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Report 2024-154

Report Title: Green Roads

Committee Name: Public Works

Committee Meeting Date: December 2, 2024

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Council Meeting Date: December 18, 2024

Strategic Plan Priorities: Innovate for Service Excellence
 Ignite Economic Opportunity
 Foster a Thriving Community
 Propel Sustainable Growth
 Champion a Vibrant Future

Information Report

That the Public Works Committee receive Report 2024-154 'Green Roads' for information; and

Further That the Committee recommend that County Council receive this report for information."

Purpose

The purpose of this report is to provide information regarding an innovative road base treatment method using bio-resin (trade name Green Roads), and the company Bio Diffusion Technologies that provides the product.

Background

Bio Diffusion Technologies Inc. is a company that manufactures and supplies bio-based binders and plant-based resins. Bio Diffusion Technologies was incorporated in December 2021 and built its first commercial scale plant in Cambridge, Ontario in August 2022.

While Bio Diffusion Technologies is not formally accredited by any specific body, it is a member in good standing with Ontario Good Roads Association. As for the accreditation process, the company believes that the standards outlined in the Ontario Provincial Standard Specifications may be insufficient for measuring the effectiveness of innovative products. Therefore, accreditation will be based on results yielded by trials in operational environments which are on-going.

The product itself dates back many years with testing and trial applications at testing facilities, or use in heavy industrial settings, taking place before the current commercial push to use the product on public roads. Bio Diffusion Technologies is currently working toward getting the product on the Ministry of Transportation's, Designated Sources of Materials list.

As a base stabilization agent, the use of the resin is meant to enhance the performance of other materials and contribute to more resilient and longer lasting roads. The naturally engineered binder additive has been formulated with the intent to replace the traditional binders (produced from petroleum refining residue). The bio-resin is incorporated into existing processes and intended to reduce the life cycle costs as well as the environmental benefits.

The bio-resin product can add strength to the road base and binds aggregates so that the impact of deflection is reduced. Bio Diffusion technologies is currently refining application rates based on different aggregate make-ups and each project is evaluated separately until the ideal application rate has been determined.

This product does not eliminate the need for asphalt or concrete products but rather is intended to allow these products to be better utilized on heavy-traffic pavements. The bio-resin is meant to be applied in liquid form to the loose surface gravel base before paving, then the surface is compacted and will cure in approximately one-hour to form a hard surface in warm weather. The natural hard surface solution is intended to support the economy through the repurposing of unused recycled asphalt products, previously used or unusable aggregate and concrete surfaces.

To date the Green Roads product has been applied to public roads in Ontario through trial sections on several low-volume roads with historically weak bases and particularly in areas with heavy vehicle traffic. Trial sections that have been used for testing included various construction methods such as varying application methods and varying depths of application from 75mm to 150mm. The application methods included two options. Option one was to pulverize the existing base, followed by the application of the Green Roads product and a curing period. Option two included pulverizing the existing base, followed by the application of the Green Roads product, pulverizing a second time, compaction and a curing period. Depending on the results of geotechnical investigations a layer of granular material may be added prior to the

application of the bio-resin while incorporating of up to 100% Recycled Asphalt Product to the base.

The only performance data collected during the past two years is from the first two trial projects completed in Ontario during the summer of 2023. Testing results from these two projects has confirmed that the road bases built using the bio-resin product continues to increase in strength.

Analysis completed to date is based on the logic that strengthening a road base should result in a longer life cycle for the road surface. Since road segments differ from one another the product is not meant to be a solution for everything and will have specific applications where performance is more effective than others.

Consultations

In Ontario the Township of Centre Wellington was reported as the first municipality to use the bio-resin product and included a pilot project with a length of 300 metres that was completed in the summer of 2023. The Township was able to secure approximately \$50,000 for the pilot project through a Natural Products Canada grant to expand the original construction budget.

Bio Diffusion Technologies have noted that the Green Roads product has also been used by three other Municipalities in Ontario and include the City of Guelph, the Township of Puslinch, and the Township of North Dundas.

The Township of Centre Wellington collaborated with Bio Diffusion Technologies Inc. to trial the road base treatment on a road segment where the existing asphalt surface was in poor condition with the expectation to extend the service life of the asphalt surface. When applied, bio-resin is expected provide a stronger road base at a substantially lower cost compared to traditional road re-construction methods that include the removal and replacement of granular base materials.

The Township road that was used for the pilot project has an average daily traffic count of approximately 1,000 vehicles per day with significant truck traffic. The road segment was selected as it showed patterns of pavement failure that suggested the road base was structurally deficient for its intended traffic. The deficiencies included alligator cracking, wheel-path rutting, edge cracking and distortions. That failure of the road base was believed to be reducing the expected service life of the asphalt-paved surface and made the road an ideal candidate for the application of Bio Diffusion Technologies bio-resin.

It is expected that the application of the bio-resin product would result in higher construction costs between \$50,000 and \$100,000 per kilometre for a road width of 7.0 metres and depends on depth of base stabilization required. To determine the depth of base stabilization additional geotechnical investigation and reporting may be required which would increase costs as well. That translates to between a 15% and 25% increase over the typical construction costs. It should also be noted that given the average width of a County Road that may be considered for the use of bio-resin is approximately 10 metres could also increase cost per kilometre.

In 2024, the staff at the Township of Centre Wellington organized a larger scale application of the product by extending the 2023 pilot project length by an additional 2 kilometres. Although testing results from the 2024 extension are limited, the results from the 2023 section after one year of service have shown a reduction in deflection.

Legislative Authority / Risk Considerations

For the Township of Centre Wellington project, Bio Diffusion Technologies Inc. was said to be excluded from any liability for any damages or loss of whatever kind, direct or indirect, caused by and/or arising from work done by Bio Diffusion Technologies using the bio-resin, and the instructions for use, or application of the bio-resin, which includes the performance of the bio-resin on roads or any other use where the bio-resin was applied.

Discussion / Options

The trial segment completed by the Township of Wellington was reportedly subjected to a number of deflection tests to assess the pre and post application strength of the road. Testing reports suggested that the segment treated with bio-resin was approximately 20% stronger than the segment not treated with bio-resin. This is expected to translate to an increase in the expected service life of the asphalt pavement surface by approximately 5 years. Traditionally the expected service life for an asphalt surface is 20 years.

With the expected longer life cycle of the asphalt surface when using the bio-resin product there is the potential to reduce maintenance costs along with sustainability benefits. The extension of the service life of the road depends on factors such as pavement strength, heavy vehicle type and frequency, as well as environmental conditions and would have an impact on asset management.

To put that into perspective, the report from the Township of Centre Wellington stated that the potential lifecycle cost savings associated with the expected longer service life of the pavement may translate to an estimated \$25,000 cost benefit per kilometre of roadway. This is despite the higher upfront capital cost associated with applying the bio-resin. It is still unconfirmed exactly how the amount of \$25,000 in savings was determined by the Township of Centre Wellington.

The report from the Township of Centre Wellington also stated that the segment of road selected had an average daily traffic count of approximately 1,000 vehicles per day. Some comparable County Roads with a daily traffic count around 1,000 vehicles per day would be County Roads 21, 24, 26, 29 and 65. It is believed that there is not a daily traffic count limit for use of the product, however the product should be used strategically to obtain the most beneficial results.

According to the Bio Diffusion Technologies' website, their product is manufactured from 100 percent naturally occurring bio-resins that create a hard, hydrophobic surface for roads and other surfaces when combined with recycled asphalt, aggregate or recycled concrete. Bio Diffusion Technologies was able to provide a report that was prepared by Stantec Consulting that states the bio-resin is made from entirely biogenic carbon materials.

The procurement of the product would need to be a single source award to Bio Diffusion Technologies Inc. to apply bio-resin since the technology used by Bio Diffusion Technologies is proprietary and cannot be provided by another vendor.

The works completed by Bio Diffusion Technologies would need to be coordinated with the Contractor that is awarded the construction contract for asphalt paving. The coordination and construction sequencing to allow for the use of the product could result in additional costs and time delays as compared to the conventional construction sequencing.

Financial Impact

The application of the bio-resin would result in higher upfront capital costs which have not been factored into the County's current approved budget. Currently the impact associated with the cost to complete the supply and application of road base stabilization bio-resin is an estimated additional cost of \$50,000 to \$100,000 per kilometre, or between a 15% to 25% increase over the typical construction costs. However, that exact cost depends on the depth of base stabilization required, the width of the road completed, coordination or delay costs and does not include any geotechnical investigations required.

The lifecycle cost savings associated with the estimated five-year increase in the service life of the pavement surface after the use of bio-resin may translate to an estimated \$25,000 savings per kilometre of roadway. Although it is still unconfirmed exactly how the amount of \$25,000 in savings was determined by the Township of Centre Wellington. Economic benefits will vary depending on the exact increase in pavement life.

Member Municipality Impacts

N/A

Conclusion / Outcomes

Due to the very small sample size of trial locations and the limited reported results, staff recommend continuing to monitor the performance of the trial sections for several years prior to implementing the use of bio-resin on County roads. Staff also recommend ongoing communication with participating municipalities using bio-resin to discuss the results and/ or impacts to the road surface. It would also be beneficial to confirm the life cycle savings that would be realized by using the bio-resin. This will allow staff to be able to make an informed decision, with results to substantiate the decision, regarding the use of bio-resin on County Roads in the future when reporting to the Public Works Committee.

Attachments

N/A