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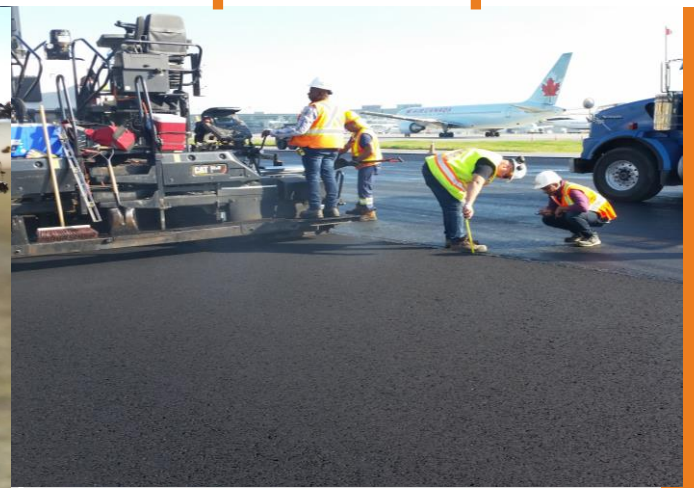
Aramid Fibre Reinforced Asphalt Pavement

An Innovative Technology to Improve Airport Asphalt Pavements





Presented To: SWIFT 2019
10 September 2019

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Nilex Inc.

Outline

- Fibre Reinforced Asphalt History
- Aramid Fibre
- Fibre Reinforcement for Asphalt Pavement
- Mixing
- Canadian Airport Projects
- Questions

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Historical Asphalt Fibre Additives

- **Steel**
- **Mineral**
- **Asbestos**
- **Cellulose**
- **Polyester**
- **Fiberglass**
- **Polypropylene**

Most have proven unreliable and with varying results in the mixing process as well as in field performance.

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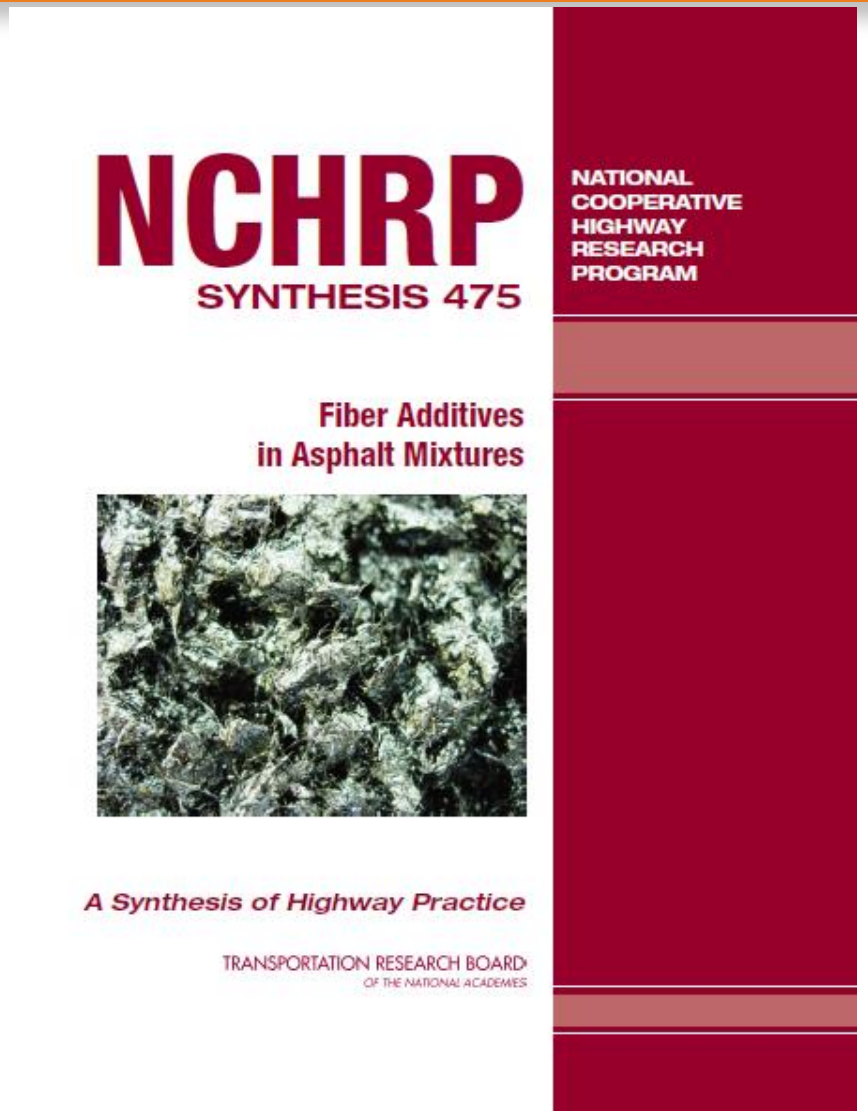
Synthesis 475



- NCHRP summary of fibre additives
- Released 2015

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Asphalt Fibre Additives

Cellulose Fibre ≠ Reinforcing Fibre

- Cellulose fibre added to SMA mixes to prevent drain-down of asphalt cement
- Cellulose fibre absorbs asphalt cement
- Reinforcing fibre added to improve mechanical performance of asphalt mix
- Reinforcing fibre does not absorb asphalt cement

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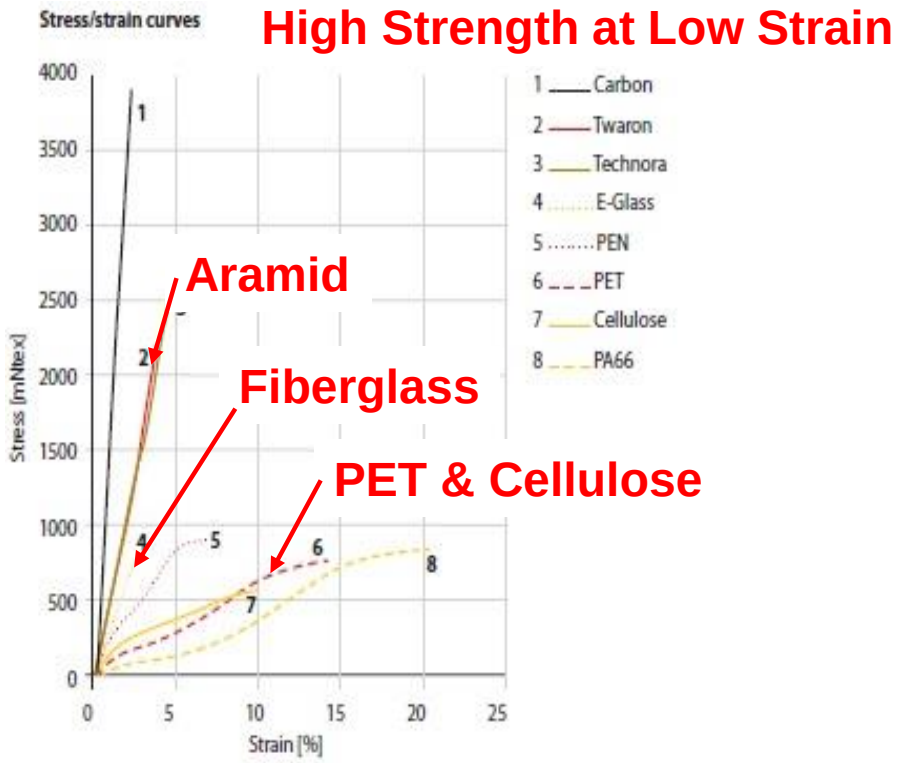
What is Aramid Fibre?

- A synthetic, high-performance fibre
- Kevlar® is one commercial name of aramid
- 5X the strength of steel
- High modulus
- Extremely high melting point – over 425°C
- Aramid fibre is non-absorptive



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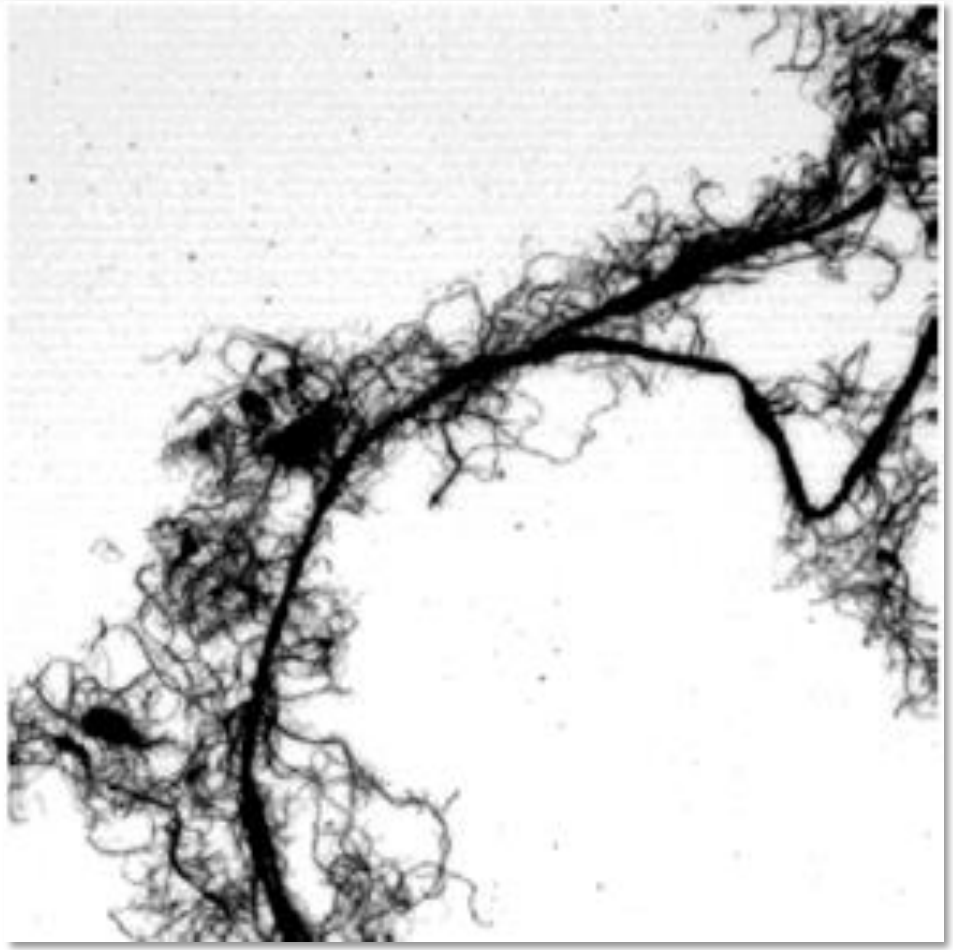
Micro-roots in Aramid



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Fibre Reinforced Asphalt Pavement

General Technical Benefits

- 50% increase in rutting resistance
- 150% increase in strength
- 140% increase in reflective crack resistance
- 40% increase in fatigue crack resistance
- 20% increase in thermal crack resistance

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What can FRAP do?

- Slow down the development of cracking in asphalt pavements
- Mitigate the size of the cracks that appear in asphalt pavements
- Extend out the timeframe for crack repair
- Make your pavements last longer
- FRAP may control and mitigate asphalt distresses
- FRAP can adjust your asphalt design parameters

FRAP WILL NOT FIX STRUCTURAL BASE ISSUES

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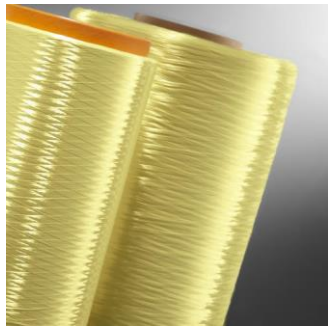
Aramid Fibre

- For any reinforcement to be effective, it must be capable of being used in a manner that does not interfere with standard asphalt mixing and construction techniques in order to gain acceptance by contractors
- In order to introduce the aramid fibre into an asphalt mix, there must be a way to get the fiber into the mix without having it captured by dust collection systems
- Fibres are “treated” by combining aramid fiber with other materials to create products that have mass, but will blend effectively with asphalt mixtures

What is Aramid Fibre Asphalt Reinforcement?

Aramid Fibre
(65 g/tonne)



+ **Treatment**

=

Aramid Fibre + Sasobit Wax
65g/t aramid + 65g/t Sasobit wax

or

Aramid Fibre + Polyolefin
65g/t aramid + 435g/t polyolefin plastics

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Aramid Variables

- Aramid fibre length can be varied – 19mm or 38mm
  - Think long hair vs short hair
- Aramid fibre dosage can be varied – 65g/t is current standard (10M fibres/t)
- Different applications may benefit from increased dosage
  - Asphalt overlays on concrete pavements
  - Heavy loading
  - Steel decking overlays

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Aramid Fibres

Raw Fibre

Fibre in Asphalt Mixture

Extraction Recovered Fibre

Aramid Fibre Specifications

- Aramid fibre dosage is 65g/t (0.0065%)
- Aramid fibre length is 38mm (most commonly used)
- Continuous stream-like feed of fibres
- Verified QA/QC certification for project dosing

Build a specification around these points

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Asphalt Mix Designs

- The addition of aramid fiber reinforcement will not modify the volumetric properties of an asphalt mix design
  - Aramid fiber does not absorb binder – no change to %AC
  - It will increase the performance of the mix
  - Continuous feedback from testing labs
- It is a additive that can be used with any hot or warm mix asphalt

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Canadian Usage of Aramid Fibre Asphalt

- First installations in QC circa 2011
- MTQ 2012 – A-20
- Most applications (outside QC) began 2016
- MTO began trials in 2016
- Commercial Property usage 2017
- Significant increase in usage in 2018
- SK Hwy and BCMoTI started using in 2018
- Airport usage began in 2018
- Contractor warranty usage 2018 (Design/Build)

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Where can FRAP be used?

- Groundside Pavements
  - Bridge Decks
  - Urban Infrastructure Conflicts
  - Parking Lots
  - Truck Routes
  - Bus Lanes
  - Roundabouts
- Airside Pavements
  - Runways/ Taxiways
  - Aprons
  - Boarding Gates

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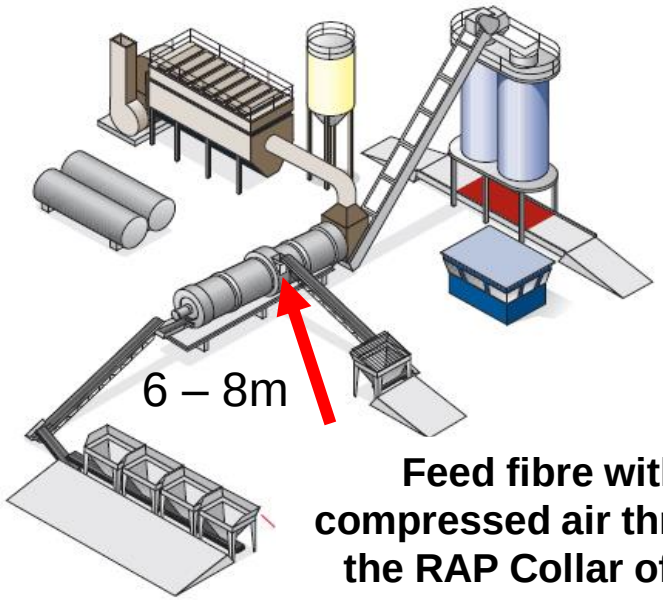
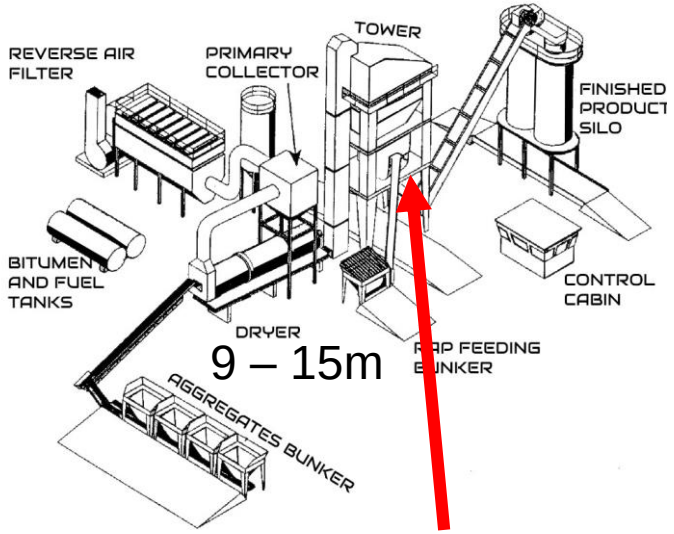
Mixing Process

DRUM PLANT



Feed fibre with compressed air through the RAP Collar of the Mixing Drum

BATCH PLANT



Feed fibre with comp air up to the Weigh Hopper or Pug Mill

Fibre requires 25-30s mixing time w/ heated dry aggregate to distribute though mix prior to addition of AC

FRAP Limitation – not suitable for projects requiring small quantities of asphalt

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Mixing Process

Meter or Weigh Station

Dosing Station

Feed fibre with Automated Dosing Machine Through the RAP Collar of the Mixing Drum

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Canadian Airport Usage

- 4 Airports have used FRAP
- All projects to date are trials
- All projects used Material Transfer Vehicles during placement

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YYZ – Taxiway

- Lab Design Program 2017 SNC Lavalin
- Constructed May – September 2018
- 3 sections - unreinforced and reinforced sections
- 19mm fibre used
- New surface wearing course over milled surface and new base course, 65mm thick
- Contractor was a JV of Pave-Al + Gazzola Paving
- FAA P-401 mix x/ PGAC 70-28P

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YYZ – Taxiway

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YYZ – Taxiway

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YYC – Taxiway Charlie

- Section constructed October 2018
- 38mm long fibre used
- New surface wearing course existing asphalt surface over concrete panels
- 65mm thick lift
- Contractor was a Standard General (Colas)
- PG 70-31

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YYC – Taxiway

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Hanna Airport
CEL4 Pavement Rehabilitation
30
MPE
Engineering Ltd.
Hanna
Worth the drive !

YVR – Taxiway Hotel and Lima

- Sections constructed May 2019
- Night time operations
- 38mm fibre used
- Contractor was BA Blacktop (Eurovia)
- Fibre Reinforced asphalt mix placed over fibreglass geogrid interlayer
- PGAC 76-22

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YVR

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Summary

- Aramid fibre reinforced asphalt pavements are a commercial available technology that can be used in most asphalt mixtures
- Fibre reinforced asphalt pavements are a strategic tool that can be applied when and were necessary to enhance the pavement performance
- As a tool, fibre reinforced asphalt pavements can be used in combination with other materials and technologies (geogrids, WMA, etc.) to customize pavements to site specific challenges

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THANK YOU!

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