ALBERTA INNOVATES

CLEAN ENERGY

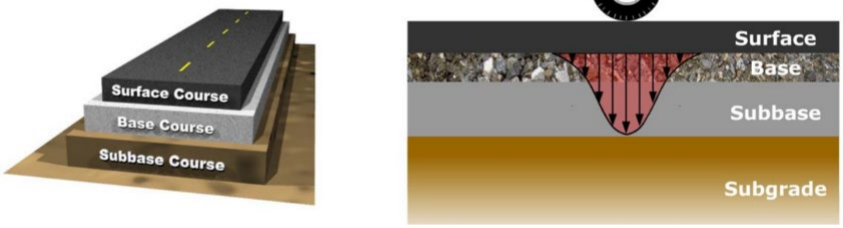
ADVANCED HYDROCARBONS

BITUMEN ADVANCED MATERIALS

FUNDING DETAILS

Structural Design and Benefit Assessment of Asphalt Base Courses Featuring Asphalt Binder and Asphaltenes Derived from Alberta Oil Sands

The aim of proposed research project is to structurally design and analyze the benefits of three different base course layers for pavement structures: (1) a high-modulus asphalt concrete (HMAC) base course made of Alberta oil sands-derived asphaltenes-enriched binder featuring fibres, (2) a high- modulus asphalt concrete (HMAC) base course made of Alberta oil sands-derived binder and recycled asphalt pavement (RAP) and (3) an asphalt emulsion-stabilized base course consisting of aggregates or (RAP) modified using asphaltenes. The proposed project will include a three-year laboratory investigation on material, finite element modelling and pavement design, all conducted at the University of Alberta Laboratory.



Schematic of a flexible pavement, showing the typical layers

RECIPIENT:
University of Alberta – Dr. Leila Hashemian

PARTNERS:
Alberta Transportation, Town of Stony Plain

TOTAL BUDGET:
$852,000

AI FUNDING:
$426,000

PROJECT DATES:
FEB 2024 – MAR 2027

PROJECT TRL:
Start: 5
End: 6

APPLICATION

Roads often face premature failure due to low-quality material or design, burdening taxpayers and end users. To improve durability and longevity, incorporating high-quality materials in pavement layers is crucial. Employing a sturdy, high-strength base course in the pavement structure yields a durable road with an extended life cycle and reduced thickness compared to traditional pavements. This research introduces three innovative, high-quality base course materials aimed at fostering the development of long-lasting and resilient pavements.

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PROJECT GOALS

This innovative research aims to investigate the potential benefits of using the two developed HMAC base courses in pavement structures as an alternative to a conventional base course using stiff asphalt binder from Alberta oil sand. The stiff binder could be prepared with two different methods: asphaltenes modification, or in lieu of asphaltenes, the addition of hard asphalt to RAP material. To improve the low-temperature properties of the developed HMAC using both methods, PET fibres will be added to the developed mixes. Also, the research will investigate the prospect of replacing commonly used additives (i.e., cement powder) in cold recycled mixes with asphaltenes. Pavement sections will be designed for all three developed base course material and will be compared with conventional pavement sections in Alberta.

BENEFITS TO ALBERTA

The quantity of asphalt mix utilized for new construction and rehabilitation in Alberta has been documented at approximately 4 million tonnes, with an associated cost of around $400 million. The incorporation of high-quality base courses in the pavement structure is anticipated to result in a 30% reduction in the overall pavement thickness. This not only reduces the construction cost and time but also diminishes the necessity for maintenance. Assuming that this technology translates into a 5% reduction in the required asphalt for both new construction and maintenance, it is estimated that Albertans could save approximately $20 million per year. Other potential environmental benefits for Alberta could include reduced consumption of high-quality raw materials and lower greenhouse gas (GHG) emissions, improved road conditions and enhanced safety.

6 Publications

5 Collaborators

101-1000 Future Jobs

3 New Products/Services

2 Students Trained

5 Sector HQSP Trained

CURRENT STATUS

JUN 2025

1) The effect of asphaltenes modification on the workability and aging of two asphalt binders, from crude oil and Alberta oil sands, was evaluated. 2) The properties and performance of HMAC with 50 % RAP was assessed through laboratory testing, including performance grading of modified asphalt binders, dynamic modulus and low temperature cracking of asphalt mixes. 3) Asphalt emulsion cement and asphaltenes modified mixes were compared for permanent deformation and dynamic modulus. Recycled mixes with 100% RAP and varying asphaltenes content were also evaluated for viscoelastic behaviour.