Sustainability – How It Pertains to Airport Pavement Construction

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Presentation Outline

- Sustainability for Pavement Construction
- Design Considerations
- Material Properties
- Recycling Opportunities
- Construction Practices
- Sustainability Procedures and Resources

Defining Sustainability

- Classical Definition:

"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs"

UN Brundtland Commission, 1983

“Triple Bottom Line” (TBL) Definition

- TBL more widely accepted approach to sustainability. (phrase coined by John Elkington, 1994)

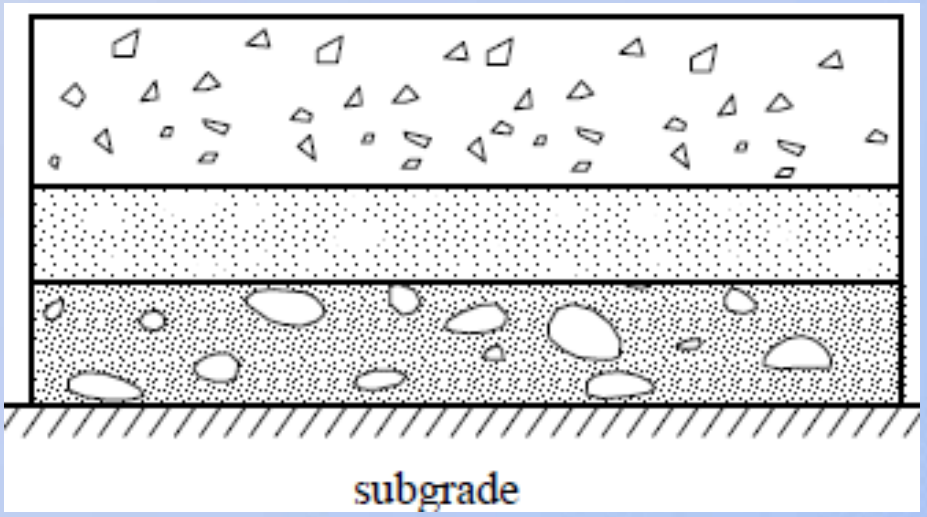
Design Considerations

- Pavement Types – New and Rehab
  - Concrete (rigid) and Asphalt (flexible)
- Pavement Life
  - Life considerations
- Pavement Layers and Material Choices
  - PCC, HMA, Stabilized Layers, Granulars, Recycling
- Pavement Support
  - Earthworks, Drainage, Landscaping

Design Considerations

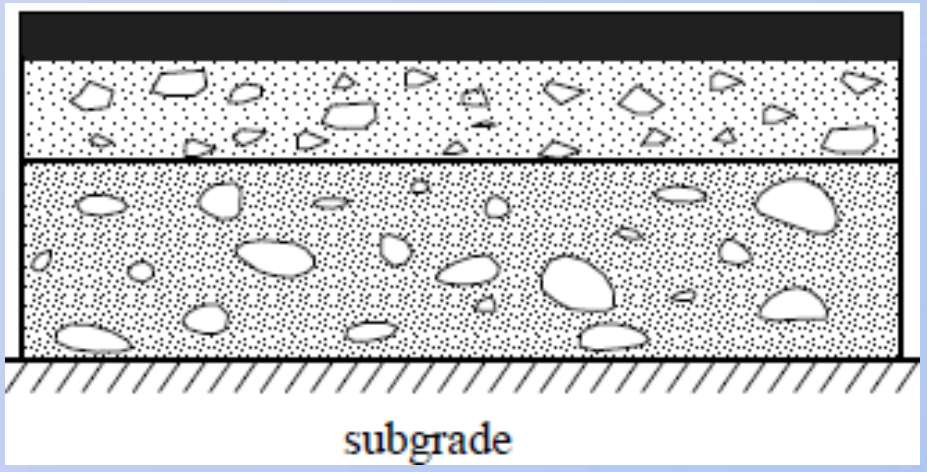
- Pavement Types
  - New Concrete (rigid)
  - New Asphalt (flexible)
  - Composite Rigid (Rehab) or New with Stabilized Base
  - Composite Rigid
  - Composite Flexible (Rehab)
- What can be done in each layer of the pavement system?

New Concrete (Rigid)



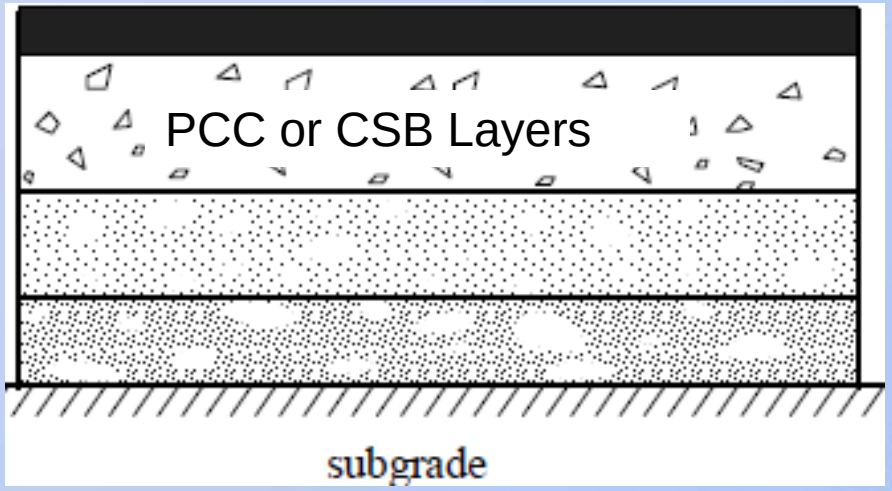
- PCC surface design for 30-40 years not just 20 year life
- Stabilized Base (use recycled PCC, recycled CSB, recycled HMA, recycled granulars)
- Granular Base (recycled base, recycled HMA, recycled PCC, CSB.

New Asphalt (Flexible)



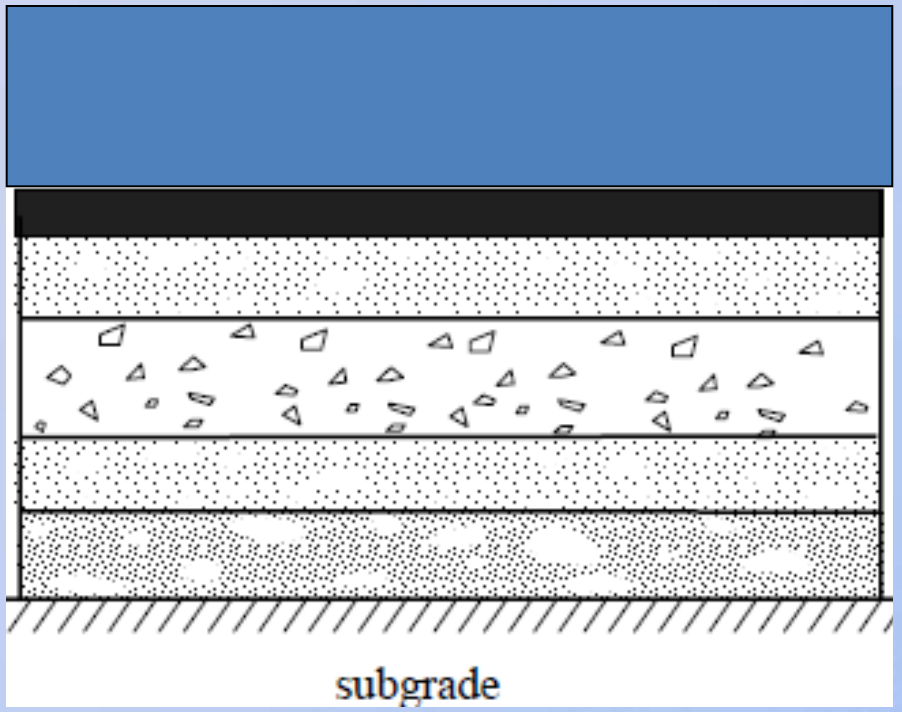
- Design surface for longer life cycle – wider use of Polymer Modified Asphalt (PMA) and fuel resistant PMA.
- Use of “premium” aggregates in selected areas
- Use of “Stabilized” asphalt under premium HMA – lower quality and RAP considerations.
- Lower layers as per rigid.

Composite Rigid



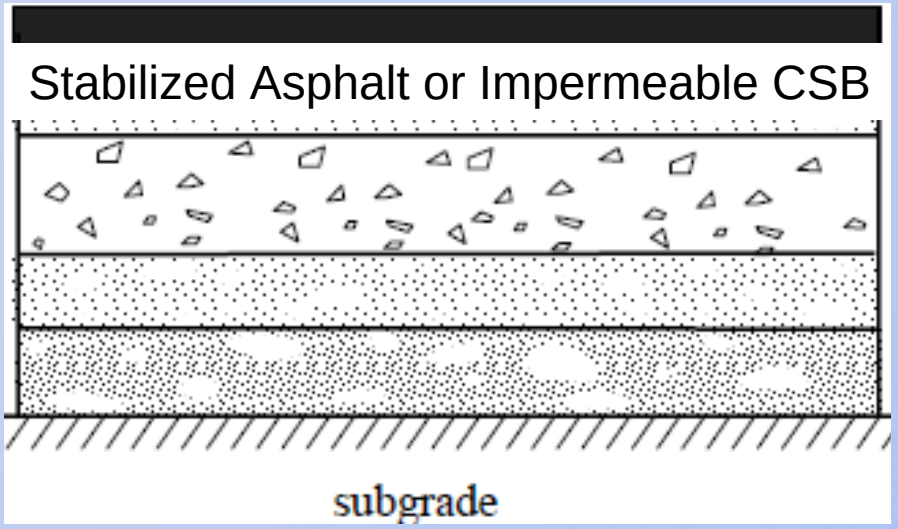
- Depends on structural upgrade or surface condition if overlay on PCC (use of PMA)
- HMA on cement stabilized base allows use of RAP in lower layers or recycled PCC, CSB or granulars.
- Look at life cycle to beef up subgrade instead of granulars.

Composite Rigid - Whitetopping



- Reuse existing asphalt base for new concrete surface. No removals of existing – take advantage of existing stable structure.

Composite Flexible



- Depends on thickness of flexible layer on top of old PCC – can use premium HMA on top and lower stabilized layers with recycled HMA, PCC and CSB. Need to be careful to avoid trapped water with “sandwich” construction.

Life Cycle Costing (LCC)

- Concrete and Asphalt – which one is best?? What should be included in the LCC calculation and what is the time line?
- No decision here – look but look at some of the issues that may increase the life of each and may and benefit the sustainability of the pavement structure.
- Increase sustainability by increasing life cycle.

Increase Pavement Life Cycle

- Concrete:
  - Increase Thickness – generally only costs you about 50 mm extra thickness in a 380 mm PCC pavement to gain 10-15 years extra life (based on cumulative damage factor) when using FAA FAARFIELD finite element design methods.
  - Use premium ancillary products

Sustainability and Material Properties

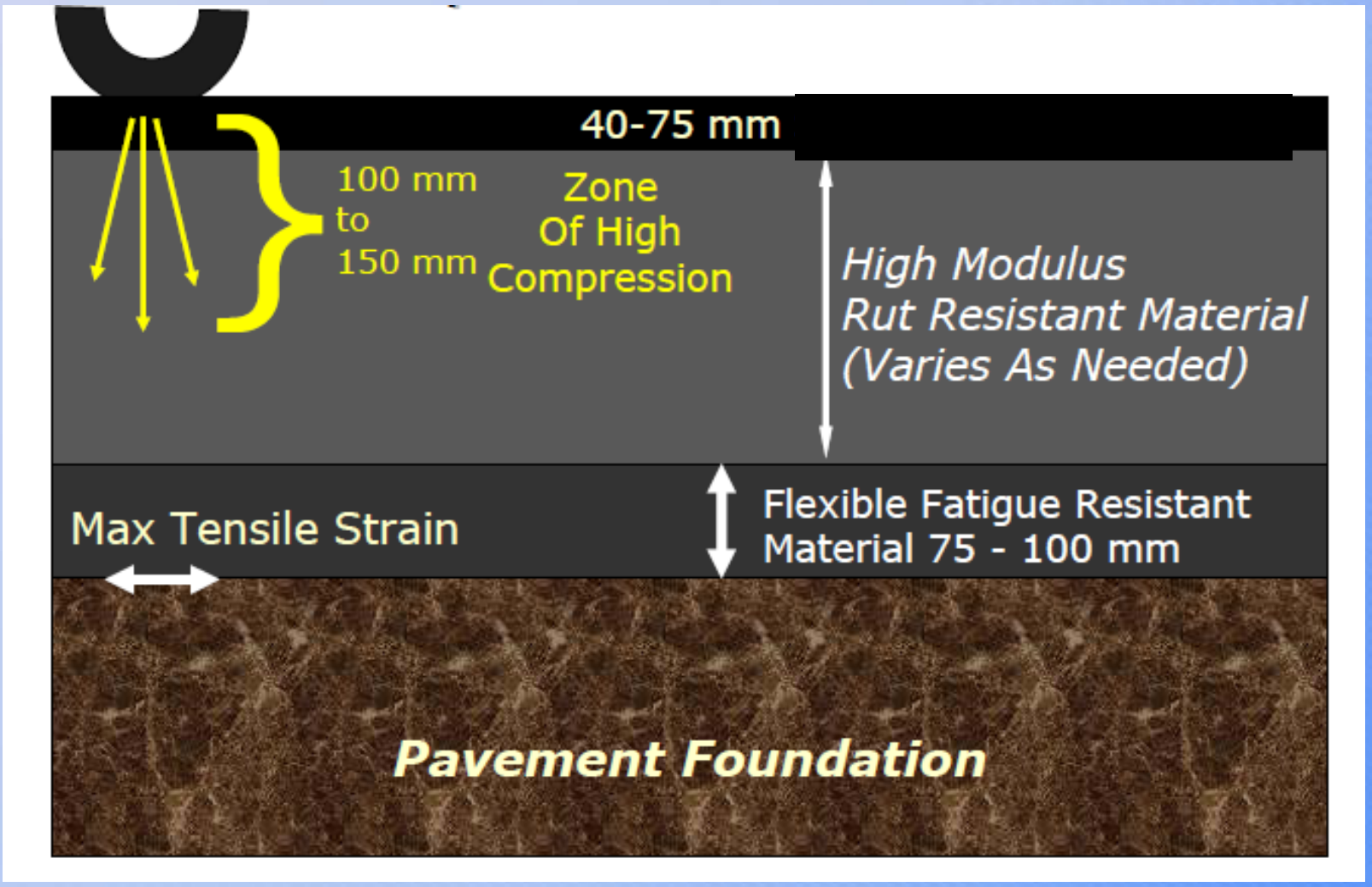
- Concrete
  - Use of fly ash, blast furnace slag, and silica fume to improve properties, decrease costs, recycle materials and potentially decrease ASR.
  - Thinner pavement structures where granular supply is a problem – but may not be an issue depending on minimum frost protection requirements .
  - Reflectivity on runway surfaces.
  - Stability of inset lighting systems.

Increase Pavement Life Cycle

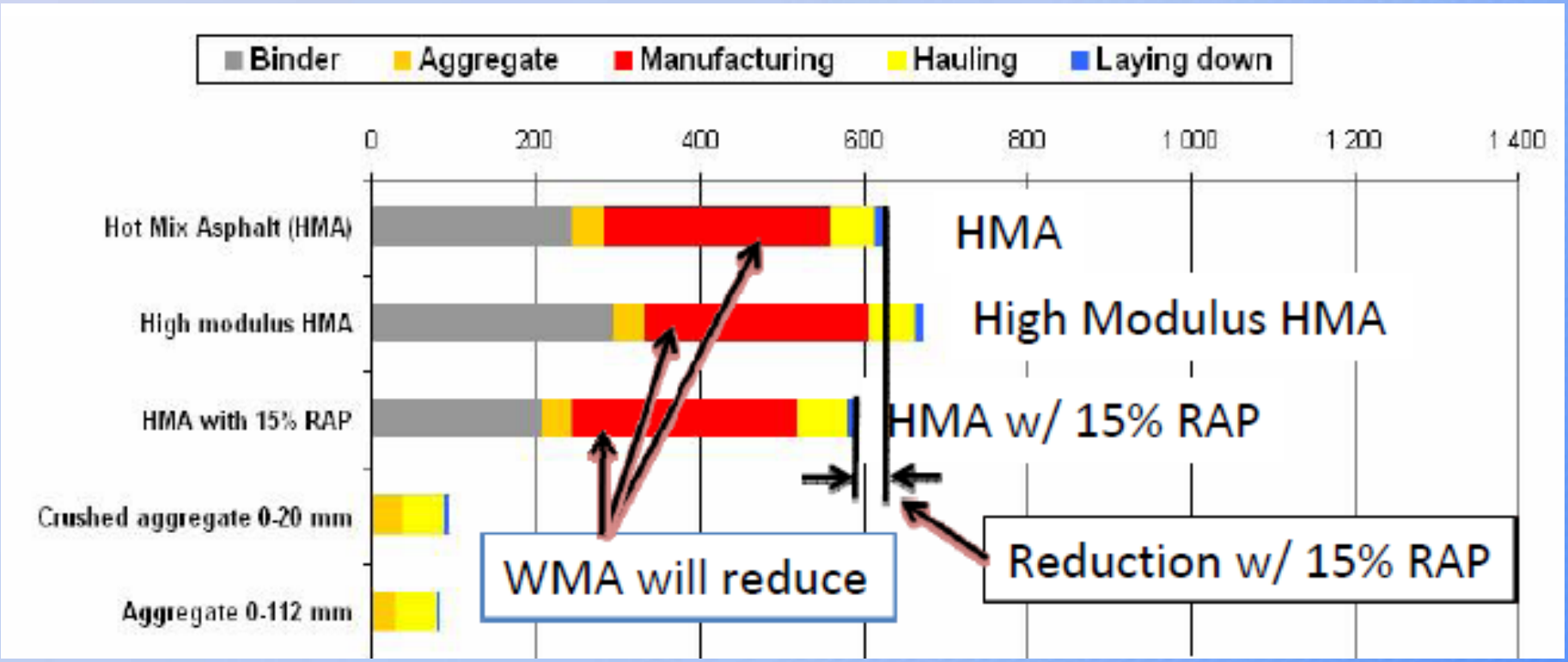
Asphalt:

- Surface Durability (PMA, Rubberized, Premium surface course in selected areas to be HIR)
- Use of RAP in stabilized layers
- Marshall vs. Superpave
- Warm Mix Asphalt (not widely used on airports except at Logan Boston) – way of the future
- Asphalt (Perpetual Pavements – airport pavements?)

Asphalt – Perpetual Pavement (PP)



Asphalt Properties and Warm Mix



Recycling Issues in Sustainability

- PCC – meet 50mm minus granular base gradation
- HMA – milled material or RAP watch bitumen content. Still not allowed in surface courses in most jurisdictions.
- Stabilized Base – same as PCC
- Granulars – reuse as is subject to gradation.

YYZ Old T1 Demolition and Recycling

YYZ Old T1 Demolition and Recycling Achievements

Old T1 Demolition		
Material Category ([19]) (Quantities rounded)	**tonnes**	**Percentage Recycled**
Scrap Metal	*24000*	*100%*
Concrete	*253000*	*100%*
Asphalt	*10000*	*99%*
Waste	*2900*	*95%*
Brick Rubble	*1500*	*100%*
Drywall	*110*	*99%*
Hazardous Materials (Asbestos, Vermiculite Panels, etc)	*2900*	*100% Reduction*

Sustainable Practices for Pavement Support Systems Construction

- Earthworks
- Grading and Topsoiling
- Drainage
- Pavement Details

Sustainable Earthworks Issues

- Balanced design and best use of materials in pavement embankment
- Truck hauling and strict dust suppression (keep 600 mm of freeboard)
- Topsoil and seeding for sustainable design – taxiway shoulders do not have to be asphalt if stable (YVR, YYC etc.). Keep asphalt on hard turns where jet blast an issue.

Tree Clearing and Mulching for Topsoil

Grading and New Grass with Mulching

Silt Fencing and Runoff Prevention

Reuse of Milled HMA on Surface for Protection instead of imported granular

Cutting Joints in CSB under HMA

Prevents reflective cracking in HMA surface when cement Contents are high

Standardize Manholes/Manufacture Yard

PCC Doweling and Reinforcing

Use Spreaders For CSB and HMA

PCC Panel Reinforcing

Consider Using
Preformed Joint Filler
To avoid sealing and
Resealing.

Long Term Construction Management

- Electronic As-builts Mandatory – sustainability of records and instant access
- On-call crushing contractor for recycling allows stockpiling, grading and reuse of recycled materials on a continuous basis
- Engage Public Stakeholders on construction schedules and disruptions

Long Term Construction Management

- Engage contractors on best practices and lowest costs by presenting designs at 30% for inputs – expect biased views but input can be vetted to suit airport sustainability program.
- Airport Registration in ISO14001 leads to sustainability in design, specification and construction practice. Airport Specifications will ensure contractors buy into the airport ISO 14001 plan.

Airport and Pavement Sustainability Websites

- http://www.aci-na.org/sustainability/sustainability-links.html
- http://pavementinteractive.org/index.php?title=Main_Page
- http://www.cement.ca/
- http://www.warmmixasphalt.com/
- http://www.acpa.org/

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