City of Richmond Hill

Transportation Master Plan Development Charge Background Study Report

Transportation Infrastructures

December 19, 2023

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1 Introduction

HDR has been retained by the City of Richmond Hill (the City) to conduct a Transportation Master Plan Development Charges (D.C.) Background Study for the year 2023 in accordance with the Development Charges Act (1997, S.O. 1997, C.27) and associated regulations. This study needs to be completed concurrently with and in support of the City's ongoing Transportation Master Plan (TMP) Update and D.C. By-law Update.

The 2041 transportation improvements and beyond identified through the City's capital program and the City's 2022 TMP Update form the basis of this D.C. Study. This report documents the following six components:

- A thorough review of relevant background study reports and databases to understand the context of the Transportation Background Study and to identify available information for the technical analysis;
- Transportation infrastructure improvements identified for the future planning horizon years of 2031, 2041, and post 2041;
- Cost estimates for transportation improvement projects using the most up-to-date unit prices and construction costs;
- Historical service level analysis (for the past 15-year period) and future (2041) service levels analysis based on Average Vehicles per Lane, Lane-kms per Capita (i.e., the total number of population and employment), and Historical Infrastructure Value per Capita;
- Summary of Benefit to Existing (BTE) and Post-Period Benefit (PPB) shares adopted by different municipalities and proposed BTE and PPB to be used by the City; and,
- D.C.-eligible costing analysis considering the deductions of BTE and PPB.

2 Summary of Background Databases and Studies

At the commencement of the study, thorough review of relevant background study reports and databases was undertaken to understand the context of the Transportation Background Study for the 2023 Development Charges Update and to identify available information for the technical analysis. The relevant background documents, analysis, working files, and data sources were made available by the City staff are described below:

1. **Construction Contracts –** The unit prices for various construction and infrastructure items were extracted from past five-year period construction contracts and used in this study.
2. **Historical Traffic Data –** Historical traffic data for the City's arterial and collector roadways was reviewed based on the Average Daily Traffic (ADT) data received from the City. The historical traffic counts were used for Service Level Analysis per the first methodology – Average Vehicles per Lane.
3. **Standards and Specifications Manual –** The City's most-recent Transportation and Roadworks Standards and Specifications Manual (November 2022) was reviewed to identify the typical road cross-sections and other design criteria and specifications.
4. **Population and Employment Data –** The City's historical population and employment data were reviewed and used for the Service Level Analysis to derive Lane-kms per Capita and Historical Infrastructure Value per Capita.
5. **EAM Database –** The City's EAM database includes the latest (2022) and most-complete transportation inventory data. This database contains historical inventory data for active transportation facilities, structures, and roadway segments. The historical inventory data extracted from the EAM database forms the basis for Service Level Analyses – Lane-kms per Capita and Historical Infrastructure Value per Capita.
6. **TCA Database –** The City's TCA database documents transportation assets within the ROW, including roadways, illumination, sidewalks, structures, traffic signals, etc. The information extracted from this database was used as supplementary information for developing the historical inventory data.
7. **Traffic Signal Inventory –** The most recent traffic signal inventory data indicates that there are a total of 28 traffic signals maintained and operated by the City. The traffic signal data was used in developing the historical infrastructure values.
8. **Land Values –** The land values for different categories (residential, industrial, commercial, etc.) were derived from the City's 2023 Land Rate Study and used to estimate the land acquisition cost and Right-of-Way (ROW) property value.

9. **BTE and PPB Methodologies –** The Benefit to Existing (BTE) and Post-Period Benefit (PPB) Methodologies used in the 2019 D.C. Study were reviewed along with the City's current approaches and methodologies.
10. **GIS Database –** The City's GIS layers including roadway network, bike paths, bus routes and bus stops, railways, land use types, signs, etc. were reviewed and used as supplementary information for developing the historical inventory data.
11. **Off-Road Trails –** The existing off-road trail inventory was received from the City. The inventory data includes trail name, surface type, length info, etc.

In addition, the City's strategic planning study reports and other relevant reports were reviewed. A summary of the background databases and studies is presented in **Appendix A**.

3 Transportation Infrastructure Improvements

With the City's on-going Transportation Master Plan (TMP) Study, the City provided a list of transportation infrastructure improvements identified for the future planning horizon years of 2031, 2041, and post-2041. The travel demand model (Emme-based) used for the TMP Study was also provided to HDR by the City.

3.1 Transportation Improvement Projects

The future transportation improvement projects were identified by the City's 2022 TMP Update Study and received from the City on April 13, 2023. The transportation improvement projects include Road Infrastructure Projects, Active Transportation (AT) and Trail Infrastructure Projects, York Region Boulevard Projects, and other city-wide projects.

Road Infrastructure Projects

Road Infrastructure projects include future transportation network improvements for roadways (new construction, road widening, and reconstruction), intersections (geometric improvements and traffic signals), and structures (new bridge/culvert and new grade separation).

It is noted that some new road projects in the North Leslie Area are currently under construction and have not been included in this D.C. study. The grade separations proposed on the Regional Roads (Elgin Mills Road East, 19th Avenue, and Leslie Street) were also identified in the City's TMP Update Study; however, these projects are not included in the City's D.C. study as they are proposed regional rail crossings and are expected to be captured in the York Region D.C. study.

AT and Trail Infrastructure Projects

AT and Trail Infrastructure Projects include City-wide active transportation improvements for bicycle facilities (i.e., signed bike route, signed bike route with edge line, signed bike route with super sharrows, bike lane/buffered bike lane, and cycle track), multi-use pathway (MUP) within right-of-way (ROW), off-road trail, sidewalk, and AT bridges over CNR. In addition, cycling facilities on local roads along priority spine routes and within York Region Major Transit Station Areas (MTSAs) were also included in the D.C. Study. Those AT projects have been captured by the road improvement programs and York Region programs were not included to avoid double-counting.

York Region Projects

The City is responsible for AT infrastructure and illumination upgrades along York Region's corridors. The preliminary project list was developed by the City based on the York Region 2022 TMP Study. City staff reviewed each project with reference to EAs, D.C.s, and the TMP and made assumptions on the required AT and illumination improvements in terms of Sidewalks, Bicycle Facilities, and Illumination. HDR team

reviewed the City's preliminary project list and compiled the improvements to include estimated segment lengths (based on Google Earth measurements).

Other Projects

Other projects that need to be included in the D.C. were derived from the City's PNF forms. These projects were not identified in the TMP infrastructure project list, however, deemed necessary to provide City-wide transportation improvements and satisfy Official Plan/D.C. By-law requirements.

3.2 Review of Travel Demand Model

The travel demand model (Emme-based) used for the 2022 Richmond Hill TMP Update Study was received from the City on November 10, 2022. The TMP model was developed based on the York Region's Travel Forecast Demand Model (YRTFDM) 2011 update. The TMP model includes a calibrated for the base year of 2016, and future planning horizons for 2031, 2041, and 2051.

The travel demand model review for the D.C. Background Study was conducted using the 2041 municipal referred scenario. Based on the preliminary list of transportation infrastructure improvements, it was confirmed that the future transportation improvements (i.e., new roadways, extensions, widenings, etc.) were properly coded in the model. Some of the road segments were initially coded with less number of lanes compared to the existing condition (e.g., the existing condition has a four-lane cross-section, while it was coded as a two-lane cross-section in the future year model). The TMP Study team has modified lane numbers in the model accordingly for the above roadway segments.

A preliminary review of the future (2041) network performance indicates that the total vehicle-kilometres travelled (VKT) and lane-kilometers (lane-km) derived from the future model are higher than the 15-year historical values. This result indicates future 2041 modelling outputs would be useful for service level analyses (SLA) as the future network performance is expected to deteriorate compared to the historical service level.

4 Cost Estimates for Transportation Projects

Cost estimates for transportation improvement projects were developed using the most up-to-date unit prices and construction costs. This section summarizes the costing methodology and cost estimates for future transportation improvement programs as discussed in **Section 3.1**.

4.1 Costing Methodology

4.1.1 Price Index

The Price Index was applied to those unit prices which are not available for the most-recent year (2023). The price index was estimated based on the non-residential buildings [type 622] construction price indexes from Statistics Canada for the Toronto Census Metropolitan Area over the last 6 years (2017 to 2023). The construction price index used to update the transportation infrastructure costs is approximately 9.9% per annum.

4.1.2 Unit Prices for Basic Construction Items

Unit prices for basic construction items were developed based on recent construction tender data provided by the City between 2016 and 2022. These basic construction items include excavation, granular, asphalt, curb and gutter, utility relocation, manhole, catch basin, etc.

For a few items, unit prices were not available from the most recent tenders. For these items, unit prices used in other municipal D.C. studies were reviewed and applied in this study. The final unit prices used in this study were reviewed and approved by the City staff.

4.1.3 Road Construction Benchmark Costs

The road construction benchmark costs represent the cost for ‘curb-to-curb’ construction, which were estimated on a per kilometre basis using unit prices, plus other infrastructure items within the Right-of-Way (ROW) such as multi-usage path (MUP), bicycle facilities, sidewalks, illumination, landscaping, etc.

The road construction benchmark costs were reviewed and estimated for different road improvement types, including new road construction/extension, road widening, and reconstruction. The City’s most-recent *Transportation and Roadworks Standards and Specifications Manual* (November 2022) was used to determine construction requirements such as curb-to-curb widths for different cross-section types, structural requirements (i.e., types and depths for base and pavement), spacing requirement for catchbasins, etc. The benchmark costs for road construction are presented in **Table 1**.

4.1.4 Unit Costs for Other Infrastructure Items

Unit costs for other transportation infrastructure items within the ROW are described below and presented in **Table 2**. These costs were derived from previous contracts/studies, cost estimation per the City's standards and guidelines, City's estimation/provision, other municipalities' D.C. studies, and indexed from the unit costs in the 2019 D.C. study.

In addition, the value of the road right-of-way was estimated based on the City's 2023 Land Rate Study (June 31, 2023) and confirmed by the City. The unit prices are $1,300, $740, and $680 per square meter of the right-of-way area for a roadway within residential, industrial, and commercial land use, respectively.

Table 1: Road Construction Benchmark Costs (per km)

Improvement Type		Proposed Road Feature	ROW (m)	AT Facility	Curb-to-curb Width (m)	Benchmark Cost (2023 $)
New Construction/ Extension	Two-lane	Urban Collector	20	Bike Lane	9.2	5,949,200
	Two-lane	Urban Collector	20	Cycle Track	9.2	6,191,120
	Two-lane	Minor Collector	23	Bike Lane	9	5,933,200
	Two-lane	Minor Collector	23	Cycle Track	9	6,175,120
	Four-lane	Major Collector	26	Bike Lane	12.6	6,904,200
	Four-lane	Major Collector	26	Cycle Track	12.6	7,146,120
	Four-lane	Major Collector	26	Multi-Use Pathway	12.6	7,124,280
Road Widening	Two-lane Upgrade	Minor Collector	23	Cycle Track	9	6,678,120
	Two-lane to Four-lane	Major Collector	26	Buffered Bike Lane	12.6	7,039,440
	Two-lane to Four-lane	Major Collector	26	Multi-Use Pathway	12.6	7,625,280
Reconstruction	Two-lane Urban	Minor Collector	23	Multi-Use Pathway	9	3,635,280
	Two-lane Rural	Major Collector	26	Buffered Paved Shoulder	11	2,385,440

Table 2: Unit Costs for Other Infrastructure Items

Infrastructure Item		Unit	2023 Unit Price	Remark
Bicycle Facility (one-side)	Cycle Track	km	$280,800	Raised and curb separated; could include bike signals, bike boxes, minor utility / lighting pole relocations, etc.
	Bike Lane[1]	km	$180,000	Separated from vehicular lanes, 1.8m width, light duty with asphalt surface
	Buffered Bicycle Lane	km	$27,600	With hatched pavement markings; not include cost for road reconstruction or road diet
	Signed Bike Route with Edge	km	$15,000	Within roadway curb-to-curb, 1.8m width (considered costs for edgeline, signage, and lane markings)
	Signed Bike Route without Edge	km	$4,400	Within roadway curb-to-curb, 1.8m width (considered costs for signage)
Grade Separation		1 Unit	$60,000,000	Derived from other municipalities' D.C. studies. This D.C. Study used $60 M per unit including land acquisition cost.
Illumination	Roadway Light	1 Unit	$11,400	Estimated based on previous contracts
	Trail/Path Light	1 Unit	$6,800	Used for AT facilities; provided by the City
Landscaping (one-side)		km	$35,000	Assume one tree every 10m of frontage on one side of the road; $350 per tree estimated based on previous contract
MUP within ROW (one-side)		km	$626,700	Estimated based on previous contracts
Off-Road Trail		km	$630,000	Provided by the City
Roundabout		1 Unit	$4,828,700	Approximate value derived from other municipalities' D.C. studies
Sidewalks (one-side)		km	$355,000	Provided by the City; assume 1.5m width
Structures	Bridge	m^2	$9,600	Estimated based on City's EAM database (excl. contingency and soft cost)

Infrastructure Item		Unit	2023 Unit Price	Remark
	Culvert	m^2	$12,000	Estimated based on City's EAM database (excl. contingency and soft cost)
Intersection Improvements	Full Traffic Signal	1 Unit	$400,000	Derived from other municipalities' D.C. studies. This D.C. Study used $400,000 per intersection
	Intersection Pedestrian Signal (IPS)	1 Unit	$100,000	Extracted from previous studies
	Mid-Block Pedestrian Signal (MPS)	1 Unit	$100,000	Assume the same cost as IPS
	Pedestrian Crossover	1 Unit	$95,000	Approximate value derived from other municipalities' D.C. studies
	Flashing Beacons	1 Unit	$3,600	Based on York Region 2022 Designer Estimate Rates
	Geometric Improvements	1 Unit	$615,500	Turning lane optimization/adding turning lane(s) per intersection
Speed Enforcement Camera		1 Unit per year	$160,000 - $250,000	Approximate range received from the City

Note: The unit cost for bike lanes implemented on existing roadways (as part of AT and Trail Infrastructure Projects) was estimated assuming a two thirds/one third split between bike lanes within curb-to-curb pavement (similar to buffered bike lanes) and separated bike lanes (in-boulevard). The implementation type for each project is unknown at this stage and the costs for particular projects will be determined in future studies/construction phases.

4.2 Transportation Infrastructure Costs

The total costs for transportation infrastructures are summarized in **Table 3**. For those projects with 'Phasing' post 2041 will be included in the D.C. Study with 100% PPB, i.e., no D.C.-eligible cost.

Table 3: Transportation Infrastructure Cost Summary

Transportation Infrastructure		Phasing	Quantity	Total Cost Estimate
Road Infrastructure	Roadway	By 2031	7.47 km	$90,481,800 (Incl. $31,040,800 for land acquisition)
		By 2041	4.82 km	$111,727,800 (Incl. $76,892,800 for land acquisition)
		Post 2041[1]	1.74 km	$37,972,700 (Incl. $25,815,700 for land acquisition)
	Intersection Improvements	By 2031	10 Intersections	$6,955,000 (Incl. $637,000 for land acquisition)
		By 2041	15 Intersections	$9,555,000 (Incl. $637,000 for land acquisition)
		Post 2041[1]	3 Intersections	$1,560,000
	Structure	By 2031	1 Highway overpass	$22,862,000
		By 2041	1 Highway overpass 1 New Bridge	$16,932,000
		Post 2041[1]	5 Grade separations 1 Highway overpasses	$320,693,000
AT and Trail	Priority AT Spine Routes	By 2031	30.30 km	$24,516,000
		By 2041	4.22 km	$511,200
		Post 2041[1]	-	$0
		By 2031	84.73 km	$35,727,400

Transportation Infrastructure		Phasing	Quantity	Total Cost Estimate
	Other AT Facilities and Trails	By 2041	38.46 km	$34,767,300
		Post 2041[1]	8.14 km	$53,720,600
York Region Projects		By 2031	77.40 km	$35,221,000
		By 2041	51.52 km	$30,475,000
		Post 2041[1]	90.68 km	$41,373,000
Other Projects		By 2031 and 2041	-	$40,743,500
		Post 2041[1]	-	$0
Total		**By 2031 and 2041**	**-**	**$460,475,000** (Incl. $109,207,600 for land acquisition)
		Post 2041[1]	**-**	**$455,319,300** (Incl. $25,815,700 for land acquisition)

Note: 1. Projects with Phasing post 2041 will be included in the D.C. Study with 100% PPB, i.e., no D.C.-eligible cost.

5 Service Level Analysis

The historical service level (for the past 15-year period) and future (2041) road service levels were assessed to confirm if the proposed improvements are eligible as per the D.C. Act. This will be the primary basis for the justification that all future road improvements are predominantly growth-related. The service level analysis was undertaken using the following three methodologies:

- Average vehicles per lane
- Lane-kms per capita (i.e., the total number of population and employment)
- Historical road infrastructure value per capita

Detailed description of these three methodologies and analysis results are presented in **Appendix B**.

5.1 Historical Service Level Analysis

The '**Average vehicles per lane**' service level measure consists in determining the average daily vehicles per lane for the major road network over the past 15 years. This approach utilizes traffic databases compiled by the City that include daily traffic counts by road segments (at count stations) for 'collector' and 'arterial' roadways.

The historical average service level was established by averaging the service levels for the past fifteen years. The historical average vehicles per lane service level is presented in **Table 4**.

Table 4: Historical Average Vehicles per Lane (2008-2022)

Year	Lane-kms	Vehicle-kms	Average Vehicles per Lane
2008	224.8	447,605	1,991
2009	237.5	461,429	1,943
2010	245.7	474,665	1,932
2011	245.7	477,310	1,943
2012	245.7	476,271	1,939
2013	248.2	475,295	1,915
2014	248.2	485,199	1,955
2015	252.4	501,816	1,988
2016	262.9	528,171	2,009
2017	280.5	545,863	1,946
2018	280.5	538,581	1,920
2019	280.5	534,113	1,904
2020	280.5	491,557	1,753
2021	280.5	494,540	1,763
2022	280.5	500,443	1,784
Average	**259.6**	**495,524**	**1,909**

The second service level measure used to assess the historical service level for the City's road network consists of measuring **lane-kms per capita** (i.e., the total population and employment). This measure is based on the historical lane-kms estimated using road segment lengths and the number of lanes, and the City's population and employment totals for the respective fifteen years (2008-2022). The historical lane-kms per capita (for 2008-2022) service level analysis is presented in **Table 5**.

Table 5: Historical Lane-Kms per Capita (2008-2022)

Year	Lane-km	Population	Employment	Capita (Pop. + Emp.)	Lane-kms per 1,000 Capita
2008	224.8	172,088	65,618	237,706	0.95
2009	237.5	175,497	67,882	243,379	0.98
2010	245.7	179,826	70,146	249,972	0.98
2011	245.7	185,541	72,410	257,951	0.95
2012	245.7	187,558	73,688	261,246	0.94
2013	248.2	190,120	74,966	265,086	0.94
2014	248.2	191,171	76,244	267,415	0.93
2015	252.4	193,063	77,522	270,585	0.93
2016	262.9	195,022	78,800	273,822	0.96
2017	280.5	198,284	80,217	278,501	1.01
2018	280.5	198,982	81,634	280,616	1.00
2019	280.5	200,176	83,051	283,227	0.99
2020	280.5	201,076	84,468	285,544	0.98
2021	280.5	202,022	85,885	287,907	0.97
2022	280.5	207,785	86,799	294,584	0.95
Average	**259.6**	**191,881**	**77,289**	**269,169**	**0.96**

Note: The population data was collected based on City-wide Census data for year 2011, 2016, and 2021, and received from Watson for the other years; the employment data for year 2006, 2011, 2021, and 2023 was received from Watson and interpolated for the other years.

An inventory of the City's road and road-related infrastructures for the past fifteen-year period (2008-2022) was compiled to calculate the **historical infrastructure value**, since the D.C. Act, 1997 and associated regulations require that the service level to be applied to future growth not exceed the historical average over the last fifteen years. The existing right-of-way (ROW) inventory was developed based on the City's roadway and structure database and included additional infrastructure items and land within the ROW. The infrastructure items included in the inventory are as follows:

- Roadways (curb-to-curb)
- Structure (Bridges and Culverts)
- Traffic Signals
- Bike Facilities
- Multi-Use Path (MUP) within ROW
- Off-road Trails
- Sidewalks
- Grade Separations
- Roundabouts
- Illumination
- ROW Land

The average historical infrastructure value per capita service level is presented below in **Table 6**.

Table 6: Historical Infrastructure Value per Capita (2008-2022)

Year	Road Infrastructure Value ($ Millions)	Capita (Pop. + Emp.)	Road Infrastructure Value per 1000 Capita ($ Millions)
2008	$4,785,377,857	237,706	$20.13
2009	$5,015,386,121	243,379	$20.61
2010	$5,188,309,357	249,972	$20.76
2011	$5,193,299,556	257,951	$20.13
2012	$5,200,520,705	261,246	$19.91
2013	$5,251,757,785	265,086	$19.81
2014	$5,255,947,584	267,415	$19.65
2015	$5,340,851,444	270,585	$19.74
2016	$5,462,087,903	273,822	$19.95
2017	$5,625,416,229	278,501	$20.20
2018	$5,680,004,204	280,616	$20.24
2019	$5,682,567,026	283,227	$20.06
2020	$5,682,637,174	285,544	$19.90
2021	$5,682,767,174	287,907	$19.74
2022	$5,682,767,174	294,584	$19.29
Average	**$5,381,979,819**	**$269,169**	**$19.99**

5.2 Future (2041) Service Level Analysis

The future (2041) service level is estimated for the measures of Average Vehicles per Lane, and Lane-kms per Capita. The future service levels were reviewed and compared with the historical service levels, providing needs and justification for the proposed road and road-related programs, without resulting in excess road network capacity.

The future service level of **average vehicles per lane** was estimated based on the forecasted vehicle-kms travelled and the total lane-kms derived from the City's travel demand model (York Region Travel Demand Forecast Model based Emme model), as presented in **Table 7**. The 'Growth Portion Only' calculation reflects the growth-related component of the future vehicle-kms and lane-kms as derived from the City's travel demand model.

Table 7: Historical and 2041 Forecast Average Vehicles per Lane

Period	Lane-kms	Vehicle kms	Average Vehicles / Lane
Historical Service Level	259.6	495,524	1,909
Growth Portion Only*	21.5	445,180	20,706
Future Service Level for 2041	302	945,623	3,133

Note: the 'Growth Portion Only' indicates the difference between 2022 and 2041.

The results of the Average Vehicles per Lane service level analysis indicate the following:

- the average vehicles per lane is forecast to increase significantly by 2041;
- the future road network will be more congested in the future planning horizon year (2041) than it has been over the past fifteen years;
- the service level for the 'Growth Portion Only' is forecast to decline from the historical 15-year average; and,
- the road network service level is forecast to deteriorate over the next 19 years.

The future **lane-kms per capita** service level is calculated using the proposed road network improvements, and projected population, and employment for the year 2041. The future lane-kms per capita measure is expressed in terms of 'Forecast 2041' and 'Growth Portion Only'.

The 'Forecast 2041' measure considers 2041 road infrastructure, population, and employment; while the 'Growth Portion Only' measure is estimated based on additional lane-kms expected to serve the population and employment growth from 2022 to 2041. The forecast lane-kms per population and employment service levels are presented in **Table 8**.

Table 8: Historical and 2041 Forecast Lane-Kms per Capita

Period	Lane km	Population	Employment	Capita (Pop. + Emp.)	Lane-kms per 1,000 Capita
Historical Service Level	259.6	191,881	77,289	269,169	0.96
Growth Portion Only*	21.5	70,395	23,101	93,496	0.23
Future Service Level for 2041	302	278,180	109,900	388,080	0.79

Note: the 'Growth Portion Only' indicates the difference between 2022 and 2041.

The lane-kms per capita service level assessment shows that the service level is forecast to decline (decreasing lane-kms per capita) over the next 19 years.

The results of the historical and forecast year 2041 service level analysis using vehicles per lane (**Table 7**) and lane-kms per capita (**Table 8**) indicate that the service levels are forecast to decline over the next 19 years, as presented in **Table 9**.

Table 9: Road Network Service Level Summary

Period	Average Vehicles per Lane	Lane-kms per 1,000 Capita
Historical Service Level	1,909	0.96
Growth Portion Only*	20,706	0.23
Future Service Level for 2041	3,133	0.79

The service levels for the City's road network are forecast to decline by 64% based on the average vehicles per lane measure, and by 18% based on lane-kms per capita. Therefore, it is concluded that regardless of the service level measure that is used, the City's road infrastructure is forecast to experience deterioration in the service level over the next 19 years with the planned growth in the City.

5.3 Allowable Funding Envelope

Based on the average service standard for roads and structures, a maximum allowable D.C.- eligible cost of **$1.55 billion** was estimated to meet the future increase in needs for transportation services for roads and road-related infrastructure. The details of the funding envelope are addressed in the D.C. Background Study report prepared by Watson & Associates Economists Ltd.

6 D.C.-Eligible Costing Analysis

This section summarizes the growth-related D.C.-eligible share considering the deductions of BTE and PPB. Details for D.C.-eligible costing analysis are presented in **Appendix D**.

6.1 Benefit to Existing (BTE) and Post-Period Benefit (PPB)

Development charges are fees collected by municipalities from development to fund growth-related infrastructure. Infrastructure projects funded by development charges must serve growth. Development charges are collected for many municipal services including roads, transit, public works, libraries, parks and recreation, fire services and others.

The Development Charges (D.C.) Act, in Section 5 (1) 6, stipulates that "the increase in the need for service must be reduced by the extent to which an increase in service to meet the increased need would benefit existing development". This apportioning of costs is referred to as **Benefit to Existing (BTE) development or the non-growth share**. While this section of the Act can be used to justify reductions to D.C. capital cost recovery, the intent of the D.C. Act is that growth should pay for itself and not be a burden on existing taxpayers.

The D.C. Act does not specify how the non-growth share is to be determined and different approaches can be used to determine a dollar value that can be attributed to the existing residents.

Post-Period Benefit (PPB) share refers to the cost of oversized infrastructure capacity which is not required by development anticipated within the planning period (i.e., up to 2041 for this D.C. study), and will clearly benefit development in a subsequent period (i.e., post 2041).

PPB is not explicitly addressed within the D.C. Act. For the most part, the various roads and associated needs are identified through traffic modelling and master planning and targeting specific residential and non-residential growth assumptions. The projects included in the Transportation Background Study for the D.C. update are meant to address the transportation needs for the trips that would be generated from proposed/planned growth that would add to the City road system. Generally, the projects included in the planning horizon are meant to address needs for the planning horizon year (i.e., 2041) and are not designed for oversizing provisions.

6.2 Review of BTE and PPB Allocations

Each municipality may define project categories somewhat differently and project categories may not match those of the City of Richmond Hill. The rationale for the BTE approach is not always described and the level of detail on the BTE approach

presented in each D.C. Background Study report varied. Where the approach to BTE is not described, the applied BTE was inferred through a review of the infrastructure capital programs and observed cost deductions.

A few different methods were utilized by municipalities to assign PPB, including:

- The timing of construction relative to the planning period identified in the D.C. study (e.g., assign 25% PPB for capacity improvement projects in the last 10 years of the planning period);
- Measure future service levels compared to historical service levels (vehicles per lane or lane-kms per capita);
- Calculate volume to capacity ratios for roadway improvement programs;
- Based on the value of any anticipated surplus capacity at the end of the forecast period which is to be recovered from subsequent development;
- Based on phasing of growth where secondary plans are available that identify works required only for phases that are in the post-planning period; and
- The TMP identified projects would provide excess capacity to accommodate growth post the planning horizon year.

A summary of BTE and PPB shares adopted by different municipalities is provided in **Appendix C**.

6.3 Proposed BTE and PPB Allocations

The proposed BTE allocations used in this D.C. study are presented in **Table 10**.

The PPB allocations adopted in this D.C. study considered the timing of construction relative to the planning period identified in the D.C. study:

- For projects in the earlier phases of the D.C. planning period, the need for improvement projects is driven by growth within the planning period, and thus a post-period deduction was not applied to projects identified for implementation in the first 10 years (2023- 2031).
- **A PPB capacity deduction of 25%** was used for projects in the last 10 years (2032-2041) of the planning period.
- **A 100% PPB deduction** was applied to those projects proposed post-2041, i.e., no D.C.-eligible cost was considered for this study.

Table 10: Proposed BTE Allocations

Category	Sub-Category	Benefit to Existing %	Remarks
Road	New Road	0%	Includes new roads, road extensions, missing link
	Road Widening	20%	For a 2-lane to 4-lane widening
Structure	New Grade Separation	10%	New grade separation
	New Structure	0%	New bridge, culvert, freeway overpass
Intersection Improvements	New Signals	0%	Standalone new traffic signals
	Geometric Improvement	0%	Standalone new turning lanes
Active Transportation	New Area	0%	For new development area or new corridor
	Other	10%	For all other projects, including standalone projects in established area, dedicated cycling corridors, partnership programs, and initiatives to support active and sustainable transportation
Traffic Safety	New Area	0%	For new development area or new corridor
	PXOs	70%	Standalone project for the established area
	Other	70%	Standalone project for the established area - ASE, radar boards, etc.
Miscellaneous	New Area	0%	For new development area or new corridor
	Smart Commute	10%	To support active and sustainable transportation
	Illumination	10%	Standalone project for the established area
	Other City-wide	70%	Other City-wide projects mainly for the established area

Note: a maximum BTE of 70% is derived based on the 30% City-wide capita growth from 2023 to 2041.

6.4 Grants, Subsidies and Other Contributions

Any applicable grants, subsidies and other contributions shall be deducted from the D.C.-eligible costs in accordance with the requirements of the Act. The grants are primarily from other levels of government and their amounts vary by project. For the projects included in the 2023 D.C. Background Study, grants, subsidies, and other contributions have been considered and excluded from the total cost estimation, i.e., the total cost estimation is for City share only. Therefore, the applicable grants/ subsidies are $0.

6.5 D.C.-Eligible Transportation Infrastructure Costs

The transportation infrastructure costs are separated into 'growth' related (i.e., either City-wide roads and road-related or charge to the developers) and 'non-growth' related components as presented in **Table 11**. Detailed project locations and their D.C.-eligible costs are provided in **Table 12**.

As presented in the table, the total capital cost for the transportation programs is **$915.79 million**. The 'non-growth' related share (BTE) of the cost is **$85.31 million**, the 'post-period benefit' share of the cost is **$468.81 million**, and the growth-related D.C.-eligible shares are **$361.67 million**.

Table 11: DC-Eligible Transportation Infrastructure Costs

Transportation Infrastructure		Total Capital Cost	Grants, Subsidies and Other Contributions	Benefit to Existing (Non-Growth Related)	Net Capital Cost	Post-Period Benefit	Total Deductions	Potential D.C. Recoverable Cost (City-wide D.C.-Eligible)
Road Infrastructure	Roadways	$ 106,433,000	$ 0	$ 10,337,000	$ 96,096,000	$ 20,803,700	$ 31,140,700	$ 75,292,300
	Intersection Improvements	$ 16,796,000	$ 0	$ 0	$ 16,796,000	$ 3,789,500	$ 3,789,500	$ 13,006,500
	Structures	$ 360,487,000	$ 0	$ 30,000,000	$ 330,487,000	$ 294,926,000	$ 324,926,000	$ 35,561,000
	Land Acquisition	$ 135,023,300	$ 0	$ 1,638,100	$ 133,385,200	$ 45,198,300	$ 46,836,400	$ 88,186,900
AT and Trail	Priority AT Spine Routes	$ 25,027,200	$ 0	$ 2,502,700	$ 22,524,500	$ 115,100	$ 2,617,800	$ 22,409,400
	Other AT Facilities and Trails	$ 22,924,600	$ 0	$ 1,852,600	$ 21,072,000	$ 4,451,800	$ 6,304,400	$ 16,620,200
	Sidewalk on Collector Roads	$ 20,290,700	$ 0	$ 1,046,000	$ 19,244,700	$ 6,079,700	$ 7,125,700	$ 13,165,000
	AT Bridges	$ 81,000,000	$ 0	$ 8,100,000	$ 72,900,000	$ 46,350,000	$ 54,450,000	$ 26,550,000
York Region Boulevard Improvements		$ 107,069,000	$ 0	$ 10,706,900	$ 96,362,100	$ 44,092,600	$ 54,799,500	$ 52,269,500
Other Projects		$ 40,743,500	$ 0	$ 19,131,400	$ 21,612,100	$ 2,999,300	$ 22,130,700	$ 18,612,800
All Transportation Infrastructures		**$915,794,300**	**$0**	**$85,314,700**	**$830,479,600**	**$468,806,000**	**$554,120,700**	**$361,673,600**

Table 12: Detailed Transportation Infrastructure Costs

Transportation Infrastructure		ID	Location/ Project Name	Section	Improvement Category	Phasing	Total Capital Cost	Benefit to Existing (Non-Growth Related)		Net Capital Cost	Post-Period Benefit		Total Deductions	Potential D.C. Recoverable Cost (City-wide D.C.-Eligible)
								%	$		%	$		
Road Infrastructure	Roadways	1	East Beaver Creek Road	Leslie Street to Highway 7	Road-Road Widening	By 2031	$ 15,938,000	20%	$ 3,187,600	$ 12,750,400	0%	$ 0	$ 3,187,600	$ 12,750,400
		2	Wertheim Court	West Beaver Creek to Leslie Street	Road-New Road	Post 2041[1]	$ 4,827,000	0%	$ 0	$ 4,827,000	100%	$ 4,827,000	$ 4,827,000	$ 0
		3	Wertheim Court	Leslie Street to East Beaver Creek	Road-New Road	Post 2041[1]	$ 1,383,000	0%	$ 0	$ 1,383,000	100%	$ 1,383,000	$ 1,383,000	$ 0
		4	West Beaver Creek Road	Leslie Street to Highway 7	Road-Road Widening	By 2031	$ 17,968,000	20%	$ 3,593,600	$ 14,374,400	0%	$ 0	$ 3,593,600	$ 14,374,400
		5	Far Niente Street Extension	High Tech Road to Highway 7	Road-New Road	By 2041	$ 3,938,000	0%	$ 0	$ 3,938,000	25%	$ 984,500	$ 984,500	$ 2,953,500
		6	Garden Avenue Extension	Red Maple Road to Bayview Avenue	Road-New Road	By 2041	$ 9,169,000	0%	$ 0	$ 9,169,000	25%	$ 2,292,300	$ 2,292,300	$ 6,876,700
		7	Cedar Avenue Extension	High Tech Road to Langstaff Road	Road-New Road	By 2031	$ 2,933,000	0%	$ 0	$ 2,933,000	0%	$ 0	$ 0	$ 2,933,000
		8	Garden Avenue Extension	Yonge Street to Red Maple Road	Road-New Road	Post 2041[1]	$ 3,066,000	0%	$ 0	$ 3,066,000	100%	$ 3,066,000	$ 3,066,000	$ 0
		9	North-South Road	Carville Road to Garden Avenue	Road-New Road	By 2041	$ 10,515,000	0%	$ 0	$ 10,515,000	25%	$ 2,628,800	$ 2,628,800	$ 7,886,200
		17	Addison Street Extension	to Weldrick Road West	Road-New Road	By 2031	$ 3,463,000	0%	$ 0	$ 3,463,000	0%	$ 0	$ 0	$ 3,463,000
		18	Addison Street Extension	to Yonge Street	Road-New Road	By 2041	$ 768,000	0%	$ 0	$ 768,000	25%	$ 192,000	$ 192,000	$ 576,000
		19	Enford Road Extension	to Yonge Street	Road-New Road	By 2041	$ 4,279,000	0%	$ 0	$ 4,279,000	25%	$ 1,069,800	$ 1,069,800	$ 3,209,200
		27	Collector Road	Bawden Drive to future Highway 404 Overpass	Road-New Road	Post 2041[1]	$ 2,881,000	0%	$ 0	$ 2,881,000	100%	$ 2,881,000	$ 2,881,000	$ 0
		31	Performance Drive Extension	to future Highway 404 Overpass	Road-New Road	By 2041	$ 2,275,000	0%	$ 0	$ 2,275,000	25%	$ 568,800	$ 568,800	$ 1,706,200

Transportation Infrastructure		ID	Location/ Project Name	Section	Improvement Category	Phasing	Total Capital Cost	Benefit to Existing (Non-Growth Related)		Net Capital Cost	Post-Period Benefit		Total Deductions	Potential D.C. Recoverable Cost (City-wide D.C.-Eligible)
								%	$		%	$		
		34	Brodie Drive Extension		Road-New Road	By 2041	$ 1,547,000	0%	$ 0	$ 1,547,000	25%	$ 386,800	$ 386,800	$ 1,160,200
		36	Orlando Avenue Extension	to Highway 404 Overpass	Road-New Road	By 2031	$ 2,607,000	0%	$ 0	$ 2,607,000	0%	$ 0	$ 0	$ 2,607,000
		37	Newkirk Road	Elgin Mills Road E to Major Mackenzie Drive East	Road-Road Widening	By 2031	$ 16,532,000	20%	$ 3,306,400	$ 13,225,600	0%	$ 0	$ 3,306,400	$ 13,225,600
		39	East-West Minor Collector Road	between North-South Minor Collector Road and Yonge Street	Road-New Road	By 2041	$ 1,097,000	0%	$ 0	$ 1,097,000	25%	$ 274,300	$ 274,300	$ 822,700
		40	Oak Avenue	from North-South Road (ID #9) to Yonge Street	Road-Road Widening	By 2041	$ 1,247,000	20%	$ 249,400	$ 997,600	25%	$ 249,400	$ 498,800	$ 748,200
	Intersection Improvements	-	Multi-locations	4 intersections	Intersection Improvement-Geometric	By 2031	$3,198,000	0%	$0	$3,198,000	0%	$0	$0	$3,198,000
		-	Multi-locations	4 intersections	Intersection Improvement-Geometric	By 2041	$3,198,000	0%	$0	$3,198,000	25%	$799,500	$799,500	$2,398,500
		-	Multi-locations	6 intersections	Intersection Improvement-New Traffic Signal	By 2031	$3,120,000	0%	$0	$3,120,000	0%	$0	$0	$3,120,000
		-	Multi-locations	11 intersections	Intersection Improvement-New Traffic Signal	By 2041	$5,720,000	0%	$0	$5,720,000	25%	$1,430,000	$1,430,000	$4,290,000
		-	Multi-locations	3 intersections	Intersection Improvement-New Traffic Signal	Post 2041[1]	$1,560,000	0%	$0	$1,560,000	100%	$1,560,000	$1,560,000	$0
	Structures	C1	Iconic Bridge Improvement in Richmond Hill Centre	-	Structure-New Grade Separation	Post 2041[1]	$60,000,000	10%	$6,000,000	$54,000,000	100%	$54,000,000	$60,000,000	$0
		C2	Weldrick Road East	-	Structure-New Grade Separation	Post 2041[1]	$60,000,000	10%	$6,000,000	$54,000,000	100%	$54,000,000	$60,000,000	$0

Transportation Infrastructure		ID	Location/ Project Name	Section	Improvement Category	Phasing	Total Capital Cost	Benefit to Existing (Non-Growth Related)		Net Capital Cost	Post-Period Benefit		Total Deductions	Potential D.C. Recoverable Cost (City-wide D.C.-Eligible)
								%	$		%	$		
		C3	Centre Street East	-	Structure-New Grade Separation	Post 2041[1]	$60,000,000	10%	$6,000,000	$54,000,000	100%	$54,000,000	$60,000,000	$0
		C4	Crosby Avenue	-	Structure-New Grade Separation	Post 2041[1]	$60,000,000	10%	$6,000,000	$54,000,000	100%	$54,000,000	$60,000,000	$0
		C8	Bethesda Sideroad	-	Structure-New Grade Separation	Post 2041[1]	$60,000,000	10%	$6,000,000	$54,000,000	100%	$54,000,000	$60,000,000	$0
			Performance Drive Rouge River Crossing (City-wide Share)	-	Structure-Widening	By 2041	$3,200,000	0%	$0	$3,200,000	25%	$800,000	$800,000	$2,400,000
		O	Highway Overpass North of 16th Avenue	-	Structure-New Structure	By 2031	$22,862,000	0%	$0	$22,862,000	0%	$0	$0	$22,862,000
		O	Highway Overpass North of Major Mackenzie Drive	-	Structure-New Structure	By 2041	$13,732,000	0%	$0	$13,732,000	25%	$3,433,000	$3,433,000	$10,299,000
		O	Highway Overpass North of Elgin Mills Road	-	Structure-New Structure	Post 2041[1]	$20,693,000	0%	$0	$20,693,000	100%	$20,693,000	$20,693,000	$0
	Land Acquisition	-	-	-	-	-	$ 135,023,300	-	$ 1,638,100	$ 133,385,200	-	$ 45,198,300	$ 46,836,400	$ 88,186,900
AT and Trail	Priority AT Spine Routes	-	-	City-wide	Active Transportation-Other	-	$ 25,027,200	-	$ 2,502,700	$ 22,524,500	-	$ 115,100	$ 2,617,800	$ 22,409,400
	Other AT Facilities and Trails	-	-	City-wide	Active Transportation-Other	-	$ 22,924,600	-	$ 1,852,600	$ 21,072,000	-	$ 4,451,800	$ 6,304,400	$ 16,620,200
	Sidewalk on Collector Roads	-	-	City-wide	Active Transportation-Other	-	$ 20,290,700	-	$ 1,046,000	$ 19,244,700	-	$ 6,079,700	$ 7,125,700	$ 13,165,000
	AT Bridges	2	German Mills Creek / CNR	-	Active Transportation-Other	LT[2]	$7,000,000	10%	$700,000	$6,300,000	100%	$6,300,000	$7,000,000	$0

Transportation Infrastructure	ID	Location/ Project Name	Section	Improvement Category	Phasing	Total Capital Cost	Benefit to Existing (Non-Growth Related)		Net Capital Cost	Post-Period Benefit		Total Deductions	Potential D.C. Recoverable Cost (City-wide D.C.-Eligible)
							%	$		%	$		
	67	Trailwood Reserve Watercourse and Trail / CNR	-	Active Transportation-Other	LT[2]	$7,000,000	10%	$700,000	$6,300,000	100%	$6,300,000	$7,000,000	$0
	73	Off-Road Trail West of Leslie Street / CNR	-	Active Transportation-Other	LT[2]	$7,000,000	10%	$700,000	$6,300,000	100%	$6,300,000	$7,000,000	$0
	96	Trans Richmond Trail South of 29th Avenue/CNR	-	Active Transportation-Other	LT[2]	$7,000,000	10%	$700,000	$6,300,000	100%	$6,300,000	$7,000,000	$0
	97	David Dunlop Observatory Park Trail/CNR	-	Active Transportation-Other	ST	$7,000,000	10%	$700,000	$6,300,000	0%	$0	$700,000	$6,300,000
	99	Off Road Trail West of Oneida Crescent/CNR	-	Active Transportation-Other	ST	$10,000,000	10%	$1,000,000	$9,000,000	0%	$0	$1,000,000	$9,000,000
	101	Newberry Park/CNR	-	Active Transportation-Other	LT[2]	$7,000,000	10%	$700,000	$6,300,000	100%	$6,300,000	$7,000,000	$0
	102	Roseview Avenue Trail/Richmond Hill GO (Funding subject to Metrolinx)	-	Active Transportation-Other	LT[2]	$7,000,000	10%	$700,000	$6,300,000	100%	$6,300,000	$7,000,000	$0
	103	Iconic Bridge in Richmond Hill Centre	-	Active Transportation-Other	MT	$10,000,000	10%	$1,000,000	$9,000,000	25%	$2,250,000	$3,250,000	$6,750,000
		Crossing south of Carrville and east of Yonge	-	Active Transportation-Other	LT[2]	$7,000,000	10%	$700,000	$6,300,000	100%	$6,300,000	$7,000,000	$0
		High Tech Road	-	Active Transportation-Other	ST	$5,000,000	10%	$500,000	$4,500,000	0%	$0	$500,000	$4,500,000
York Region Boulevard Improvements	-	-	-	-	-	$107,069,000	-	$10,706,900	$96,362,100	-	$44,092,600	$54,799,500	$52,269,500
Other Projects	-	Walkway Illumination	City-wide	Miscellaneous-Illumination	2027-2041	$4,198,500	10%	$ 419,900	$ 3,778,600	0-25%	$ 629,800	$ 1,049,700	$ 3,148,800

Transportation Infrastructure	ID	Location/ Project Name	Section	Improvement Category	Phasing	Total Capital Cost	Benefit to Existing (Non-Growth Related)		Net Capital Cost	Post-Period Benefit		Total Deductions	Potential D.C. Recoverable Cost (City-wide D.C.-Eligible)
							%	$		%	$		
	-	Walkway & Street Illumination	City-wide	Miscellaneous-Illumination	2024-2026	$1,000,000	10%	$ 100,000	$ 900,000	0%	$ 0	$ 100,000	$ 900,000
	-	Sidewalk Program	City-wide	Active Transportation-Other	2024-2041	$10,450,000	10%	$ 1,045,000	$ 9,405,000	0-25%	$ 1,306,300	$ 2,351,300	$ 8,098,700
	-	Pedestrian Crossover (PXO) Implementation	City-wide	Traffic Safety-PXOs	2024-2041	$5,400,000	70%	$ 3,780,000	$ 1,620,000	0-25%	$ 225,000	$ 4,005,000	$ 1,395,000
	-	Automated Speed Enforcement (ASE) Implementation	City-wide	Traffic Safety-Other	2025-2041	$7,140,000	70%	$ 4,998,000	$ 2,142,000	0-25%	$ 315,000	$ 5,313,000	$ 1,827,000
	-	TSOS Implementation	City-wide	Miscellaneous-Other City-wide	2024-2041	$5,625,000	70%	$ 3,937,500	$ 1,687,500	0-25%	$ 234,400	$ 4,171,900	$ 1,453,100
	-	Annual Traffic Improvements	City-wide	Miscellaneous-Other City-wide	2024-2041	$6,930,000	70%	$ 4,851,000	$ 2,079,000	0-25%	$ 288,800	$ 5,139,800	$ 1,790,200
All Transportation Infrastructures	**-**	**-**	**-**	**-**	**-**	**$915,794,300**	**-**	**$85,314,700**	**$830,479,600**	**-**	**$468,806,000**	**$554,120,700**	**$361,673,600**

Note: 1. Projects with Phasing post 2041 (greyed-out items) will be included in the D.C. Study with 100% PPB, i.e., no D.C.-eligible cost.

2. Projects with Phasing LT-long term (i.e., post 2041 greyed-out items) will be included in the D.C. Study with 100% PPB, i.e., no D.C.-eligible cost.

7 Conclusions

The total capital cost for the transportation programs is **$915.79 million**. The 'non-growth' related share (BTE) of the cost is **$85.31 million**, the 'post-period benefit' share of the cost is **$468.81 million**, and the growth-related D.C.-eligible shares are **$361.67 million**.

The technical analysis presented in this report is used in calculating the growth-related development charge for the roads and road-related service. The cost estimation and findings will be used as the input to the Development Charge Background Study for the update of the City's D.C. By-law.