Field Performance Evaluation of Low Volume Gravel Road Sealed with Bituminous Surface Treatment

Presented by:

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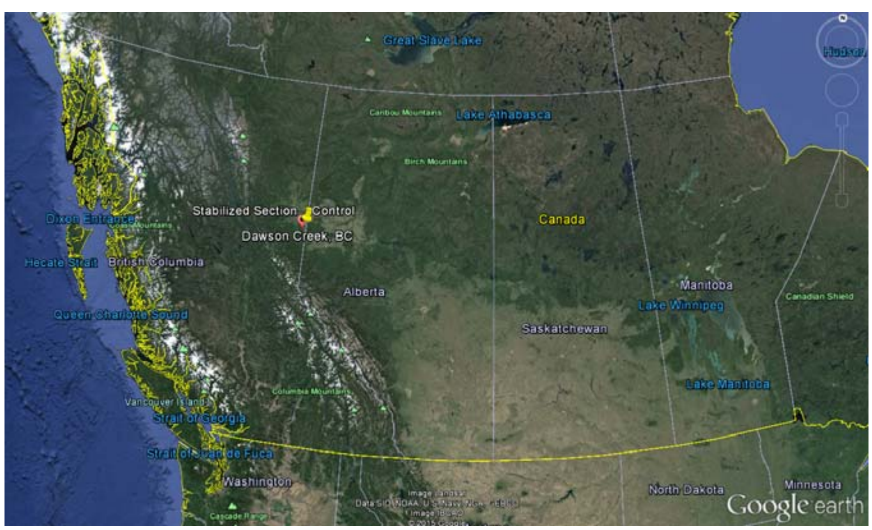
Project Location – Dawson Creek, BC



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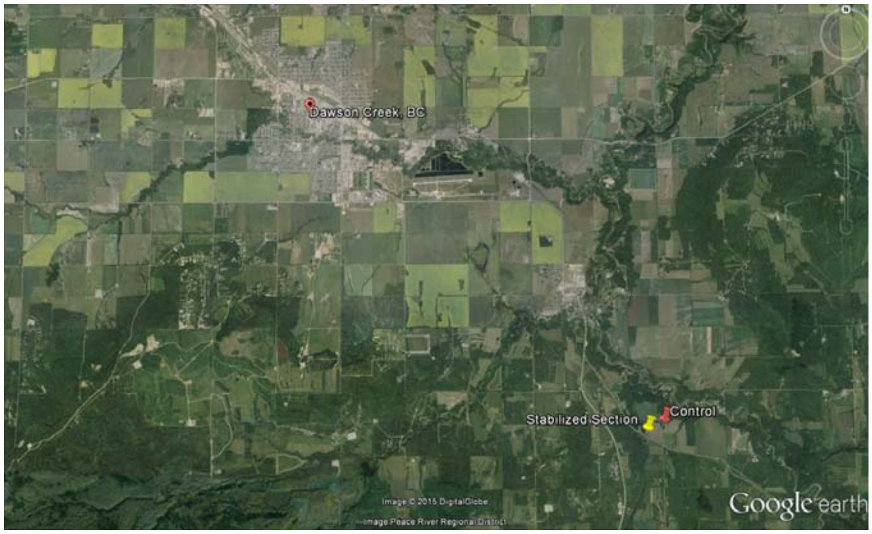


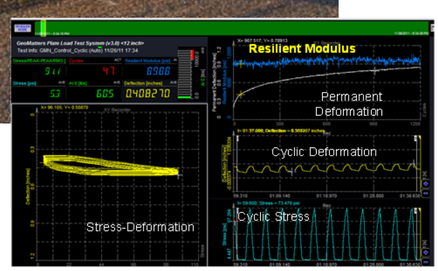
Field testing focused on evaluating unpaved/thin chip seal surfaced roads with TX geogrids in BC

Drilled hole through geogrid reinforcement.

Example of 20 to 30 mm thick chip seal surface.

Benkelman Beam method is commonly used in BC for setting load restrictions

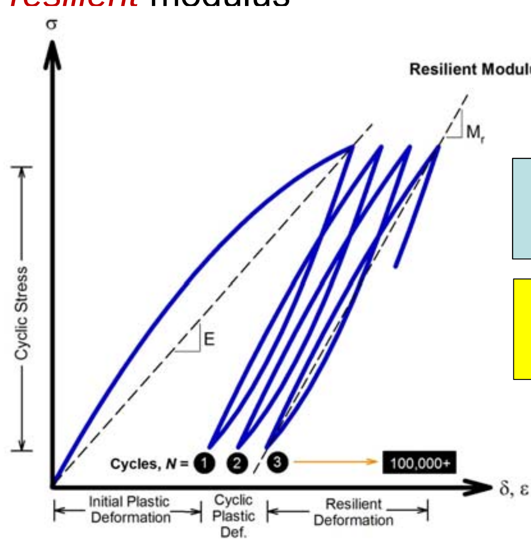
Newly developed APLT was used to directly determine *k* and M_r values



Automated Plate Load Test (APLT)

- The APLT equipment is capable of accurately and efficiently measuring a range of parameters including the following:
  - Modulus of subgrade reaction
  - Confining stress dependent resilient modulus
  - Undisturbed tube sampling and extrusion
  - Stress controlled wheel rutting simulation
  - Bearing capacity
  - Shear wave velocity/modulus
  - Cone penetration testing
  - Borehole shear testing

It is important to differentiate *elastic* versus *resilient* modulus



$M_r = (1-v^2)\, f\, \sigma_o\, (a / d_r)$

d_r = ***recoverable*** deformation

$E = (1-v^2)\, f\, \sigma_o\, (a / d_0)$

d_o = ***Elastic*** deformation

12 in. and 8 in. APLT configurations were used on this site

12 in. plate on Gravel

12 in. plate on chip seal surface

8 in. plate on gravel (after punching shear failure)

APLT Tests

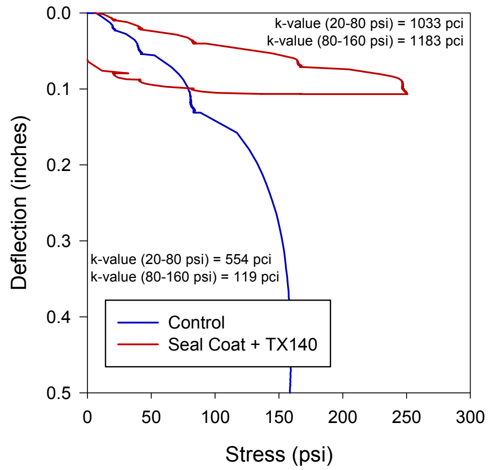
- Static tests
  - 8 in. diameter plate
  - @ increments of 2, 4, 10, 20, 80, 160, and 250 psi
- Cyclic tests
  - 12 in. diameter plate
  - 200 to 250 cycles @ cyclic stress of 20 psi and 80 psi.
  - 1000 cycles @ cyclic stress of 70 psi

Comparison between control and geogrid stabilized sections

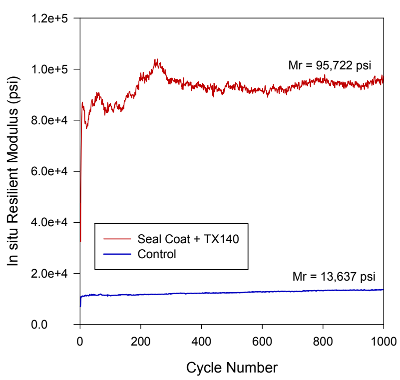
Location	Control (Rd 207)		Old Edmonton	
Construction	control		2012	
Deigned Pavement Section	~150 mm gravel over subgrade		300mm crushed gravel base and TX140 triaxial geogrid	
Seal Coat (Y/N)	N		Y	
Beam Deflection (mm)	6.2		**1.08**	
Mr (psi) @ 80 psi (70 psi for 1000 cycle tests)	16,560	13,640	**68,720**	**95,720**
δp (in) @ 80 psi (70 psi for 1000 cycle tests)	0.421	0.475	**0.094**	**0.124**
1,000 cycle test	N	Y	**N**	**Y**
k-values (80-160 psi) (pci)	120	—	**2620**	**—**
Crushed gravel base (mm)	150mm +100mm mixed gravel		330	
Geogrid			TX140	
Gravel below geogrid (mm)			190	
Subgrade	Glacial till			

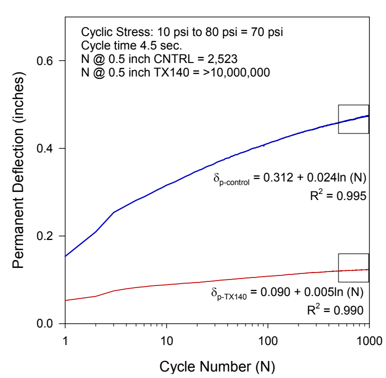
Thickness verification using DCP and Hand auger

APLT results showed significant improvement in *k-values* in TX geogrid stabilized section

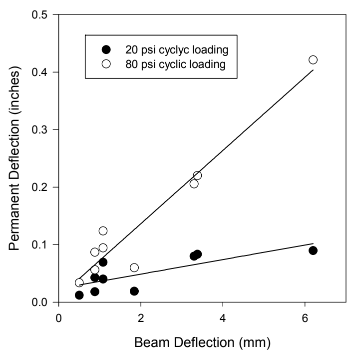


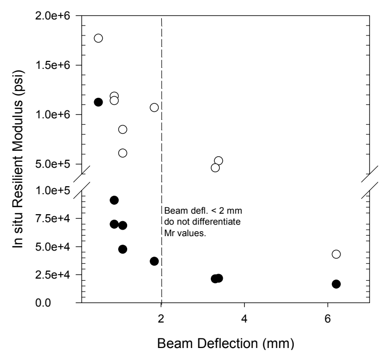
APLT results showed significant improvement in M_r and resistance to permanent deformation in TX geogrid stabilized section



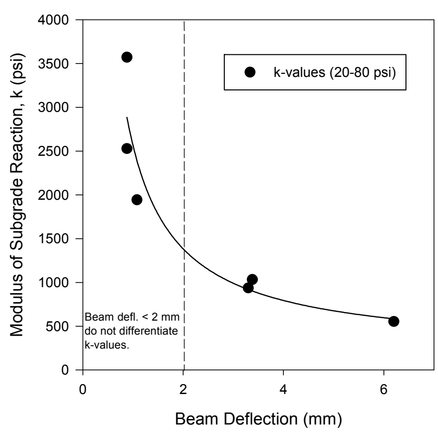


BB results correlated with permanent deflections but not sensitive to M_r values at < 2 mm deflection

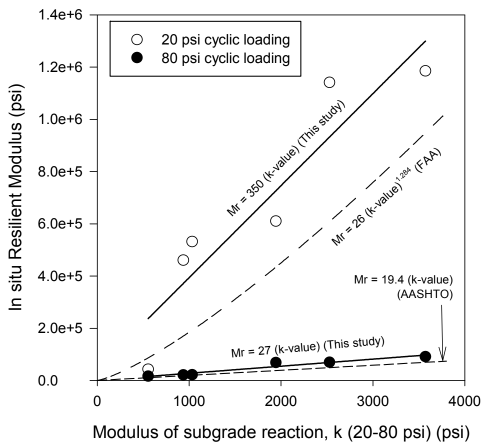




BB results not sensitive to high *k* values at < 2 mm deflection



M_r versus *k* relationship is cyclic stress dependent – *Empirical relationships have limitations*



Key Findings

- TX geogrid stabilized sections demonstrated improved performance over control sections
- BB results correlated to the APLT measurements, but are not sensitive to high k-values (> 1000 pci) and high in-situ M_r values (> 40,000 psi)
- In-situ M_r versus *k* relationships are cyclic stress dependent.
- APLT testing during spring-thaw is recommended.

Questions are welcome.

Thank you for your interest.

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