Runway 9-27 Rehabilitation with FDR Treatment

Purdue Road School

PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDOT
INDIANA DEPARTMENT OF TRANSPORTATION

Agenda

- Review Problem Statement and Sponsor's Goal
- Consideration of Alternatives by Airport Authority
- History/Existing Conditions
- Field Studies: Traditional vs New Technologies
- Forensic Studies Accomplishments
- VPZ Selection Process
- Full-Depth Reclamation Treatment (General)
- Full-Depth Reclamation Treatment at VPZ
- Project Considerations/Lessons Learned
- Industry Initiatives

PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDOT
INDIANA DEPARTMENT OF TRANSPORTATION

Problem Statement and Sponsor's Goal

Problem:

Existing runway and taxiway pavements within the project area would historically deteriorate at a faster rate than design life expectance would project

Goal:

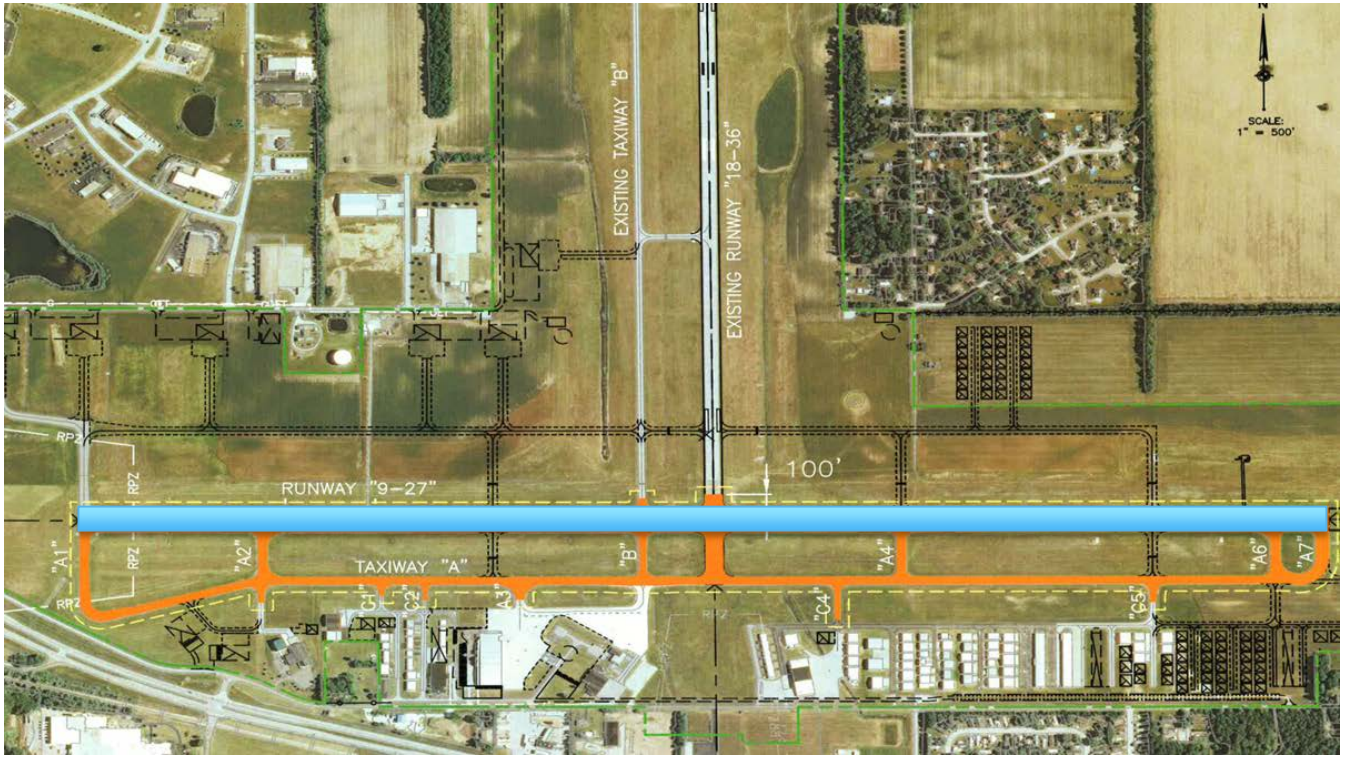
Design new reconstructed or rehabilitated pavements that meet or exceed expected design life with minimal maintenance

PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDOT
INDIANA DEPARTMENT OF TRANSPORTATION

VPZ Runway Project Limits



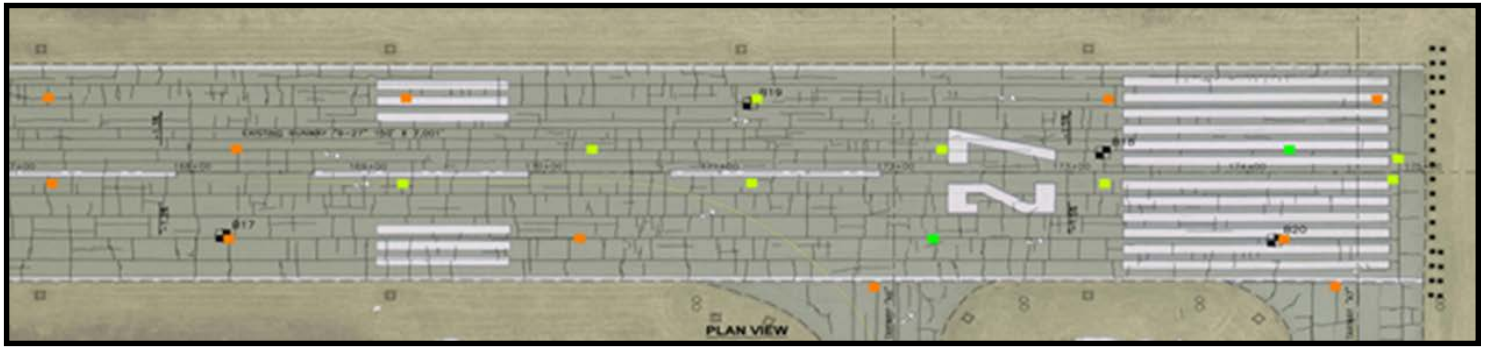
PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDIANA DEPARTMENT OF TRANSPORTATION
INDOT

Airport Authority:
Consideration of Alternatives

How can we apply modern technology to improve and more efficiently manage pavements?



PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDOT
INDIANA DEPARTMENT OF TRANSPORTATION

The Decision to be Made (AIP Handbook)

- **Rehabilitation** is a more comprehensive restoration of an original functionality that results in a piece of pavement, piece of equipment, or building with a useful life of at least 10 years
- **Reconstruction** is a complete restoration of an original functionality that results in a virtually new piece of pavement
  - **FDR (Modification of Standards)**

PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDOT
INDIANA DEPARTMENT OF TRANSPORTATION

History/Existing Conditions

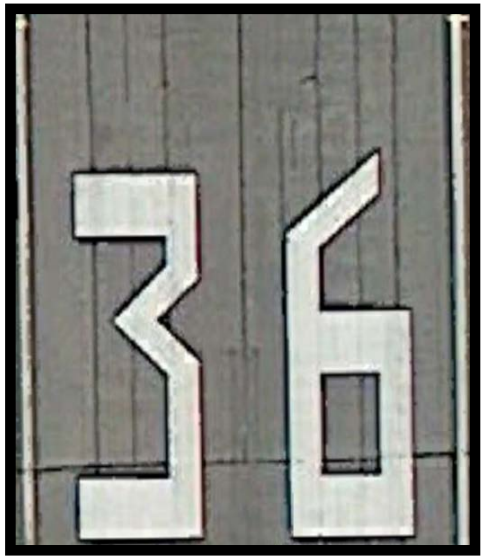
- 6,000’ Runway 9-27 originally placed in 1966 (17 years)
- 1st Overlay 1983 (16 years)
  - Loss of centerline crown (16”)
  - Remanufactured materials (surface brittle)
- 2nd Overlay 1999 (15 years)
  - Slag Aggregate HMA
  - Severe cracking…again

PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDOT
INDIANA DEPARTMENT OF TRANSPORTATION

History/Existing Conditions



1997 versus 1999 Pavements

PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDOT
INDIANA DEPARTMENT OF TRANSPORTATION

VPZ Surface Comparisons

Similar Pavement: Runway 18-36

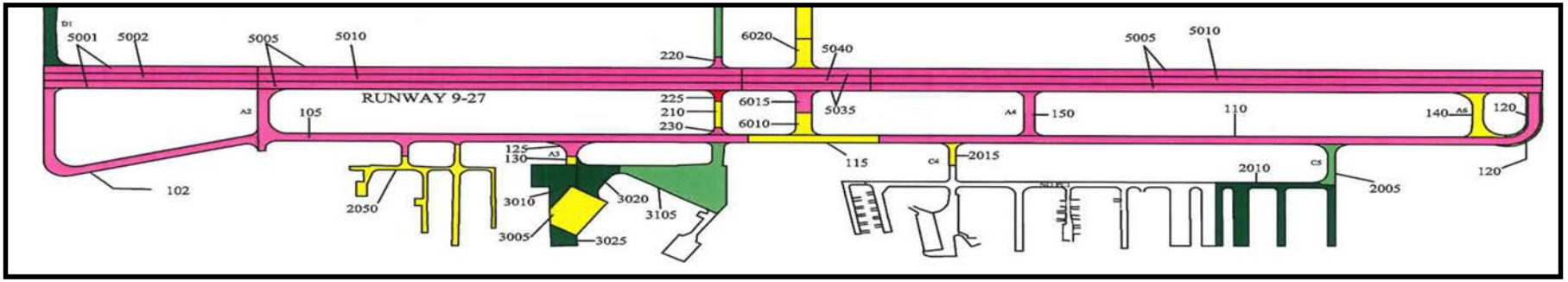
Failing Pavement: Runway 9-27

PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDOT
INDIANA DEPARTMENT OF TRANSPORTATION

INDOT PCI Reports



Minimum Service Level PCI Score:

- Runway = 60 & Taxiway = 55

Runway 9-27:

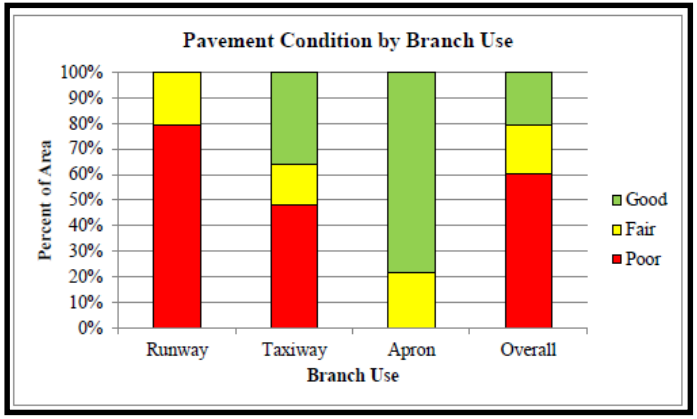
- Between 41 and 55 (Poor)

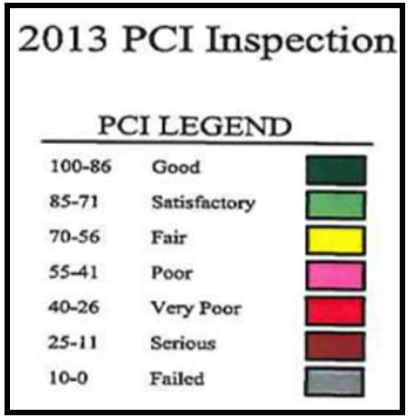
Taxiway A:

- Between 41 and 55 (Poor)

Cause for Distresses:

- 50-70% age related
- 30-45% materials & load related



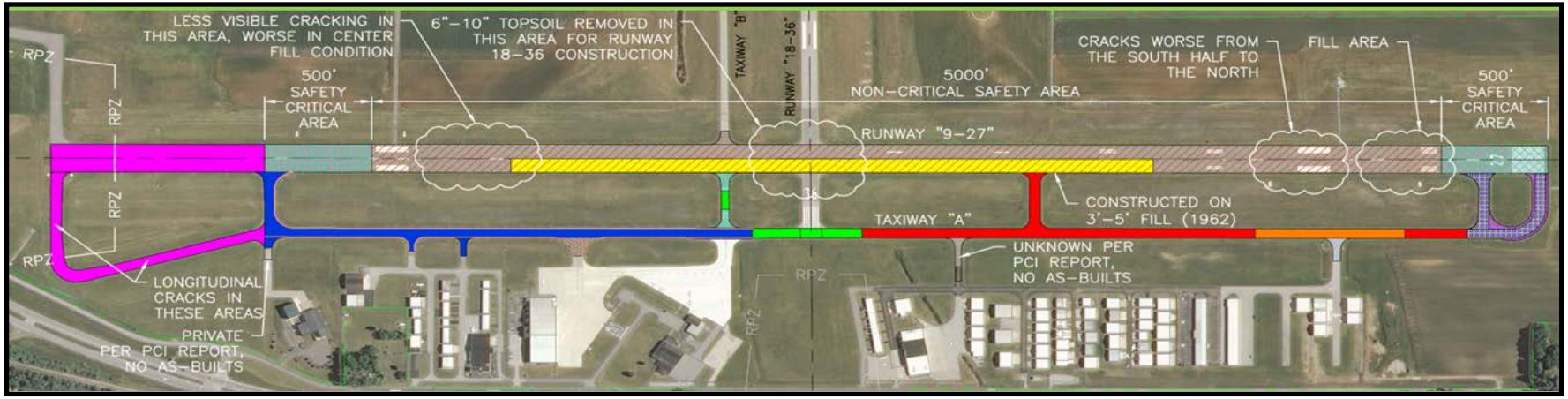


PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDIANA DEPARTMENT OF TRANSPORTATION
INDOT

VPZ Pavement Build-Out History



Historic Performance:

- Pavements installed with multiple, variable materials and pavement sections between 1962 and 1999
- Pavements not reaching the anticipated Life Cycle
- Partial underdrain installation

PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDOT
INDIANA DEPARTMENT OF TRANSPORTATION

Field Studies:
Traditional vs New Technologies

PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDOT
INDIANA DEPARTMENT OF TRANSPORTATION

Why Mobile Mapping over Survey?

Technology Benefits:

- Increased airfield safety
- Reduce runway closure times
- Baseline for future assessments/analysis (crack, patch plan with locations and quantities)
- More detailed, high resolution dataset
- Geospatially referenced – aGIS supported
- Faster collection methods
- Future data extraction without additional field visits (lights, signs, markings, etc.)

PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDOT
INDIANA DEPARTMENT OF TRANSPORTATION

Why VPZ and Mobile Mapping?

- Multiple imagery of existing conditions prior to construction (FAA Requirements) – baseline
  - This includes crack and patch plan
- More accurate cross section and transitional section data
- Would best supplement NDT
  - Image overlay with low-strength or distresses areas
- Can be merged with existing Mobile Data
- More feature information – GIS Layers – Bang for $$$

PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDOT
INDIANA DEPARTMENT OF TRANSPORTATION

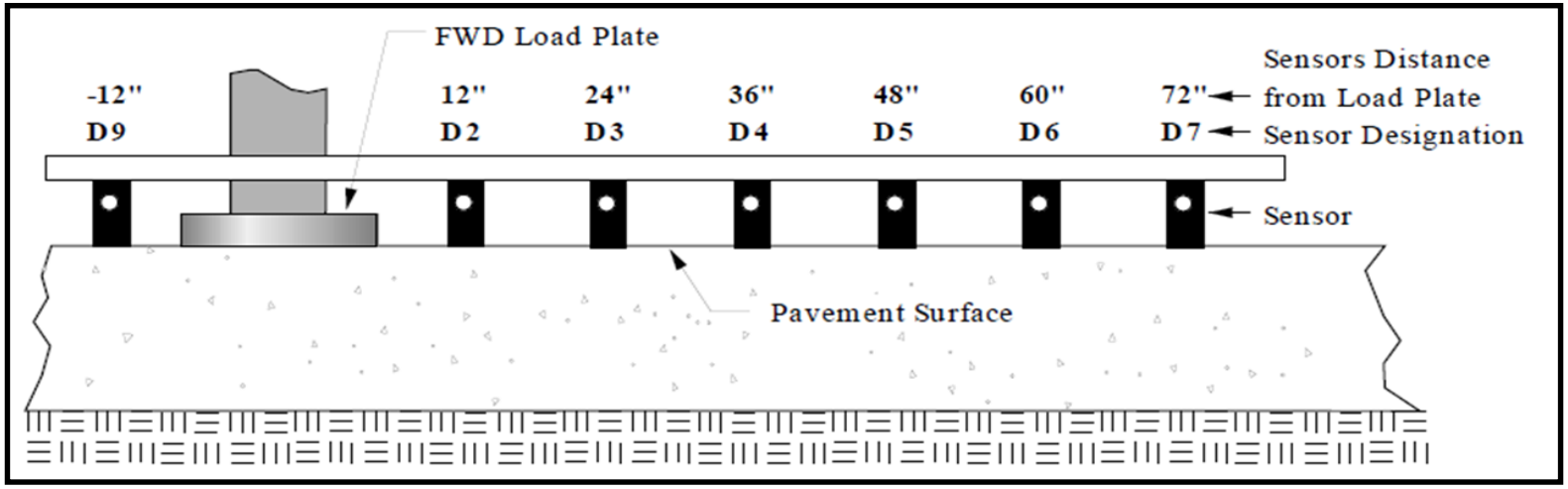
Supplemental Testing:
Why Non-Destructive Testing (NDT) over Coring?

PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDIANA DEPARTMENT OF TRANSPORTATION
INDOT

Non-Destructive Testing (NDT) using Falling Weight Deflectometer (FWD)



- Measures pavement surface deflections after applying a static or dynamic load to the pavement for material, strength information
- Provides GPS Relative Layer Strengths

PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDIANA DEPARTMENT OF TRANSPORTATION
INDOT

Why NDT and VPZ?

- PCI's may not be telling the whole story
  - Environmental and subsurface distresses
- Structural or Overload Concerns
  - "Thin" Asphalt Section, Limited As-Builts, Heavy Loading, Multiple Variable Pavement Sections
- Construction Cost Concerns
  - More design input will improve evaluation of alternatives, their justification and isolated areas
- Runway Closure Times
  - Traditional: 13-14 days
  - NDT: 6-7 days

PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDOT
INDIANA DEPARTMENT OF TRANSPORTATION

Time/Safety Difference: MMS/NDT vs Traditional

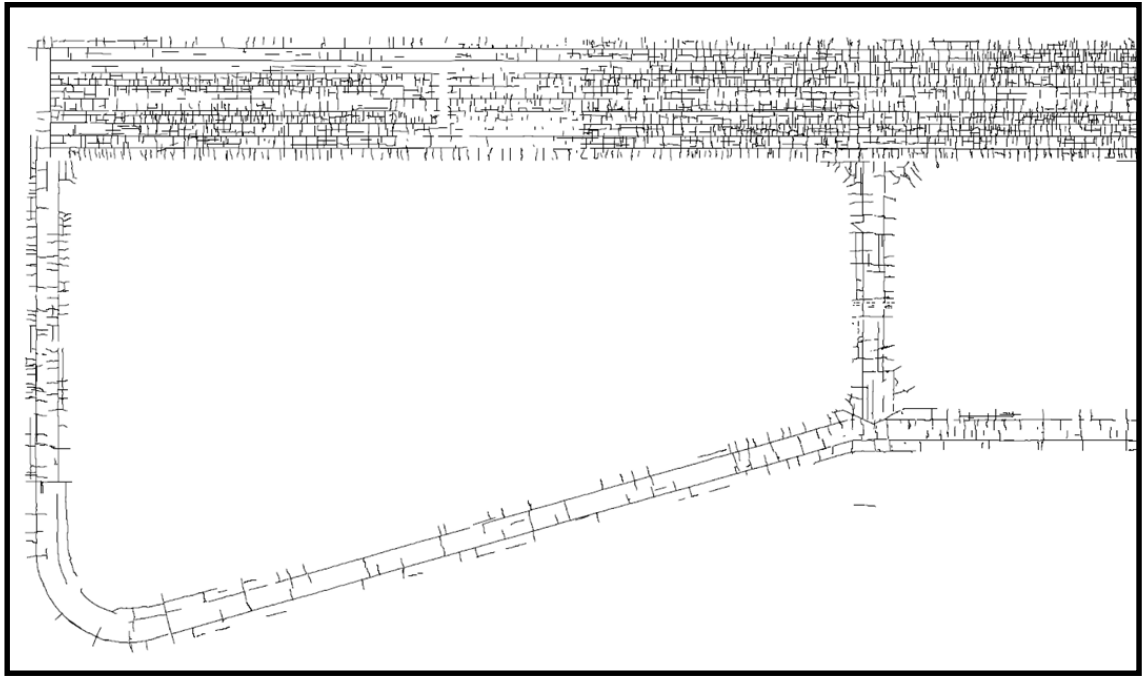
- MMS/NDT
  - Survey Targets/Scan — 2 Days Total 1 Each (15-min PPR)
  - Geotechnical — 30 cores performed at night (3 nights)
  - NDT — 3 Night Closures
  - Distress Map — 3-4 Office Days
  - **TOTAL Runway Closure Days** — **5 Days**
- Traditional
  - Survey — 4 Days Total (15-min PPR)
  - Geotechnical — 90 cores performed at night (5 nights)
  - Distress Map — 2 Field Days and 5 Office Days
  - **TOTAL Runway Closure Days** — **11 Days**

PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDOT
INDIANA DEPARTMENT OF TRANSPORTATION

VPZ Cracking Conditions



- 202,725 LF of Mapped Cracks
- 82% on Runway, 18% on Taxiway

PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDOT
INDIANA DEPARTMENT OF TRANSPORTATION

Forensic Study Accomplished

- Identification of the problem
- More accurate detail of cracking
- Allowed a forum of discussion between the stakeholders (Airport, FAA, INDOT)
- Justification as to the decision to rehabilitate or reconstruct
- Conventional Funding (FAA, INDOT)
- Leverage of additional funding (County, RDA)

PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDOT
INDIANA DEPARTMENT OF TRANSPORTATION

VPZ Selection Process

Repair Options	Object. #1 (20 pts) Provide Good 20-year Perfor.?	Object. #2 (20 pts) Length of Runway Closure, Ease of Construction	Object. #3 (20 pts) Amount of Future Maintenance & Rehab Work	Object. #4 (15 pts) Proven Technology	Object. #5 (15 pts) Base & Subgrade Not Exposed Removed or Replaced	Object. #6 (10 pts) Acceptable Performance Including Reflective Cracking Mitigation	Total Points from Object. 1 to 6	Option Rank
1	20	15	20	15	7	10	87	2
2	20	13	20	15	7	10	85	3
3	19	18	18	15	12	9	91	1
4	20	8	20	15	12	10	85	3
5	10	20	12	15	15	4	76	5

Option 1 - Remove all AC layers and install new 9 inch P-401/P-403 section on existing limestone granular base

Option 2 - Remove all AC layers and install new 12 inch P-501 section on existing limestone granular base

Option 3 - Remove all AC layers western most 1,000 feet, mill and remove 8 inches of top AC layers for remaining 6,000 feet and install new 9 inch P-401/403 section on remaining existing AC layers and limestone granular base

Option 4 - Remove all AC layers western most 1,000 feet, mill and remove 9 inches of top AC layers for remaining 6,000 feet and install new 12 inch P-501 section on remaining existing AC layers and limestone granular base

Option 5 - Mill and remove 4 inches of top AC layers and install new 4 inch P-401 section on remaining AC layers and granular base

Primary Objectives:

- Construct an actual 20-year pavement
- Minimize runway closure as much as possible
- Minimize future maintenance/rehabilitation costs
- Apply a proven methodology
- Minimize subgrade exposure
- Minimize/Mitigate pavement distresses

Secondary Objectives:

- Minimize changes to pavement elevations
- Minimize disruptions at taxiway transitions
- Consider initial construction cost

Outcome:

- Option 3 was chosen and then modified to include Full-Depth Reclamation (FDR) treatment

PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDIANA DEPARTMENT OF TRANSPORTATION
INDOT

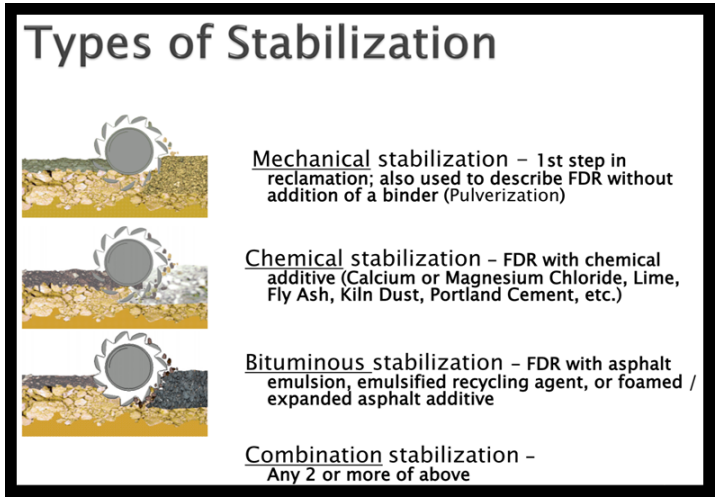
Full-Depth Reclamation (FDR) Treatment

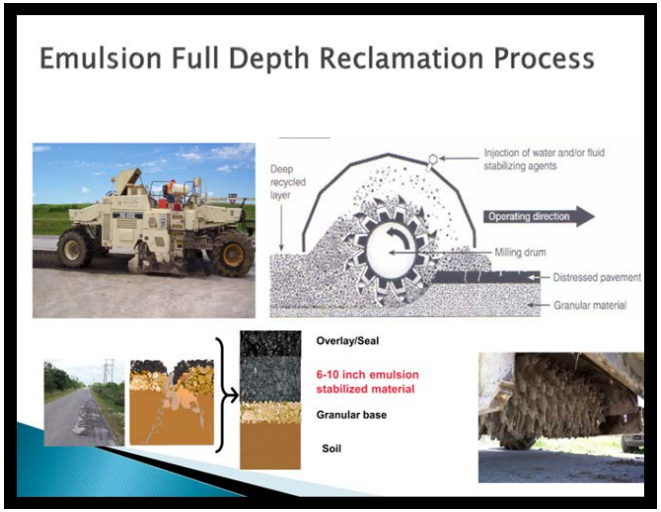
What is FDR?

- A pavement stabilizing solution that utilizes blended pulverized asphalt and base materials to provide a homogeneous structure.
- 3 Types:
  - Mechanical Stabilization
  - Chemical Stabilization
  - Bituminous Stabilization

Why do it?

- Stronger base
- More uniform base
- Eliminates subsurface distresses
- Reduces potential for infiltration
- Sustainable
- Cheaper than total reconstruction but provides similar-type structure
- Leftovers great for topping haul routes/access roads





PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

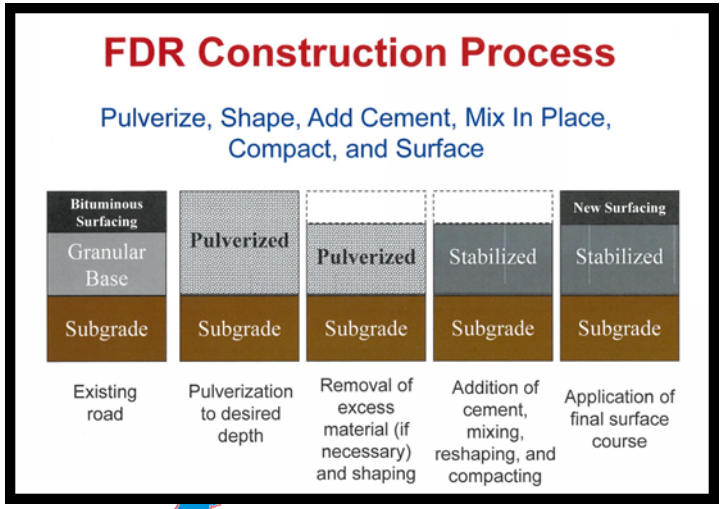
WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDIANA DEPARTMENT OF TRANSPORTATION
INDOT

FDR Treatment

What's the process?

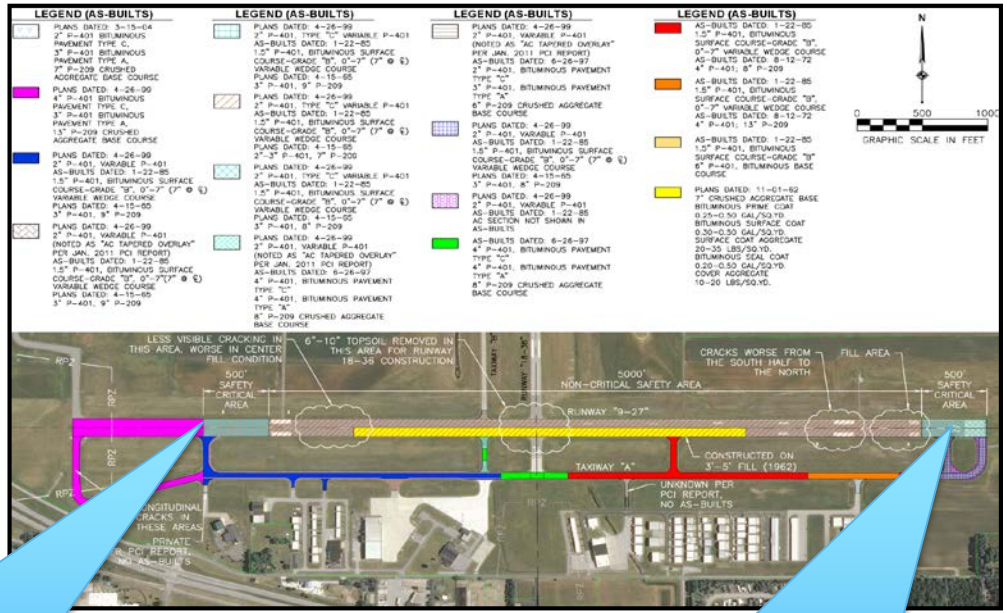
- Sampling
- Pulverization & Reshaping
- Distributing
- Mixing
- Compacting & Fine Grading
- Curing
- Paving

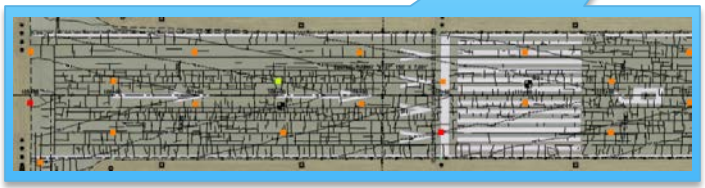


FDR Treatment at VPZ

Why FDR at VPZ?

- Multiple “Typical Sections”
- Exponential number of pavement distresses and structural decline
  - Typical AC Modulus values were very low for a 14-year pavement. Typical values should be greater than 500,000 psi whereas actual values ranged from 101,000 to 271,000 psi
- Subbase/Moisture concerns
  - NDT identified multiple weak areas
- Cheaper alternative than Full Reconstruction
  - Estimate: $8 Million vs $14 Million
  - Actual: $6.9 Million
- Provides full-depth structure
- Reduced long-term maintenance & life-cycle costs





PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDOT INDIANA DEPARTMENT OF TRANSPORTATION

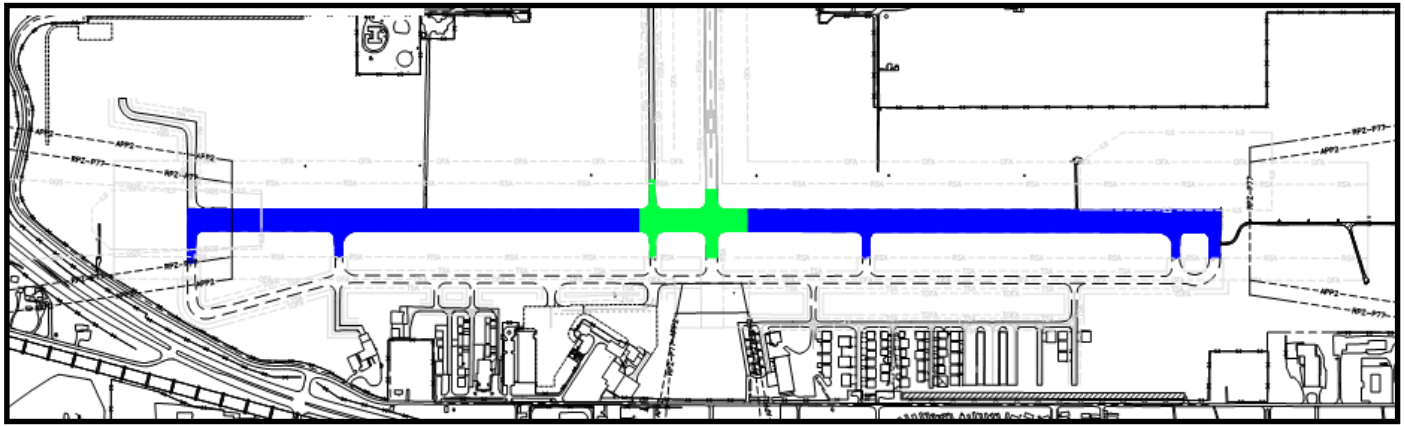
FDR Treatment at VPZ

FDR Design Parameters:

- **MODIFICATION OF STANDARDS**
- No Subgrade allowed in Mix
- Cement Content: 4-6%
- Elasticity Modulus: 250,000 psi
- 7-Day Compressive Strength: 300-500 psi

Runway Program Completion:

- Two (2) Phases of Construction
  - Phase 1: RW/RW Intersection out to RSAs
  - Phase 2: Remaining east & west portions



PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDOT
INDIANA DEPARTMENT OF TRANSPORTATION

Project Considerations/Lessons Learned

- Mix Designs are required to establish cement content
- Cement slurry should be considered where dust control is vital
- Designer should consider field-mixed proctors to test unconfined compressive strength
- Soils with over approximately 1,000 PPM of soluble sulfate should not be treated with an FDR method.
- Thicker lifts can decrease the integrity of the FDR base. 10” should be considered the maximum.
- Discuss Grade control
- Discuss Elasticity Modulus ranges:
  - 1-2% Cement: 15,000 psi
  - 3-4% Cement: 50,000-150,000 psi
  - 5-6% Cement: 250,000-500,000 psi
- Discuss timing of contractor mix design
- 7-Day Unconfined Compressive Strength Criteria:
  - INDOT RSP 413-R-634:
    - > 3” Overlay: 300 psi
    - 1.5-3” Overlay: 400 psi
    - < 1.5” Overlay: 500 psi
  - BYU Professor, Spencer Guthrie: 400-500 psi

PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDOT
INDIANA DEPARTMENT OF TRANSPORTATION

Industry Initiatives

- INDOT RSP 413-R-634 is considering some additional requirements for FDR Treatments. These are as follows:
  - Just In-Time Training (JITT) for field personnel
  - Compaction required until pad foot rollers leave cleat indentation less than 3/16”
  - Compaction required to continue until pneumatic tire rollers do not leave any wheel impressions
  - Weather limitations require FDR not performed below 50^{o} F and may restrict work when heat index grater than 100^{o} F
  - FDR required to be performed after May 1st and before October 1st

PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDOT
INDIANA DEPARTMENT OF TRANSPORTATION

Time Lapse Videos

Camera 1:
https://www.youtube.com/playlist?list=PLmuYdRh49akIsWncbgh2mrvvwMQ2MJ6iE

Camera 2:
https://www.youtube.com/playlist?list=PLmuYdRh49akIsWncbgh2mrvvwMQ2MJ6iE

PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDOT
INDIANA DEPARTMENT OF TRANSPORTATION

Questions?

PORTER COUNTY REGIONAL AIRPORT
Northwest Indiana's Premier Business and General Aviation Airport

WOOLPERT
ARCHITECTURE | ENGINEERING | GEOSPATIAL

INDOT
INDIANA DEPARTMENT OF TRANSPORTATION