Administrative Report

Infrastructure Services

To:	**Warden McNamara and Members of Essex County Council**
From:	**Peter Bziuk, P.Eng., Manager, Design and Construction**
	Jerry Behl, P.Eng., Manager, Transportation Planning and Development
Date:	**Wednesday, December 01, 2021**
Subject:	**2022 Infrastructure Rehabilitation Program**
Report #:	**2021-1201-ISD-R024-PB-JB**

Purpose

The purpose of this report is to provide to County Council information and recommendations pertaining to the development of the 2022 Rehabilitation Program and approval of early release projects.

Background

The County Construction Program (Program), consisting of the Capacity Expansion, Rehabilitation, Municipal Drainage, Planning/Engineering, CWATS as well as the Administration programs, provides for major improvements to the roads, bridges, railway crossings, active transportation and drainage infrastructure that make up the Essex County Highway Network. The Program, subject to approval of the 2022 budget, consists of sub programs that are undertaken on an annual basis. The sub-programs include:

- Roadway Expansion
- Rehabilitation Program
- Traffic Operations
- Municipal Drainage

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- Planning / Design / Engineering
- CWATS

Continuing in 2022, staff is evaluating various strategies to optimize the use of capital funding for these road sub-programs while considering complexity of projects, opportunities in delivery strategy and coordination of work with the local municipalities.

A brief overview of the select subprograms is provided, however, the focus of this report is to present the Rehabilitation Program and the request to advance approval for early release for some of the projects.

Roadway Expansion Program

This program includes a series of Roadway Expansion projects supporting the network capacity improvements identified in the Essex Windsor Regional Transportation Master Plan and include the undertaking of Environmental Assessments, Engineering Studies, Preliminary and Detailed Design assignments, utility works and property acquisition. Construction projects related to highway capacity expansion, rehabilitation, Municipal drains, and County Connecting Links and intersection improvements are also supported through this program.

CWATS Program

The Countywide Active Transportation System Master Plan is in the process of completing its first full update since its adoption in 2012. The review and update consider the recommendations of the original study, implementations to date and changes to the active transportation environment, as well as pertinent legislative changes. The CWATS Program is developed with local partners to construct and maintain active transportation facilities across the County.

The program also supports numerous initiatives to promote and encourage active transportation, as well as a sub program for the paving of shoulders on County Roads. The 2022 CWATS Core Program will be brought forward for County Council's consideration in a separate report.

Infrastructure Services continues to bring forward specific details related to the annual rehabilitation program prior to the annual budget presentation as the department continues the delivery of its **early release program**.

Discussion

Rehabilitation Program

The Rehabilitation Program focuses on maintaining and improving the condition of all the assets on the County Road Network including:

- Road Pavements
- Drainage Systems
- Bridge Structures
- Culvert Structures
- Intersections & Guiderails

2021 Infrastructure Rehabilitation Program Highlights

The current construction year has been busy and challenging through the pandemic. It was necessary to implement measures to protect all workers by keeping jobsites clean, social distancing and installation of hand washing stations to support hand washing and disinfection on a regular basis.

In 2021, the department delivered 100% of the rehabilitation projects. This includes the rehabilitation of 50km of roads, the rehabilitation of 2 bridges and replacement of 4 culverts. Multiple preservation projects were also completed including emergency culvert replacements on various roads.

County Road System Needs 2022

Programming and packaging of projects must consider the following needs and considerations:

- Prioritized pavement preservation needs;
- Other roadway needs including other roadway components (e.g., culverts, bridges);
- Operational improvements (e.g., widening at an intersection and system expansion), and safety improvements.
- System operation including staging projects to minimize inconvenience to the public and advancing projects because of new development; and/or

- Related projects, such as work on underground utilities, or alignment with municipal works is coordinated to minimize disruption to the public

The Infrastructure Services Department annually evaluates pavement condition based on surface condition, ride quality, friction, rutting, base condition and drainage. The Department uses a three-tier approach of reconstruction, rehabilitation and preventative maintenance to address the worst highways through reconstruction, improve poor highways by rehabilitation and extend the life of good pavement through preventative maintenance. Also incorporated is an asset management philosophy by developing programs that prioritize projects based on factors such as remaining service life, traffic volumes, truck volumes, cost/benefit, ride quality, maintenance savings and condition of bridge/culverts in a corridor.

In addition to the factors described above, consideration is also given to: years since last rehabilitation, history of maintenance and preservation works completed and field experience with the observed rate of deterioration.

Based on the information collected and analyzed, each road section is assigned a rating indicating an approximate time period in which reconstruction/rehabilitation should be undertaken. The rating is not representative of preservation timings. The classification of 1 to 3 years is further reviewed to identify road sections that are comparably in the worst condition.

2022 Rehabilitation Program Development

The Annual Program, as well as the 5 Year Rehabilitation Program, supports the principles and objectives established in the Corporation's Asset Management Plan. The 2022 Rehabilitation program is valued at $11,541,200 and is supported by the following documents:

- Infrastructure Services 2022 Program Presentation (Appendix 1.0)
- County Road Map (Appendix 2.0)
- Bridge Location Map (Appendix 3.0)
- Culvert (Span over 3m) Location Map (Appendix 4.0)
- Pavement Condition Rating Map (Appendix 5.0)
- Proposed 2022 Rehabilitation Program Project Listing (Appendix 6.0)
- 2022 Rehabilitation Project Location Map (Appendix 7.0)
- 5-year Rehabilitation Project Listing (Appendix 8.0)

- 5-year Rehabilitation Program Map (Appendix 9.0)
- 2022 Paved Shoulder Candidate Project Map (Appendix 10.0)

Bridges

The Bridge inventory currently includes 84 structures ranging in age from new to 88 years with an average age of 52 years and full replacement value of all structures estimated at $160,000,000.

Under the Public Transportation and Highway Improvement Act, 1990 and Ontario Regulation 104/97 and Ontario Regulation 472/10 Standards for Bridges, municipalities are required to inspect bridges every two years in accordance with the OSIM document procedure. From the inspections completed in 2020, a maintenance workplan was developed for the 1-5 year timeframe. The information noted for overall structure conditions was analyzed and updated for a majority "condition-based" management program, with minor consideration to "age-based" management. A general asset management best practice is to maintain good assets in good condition. In such cases, the focus of these assets should be preventative maintenance activity and rehabilitation efforts. Ultimately, this will extend the useful life of that asset, reduce long term total life-cycle costs, and continue to delay costly full replacement activities.

Bridge projects are typically undertaken as multiyear projects owing to the length of time required to complete the design/approval process. The engineering work and approvals are done in one year and construction typically follows the next.

Culverts

The culvert inventory includes 113 culverts with a span greater than 3m. These structures range in age from new to 88 years with an average age of 46 years and full replacement value of $90,000,000.

A similar process is used for culvert inspections with completion in alternate years. The culvert inspections were completed in 2019. Culvert projects are also typically undertaken as multiyear projects owing to the length of time required to complete the design/approval process. The engineering work and approvals are done in one year and construction typically follows the next.

The costs associated with the smaller culverts are accounted for in two different methods. When considering a multiyear corridor improvement project, the costs to rehabilitate or replace several culverts are identified as a stand-alone project. This allows for the work to be undertaken in the year before the road project is undertaken.

In other circumstances where only one culvert or several small culverts require rehabilitation/replacement, these costs are built into the overall costs for the road project. Large culvert rehabilitation /replacements may also be considered as candidates for a stand-alone project.

In 2010, a new program to address the needs within the medium size culvert inventory was introduced and is continued for 2022 as it has proven to be very successful.

Roads

The County of Essex maintains a network of approximately 1500 km of road. The pavement infrastructure has been constructed, maintained and enhanced over many years.

The most cost-effective way to maintain the road system is to provide timely preventative treatments to the pavements. The benefits of timely and appropriate application of these options are realized in the form of lower costs, longer serviceability and less disruption to the travelling public.

Costs increase significantly if roads are allowed to deteriorate too far, resulting in full reconstruction costs. Consequently, pavements can deteriorate faster as they can be disturbed at any time during the year and sometimes different utilities or local municipalities may need access to their infrastructure on a shorter frequency cycle resulting in pavements that have been cut into and repaired many times.

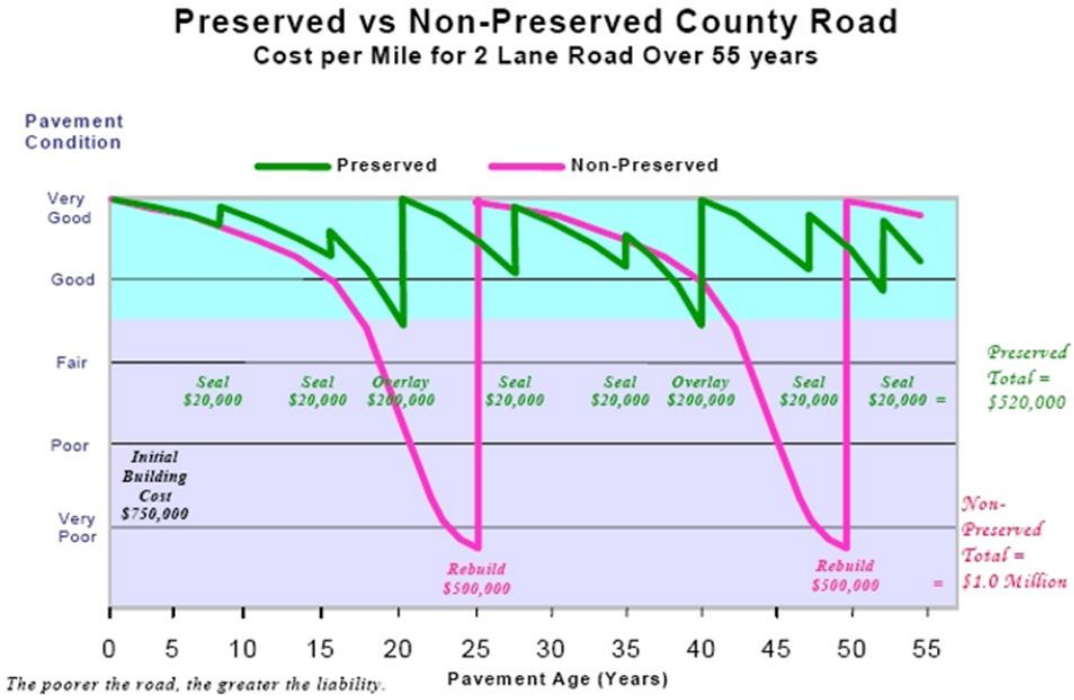
Periodic overlays eliminate the need for major repairs or full replacement of a badly deteriorated road. Many more kilometers of road can be maintained, with the same budget, by applying lower cost preventative treatments than can be achieved by performing major repairs.

Pavement evaluations are conducted to determine functional and structural conditions of a road section for the purposes of either routine monitoring or planned corrective action. Pavement surveys are completed to evaluate the Pavement Condition Index (PCI). After establishing the PCI, the road is classified as Very Good, Good, Fair, or Poor. Evaluation is based on physical parameters such as riding quality of the surface and the extent and severity of distress. The "poor to fair" road sections are brought forward as potential candidate projects for the Rehabilitation Program utilizing various technologies. Further review of the candidate projects is undertaken to evaluate potential conflicts with other projects within the program or with other partner projects.

Figure 1: Pavement Condition

The sample chart below represents the costs to maintain a road over a life span of 55 years through a Preserved or Non-Preserved maintenance strategy. The chart shows a typical method that demonstrates with the timely application of preservation works the full life cycle costing can be reduced from $1.0 million to $520,000 over its 55-year life cycle for each mile of 2-lane road. Such procedures are reviewed annually for each road segment in the five (5) year plan to review and evaluate the differences between competing pavement design alternatives and subsequent rehabilitation strategies.

Figure 2 – Life Cycle of Pavement Condition



Rehabilitation strategies are designed to help extend the life of an existing pavement. At the project level, resurfacing vs. reconstruction options should be selected based on the current condition and service life of the pavement, pavement type, road classification and traffic. A proper geotechnical investigation and/or non-destructive testing, along with a life cycle cost analysis as part of a pavement design report is required to determine the best strategy to maintain the pavement in a good state of repair. Recognizing that pavement damage is largely a function of traffic loading, higher volume roads (Class 1 and 2) are considered higher priority.

Asset Management Plan

The Asset Management Plan and its projected expenditure requirements is updated on an annual basis to address changes resulting from updated asset condition ratings, scope of work adjustments and market forces. The Asset Management Plan supports the County's corporate goals that rely upon adequate infrastructure and a defined level of service that the County is committed to providing. The objectives of the process are (a) to establish the amount of money available or needed and (b) to decide on the best way to invest the money in the pavement infrastructure. The quality of the planning and budgeting process has a major impact on the condition of the pavement network and on the life-cycle cost of maintaining it.

O. Reg. 588/17: Asset Management Planning for Municipal Infrastructure came into effect on January 1, 2018 and requires municipalities to have a Council approved Asset Management Plan for core infrastructure assets by July 1, 2021. Development of the updated Asset Management Strategy to drive sustainable long-term investment in 'State of Good Repair' (SOGR) projects and reduce the backlog is underway.

Pavement Performance Prediction

Performance prediction is a critical requirement for the identification of future pavement preservation needs. There are various pavement preservation treatments that are utilized on the County Road network.

Pavement type selection balances issues of both short and long-term performance while considering initial and long-term costs. A common method includes cold-in-place recycling (CIR) as a rehabilitation technique where an existing asphalt layer with distresses is milled, screened, processed and mixed with an asphalt recycling agent and compacted with a paver. The County continues to consider sustainability principles when evaluating rehabilitation treatments.

A significant percentage of a road maintenance program budget should be spent on preservation of fair and good pavements, rather than full rehabilitation or reconstruction. The transition will be undertaken incrementally to improve the overall rating of the network. As the overall condition of the network is improved, there will be a planned transition to a higher percentage of the program being dedicated to preservation activities intended to extend the life cycle of the pavements, bridges and culverts.

Level of Service

The intent of the Rehabilitation Program is to provide a safe and reliable road network while providing for value added and cost-effective maintenance of the County's road network. Specific objectives include:

- To maintain 100% of bridges in the good to fair condition range
- To maintain 80% of culverts in the good to fair condition range
- To maintain 100% Class 1 /2 roads in the good to very good condition

The assets are continually inspected and provide defined condition ratings which are used to establish network priorities. *Minimum safety-related levels of service* are typically defined in terms of individual pavement defects, such as potholes, cracking, and wheel track rutting and are captured in the overall pavement preservation project.

Trigger values are usually associated with specific pavement preservation treatments (such as sealing cracks in asphalt concrete pavement or sealing joints in concrete pavement) and are related to the need to apply a preservation treatment at the right time to be effective, or before the pavement reaches a condition where a different, more expensive treatment would be required.

Cost Escalation

The overall condition of the network has been improving over the last several years due to increased annual funding and utilization of funding programs from the senior levels of Government. Utilization of the Federal Canada Community Building Fund has allowed the Annual Rehabilitation Program to incrementally increase to the targeted annual funding level.

Cost escalations have been experienced across all types of construction activities from rehabilitation and preservation projects through large road and bridge projects. Labour, material and equipment costs have all increased. A good example of this escalation is the unit rate for a tonne of hot mix asphalt laid in a resurfacing project.

The following information and graph clearly show the cost escalation experienced since 2012 to 2021 for a tonne of Hot Mix Asphalt (HMA).

Year	HMA Cost/Tonne	Year	HMA Cost/Tonne
2012	92.87	2017	100.10
2013	86.63	2018	107.18
2014	100.55	2019	108.09
2015	102.25	2020	109.95
2016	111.14	2021	114.37

Figure 3 – Asphalt Cost

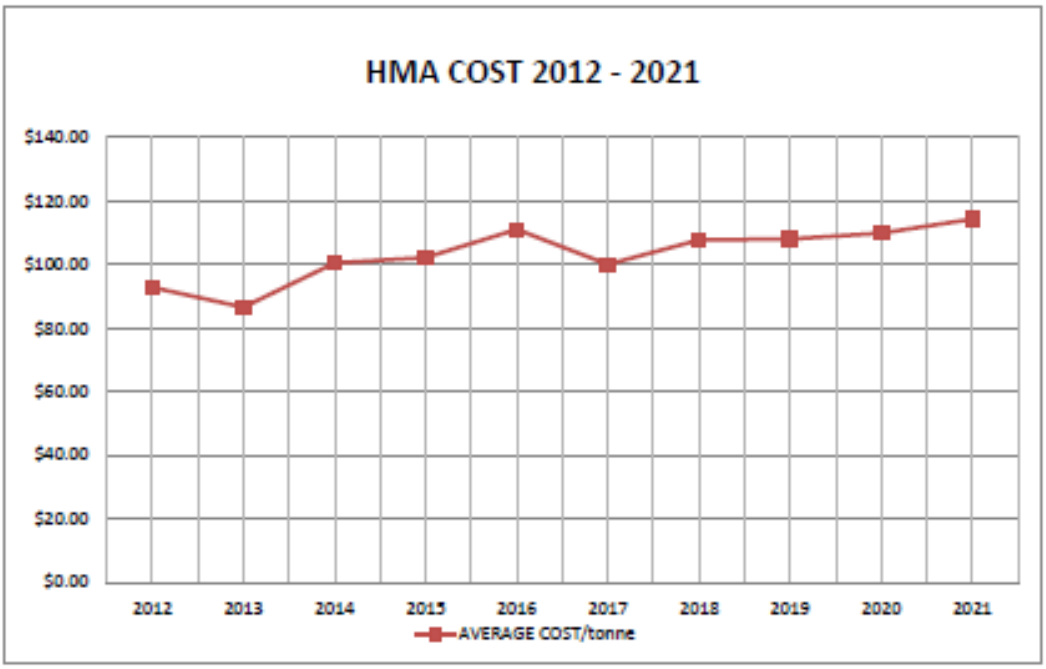
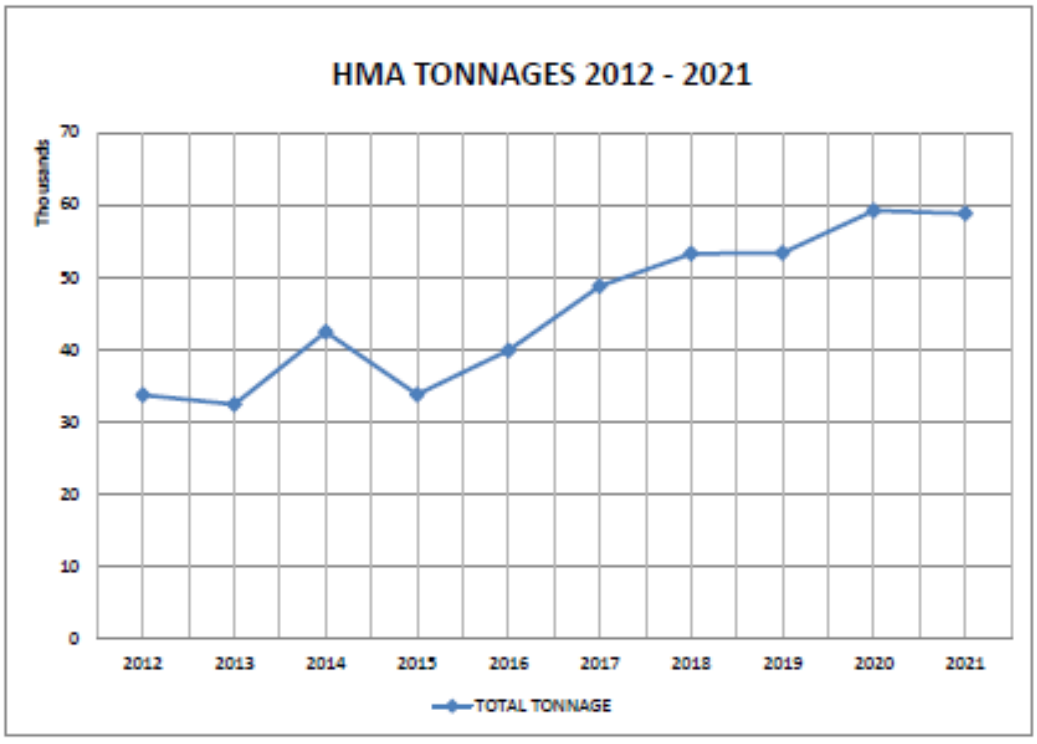


Figure 4 – Asphalt Tonnage



5 Year Rehabilitation Program – Roads, Bridges & Culverts

The County has implemented a tailored life cycle activity framework for the road network as described in the 2017 Asset Management Plan strategy. Key attributes for the road network, including quantities of various assets, their useful life, replacement cost and the valuation method by which replacement cost is derived is valued at $398 million.

The priority planning and budgeting process determines which sections should receive pavement preservation treatments and during which year, the approximate type of the treatment (e.g., a thin overlay), and the estimated cost of the treatment. Project design determines the actual treatment type and provides additional details required for the construction of the project (such as the layer thickness, type of material, and construction methods). Properly designing a durable and economical rehabilitation strategy requires knowledge of a pavement's structural capacity. Staff continuously utilize non-destructive testing to select the appropriate rehabilitation method for each road segment.

The accessible funding level does not adequately address the needs of the network. Increased traffic volumes, age of the network, severe weather and lack of timely preservation works have resulted in a rate of deterioration that is outpacing the rate of rehabilitation. The cost of rehabilitation work continues to escalate each year resulting in less volume of works completed within the fixed budget.

2022 Rehabilitation Program

A 5 Year Rehabilitation Program project listing and map is attached to this report for information. This program is developed as a planning tool that establishes a listing of proposed projects and associated costs for works to be undertaken over the next five years. The program is focused mainly on full rehabilitation or reconstruction; with some preservation projects included. The attached project listing includes:

- 2 Bridge Rehabilitations
- 2 Bridge Engineering Assignments
- 2 Culvert Rehabilitation/Replacements
- 4 Culvert Engineering Assignments

- 17 Road Rehabilitation Projects

Another program to address the deficiencies in the medium sized culvert inventory is continued for 2021 and 2022. These are the culverts with spans or diameters under 3m that are not included in the Culvert Inventory (>3m). Many of these culverts are in deteriorated condition and require replacement. The preservation allocation within the Rehabilitation Program provides funding to improve the condition of this culvert inventory.

The 2022 Rehabilitation Program represents a program at the accessible funding level inclusive of Canada Community Building Fund revenue in the amount of $11,541,200. This includes the Canada Community Building Fund contribution of $2,302,900.

Challenges continue to be presented related to the purchasing power of the program as the unit rates for rehabilitation continue to escalate. As a result, the target level of expenditure will require monitoring and an upward adjustment in the future in order to keep pace with the rate of deterioration experienced across the network.

Since 2004, a revised program was approved by County Council, which pre-committed a level of expenditure for the early development and release of tenders associated with bridge, culvert and road projects. This approach has worked well allowing for completion of road projects on an expedited schedule with highly competitive tender results. Based on previous years' experiences, it is proposed to follow a similar process for the 2022 Rehabilitation Program.

Project Prioritization and Risk Management

Infrastructure needs exceed municipal capacity and the County has relied on provincial and federal programs to finance the annual rehabilitation program. The goal is to deliver a program at the best possible cost over an asset’s life cycle within an acceptable level of risk. The Corporate Asset Management Plan, was approved by County Council in 2017 and provides general guidance to deliver the program. In 2017 the performance of the road network was graded as a C+ and the rehabilitation needs were forecasted to top $54 million over the next five years.

In 2021 the pavement condition ratings were performed by a third-party firm using specialized assessment vehicles that drove the entire road network. The deliverables confirmed the annual pavement condition ratings performed by County of Essex staff are equal to the vehicle assessment.

The assessment vehicle collected scientific data and the respective computer software provided the output reports. Based on 2021 data, the road network rehabilitation deficit is $54.2 million and there are 177 km of the road network in need of rehabilitation.

The 2022 program developed with the allocated funding captures a fraction of those road segments for a total of 46.15 km.

As the County and its associated infrastructure ages, the need for maintenance, repairs, servicing, upgrades and replacement of utilities continues to grow. The timing and frequency of these various events fluctuates significantly. Consequently, pavements can be disturbed at any time during the year and sometimes different utilities may need access to their infrastructure on a shorter frequency cycle resulting in pavements that have been cut into and repaired many times. Cuts made during the winter months exasperate pavement damage because of infiltration of moisture resulting in freeze/thaw action. In the 2017 AMP, the probability of failure is predicted by the condition of the asset as shown in Figure 5.

Figure 5 –Probability of Failure – All Assets

Condition Rating	Probability of Failure
0-20 Very Poor	5 – Very High
21-40 Poor	4 – High
41-60 Fair	3 - Moderate
61-80 Good	2 - Low
81-100 Excellent	1 – Very Low

2022 Paved Shoulder Program

County Council adopted the Paved Shoulder Program in 2016 that provides for the efficient and cost-effective construction of paved shoulders currently included in the CWATS network. As per recommendation 7-37 in the CWATS master plan, the twenty-year implementation plan be fully integrated with the County Rehabilitation and Capacity Improvement Programs.

The construction of CWATS facilities when a County Road is rehabilitated or reconstructed within the County's 5-year Road Rehabilitation Program requires an additional annual budget to realize the opportunities. Funding to support the program is provided from the Infrastructure Expansion Reserve with a 2022 construction value of $2,800,000. The following table highlights

the proposed 2022 Projects and are shown on the attached map as Appendix 10.0.

2022 Paved Shoulder Program – Candidate Projects

CWATS ID.	Road Number	Limits	Length	Estimate
Amh-1	CR 18	CR 11 to CR 9	2.5 km	$500,000
Ess-1	CR 18	Coulter to CR 11	5.9 km	$900,000
Amh-2	CR 50	7th Conc. to Collison Sideroad	1.4 km	$850,000
Ess-11	CR 50	Dunn Road to Dahinda	1.3 km	$250,000
Amh-2	CR 50	CR 41 to 7th Concession utility relocation	4.7 km	$300,000

Paved Shoulders are built in accordance with Ontario Provincial Standards Specifications (OPSS) and the Ontario Traffic Manual (OTM) Book 18 with desirable measurement of shoulder widths for rural bicycle routes as 1.5 to 2.0 meters on both sides of the road plus buffer separation where applicable.

Financial Implications

The financial implications to the 2022 budget are outlined in this report.

Recommendation

That Essex County Council approve the 2022 Rehabilitation Program as presented and the highlighted projects be advanced as early release projects; and

That the Paved Shoulder Program be approved, and advanced as early release projects to coincide with the rehabilitation projects.

Respectfully Submitted

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Jerry Behl

Jerry Behl, P. Eng., Manager, Transportation Planning and Development

Concurred With,

Mike Galloway

Mike Galloway, Chief Administrative Officer

Appendix Number	Title
1.0	Infrastructure Services 2022 Program Presentation
2.0	County Road Map
3.0	Bridge Location Map
4.0	Culvert (Span over 3m) Location Map
5.0	Pavement Condition Rating Map
6.0	Proposed 2022 Rehabilitation Program Project Listing
7.0	2022 Rehabilitation Project Location Map
8.0	5-year Rehabilitation Project Listing
9.0	5-year Rehabilitation Program Map
10.0	2022 Candidate Paved Shoulder Program