City of Toronto

Toronto Fire Department Superannuation and Benefit Fund

Registration #0351601

Actuarial Valuation Report as of December 31, 2019 **[DRAFT]**

July 2020

BUCK

Contents

1 Introduction

This report has been prepared for and at the request of the Benefit Fund Committee of the Toronto Fire Department Superannuation and Benefit Fund and presents the key results of the actuarial valuation of the Toronto Fire Department Superannuation and Benefit Fund (the “Fund” or the “Plan”) as of December 31, 2019. The previous valuation of the Plan was prepared by Buck Canada HR Services Limited (“Buck”) as of December 31, 2018.

1.1 Primary purpose

The primary purpose of this actuarial valuation report is to comply with regulatory filing requirements and more specifically:

- To determine the financial position of the Plan on a going concern basis using the projected unit credit actuarial cost method;
- To compare actual and expected experience on a going concern basis;
- To determine the financial position of the Plan on a solvency/hypothetical wind up basis using the present value of accrued benefits;
- To provide the range of permissible contributions;
- To assess the financial position of the Plan in order to provide Cost of Living adjustment (”COLA”) to pensioners; and
- To form part of the government filings, as required by the Financial Services Regulatory Authority of Ontario (“FSRA”) and Canada Revenue Agency (“CRA”) for statutory and tax purposes.

These tasks are conducted in accordance with the Canadian Institute of Actuaries Standards of Practice for Pension Plans (“Standards of Practice”), the funding policy of the Plan and all relevant regulations.

1.2 Changes since the last valuation

Since last valuation, there have not been any other changes in the legislation, actuarial standards of practice etc. that have an impact on the financial position of the Plan.

1.3 Terms of engagement

The terms of engagement that are material are as follows:

- To consider all benefits of which we are aware, including contingent benefits, payable under the pension plan;
- To use a smoothed value of assets on a going concern basis to moderate the volatility of contribution rates;
- To use the market value of assets on both a solvency and a wind up basis;
- To include considerations such as the security of benefits and related provisions for adverse deviations;
- To include "Plausible Adverse Scenarios" in accordance with paragraph 3260.06.5 of the Standard of Practice and FSRA's requirements as per Guidance PE0204INF; and
- To assess the financial impact of providing COLA to pensioners based on 100% Consumer Price Index ("CPI").

The terms of our engagement are in accordance with the Standards of Practice, the funding policy of the Plan and all relevant regulations.

1.4 Limitations

It should be noted that the results of this valuation are presented at a single point in time. Both the going concern and solvency funded positions of the Plan can change with time and the reader should bear that in mind when using this report as a guide for the current funded positions, now or in the future.

The solvency valuation is for the most part based on prescribed assumptions, whereas the going concern valuation is based on assumptions made by the Plan actuary, subject to discussions with the Plan sponsor. Those assumptions lie within a reasonable range of potential outcomes.

By necessity, we make a single estimate and this should not be taken to imply that it is the only possible outcome.

1.5 Third Party disclaimer

This report is intended for the Benefit Fund Committee of the Toronto Fire Department Superannuation and Benefit Fund and the City of Toronto. This report may be posted to a website or distributed as long as it is authorized by the Benefit Fund Committee or the City of Toronto. Please note that we take no responsibility for any actions that may be taken by third parties based upon the contents of this report.

1.6 Cost of living increases (Plan amendments)

Commencing 1986, City Council adopted a policy of providing ad hoc increases in pension to pensioners based on an excess interest indexing methodology. The policy provided for, subject to City Council approval, annual ad hoc increases subject to a minimum of 50% increase in the CPI, measured December to December, and a maximum increase equal to the lesser of the increase from “excess interest” and 100% CPI.

Commencing 1997, the Plan by-laws were amended to provide for future increases to pensioners including spouses of deceased retired members, based on the lesser of:

a. the investment rate of return of Fund assets (using a 5-year smoothing technique) in excess of the rate of return required to maintain the actuarial solvency of the Benefit Fund as determined by the Actuary, and

b. the increase in the year over year level of the average CPI, to the extent that actuarial surplus is available.

Based on the foregoing, pension in payments to pensioners and spouses that commenced prior to January 1, 2018 were increased by 2.30% effective January 1, 2019 through an automatic provision as per Council’s governing by-law with respect to the Fire Plan. This cost was $4,129,000 as of January 1, 2019 on a going concern basis (including PfAD).

In respect of 2019, there is an excess investment return as outlined in (a) above, equal to 3.15%. The increase in the year over year level of the average CPI outlined in (b) above was 1.95%. Therefore, an automatic cost of living adjustment is warranted in respect of 2019 equal to 1.95%. The cost as at January 1, 2020 to provide a cost of living adjustment equal to 100% CPI is $3,520,000 on a going concern basis (including PfAD) and $3,651,000 on a solvency basis. This increase is subject to City Council approval.

For information purposes only, the estimated cost at December 31, 2019 to provide anticipated future ad hoc pension increases each year to current pensioners based on 100% of the increase in the CPI (2.00% per annum assumption and 1.95% increase at January 1, 2020) is $25,232,000 based on the current valuation data and going concern valuation assumptions (including PfAD).

1.7 Subsequent events

Since the start of 2020 there has been significant volatility in the financial markets with both a decline in global equity markets and decreases in long term interest rates. This combination of events could have a negative impact on the financial position of the Plan. This financial impact of these events is not reflected in the valuation results at December 31, 2019 but will be reflected in a subsequent valuation report.

Other than the above noted events to the best of our knowledge we are unaware of any events subsequent to the valuation date that would have a material impact on the results of this Report.

1.8 Confirmation

We confirm that this report complies with the Canadian Institute of Actuaries Standards of Practice, the Pension Benefits Act (Ontario), and the Income Tax Act (Canada).

2 Asset information

2.1 Source of information

The custodian of the Plan assets is CIBC Mellon. For the purposes of this valuation, we have relied on the draft pension fund financial statements for 2019 as provided by the City of Toronto.

2.2 Asset reconciliation (Market value)

The table below reconciles the change in the market value of assets from the last valuation of the Plan to the market value of assets as of December 31, 2019.

Asset reconciliation	2019
Adjusted market value of assets at beginning of period	$ 197,908,815
Employer contributions	-
Benefit payments	(19,308,101)
Investment earnings	25,420,717
Fees and expenses	(936,758)
Market value of assets at end of period	203,084,673
Plus: Net outstanding amounts - investments	(87,056)
Less: Net benefits payables	(826,515)
Adjusted market value of assets at end of period	$ 202,171,102

2.3 Asset allocation (Mix)

The asset mix of the Plan as of December 31, 2019 was allocated between the following major investment categories:

Asset class	Amount	Actual asset mix	Investment policy target
Canadian equities	$ 40,948,047	20.2 %	20.0 %
US equities	32,441,093	16.0 %	15.0 %
Foreign equities	29,595,797	14.5 %	15.0 %
Fixed income	92,846,588	45.7 %	48.0 %
Cash equivalent	7,253,148	3.6 %	2.0 %
Total invested assets as of December 31, 2019	$203,084,673	100.0 %	100.0 %

2.4. Value of assets

The value of assets used for the going concern valuation is the smoothed value of assets. The value of assets used for the solvency valuation is the market value of assets.

The smoothed value of assets is a four-year smoothed value used to reduce contribution volatility. The smoothed value of assets does not take full account of recent investment gains and losses. Only a proportion of that experience will be recognized immediately, resulting in a smoothed investment return that differs from the actual return on a market value basis.

There was no change in asset valuation methods since the last actuarial valuation.

2.5 Performance of the fund

The annual net rates of return (investment income and capital appreciation, less investment and administrative expenses) earned on the market value of the assets in the past five years were as follows:

Year	Net return on Investments(1)	Net return on smoothed value
2019	12.96 %	5.87 %
2018	(2.04)%	4.50 %
2017	8.09 %	7.66 %
2016	5.85 %	9.33 %
2015	5.44 %	10.96 %
Five-year average	5.95 %	7.64 %

(1) Based on the adjusted market value of assets.

The rate of return calculation assumes that all cash flow items are uniformly distributed throughout the year.

2.6 Development of smoothed value of assets

The following information shows the development of the smoothed value of assets.

Market value experience	2019	2018	2017
Discount rates	5.25 %	5.25 %	5.25 %
Expected net investment income	$ 9,868,440	$ 11,170,543	$ 11,362,639
Actual net investment income	24,396,903	(4,355,501)	17,527,390
Market value investment gain/(loss)	$ 14,528,463	$ (15,526,044)	$ 6,164,751

Year end	Investment gain/(loss) $	% of gain/(loss) Deferred	Deferred gain/(loss) $
2019	$ 14,528,463	75 %	$ 10,896,347
2018	(15,526,044)	50 %	(7,763,022)
2017	6,164,751	25 %	1,541,188
Smoothed value of assets adjustment			$ 4,674,513

Smoothed value of assets	December 31, 2019
Adjusted market value of assets	$ 202,171,102
Less: Smoothed value of assets adjustment	(4,674,513)
Smoothed value of assets	$ 197,496,589

2.7 Plan asset data tests

The tests performed in review of the plan asset data include the following:

- Comparison of the opening market value of assets disclosed in the financial statements with the ending values disclosed in the most recent actuarial valuation report;
- Comparison of pension payments made out of the fund with the total monthly pensions found in the retiree data, taking into account new retirees and deaths during the inter-valuation period; and
- Consideration of all important changes in the composition of the funds invested.

Any anomalies or discrepancies discovered through testing, if any, have been resolved. The asset data was reviewed for reasonableness and consistency and found to be sufficient and reliable for the purposes of the valuation.

3 Going concern valuation

The financial position of the Plan on a going concern basis is determined by comparing the smoothed value of assets to the going concern liabilities, in respect of accrued benefits, assuming the Plan will continue indefinitely.

To determine the value of the liabilities, we build a model of all future expected cash flows to be paid from the Plan, adjusted for the likelihood of payment, and discounted to the valuation date in accordance with the assumptions made.

Details of the actuarial methods and assumptions are set out in Appendix A to this Report.

If the going concern liabilities exceed the smoothed value of assets, the shortfall, known as the going concern unfunded liability, must be amortized and paid for over no more than 10 years.

3.1 Financial position

The financial positions of the Plan on a going concern basis as of December 31, 2019 and December 31, 2018 are:

Financial position	December 31, 2019	December 31, 2018
Smoothed value of assets	$ 197,497,000	$ 206,125,000
Going concern liabilities		
Pensioners	$ 106,335,000	$ 106,547,000
Beneficiaries	57,752,000	56,722,000
Total going concern liabilities	$ 164,087,000	$ 163,269,000
Going concern surplus/(unfunded liability)	$ 33,410,000	$ 42,856,000
PfAD on liabilities [1]	$ 16,409,000	$ 16,327,000
Going concern surplus/(unfunded liability) after PfAD	$ 17,001,000	$ 26,529,000

[1] PfAD calculation in Appendix B2.

3.2 Reconciliation of the going concern surplus/(unfunded liability)

The following table is a reconciliation of the going concern surplus/(unfunded liability) from the last valuation to this valuation. An explanation of the major items is provided in Section 3.3.

Reconciliation of financial position from previous valuation	Before PfAD	PfAD	After PfAD
Going concern surplus/(unfunded liability) at beginning of period	$ 42,856,000	$ (16,327,000)	$ 26,529,000
Interest on going concern surplus/(unfunded liability)	2,250,000	(857,000)	1,393,000
PfAD released from the benefit payouts	n/a	2,066,000	2,066,000
Expected going concern surplus/(unfunded liability)	$ 45,106,000	$ (15,118,000)	$ 29,988,000
Experience gains/(losses) due to:			
Investments	$ 1,206,000	n/a	$ 1,206,000
Mortality	(498,000)	(50,000)	(548,000)
Total experience gains/(losses)	$ 708,000	$ (50,000)	$ 658,000
Cost of living adjustments in 2019	(3,951,000)	(395,000)	(4,346,000)
Assumption gains/(losses) due to:			
Economic	$ (3,537,000)	$ (354,000)	$ (3,891,000)
Demographic	(4,906,000)	(491,000)	(5,397,000)
Total assumption gains/(losses)	$ (8,443,000)	$ (845,000)	$ (9,288,000)
Other experience	(10,000)	(1,000)	(11,000)
Going concern surplus/(unfunded liability) at end of period	$ 33,410,000	$ (16,409,000)	$ 17,001,000

3.3 Explanation of reconciliation of going concern surplus/(unfunded liability) items

The following section briefly describes the major gain/loss items that occurred since the prior valuation.

a. Investment experience

The Plan's actual return on the smoothed value of assets of 5.87% per annum was higher than the expected investment return assumption of 5.25% per annum, net of all expenses, for the valuation period. This resulted in a gain of $1,206,000.

b. Mortality experience

Since the last valuation, the actual number of deaths was lower than expected, increasing the going concern liabilities by $548,000.

c. Cost of living adjustment in 2019

Through an automatic provision as per the Council's governing by-law, there was an increase in post-retirement pensions of 2.30% per annum granted effective January 1, 2019 to eligible retirees and beneficiaries. The actual cost of this increase was $4,346,000 with interest to the valuation date.

d. Assumption changes

Since the last valuation, the following assumptions were changed:

- As a result of change in the discount rate from 5.25% to 4.90% per annum, the going concern liabilities were increased by $3,891,000.
- Reflecting actual spousal data (marital status of pensioners and spouse's age) for pensioners compared to spousal assumption resulted in a loss of $5,397,000.

e. Other sources

There are a number of other sources of gain and loss items such as timing of cash flows, difference between the actual and expected pension payouts based on the 2019 cost of living adjustments. Combined, these other experience items have resulted in a loss of $11,000 as of the valuation date.

3.4 Normal cost

Since there are no longer any active members accruing service, there is no Normal Cost under the Plan.

3.5 Schedule of going concern special payments

As the Plan has a going concern surplus, there are no special payments required.

4 Solvency valuation

The Pension Benefits Act (Ontario) requires a measure of solvency based on prescribed assumptions, to assess the financial status of the Plan in the event of Plan termination and wind up.

4.1 Financial position

The financial position of the Plan on a solvency basis is determined by comparing the solvency assets to the solvency liabilities (the actuarial present value of benefits, earned for service prior to the valuation date, calculated as if the pension plan were wound up on that date).

The financial positions of the Plan on a solvency basis as of December 31, 2019 and December 31, 2018 are:

Financial position	December 31, 2019	December 31, 2018
Solvency assets		
Adjusted market value of assets	$202,171,000	$197,909,000
Wind-up expenses	(200,000)	(200,000)
Total solvency assets	$201,971,000	$197,709,000
Solvency liabilities		
Pensioners	$121,200,000	$121,039,000
Beneficiaries	65,988,000	65,300,000
Total solvency liabilities	$187,188,000	$186,339,000
Solvency surplus/(unfunded liability)	$ 14,783,000	$ 11,370,000

If the Plan were to be wound up on the valuation date, the wind up liabilities would be equal to the solvency liabilities. Consequently the wind up surplus/(unfunded liability) as of the valuation date is $14,783,000. For the purpose of the solvency and wind up financial position, no potential post retirement ad hoc adjustments have been included in the liabilities.

4.2 Incremental cost

Given the Plan has met the minimum requirements under the Plan by-laws to grant pension indexing at January 1, 2020, the incremental cost for the Plan on a solvency basis is $3,651,000. The cost is based on an increase in average CPI of 1.95%. Please refer to section 1.6 for further details.

4.3 Transfer and solvency ratios

The Plan's transfer ratio is determined by dividing the market value of assets by the solvency liabilities. As of December 31, 2019, the Plan's assets exceed its solvency liabilities; therefore the Plan has a solvency transfer ratio of 1.0.

Because this ratio is more than 0.85, the next required actuarial valuation to be filed with the authorities is a valuation dated not later than December 31, 2022.

4.4 Pension Benefits Guarantee Fund (PBGF) assessment

Under Section 47(1) of Regulation 909 of the Pension Benefits Act, R.S.O. 1990, the pension benefits provided by this Plan are not guaranteed by the Pension Benefits Guarantee Fund and this Plan is exempt from any Guarantee Fund assessment.

5 Reduced solvency deficiency

The reduced solvency deficiency position of the Plan is determined by comparing the solvency value of assets to 85% of the solvency liabilities, in respect of accrued benefits, assuming the Plan it terminated and wound up at the valuation date. Special payment contributions into the Plan are established based on the reduced solvency deficiency.

Details of the actuarial methods and assumptions are set out in Appendix C.

5.1 Financial position

The reduced solvency unfunded liability subject to funding as of December 31, 2019 and December 31, 2018 are:

Financial position	December 31, 2019	December 31, 2018
Solvency assets		
Adjusted market value of assets	$202,171,000	$197,909,000
Windup expenses	(200,000)	(200,000)
Total solvency assets	$201,971,000	$197,709,000
Reduced solvency liabilities		
85% of the solvency liability	$159,110,000	$158,388,000
Reduced solvency surplus/(unfunded liability)	$ 42,861,000	$ 39,321,000

5.2 Reduced solvency excess/(deficiency)

The December 31, 2019 and the December 31, 2018 actuarial valuations revealed that the Plan is in surplus position. Therefore, there is no solvency deficiency.

5.3 Schedule of solvency special payments

As the Plan has a solvency surplus, there are no special payments required.

6 Employer contributions

In this section we set out the range of permissible employer contributions to the Plan for the next three years. The range of permissible employer contributions is based on the minimum that the employer must pay each year as prescribed by provincial pension regulations and the maximum permissible as prescribed by the Income Tax Act.

6.1 General

The permissible range of employer contributions is based on the following different measures:

- minimum going concern funding (normal cost plus going concern special payments);
- going concern maximum or “excess surplus”; and
- reduced solvency funding (solvency special payments).

If the Plan has a reduced solvency deficiency or a solvency deficit, then the going concern maximum or “excess surplus” measure is not applicable. In addition, the calculation of any solvency special payments recognizes any going concern special payments that are required to be made.

Sections 6.2 below show the range of permissible employer contributions after considering the different measures mentioned above.

6.2 Minimum and Maximum employer contributions

The Plan is fully funded on a going concern and a solvency basis and therefore contributions are not required.

There is no excess actuarial surplus, pursuant to Section 147.2(2) of the Income Tax Act (Canada).

7 Sensitivity analysis

It should be noted that the results of this valuation are presented at a single point in time. Both the going concern and solvency funded positions of the Plan can change with time and the potential for such variations must be borne in mind when using this report as a guide for the funded positions, now or in the future.

This section provides details on the sensitivity of discount rate on the going concern and solvency valuation results.

7.1 Discount rates

The following table summarizes the effects if the future long-term annual rate of return on plan assets is on average 1.0% (i.e., 100 basis points) higher or lower than our current assumption of per annum, or if the prescribed solvency discount rate and the annuity purchase rate change by 1.0% from current levels.

	Change in percentage using discount rate 1% lower	Change in amount using discount rate 1% lower	Change in amount using discount rate 1% higher
Going concern liabilities [(1)]	6.7%	$ 12,048,000	$ (10,711,000)
Solvency liabilities	7.5%	$ 14,087,000	$ (12,380,000)

[(1)] Includes PfAD.

8 Plausible adverse scenarios

The main risks that may have significant impact on the long term financial position of the Plan are the interest rate risk, longevity risk and a significant decrease of the assets values of the Plan. These risks are considered under the plausible adverse scenarios that impact the Plan's financial position. Please bear in mind that these risks are not the only risks with significant long-term impact, but for simplicity and illustrative purposes only, and in order to comply with the Standards of Practice and FSRA policy, we will only assess their impacts on the Going Concern and Solvency basis.

8.1 Adverse scenarios

The following plausible adverse scenarios have been considered in isolation:

- Interest rate risk: Interest rates on fixed income assets decrease by 1% immediately and result in a 1% decline in the future return expectations on all the asset classes in which the plan is expected to invest leading to a 1% decrease in the discount rate. So combinations of 1% drop in discount rate and adjustment to fixed income asset values based on modified duration (of the fixed income investments) of 7.91 at December 31, 2019. No changes to other asset values and economic assumptions;

- Deterioration of asset values: Equity values (including real estate investments) decrease 20% immediately, and no changes to other asset values and economic assumptions; and

- Longevity risk: Mortality improved by 10% at all ages over current assumptions. In addition, mortality improvements to follow MI-2017 improvement scale. No changes to other assumptions.

8.2 Financial Impact

The following table summarizes the effects on the Plan's financial position, normal cost as well as additional deficiency contribution, if applicable, under the above mentioned adverse scenarios.

9 Actuarial cost certificate and opinion

City of Toronto

Toronto Fire Department Superannuation and Benefit Fund

Canada Revenue Registration # 0351601

In our opinion, for the purposes of this actuarial valuation report, the membership data on which the valuation is based is sufficient and reliable, the assumptions are appropriate and the methods employed in the valuations are appropriate.

This report has been prepared, and my opinions given, in accordance with accepted actuarial practice in Canada. This actuarial valuation report has been conducted in accordance with the funding and solvency standards prescribed by the Pension Benefits Standards Act and Regulation, and in conformity with the requirements of the Income Tax Act (Canada) and Regulation. This actuarial opinion forms an integral part of the report.

Based on the results of this actuarial valuation report as of December 31, 2019, we certify that in our opinion:

1. The Plan does not have a prior year credit balance or prepaid contribution balance.
2. Because the plan no longer has active members there is no employer normal cost.
3. There is an actuarial surplus of $17,001,000 in the Plan on a going concern basis (including PfAD). As a result, there is no schedule of going concern special payments.
4. There is no excess actuarial surplus, pursuant to Section 147.2(2) of the Income Tax Act (Canada).
5. There is no solvency and reduced solvency deficiency under the Plan.
6. If the Plan had been wound up on the valuation date, the market value of Plan assets (net of wind up expenses) would have been $14,783,000 more than the wind up liabilities of the Plan.
7. The transfer ratio, as defined in the Regulation to the Pension Benefits Act (Ontario), is 1.0.
8. The cost of providing the COLA based on 100% of CPI is $3,520,000 on a going concern basis (including PfAD) and $3,651,000 on a solvency basis as at January 1, 2020. In our opinion, the Plan remains in a surplus position on a going concern and a solvency basis as at January 1, 2020, should the cost of the January 1, 2020 COLA be reflected in the current valuation results
9. Under Section 47(1) of Regulation 909 of the Pension Benefits Act, R.S.O. 1990, the pension benefits provided by this Plan are not guaranteed by the Pension Benefits Guarantee Fund and this Plan is exempt from any Guarantee Fund assessment.

10. In accordance with the Regulation to the Pension Benefits Act (Ontario), the next actuarial valuation report should be prepared with a valuation date not later than December 31, 2022, should this report be filed.

11. We are unaware of any significant events since the valuation date that would have a material impact on the results of this report.

The undersigned is available to answer any questions with respect to this valuation report.

Buck Canada HR Services Limited

______________________________	July XX, 2020
Alfonse Komi Souka, FCIA, FSA Fellow, Canadian Institute of Actuaries Fellow, Society of Actuaries	Date
______________________________	July XX, 2020
Ajaybir Sekhon, FCIA, FSA Fellow, Canadian Institute of Actuaries Fellow, Society of Actuaries	Date

Appendix A Going concern assumptions and methods

The assumptions and methods used in the going concern valuation are described below. If actual Plan experience differs from the assumptions below, gains and losses will arise in future valuations.

A.1 Economic assumptions

	At December 2019	At December 2018
Investment return:	4.90% per annum, net of investment and administrative expenses.	5.25% per annum, net of investment and administrative expenses.
Provision for PfAD	Same	10.0% of going concern liabilities.
Post-retirement indexation:	Same	No provision has been made for future post-retirement ad hoc adjustments in the liabilities based on the cost-of-living provisions of the Plan by-laws.

A.2 Demographic assumptions

	At December 2019	At December 2018
Mortality:	Same	CPM 2014 Public table with CPM-B projection with 1.0016 size adjustment factor for males and 0.9943 size adjustment factor for females.
Marital status:	Actual information	60% assumed to have a spouse at retirement based on recent Plan retiree experience.
Spouse’s age::	Actual information	Females three years younger than males.

A.3 Methods

	At December 2019	At December 2018
Actuarial cost method:	Same	Unit Credit The accrued liability for pensioners and beneficiaries is the present value of their respective benefits.
Smoothed value of assets:	Same	The smoothed value of assets is a 4-year moving-average market value. This method recognizes realized and unrealized investment gains and losses over a period of 4 years based on the expected investment return assumption.

Appendix B Rationale for going concern assumptions

The following rationale is provided to support the most significant going concern actuarial assumptions used in this report:

B.1 Investment return (Discount rate)

The expected future benefit payments have been discounted using the expected investment return on the fund. The discount rate of 4.90% per annum was selected and the components of which are as follows:

Assumed Gross investment return	5.01%
Plus: Diversification of asset classes	0.30%
Plus: Additional return due to active management net of investment expenses	0.00%
Less: Non-investment administration fees	0.10%
Less: Passive Investment management fees	0.10%
Less: Margin for adverse deviation	0.25%
Discount rate	4.86%
Discount rate, rounded to the nearest 0.10%	4.90%

The above items are supported as follows:

- The best estimate gross rate of return was developed by establishing expected returns for each major asset class in which the pension fund is invested and then using a building block approach based on the Plan's target asset allocation presented in Section 2.3. It is assumed that the Plan's long term asset allocation will not change over time. In determining a return on equity investments, we have assumed an equity risk premium (i.e. the difference between expected return on Canadian equities and Canadian bonds) of 4.45% per annum.

- We have assumed a margin for adverse deviation of 0.25% per annum in additional to the required PfAD as developed in Section B.2.

- A regularly rebalanced portfolio of assets in more than one asset class will produce returns in excess of the weighted average of the long-term average rates of returns of the individual asset classes due to correlations amongst the asset classes. This is called the diversification effect. We have assumed that the portfolio is maintained reasonably close to the original target asset mix and that they allowance for this diversification effect would be 0.30% per annum.

- We have assumed no additional return due to active management. The long term investment assumption assumes that any future value from active management will be offset by the fees due to active investment management.

B.2 Provision for Adverse Deviation (PfAD)

As per Ontario's Regulation 250/18, the level of the new PfAD depends on three plan specific factors; i) open or closed plan ii) asset mix and iii) the going concern discount rate. Below is the development of PfAD:

Closed Plan	5.00%
Plan asset mix [(1)]	5.00%
Going Concern discount rate [(2)]	0.00%
PfAD	**10.00%**

[(1)] Based on the table below and the information on the target asset mix on section 2.3 of this report.

Percent of NFI	Closed Plan
0%	0%
20%	2%
40%	4%
50%	5%
60%	7%
70%	11%
80%	15%
100%	23%

[(2)] Based on the Plan duration of 6.30 year and BDR of 5.51% (Sum of December 31, 2019 CANSIM V39056 rate of 1.76%, 3.25% return based on the Plan's target asset mix and 0.50%.)

B.3 Mortality

The Canadian Pensioner's Mortality Registered Pension Plan Public Table ("CPM2014 Publ") reflects the mortality experience as of 2014 from a public sector analysis of members in Canadian registered pension plans. In addition, future mortality experience is expected to follow Scale CPM-B. The mortality size adjustment factors were determined based on the size of pensions payable to the pensioners and the beneficiaries at the valuation date.

This table is used since the mortality experience of the membership of a plan is insufficient to assess plan-specific experience and where there is no reason to expect the mortality experience of the plan to differ significantly from that of other pension plans. Both of these are true for this Plan and, therefore, the use of this mortality table is considered reasonable.

Appendix C Solvency assumptions and methods

The assumptions and methods used in the solvency valuation are prescribed by regulation and are described below. Any changes to assumptions from the previous valuation are referenced by footnote.

C.1 Assumptions and methods

	At December 2019	At December 2018
Mortality:	Same	CPM2014 Combined Table with CPM-B projection.
Annuity purchase rate:	2.80% per annum [(1)] (Plan duration of 6.98 years).	3.06% per annum (Plan duration of 6.75 years).
Election experience:	Same	100% of members assumed to have annuities purchased on their behalf.
Actuarial cost method:	Same	Present value of accrued benefits. No benefits payable on plan wind up were excluded from the valuation.
Value of assets:	Same	Market value of assets.
Provision for wind up expenses:	Same	$200,000.00
Marital status:	Actual Information	60% assumed to have a spouse at retirement based on recent Plan retiree experience.
Spouse's age:	Actual information	Females three years younger than males.

(1) As per the April 24, 2020 Educational Note: Assumptions for Hypothetical Wind Up and Solvency Valuations with Effective Dates between December 31, 2019 and December 30, 2020.

C.2 Provision for windup expenses

Actuarial expense reasonably expected to wind up the plan have been included in the expense assumption. These expenses are assumed to be charged to the Plan. These wind up expenses do not include other expenses assumed to occur post valuation date up to the time of actual settlement. These additional expenses can include trustee, investment management, legal, administration and consulting expenses that may be incurred up until the time of final settlement. In addition any legal or actuarial expenses related to surplus ownership and or distribution, if any, are not included in these expense provisions.

Appendix D Summary of membership data

The membership data was provided and maintained by the City of Toronto. The membership data was compiled on December 31, 2019 and reviewed for reasonableness and consistency and found to be sufficient and reliable for the purposes of the valuation. These data tests are, by nature, high level and will not capture all possible deficiencies in the data. Therefore, reliance is also placed on the certification of the Benefit Fund Committee of the Toronto Fire Department Superannuation and Benefit Fund (Appendix F) as to the quality of data.

D.1 Data tests

The tests done in review of the data include the following:

- High level review of the data to determine that an appropriate number of records was obtained, the appropriate data fields were provided and that the data fields contained valid information;
- A membership reconciliation was prepared to ensure the complete membership of the pension plan was accounted for;
- For retired members and beneficiaries, dates of birth and pension amounts were reviewed against the prior valuation data for consistency; and
- Aggregate pension payments in the data were compared to actual payments shown in the trust statement.

Since the form of pension and spouse date of birth for inactive vested and retired members are not readily available for valuation purposes, the assumptions shown in Appendix A2 have been adopted. The form of pension for members assumed to be married is life with 66-2/3% of the member's pension continuing to the spouse following the member's death. The form of pension for members not assumed married is lifetime pension only.

D.2 Summary of plan participants included in the valuation

	December 31, 2019	December 31, 2018
Pensioners		
Number	317	340
Average age (years)	82.3	81.6
Annual benefit	$12,385,133	$12,944,019
Average annual benefit	$39,070	$38,071
Beneficiaries		
Number	299	303
Average age (years)	82.2	81.8
Annual benefit	$7,307,565	$7,177,555
Average annual benefit	$24,440	$23,688

D.3 Data reconciliation

	Pensioners	Beneficiaries	Total
Number at December 31, 2018	340	303	643
Changes due to:			
Deaths	(23)	(21)	(44)
New survivor	0	17	17
Family law separation new record	0	0	0
Total changes	(23)	(4)	(27)
Number at December 31, 2019	317	299	616

Appendix E Summary of plan provisions

The following summary describes the main features of the Plan which are of financial significance to the actuarial valuation and does not encompass all details required to properly administer the Plan. This summary is based on the most recent Plan document and amendments. For a detailed description of the benefits, please refer to the Plan document.

Plan members:	All members of the Fire Department, except those who became members after May 8, 1961, at an age in excess of 26 years, or after July 1, 1968.

E.1 Post-retirement benefit

Normal form of pension:

• No spouse:	Pension payable for life
• With a spouse:	Pension with a spouse lifetime pension of 66-2/3% of the initial amount following the later of the member's death.

E.2 Ad hoc post-retirement adjustments

Commencing 1986, City Council adopted a policy of providing ad hoc increases in pensions to pensioners based upon an excess interest indexing methodology. Subject to City Council approval, each year, ad hoc increases in pension were provided, with a minimum increase of 50% of the increase in the Consumer Price Index (CPI) on a year over year basis, and a maximum increase of the lesser of the excess investment return on the Benefit Fund and 100% CPI.

Commencing 1997, the Plan by-laws were amended to provide for future increases to pensioners including spouses of deceased retired members, based on the lesser of:

a. the investment rate of return of Fund assets (using a 5-year smoothing technique) in excess of the rate of return required to maintain the actuarial solvency of the Benefit Fund as determined by the Actuary, and

b. the increase in the year over year level of the average CPI to the extent that actuarial surplus is available.

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Appendix F Employer certification

City of Toronto

Toronto Fire Department Superannuation and Benefit Fund

Canada Revenue Registration # 0351601

I hereby certify on behalf of the Toronto Fire Department Superannuation Benefit Fund Committee, that to the best of my knowledge and belief:

1. The significant terms of engagement contained in Section 1.3 of this report are accurate and reflect the plan administrator's judgement of the plan provisions and/or an appropriate basis for the actuarial valuation of the plan;
2. The asset information summarized in Sections 2.2 and 2.3 is complete and accurate;
3. The membership data summarized in Appendix D is complete and accurate for all persons who are entitled or will become entitled to benefits under the Plan in respect of service up to the date of the valuation;
4. The Plan Provisions summarized in Appendix E are accurate and up to date for the purpose of representing member benefit entitlements that significantly affect the financial condition of the Plan; and
5. There have been no subsequent events that would materially change the Plan's financial position since the valuation date.

Toronto Fire Department

Name	Signature
Title	Date