CASE STUDY
ELIZABETH CITY REGIONAL AIRPORT
APRON REHABILITATION

May 2018
Dion J. Viventi, PE
Tim Gruebel, PE
PROJECT OVERVIEW

- Owners
- Funding Partners
- Design Team
DESIGN TEAM

- Prime Consultant: Parrish and Partners
- NCDOT Services: Atkins - Survey and Geotechnical Coordination
  - MA Engineering - Survey
  - Terracon - Geotechnical
- Sub Consultant: Hyman and Robey - Drainage, Sedimentation & Erosion Control
EXISTING CONDITIONS

- Fixed Boundaries on all sides
- 25,250 SY
- Poor Pavement Condition
- Varying Pavement Sections
  - Asphalt: 2” - 10”
  - Stone Base: 6.5” - 7”
  - Subgrade: Poorly Graded Sand to Fat Clay
- Drainage Conditions
  - Standing water
  - Undersized Drainage System
  - Not Enough Inlets
- Utilities
  - FAA VORTAC Cables
EXISTING CONDITIONS
DESIGN PARAMETERS

- Fleet Mix - Cessna to C-130
- Fueling Operations
- 20 Year Design Life
- Layout Revision to New Design Standards
- Revised Drainage and Grading
- Additional Considerations
  - LED Lighting
  - Flush Mount Fire Hydrant
## DESIGN PARAMETERS

### No. | Name | Gross Wt. (lbs) | Annual Departures | % Annual Growth
---|---|---|---|---
1 | Skylane-1-82 | 3,110 | 1,771 | 2.00
2 | Seneca-II | 4,570 | 1,007 | 2.00
3 | KingAir-B-100 | 11,500 | 120 | 2.00
4 | Citation-V | 16,500 | 121 | 2.00
5 | Falcon-50 | 38,800 | 97 | 2.00
6 | Gulfstream-G-IV | 75,000 | 83 | 2.00
7 | Sngl Whl-75 | 75,000 | 20 | 2.00
8 | Sngl Whl-45 | 45,000 | 20 | 2.00
9 | C-130 | 155,000 | 20 | 0.00

### Notes:
- *Modeled as single wheel main gear at 45,000lb
- **Modeled as single wheel main gear at 75,000lb

### KECG Ramp Rehabilitation

#### Pavement Design Fleet Mix

![Pavement Design Fleet Mix Diagram](image-url)

- **Cessna 182 (2600lb)**: 54%
- **Piper Seneca (4500lb)**: 31%
- **Beech King Air (10,900lb)**: 3%
- **Cessna Citation - V (16,300lb)**: 2%
- **Falcon 50 (38,800lb)**: 1%
- **Gulfstream G-IV (75,000lb)**: 1%
- **C-130 (155,000lb)**: 0%
ALTERNATIVES ANALYSIS

- **Alternative A: Asphalt Overlay**
  - Milling the existing asphalt to scarify the surface in order to avert slippage of new asphalt.
  - Application of tack coat.
  - Placement of two (2) 2.5” lifts of new asphalt (P-401) for a total new asphalt thickness of 5”.

![Diagram of Alternative A - Bituminous Pavement Overlay]
ALTERNATIVES ANALYSIS

- Alternative B: PCC White Topping
  - Placing a new 9.5" thick Portland Cement Concrete (PCC) surface over the existing asphalt surface.
ALTERNATIVES ANALYSIS

- **Alternative C: New PCC with Cement Treated Base**
  - Removal of existing pavement and base.
  - Placing a new 5” thick Cement Treated Base (CTB).
  - Placing a new 9.5” thick Portland Cement Concrete (PCC) surface.
ALTERNATIVES ANALYSIS

- Alternative D: New PCC with FDR Base
  - Uniformly pulverizing and blending the existing asphalt, base, and subgrade to a depth of approximately 18” using specialty equipment.
  - Removal of Excess Material and Grade Adjustments to Leave 8” Uniform FDR Base
  - Application of Portland Cement and blending with pulverized material and water.
  - Placing a new 9” thick Portland Cement Concrete (PCC) surface.
ALTERNATIVES ANALYSIS

- Criteria - Scoring
  - Scale 1 to 5 (Highest Score Wins)
  - Alternative D Provided Greatest Flexibility
  - Reduced Need for New Aggregates (Very High local Cost)

<table>
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<tr>
<th>Criteria</th>
<th>Alt-A</th>
<th>Alt-B</th>
<th>Alt-C</th>
<th>Alt-D</th>
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<td>Longevity</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>4</td>
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<tr>
<td>Fuel Resistance</td>
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<td>4</td>
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<td>Tolerance to Grade Corrections</td>
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<tr>
<td>Cost</td>
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<td>1</td>
<td>3</td>
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<td>Sustainability/Rcycled Material</td>
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<td><strong>17</strong></td>
<td><strong>22</strong></td>
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CONSTRUCTION TEAM

- CA and Inspection: Parrish and Partners
- Prime Contractor: Barnhill Contractors
  - FDR: Slurry Pavers
  - Paving: McCarthy Improvement
  - Electrical: B&M Electrical Contractors
  - Concrete Vendor: CRMP Inc.
CONSTRUCTION PHASING

Phase I
CONSTRUCTION PHASING

Phases II & III
CONSTRUCTION PHASING

Phase II

Phase III
PULVERIZATION

- Varying Depth Based on New Grades
- Removal of Excess material
- Undercut of Unsuitable and Backfill Sand
PULVERIZATION
GRADING & DRAINAGE

- Whole New System Configuration
- 87,500 LB Load Requirement for Inlets & Grates
- Class V RCP
GRADING & DRAINAGE
CEMENT TREATMENT, COMPACTION, & ROLLING

- FAA P-301 Modified (Modulus of 250,000 PSI)
  - Greg Dean, Stan Bland, Andrew Johnson
- The minimum compressive strength of soaked specimens shall be 300 PSI at 7 days, and the maximum compressive strength shall be 400 PSI at 7 days. The samples compressive strength should increase with both age and increase in cement content.
- Initial Mix Designs at 4%, 5%, and 6% Cement Content
  - Compressive Too High
- Final Mix Design - 3% Cement Content
- Huge Cost Savings!
- 2 Hour Limit to Work Base
CONCRETE PAVING

- 650 PSI Flexural Strength
- Typical 0.5% to 1.5% Cross Slope
- Slip Form Paving of Lanes
- Hand Forming of Irregular Areas
CONCRETE PAVING
REINFORCEMENT

- W5.5 WWF for Irregular Shaped Slabs
- 1" Dowels Along Perimeter
- Dowel baskets pins had to be hammer drilled in due to rigidity of FDR base
LED LIGHTING

- Musco Green Generation LED
- First use in NC Aviation
- Brighter - Less Wattage
- Low Maintenance 100,000 Hour Bulb Life
LED LIGHTING
QUALITY CONTROL & QUALITY ASSURANCE

- Trimat Testing (QA)
  - FDR P-301 Nuclear Gage with Pills Tested per NCDOT Spec
  - PCC P-501 Cured beams
  - Subgrade P-152
QUALITY CONTROL & QUALITY ASSURANCE
CONSTRUCTION ADMIN / INSPECTIONS

- Owners Resident Project Representative
  - Darrick Olinger
- Owners Engineer
  - Tim Gruebel, PE
SAVINGS

- Cement Content
- Aggregate
- On & Offsite Hauling
CRITICAL ISSUES

- Tenant Coordination Throughout Design & Construction
- Coordination with Users and FAA
- Contractor Engineer Relationship
  - Allow Flexibility in Phasing
  - Communication
- Evaluation of Material Suppliers
  - Single Cement Provider
  - No Aggregate Sources Nearby
- QA Survey Verification
- Staging and Dust Control Near Aircraft
- Provide for Contingencies Such as Undercut and Subgrade Replacement
QUESTIONS?

Thank You