

Emerging Approaches to RAP: Municipal Experiences and Challenges

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Town of Innisfil

Asphalt.

ONTARIO RIDES ON US

ORBA

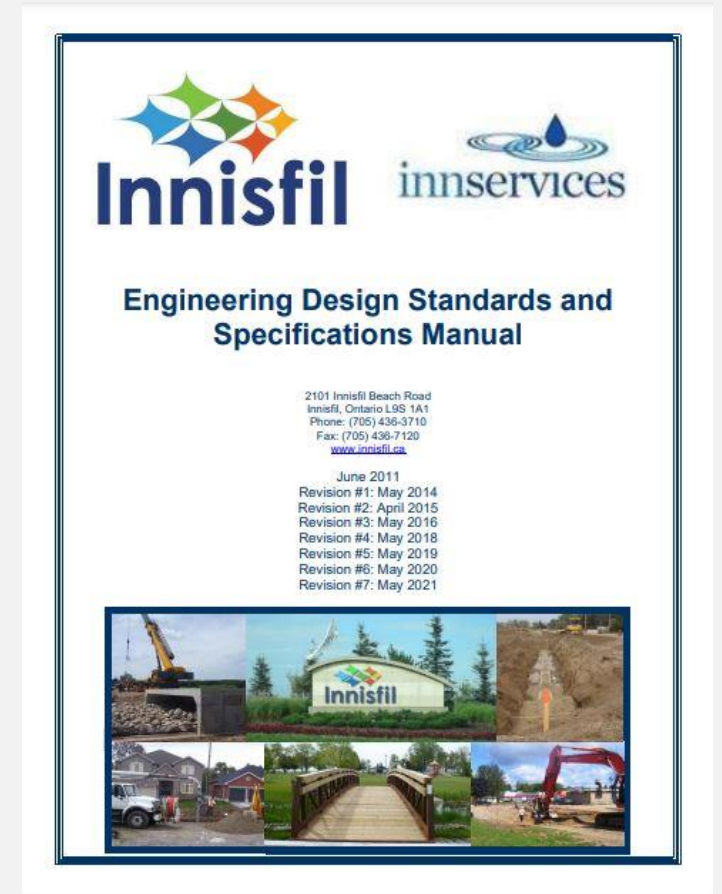
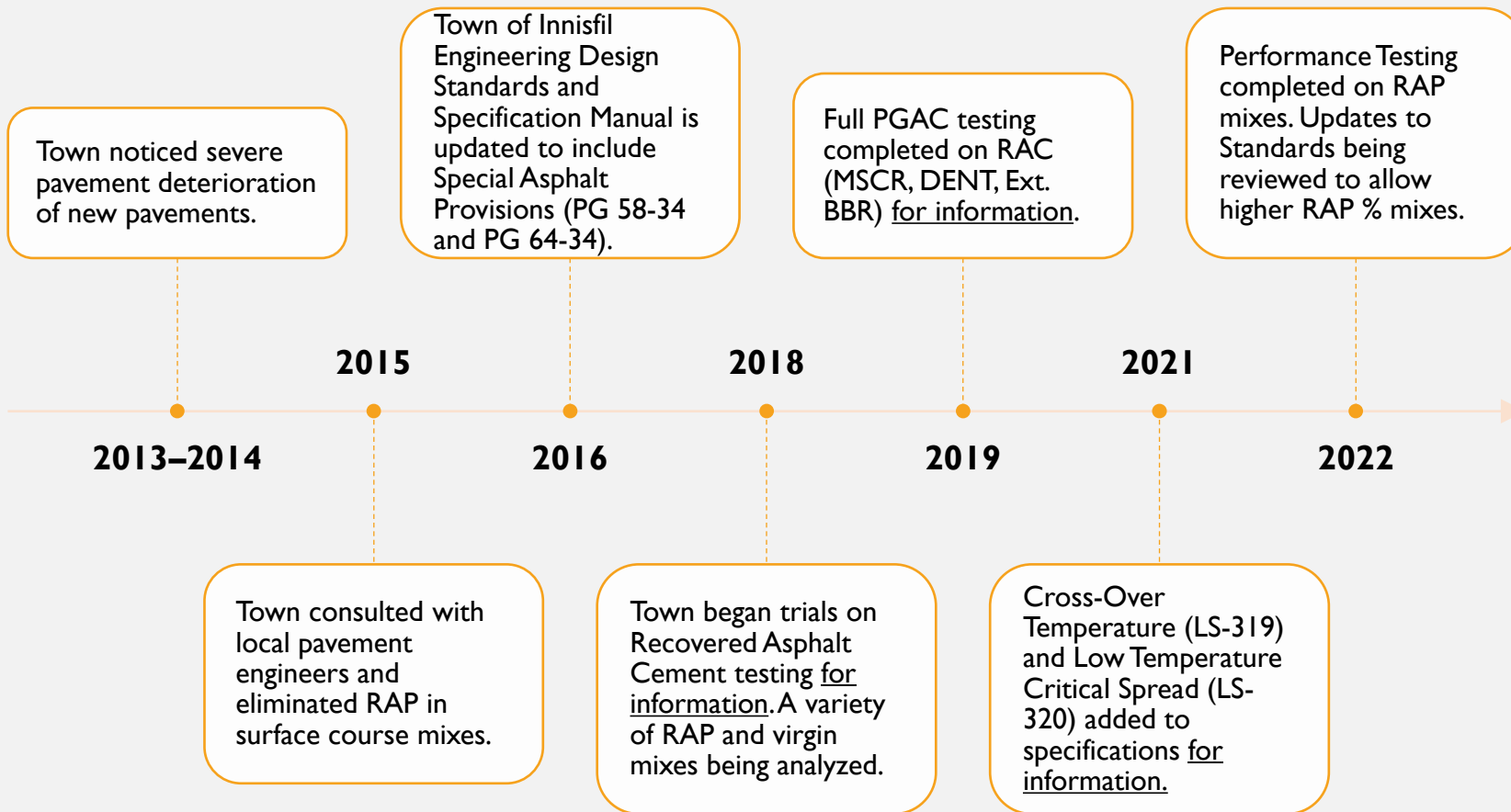




TOWN OF INNISFIL

- Located in the County of Simcoe between the City of Barrie and the Town of Bradford West Gwillimbury.
- Road Network (Approx. Centreline km):
 - 325 km of HMA
 - 40 km of Surface-Treated
 - 30 km of Gravel

TOWN OF INNISFIL STANDARDS UPDATES



WHY USE RAP?

Environmental Benefits

- Reduces the volume of construction debris in landfills.
- Conserves natural aggregate and petroleum sources.
- Reduces CO₂ levels generated by mining and extracting virgin aggregate and petroleum products.



WHY USE RAP?

Economical Benefits

- Using recycled aggregates and AC can reduce HMA production costs.
- RAP can be recycled multiple times when utilized in asphalt surface/wearing layers.
- May reduce reconstruction and rehabilitation costs when good quality RAP can be recovered for future use.





CHALLENGES WITH RAP

Quality Control Challenges

- Variation in aggregate gradation.
- Variation in AC %.
- Variation in AC grade.



CHALLENGES WITH RAP

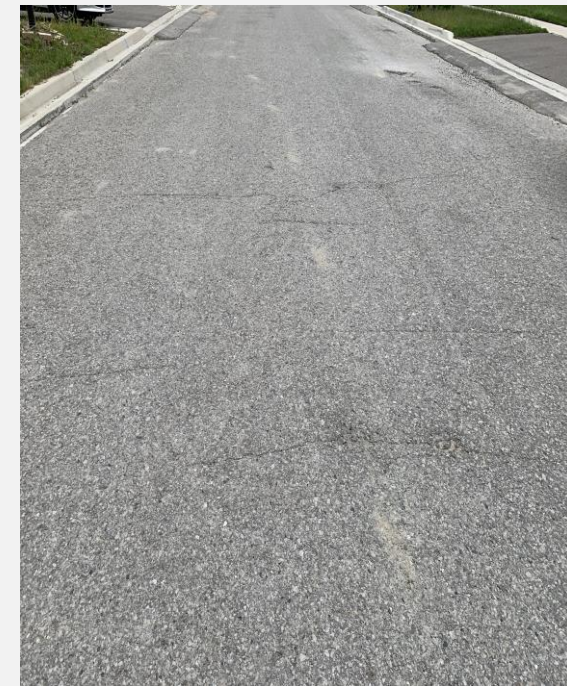
Long-Term Durability

- Introducing RAP to HMA can make the mix stiff and brittle which may lead to premature pavement failure.
 - Cracking and Ravelling

CASE STUDY #1

- Local subdivision road constructed in 2014.
- By 2016 the roadway exhibited:
 - Extensive - moderate to severe ravelling,
 - Frequent - slight to moderate transverse cracking,
 - Frequent - slight to moderate random/map cracking.

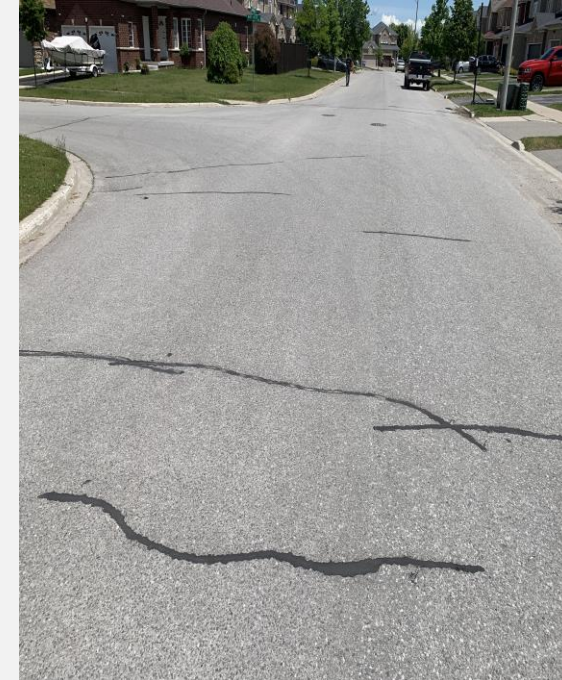
Road Classification	Pavement Layer	AC %	RAP %	PGAC	Years Until Distress Observed
Local	HL-8 - Binder Course	4.7 %	30 %	52-34	2 Years



CASE STUDY #2

- Local subdivision road constructed in 2014.
- By 2018 the roadway exhibited:
 - Frequent - slight to moderate transverse cracking,
 - Frequent - slight random cracking.

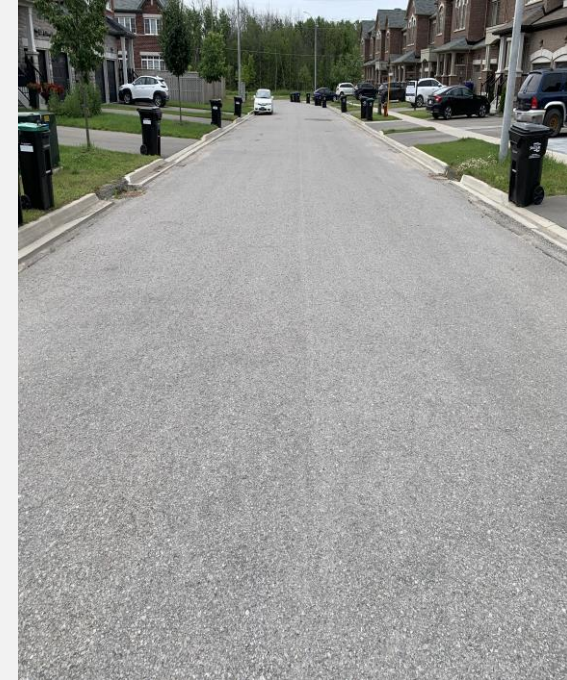
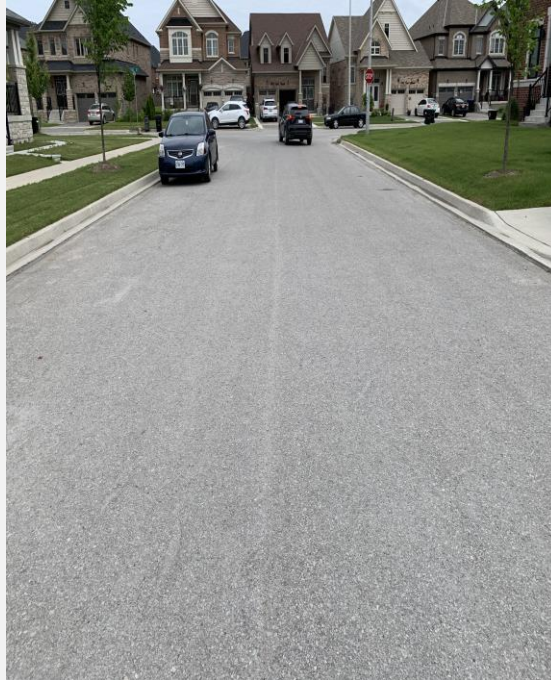
Road Classification	Pavement Layer	AC %	RAP %	PGAC	Years Until Distress Observed
Local	HL-3 - Surface Course	5.0 %	15 %	58-28	3-4 Years



CASE STUDY #3

- Local subdivision road constructed in 2016.
- In 2022 the roadway has only shown a few localized areas of slight to moderate ravelling. No cracking has been observed to date.

Road Classification	Pavement Layer	AC %	RAP %	PGAC	Years Until Distress Observed
Local	HL-8 - Binder Course	4.7 %	20 %	58-34	-




CASE STUDY #4

- Major Collector road constructed in 2013.
- In 2022 the roadway has only shown slight to moderate cracking at construction joints. No cracking related to the quality of materials.

Road Classification	Pavement Layer	AC %	RAP %	PGAC	Years Until Distress Observed
Major Collector	SP 12.5 - Surface Course	4.7 %	20 %	58-28	-





CASE STUDY SUMMARY

- Two surface course and two binder course pavements of different ages.
- Varying AC %, RAP %, and PGAC
- Oldest pavement (2013) showing some of the best performance.
- Softest PGAC (52-34) showing the worst performance.
- With the testing procedures in place at the time of construction, it's difficult to suggest a direct relationship between RAP % and pavement performance.

CASE STUDY DISCUSSION TOPICS

- QA testing confirmed that all mixes met the project specifications.
- Other factors can play a role in premature cracking including poor compaction, and improper placement / production procedures.
- Asphalt mixtures can be successfully designed and produced with RAP for both surface and binder course pavement layers.
- RAP can also have a negative impact on pavement performance if not properly designed and produced.



WHAT'S
NEXT?

TOWN OF
INNISFIL
UPDATES

Review / Update Specifications

- The Town will continue to review and update our maximum RAP % specifications in 2023.

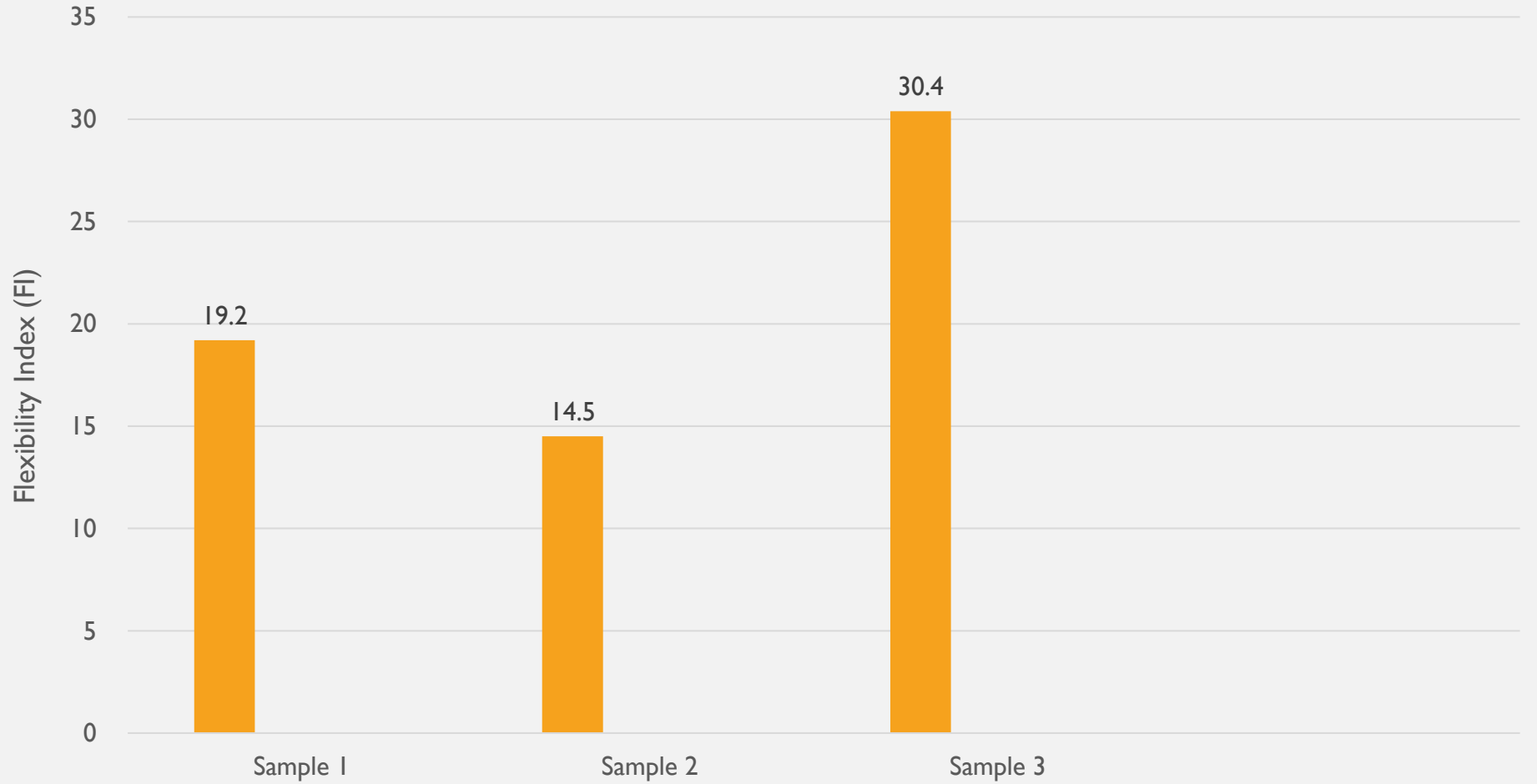
Recovered Asphalt Cement Testing

- The Town will continue to test RAC for information purposes.

Performance Testing

- The Town has recently collected 3 field samples for SCB-IFIT testing.
- Samples were collected from different HMA producers with different AC and aggregate suppliers.
- HWT and DCT tests hopefully to follow within the next couple of years.

Performance Testing Results



SP 19.0

15% RAP

PG 58-34XJ



USING RAP EFFECTIVELY AND RESPONSIBLY

Contractors / Producers

- I. Follow best practices when processing RAP.
 - i. Fractionate RAP
 - ii. Proper Stockpiling
2. Quality Control - Know your RAP !
 - i. Keep track of different sources and separate accordingly
 - ii. Sample regularly (gradation, AC%, PG)
 - iii. Sample plant produced trial mixtures
3. Don't Overuse – Follow the Mix Design.

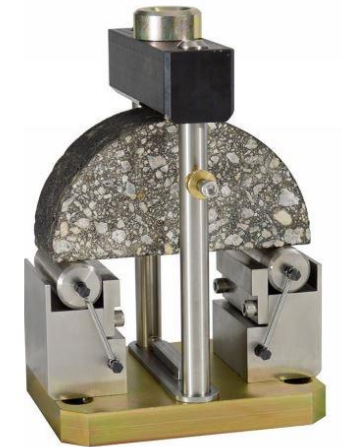
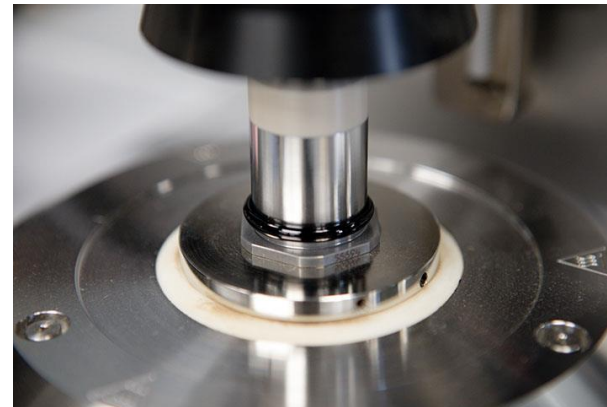


USING RAP EFFECTIVELY AND RESPONSIBLY

- **Owners / Agencies**
 - Update Specifications
 - Minimum AC %,
 - Softer PGAC (58-34, 52-34)
 - Understand how RAP is impacting your mixes.
 - Recovered Asphalt Cement (RAC) testing. – **For Information.**
 - Performance Testing – **For Information.**
 - Utilize industry resources.
 - Discuss your concerns with your Consultants, and Producers / Contractors.
 - Reach out to a member of the OAETG or HMA Municipal Liaison Committee.
 - Many publications available from OAPC, Asphalt Institute, MTO, etc. available for education on RAP usage.

INDUSTRY NEXT STEPS

- Better understanding of AC diffusion in recycled mixes. Are the current min. AC% sufficient?
- Better understanding of the impacts of oxidized binder in recycled mixes.
 - Improving stiffness properties can be relatively simple.
 - Can we adequately restore rheological properties (phase angle, δ) to reduce age-related surface damage?
- Move towards adopting performance-based specifications.



SUMMARY

- Asphalt mixtures can be successfully designed and produced with RAP that have little to no impact on long-term pavement performance.
- Agencies and Producers must be careful when specifying / producing RAP mixtures. Improper production or design procedures can lead to premature pavement failure.
- Producers and Agencies should experiment with new testing procedures and technology to better understand how RAP is impacting their mixes.
- Industry needs to take an educated and careful approach to using RAP.

QUESTIONS

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