Date  August 13, 2019  Report No. 2019-433

To  Chair and Members
    Committee of the Whole – Operations and Administration

From  E. (Beth) Goodger
       General Manager Public Works Commission

1.0  Type of Report

    Consent Item  [ ]
    Item For Consideration  [X]

2.0  Topic  Options for Road Painting Methods [Financial Implications - $100,000]

3.0  Recommendation

    A. THAT Report 2019-433, entitled “Options for Road Painting Methods”, BE RECEIVED; and

    B. THAT staff BE DIRECTED to develop an asset tracking database of pavement markings and type throughout the city; and

    C. THAT staff BE DIRECTED to develop a long range maintenance budget program to ensure continuity of reflectivity based on original design.

4.0  Purpose and Overview

    To provide Council with a report outlining options regarding road painting methods, materials and any other methods by which a lane can be delineated as requested by Council at its May 28, 2019 meeting.
5.0 Background

At the May 14, 2019 meeting of Committee of the Whole – Operations & Administration Committee, staff was requested to report back on options to improve the visibility of pavement markings, especially at night. Visibility of pavement markings was identified as a concern in the public feedback on North Park Street – Road Diet (Report No. 2019-259) and was noted as being an issue for other streets in Brantford. The following resolution was passed by Council, on May 28, 2019 as Item 5(b) of Committee of the Whole – Operations & Administration Report No. 2019-05-14:

B. THAT staff BE DIRECTED to provide a report by August 31st outlining options regarding road painting methods, materials and any other methods by which the lane can be delineated.

6.0 Corporate Policy Context

The specifications for pavement markings are set out in the City of Brantford’s Design and Construction Municipal Linear Infrastructure Manual that was approved by Council in 2017 (Report PW2017-053). The manual is reviewed on an annual basis and updated to reflect evolving changes in technical requirements and standards.

7.0 Input From Other Sources

All pavement marking material and techniques have different pros and cons for location and use. Staff from Operational Services met with engineers from the Ministry of Transportation, Materials Engineering & Research Office to discuss current pavement marking trends within the province. Below are some of the highlights from the meeting:

- Improper installation is a key issue for early pavement marking failures
  - Not enough material used
  - Glass bead rate is too low
- Proper field inspection is critical
- Provincial specification for pavement markings is in the process of being updated and expected to be completed by end of 2019.
- Recessed markings (no matter type of material used) performs the best
- Recessed cutting costs approximately $2.50/m.
- States and Provinces adjacent to Ontario use this method and report positive results
- Equipment required for this option is currently not available in Ontario
- MTO is confident that once method is included in specifications, equipment availability will follow

- MTO is close to implementing an “interim marking” guideline for construction contracts
  - New asphalt is not ideal to apply markings as it has release agents for rollers and other oils
  - Markings should not be applied for 2 to 4 weeks after new asphalt laid
  - Address difficulties in timing of construction for contractors
  - Interim marking will be in new Ontario Provincial Standards Specification

### 8.0 Analysis

Pavement markings are used to convey messages to roadway users. They indicate which part of the road to use, provide information on conditions ahead, and indicate where passing is allowed. Pavement markings help to channel and guide traffic flow in an orderly, safe stream. They are often used in conjunction with signs and signals, where particular attention is demanded of motorists.

Safety bollards are used to delineate car-free zones, prevent spillover parking, and reduce traffic speed by narrowing lanes. Bollards enhance delineation, however are problematic for garbage pickup and winter maintenance (requiring removal during winter months or specialized snow clearing equipment).

The most common method of applying pavement markings is by painting as it is typically the least expensive. Night visibility is achieved with the use of glass beads embedded in the paint to produce retro-reflective surface which causes the markings to appear luminous under night conditions. Existing materials used in Canada are:
- Water based paint (Brantford)
  - Paint is an inexpensive mixture of a binder (base material) pigment (for colour), retroreflective glass beads and a carrier.
  - The average drying time of a paint system ranges from 30 seconds to 10 minutes.
  - Most paints have a service life ranging from six to twelve months. The length of service life depends on many factors including the type and condition of the pavement surface, the climate, daily traffic volumes and percentage of heavy trucks.

- Durable
  - Thermoplastic
    - Thermoplastic materials are a mixture of plastic, pigment, binder and retroreflective glass beads.
    - The average drying time is two to ten minutes
    - Thermoplastic materials require high temperature for application, which creates a demand for high level of quality control during installation and maintenance
    - A typical service life ranges from two years to the life of the asphalt. The length of service life depends on many factors including the type and condition of the pavement surface, the climate, daily traffic volumes and percentage of heavy trucks.
  - Methyl Methacrylate
    - Methyl Methacrylate is a two-component cold curing material.
    - During installation the material is mixed in a static mixer generating an exothermic reaction. As the material hardens it then bonds with the pavement.
    - A typical service life ranges from two years to ten years. The length of service life depends on many factors including
the type and condition of the pavement surface, the climate, daily traffic volumes and percentage of heavy trucks.

- Preformed tape
  - The preformed tape system contains resin binder and pigment with optional glass beads and adhesive.
  - Tapes are suitable for locations where durability is a prime concern and where only a very small quantity of marking is required.
  - Tapes have a high initial cost and should only be considered in limited locations.
  - A typical service life ranges from two years to four years. The length of service life depends on many factors including the type and condition of the pavement surface, the climate, daily traffic volumes and percentage of heavy trucks.

- Recessed marking
  - Recessed Pavement Markings are primarily used to protect markings from snowplow damage.
  - By grooving the road surface and recessing the marking in the groove, plows cannot scrape the lines off the surface.
  - Marking could be paint or durable but is applied to a groove in the surface

- Glass beads
  - All pavement markings can be reflective with the use of glass beads
  - Glass beads have to be applied at specific rates and embedded properly in the pavement marking material to achieve a reflective marking
  - They are applied with a hand-held dispenser, line stripper or by hand
  - The beads give the markings its reflective properties at night
All of these materials and techniques have different pros and cons for location and use. Several factors must be considered when selecting material suitable for pavement markings. These factors are:

- Traffic volumes and traffic composition
- Type of roadway surface
- Regional climate and weather conditions
- Functional classification of roadway
- Life-span of roadway
- Material durability/retroreflectivity
- Cost

All of the above factors will either directly or indirectly affect the markings visibility and durability as an application technique.

**Pavement Marking Maintenance (Operational Services)**

Traffic Operations is required, in accordance with Provincial legislation, to maintain the pavement markings on the City's 553 kilometres of roadways. This service consists of the retracing of centre lines, lane lines, turn arrows, stop bars and crosswalks each year.

Pavement markings, because they are higher than the surrounding pavement surface, are subject to rapid wear caused by traffic and snowplows. As they wear they lose visibility their ability to guide drivers particularly in wet weather. As with any road material, markings must be maintained and updated periodically to offer the safety advantages to motorists.

Traditionally the City of Brantford applies water-based paint once a year at a cost of approximately $0.23/m/line and contract value of $205,000. The workmanship and final product was not to an appropriate level in 2018 from our Contractor. To address these issues Operational Services has recently issued an updated pavement marking retracing contract with updated specifications for 2019.

Key changes for 2019 are as follows:

- Enhanced quality of oversight and inspection of marking application and material
  - in addition to typical line thickness and bead rate we have added retro-reflectivity, visibility, colour and appearance as outcome targets
  - This will allow for both qualitative and quantitative oversight
• Adhering to new Ontario Provincial Specification
  o Now requiring the beads to be embedded
  o This technique will assist in improving the visibility of markings throughout the life of the marking.
• Contractor to provide a work schedule at start up and provide notification of any changes to scheduling
• Contractor to ensure road conditions are appropriate – swept and clear of debris including oils
• Environmental compliance expectations
• Enhanced ‘vendor performance’ documentation, including hold back and bonding applied to contract.

With these enhancements line markings increased by $0.12/m/line to $0.35/m/line and the total cost for this year’s contract increased by $100,000 (not budgeted). As a result the 2019 Operating Budget for Contracted Services will go over budget and will be reflected in the quarterly variance reporting. It is evident the updated changes to the 2019 contract have been understood by this year’s contractor as the price increase reflects.

The end goal is to apply better markings in a timely manner that will be visible at night, in rain and throughout the winter so that roadways are safer and easier to navigate.

**Replacement & New Development (Engineering Services)**

Engineering Services adheres to the latest version(s) of the Ontario Provincial Specification, Ontario Traffic Manual, Book 11 referred to in the City of Brantford’s Design and Construction Municipal Linear Infrastructure Manual. The City standards require Durable markings be applied for all symbols, stop bars and crosswalks, or as otherwise directed by the City, to improve visibility and longevity at critical locations.

General contractors through development or city capital projects procure the services of a sub-contractor that is specialized to perform and authorize the work. Specialized equipment is required to meet the standards that identify, but not limited to, the type of line marking(s), water based paints, and the reflectivity for the road class and durable marking materials for road symbols.

Typically, when the City constructs a road, only, a base course of asphalt is paved to allow for any deficiencies, change of line markings and service cuts that may require repair prior to the warranty period expire date. A short term line
marking is applied during this time until the next season when a top lift of asphalt is paved and permanent line markings are completed.

The short term and permanent line markings and symbols are inspected during the application process and a year after, in accordance with the line marking drawings and standards in respect to accuracy of the layout, traffic control, clean road surface, visibility, paint and reflectivity beads application.

The changes made to the 2019 Pavement Marking Retracing contract are quick wins. To have more visible markings on our roadways during all seasons, the following would need to be completed:

- Evaluate the material used (Paint vs Durable), number of annual applications (i.e. increase retrace to twice per year) and improve the quality and detail of inspections.

- Implement a decision matrix as part of the design Standards to select pavement marking material based on:
  - Traffic volumes
  - Traffic type (cyclists, trucks)
  - Classification of roadway
  - Life-span of the roadway
  - Design of roadway
  - Material of roadway
  - Pavement remaining service life
  - Benefit cost

- Develop an asset tracking database of pavement markings
  - To create an inventory of existing markings
  - To provide mapping with attributes
  - To create a cost estimate for maintenance
To track new markings (Capital and Development) and how that impacts budget

- To track a percentage added each year
- To help with creating future budgets

- Develop a long range maintenance budget program to ensure marking material first applied is continually used.
- Yearly review and update to the Design and Construction Municipal Linear Infrastructure Manual to reflect lessons learned and best practices
- Enhanced tools and inspection processes to better monitor the products and application requirements for line markings.

9.0 Financial Implications

With the enhancements to the 2019 Pavement Marking Retracing contract, line markings increased by $0.12/m/line to $0.35/m/line and the total cost for this year’s contract increased by approximately $100,000 (not budgeted). As a result the 2019 Operating Budget for Contracted Services will go over budget to reflect the pricing adjustments identified in the 2019 Pavement Marking Contract. This change will be reflected in the quarterly variance reporting.

An economic analysis using life-cycle benefits and costs should be undertaken to determine which material type is the most cost effective option for the given set of roadway, geometrics, operational and capital investment conditions. Some factors to consider are:

- Initial capital cost of the investment including material cost, cost of installation etc.
- Maintenance costs and other costs that may be incurred during life-cycle
- The life span of the roadway and material
- Regional cost factors
- Safety impact and liability

As with any product, pricing varies greatly among types of markings. The materials, application method used and inspection levels affect the overall cost.
10.0 Conclusion

Staffing constraints limit the time that staff has available for program improvements. The Public Works Commission put forward unmet needs as part of the 2019 Estimates Process for additional resources to support traffic operations, which if in place, would enable faster progress. The positions were as follows:

- Supervisor Right of Way Control within the Transportation Services Division of the Engineering Services Department
- Operational Services Technologist in the Traffic and Parking Operations Division of the Operational Services Department
- Traffic Sign Maintenance Backlog (2 Traffic Technicians) in the Traffic and Parking Operations Division of the Operational Services Department

Additional inspection resources are required and will be put forward as an unmet need for the 2020 Estimates Process. Approvals for invoices and quality control will be confirmed by third party inspections in conjunction with Operational Services.

In the meantime, Public Works staff will continue to make improvements on pavement markings as they are able to within existing staffing levels and budgets.

Nello Violin
Director, Operational Services

E. (Beth) Goodger
General Manager, Public Works Commission

In adopting this report, is a by-law or agreement required? If so, it should be referenced in the recommendation section.

By-law required [ ] yes [X] no
Agreement(s) or other documents to be signed by Mayor and/or City Clerk [ ] yes [X] no
Is the necessary by-law or agreement being sent concurrently to Council? [ ] yes [X] no