Cuyahoga County Engineer’s Office

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County Engineer

Cuyahoga County Constructs a Perpetual Pavement

Presented by:
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The Project Was Designed and Constructed as a Perpetual Pavement
Perpetual Pavement: A Quick Primer

► From FPO Website:
  - ...the concept produces a deep-strength asphalt pavement that can resist structural fatigue for a long time (at least 50 years)...

► From Asphalt Pavement Alliance (APA):
  - ... paving design process, that with routine maintenance, extends the useful life of a roadway to half a century or more.
Perpetual Pavement: A Quick Primer

►► How it Works:

- High Performing Surface Course (3”)
- Rut Resistant Upper Layers (?”)
- Fatigue Resistant Asphalt Base (3”-4”)

Perpetual is a Big Word!

- PERPETUAL Pavement
- SUPERpave
- SMOOTHseal
- Warm Mix Asphalt
Perpetual is a Big Word!

►► I had a couple of questions:

- Perpetual: Is it just marketing?
- Can you really build an asphalt pavement that lasts 50 years?
- I KNOW we can build a concrete pavement that lasts 50 years!
Wilson Mills Road - 1958

9” Reinforced Concrete Pavement
Wilson Mills Road - 1987
3” Asphalt Overlay
Wilson Mills Road - 2007
Wearing Course Removed
3" Asphalt Overlay
Perpetual is a Big Word!

►► OK, we can build a concrete pavement that meets the definition of “perpetual”.

►► Hey, it needed the help of some asphalt didn’t it!

►► But, can we build a long-life full-depth asphalt pavement?
Fitch Road - 1953
Original Construction
Fitch Road - 1953
2-1/2” Asphaltic Surface Course T-50
5” Insulation Course
6” Subbase
Fitch Road - 1989
Operations Resurfacing Program
Fitch Road - 1989

3” Mill and Fill

Structural Shoulder Construction
Fitch Road - 2002
Operations Resurfacing Program
Fitch Road - 2002

3” Mill and Fill

More Structural Shoulder Construction
Quick Review

- Perpetual Pavement = 50+ Year Useful Life
- Multiple Asphalt Layers Designed Mechanistically to Resist Long-Term Structural Problems Such As Fatigue and Rutting
- History Has Shown That This CAN Be Accomplished With BOTH Concrete AND Asphalt Pavements!
Project Overview

- Cedar Road Reconstruction and Widening
- From Brainard Rd. to Lander Rd.
- In the Cities of Lyndhurst, Mayfield Heights, and Pepper Pike
Project Overview

- Design and Construction Managed by the Cuyahoga County Engineer’s Office
- Plans Prepared by DLZ
- Design Assistance Provided by Flexible Pavements of Ohio
- Contractor: Burton Scot Contractors, LLC
- Bid Amount: $5,160,899.00
Project Overview

► Approximately 0.7 Miles of Full-Depth Full-Width “Perpetual Pavement” Between Brainard Rd. and Lander Rd.

► Some Composite Pavement West of Brainard

► Some Composite Pavement on Brainard

► Some Composite Pavement on Lander
Project Overview

► New Lane Configuration Varies and Isn’t Really Important Here

► Project Also Includes:
  - Sanitary Sewer
  - Storm Sewers and Culverts
  - Sidewalk
  - Traffic Signals
Conventional Asphalt Pavement

- Pavement Type Selection: Decision Made Early On. 2002 or 2003?

- Choice was Full-Depth Flexible.

- "Perpetual Pavement" Was (practically) Unknown
Conventional Asphalt Pavement

- DLZ Provided a Conventional Full-Depth Flexible Pavement Design

- Used All the Regular Parameters:
  - Current ADT (22676)
  - Design ADT (23421)
  - Trucks 5%
  - B:C Ratio 2:1
  - Directional Distribution (57% Eastbound)
  - Mr 7200 PSI (From Geotechnical Report)
  - CBR 6 (From Geotechnical Report)
  - G.I. 8 to 11 (From Geotechnical Report)
Conventional Asphalt Pavement

Follow the Design Guidelines in Section 200 and 400 of the ODOT Pavement Design & Rehabilitation Manual
Conventional Asphalt Pavement

The Result: Design Structural Number: 4.5

- 448 AC Surface  1.25” x 0.35 = 0.44
- 448 AC Intermediate  1.75” x 0.35 = 0.61
- 302 Bitum. Agg. Base  9” x 0.35 = 3.15
- 304 Aggregate Base  6” x 0.14 = 0.84
- Total Pavement Structure  18” = 5.04
Perpetual Pavement

► OK, Finally Let’s Talk About Perpetual Pavement!

► We had DLZ Talk To Flexible Pavements of Ohio

► Flexible Pavements of Ohio Turned to Their Own Experts to Provide a Perpetual Pavement Design
Perpetual Pavement

The Resulting Perpetual Pavement Design:

- 1.5” 442 AC Surface Course, 12.5 mm Superpave Type A (446), PG 70-22M
- 1.75” 442 AC Intermediate Course, 19mm Superpave Type A (446), PG 70-22M
- 4.75” 302 Bit. Agg. Base, PG 64-22 Compacted to 93% Minimum Density
- 4” 302 Bit. Agg. Base, PG 64-22 Designed at 3% Air Voids, Compacted to 94% Minimum Density
- 6” 304 Aggregate Base
- TOTAL PAVEMENT STRUCTURE = 18”
Perpetual Pavement Cost Factors

- But Could We Afford the “Good Stuff”? 

- Flexible Pavements of Ohio Estimated Perpetual Pavement to Be 10% More Than Conventional Full-Depth Flexible Pavement
## Perpetual Pavement Cost Factors

- **Cost of Perpetual Pavement (From Cedar Rd. Bid Tabs)**
- **Area of Perpetual Pavement = 22,464 S.Y.**

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Description</th>
<th>Cost</th>
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</thead>
<tbody>
<tr>
<td>Item 442 1-1/2” Surface</td>
<td>$121,680</td>
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<tr>
<td>Item 407 Tack for Int.</td>
<td>$1,864</td>
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<td>Item 442 1-3/4” Intermediate</td>
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<tr>
<td>Item 302 4-3/4” 93% Min. Density</td>
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<td>Item 407 Tack</td>
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<td>Item 302 4” 3% Air, 94% Den.</td>
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<td>Item 408 Prime Coat</td>
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<td>Item 304 6” Agg. Base</td>
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<td>Item Spl. Geotextile Fabric</td>
<td>$28,080</td>
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<td>Item 204 Subgrade Compaction</td>
<td>$33,699</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$995,645</strong></td>
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</table>
Perpetual Pavement Cost Factors

- Total Bid Price = $5,160,899.00
- Total Cost of Perpetual Pavement = $995,645*
- So a 10% Premium for Perpetual Pavement Means We Paid About $100,000 More.
- $5,160,899/$5,060,899 = 102%
- Therefore, We Can Assume That We Paid a 2% Premium Over Total Cost of Project.
Perpetual Pavement Cost Factors

Let’s Compare to Conventional Full-Depth Flexible

- DLZ Had Provided a Pavement Design for Conventional Full-Depth Flexible Pavement.

- Our Cedar Rd. Project Contained Conventional Pavement Courses Such as 448 Intermediate and 448 Surface.

- The Only Bid Item Not Available in the Cedar Rd. Contract Was the Conventional 302 Bituminous Aggregate Base.
Perpetual Pavement Cost Factors

► Let’s Compare to Conventional Full-Depth Flexible

- Cedar Rd.: 442 Surface 12.5 mm Type A (448) – 936 C.Y. @ $130.00
- Cedar Rd. 448 Surface Type 1 – 780 C.Y. @ $118.00
- Cedar Rd. 442 Intermediate 19mm Type A (448) 1092 C.Y. @ $120.00
- Cedar Rd. 448 Intermediate Type 2 – 1092 C.Y. @ $105.00
Perpetual Pavement Cost Factors

Let’s Compare to Conventional Full-Depth Flexible

- Fortunately For Us, We had Bid a Conventional Full-Depth Flexible Road Project at Around the Same Time.

- This Project Contained 302 Bituminous Aggregate Base.

- Bassett-Crocker Rd.: 302 Bit. Agg. Base – 5617 C.Y. @ $100.00

- Cedar Rd.: 302 Bit. Agg. Base 3% Air Compacted to 94% Min. Density – 2495 C.Y. @ $93.00

- Cedar Rd.: 302 Bit. Agg. Base Compacted to 93% Minimum Density – 2964 C.Y. @ $93.00
Perpetual Pavement Cost Factors

- **Let’s Compare to Conventional Full-Depth Flexible**

  - Item 448 1-1/4” Surface       $ 92,040
  - Item 407 Tack for Int.       $  1,864
  - Item 448 1-3/4” Intermediate $114,660
  - Item 407 Tack for Int.       $  1,864
  - Item 302 9” Bit. Agg. Base   $561,700 ***
  - Item 408 Prime Coat          $  23,667
  - Item 304 Agg. Base           $142,272
  - Item Spl. Geotextile Fabric  $  28,080
  - Item 204 Subgrade Compaction $  33,699

- **TOTAL**                     $999,846
Cost Factors

► What About --- Gulp! --- CONCRETE??

► Our (County Standard) Minimum Thickness Would Be 10”

► Burton Scot Bid $42.50 / sy for 9” RCP

► On Crocker-Stearns (10” RCP), Low Bidder = $39.50 / sy

► Average of All Crocker-Stearns Bidders = $47.00 / sy
Cost Factors

Cost of Concrete Pavement

- Item 451 10” RCP: $1,055,808
- Item 304 6” Agg. Base: $142,272
- Item Spl. Geotextile Fabric: $28,080
- Item 204 Subgrade Compaction: $33,699

TOTAL: $1,259,859

$1,259,859 / $995,645 = 127%
Construction Administration Concerns

► Testing

- Plans Called for Item 302 Base Course To Be Placed With a Density Requirement

- County Had No Experience Testing for Density Due to Use of Item 448 on County Jobs

- Flexible Pavements of Ohio Suggested Use of ODOT SS 1055 for Both Base Courses and Intermediate / Surface Courses
Construction Administration Concerns

Other Considerations

- Both Surface and Intermediate Courses Utilize PG 70-22M Binder
- Normal ODOT Specification (442.04) Calls for PG 64-22 Intermediate Course
Construction Administration

Concerns

► Other Considerations (Cont.)

- Subgrade Preparation
- Utility Issues
- Maintenance of Traffic – Elevated Pavement Placement Temperatures