), the current actuarial assumptions were developed from the actuarial investigation of the experience of TMRS over the four year period from December 31, 2010 to December 31, 2014. These assumptions were adopted in 2015 and were first used in the December 31, 2015 valuation. Healthy post-retirement mortality rates and the APRs used to annuitize members' account balances at retirement were updated based on the mortality experience investigation study dated December 31, 2013. In addition, in conjunction with these changes made for the December 31, 2013 valuation, the Board adopted a change in the actuarial cost method from Projected Unit Credit (PUC) to Entry Age Normal (EAN) and a one-time change to the amortization policy. The change to EAN was made to decrease the rate volatility compared to PUC and to align the assumptions and methods used for funding purposes and financial reporting. The assumptions and methods used in this valuation are summarized in the Actuarial Section of the Comprehensive Annual Financial Report (CAFR). There were no changes in the actuarial assumptions or methods since the prior valuation.

The results of the actuarial valuation are dependent on the actuarial assumptions used. Actual results can and almost certainly will differ, as actual experience deviates from the assumptions. Even seemingly minor changes in the assumptions can materially change the liabilities, calculated contribution rates and funding periods.

It is our opinion that the recommended assumptions and methods are internally consistent and are reasonably based on past and anticipated future experience of the System and comply with the parameters for disclosure as set forth in Governmental Accounting Standards Board Statement No. 67. We prepared all of the supporting schedules in the Actuarial Section.

The financing objective for each TMRS plan is to provide retirement, death and disability benefits for a member city's employees financed by an employer contribution rate. This rate is determined annually and is expected to remain approximately level as a percentage of the employer's covered payroll. In TMRS, a city's actuarially determined contribution rate consists of two components: the employer normal cost contribution rate and the prior service contribution rate. Both rates are determined as a

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level percentage of payroll. The normal cost contribution rate finances the portion of an active member's projected retirement benefit allocated annually. The prior service contribution rate amortizes the unfunded actuarial accrued liability ("UAAL") over the applicable period for that city. Both the normal cost and prior service contribution rates include recognition of the projected impact of annually repeating updated service credits and annuity increases.

The employer contribution rates for the municipalities participating in TMRS are certified annually by the Board of Trustees which is responsible for establishing and maintaining the funding policy. These rates are actuarially determined and are based upon the plan provisions in effect as of April 1, 2018 and the actuarial assumptions and methodology adopted by the Board. The Board's current policy is that the contribution rates determined by a given actuarial valuation become effective one (1) year after the valuation date. For example, the rates determined by the December 31, 2017 actuarial valuation will be applicable for the calendar year beginning January 1, 2019 and ending December 31, 2019.

To test how well the financing objective for each plan is being achieved, annual actuarial valuations are made. These actuarial valuations recognize differences in the past year between the actuarial assumptions and the actual experience, and any benefit changes for each plan. A separate actuarial valuation for each participating municipality was made based upon the plan of benefits in effect as of April 1, 2018.

The TMRS staff supplied all of the data for retired, active and inactive members as of December 31, 2017. We did not audit this data, but we did apply a number of tests to the data and we concluded that it was reasonable and consistent with the prior year's data. The TMRS staff also supplied all of the asset data and financial information as of December 31, 2017. The amounts of the assets in the actuarial valuations agree with the amounts as reported by TMRS.

All of our work conforms with generally accepted actuarial principles and practices, and with the Actuarial Standards of Practice issued by the Actuarial Standards Board. In our opinion, our calculations also comply with the requirements of the TMRS Act and, where applicable, the Internal Revenue Code and the Statements of the Governmental Accounting Standards Board.

The undersigned are independent actuaries and consultants. Both are Members of the American Academy of Actuaries, both meet all of the Qualification Standards of the American Academy of Actuaries, and both are experienced in performing valuations for large public retirement systems.

Respectfully Submitted,



Mark R. Randall, MAAA, FCA, EA  
Chief Executive Officer



Joseph P. Newton, MAAA, FSA, EA  
Pension Market Leader



# Summary of Actuarial Assumptions (Pension Trust Fund)

**T**hese actuarial assumptions were developed primarily from the actuarial investigation of the experience of TMRS over the five-year period from January 1, 2010 to December 31, 2014. They were adopted in 2015 and first used in the December 31, 2015 actuarial valuation. The post-retirement mortality assumption for healthy annuitants and Annuity Purchase Rate (APRs) are based on the Mortality Experience Investigation Study covering 2009 through 2011 and dated December 31, 2013. In conjunction with these changes first used in the December 31, 2013 valuation, the System adopted the Entry Age Normal actuarial cost method and a one-time change to the amortization policy.

## I. Economic Assumptions

**A. General Inflation** — General inflation is assumed to be 2.50% per year.

**B. Discount/Crediting Rates**

1. System-wide Investment Return Assumption: 6.75% per year, compounded annually, composed of an assumed 2.50% inflation rate and a 4.25% net real rate of return. This rate represents the assumed return, net of all investment and administrative expenses. This is the discount rate used to value the liabilities of the individual employers.
2. Assumed discount/crediting rate for Supplemental Disability Benefits Fund and individual employee accounts: an annual rate of 5.00% for (1) accumulating prior service credit and updated service credit after the valuation date, (2) accumulating the employee current service balances, (3) determining the amount of the monthly benefit at future dates of retirement or disability, and (4) calculating the actuarial liability of the System-wide Supplemental Disability Benefits Fund.

**C. Overall Payroll Growth** — 3.00% per year, which is used to calculate the contribution rates for the retirement plan of each participating city as a level percentage of payroll. This represents the expected increase in total payroll. This increase rate is solely due to the effect of wage inflation on salaries, with no allowance for future membership growth. However, for cities with a decrease in the number of contributing members from 2005 to 2014, the payroll growth is decreased by half the annual percentage decrease in the count capped at a 1.0% decrease per year and rounded down to the nearest 0.1%.

**D. Individual Salary Increases** — Salary increases are assumed to occur once a year, on January 1. Therefore, the pay used for the period year following the valuation date is equal to the reported pay for the prior year, increased by the salary increase assumption. Salaries are assumed to increase by the following graduated service-based scale.

Years of Service	Rate(%)
1	10.50%
2	7.50%
3	7.00%
4	6.50%
5	6.00%
6	5.50%
7	5.25%
8 - 10	4.75%
11	4.50%
12 - 13	4.25%
14 - 16	4.00%
17 - 24	3.75%
25+	3.50%

**E. Annuity Increases** — The Consumer Price Index (CPI) is assumed to be 2.50% per year prospectively. Annuity Increases, when applicable, are 30%, 50%, or 70% of CPI, according to the provisions adopted by each city. The actual future COLA assumptions are as follows: 0.87% per year for the 30% CPI provision, 1.38% per year for the 50% CPI provision, and 1.86% per year for the 70% CPI provision.

# Summary of Actuarial Assumptions (Pension Trust Fund)

Continued

## II. Demographic Assumptions

### A. Termination Rates

1. For the first 10 years of service, the base table rates vary by gender, entry age, and length of service. For each city, the base table is then multiplied by a factor from 75% to 125% based on the experience of the individual city in comparison to the group as a whole. A further multiplier is applied depending on an employee's classification: 1) Fire – 63%, 2) Police – 88%, or 3) Other – 108%. A sample of the base rates follows:

Males		Years of Service								
Age	0	1	2	3	4	5	6	7	8	9
20	0.2920	0.2623	0.2186	0.1932	0.1850	0.1673	0.1529	0.1243	0.1022	0.0816
25	0.2653	0.2269	0.1812	0.1554	0.1429	0.1267	0.1148	0.1006	0.0926	0.0757
30	0.2451	0.2052	0.1610	0.1322	0.1079	0.0998	0.0896	0.0774	0.0744	0.0621
35	0.2505	0.2070	0.1577	0.1265	0.1050	0.0994	0.0848	0.0719	0.0621	0.0567
40	0.2467	0.2060	0.1561	0.1213	0.1046	0.0943	0.0805	0.0710	0.0621	0.0577
45	0.2268	0.1934	0.1556	0.1220	0.1053	0.0926	0.0813	0.0711	0.0605	0.0575
50	0.2078	0.1731	0.1412	0.1149	0.1016	0.0887	0.0807	0.0716	0.0604	0.0578
55	0.2003	0.1668	0.1265	0.1074	0.0861	0.0864	0.0771	0.0682	0.0609	0.0560
60	0.1999	0.1542	0.1231	0.1060	0.0790	0.0868	0.0753	0.0683	0.0571	0.0549
65	0.2000	0.1463	0.1238	0.1063	0.0803	0.0867	0.0757	0.0700	0.0547	0.0551
70	0.2000	0.1477	0.1237	0.1063	0.0802	0.0867	0.0756	0.0697	0.0551	0.0551

Females		Years of Service								
Age	0	1	2	3	4	5	6	7	8	9
20	0.3030	0.2790	0.2221	0.2098	0.1997	0.2021	0.1536	0.1539	0.1564	0.1574
25	0.2782	0.2409	0.2067	0.1962	0.1710	0.1663	0.1369	0.1352	0.1186	0.1125
30	0.2574	0.2188	0.1949	0.1762	0.1347	0.1348	0.1276	0.1126	0.0973	0.0804
35	0.2424	0.2118	0.1805	0.1438	0.1273	0.1238	0.1112	0.1085	0.1000	0.0769
40	0.2244	0.1993	0.1614	0.1342	0.1295	0.1097	0.1023	0.0924	0.0834	0.0733
45	0.2191	0.1853	0.1427	0.1337	0.1054	0.1017	0.0894	0.0784	0.0705	0.0725
50	0.2201	0.1793	0.1347	0.1229	0.0886	0.0881	0.0823	0.0723	0.0675	0.0617
55	0.2200	0.1738	0.1350	0.1199	0.0834	0.0806	0.0713	0.0705	0.0685	0.0551
60	0.2200	0.1523	0.1350	0.1172	0.0798	0.0843	0.0646	0.0639	0.0429	0.0379
65	0.2200	0.1431	0.1350	0.1150	0.0800	0.0857	0.0667	0.0593	0.0276	0.0280
70	0.2200	0.1447	0.1350	0.1154	0.0800	0.0854	0.0664	0.0601	0.0303	0.0298

2. After 10 years of service, base termination rates vary by gender and by the number of years remaining until first retirement eligibility. For each city, the base table is then multiplied by a factor from 75% to 125% based on the experience of the individual city in comparison to the group as a whole (same factor as above). A further multiplier is applied depending on an employee's classification: 1) Fire – 52%, 2) Police – 79%, or 3) Other – 115%. A sample of the base rates follows:

Years From Retirement	Males	Females
1	.0172	.0220
2	.0229	.0297
3	.0271	.0354
4	.0306	.0401
5	.0335	.0441
6	.0361	.0477
7	.0385	.0510
8	.0407	.0540
9	.0428	.0568
10	.0447	.0594
11	.0465	.0619
12	.0482	.0643
13	.0498	.0666
14	.0514	.0687
15	.0529	.0708

Termination rates end at first eligibility for retirement.

## B. Forfeiture Rates (withdrawal of member deposits from TMRS)

Rates for vested members vary by age and employer match, and they are expressed as a percentage of the termination rates shown in (A). The withdrawal rates for cities with a 2-to-1 match are shown below. 4% is added to the rates for 1½-to-1 cities, and 8% is added for 1-to-1 cities.

Age	Percent of Terminating Employees Choosing to Take a Refund
25	41.2%
30	41.2%
35	41.2%
40	38.0%
45	32.6%
50	27.1%
55	21.7%

Forfeiture rates end at first eligibility for retirement.

# Summary of Actuarial Assumptions (Pension Trust Fund)

Continued

## C. Service Retirees and Beneficiary Mortality Rates

For calculating the actuarial liability and the retirement contribution rates, the Gender-distinct RP2000 Combined Healthy Mortality Tables with Blue Collar Adjustment are used with male rates multiplied by 109% and female rates multiplied by 103%. The rates are projected on a fully generational basis by scale BB to account for future mortality improvements.

## D. Disabled Annuitant Mortality Rates

For calculating the actuarial liability and the retirement contribution rates, the Gender-distinct RP2000 Combined Healthy Mortality Tables with Blue Collar Adjustment are used with male rates multiplied by 109% and female rates multiplied by 103% with a three-year set-forward for both males and females. In addition, a 3% minimum mortality rate will be applied to reflect the impairment for younger members who become disabled. The rates are projected on a fully generational basis by scale BB to account for future mortality improvements subject to the 3% floor.

## E. Annuity Purchase Rates

For determining the amount of the monthly benefit at the time of retirement for both healthy and disabled annuitants, the annuity purchase rates (APRs) for 2014 were based on the UP-1984 Table with an age setback of two years for retirees and eight years for beneficiaries. Beginning in 2027 the APRs will be based on a unisex blend of the RP-2000 Combined Healthy Mortality Tables with Blue Collar Adjustment for males and females with both male and female rates multiplied by 107.5% and projected on a fully generational basis with Scale BB. For members, a unisex blend of 70% of the males table and 30% of the female table is used, while 30% of the male table and 70% of the female table is used for beneficiaries. From 2015 through 2026, the fully generational APRs will be phased in.

## F. Pre-Retirement Mortality Rates

For calculating the actuarial liability and the retirement contribution rates, the Gender-distinct RP2000 Combined Healthy Mortality Tables with Blue Collar Adjustment are used with male rates multiplied by 54.5% and female rates multiplied by 51.5%. The rates are projected on a fully generational basis by scale BB to account for future mortality improvements.

## G. Disability Rates

Age	Males & Females
20	0.000004
25	0.000025
30	0.000099
35	0.000259
40	0.000494
45	0.000804
50	0.001188
55	0.001647
60	0.002180
65	0.002787

## H. Service Retirement Rates (applied to both active and inactive members)

The base table rates vary by gender, entry age group, and age. For retirees under the age of 62, the rates for active members are then multiplied by 2 factors based on 1) employee contribution rate and employer match and 2) if the city has a recurring COLA.

Age	Males			Females		
	Entry Age Groups			Entry Age Groups		
	Ages 32 and under	Ages 33-47	Ages 48 and over	Ages 32 and under	Ages 33-47	Ages 48 and over
40-44	0.06	-	-	0.06	-	-
45-49	0.06	-	-	0.06	-	-
50-52	0.08	-	-	0.08	-	-
53	0.08	0.10	-	0.08	0.10	-
54	0.08	0.10	-	0.11	0.10	-
55-59	0.14	0.10	-	0.11	0.10	-
60	0.20	0.15	0.10	0.14	0.15	0.10
61	0.25	0.30	0.20	0.28	0.26	0.20
62	0.32	0.25	0.12	0.28	0.17	0.12
63	0.32	0.23	0.12	0.28	0.17	0.12
64	0.32	0.35	0.20	0.28	0.22	0.20
65	0.32	0.32	0.20	0.28	0.27	0.20
66-69	0.22	0.22	0.17	0.22	0.22	0.17
70-74	0.20	0.22	0.25	0.22	0.22	0.25
75 and over	1.00	1.00	1.00	1.00	1.00	1.00

Note: For cities without a 20-year/any age retirement provision, the active employee rates for entry ages 32 and under are loaded by 20% for ages below 60.

Plan design factors applied to base retirement rates are as follows:

Employer Match	Employee Contribution Rate		
	5%	6%	7%
1 - 1	0.75	0.80	0.84
1.5 - 1	0.81	0.86	0.92
2 - 1	0.86	0.93	1.00

Recurring COLA: 1.00

No Recurring COLA: 0.90

## III. Methods and Assumptions

- A. Valuation of Assets** — The actuarial value of assets is based on the fair value of assets with a ten-year phase-in of actual investment return in excess of (less than) expected investment income. Offsetting unrecognized gains and losses are immediately recognized, with the shortest remaining bases recognized first, and the net remaining bases continue to be recognized on their original timeframe. The actuarial value of assets is further adjusted by 33% of any difference between the initial value and a 15% corridor around the fair value of assets, if necessary.
- B. Actuarial Cost Method** — The actuarial cost method being used is known as the Entry Age Normal actuarial cost method. The Entry Age Normal actuarial cost method develops the annual cost of the Plan in two parts: that attributable to benefits accruing in the current year, known as the normal cost, and that due to service earned prior to the current year, known as the amortization of the unfunded actuarial accrued liability. The normal cost and the actuarial accrued liability are calculated individually for each member. The normal cost rate for an employee is the contribution rate which, if applied to a member's compensation throughout their period of anticipated covered service with the municipality, would be sufficient to meet all benefits payable on their behalf. The normal cost is calculated using an entry age based on benefit service with the current city. If a member has additional time-only vesting service through service with other TMRS cities or other public agencies, they retain this for determination of benefit eligibility and decrement rates. The salary-weighted average of these rates is the total normal cost rate. The unfunded actuarial accrued liability reflects the difference between the portion of projected benefits attributable to service credited prior to the valuation date and assets already accumulated. The unfunded actuarial accrued liability is paid off in accordance with a specified amortization procedure outlined in C below.
- C. Amortization Policy** — For “underfunded” cities with twenty or more employees, the amortization as of the valuation date is a level percentage of payroll over a closed period using the process of “laddering.” Bases that existed prior to this valuation continue to be amortized on their original schedule. Beginning January 1, 2016, all new experience losses are amortized over individual periods of not more than 25 years. Previously, some cities amortized their losses over a 30-year period. New gains (including lump sum contributions) are offset against and amortized over the same period as the current largest outstanding loss base for the specific city, which in turn decreases contribution rate volatility.

Once a city reaches an overfunded status, all prior non-ad hoc bases are erased, and the surplus for overfunded cities is amortized over a 25-year open period.

Ad hoc benefit enhancements are amortized over individual periods using a level dollar policy. The period will be based on the minimum of 15 years or the current life expectancy of the covered group.

For the December 31, 2013 actuarial valuation, there was a one-time change in the amortization policy for underfunded cities implemented in conjunction with the changes to the assumptions and cost method to minimize rate volatility associated with these changes. An initial Actuarially Determined Employer Contribution (ADEC) was developed using the methodology described above. For cities with a decrease in the rate compared to the rate calculated prior to changes, the amortization period for all non-ad hoc bases was shortened enough to keep the rates stable (if possible). Cities with an increase of more than 0.50% were allowed to extend the amortization periods for non-ad hoc bases up to 30 years to keep the full contribution rate from increasing. For cities with an increase of 0.50% or less, the amortization periods for all non-ad hoc bases could be

extended to 25 years to keep the rate from increasing. The amortization period calculated in the prior steps was then rounded up to the nearest integer to calculate the final full contribution rate.

**D. Small City Methodology** — For cities with fewer than twenty employees, more conservative methods and assumptions are used. First, lower termination rates are used for smaller cities, with maximum multipliers of 75% for employers with less than 6 members, 85% for employers with 6 to 10 members, 100% for employers with 11 to 15 members, and 115% for employers with less than 100 members.

1. There is also a load on the life expectancy for employers with less than 15 active members. The life expectancy will be loaded by decreasing the mortality rates by 1% for every active member less than 15. For example, an employer with 5 active members will have the baseline mortality tables multiplied by 90% (10 active members times 1%).

For underfunded plans, the maximum amortization period for amortizing gains and losses is decreased from current levels by one year for each active member less than the 20-member threshold. For example, an employer with 8 active members and a current maximum amortization period of 25 will use a  $(25 - (20 - 8)) = 13$  year amortization period for the gain or loss in that year's valuation. Under this policy, the lowest amortization period will be  $25 - (20 - 1) = 6$  years. Once the plan is overfunded, the amortization period will revert back to the standard 25 years.

## IV. Other Assumptions

1. Valuation payroll (used for determining the amortization contribution rate): An exponential average of the actual salaries paid during the prior fiscal years, with 33% weight given to the most recent year and 67% weight given to the expected payroll for the previous fiscal year, moved forward with one year's payroll growth rate and adjusted for changes in population.
2. Individual salaries used to project benefits: For members with more than three years of service, actual salaries from the past three fiscal years are used to determine the USC final average salary as of the valuation date. For future salaries, this three-year average is projected forward with two years of salary scale to create the salary for the year following the valuation. This value is then projected with normal salary scales.
3. Timing of benefit payments: Benefit payments are assumed to be made in the middle of the month. Although TMRS benefits are paid at the end of the month, eligibility for that payment is determined at the beginning of the month. A middle of month payment approximates the impact of the combination of eligibility determination and actual payment timing.
4. Percent married: 100% of the employees are assumed to be married.
5. Age difference: Male members are assumed to be three years older than their spouses, and female members are assumed to be three years younger than their spouses.
6. Optional Forms: Healthy members are assumed to choose a life only benefit when they retire. Disabled members are assumed to select a 50% Joint and Survivor option when they retire.
7. Percent electing annuity on death (when eligible): For vested members not eligible for retirement, 75% of the spouses of male members and 70% of the spouses of female members are assumed to commence an immediate benefit in lieu of a deferred annuity or a refund. Those not electing an immediate benefit are assumed to take a refund. All of the spouses of

# Summary of Actuarial Assumptions (Pension Trust Fund)

Continued

married participants who die after becoming eligible for a retirement benefit are assumed to elect an annuity that commences immediately.

- 8.** Partial Lump Sum utilization: It is assumed that each member at retirement will withdraw 40% of his/her eligible account balance.
- 9.** Inactive Population: All non-vested members of a city are assumed to take an immediate refund if they are not contributing members in another city. Vested members not contributing in another city are assumed to take a deferred retirement benefit, except for those who have terminated in the past 12 months for whom one year of forfeiture probability is assumed. The forfeiture rates for inactive members of a city who are contributing members in another city are equal to the probability of termination multiplied by the forfeiture rates shown in II(A) and II(B), respectively. These rates are applied each year until retirement eligibility. Once a member is retirement eligible, he or she is assumed to commence benefits based on the service retirement rates shown in II(H).
- 10.** There will be no recoveries once disabled.
- 11.** No surviving spouse will remarry and there will be no children's benefit.
- 12.** Decrement timing: Decrements of all types are assumed to occur mid-year.
- 13.** Eligibility testing: Eligibility for benefits is determined based upon the age at nearest birthday and service at nearest whole year on the date the decrement is assumed to occur.
- 14.** Decrement relativity: Decrement rates are used directly from the experience study, without adjustment for multiple decrement table effects.
- 15.** Incidence of contributions: Contributions are assumed to be received continuously throughout the year based on the computed percent of payroll shown in this report, and the actual payroll payable at the time contributions are made.
- 16.** Benefit service: All members are assumed to accrue one year of eligibility service each year.
- 17.** The decrement rates for service-related decrements are based on total TMRS eligibility service.

1. **Actuarial gain (loss)** — A measure of the difference between actual experience and that expected based upon the actuarial assumptions, during the period between two actuarial valuation dates, as determined in accordance with the actuarial cost method used.
2. **Actuarial accrued liability** — The actuarial present value of benefits attributable to all periods prior to the valuation date.
3. **Actuarial present value** — The value of an amount or series of amounts payable or receivable at various times, determined as of a given date (the valuation date) by the application of the actuarial assumptions.
4. **Actuarial value of assets** — The value of cash, investments, and other property belonging to a pension plan, as used by the actuary for the purpose of an actuarial valuation.
5. **Amortization period** — The period over which the existing unfunded or overfunded actuarial accrued liability is projected to be paid off, as a level percentage of payroll.
6. **Actuarially Determined Employer Contribution (ADEC)** — The employer's periodic required contributions to the defined benefit pension plan, calculated in accordance with current TMRS funding policy.
7. **Average age of contributing members** — The average attained age as of the valuation date.
8. **Average length of service of contributing members** — The average length of total credited service in TMRS as of the valuation date.
9. **Current service benefits** — Benefits attributable to the member's accumulated deposits and an amount provided by the municipality at retirement to match the accumulated deposits at the matching ratio in effect when the deposits were made.
10. **Entry Age Normal actuarial cost method** — The Entry Age Normal actuarial cost method develops the annual cost of the plan in two parts: that attributable to benefits accruing in the current year, known as the normal cost, and that due to service earned prior to the current year, known as the amortization of the unfunded actuarial accrued liability. The normal cost and the actuarial accrued liability are calculated individually for each member. The normal cost rate for an employee is the contribution rate which, if applied to a member's compensation throughout their period of anticipated covered service, would be sufficient to meet all benefits payable on their behalf. The salary-weighted average of these rates is the total normal cost rate. The actuarial accrued liability is based on the portion of benefits attributable to service credited prior to the valuation date. Actuarial gains (losses), as they occur, reduce (increase) the unfunded actuarial accrued liability.
11. **Funded ratio** — The actuarial value of assets expressed as a percentage of the actuarial accrued liability.
12. **Funding policy** — The program for the amounts and timing of contributions to be made by plan members and employers to provide the benefits specified by a pension plan.
13. **Normal cost contribution rate** — The actuarial present value of benefits allocated to a valuation year by the actuarial cost method, expressed as a percentage of the covered payroll. It is equal to the sum of the actuarial present value of benefits allocated to the year following the valuation date divided by the compensation expected to be received during the next year for the closed group of members as of the valuation date.
14. **Overfunded actuarial accrued liability** — The excess of the actuarial value of assets over the actuarial accrued liability.
15. **Phase-in rate** — The minimum required contribution rate to TMRS, which reflects the portion of the full rate being phased in due to the changes in actuarial assumptions and methods.

# Definitions (Pension Trust Fund)

Continued

- 16. Prior service benefits** — Benefits other than current service benefits. These include all benefits arising from prior service credits, special prior service credits, antecedent service credits, updated service credits, and increases in monthly benefit payments to annuitants — also referred to as Annuity Increases (AI) or cost-of-living adjustments (COLAs).
- 17. Prior service contribution rate** — The level percentage of payroll required to amortize the unfunded or overfunded actuarial liability over a specified amortization period. If the rate is negative, it is offset against the normal cost contribution rate, with the limitation that the sum of the two rates cannot be negative.
- 18. Projected Unit Credit actuarial cost method** — A method under which the benefits of each individual included in the valuation are allocated by a consistent formula to valuation years based on years of service. Benefits are allocated equally to each year of service over the individual's career from hire to retirement. Normal costs are based on the portion of the benefit allocated to the year following the valuation year. Accrued liabilities are based on benefits allocated to the time preceding the date of the actuarial valuation. Under this method, actuarial gains (losses), as they occur, reduce (increase) the unfunded actuarial liability.
- 19. Retirement contribution rate** — The sum of the normal cost contribution rate and the prior service contribution rate.
- 20. Unfunded actuarial accrued liability** — The excess of the actuarial accrued liability over the actuarial value of assets.

# Participating Employers and Active Members (Pension Trust Fund)

Valuation Date	Number of Active Cities	Contributing Members			
		Number	Annual Payroll	Average Annual Pay	Percent Increase In Average
12/31/2008	829	100,459	\$ 4,529,989,369	\$ 45,551	4.7 %
12/31/2009	833	102,419	4,769,041,587	47,014	3.2
12/31/2010	837	101,240	4,797,903,131	47,117	0.2
12/31/2011	842	101,151	4,853,135,055	47,958	1.8
12/31/2012	844	101,827	4,961,671,305	48,889	1.9
12/31/2013	844	102,870	5,142,446,602	50,244	2.8
12/31/2014	853	104,019	5,374,536,634	51,956	3.4
12/31/2015	859	106,894	5,683,846,845	53,898	3.7
12/31/2016	864	108,891	5,884,788,962	54,543	1.2
12/31/2017	875	110,208	6,188,490,343	56,490	3.6

As of December 31, 2017, there were seven cities with no contributing members and no employer contributions due. In addition, one privatized hospital had no contributing members, but paid a dollar contribution amount to TMRS that is calculated annually by the actuary. Thus, there were 883 total cities, with 875 of them active.

The average annual pay was calculated by dividing the annual payroll by the average of the number of contributing members at the beginning and the end of the year.

## Retiree and Beneficiary Data (Pension Trust Fund)

Year Ended	Added to Rolls		Removed from Rolls		End of Year		% Increase in Annual Benefit	Average Annual Benefit
	Number of Accounts	Annual Benefit	Number of Accounts	Annual Benefit	Number of Accounts	Annual Benefit		
12/31/2008	2,962	\$ 59,560,238	609	\$ 6,232,194	36,863	\$ 577,323,585	10.2 %	\$ 15,656
12/31/2009	2,750	43,466,305	633	7,356,347	38,980	613,433,543	6.3	15,737
12/31/2010	3,193	61,116,748	714	8,750,654	41,459	665,799,637	8.5	16,059
12/31/2011	3,390	58,001,287	782	4,399,586	44,067	719,401,338	8.1	16,325
12/31/2012	3,545	72,731,553	710	8,898,201	46,902	783,234,690	8.9	16,699
12/31/2013	3,890	72,535,316	823	11,113,993	49,969	844,656,013	7.8	16,904
12/31/2014	4,319	92,940,036	833	11,533,222	53,455	926,062,827	9.6	17,324
12/31/2015	3,916	76,796,719	890	12,357,106	56,481	990,502,440	7.0	17,537
12/31/2016	4,073	82,664,225	943	13,821,624	59,611	1,059,345,041	7.0	17,771
12/31/2017	4,198	95,727,539	1,033	14,068,157	62,776	1,141,004,423	7.7	18,176

The number of retirement accounts is greater than the number of people who retired, as some retirees worked for more than one city in TMRS and retired with a separate benefit from each city. As of December 31, 2017, there were 7,111 more retirement accounts than people who retired. In addition, this schedule excludes 861 retirees with a “cash-out” in lieu of a monthly benefit. These individuals are still entitled to supplemental death benefits.

The annual benefit is 12 times the amount payable in January following the valuation date, including any annuity increase, if applicable.

# Summary of Actuarial Liabilities and Funding Progress (Pension Trust Fund)

**(Amounts in Millions of Dollars)**

Annual Report Year	Actuarial Value of Assets	Actuarial Accrued Liability (AAL)	Funded Ratio (1) / (2)	Unfunded AAL (UAAL) (2) - (1)	Covered Payroll	UAAL as a Percentage of Covered Payroll (4) / (5)	City Contributions	Average City Rate (7) / (5)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2008	\$ 15,149.7	\$ 20,360.8	74.4 %	\$ 5,211.1	\$ 4,530.0	115.0 %	\$ 567.2	12.5 %
2009	16,305.7	21,525.1	75.8	5,219.4	4,769.0	109.4	641.7	13.5
2010*	16,986.0	20,481.5	82.9	3,495.5	4,797.9	72.9	679.3	14.2
2011	18,347.0	21,563.3	85.1	3,216.4	4,853.3	66.3	703.8	14.5
2012	19,784.8	22,683.8	87.2	2,899.0	4,961.7	58.4	664.4	13.4
2013**	21,293.6	25,320.7	84.1	4,027.1	5,142.4	78.3	680.8	13.2
2014	22,861.0	26,647.5	85.8	3,786.5	5,374.5	70.5	719.2	13.4
2015***	24,347.7	28,378.9	85.8	4,031.2	5,683.9	70.9	750.8	13.2
2016	25,844.0	29,963.3	86.3	4,119.3	5,884.8	70.0	767.1	13.0
2017	27,813.6	31,811.6	87.4	3,998.0	6,188.5	64.6	837.1	13.5

\* Actuarial assumptions were modified with the December 31, 2010 valuation, along with a change in the funding structure of TMRS that resulted from the passage of Senate Bill 350 (combined separate employee, employer, and annuity funds into one Benefit Accumulation Fund). This more efficient funding structure reduced year-to-year volatility in city contribution rates, resulted in lower contribution rates for most cities, and improved actuarial funding ratios for most cities. The most significant assumption changes from the prior valuation involved altering the structure of the retirement assumption to reflect a city's plan provisions and generally decreasing the turnover and forfeiture assumptions.

\*\* The healthy annuitant mortality assumption and Annuity Purchase Rates were modified with the December 31, 2013 valuation, along with a change in the actuarial cost method from Projected Unit Credit to Entry Age Normal.

\*\*\* Actuarial assumptions were modified as of the December 31, 2015 valuation.

Each city participating in TMRS is financially responsible for its own plan. Therefore, the aggregate numbers shown on the above chart reflect only the aggregate condition of TMRS and do not indicate the status of any one plan.

Columns (1) and (2) on the chart also include the assets and liabilities of the Supplemental Disability Benefits Fund, and for the years 2008 and 2009, also include the assets and liabilities of the former Current Service Annuity Reserve Fund.

# Funded Portion of Actuarial Liabilities by Type (Pension Trust Fund)

(Amounts in Millions of Dollars)							
Valuation Date	Actuarial Liabilities for			Net Assets Available for Benefits	Portion of Actuarial Liabilities Covered by Net Assets		
	(1) Current Member Contributions	(2) Retirees and Beneficiaries	(3) Current Members (Employer-Financed Portion)		(1)	(2)	(3)
12/31/2008	\$ 3,968.0	\$ 7,550.3	\$ 8,842.5	\$ 15,149.7	100.0 %	100.0 %	41.1 %
12/31/2009	4,203.9	7,941.6	9,379.6	16,305.7	100.0	100.0	44.4
12/31/2010	4,403.9	7,598.6	8,479.0	16,986.0	100.0	100.0	58.8
12/31/2011	4,589.5	8,188.0	8,785.9	18,347.0	100.0	100.0	63.4
12/31/2012	4,775.2	8,832.0	9,076.6	19,784.8	100.0	100.0	68.1
12/31/2013	4,956.7	9,861.5	10,502.5	21,293.6	100.0	100.0	61.7
12/31/2014	5,088.2	10,768.5	10,790.8	22,861.0	100.0	100.0	64.9
12/31/2015	5,312.3	11,615.5	11,451.1	24,347.7	100.0	100.0	64.8
12/31/2016	5,530.0	12,478.4	11,954.9	25,844.0	100.0	100.0	65.5
12/31/2017	5,747.3	13,412.0	12,652.3	27,813.6	100.0	100.0	68.4

The financing objective for each TMRS plan is to finance long-term benefit promises through contributions that remain approximately level from year to year as a percentage of the city's payroll. If the contributions to each plan are level in concept and soundly executed, each plan will pay all promised benefits when due — the ultimate test of financial soundness. Testing for level contribution rates is the long-term test.

Presented above is one short-term means of checking a system's progress under its funding program. The present assets are compared with: (1) current member contributions on deposit; (2) the liabilities for future benefits to present retired lives; and (3) the employer-financed portion of the liabilities for service already rendered by current members. In a system that has been following the discipline of level percentage of payroll financing, the liabilities for current member contributions on deposit (liability 1) and the liabilities for future benefits to present retired lives (liability 2) will be fully covered by present assets (except in rare circumstances). In addition, the employer-financed portion of liabilities for service already rendered by current members (liability 3) will be at least partially covered by the remainder of present assets. Generally, if a system has been using level cost financing, and if there are no changes in the plans of benefits, actuarial assumptions, or methods, the funded portion of liability 3 will increase over time, although it is uncommon for it to be fully funded.

Each city participating in TMRS is financially responsible for its own plan. Therefore, the aggregate numbers shown above reflect only the aggregate condition of TMRS and do not indicate the status of any one plan.



# Actuary's Certification Letter (Supplemental Death Benefits Fund)



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May 25, 2018

Board of Trustees  
Texas Municipal Retirement System ("TMRS" or the "System")  
Austin, Texas

Dear Trustees:

The TMRS Supplemental Death Benefits Fund (SDBF) is an optional cost-sharing multiple-employer defined benefit group life insurance plan. It provides death benefits to both active and retired members, and each participating municipality can elect to cover just active members, or active and retired members. A supplemental death contribution rate is determined annually for each participating municipality as a percentage of that city's covered payroll. The contribution rate finances the expected benefit payments each year on a pay-as-you-go basis.

The death benefit for active employees provides a lump sum payment approximately equal to the employee's annual salary (calculated based on the employee's actual earnings for the 12-month period preceding the month of death). The death benefit for retirees is a fixed amount of \$7,500.

Benefits are paid to both actives and retirees from the SDBF. Therefore, it is our understanding that reporting under the Governmental Accounting Standards Board ("GASB") Statement No. 74 is not required, since the SDBF is not an OPEB trust as described in paragraph 3 of the statement. GRS will provide information to each participating employer for their reporting under GASB Statement No 75.

The employer contribution rates for the municipalities participating in the SDBF are certified annually by the Board of Trustees which is responsible for establishing and maintaining the funding policy. These rates are determined actuarially, based on the plan provisions in effect as of April 1, 2018 and the actuarial assumptions and methodology adopted by the Board. The Board's current policy is that the contribution rates determined by a given actuarial valuation become effective one (1) year after the valuation date. For example, the rates determined by the December 31, 2017 actuarial valuation will be applicable for the calendar year beginning January 1, 2019 and ending December 31, 2019.

The TMRS staff supplied all of the member data and annuitant data for active and retired members as of December 31, 2017. We did not audit this data, but we did apply a number of tests to the data and we concluded that it was reasonable and consistent with the prior year's data.

We prepared all of the supporting schedules in the Actuarial Section. All of our work conforms with generally accepted actuarial principles and practices, and with the Actuarial Standards of Practice issued by the Actuarial Standards Board. In our opinion, our calculations also comply with the requirements of the TMRS Act and, where applicable, the Internal Revenue Code and the Statements of the Governmental Accounting Standards Board.

5605 North MacArthur Boulevard | Suite 870 | Irving, Texas 75038-2631

Board of Trustees  
May 25, 2018  
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The undersigned are independent actuaries and consultants. Both are Members of the American Academy of Actuaries, both meet all of the Qualification Standards of the American Academy of Actuaries, and both are experienced in performing valuations for large public retirement systems.

Respectfully Submitted,



Mark R. Randall, MAAA, FCA, EA  
Chief Executive Officer



Joseph P. Newton, MAAA, FSA, EA  
Pension Market Leader



**T**he actuarial assumptions used in the calculation of the funding valuation for the Supplemental Death Benefits Fund (SDBF) are based on the Mortality Experience Investigation Study covering 2009 through 2011, and dated December 31, 2013. These assumptions were first used in the December 31, 2013 valuation. For purposes of developing the SDBF contribution rates, no other demographic assumptions are applicable.

## I. Assumptions

- A. Mortality Rates** — Same as for the Pension Trust Fund.
- B. Investment Return** — A statutory interest credit of 5% is allocated annually and is not dependent on investment earnings.
- C. Actuarial Cost Method** — For the purpose of calculating an employer's actuarially determined contribution rate, the one-year term cost is used.
- D. Valuation of Assets** — Assets in the SDBF are valued at fund value (or fund balance); however, since the contribution rates are based just on the one-year term cost, assets are not included in developing the rate.
- E. Changes in Actuarial Assumptions and Methods** — There were no changes since the prior valuation.

## II. Benefit Provisions

- A. Participation in SDBF** — Participation in the SDBF is optional and may be rescinded. Each municipality that chooses to participate can elect to cover just active members, or both active and retired members.
- B. Benefit Eligibility** — Benefits are payable if the death occurs during the period in which a municipality has elected to participate in the SDBF. For retirees who had service with multiple TMRS employers, benefits are payable only if the municipality from which the member retired participates in the SDBF when the death occurs.
- C. Benefit Amount** — The death benefit for active employees provides a lump sum payment approximately equal to the employee's annual salary (calculated based on the employee's actual earnings for the 12-month period preceding the month of death). The death benefit for retirees is a fixed amount of \$7,500.

# Summary of Actuarial Assumptions (Supplemental Death Benefits Fund)

Continued

Actuarial Valuation Date	Number of Member Municipalities	Active Members	Retiree Members	Inactive Members	Total Members	Annual Payroll	Average Annual Pay	Percent Increase in Average Annual Pay
12/31/2012	733	67,426	20,655	6,758	94,839	\$ 3,233,396,110	\$ 47,955	1.5 %
12/31/2013	734	68,669	22,986	7,233	98,888	3,363,325,456	48,979	2.1
12/31/2014	743	69,391	24,569	7,672	101,632	3,526,108,551	50,815	3.7
12/31/2015	753	71,287	25,819	7,921	105,027	3,707,706,923	52,011	2.4
12/31/2016	753	72,742	26,884	8,513	108,139	3,887,244,457	53,439	2.7
12/31/2017	764	73,757	28,947	8,989	111,693	4,096,626,695	55,542	3.9

Actuarial Valuation Date	Average Contribution Rates	
	Active Coverage	Retiree Coverage
12/31/2012	0.16 %	0.05 %
12/31/2013	0.16	0.05
12/31/2014	0.17	0.05
12/31/2015	0.16	0.05
12/31/2016	0.17	0.05
12/31/2017	0.17	0.06

Note: Contribution rates are effective beginning one year from the actuarial valuation date.

