



Final Report

Ride & Stride: City of Markham Active Transportation Master Plan

10-Year Implementation Strategy Summary Report



Prepared for City of Markham
by IBI Group

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1.0 Introduction

1.1 Purpose of This Report

This 10-Year Implementation Strategy Summary Report provides a roadmap for the implementation of programming and network initiatives over the next ten years in support of the City of Markham's Active Transportation Master Plan (ATMP).

This implementation plan discusses a ten-year strategy to advance the various infrastructure projects identified in the ATMP. The intent is to provide guidance to help the City enact the recommendations in the ATMP.

1.2 What's Inside

The 10-Year Implementation Plan has been structured around the following sections:

- **Chapter 1** provides an overview of the implementation plan purpose in the context of the ATMP and summarizes precedence of active transportation expenditures in comparable municipalities.
- **Chapter 2** focuses on the priority cycling network proposed in the 10-Year Implementation Plan. An overview is provided of the project prioritization process used to develop the 1-5 year and 6-10 year priority cycling networks. The 10-year priority network and 5-year project priorities are identified in this section.
- **Chapter 3** provides a summary of the capital and operating costs associated with the implementation of the 10-year priority network and programming initiatives. Funding sources to carry out the recommendations are included.
- **Appendix A** includes a package of network maps showing the phasing and proposed facilities types of the 10-year priority network; the start year of the first five year projects; and the networks in the Low, Medium, and High Investment Scenarios.
- **Appendix B** includes the summary list of the first five year priority projects, along with details on the facility type, start year, as well as capital, O&M, lifecycle and TCO costs.
- **Appendix C** is the *Summary of ATMP Cycling Facility Selection Process Memo* which summarizes the review process undertaken to determine the appropriate cycling facility time and implementation strategy.

1.3 Background & Stakeholder Consultation

In November 2021, the ATMP received support from Council with the direction for City staff to develop an implementation plan clarifying the prioritization

process for the 10-year plan while addressing other issues relating to identifying 5-year and 10-year priority projects, capital and operating costs, lifecycle costs and other funding requirements.

The following is an overview of the four main infrastructure elements of the ATMP, along with their relevance to this implementation plan:

- The **sidewalk gaps program** will be updated in parallel with and outside of this implementation plan scope. The sidewalk gaps program was approved by Council in 2018 and an update was provided to Council in Q1 2022. The updated report proposed constructing 59 kilometers of sidewalk by 2030, costing a total of \$28.3M. This will be funded 65% by development charges (DCs) and 35% by other sources. The sidewalk gaps program is one of the recommendations of the ATMP but the implementation of the sidewalk program is excluded from the 10-Year Implementation Plan costs presented in this memo.
- The **pedestrian priority area program** recognizes that there is a need to identify improvements in pedestrian improvement areas, with consideration for access to schools and community centres, pedestrian-related collision history and streetscaping needs. Further work is needed to define the scale and scope of this program, so it is excluded from the 10-Year Implementation Plan costs presented in this memo.
- The **cycling and trails ultimate network** were developed through the ATMP, building upon previous plans. This network was refined based on internal and external stakeholder consultation, and three rounds of public consultation. Numerous projects from the ultimate network program have been included as part of the 1-5 year and 6-10 year priority networks.
- The **existing network upgrades program** involved a review of the need to upgrade existing cycling facilities. Numerous projects from the network upgrades program have been included as part of the 1-5 year and 6-10 year priority networks.

Two workshops were held on January 31st and February 25th, 2022 with internal stakeholders from the City to present and invite feedback on the priority (short-term) cycling projects and assumptions used to determine the capital, operating and lifecycle costs of the priority network projects.

1.4 City of Markham Internal Review

An internal review of this report was conducted by City of Markham staff following the submission of this draft report in May 2022. Based on feedback received through the internal review process, revisions were made to the following content and documented in the separate “*Active Transportation Master Plan Implementation Strategy and Capital Plan*” Council report, dated May 30, 2022:

- Definition and structure of investment scenarios;

- Capital cost assumptions for the 10-year priority network by facility type;
- Capital and operating costs of the 10-year priority network by facility type;
- Proportion of 2031 population living within 200 m of cycling network by investment scenario.

These revisions were not reflected in this Implementation Plan report, resulting in differences in content that is documented in this report and what was presented to council. However, **it is important to note that overall recommendations made to Council are still in line with takeaways in this report such as the projects included in the 10-year priority cycling network, 5-year priority projects, and the preference to proceed with the medium investment scenario.** This report is provided to summarize the overall process and philosophy informing the final Council recommendations.

2.0 Cycling Network Improvements

2.1 Prioritization Process

The prioritization of cycling corridors within an overall network is an iterative process, typically considering a variety of inputs and factors based on information available at any given time. For most municipalities, network priorities must adapt year-over-year as considerations such as funding availability, capital projects and project support inform implementation.

The prioritization process applied to the development of this plan reflects available information as of March 2022 and considers the following factors, explained in further detail in the following sections of this report:

- **Capital Project & Development Coordination:** Coordination with timelines for planned capital work or development where active transportation improvements will be bundled with other works. This also includes considering connections into and out of these planned capital projects.
- **Ease of Implementation:** The overall feasibility and complexity of project implementation considering planning and design complexity as well as public consultation requirements.
- **Cycling Impact Analysis:** Evaluation tool to assess the relative value or impact of specific corridors to the overall cycling network. The following five factors were used to evaluate the overall cycling impact of a potential link: **connectivity, density, key destinations, existing demand, and barriers.**
- **Overall Network Connectivity & Geographic Distribution:** Network lens that considers overall network connectivity to try to ensure the network development takes advantage of existing links and expands the overall network reach throughout the City.

- **Priority Neighbourhood Score:** A measure of the neighbourhood priority score around the proposed network link based on the Ontario Marginalization Index.
- **Public & Stakeholder Input:** High-priority projects as noted through public and stakeholder discussions over the course of the ATMP.

2.1.1 Capital Project & Development Coordination

The latest planned and proposed projects by the City of Markham, York Region and Toronto Conservation Authority (TRCA) have been reflected in the updated 10-year priority network (as of March 2022).

A recognition that each capital project can be leveraged to incrementally improve the network over time is important to advance the development of cycling facilities. On-going coordination will be needed with the Region as their capital plan is subject to change on an annual basis. While the ATMP originally considered the York Region 2018 capital plan, the updated priority network reflects updated York Region 2022 capital plan (refer to Exhibit 1) and City of Markham Environmental Services Capital Program (2021-2031).

City of Markham

The latest City of Markham secondary plans and 10-year capital plan were reviewed to identify priority cycling corridors where capital road projects are being planned in the short-to-medium term. This exercise helps coordinate the implementation of proposed cycling facilities with planned capital projects, effectively reducing cost and minimizing the need for retrofit interventions. Cycling facility types from committed works and from the City's secondary plans that are expected to be implemented in the short-to-medium term are adopted directly into the priority network. Proposed cycling facilities within the following secondary areas are expected to be included in the priority network:

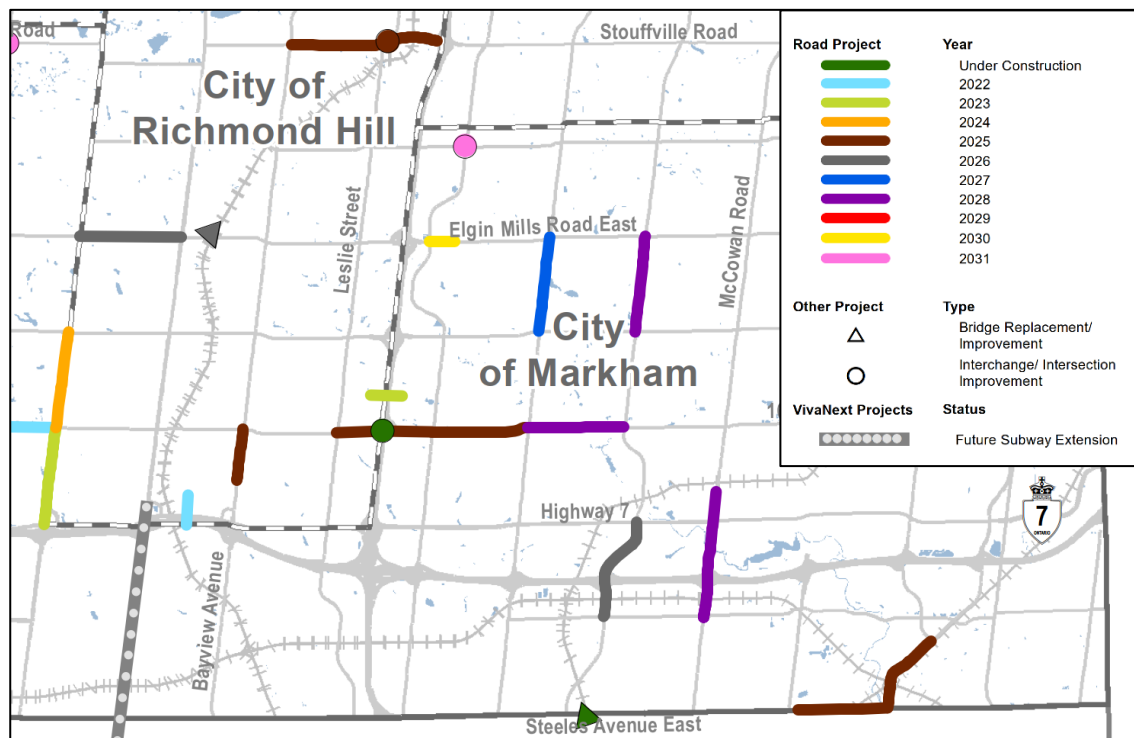
- Future Urban Area (FUA) Berczy Glen Secondary Plan;
- Langstaff Secondary Plan;
- Markham Centre Secondary Plan; and
- Mount Joy secondary Plan.

The 2022 Road Rehabilitation program was reviewed to avoid including corridors in the 1-5 year network that had recently been resurfaced. Opportunities to bundle cycling facility projects with capital work for watermain replacement and flood remediation in the near term have also been considered.

York Region

The York Region 10-year capital plan (Exhibit 1) was reviewed to identify opportunities to bundle priority projects with planned capital work on regional roads.

Exhibit 1: York Region 10-Year Roads and Transit Construction Program (2022)



Anticipated cycling / trails works have also been included in the priority network. An example would be the South York Greenway, which is planned to extend across York Region and was undergoing public consultation to finalize its alignment at the time of this writing. The South York Greenway is assumed to be funded by the Region. Exhibit 2 shows a sample alignment for the South York Greenway between Highway 404 to Birchmount Road.

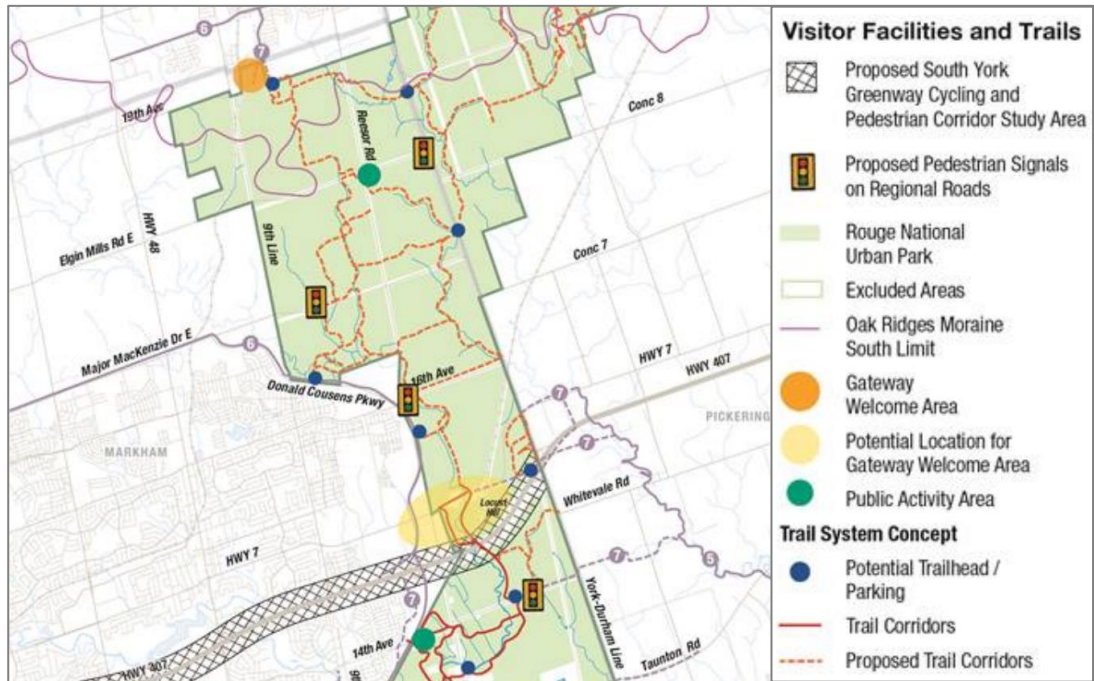
Exhibit 2: South York Greenway – Alignment Alternatives from Highway 404 to Birchmount Road



Parks Canada

Parks Canada is undertaking the planning and construction of a new trail through the Markham area of Rouge National Urban Park. Construction of the trail north of Highway 7 will be completed by the end of the year (2022). Based on correspondence with Parks Canada, proposed alignments around Highway 7 shown in Exhibit 3 are currently under review and are expected to be determined within the next five years, however the primary north-south trail through Rouge Park is largely anticipated to be completed within a 5-year horizon. Planned new trails are included in the 10-year priority network to illustrate the potential connectivity in the cycling network; however, these projects are not accounted for in the capital and operating costs since it is assumed that Parks Canada will cover the cost of construction and maintenance of these facilities.

Exhibit 3: Rouge National Urban Park Proposed Trail



2.1.2 Ease of Implementation

A range of implementation strategies are available to deliver cycling facilities on urban roads with differing functions. In selecting between various facility types and implementation strategies within each identified class, professional judgement was applied, considering the detailed evaluation factors (Step 2) of the OTM Book 18 Facility Selection Process, and in accordance with the process outlined in the *Summary of ATMP Cycling Facility Selection Process Memo (Appendix C)*.

Each possible implementation strategy has a relative anticipated ease of implementation that considers impacts such as complexity of design and construction, cost and political/public acceptability (i.e. removal of on-street parking or travel lanes). A summary is presented in Exhibit 4.

Exhibit 4: Implementation Strategies for Cycling Facilities

ROAD CLASS	FACILITY TYPE	CYCLING FACILITY / IMPLEMENTATION STRATEGY	FACILITY CLASS	TYPICAL CONTEXT	EASE OF IMPLEMENTATION 1-LOW COMPLEXITY 4-HIGH COMPLEXITY
Local Roads (Urban)	Neighbourhood Bikeways	Signed Routes	Shared	Retrofit	1
Local Roads (Urban)	Neighbourhood Bikeways	Advisory Bike Lanes	Shared	Retrofit	1-2 depending on parking impacts
Local Roads (Urban)	Neighbourhood Bikeways	Bicycle Boulevard	Shared	Retrofit	1-2 depending on parking impacts
Collector & Arterials (Urban)	Bike Lanes & Cycle Tracks	Stripe bike lanes to existing wide lanes	Designated	Retrofit	1
Collector & Arterials (Urban)	Bike Lanes & Cycle Tracks	Retrofit bike lane to existing travel lane	Designated	Retrofit	1-2 depending on parking impacts
Collector & Arterials (Urban)	Bike Lanes & Cycle Tracks	Retrofit buffered bike lane to existing road	Designated	Retrofit	1-2 depending on parking / traffic impacts
Collector & Arterials (Urban)	Bike Lanes & Cycle Tracks	Retrofit protected bike lane to existing road	Separated	Retrofit	1-2 depending on parking / traffic impacts
Collector & Arterials (Urban)	Bike Lanes & Cycle Tracks	Construct cycle tracks in boulevard	Separated	Retrofit or Capital	2-4 depending on construction complexity
Collector & Arterials (Urban)	Multi-use Paths & Trails	Remove existing sidewalk and construct boulevard multi-use path	Separated	Retrofit	3
Collector & Arterials (Urban)	Multi-use Paths & Trails	Construct boulevard multi-use path	Separated	Retrofit or Capital	3
Collector & Arterials (Urban)	Multi-use Paths & Trails	Construct off-road multi-use trail	Separated	Capital	2-4 depending on context

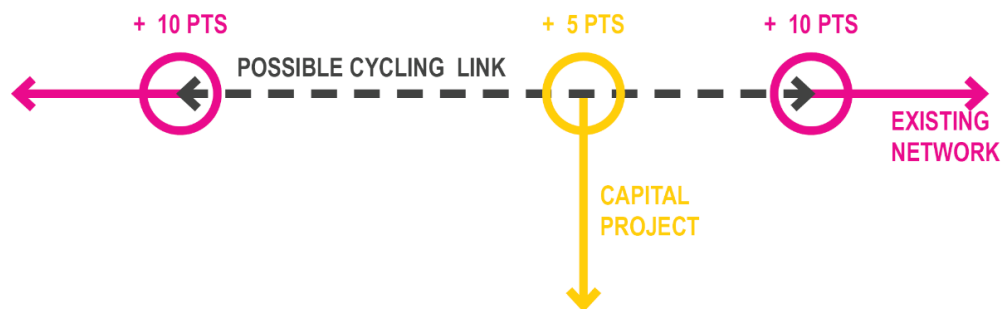
It is important to note that the short-term network development generally focused on retrofit projects within the current road context wherever possible, except for coordinated capital projects. This approach reflects a desire to expand the network as rapidly as possible while minimizing the overall budget needed to deliver cycling improvements.

2.1.3 Cycling Impact Analysis

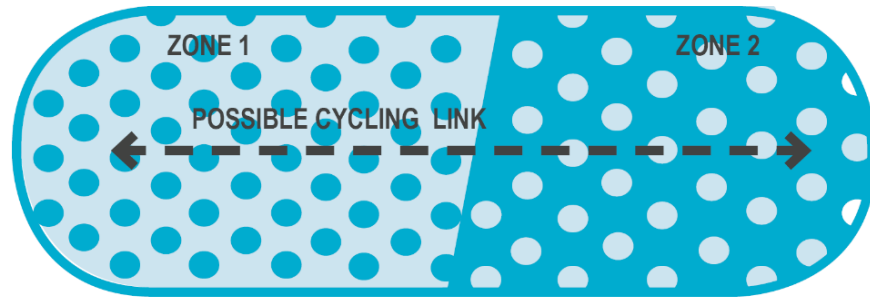
As part of the development of the ATMP, a cycling impact analysis was conducted. This analysis was used to assess the relative value or impact of specific corridors to the overall cycling network. The following five factors were used to evaluate the overall cycling impact of a potential link: **connectivity**, **density**, **key destinations**, **existing demand**, and **barriers**.

For further detail on the methodology, refer to the standalone *Cycling Impact Analysis Memo* prepared as part of the ATMP network development process or summary of the process presented in the ATMP Final Report. A summary of the five analysis factors is provided below:

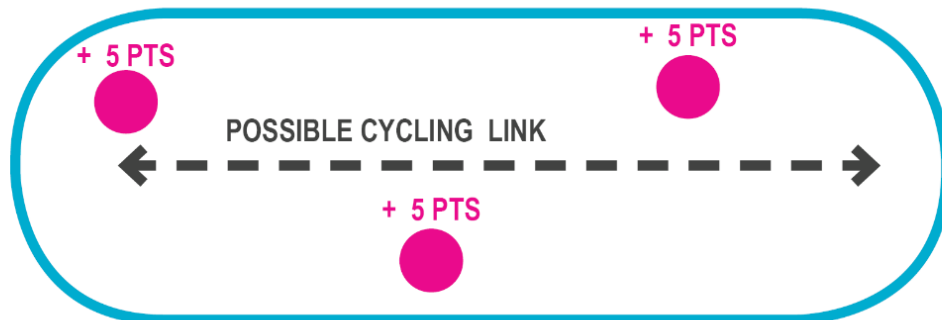
- **Connectivity:** This factor evaluated the number, type and length of network connections that are made by a particular link. The number of links that connect on either end of a potential link or midway through the link were calculated and used to determine its rating for the criteria. A link scores based on the type and total continuous length of facility the link connects to. Scores were “bumped-up” where a facility connects a gap between the existing network and/or where a cycling facility connects to a network gateway.



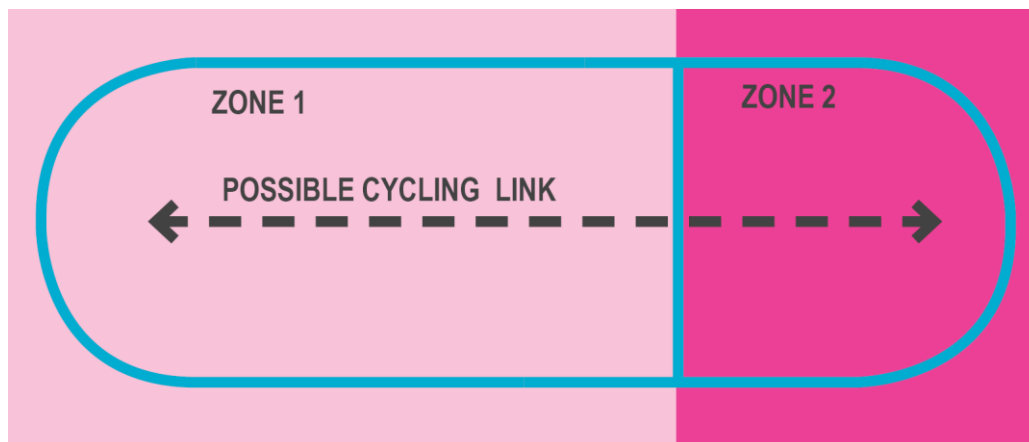
- **Population & Employment Density:** This factor used projections for population & employment density to ensure that the cycling network development considers future conditions. A 500m buffer of the infill corridor was created. A total density was calculated based on area within the buffer and the density of the zone in that area. Thresholds based on the average density were used to determine the rating for the criteria. The analysis assumes that density is evenly distributed throughout the zone.



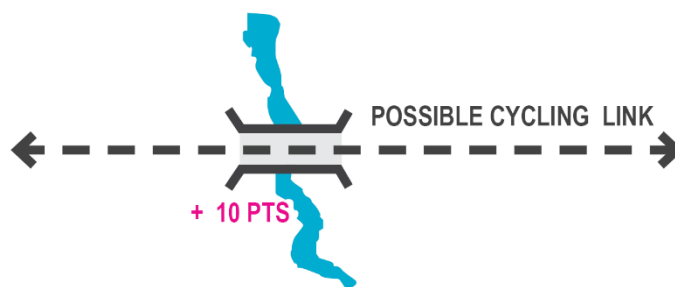
- **Key Destinations:** Key destinations were identified based on available City shapefiles around the following themes: providing access to community destinations; supporting active school travel; and addressing the first / last kilometre. A 500m buffer was assigned around each corridor and the number of trip generators within the buffer were used to determine its score for the criteria, up to a maximum of 25 pts. This approach assumes that a short trip is more likely to be made by bicycle if the destination is located within 500 m of a cycling facility.



- **Future Demand:** Although it is challenging to get a detailed representation of “cycling potential” for every intersection / corridor throughout the City, it is possible to draw on zonal level information from the Transportation Tomorrow Survey (TTS) to consider existing short trips (<5 km) taken by auto modes that may be candidates to become cycling trips. A 500m buffer of the infill corridor is created. A weighted number of auto short trips started or ending in that area was calculated based on the area within a buffer and the number of trips in that area. Thresholds based on the number of auto trips were used to determine the rating for the criteria. The analysis assumes that the number of trips is evenly distributed throughout the zone.



- Barriers:** Major barriers such as rail lines, water bodies or freeways can severely restrict active transportation. For this reason, cycling facilities that cross a major barrier provide critical linkages. Major barriers identified in Markham include Highway 407 & Highway 404, rail corridors with limited crossing opportunities and various watercourses. Any links crossing a barrier were assigned additional points.



Once all of the factors were individually analysed, scores were assigned based on the relative weighting shown in Exhibit 5 to calculate the final cycling impact score.

Exhibit 5: Cycling Impact Analysis Weighting

CRITERION	WEIGHTING
Connectivity	30
Density	20
Future Demand	15
Key Destinations	25
Barriers	10
TOTAL	100

2.1.4 Overall Network Connectivity & Geographic Distribution

Network phasing considers the overall network connectivity at a given time interval, for example after 5 years. Efforts were made to establish some minimum connectivity across all City Wards and neighbourhoods at each 5-year milestone when determining links to include. This helps ensure the network is practical and useful for trip-making between neighbourhoods while ensuring geographic equity across the City.

2.1.5 Priority Neighbourhood Score

Equity is an important consideration in project prioritization. Proposed cycling links were assigned a priority neighbourhood score based on the neighbourhood(s) it passes through based on the **Ontario Marginalization Index**. The Ontario Marginalization Index (ON-Marg) uses data from 2001, 2006, 2011 and 2016 to illustrate levels of marginalization across the province. ON-Marg focuses on four dimensions that contribute to the process of marginalization: residential instability, material deprivation, dependency and ethnic concentration. Links are scored overall from 0-5; with 5 being the most marginalized and highest priority.

2.1.6 Public & Stakeholder Input

Public and stakeholder engagement was a major component throughout the development of the ATMP. Public engagement activities included two rounds of Public Information Centres (PICs), various pop-up events, presentations and panel discussions, online consultation and an external technical advisory group. These opportunities for two-way conversation provided an overview of the ATMP, gathered feedback on draft networks and other recommendations.

Interactive components of the activities included voting on active transportation priorities, identifying where urgent walking and cycling facility improvements are needed. Comments from the public on the importance of overall network links informed priorities and led to the identification of critical links throughout the network. Throughout the ATMP engagement process, there was a desire from residents to have the active transportation network connected to key destinations, such as schools, shopping centres and community centres. Active transportation improvements along major routes were also desired and needed. Specific corridors highlighted multiple times by residents as needing improvements included John Street (connections to/from Thornhill), McCowan Road, Kennedy Road and Highway 7.

2.2 10-Year Priority Cycling Network

Based on the prioritization process outlined in Section 2.1, the 10-year priority network was identified and divided into 1-5 year and 6-10 year projects, based on the start year of project planning and design. A map of the phasing for 1-5 year and 6-10 year priority network projects is provided in Appendix A.

Projects that are constructed by Parks Canada and land developers (e.g. in the FUA) are differentiated from other projects since it is assumed that no cost will be incurred by the City for these projects. Generally, projects were added to the 1-5 year priority network if they align with capital road works planned within that timeframe. “Quick win” projects that are easier to implement were also included in the 1-5 year priority network, such as converting routes with existing edge lines to bike lanes or retrofitting a roadway with sufficient pavement width to accommodate bike lanes.

Exhibit 6 shows the total length of cycling facilities proposed to be implemented within the 1-5 year and 6-10 year timelines. Generally, most bike lane projects were included in the 1-5 year priority network since they are relatively easy to implement. The cycle track projects in the 1-5 year priority network are largely driven by capital road work taking place within that timeframe.

A map of the proposed facility type for projects in the 10-year priority network is provided in Appendix A.

Exhibit 6: Length of Facility Implemented in 1-5 Year and 6-10 Year Timelines

CYCLING FACILITY	TOTAL LENGTH OF FACILITY IMPLEMENTED (1 – 5 YEARS)	TOTAL LENGTH OF FACILITY IMPLEMENTED (6 – 10 YEARS)
Shared Roadways	9.0	6.3
Multi-use Paths (concrete)	14.8	23.2
Bike lanes	40.2	2.2
Buffered & protected bike lanes	18.6	8.0
Cycle tracks (asphalt)	3.0	7.3
Off-road trails (stone dust)	1.2	0.9
Total	86.8	47.9

2.3 First 5-Year Priority Projects

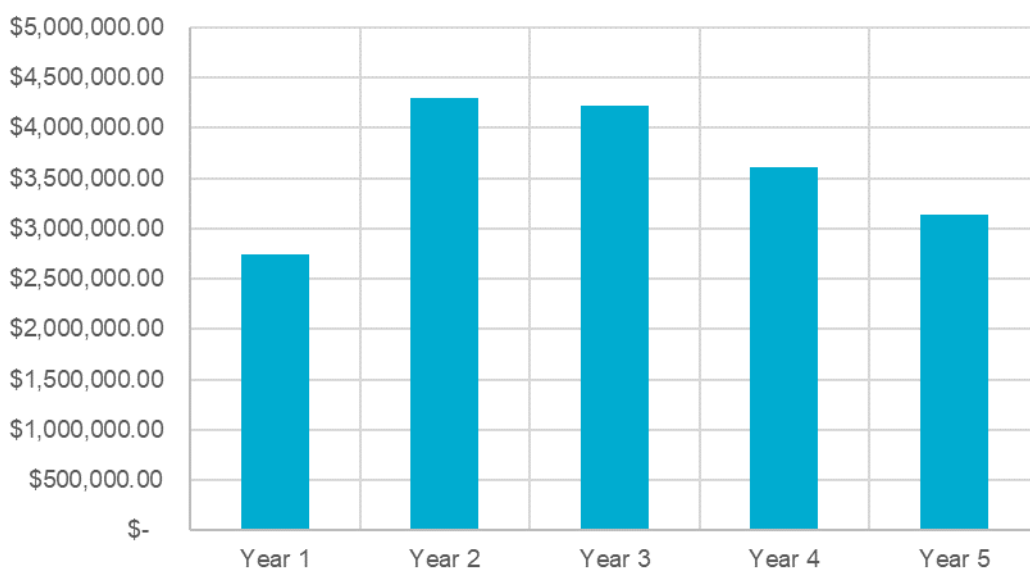
The start year (i.e. year that planning/designs begins) of projects in the 1-5 year plan was determined by distributing project capital costs as evenly as possible over the 5-year period. A network map indicating the start year of each project is provided in Appendix A. A summary list of 1-5 year projects, including the proposed facility type, implementation strategy, high-level capital, operating and lifecycle cost estimates, recommended start years, project durations, and coordination with capital projects can be found in Appendix B.

For projects with an ease of implementation rating of 1, it is assumed that the project duration will be one year with 100% of the capital cost incurred in that year. For projects with an ease of implementation rating of 2, it is assumed that the project duration will be two years with 25% of the capital cost incurred in the first year and 75% of the cost incurred in the second year. For projects with an

ease of implementation rating of 3, it is assumed that the project duration will be three years with 25% of the capital cost incurred evenly over the first two years, and 75% of the cost incurred in the third year.

The distribution of capital costs of the first five year projects is shown in Exhibit 7. It should be noted that the project cost in Year 1 is lower relative to Years 2 through 5 since projects that are easy to implement with lower cost would be constructed in the first year. Projects that are more difficult to implement (e.g. cycle tracks, MUPs), would require planning and design to occur in the first year, with construction occurring in years 2 or 3.

Exhibit 7: Distribution of 1-5 Year Capital Costs



3.0 Costs and Funding

This section provides an overview of the assumptions used to calculate capital and operating costs for the recommended 10-year priority network. A discussion is also included on the methodology for determining lifecycle costs as well as total cost of ownership (TCO) for the first five year projects. Operating costs for AT infrastructure over the next 10-years are included, along with the identification of potential funding sources.

As described in Section 1.4, **revisions were made to the cost assumptions, total capital and operating costs of the 10-year priority network and scenario definitions and documented in the “Active Transportation Master Plan Implementation Strategy and Capital Plan” Council report, dated May 30, 2022.** However, **overall recommendations made to Council are still in line with takeaways in this report such as the projects included in the 10-year priority cycling network, 5-year priority projects, and the recommendation to proceed with the medium investment scenario.**

3.1 Cost Assumptions

Exhibit 8 presents typical order-of-magnitude capital and operating unit cost assumptions derived from a combination of inputs from internal City stakeholders, comparable previous projects completed in southern Ontario and best practice costing guidelines. These assumptions were reviewed during the development of the Implementation Plan and are pro-rated to 2022 values, assuming a 8% annual rate of inflation for construction.

Exhibit 8: Capital And Operating Unit Cost Assumptions for the 10-Year Priority Network by Facility Type

CYCLING FACILITY	IMPLEMENTATION STRATEGY	DESCRIPTION	CAPITAL COST (/KM)	% OF COST FOR ENG. & CA	O&M COST (\$/KM/YEAR)
Upgrades to Existing Facilities	Formalize existing edge lines	Formalize bike lanes along 2-lane road with existing edge lines	\$11,664	25.00%	\$1,000
Upgrades to Existing Facilities	Add edge lines to existing wide lanes and formalize over time	Add edge lines to existing wide, 2 lane road - sign and mark as bike lanes over time	\$23,328	25.00%	\$6,000
Upgrades to Existing Facilities	Advisory Bike Lanes	Add advisory bike lanes to existing wide, 2 lane road	\$23,328	25.00%	\$6,000

CYCLING FACILITY	IMPLEMENTATION STRATEGY	DESCRIPTION	CAPITAL COST (/KM)	% OF COST FOR ENG. & CA	O&M COST (\$/KM/YEAR)
Shared Roadways	Shared Roadways	Signed and marked route	\$11,664	25.00%	\$1,000
Shared Roadways	Bicycle Boulevard	Signed and marked route with traffic calming des	\$52,488	25.00%	\$4,500
Bike Lanes	Stripe bike lanes on existing road	Sign and mark bike lanes to wide roadway (no changes to other pavement markings / travel lanes)	\$23,328	15.00%	\$6,000
Bike Lanes	Retrofit bike lanes to existing road	Narrow travel lanes or remove parking to re-stripe with bike lanes	\$ 46,656	15.00%	\$6,000
Buffered Bike Lanes	Stripe buffered bike lanes on existing road	Sign and mark bike lanes to wide roadway (no changes to other pavement markings / travel lanes)	\$34,992	15.00%	\$6,000
Buffered Bike Lanes	Retrofit buffered bike lanes to existing road	Narrow travel lanes or remove parking or travel lane to re-stripe with bike lanes	\$58,320	15.00%	\$6,000
Protected Bike Lanes & Cycle Tracks	Retrofit protected bike lane to existing travel lane	Remove travel lane to retrofit with bike lane, buffer and separators (combination of flexible posts, curbs and planters)	\$291,600	15.00%	\$12,000
Protected Bike Lanes & Cycle Tracks	Widen for raised cycle tracks or add cycle tracks into boulevard	Cycle tracks added in roadway boulevard	\$1,516,320	15.00%	\$25,279

CYCLING FACILITY	IMPLEMENTATION STRATEGY	DESCRIPTION	CAPITAL COST (/KM)	% OF COST FOR ENG. & CA	O&M COST (\$/KM/YEAR)
Multi-use Trail	Remove existing sidewalk and construct boulevard multi-use trail	Remove existing concrete sidewalk; construct new 3.0 m concrete trail; assume 30% utility pole relocations	\$1,061,424	15.00%	\$6,250
Multi-use Trail	Construct boulevard multi-use trail (concrete)	Construct new 3.0 m wide concrete trail; assume 30% utility pole relocations	\$933,120	15.00%	\$6,250
Multi-use Trail	Construct boulevard multi-use trail (asphalt)	Construct new 3.0 m wide asphalt trail; assume 30% utility pole relocations	\$699,840	15.00%	\$6,250
Multi-use Trail	Construct greenway system trail	Construct new 2.7m wide stone dust trail	\$437,400	15.00%	\$4,500

Three types of projects were identified for potential cost sharing opportunities with various jurisdictions:

- City of Markham:** These projects take place along local roads and make up the majority of projects within the 10-year priority network. These projects are assumed to be completely paid for by the City.
- York Region:** These are projects take place along Regional roads in conjunction with road widening or resurfacing projects. If there are existing sidewalks on roads, the Region will pay 100% of replacement of the sidewalk (typ. 1.5-1.8m) and the City is responsible for the cost to upgrade the sidewalk to a multi-use path (MUP). For sections without existing sidewalks, the City pays 100% of the MUP cost. Given the variety of different conditions (i.e. presence of sidewalk, sidewalk on one side, sidewalk missing), an overall assumption was applied that the City would be responsible for 50% of the capital cost across these projects.
- Parks Canada / TRCA:** These off-road trail projects are assumed to be completely funded by other agencies and jurisdictions.

3.2 Investment Scenarios

Three potential levels of investment scenarios were developed for the implementation of the 10-year priority cycling network. The three scenarios are as follows:

- **Low Investment Scenario:** Complete the priority cycling network over 20-years;
- **Medium Investment Scenario:** Complete the priority cycling network in 10-years;
- **High Investment Scenario:** Complete the priority cycling network in 5-years.

The network representation of these three scenarios are shown in Appendix A. The breakdown of capital cost for these scenarios can be found in Exhibit 9.

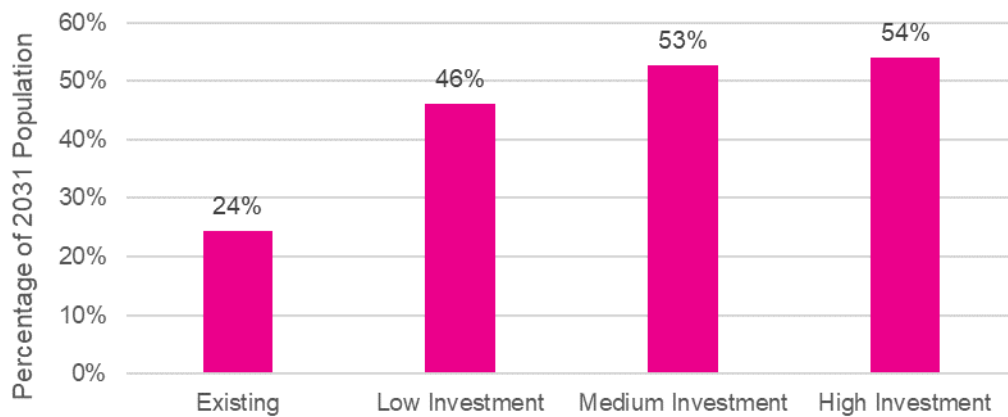
Exhibit 9: Capital Cost Assumptions for the 10-Year Priority Network by Facility Type

CYCLING FACILITY	TOTAL LENGTH OF FACILITY (KM) - LOW	TOTAL LENGTH OF FACILITY (KM) - MEDIUM	TOTAL LENGTH OF FACILITY (KM) - HIGH	CAPITAL COST (LOW)	CAPITAL COST (MEDIUM)	CAPITAL COST (HIGH)
Shared Roadways	9.0	15.3	15.3	\$224,000	\$463,000	\$463,000
Multi-use Paths	23.5	38.0	43.4	\$16,428,000	\$31,745,000	\$36,745,000
Bike lanes	40.2	42.4	42.4	\$763,000	\$853,000	\$853,000
Buffered and protected bike lanes	18.6	26.6	26.6	\$4,822,000	\$6,860,000	\$6,860,000
Cycle tracks	5.9	10.3	19.6	\$6,898,000	\$12,390,000	\$26,400,000
Off-road trails	1.6	2.1	28.9	\$514,000	\$736,000	\$12,433,000
TOTAL	99.4	134.7	176.1	\$29,649,000	\$53,047,000	\$93,179,000

The scenarios were evaluated based on the proportion of City residents with access to the network. Exhibit 10 shows the proportion of the projected 2031 population living within 200 m of designated and separated facilities in the existing cycling network, as well as the Low, Medium, and High Investment Scenario cycling networks. This serves as an indicator of how each scenario provide connections to all parts of the City, public transit and access to key origins and destinations.

If no investments are made to the cycling network (i.e., the 2031 network remains the same as the existing network), only 24% of residents will be within 200 m of designated or separated facilities in the network. The Low Investment Scenario will provide accessibility to the cycling network to 46% percent of total residents, while the Medium Investment Scenario will increase coverage to more than half of all residents.

Exhibit 10: Proportion of 2031 Population Living Within 200m of Cycling Network (Designated or Separated Facilities)



In recent years, municipalities across the country have recognized the importance of active transportation and have committed funding to build active transportation capacity through network improvements and programming initiatives. Exhibit 11 summarizes the total and annualized active transportation expenditures from municipalities that have comparable population sizes to the City of Markham. For reference, Exhibit 12 summarizes the total and annualized active transportation expenditures for the City of Markham.

Exhibit 11: Comparison of Cycling Infrastructure Investment in Similar Municipalities

MUNICIPALITY ¹	POPULATION	AVERAGE ANNUAL BUDGET (\$M)	ANNUAL BUDGET PER CAPITA (\$)
Brampton	656,480	6.80	10.36
Mississauga	717,961	5.00	6.96
Vaughan	323,103	2.10	6.50
Oakville	213,759	4.10	19.18

Exhibit 12: City of Markham Cycling Infrastructure Spending Across Investment Scenarios

INVESTMENT SCENARIOS	POPULATION	AVERAGE ANNUAL BUDGET (\$M)	ANNUAL BUDGET PER CAPITA (\$)
Low Investment	338,503	2.99	8.83
Medium Investment	338,503	5.35	15.80
High Investment	338,503	8.44	24.94

Based on the evaluation of the scenarios against overall cycling network coverage and comparisons with cycling infrastructure investments in peer municipalities, **it is recommended that the Medium Investment Scenario be used as the basis for the development of the 10-year plan.**

3.3 Recommended Priority Network Costs

This section provides an overview of the assumptions used to calculate capital and operating costs for the recommended 10-year priority network. A discussion is also included on the methodology for determining lifecycle costs as well as total cost of ownership (TCO) for the first five year projects.

3.3.1 Capital Costs for 10-Year Priority Network

The capital and operating costs for the 10-Year priority network were calculated using the unit cost assumptions presented in Section 3.3.1, multiplied by the project length. The total capital costs for the 1-5 year and 6-10 year projects by facility type are presented in Exhibit 13.

¹ *Budget numbers for the investment scenarios are projected numbers while those for the peer municipalities are approved budgets.

Exhibit 13: 10-Year Priority Network Capital Costs by Facility Type

CYCLING FACILITY	CAPITAL COST 0 – 5 YEARS	CAPITAL COST 6 – 10 YEARS
Shared Roadways	\$216,000	\$247,000
Multi-use Paths (concrete)	\$10,533,000	\$21,212,000
Bike lanes	\$763,000	\$90,000
Buffered & protected bike lanes	\$4,822,000	\$2,038,000
Cycle tracks (asphalt)	\$4,552,000	\$7,838,000
Off-road trails (stone dust)	\$349,000	\$387,000
Total	\$21,235,000	\$31,812,000

3.3.2 Operating Costs for 10-Year Priority Network

The total operating costs for the 1-5 year and 6-10 year projects by facility type are presented in Exhibit 14. Operating costs were calculated for each individual project starting from the year after the project is completed, then summed up to find the total operating costs over the 5-year period for all projects. For the 6-10 year projects, it is assumed that all 1-5 year and 6-10 year projects will incur operating expenses starting in Year 6.

Exhibit 14: 10-Year Priority Network Operating Costs by Facility Type

CYCLING FACILITY	OPERATING COST 0 – 5 YEARS	OPERATING COST 6 – 10 YEARS
Shared Roadways	\$132,000	\$392,000
Multi-use Paths (concrete)	\$132,000	\$1,232,000
Bike lanes	\$359,000	\$575,000
Buffered & protected bike lanes	\$406,000	\$1,489,000
Cycle tracks (asphalt)	\$139,000	\$1,307,000
Off-road trails (stone dust)	\$14,000	\$48,000
Total	\$1,182,000	\$5,043,000

3.3.1 Total Cost of Ownership for 5-Year Priority Projects

TCO is an estimate of the cost to purchase a facility plus the cost to operate it over the service life. It is intended to be used as a tool to help the City determine the direct and indirect costs of owning a facility. Rehabilitation costs are assumed to be accounted for in the annual operating costs. Inflation is not

included for in the TCO unit cost assumptions. TCO is calculated as an annualized value for each proposed cycling project as follows:

$$\text{Total Cost of Ownership (Annual)} = \frac{\text{Initial Capital Cost}}{\text{Service Life}} + \text{Annual Operating Cost}$$

The total cost of ownership (TCO) unit cost assumptions by facility type are summarized in Exhibit 15. The annual total cost of ownership for the 1-5 projects by facility type are presented in Exhibit 16.

Exhibit 15: Service Life, Annual Total Cost of Ownership for the First Five Year Projects by Facility Type

CYCLING FACILITY	IMPLEMENTATION STRATEGY	SERVICE LIFE (YEARS)	ANNUAL TCO (\$/KM)
Upgrades to Existing Facilities	Formalize existing edge lines	20	\$1,551
Upgrades to Existing Facilities	Add edge lines to existing wide lanes and formalize over time	20	\$7,103
Upgrades to Existing Facilities	Advisory Bike Lanes	20	\$7,103
Shared Roadways	Shared Roadways	20	\$1,551
Shared Roadways	Bicycle Boulevard	20	\$6,981
Bike Lanes	Stripe bike lanes on existing road	20	\$7,103
Bike Lanes	Retrofit bike lanes to existing road	20	\$8,205
Buffered Bike Lanes	Stripe buffered bike lanes on existing road	25	\$7,323
Buffered Bike Lanes	Retrofit buffered bike lanes to existing road	25	\$8,205
Protected Bike Lanes & Cycle Tracks	Retrofit protected bike lane to existing travel lane	25	\$23,025
Protected Bike Lanes & Cycle Tracks	Widen for raised cycle tracks or add cycle tracks into boulevard	40	\$55,598
Multi-use Trail	Remove existing sidewalk and construct boulevard multi-use trail	40	\$31,332
Multi-use Trail	Construct boulevard multi-use trail (concrete)	40	\$28,300
Multi-use Trail	Construct boulevard multi-use trail (asphalt)	20	\$39,325
Multi-use Trail	Construct greenway system trail	15	\$33,813

Exhibit 16: Total Cost of Ownership (Annual) for 1-5 Year Network by Facility Type

CYCLING FACILITY	TCO (ANNUAL)
Shared Roadways	\$102,000
Multi-use Paths (concrete)	\$1,217,000
Bike lanes	\$153,000
Buffered & protected bike lanes	\$574,000
Cycle tracks (asphalt)	\$776,000
Off-road trails (stone dust)	\$703,000
Total	\$3,525,000

3.4 Funding Sources

The primary source of funding for the 10-year Implementation Plan will be from development charges made available in the 2022 Development Charge (DC) Background Study. Project costs incurred to the City of Markham will be covered 65% by DCs and 35% by other sources. The DC Bylaw includes the updated sidewalk program at a cost of \$28.3 million and the 10-Year ATMP Implementation Plan. Additional costs to implement the ATMP recommendations will be considered in future DC Bylaw updates.

Part or all of the 35% of project funding may come from Federal, Provincial, and York Region funding programs. Many organizations and government bodies at varying levels provide financial support for active transportation programs and infrastructure improvements. These alternative funding sources can be pursued to supplement municipal funding in order to accelerate delivery of the Implementation Plan. Possible alternate funding sources including various grant programs to assist with operating expenses for network and programming improvements are identified in Exhibit 17.

Exhibit 17: Potential External Funding Sources for Active Transportation Implementation and Expansion

Organization / Fund	Geographic Eligibility	Active Transportation Requirements
York Region Pedestrian & Cycling Municipal Partnership Program	Municipalities within York Region	<ul style="list-style-type: none"> • Purpose of the Pedestrian and Cycling Municipal Partnerships Program is to encourage walking and cycling by accelerating the implementation of pedestrian and cycling infrastructure throughout York Region. • The Partnership Program will assist local municipalities and key

Organization / Fund	Geographic Eligibility	Active Transportation Requirements
		<p>stakeholder groups in expanding their network by funding up to 50% of eligible capital work.</p> <ul style="list-style-type: none"> The partnership program is funded in the amount of \$500,000 per year and will be based on approved submissions for a particular budget year.
Infrastructure Canada Active Transportation Fund	<ul style="list-style-type: none"> Canadian Municipal, local and regional Governments Indigenous communities and organizations Not-for-profit organizations 	<ul style="list-style-type: none"> The fund will provide \$400 million over five years in support of Canada's National Active Transportation Strategy The fund will support investments to build new and expanded active transportation networks, and support for programming and engagement activities.
Federation of Canadian Municipalities (FCM)	<p>Canadian Municipal Governments and their project partners including:</p> <ul style="list-style-type: none"> Private sector entities Indigenous communities Municipally-owned corporations A regional, provincial or territorial organization delivering municipal services Non-governmental organizations Not-for-profit organizations Research institutes 	<ul style="list-style-type: none"> The FCM funds pilot projects that reduce pollution by improving transportation networks or promoting people to switch to less polluting transportation options The program offers a combined loan and grant funding for capital projects Regular loans and grants: low-interest loan of up to \$5 million and a grant worth up to 15% of the loan; cover up to 80% of eligible costs High-ranking project loans and grants: low-interest loan of up to \$10 million and a grant worth up to 15% of the loan; cover up to 80% of eligible costs
The Atmospheric Fund (TAF)	<ul style="list-style-type: none"> Registered Charities Not-for-profit organizations Municipalities in the GTHA 	<ul style="list-style-type: none"> TAF grant program focuses on reducing carbon emissions in the building and transportation sector

Organization / Fund	Geographic Eligibility	Active Transportation Requirements
		<ul style="list-style-type: none"> • Funding is provided to projects at different stages; Standard applications are for fully-developed projects • Concept development applications are for early-stage ideas to help demonstrate feasibility; these grants tend to be smaller (\$10,000 - \$20,000) • The Grants and Programs Committee reviews each application and makes a funding recommendation