City of Edmonton

Neighbourhood Renewal Price Index, Backgrounder

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1.0 Introduction

1.1 Neighbourhood Renewal

The Neighbourhood Renewal Program is a cost-effective, long-term approach to address Edmonton's neighbourhood infrastructure needs. It involves the renewal and rebuilding of roads, sidewalks and street lights in existing neighbourhoods and collector roadways. The program balances the need to rebuild in some neighbourhoods with the need for preventative maintenance in others.

The types of neighbourhood renewal work vary depending on the state of infrastructure and include:

1. **Preventative maintenance** – roads are resealed to extend their lifespans.
2. **Overlay** – roads are repaved, and sidewalk panels are treated to eliminate trip hazards.
3. **Reconstruction** – roads are repaved, and streetlights and sidewalks are replaced.

By effectively combining reconstruction, overlay and preventative maintenance, the City of Edmonton can improve all of Edmonton's neighbourhoods within 30 years.

The costs of implementing the Neighbourhood Renewal Program have fluctuated considerably in recent years. As such, an index to measure the inflation of neighbourhood renewal costs was developed.

1.2 Understanding Inflation

Inflation is an increase in the price level of goods and services in an economy over a period of time. In essence, inflation means that as time passes, more money is required to purchase a particular good or service. If an item costs $100.00 in period 1, and period-to-period inflation is two per cent, that same item will cost $102.00 in period 2, $104.04 in period 3 and so forth.

Since 1991, the Bank of Canada has employed an inflation control target that aims to maintain annual consumer inflation at approximately two per cent per year. This monetary policy has been successful, and consumer inflation, as measured by the Consumer Price Index (CPI), has been, on average, stable at the national level.

The costs of implementing the Neighbourhood Renewal Program also face inflation. From year to year, a larger amount of money is required by the City to purchase the same quantity of inputs necessary for neighbourhood renewal. However, because the basket of goods and

services purchased by the Neighbourhood Renewal Program is considerably different compared to the basket of goods and services purchased by the average consumer, the CPI is not an adequate measurement of the inflation rate facing neighbourhood renewal. Moreover, the inflation rate facing the Neighbourhood Renewal Program tends to be considerably more volatile than the rate facing the average consumer.

1.3 Developing a Neighbourhood Renewal Price Index (NRPI)

The development of the Neighbourhood Renewal Price Index (NRPI) was undertaken by a steering committee of representatives from the Office of the Chief Economist and senior managers from Integrated Infrastructure Services. Prior to developing the NRPI, the Office of the Chief Economist constructed a Municipal Price Index (MPI). The MPI was designed to measure year-to-year inflation affecting the City's operating budget. The MPI does not, however, measure inflation for the City's capital projects. As a result, the NRPI project was launched with a specific goal to measure the year-to-year inflation facing the Neighbourhood Renewal Program.

Measuring and understanding inflation is important as it affects both the planning and administering of municipal services. By understanding inflationary pressures, management can make informed decisions with respect to the Neighbourhood Renewal Program and strategically respond to external economic conditions.

2.0 CPI versus NRPI

The Consumer Price Index (CPI) is produced by Statistics Canada and measures the rate of price change for goods and services bought by Canadian consumers. It is the most widely used calculation of inflation for Canada, the provinces and municipalities. The CPI can be thought of as a measure of the percentage change over time in the average cost of a large basket of goods and services purchased by consumers.

Goods and services within the basket are grouped together if they have similar end uses or are deemed substitutes for one another. At the highest level, these groupings of products are called major components. The major components that comprise the CPI basket of goods and services are: food; shelter; household operations, furnishings and equipment; clothing and footwear; transportation; health and personal care; recreation, education and reading; and alcoholic beverages, tobacco products and recreational cannabis[1].

Major components of the CPI basket are given a weight in relation to the spending trends of Canadian consumers. For example, the proportion of the total basket that each major component comprises is based on the proportion of total consumer expenditures made on those goods and services. These proportions signify the relative importance (or weight) of a grouping of products in the basket.

Figure 1: 2017 CPI Weights of Major Components - Alberta
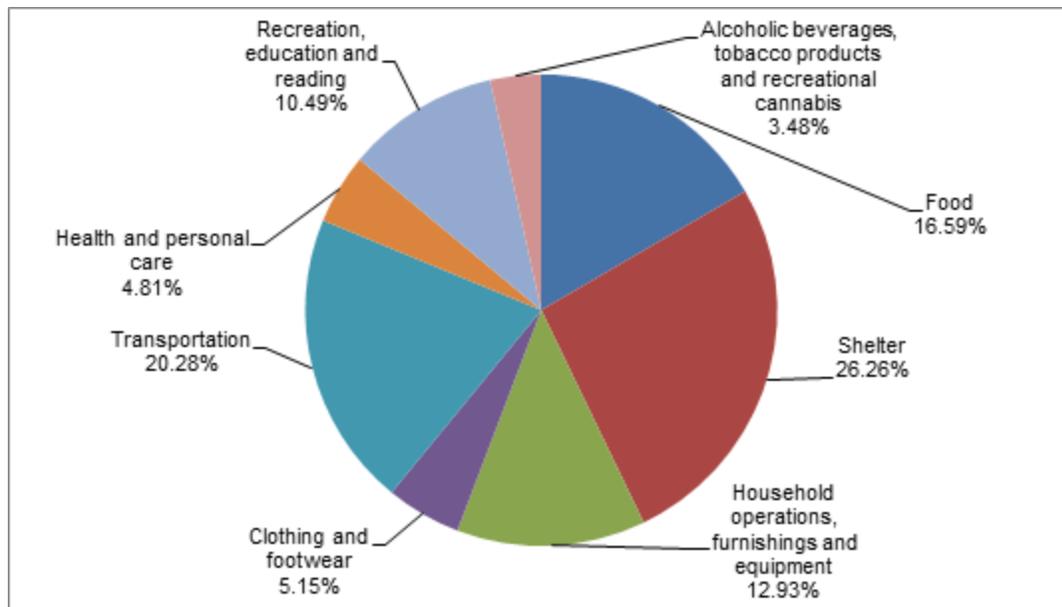
Source: Statistics Canada

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[1] Source: Statistics Canada, Table 18-10-0007-01 - Basket Weights of the Consumer Price Index.

The weight attributed to each major component determines the impact that a specific price change will have on the overall consumer budget. For example, a 10 per cent increase in the price of shelter will have a much greater impact on the average consumer budget than a 10 per cent increase in the price of clothing and footwear. In the 2017 CPI basket, the weight assigned to shelter is 26.26 per cent, whereas the weight assigned to clothing and footwear is 5.15 per cent. In an absence of weights, all goods and services would be given an equivalent degree of importance, which does not accurately represent the average consumer's expenditure basket.

The CPI is a useful indicator of cost inflation because it is consistent, well known, published by a reputable independent organization and available free of charge. It is for these reasons that so many individuals and organizations use the CPI to measure inflation. However, the expenditure profile of the Neighbourhood Renewal Program is much different than the expenditure profile of the average consumer.

The average consumer spends money on food, housing, clothing, utilities and transportation, among other things. In contrast, the Neighbourhood Renewal Program spends money on asphalt, concrete, excavation work and so on. As the CPI does not reflect the purchasing patterns of this program, it is not an accurate indicator of the inflationary pressures that the Neighbourhood Renewal Program faces. The NRPI, on the other hand, is an inflation measurement tool specifically tailored to reflect the cost pressures of the Neighbourhood Renewal Program.

3.0 Background to the NRPI

The City of Edmonton's strategic plan, The Way Ahead, outlines the vision for Edmonton in 2040 and is to be implemented according to set corporate outcomes, performance measures and targets. One of the outcomes states: "The City of Edmonton has a resilient financial position."

This corporate outcome requires the City to demonstrate a commitment to well-managed, sustainable practices for infrastructure and approved programs. The development of the NRPI is a means to achieve this outcome for neighbourhood renewal.

The concept of indexing municipal inflation originated in 1978 when American City and County began publishing what they call a Municipal Cost Index (MCI). The MCI is designed to estimate the inflation rate of the costs associated with the provision of municipal services. The MCI is a composite index—a weighted average of more detailed price indices—consisting of the CPI, the Producer Price Index and the U.S. Department of Commerce's Composite Construction Cost Indices[2].

Since then, several Canadian municipalities have used the American City and County price index as a foundation to develop their own cost indices. The City has also developed its own MPI as a means to better monitor and manage the cost inflation facing its annual budgeting process for City operations.

The NRPI expands on the Municipal Price Index approach, tailoring it to the specific expenditures of the Neighbourhood Renewal Program. The NRPI can be used by the City of Edmonton to:

1. Measure the increase in the overall neighbourhood renewal expenditures attributed to inflation.
2. Allow managers to more closely monitor the increases in spending by construction category, thus making inflationary price increases or decreases more visible.
3. Provide an indication of the historical and current-year direction of prices relative to the City's neighbourhood renewal expenditures.
4. Justify and illustrate increased expenditures attributed to inflation in the capital budgeting process.

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[2] American City and County. americancityandcounty.com

4.0 Methodology

The NRPI follows the methodology employed by the City's MPI. Its development involves determining:

- The weights of construction categories within the Neighbourhood Renewal Program.
- The weights of each construction category's factor inputs.
- The appropriate inflation factor for each construction category's factor inputs.

Once the index has been collated with this data, the inflation affecting each construction category is calculated by summing every product of weight and inflation factor. The inflation rate for neighbourhood renewal is then calculated by summing the product of each construction category's weight and inflation rate.

4.1 Construction Categories and Weights

The Neighbourhood Renewal Program involves seven broad categories of construction work. These seven categories are as follows:

1. Asphalt
2. Base Work – Sidewalk
3. Base Work – Full-Depth Reclamation (FDR)
4. Concrete
5. Drainage/Underground
6. Excavation
7. Landscaping

Each type of construction work is given a weight in relation to its proportion of the Neighbourhood Renewal Program's total cost. The weight of each construction category determines that category's relative impact on the inflation rate for neighbourhood renewal. The construction categories and weights were determined through industry consultation.

Table 1. Construction Categories and Weights for the Neighbourhood Renewal Program

No.	Construction Category	Weight
1	Asphalt	16.6%
2	Base Work - Sidewalk	19.0%
3	Base Work - Full-depth Reclamation (FDR)	9.4%
4	Concrete	30.6%
5	Drainage/Underground	9.4%
6	Excavation	11.6%
7	Landscaping	3.4%
	Total	100.0%

Note: Updated in 2018 following joint review.

The following diagram shows the construction categories and associated weights for the Neighbourhood Renewal Program. As shown, concrete, base work and asphalt comprise the majority of construction work for a typical neighbourhood renewal project.

Figure 2: Construction Categories and Weights for the Neighbourhood Renewal Program
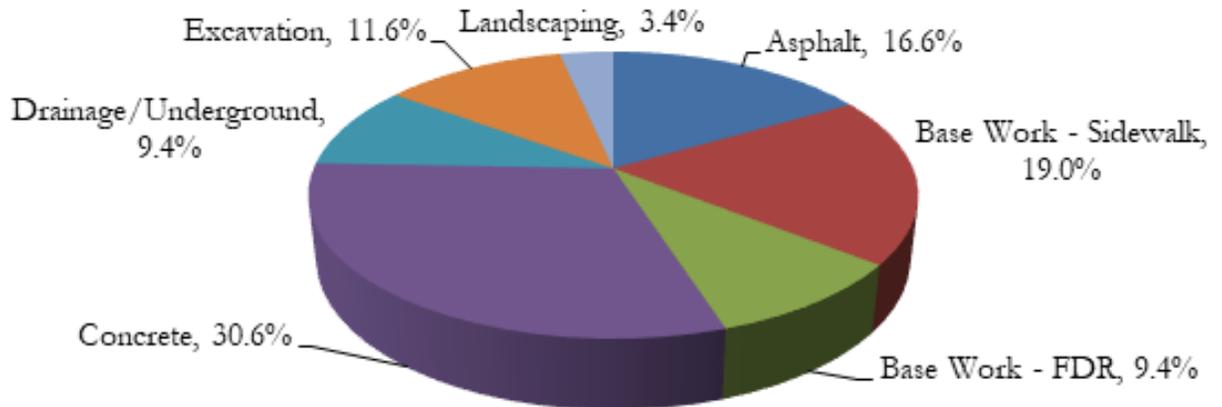
4.2 Factor Inputs and Weights

Each of the seven types of construction work listed in Table 1 is performed using three factor inputs. Factor inputs are the contributions that go into performing each type of construction, and the end product is the output of that construction category (for example, new asphalt, new sidewalks and new gutters). The three factor inputs used by each construction category are:

- Labour,
- Equipment, and
- Materials.

Labour includes operators and general labourers. The equipment used includes crawler pavers, pneumatic tire rollers and tandem-axle dump trucks, among others. The materials used are a combination of asphalt materials, concrete materials and aggregate materials[3].

The factor inputs for each construction category are attributed to a weight in relation to their proportion of total category costs. The weight of each factor input determines the impact of a specific price change on the overall construction category. The factor inputs and weights were determined through consultation with industry partners and were reconfirmed and updated in 2018.

Table 2: Factor Inputs and Weights for the Neighbourhood Renewal Program

No.	Construction Category	Factor Inputs			
		Labour	Equipment	Materials	Total
1	Asphalt	11%	13%	76%	100%
2	Base Work - Sidewalk	29%	20%	51%	100%
3	Base Work - FDR	30%	34%	36%	100%
4	Concrete	45%	9%	46%	100%
5	Drainage/Underground	40%	20%	40%	100%
6	Excavation	36%	64%	0%	100%
7	Landscaping	36%	34%	30%	100%

Note: Updated in 2018 following joint review.

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[3] Appendix 2 in section 5.2 provides definitions and a full breakdown of the factor inputs used.

Examining Table 2, we see that asphalt construction is materials heavy, consisting of 11 per cent labour, 13 per cent equipment and 76 per cent materials. In contrast, excavation is labour and equipment heavy, consisting of 36 per cent labour and 64 per cent equipment.

4.3 Inflation Factors

Once the construction categories, factor inputs and all weights were determined, the inflation factors were then calculated. Inflation factors indicate the year-to-year percentage change in the price of each factor input. The Alberta Roadbuilders and Heavy Construction Association (ARHCA) annual Labour Rates were used to populate the inflation factors for labour. Equipment inflation factors were calculated from annual Equipment Rental Rates provided by the ARHCA. The inflation factors for materials were determined by current contracts and expected price changes provided by the Corporate Procurement and Supply Services branch of the City's Corporate Services Department. The inflation experienced each year was determined by calculating the price difference from the previous year.

4.4 Calculating Neighbourhood Renewal Price Inflation

The calculation for neighbourhood renewal price inflation is the average of each construction category's price change weighted by each construction category's proportion of total expenditure. The weights for construction categories indicate their size relative to total City expenditures made on neighbourhood renewal. Each construction category's price change is calculated by the weighted average of each factor input's price change. Using weights to construct the NRPI prevents overstating the influence of any given construction category.

Neighbourhood renewal price inflation, therefore, can be calculated using the following equation:

$$NRPI = X_1(W_1/W) + X_2(W_2/W) + \cdots + X_n(W_n/W) \quad [1]$$

where:

- $NRPI$ = Neighbourhood renewal price inflation
- X_n = Price inflation for construction category n
- W_n/W = Weight of construction category n in the City's Neighbourhood Renewal Program

The price inflation for each construction category, X_n , is determined as follows:

$$X_n = Y_1(Z_1/Z) + Y_2(Z_2/Z) + \cdots + Y_m(Z_m/Z) \quad [2]$$

where:

- X_n= Price inflation for construction category n

- Y_m = Price change for factor input m

- Z_m/Z= Weight of factor input m in the construction category n

Equations [1] and [2] can be combined and rewritten as follows:

$$NRPI = \sum_{i=1...n} \left[\sum_{i=1...m} Y_m (Z_m / Z) \right]_n (W_n / W) \qquad [3]$$

Equation [3] produces a single inflation rate, which is the rate of cost increases facing the Neighbourhood Renewal Program for the year being examined.

5.0 Appendix

5.1 Appendix 1: Construction Category Definitions

No.	Construction Category	Definition
1	Asphalt	The top layer of road structure consisting of oil, aggregate and binder.
2	Base Work – Sidewalk	The substructure of a sidewalk consisting of aggregate, cement and/or soil cement.
3	Base Work – Full-Depth Reclamation (FDR)	The substructure of a roadway consisting of aggregate, cement and or/soil cement. Full-Depth Reclamation is the use of existing road base in the construction of new road base.
4	Concrete	A major component of cement-incorporated work consisting of curb and gutter, sidewalk, moonwalk lane crossings, etc.
5	Drainage/Underground	The underground component of a roadway structure associated with drainage pipes, manholes, catch basins and associated work.
6	Excavation	Roadway-associated work consisting of removal and disposal of existing soils, existing concrete, asphalt and other roadway-associated materials.
7	Landscaping	Roadway-associated work consisting of sod, black dirt and associated landscaping features.

5.2 Appendix 2: Detailed Breakdown and Definitions of Factor Inputs

No.	Component	Definition	Inputs Used
1	Labour	The productive services provided by people.	General labourers (foremen, lead hands, formsetters, concrete finishers, raker people, screed people, pipe layers, pipe layer helpers, grade people, labourers and flag people) and operators (journeymen, group 1, group 2, group 3 and group 4).
2	Equipment	The machinery used to perform the construction work.	Crawler pavers, pneumatic tire rollers, double-drum steel rollers, tandem-axle dump trucks, pneumatic steel combinations, loaders–rubber tires, loaders–skid steers, reclaimers/stabilizers, single-drum padfoots, single-drum smooth–vibratory, motor graders, loaders–backhoes, hydraulic excavators and water trucks.
3	Materials	The physical materials that are used in construction.	Asphalt material (ACF-LT, ACF-HT, 20mm-B, 10mm sandmix), concrete (class C summer mix, class C fall mix, class C cold weather mix) and aggregate supply (20mm).

5.3 Appendix 3: Detailed Breakdown and Data Sources for Factor Inputs

No.	Construction Category	Component	Inputs Used	Data Source
1	Asphalt	Labour	Combined general labourer and operator rate	Alberta Roadbuilders & Heavy Construction Association (ARHCA) 2020 Labour Rates – City of Edmonton Labour Rates
		Equipment	Crawler Pavers (Groups 3 & 4) Pneumatic Tire Rollers (Groups 5 & 6) Double Drum Steel Rollers (Group 4) Tandem Axle Dump Trucks	ARHCA 2020 Equipment Rental Rates
		Materials	Asphalt material (ACF-LT, ACF-HT, 20mm-B, 10mm sandmix)	City of Edmonton Materials Management - Corporate Services
2	Base Work - Sidewalk	Labour	Combined general labourer and operator rate	ARHCA 2020 Labour Rates – City of Edmonton Labour Rates
		Equipment	Crawler Pavers (Groups 3 & 4) Pneumatic Tire Rollers (Groups 1 & 2) Loaders-Rubber Tires (Group 5) Loaders-Skid Steers (Group 4)	ARHCA 2020 Equipment Rental Rates
		Materials	Aggregate Supply (20mm)	City of Edmonton Materials Management - Corporate Services
3	Base Work – Full-Depth Reclamation (FDR)	Labour	Combined general labourer and operator rate	ARHCA 2020 Labour Rates – City of Edmonton Labour Rates
		Equipment	Reclaimers/Stabilizers (Group 5) Pneumatic Tire Rollers (Groups 5 & 6) Single Drum Padfoots (Groups 4 & 5) Single Drum Smooth – Vibratory (Groups 4 & 5)	ARHCA 2020 Equipment Rental Rates

			Loaders – Rubber Tires (Group 5) Motor Graders (Groups 3 & 4)	
		Materials	Aggregate Supply (20mm)	City of Edmonton Materials Management - Corporate Services
4	Concrete	Labour	Combined general labourer and operator rate	ARHCA 2020 Labour Rates – City of Edmonton Labour Rates
		Equipment	Crawler Pavers (Groups 3 & 4) Loaders – Skid Steers (Group 4)	ARHCA 2020 Equipment Rental Rates
		Materials	Concrete Supply (Class C summer mix, Class C fall mix, Class C cold weather mix)	City of Edmonton Materials Management - Corporate Services
5	Drainage/ Underground	Labour	Combined general labourer and operator rate	ARHCA 2020 Labour Rates – City of Edmonton Labour Rates
		Equipment	Tandem Axle Dump Trucks Loader Backhoes (Groups 3 & 4)	ARHCA 2020 Equipment Rental Rates
		Materials	Aggregate Supply (20mm)	City of Edmonton Materials Management - Corporate Services
6	Excavation	Labour	Operator rate (journeyman, Group 1, Group 2, Group3, Group 4)	ARHCA 2020 Labour Rates – City of Edmonton Labour Rates
		Equipment	Tandem Axle Dump Trucks Hydraulic Excavators (Group 5, 6 & 9)	ARHCA 2020 Equipment Rental Rates
7	Landscaping	Labour	Combined general labour and operator rate	ARHCA 2020 Labour Rates – City of Edmonton Labour Rates
		Equipment	Loaders – Skid Steer (Group 4) Tandem Axle Dump Truck Water Trucks (8.422 – 16.380L)	ARHCA 2020 Equipment Rental Rates
		Materials	Aggregate Supply (20mm)	City of Edmonton Materials Management - Corporate Services