50-Year Concrete Pavements

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- Tunnels are designed for 150 years.

- Bridges are designed for 50 years.

- Why are pavements designed for 20 years?
• Both asphalt and concrete pavements are designed for 20 years, based on projected traffic.
• Asphalt is resurfaced after 8-14 years, and, in many cases, carry well below the 20-year design traffic.
• Most concrete pavements outlast their design life before 1st rehabilitation, and carry much higher traffic than projected.
Concrete Pavement Longevity (1)

➢ AASHTO design produces conservative thickness designs.
➢ Concrete strength is much higher than specification requirement.
➢ Joint spacing is shorter, joint width is narrower, and less expansion joints.
➢ Use of Dowels in joints.
➢ Sealed joints and more permeable support layers minimize trapped water beneath the pavement.
➢ More automation in the construction.
Concrete Pavement Longevity (2).

➢ Uniformly placed and compacted base/subgrade & attention to drainage.

❖ Above factors produce less critical stresses responsible for premature cracking, much longer fatigue life & smoother, quieter pavements.

❑ These conditions produce long-life concrete pavements requiring minimum, if any, rehabilitation.
Examples of Long-life Pavements

- I-75 Tampa – 32 yrs.
- US 1 Whitetopping – 30 yrs.
- US 17 Deland > 75 yrs.
- Brickell Ave. Miami > 75 yrs.
It is time to consider 50-year concrete pavements!
50-Year Concrete Pavements

❖ Highest quality concrete pavements. Would require minimum, if any, rehabilitation, in 1st first 30 years of service life.

❖ Used in select highways/roads/streets that carry heavy traffic. (Department would set project selection criteria)

❖ Initially, would be most suited for PPP and DB projects.

❖ Justified higher initial cost based on longevity & cost savings in maintenance, rehabilitation, traffic delays and accident prevention.
Design Requirements

➢ Design firms to demonstrate high level of experience in designing major concrete pavements

➢ The Department would be open/encourage value engineering and innovative and verifiable designs.

➢ Pavement thickness, support layer material & jointing details must promote low pavement stresses, long fatigue life, high drainability, and long-term smooth and quiet surface.

➢ Independent review of the design by the Department and/or a third party consultant to assure constructability & long-term performance.
Construction Requirements

➢ Contractors must demonstrate experience in having successfully constructed major concrete paving projects.

➢ The Department would be open to value added proposals and proven innovative construction methods.

➢ Construction & concrete specifications would be modified to include higher quality and advanced testing requirements. Industry and Department would collaborate.

➢ More quality control on paving equipment, precision surface finish, timely joint-sawing, and emphasis on curing.

➢ Greater emphasis on QC tests for concrete mix properties, dowel alignment, thickness, and surface smoothness.

➢ Protocol for slab replacement and other immediate actions in case of premature cracking or other paving deficiencies.
Concrete Mix For Long-life Pavements (Recommended)

- ≥ 4000 psi
- 500 – 600 lb w/SCMs
- Well-graded total aggregate system. (Shilstone method)
- ≤ 0.45 W/C
- Slump 1.5”-2” (slipform)
- Shrinkage test & limits
- Coefficient of thermal expansion test
Quality Issues in Construction of Long-Life Pavements
Avoid Mix Segregation During Paving
Stringless Control System of Paving Machine
Stringless Paving
QC of paving machine with dowel/tie bar implants to avoid misalignment mishaps
Surface Profile Measuring Device
Proper Curing

• Apply as soon as texturing is complete.
• Complete and full coverage of surface and sides.
• Avoid using hand held sprayer.
• Spray water intermittently for 1st 48 hours.
Maturity Device to determine joint sawing time

Top: Joint Saw Damage due to Sawing too Early. Bottom: Joint Sawed later with no Raveling.
Narrow vs. Wide Joints

Narrow joints ≤ ¼” produce quieter pavements

Joints > ½” generate noise for life
Critical Quality Issues in Paving

- Proper base preparation
- Ensure dowel alignment
- Stringline management & control
- Consistent concrete mix properties at plant
- Steady supply of concrete at paver
- Consistent concrete workability at paver
- Proper operation of paving equipment
- Controlled density of concrete – just the right vibration energy
- Well Monitored dowel/tie bar implant system and proper alignment
- Well trained and experienced workers & professionals
Thank You