

MEMORANDUM

Re:	Main Street Unionville Commercial Core Streetscape Master Plan Study – Follow up items
Date:	March 3, 2022
Prepared by:	Alain Cachola, Senior Manager, Infrastructure and Capital Works, Ext. 2711 Regan Hutcheson, Manager, Heritage, Ext. 2080
From:	Frank Clarizio, Director, Engineering, Ext. 7507
To:	Mayor and Members of Council

RECOMMENDATION:

1) That the memo titled "Main Street Unionville Commercial Core Streetscape Master Plan Study (2021), dated March 3, 2022, be received.

PURPOSE:

This memorandum provides Development Services Committee with additional information on the Main Street Unionville Commercial Core Master Plan as presented to Development Services Committee meeting on February 22, 2022.

BACKGROUND:

At the February 22, 2022 Development Services Committee meeting, City staff presented the Main Street Unionville Commercial Core Street Master Plan, various enhanced streetscape treatment options and provided a recommendation on the treatment. Staff also made a recommendation for the approval of the budget for the proposed road reconstruction work. Development Services Committee endorsed Enhanced Streetscape Treatment Option #3A, being brick pavers used for sidewalks, boulevards and on the street under the Modified Concept #2.

Development Services Committee requested that staff provide more technical information on option #3A including:

- 1) Why the Queen Quay and Main Street Markham installations of brick pavers failed;
- 2) The maintenance of brick or stone pavers versus asphalt and how it effects the lifecycle; and
- 3) The rationale for having a concrete pad underneath the pavers.

DISCUSSION:

Option #3A Option

The Enhanced Streetscape Treatment Option #3A, as endorsed by Development Services Committee, incorporates the following elements and components:

- Right-of-way Alignment: Modified Concept #2
- Sidewalk Treatment: Concrete Brick Pavers
- Boulevard Treatment: Concrete Brick Pavers
- Road Surface: Concrete Brick Pavers
- Street Breaks: Concrete Brick Pavers
- Intersection: Concrete Brick Pavers

Installation of the proposed concrete brick pavers requires that special attention be given to the design and installation to ensure success, such as:

- Concrete base
- Sand base bedding
- Proper drainage
- Pattern Layout of pavers (Herring Bone vs Bond)
- Type of Pavers
- Joint Sand (specific Type)
- Compaction equipment

It will be important to meet with the manufacturer representatives of the selected concrete brick paver to ensure that the design of the streetscape pavers is correct and to ensure that the specifications for installations are properly specified in the tender requirements.

The artist rendition below, as illustrated in Figure 1, reflects the Streetscape Treatment Option #3A features. Note that the brick colours are preliminary only and will be subject to change based on the scheduled stakeholder consultation.





Operations and Maintenance (Concrete Brick Pavers)

The design consultant has reached out to other municipalities to gather information as to how the concrete brick paver installation within the road right-of-way and boulevards are being maintained.

City of London

The City of London has recently completed the revitalization of their downtown area with the improvement of a 4-block stretch of Dundas Street costing over \$16M. As part of the design process, there was an extensive design exercise involving all impacted City departments resulting in a "City Team" to ensure the long-term management of Dundas Street as it was a key City project. The City is looking at potential Life Cycle Capital Budget scenario to allow for annual contributions for future replacement costs. This is a work in progress and has not been fully developed yet. The City is considering, as one option, developing a reserve fund to look at higher than normal "special" replacement costs at the end of life of the asset.

The design utilized a concrete base across the entire right-of-way width. The warranty period has recently lapsed with no issues to date in regards to the maintenance of the pavers. Other notable design considerations included:

- Normal winter salting practices.
- Specialized street sweepers and snow clearing equipment to reduce "scraping" of brick finish and the joint sand.
- No specific operations and maintenance cost identified for the area, but they are looking to change that as noted above.
- Built with inclusion of AODA requirements built in.
- Brick oriented to maximize long-term durability and pavement strength.

• Important that the design considered areas of concern for settlement such as at maintenance holes, round pole bases, tree pit boarders and that good workmanship was monitored throughout the design period.

The City noted that in one instance there was a car accident involving a streetlight and the base was able to be easily removed for repairs.

The City is currently considering Dundas Street as a Special Tangible Capital Asset so that it will allow for special funding considerations moving forward.

City of North Bay

The City of North Bay is in the process of replacing their interlocking brick at the North Bay Downtown Improvement Area (Main Street), which was installed in the 1980's on a granular base (no concrete). See Attachment 'A' for a case study that was undertaken prepared by Interlocking Concrete Pavement Institute some 20 years after the original installation. It notes that there was little or no deformations or rutting in wheel paths and that about 4% of the pavement surveyed had depressions concentrated in an area that had been reinstated after utility repairs that were not replaced properly. In addition, with respect to use of deicing salts and the freeze-thaw effects there was little to no degradation of the concrete pavers themselves (less than 1%) as noted in the case study, even with the high snowfall amounts the City receives.

As the installation of brick pavers on Main Street has been a good news story with respect to lifecycle, the City of North Bay has advised our consultant that there were more recent interlocking brick paver installations on sidewalks, after 2000. These installations have encountered premature failures attributed to salt corrosion and some of these brick paver sidewalk installations are currently being planned to be replaced with concrete sidewalks. The poor performance of recent brick installations did impact the City's decision in not specifying brick installation in their current design for Main St.

Winter Maintenance Equipment and Salt Effectiveness on Pavers

The concrete brick paver supplier recommends that winter maintenance clearing equipment should be equipped with special scrapers and blades with shoes or high-density plastic blades to reduce the risk of damaging paver joints and the surface of the pavement. While scraping the surface without this protection will not compromise the structural integrity of the pavers, it may effect the aesthetics of the surface by leaving behind rust marks and further damage the finish. Markham staff have advised that the proposed installation of paver on this road will require the need for a specialized maintenance route and equipment/operator, which will increase winter maintenance costs for this area.

The effectiveness of the salt on melting snow is more effective on asphalt than concrete brick pavers, as the darker asphalt will have a greater heat absorption from the sun hence increasing snow melt. The concrete brick paver supplier has indicated that Rock Salt (Sodium Chloride) use on the concrete brick pavers is effective for temperatures as low as -7 °C. Whereas, the use of Rock Salt on an asphalt surface is typically effective to temperatures as low as -12 °C.

It is important to note that the use of the following de-icing chemicals should be avoided on concrete pavers as these chemicals will rapidly attack and disintegrate the concrete:

- Ammonium Nitrate; Ammonium Sulfate
- Magnesium Calcium; Magnesium Acetate (CMA)
- Potassium Chloride (KCl); Potassium Acetate (KA)

The use of common rock salt (sodium chloride) as a de-icer is a widespread practice, and many jurisdictions use it on their paver installations. However, the brine and salt residue left on the pavers may cause future issues if the brine is permitted to enter the porous surface, freeze and cause cracking. Salt, itself, is a corrosive substance that can damage pavers over time. Therefore, a recommended operation is to rinse off and sweep the paver surfaces as soon as the temperature allows, in order to remove the brine or excess salt.

The concrete brick paver supplier recommends the liberal application of de-icing salts (Sodium Chloride), as applying only a small amount of de-icing salt can initiate a number of freeze-thaw cycles that will require repeated applications. Applying a generous amount the first time will reduce labor costs by reducing the chance of needing another application; however, this is contrary to the City of Markham's Salt Management Plan.

It should be noted that Markham staff encountered a number of winter events in the past on Main Street Markham, as seen below in Figure 2, which required a number of repeated de-icing applications to meet required maintenance standards. The repeated applications increased winter maintenance costs related to material and labour resources.



Figure 2 – Main Street Markham Salt Effectiveness for Asphalt and Paver

The table below summarizes the estimated annualized incremental cost increase to maintain and repair the interlock pavement surface along Main Street Unionville.

Operations and Maintenance Activities	Capital Cost	Estimated Annual Cost
Rehabilitation and Repair (includes the replacement of damaged and degraded unit pavers as well as any settlements)		\$120,000
Special Snow Plow Blade with High-Density Cutting Edges	\$7,500 over 1yr Lifecycle	\$7,500
Increased Winter Road Operation (includes specialized equipment for dedicated route)	\$315,600 over 10yr Lifecycle	\$31,560
Increased Winter Sidewalk Operation (includes specialized equipment for dedicated route)	\$172,400 over 7yr Lifecycle	\$24,630
Equipment Operator for dedicated route		\$14,000
Specialized Street & Sidewalk Sweeper Brooms	\$26,000 over 5yr Lifecycle	\$5,200
	Total	\$202,890

The following responses are provided to address some of the additional information requested by Development Services Committee at the February 22, 2022 meeting:

1) Why the Queens Quay and Main Street Markham installation of brick pavers failed

Queens Quay (Toronto)

The Queen Quay project covered a large area and the failure was localized on the boulevard. The design utilized for this project incorporated a concrete base below the pavers within the public right of way. As the concrete pavers were installed within the entire boulevard up to the building face, Waterfront Toronto attempted to split costs with developers or private properties to install the concrete base on private property. However, at some locations the private property owners may not have agreed to the installation of a concrete base. Unfortunately, that may have exasperated the issue of bedding sand migration, which typically results in differential settlement, which is illustrated at this one location shown below in Figure 3.

Figure 3. – Queens Quay

Main Street Markham

Based on an investigative consultant report, the result of the failures on the Main Street Markham are a combination on a number of issues. The major contributor to the failure was the type of bedding layer used between the concrete brick paver and the concrete base. It was determined that:

- the bedding layer used was a soft aggregate and was not suitable for this type of application;
- the thickness of the concrete brick paver was 7cm (vs 8cm);
- laying pattern (used square brick at crossing which is not recommended);
- lack of edge restraint to hold the concrete brick pavers in place; and
- joint width (spacing) of pavers.

Figure 4. - Main Street Markham



2) The maintenance of brick or stone pavers versus asphalt and how it effects the lifecycle

Pavers are denser and as a result are more rigid (individual bricks) and a more durable material than asphalt. Pavers are anticipated to last beyond the lifecycle of asphalt. For example, the North Bay project which was constructed in 1980's, is currently just being reconstructed now. There is no intermediate rehabilitation required for the pavers as there would be with asphalt. On the other hand, the top course of asphalt is typically replaced within a 15-20 year period through a "shave and pave" operation, which gives the asphalt added life until such time as the entire asphalt surface and base will need to be completely replaced. Asphalt is flexible pavement structure and is subject to deformation under extreme heat and loading. This dynamic stress on asphalt is one of the sources for breakdown of its structure. For both asphalt and concrete pavers, it is paramount that the granular and/or concrete base is designed to support the intended loading of the street. Additionally, the workmanship of the installation will be a big determining factor on the longevity of the installations. It is important to note that the successful use of concrete pavers is highly dependent on ensuring that utility cut repairs are restored properly with the reinstatement of the paver concrete base.

3) The reasons for having a concrete pad underneath the pavers.

The use of a concrete base is usually dependent on the loading that the road is designed to support and the quality of the subbase underneath the concrete pavers. The concrete base allows for the loads that are imparted to the pavers to be spread over a greater area of the supporting granular material reducing the likelihood of deformation of the area being loaded. Figure 5. below, illustrates a typical paver design using a concrete base.

Figure 5- Unit Pavers on a Concrete Base



ATTACHMENT: Attachment "A": North Bay Case Study