SAME Rhein-Main Post Industry Insights from Jacobs

**Topic:** Airfield Planning, Design, and Construction Workshop (hosted by Jacobs)

**Presenters:**
- Matthew Kundrot, PE, Federal Program Director Aviation, Jacobs
- Joel Putterman, FAICP, CNU-A, Federal Planning Programs, Jacobs

**Learning Objectives:**
- Provide background on the critical elements of airfield planning, design and construction and consequence of failure of misunderstanding or misapplication of the operational requirements, constraints, and standards.
- Provide a working understanding of the necessary multi-disciplined aspects of Airfield Design and Construction for in-house design and review of contracted work efforts resulting in improved airfield project quality and value.
- The presentation will utilize practical examples from a range of DOD and civil airfield projects and conditions similar to the Europe District AOR.
Airfield Infrastructure Planning and Execution

- Modernization, Adaptability, and Mission Sustainability

Professional Education Session for:

SAME Rhein-Main Post

USACE Europe District, Wiesbaden, DE

17 October 2019
Agenda

• Safety Moment
• Introductions
• Airfield Planning, Design, & Construction
• Emerging issues for the F-35
• Questions

Please do not hesitate to ask questions at any time!
Don’t touch anything metal on an airfield.
There is no electrical protection from shock or electrocution.
CH2M and Jacobs are now one

- Serving industrial, commercial, and government clients across multiple markets
- Offices in 40+ countries
- Employs 50,000+ staff & craft personnel

Military Airfields are Critical Infrastructure and Core Focus
- Integrated Aviation, Planning, & Federal Practice Staff
Airfield Criteria Applies to:

Assault Strips
3,000’ by 60’

Major Runways
12,000’ by 300’

-Heliports are just very short runways
Ramstein Air Base: Aerial photo shows the evolution and transformation into an ILS Cat III airfield. Note “Hot Spots”
Spangdahlem Air Base: Expanding airfield and missions
Heliports may have helicopter runways or helipads that are just very short runways.
Army airfield capable to serve large transport aircraft
Lask Air Base, Poland: Improving for USAF and NATO operations. UFC, NATO, and Host Nation stds.
Airfield Planning – Key Elements

UFC 3-260-01, Chapter 2: Primarily used for new facilities
- Also applies to existing facilities, but not often utilized

Airfield planning should be the center of:
- Comprehensive Plans, Master Plans, Installation Development Plans
- Airfield requirements shown in Area Development/Activity Plans

Airfield planning is typically reactive
- Airfield is typically considered fixed
- Plans result from an announced action. The decision is already made

By contrast: Civilian airport plans are required to be pro-active. The DOD can apply pro-active planning but how plans are described must be different.
JB Andrews Airfield Recapitalization & Modernization Plan
Airfield Planning – Requirements

What airfield needs are we planning for?

New Mission or Weapons System Beddown: Airfield footprint and facility impact: Pavements, hangars, etc.

- KC-135 to KC-46, F-35 replacement of F-16, F-15, A-10
- UAS

New Initiatives driving plans

- Sustainability – Resiliency (Mission focus). Cyber and UAS Threats
- Modernization – Our stuff is old and obsolete
- Waiver reduction – Safety

Infrastructure recapitalization. Examples:

- Fix Kadena AB Plan, Rebuild America’s Airfield (Andrews)
Airfield Planning – Key Steps

Inventory Phase

- Operational personnel input through interviews
  - Airfield workarounds, shortcomings, mission impacts
- Existing conditions good and bad
  - Non standard conditions and waivers. What works well?
- Document the Requirement:
  - Apron parking, runways, hangars, fueling all justified by an aircraft or operational formula
  - Know how to document an exception based on mission requirement and who is the advocate
Airfield Planning – Existing Airfield

Establish the Baseline: The Airfield is the Center and Control

- Airfield Constraints and Setbacks
  - Runway airspace and lateral (wing tip) clearance areas
  - Land use controls: Clear Zones and QD arcs

- USAFE unique standards
  - UFC, NATO, ICAO, FAA

- Provides the starting point for airfield planning
  - Pressure for new facilities to encroach on the airfield clearance areas
  - Don’t make things worse: Obstructions, land use, future beddown space
Airfield Planning – Existing Airfield

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  - Runway airspace and lateral (wing tip) clearance areas
  - Land use controls: Clear Zones and QD arcs

- USAFE unique standards
  - UFC, NATO, ICAO, FAA

- Provides the starting point for airfield planning
  - Do no harm (to the mission): Do not create obstructions, and incompatible land uses for the existing and proposed airfield configuration.
Point Mugu Airfield Optimization Plan
Figure 4: Unusable Parking Areas at NAS Point Mugu
Airfield Planning – From Concepts to Action

Develop the Alternatives: Courses of Action (COAs)

Workshops necessary to develop COAs

- Contingency requirements often classified
- Adaptability is needed but not a planning or design standard

Typical COAs

- Minimum
- Full Compliance
- Practical Alternatives: Requires compromise and may require operational risk assessment and waivers. Requires operational understanding.

Select and Preferred Action

- Maximize mission capability within practical constraints but still do no harm.
Airfield Planning – Execution of the Plan

Identify the Preferred Action

- Publish and Execute the Plan

Execution of the plan may require enabling steps

- Increasingly the conditions of existing infrastructure are a constraint on implementing the plan
- Recapitalization of obsolete, deteriorated, and broken infrastructure needs a plan for execution as much or more than a new mission beddown
- More airfield plans require assessment of existing infrastructure
• Airfield Remarks:
  
  – RSTD: RY 01L/19R SOUTH END UNDERRUN/OVERRUN UNUSABLE DUE TO PAVEMENT DEGRADATION.

  – RSTD: ALL JET ACFT ARE ADVS TO TAXI S OF TWY SIERRA CNTRLN DUE TO PAVEMENT DEGRADATION.
Airfield Infrastructure Conditions - NAVAIDs
Airfield Infrastructure Conditions-Comm
Airfield Planning – Summary

• General Guidance in UFC 3-260-01
  • Each service has supplements and unique requirements

• Do not consider the airfield layout as fixed. Changes and improvements may provide a win-win.
  • An updated Airfield Development Plan should show the existing conditions, standard requirements, and means to mitigate non-standard and deficient conditions

• Requirements are changing and new aircraft are driving changes
  • Operations must be involved and document mission requirements
  • New aircraft, UAS, and new missions, all having significant impact on the airfield
Why is this Subject Important?

The consequence of failure is significant!

• Any aircraft damage likely to exceed millions of dollars
• High potential for injury or loss of life in any mishap
• Mission dependency on the airfield infrastructure

It is critical to know the design and construction factors that can cause or prevent a mishap.
Runway Obstruction Related Catastrophe: Misawa Air Base, Japan (July 1998)

• F-16 aborted take-off

• Impact with non-frangible localizer antenna and foundation

Image Source: http://www.f-16.net/g3/f-16-photos/album30/aia
Non-Frangible Compared to Frangible Structures
Typical Runway Obstructions
Key Elements of Airfield Project Execution

• Policy: AF and Army should be applying comprehensive asset management
  – Prioritized needs based on condition assessment, operational need, and detailed site inventory and investigation effort

• Guidance: UFCs for Planning and Design for:
  – Design-Bid-Build: UFCs, AF ETLs, FAA ACs
  – Design-Build Execution: **Use UFC 3-260-11FA Airfield DB Model RFP**

• Operations and Phasing
  – Operations (Airfield Management) must be an involved stakeholder

• Airfield Design
  – Civil, Geotechnical, Electrical Engineering

• **Construction Inspection and Acceptance**
  – Full time, trained, and staffed team ready to handle multiple, concurrent activities
Lack of Comprehensive Airfield Asset Management and Qualified and Experienced Design and Construction Personnel

Result: Incomplete USAF Taxiway Repair
Airfield Design Criteria – Extends Beyond the Pavement Footprint

• UFC (Military) criteria differs from FAA (Civilian) criteria
  – Services have different standards, even for the same aircraft
  – UFCs references out of date and in revision status

• Grading and Drainage
  – Paved and turfed areas

• Clearance Areas
  – Lateral Clearance Areas (wing tips)
  – Airspace Imaginary Surfaces (extend up to 10 miles from the airport)

• Visual and Electronic Navigational Aid Critical Areas

• Noise and Land Use
Airfield Design Criteria Notes

• DOD UFCs Provide Most Guidance but...
  – Standards Vary by Service (AF, Army, Navy/Marines)
  – USAFE Instruction 32-1007 Precedent and Supplement
  – Army Regulations: AR 95-2

• Joint Use Airfields
  – UFC & ICAO Standards determined by owner of the “Activity” area

• Host Nation Requirements
  – NATO and ICAO Standards for Joint Use or Future Handover

• FAA Advisory Circulars – Referenced by UFCs. Especially for:
  – Lighting, Marking, and NAVAIDs. Good guidance: Drainage, etc.
Design Constraints Imposed by Imaginary Surfaces:
- Lateral Clearance Areas

- Site conditions can restrict ability to meet transverse grade and drainage standards
Design Constraints Imposed by Imaginary Surfaces:
- Longitudinal Profile and Line of Sight

- Runway intersections and non standard sites requires understanding of prioritization of standards to meet operational requirements

Image Credit: FAA AC 150/5300-13 (similar to UFC 3-260-01)
Design Constraints Imposed by Imaginary Surfaces: Airspace

• Imaginary surfaces are real

FAA Airspace: 14 CFR 77

Military Airspace: UFC 3-260-01
Design Constraints Imposed by Imaginary Surfaces: NAVAID Critical Areas
How Long is a Runway? Pope Army Airfield

Published Length: 7,501 feet
Actual Length: 9,501 feet
Reported Landing and Takeoff Length: 8,501 feet

Runway area obstacles restrict takeoff and landing distance available.
Improperly sited facilities can significantly obstruct/restrict operations.

Pope has two other landing surfaces in the runway area.
Why is accurate runway length important?
Qatar Airways B-777-300. Miami International Airport, Sept 2015

- Departed Runway 9 for Doha with over 4,000’ of 13,000’ takeoff runway not used
- Aircraft hit Runway 27 Approach Lights on departure
- **Runway area obstacles and frangibility conditions are critical!**
- USAF Airfield Obstruction Reduction Initiative (AORI) is still active
Phasing Plan – Runway End Work
Consequences of Failure: MC-130 Qayyarah Iraq (2004)

• Not understanding airfield construction from an operations perspective can lead to a mishap. The number one contributing factor to the mishap was “a lack of training on the part of the U.S. Army to effectively prepare their personnel for combat zone airfield management and operations.” (USAF AIB)

Image Source: http://www.cargolaw.com/2005nightmare_c130.html#the-feature
Airfield Construction Safety Equipment - Barriers
Proper Design Enhances Situational Awareness and Prevents Accidents

Airfield Signage is intended to Provide Guidance in Low Visibility

- Normal Operations to ½ Mile.
- Standards & Convention are Important.

UFC 3-535-01 Provides General Guidance.

- Signage & Marking Plan Requires Operations Coordination
Marking and Signage Standards
F-35B Increased Jet Blast and Vertical Thrust
F-35 Jet Blast Will Damage Paved Overruns
F-35 Requires Additional Apron Parking Space

- Luke AFB study determined F-35 jet blast influence reaches 200 feet
Summary

• Airfield Design and Construction Fundamentals
• Consequences of mistakes can be catastrophic
• The F-35 and other aircraft demand improved airfield infrastructure

• GET AIRFIELD DESIGN AND CONSTRUCTION TRAINING!

• Use Experienced Design & Construction Personnel
  - Specifying minimum qualifications and experience for design and construction will not increase project cost
  - This will ensure long term durability and the lowest total cost
Thank You

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LUNCH PAUSE

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CENTENNIAL

- Food Image -
Airfield Civil and Electrical Design Fundamentals
-Airfield Projects in the European AOR and the world

Professional Education Session for:
SAME Rhein-Main Post
USACE Europe District, Wiesbaden, DE

17 October 2019
Agenda: 2 Sessions

• Introductions
• Safety Moment
• Session 1) Airfield Civil and Electrical Design
  – Pavements and Lighting
• Break
• Session 2) Airfield Pavement and Electrical Construction
  – Issues of quality are world wide
• Wrap Up

Please do not hesitate to ask questions at any time!
Many airfield utility junctions are structurally unsuitable for vehicles and pedestrians.
Safety Moment

High risk of short circuit and ground faults

There is no electrical protection and the dangers of short circuits are severe!
Airfield Design Criteria Applies to:

Assault Strips (or LRRS air strips)
3,000’ by 60’

Major Runways
12,000’ by 300’
(and 50’ by 50’ Heliports)
Ramstein Air Base: 2 runways, 4 ILS, Cat III, “Hot Spots”
Ramstein Air Base: No parallel taxiways. Large aircraft can only taxi to the Runway 27 end without crossing another runway ILS approaches

Runway 9-27: 3,500’ by 90’ Landing Zones for C-130s and C-17s
Ramstein Air Base: Signs and Markings. Designers and Ops needed
- ILS Holding positions on runways is not good practice
Tenerife, March 1977 - 747 Lost on a Single Runway Airfield – 578 Fatalities
Spangdahlem Air Base: Expanding missions, more mixed traffic

- Fighters: F-16 to F-35
- Beddown of MC-130s and MV-22s
- Is concrete better than asphalt?
Weisbaden Army Airfield
- Asphalt runway
Lask Air Base, Poland:
- Concrete runway
US DOD Airfield Paving Design Issues in Europe

- We need good concrete and good asphalt!

Comments from USACE TSC Pavement Engineer:

- Adapting the concrete specifications with EN vs ASTM’s.
  - Most have equivalents but some are slightly different.

- Design challenge: Designers doing things that they would normally do on their airfield projects that may not line up with our criteria.
  - Their design plans are very different from our typical design plans.
US DOD Airfield Paving Design Issues in Europe

Comments from Jacobs Engineers (Europe):

- Design challenges include specifying the PG Grade of the asphalt mix and the calculation of the asphalt modulus of elasticity based on seasonal temperature variations and loading frequency. Values provided may be interpreted within the US using existing databases but are not easily available outside the US.

- Compressive strength of lean concrete (base) in Europe is generally higher than what is specified in USACE specifications. Consider when assessing for potential reflective cracking in asphalt pavements. On the other hand, it would help more in enhancing the load transfer efficiency in rigid pavements.

- Polymer Concrete Micro-Overlay (PCMO) for Fuel and abrasion resistant wearing surfaces is not commonly used in Europe. Experienced contractors may not be available.
US DOD Airfield Paving Design Issues in Europe

Comments from Jacobs Engineers (Europe):

- Friction on runways in a challenge in Europe, therefore it is suggested to add the UK polished stone value (PSV) tests into the USACE testing campaign for aggregates.

- Some of the rigid-flexible pavement junction and connection detailed provided within UFC 3-260-02 are not generally adopted in Europe

- The rigid pavement is still based on layered elastic analysis only. Incorporation of three-dimensional finite element (3D-FE) stress computation has not been considered yet within the latest version of PCASE.
Runway Obstruction Related Catastrophe: Misawa Air Base, Japan (July 1998)

• Impact with non-frangible localizer antenna and foundation
• Look out from the project area to include obstruction removal

Image Source: http://www.f-16.net/g3/f-16-photos/album30/aia
Non-Frangible Compared to Frangible Structures
Non-Frangible Compared to Frangible Structures
Runway and Shoulder Width is Critical: Offutt AFB RC-135 training needs all the pavement
Ramstein runway shoulder drainage gutter.
- Non UFC standard. Does it need a waiver?
Lack of Comprehensive Airfield Asset Management – Incomplete Taxiway Reconstruction, 2018
Typical Runway Obstructions
Off Pavement Obstacles and Hazards – Non Load Bearing Infrastructure
Airfield Pavements
Less Visible Hazards and Deficiencies
Non-Visible Structural Deterioration
Under Pavement Utility Conditions
Non-Visible Electrical Deterioration
Signs of Drainage Issues
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  – Civil, Geotechnical, Electrical Engineering

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Lack of Comprehensive Airfield Asset Management – Incomplete Pavement Unit Reconstruction
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• Clearance Areas
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  – Airspace Imaginary Surfaces (extend up to 10 miles from the airport)

• Visual and Electronic Navigational Aid Critical Areas

• Noise and Land Use
JBA: Airfield Infrastructure:
Airfield Operational Surfaces (AOS)
Airfield Design Criteria Notes

• DOD UFCs Provide Most Guidance but...
  – Standards Vary by Service (AF, Army, Navy/Marines)
  – International

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• Joint Use Airfields (USAFR Facilities)
  – UFC & FAA Standards Apply by Owner of the Activity Area

• Host Nation Requirements
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- Lateral Clearance Areas

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Image Credit: FAA AC 150/5300-13 (similar to UFC 3-260-01)

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Design Constraints Imposed by Imaginary Surfaces: Airspace

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FAA Airspace: 14 CFR 77

Military Airspace: UFC 3-260-01
Pope AAF—How Long is the Runway?

Published Length: 7,501 feet

Actual Length: 9,501 feet

Reported Landing and Takeoff Length: 8,501 feet

Runway area obstacles restrict takeoff and landing distance available. Improperly sited facilities can significantly obstruct/restrict operations.

Pope has two other landing surfaces in the runway area.
McGuire Field: Runway 6-24
- Published Length: 10,014’
- Full Strength Pavement Length: 12,014’
- In FLIP remarks: Runway 6-24 Underruns Avail for Dep, but length unclear to pilots
Runway 06 End Displaced Threshold
- Full strength but only 450’ of 1,000’ overrun for takeoff due to localizer location. Indicated by marking colors.
Andrews: Runway 01L Displaced Threshold

- Full 1,000’ of overrun available for takeoff. Additional paved overrun for jet blast erosion prevention.
- Not published as usable length except in remarks
Spangdahlem Air Base: Runway 05-23
- Published runway length: 10,007 feet
- Turnaround paved 500 feet into overrun.
  - Not marked as usable runway or pavement. Confusing to pilots.
  - Why is not published as 11,007’ long?
Design Constraints Imposed by Imaginary Surfaces: NAVAID Critical Areas
Balancing Construction with Air Operations

NOTES:
1. All work, including demolition, shall be done in a manner that protects the movement of aircraft and vehicles in and out of the airport, and that minimizes the impact on the surrounding community. The contractor shall coordinate with the airport operations to ensure that construction activities do not interfere with aircraft movements.

2. All equipment and materials shall be removed from the work area before the start of each workday to prevent obstruction of airport facilities.

3. All equipment and materials shall be stored in a secure and safe manner to prevent unauthorized access.

4. All work shall be done in a manner that minimizes disturbance to the surrounding environment, including noise, dust, and vibrations.

5. All work shall be done in a manner that complies with all applicable laws and regulations.

6. All work shall be done in a manner that ensures the safety of all personnel working on the site.

7. All work shall be done in a manner that ensures the structural integrity of the airport.

8. All work shall be done in a manner that ensures the safety of all vehicles and aircraft.

RESPONSE TO BIDDER INQUIRY:
- All requests for information shall be submitted in writing to the airport management.
- The contractor shall respond to all requests for information within 24 hours.
- All requests for information shall be addressed to the attention of the airport management.
- The contractor shall not disclose any information to third parties without the consent of the airport management.

LEGEND:
- PHASE A
- PHASE B
- PHASE C
- PHASE D
- PHASE E

PROJECT PHASE DESCRIPTION:
1. PHASE A includes all work to accommodate the presence of the new building.
2. PHASE B includes all work to complete the new building.
3. PHASE C includes all work to accommodate the presence of the new building.
4. PHASE D includes all work to accommodate the presence of the new building.
5. PHASE E includes all work to accommodate the presence of the new building.
WAPFB Phasing Plan – Runway End Work
Airfield Marking & Removal
FOD Can Be Catastrophic!

Boeing Field - $50 Million in Damage Due to Paint Beads
Construction Safety Practices are Critical
Taipei Airport - Runway 05R-23L Repair - 2000
Taipei Airport - October 2000 - Singapore Airlines 747-400
Lexington, Kentucky – Closed Runway Used
Airfield Construction Safety Equipment - Barriers
Lost Commercial Aircraft Mishaps

• Tenerife, Canary Islands (1977)
• Madrid, Spain (1983)
• Detroit, Michigan (1990)
• Taipei, Taiwan – Construction (2000)
• Milan, Italy (2001)
• Lexington, Kentucky – Construction (2006)
• Johannesburg, South Africa (2013)
• Incidents continue

Image Source: http://www.abc.es/fotos-archivo/20140327/rodeos-mayor-catastrofe-aerea-1612246118557.html
Proper Design Enhances Situational Awareness and Prevents Accidents

Airfield Signage is intended to Provide Guidance in Low Visibility

• Normal Operations to ½ Mile.
• Standards & Convention are Important.

UFC 3-535-01 Provides General Guidance.

• Signage & Marking Plan Requires Operations Coordination
NS Norfolk, Chambers Field
- Existing Guidance Signs
Marking and Signage: Mandatory Signs are not the only guidance signs required.
F-35B Increased Jet Blast and Vertical Thrust
F-35 Jet Blast Increased Jet Blast for Overruns
F-35 Requires Additional Apron Parking Space

• Luke AFB study determined F-35 jet blast influence reaches 200 feet
New Aircraft (F-35) Pavement Study (NAVFAC-AFCEC)

• F-35B vertical thrust impacts for Short Field Takeoffs and Landing (STOL) operations requires special consideration by pilots, and airfield operations, and engineering

• F-35A/B/C increased single engine thrust requires additional spacing in parking due to thrust and heat

• F-35A and F-35C increased takeoff thrust will dislodge thin asphalt overlays at joints and concrete patches

• F-35 tire pressures and weights similar to F-16, F-15, and F/A-18. 300 psi

• New aircraft are increasing rate and severity of aging pavement infrastructure deterioration and consequences of failure
  – New aircraft cost $80 to $200 mil. Operating costs near $50,000/hr
F-35B Requires More Concrete than Asphalt
Summary

• Project Goes Well Beyond the Footprint
• Know the Operations & Limitations – Mission First
• Understand the Unique Systems & Hazards

• Training:
  – USACE TSC Workshops: HMA and PCC Paving, Lighting, Airfield Design
  – Airport Design and Construction: ACC, AAAE, FAA

• UFC Guidance: UFC 3-260-11FA is a great scoping tool

• Use Experienced Design & Construction Personnel
  - Specifying minimum qualifications and experience for design and construction will not increase project cost.
Part 1 Break - Thank You

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Fundamentals of Airfield Paving & Electrical System Construction

Professional Education Session for:

SAME Rhein-Main Post

USACE Europe District, Wiesbaden, DE

17 October 2019
Airfield Construction - Work Under Traffic
Paving

Discuss Basics of Airfield Paving
- Scoping
- Coordinate airfield elements and phasing
- Specifications
- Mix Design

How it's Effectively Implemented
- Execution: Bidding
- Construction Experience & Expertise
- Civil – Electrical Construction Coordination
- Quality Control and Inspection

Take-Aways From Presentation
Airfield Paving Essentials: Concrete or Asphalt

- We need better concrete and asphalt!

• Scoping
  – Size the project for efficient construction and operations
  – Coordinate with drainage, lighting, electrical, obstructions
  – Check cost estimates

• Execution
  – Experienced people
  – Specifications for Design-Bid or Design-Build

• Construction
  – Experienced and Equipped
  – Quality Control
  – Inspection and Testing
PCC Airfield Slipform Paving
PCC Airfield Paving Issues
PCC Airfield Paving Issues
Inspection is Essential
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HMA Airfield Paving Issues
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Inspection is Essential
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PCC Airfield Paving Issues - Results

Surface Voids Exposed By Diamond Grinding. Voids cover approximately an 8' length.
US DOD Airfield Paving Construction Issues in Europe

Comments from USACE TSC Engineer:

Getting the correct testing done for Deleterious and ASR has been difficult.

Getting a slipform paver and having contractor with experience has been a challenge.

The PCC plants are not setup for kinds of productions needed for slipform pavers.
US DOD Airfield Paving Construction Issues in Europe

Comments from Jacobs Engineer:

Dowel bars use not widely spread in Europe. Experience and technology associated to automated dowel insertion with proper compaction at transverse joints may not be limited.

The European experience on warm mix asphalt technologies/production included within the USACE specification for the advantages of sustainability and off-peak construction may be recent and limited.

Laboratories that include equipment to carry out simple performance tests to assess asphalt mix performance and asphalt pavement analyzer (APA) to measure rutting susceptibility based on aircraft loading may be limited.

The polymer modified asphalt is mostly considered as a proprietary product in Europe. Accordingly, quality control in line with the USACE specification may not be achievable due to limited declared information and limited availability of performance testing laboratory equipment and machinery.
Electrical

Discuss Basics of Airfield Lighting
- Safety
- Standardization
- Operational Effectiveness
- Reliability & Maintainability

How its Effectively Implemented
- Stakeholder Communication
- Civil – Electrical Design Coordination
- Equipment Selection
- Design & Construction Experience & Expertise

Take-Aways From Presentation
Airfield Lighting – Older Systems
Airfield Lighting Components

Runway End and Edge Lights

Taxiway Edge Lights

In-Pavement Lighting

Illuminated Signage
Installation in New Pavement – Concrete Section Installation
Installation in New Pavement – Paving Process
Installation in New Pavement – Locate Core then Finish Core
Installation in New Pavement – Removal of Core, Target Plate, and Install Spacer Rings
Installation in New Pavement – Apply Epoxy in Gap
Installation in New Pavement – Complete
Existing Pavement Installation – Coring Pavement
Existing Pavement Installation – Core Removal
Existing Pavement Installation – Directional Drilling
Existing Pavement Installation – Holes Drilled for Dowel Bar Installation
Existing Pavement Installation – Base Can Installation
Existing Pavement Installation – Backfill Around Base Can, Install Cable and Isolation Transformer
New Shoulder Pavement Installation – Core Pavement
New Shoulder Pavement Installation – Top Section Still in Place
New Shoulder Pavement Installation – Remove Core, Target Plate, Adjust Top Section
New Shoulder Pavement Installation – Set Top Section, Backfill with Concrete, and Set Fixture
Electrical Underground Structures

**Construction Standards**

- Aircraft Rated Manholes
- Confined Space Label on MH Lids
- Fiberglass Cable Racks
- Grounding
- Ladders / Harnesses
- Neat and orderly – cables tagged
Airfield Lighting Manholes

Manholes
Tend to be below the drainage
Requires additional safety measures
Potential of live circuits in confined space
Maintainability & Organization
- Apply good order and discipline
Maintainability – Duct Banks to Pull Can Plazas

Multiple Pull Cans for Circuit Isolation and Reliability
Duct/Duct Bank Installation
Maintainability – Duct Banks to Handholes

Handholes for expandability and separation of circuit types
Airfield Lighting Vault
Airfield Lighting Vault – Open 4,160V Bus

Uninsulated 2.4kV Bus

2.4kV Fuse Cutouts
WPAFB Airfield Lighting Vault
Please don’t kick the high voltage

Design Build Airfield Lighting Vault- OCEM (Italian) Regulators
Stand Alone CCRs

More lateral space needed, but any manufacturer can be installed
Stand Alone CCRs
- What is not optimal in this photo?
Switch Gear Cabinet CCRs

More CCRs in smaller space. Requires single manufacturer and working space dolly.
CCR Options: S-1 Cutouts

Cutouts provide means to test CCR while being disconnected from circuit
Airfield Lighting Vaults – Lock Out / Tag Out

Turn Off Ckt from ALCS

Turn Off CCR Locally & Lock

S1 Cut Out Cabinet - Locked

Key Cabinet

Eliminates possibility of circuit being energized accidentally!
Operability

• How Does the Tower Want to Control the Lighting?

• Can We Turn Off Lights Not Needed Right Now?

• Are Lighting Circuits Segmented to Provide that Control?

Better Control = Increased Efficiency = Energy Savings
LED Lighting Options
LED Considerations

Enhanced Vision Systems used
Age and condition of existing system
Cost of electricity
Cost of construction
How is system maintained
CCR Power Consumption

<table>
<thead>
<tr>
<th>Output KW</th>
<th>Input KVA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10.26</td>
</tr>
<tr>
<td>Step 1</td>
<td>7.72</td>
</tr>
<tr>
<td>Step 2</td>
<td>7.05</td>
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<tr>
<td>Step 3</td>
<td>4.67</td>
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<tr>
<td>Step 4</td>
<td>7.91</td>
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<tr>
<td>Step 5</td>
<td>11.36</td>
</tr>
</tbody>
</table>
Questions and Discussion

- Project Goes Well Beyond the Footprint
- Know the Operations & Limitations – Mission First
- Understand the Unique Systems & Hazards
  - F-35A/B/C impacts are still being defined
- Training:
  - USACE TSC Workshops: HMA and PCC Paving, Lighting,
  - Airfield Design Airport Design and Construction: ACC, AAAE, FAA
- Use Experienced Design & Construction Personnel
  - Specifying minimum qualifications and experience for design and construction will not increase project cost.
- Airfield Lighting Design and Energy Utilization: Requires additional time to cover adequately.
Part 2 End - Thank You

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