

Pope Army Airfield, Fort Bragg, NC

Runway 05-23 Rehabilitation- Pavement and Electrical

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IES Aviation Lighting
Committee

Annual Conference 2022

Detroit, MI

HDR

CMT

Joint Venture



Fort Bragg, North Carolina
Home to 82nd Airborne

Pope Army Airfield Runway 05-23 Rehabilitation

Overview

- Introductions
- Project Scope Evolution
- Bid Package Phasing
- Electrical Design Elements
- Project Execution
- Lessons Learned
- Questions?



Pope Army Airfield Runway 05-23 Rehabilitation

Project Scope Evolution

- Initial Scope - Airfield Electrical System Replacement
 - Replace Edge Lighting
 - Replace Signs
 - Replace Infrastructure



Pope Army Airfield Runway 05-23 Rehabilitation

Project Scope Evolution

- Initial Scope - Airfield Electrical System Replacement
 - Replace Approach Lighting
 - Replace PAPI's
 - Replace Wind cones



Pope Army Airfield Runway 05-23 Rehabilitation

Project Scope Evolution

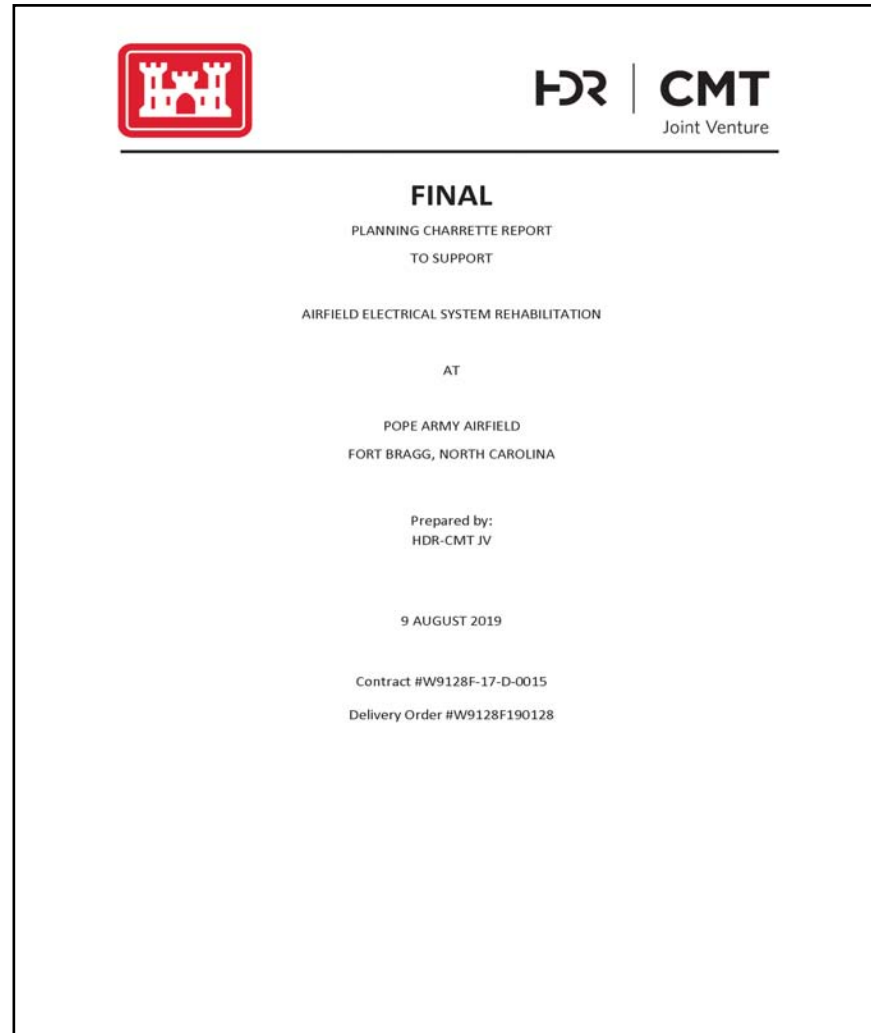
- Initial Scope - Airfield Electrical System Replacement
 - Replace Regulators
 - Vault Rehab
 - Replace Generator



Pope Army Airfield Runway 05-23 Rehabilitation

Project Scope Evolution

- May 2019: HDR-CMT JV Awarded contract
- May 2019: On-Site Design Charrette for Airfield Electrical Rehabilitation
- June 2019: Draft Design Charrette Report
- August 2019: Final Design Charrette Report



HDR | **CMT**
Joint Venture

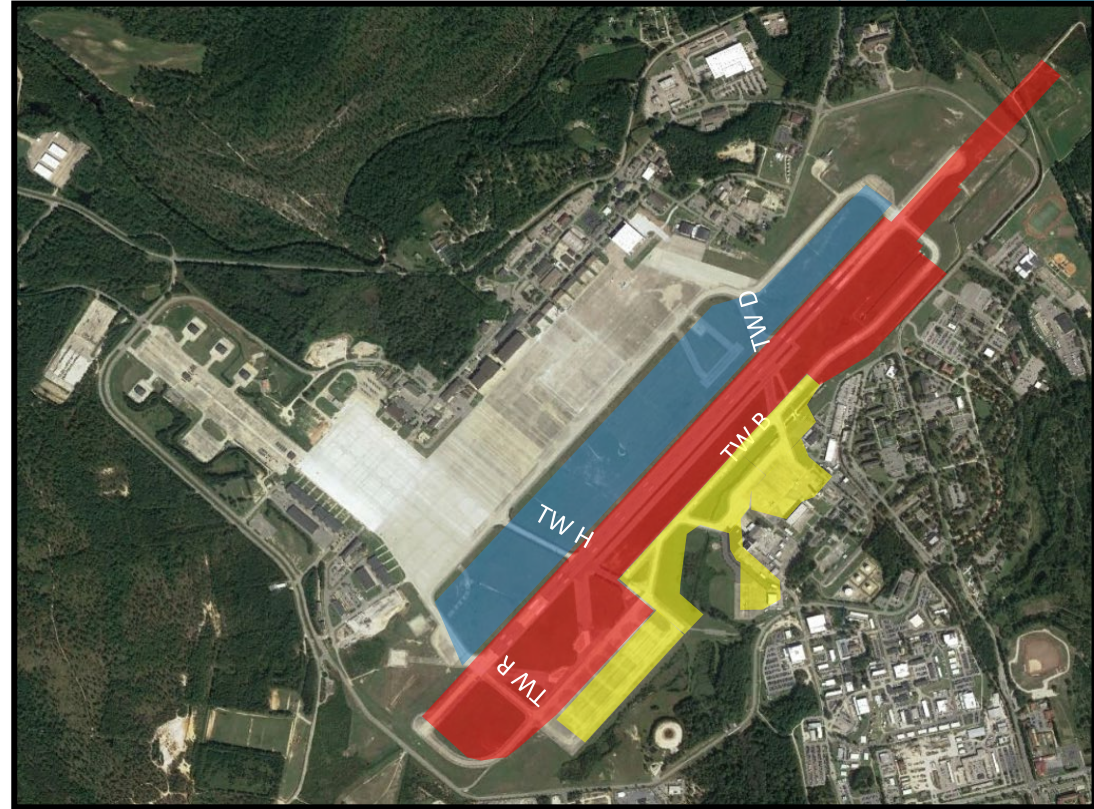
- Charrette Report Conclusions
 - CoA A: Full Runway Closure- 4 months
- CoA B: 6 months Total in 3 Phase
 - 2 months with 23 Displaced Threshold
 - 2 months with full runway closure
 - 2 months with 05 Displaced Threshold
- CoA C: 11 months Total in 3 Phases
- Runway closed Sunset to Sunrise nightly
 - Displaced Thresholds
 - Rapid Set PCC
 - Steel Plates over tranches
 - Quality Concerns with Night Work and Limited Hours



Pope Army Airfield Runway 05-23 Rehabilitation

Project Scope Evolution

- Sep 2019: Electrical Design Contract Awarded
 - 3 Construction Packages
 - Runway 5-23
 - Taxiways North
 - Taxiways South
- All lights signs and shoulder pavements, plus vault
- Phasing Approach not Decided
- Leaders considering expanding to full runway reconstruction



Pope Army Airfield Runway 05-23 Rehabilitation

Project Scope Evolution

- May 2019: Evaluation Contract Awarded
- Aug 2019: Final Charrette Report
- Sep 2019: Electrical Design Contract Awarded
- Jan 2020: Full Runway Reconstruction Added
- Feb 2020: HDR-CMT JV rapidly expands survey, geotech and design team
- Mar 2020: COVID-19
- Mar-May 2020 Design development continues
 - No travel
 - Virtual Review Meetings
 - Support from Local Partners was Critical
- Jun 2020: Final Plans Delivery
- Sep 2020: Project Advertised
- Oct 2020: Bids Received
- Nov 2020: Project Awarded to:
 - RC Construction/Millstone- Weber JV
 - Atlantic Electric, LLC



Pope Army Airfield Runway 05-23 Rehabilitation

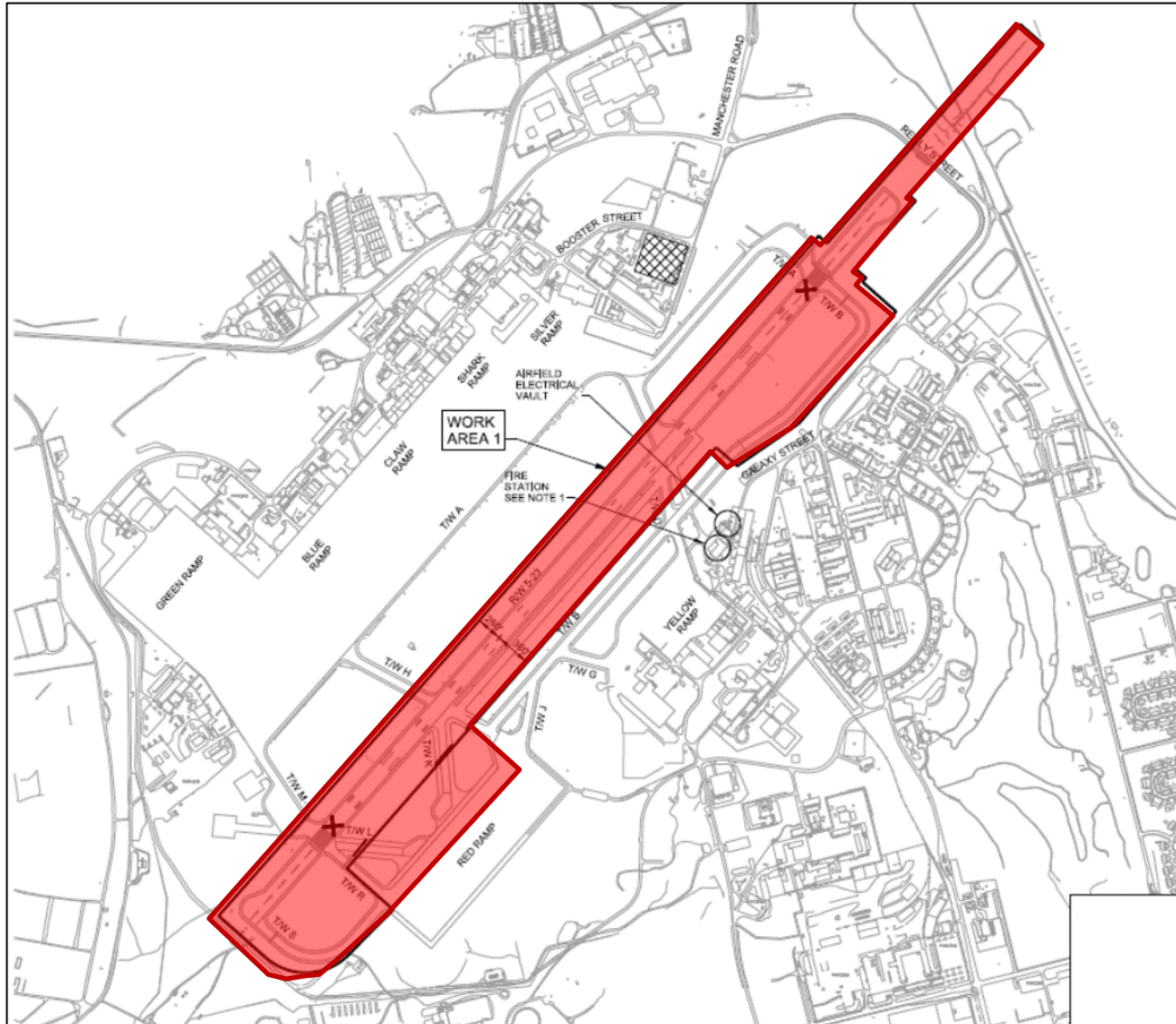
Bid Package Phasing

3 Construction Packages

- Runway 5-23
- Taxiways North
- Taxiways South



Package 1 Project Phasing



- Runway 5/23 and LZ to VFR Hold Lines
- One large work area
- Continually maintain cross field access
 - Emergency services
 - Aggregate surface allowable
- Airfield open rotary wing only
- 4-month long-duration closure
- Short-term closures for miscellaneous work
- Military operated LZ on taxiway

Package 2 Project Phasing



- Taxiway B
- Three work areas
- Maintain cross-field access
- Ramp work coordinated daily
- Fire Station #7 access 24/7

Package 3 Project Phasing

- Taxiway A
- 3 work areas
- Maintain cross-field access
- Ramp work coordinated daily
- Phase 3 - All Aircraft access - Taxiway M
- Fire Station #7 access 24/7



Electrical Design Elements

- Runway and Taxiway Edge Lighting
- Airfield guidance signs and RDR's
- Runway 23 ALSF-1 & Runway 05 Threshold
- PAPI's, Windcones, REIL's
- Airfield Lighting Vault and ALCMS
- Fiber Optic Transmission System (FOTS)
- Ramp Lighting



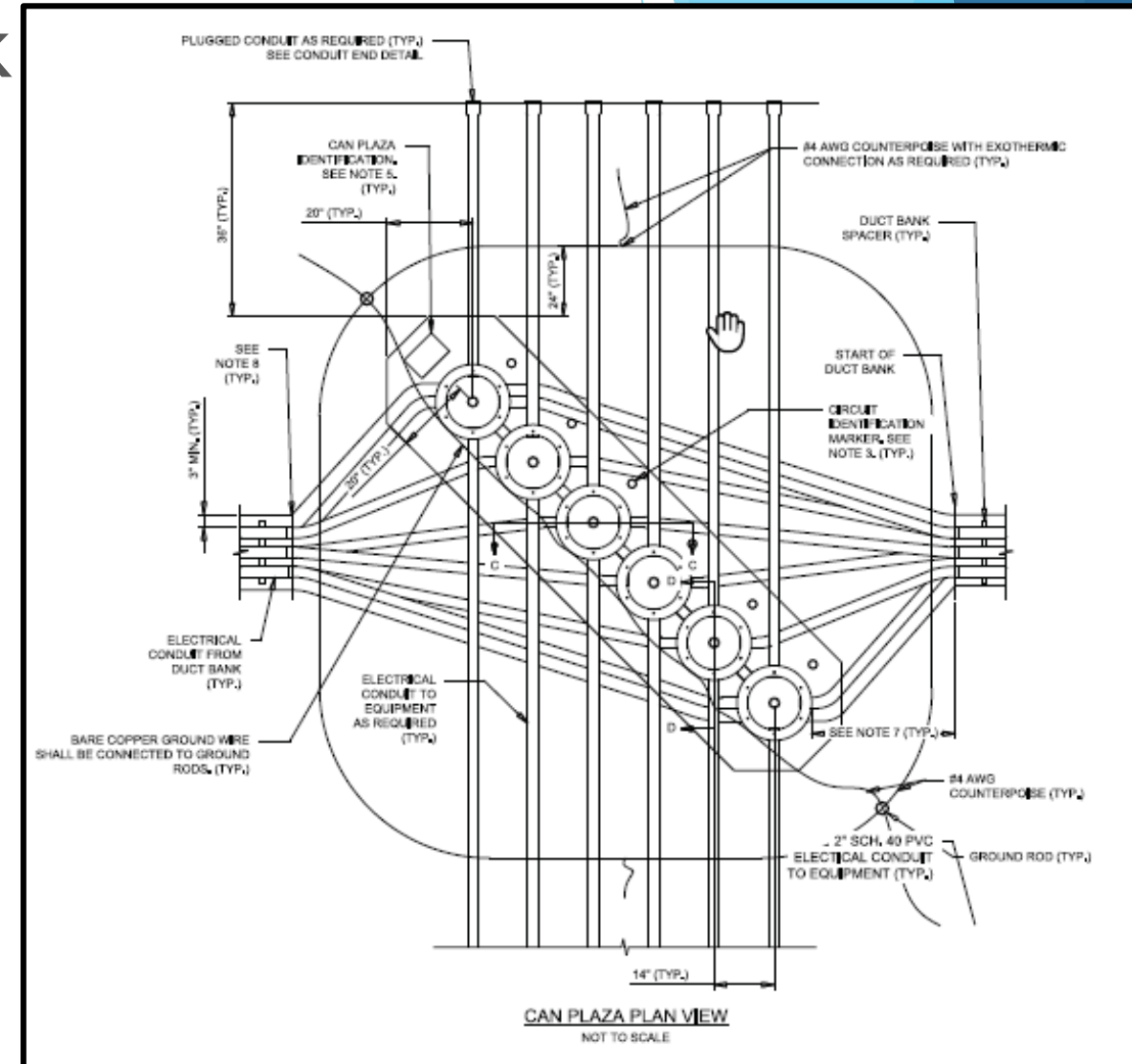
Runway and Taxiway Lighting

- Spacing per UFC
- All new fixtures and basecans
- All LED fixtures
- Runway fixtures approved for LED



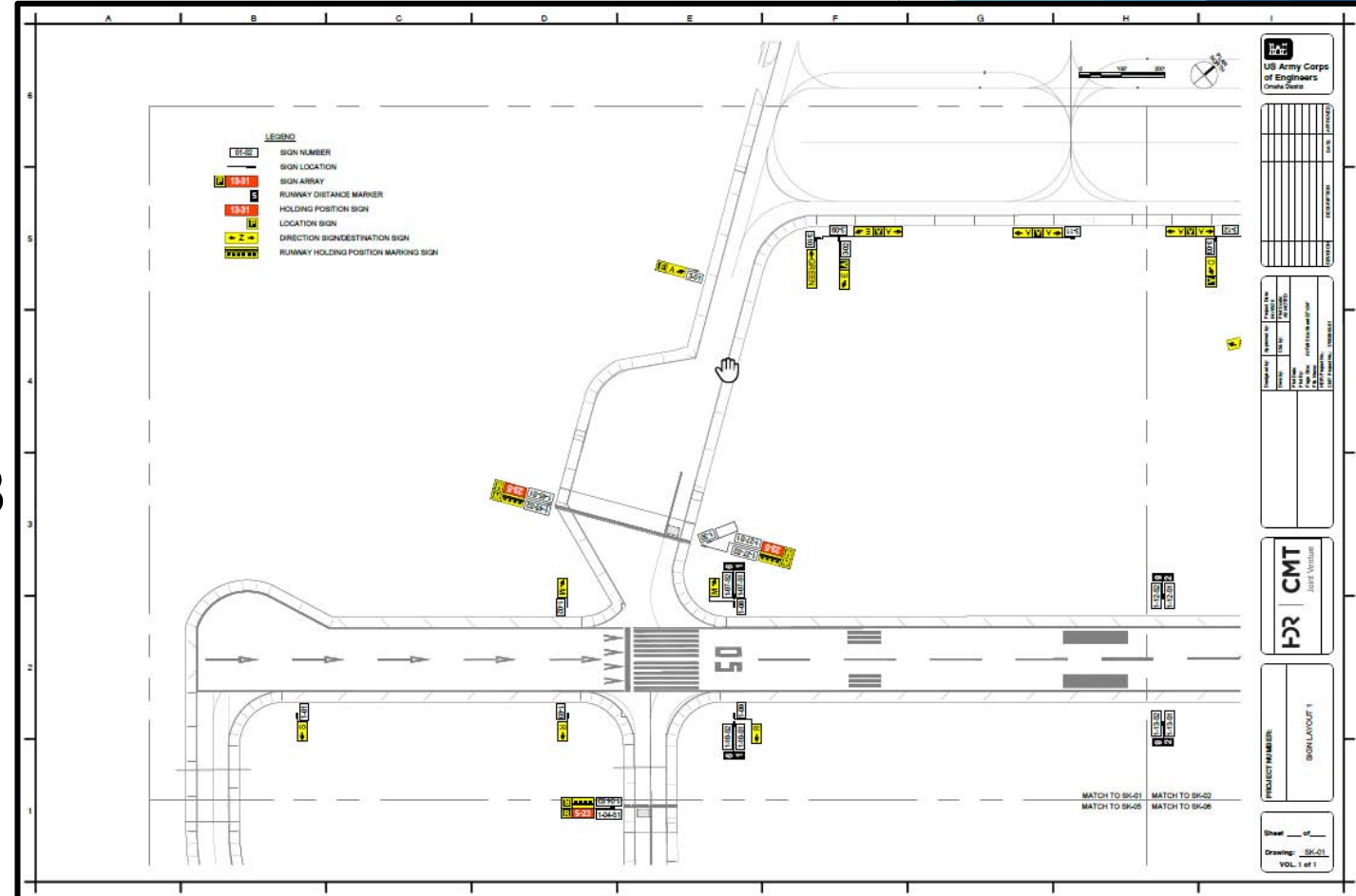
Runway and Taxiway Ductbank

- All new conduits
- Can plazas
- All 2" Conduit
- Isolated circuits (one per conduit)



Guidance Signs and RDM's

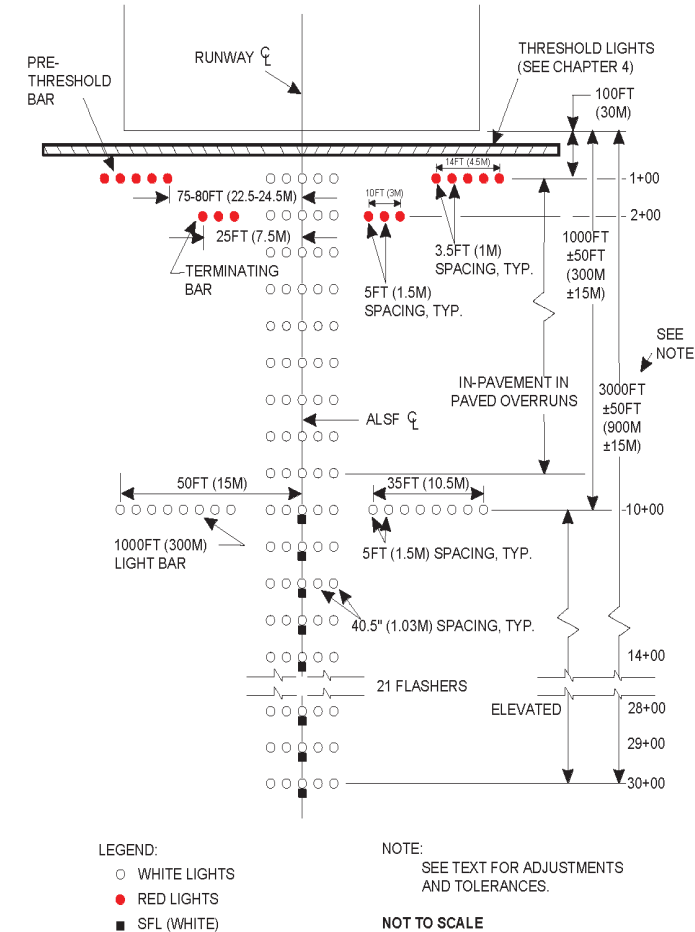
- All LED
- Runway Hold
- RDM's
- Taxiway Guidance Signs
- Landing Zone Marker Panels
- Location based on UFC criteria
- Taxiway Renaming during phase 3
 - New panels
 - Verify lengths



Runway 23 ALSF-1

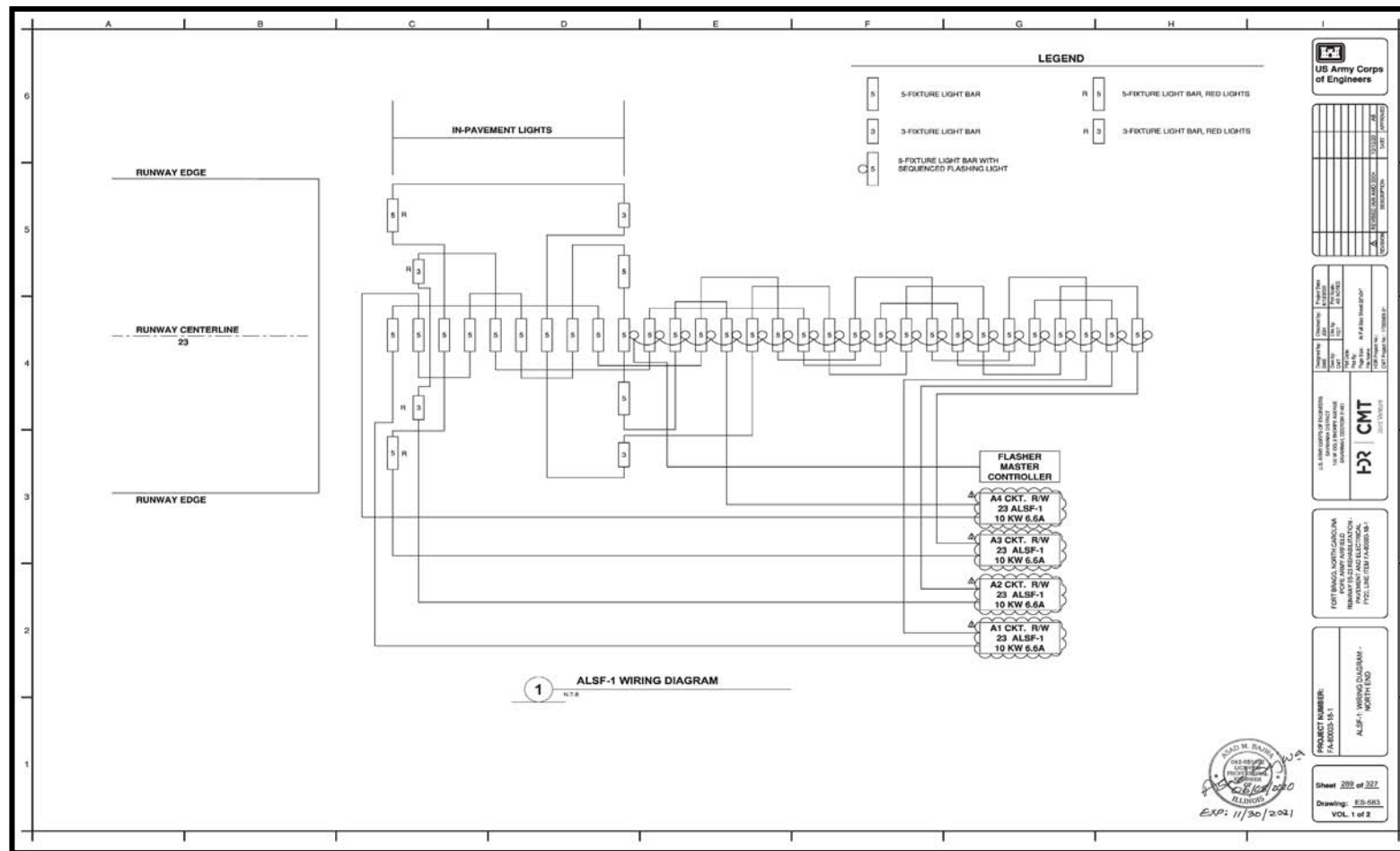
- Runway 23 ALSF-1 per UFC 3-535-01, Figure 3-1
- All LED's
- LED In-Pavement Flasher

Figure 3-1 ALSF-1 Configuration



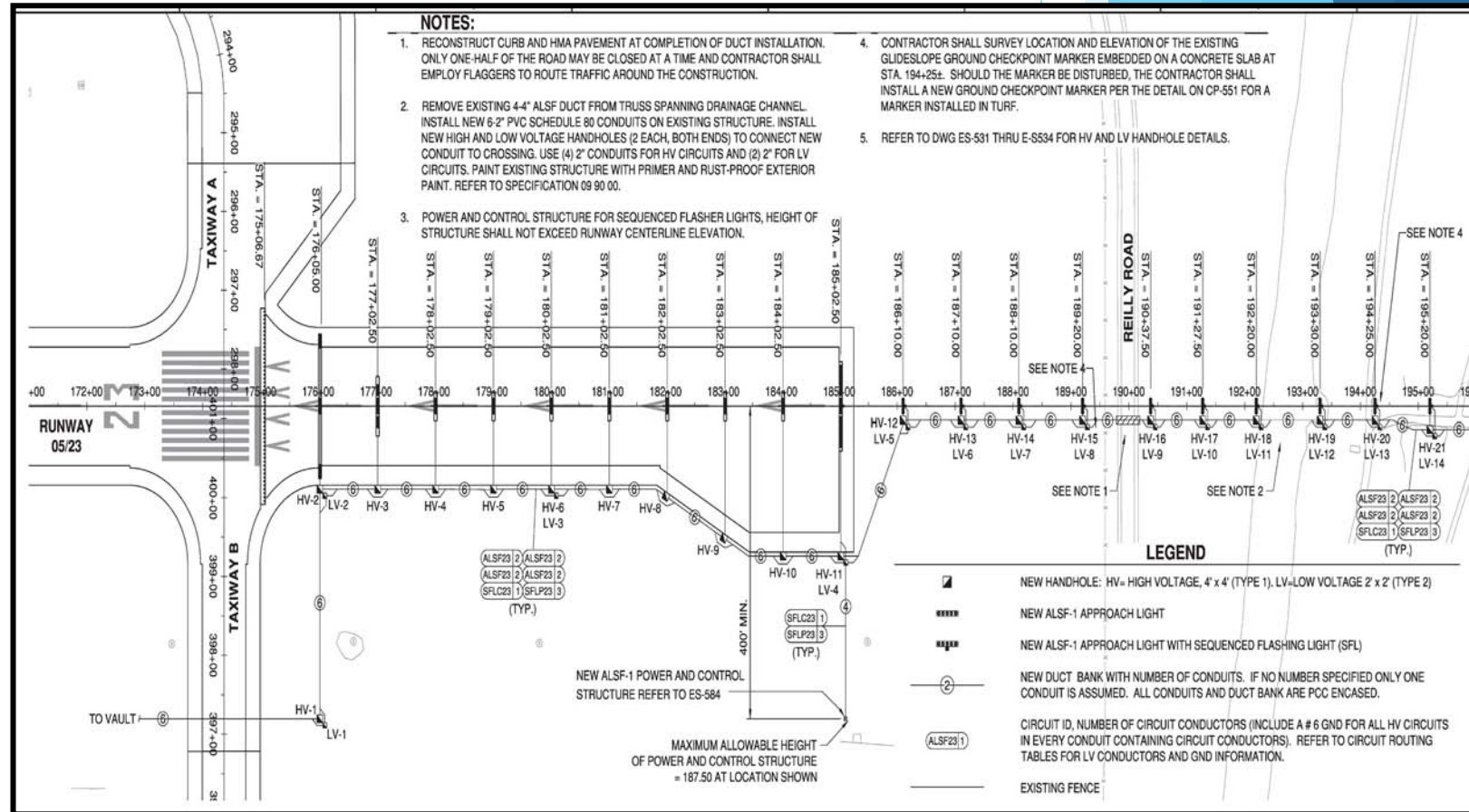
Runway 23 ALSF-1

- Runway 23 ALSF-1 circuits per UFC 3-535-01



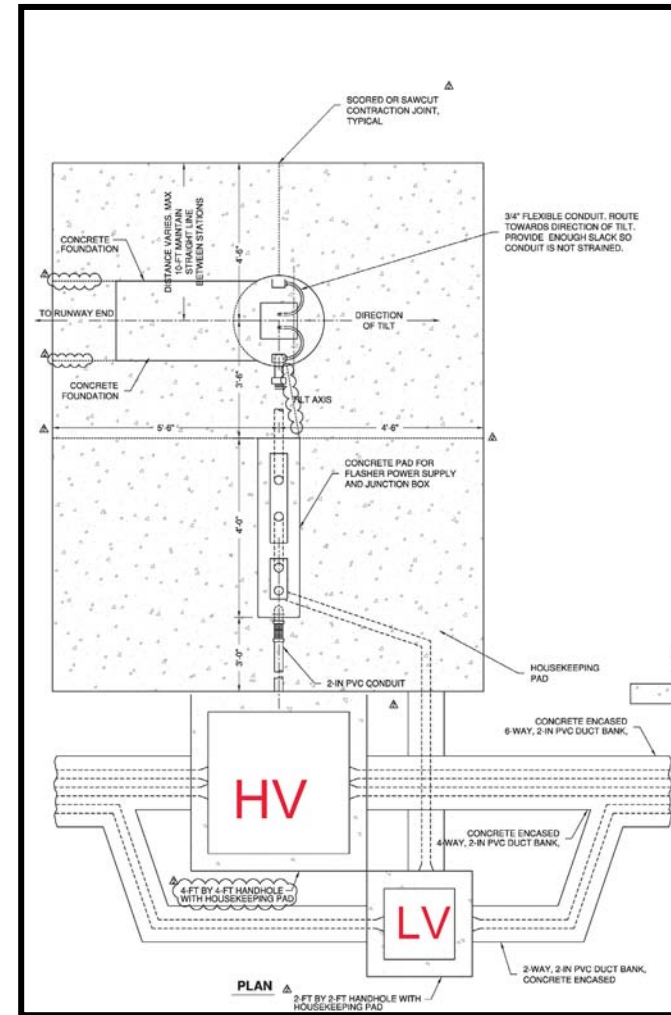
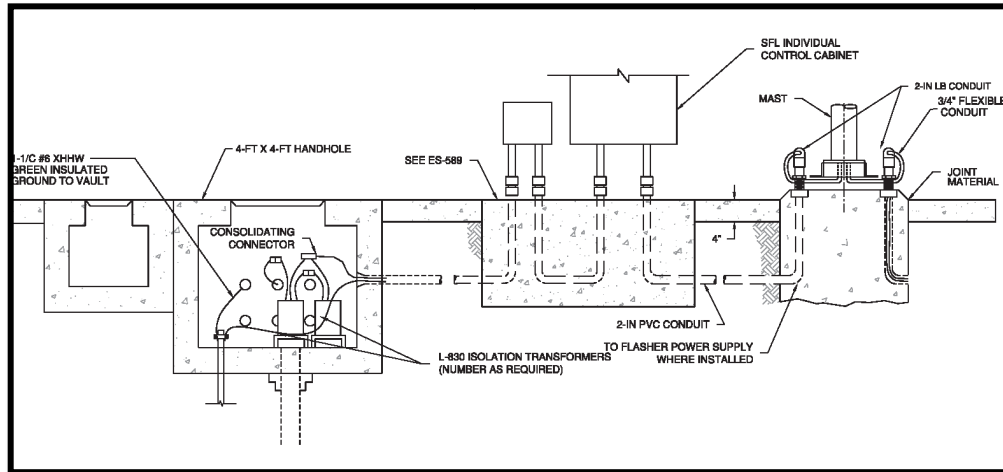
Runway 23 ALSF-1

- New ductbanks
- New LV & HV handholes
- LV SFL Circuits
- FO Communication for SFL



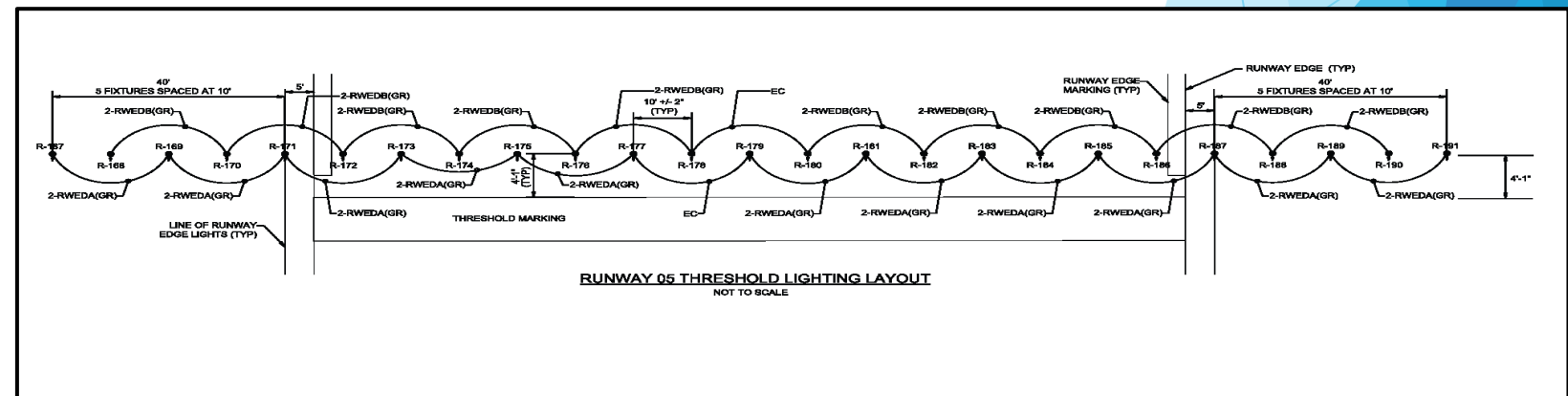
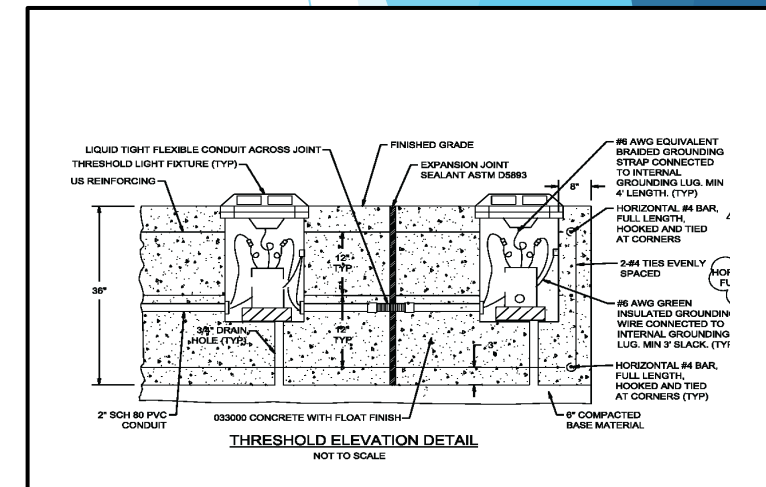
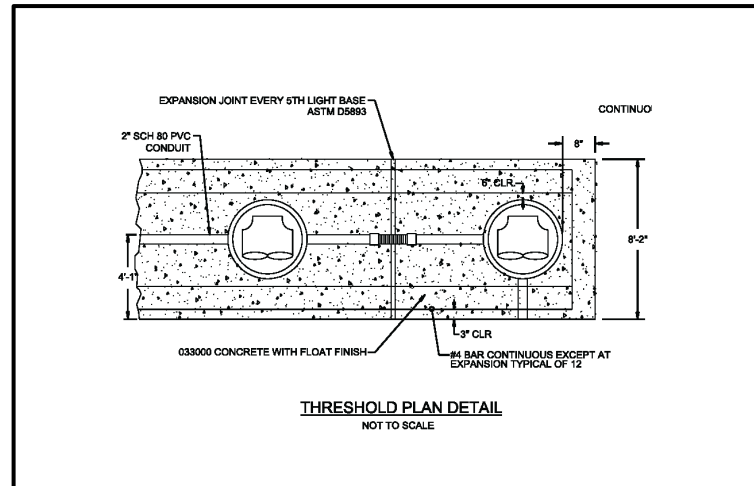
Runway 23 ALSF-1

- LV and HV handholes



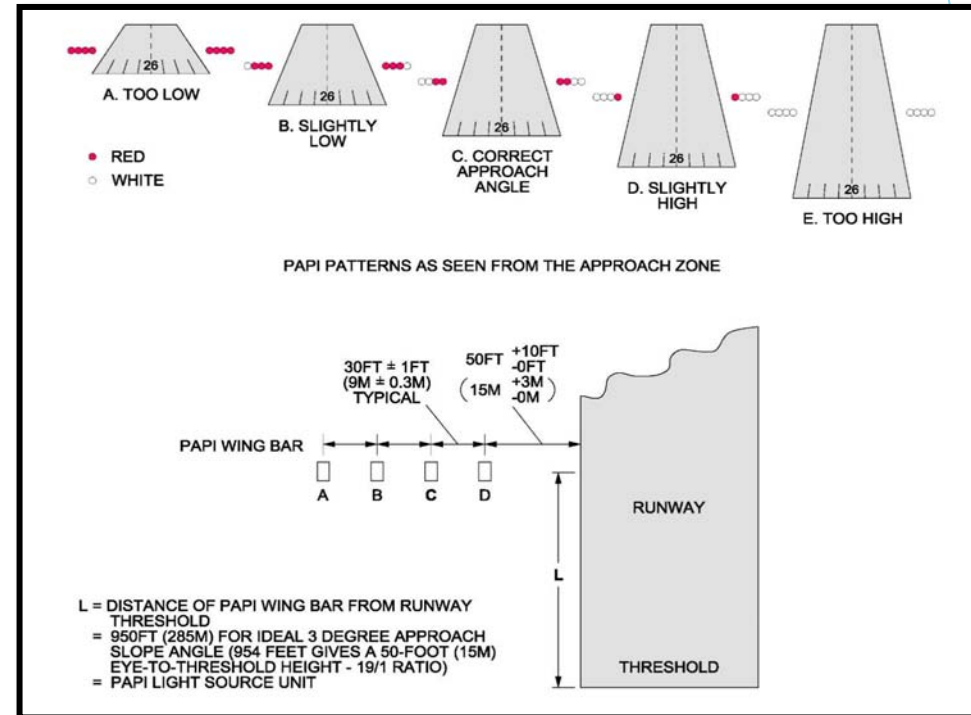
Runway 05 Threshold

- New Runway 05 Threshold
- All LED's
- Interleaved Circuits



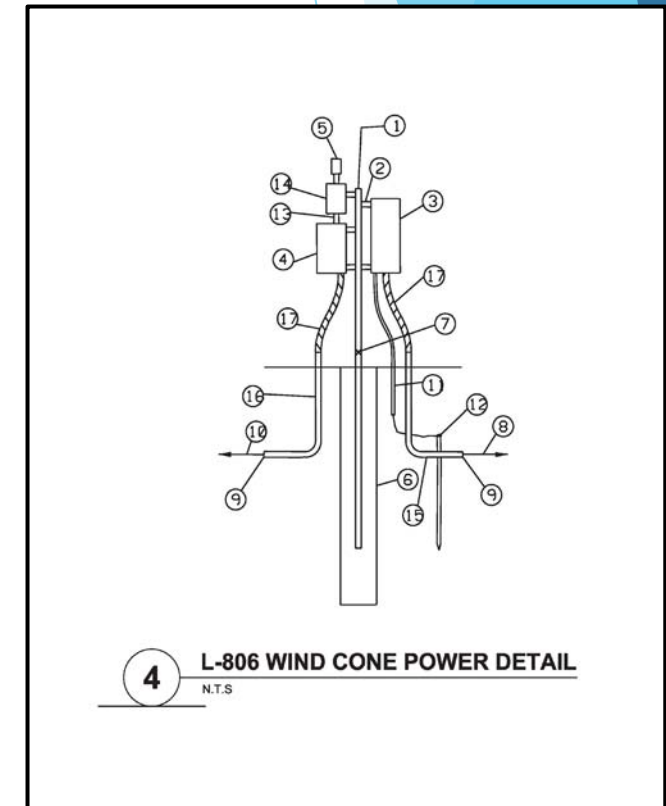
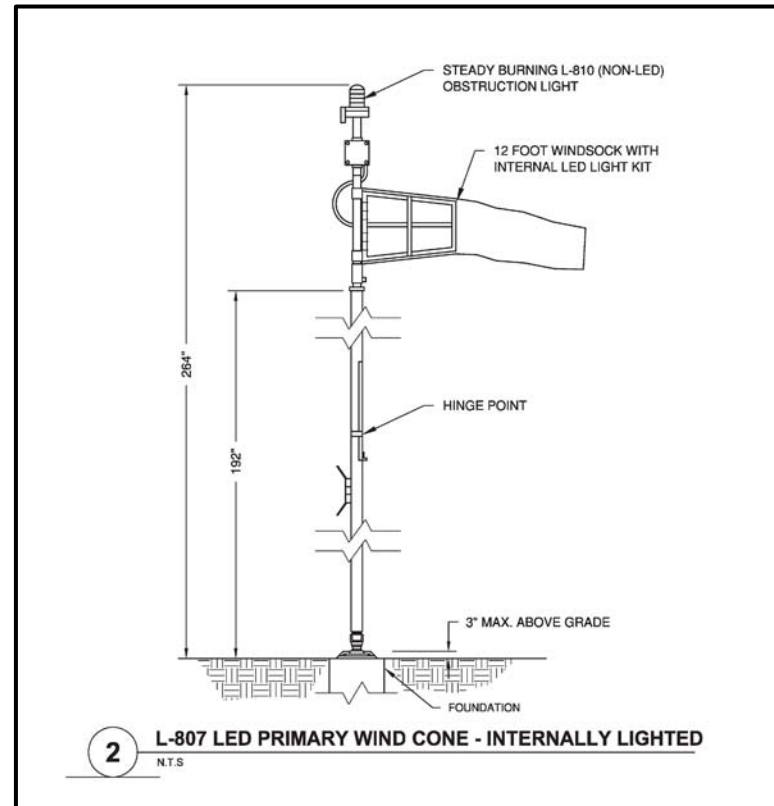
Runway 05 and Runway 23 PAPI's

- New 6.6A PAPI's for both approaches
- UFC 3-535-01, Figure 3-11
- LED PAPI's



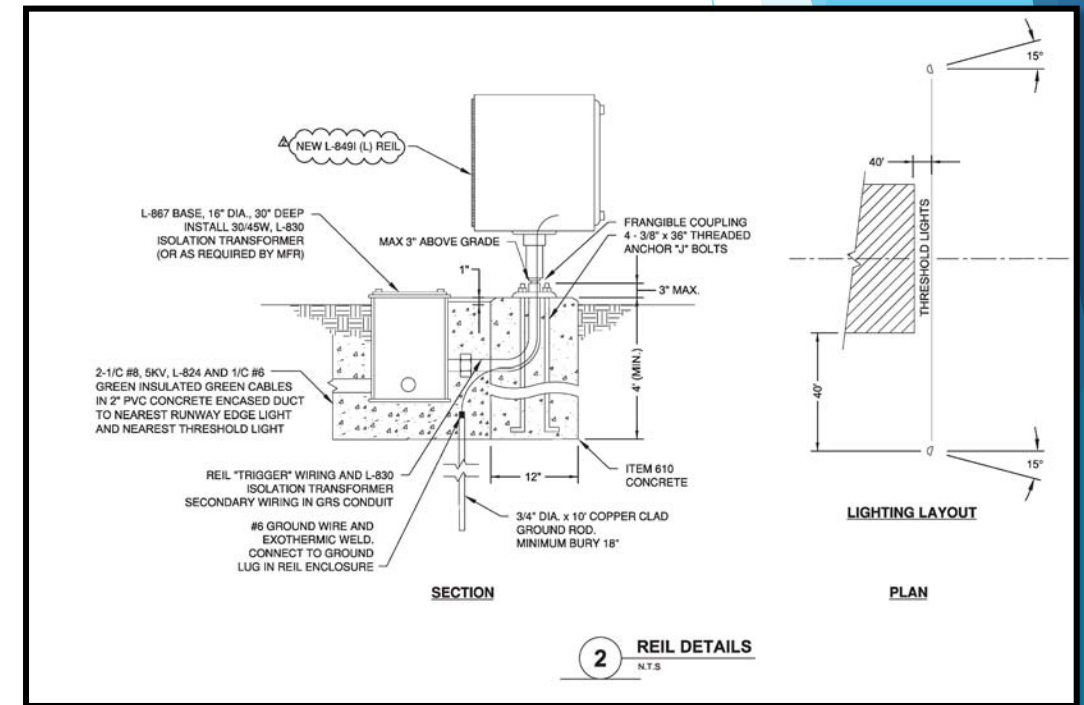
New Wind cones

- New Voltage-Driven LED Wind cones



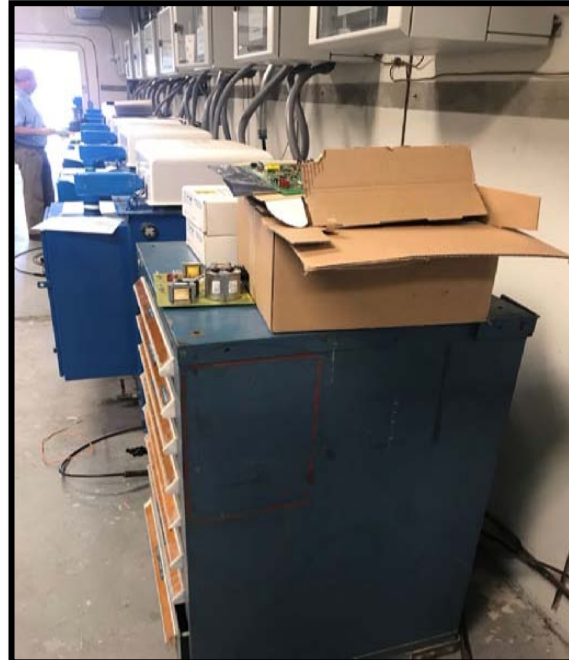
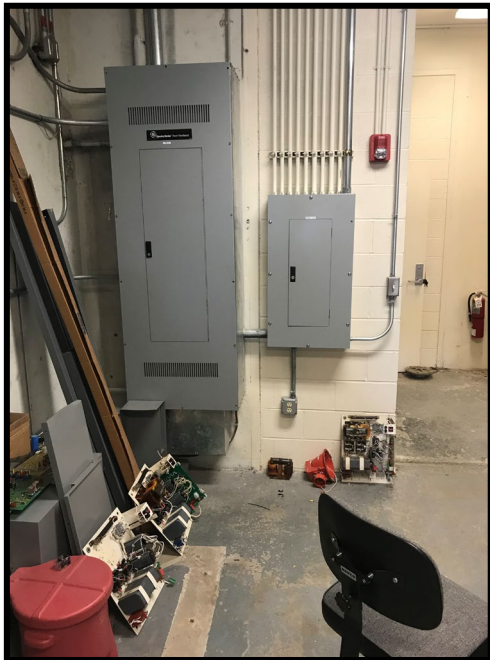
New Runway 05 REIL's

- New Voltage-Driven LED REIL's

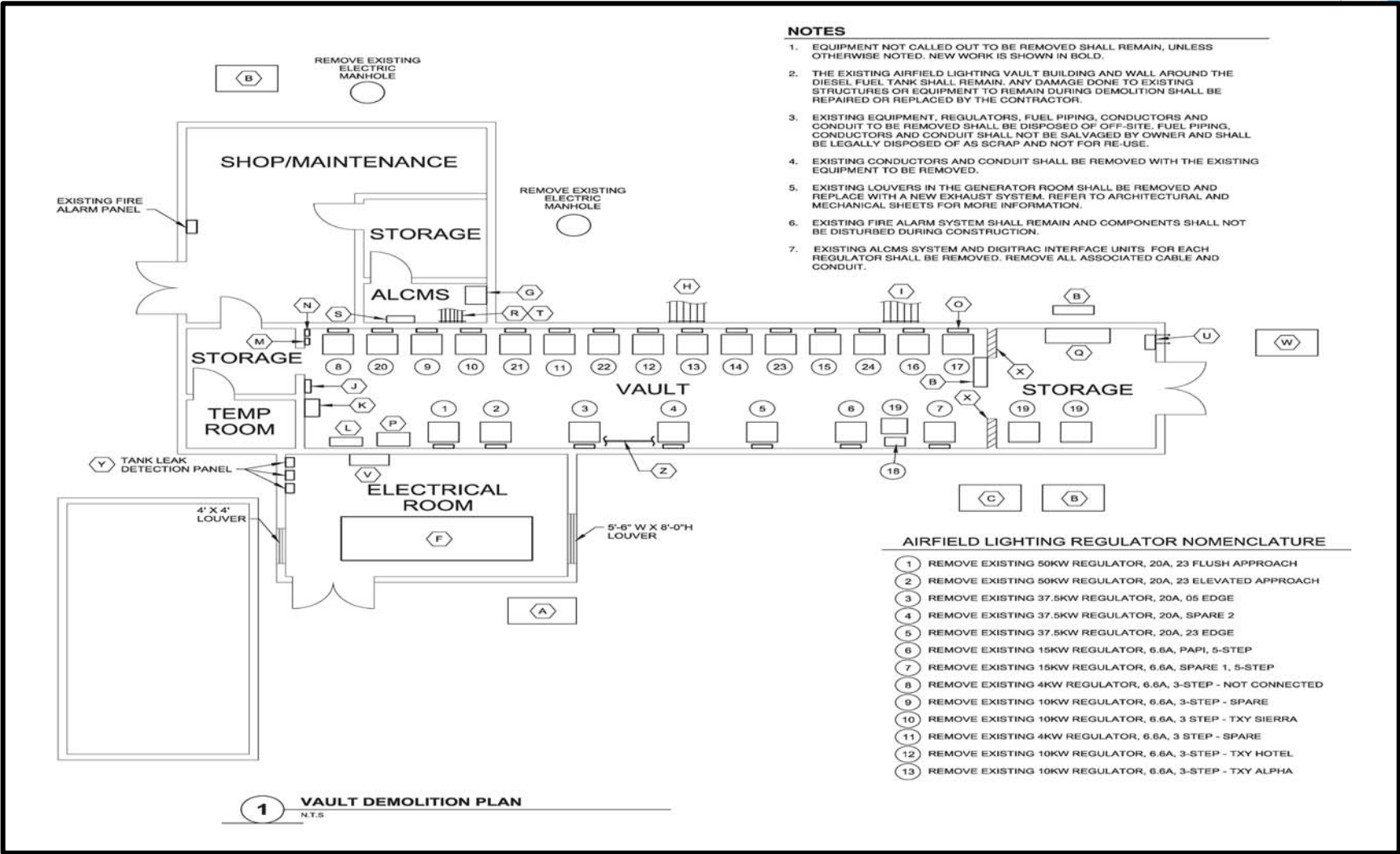


Airfield Lighting Vault

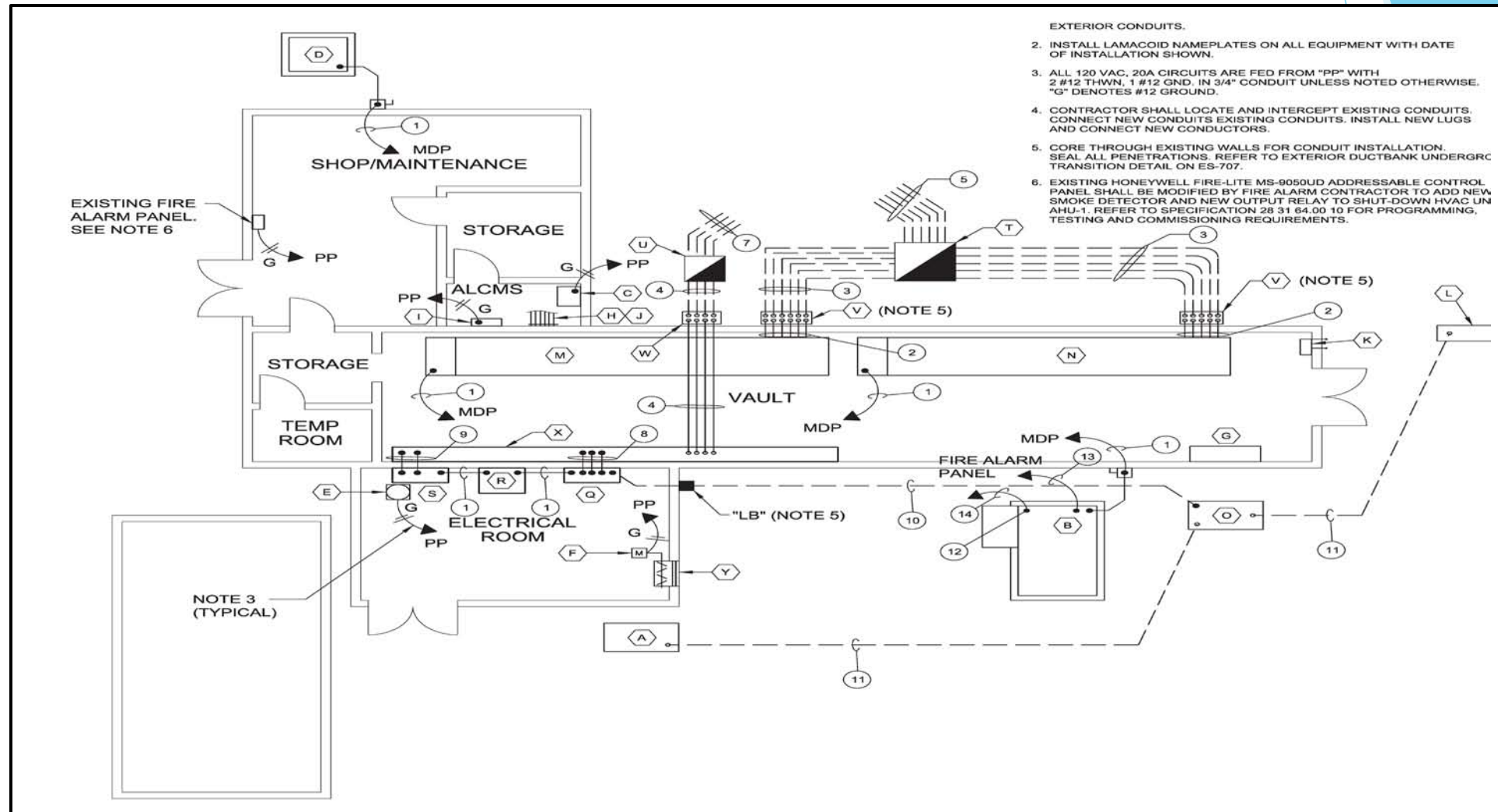
- Electric Service and Power Distribution
- Switchgear Style Regulators
- Remove existing wall
- Replace HVAC and Lighting



Airfield Lighting Vault - Demo

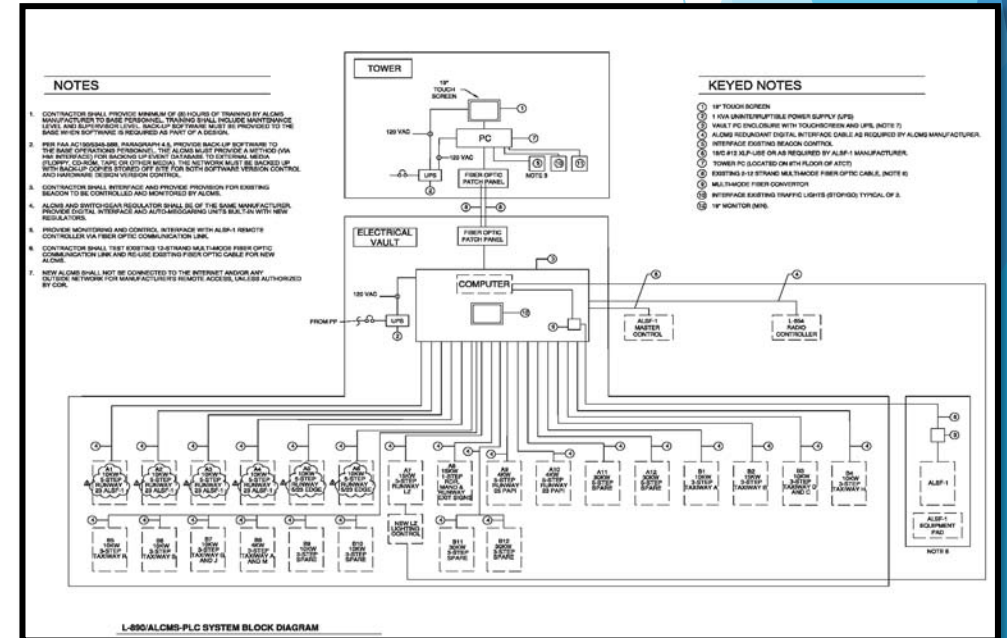
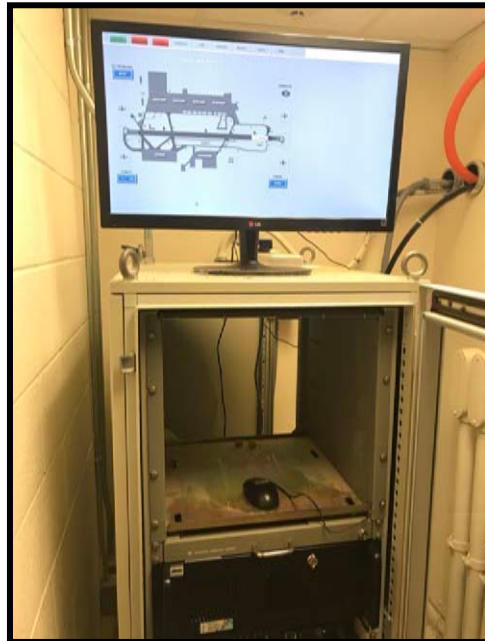


Airfield Lighting Vault - Proposed



Airport Lighting Control and Monitoring System (ALCMS)

- New ALCMS in Vault and ATCT
- Built-in interface with regulators
- Re-use existing Fiber - Vault and ATCT
- New ALCMS isolated from external networks

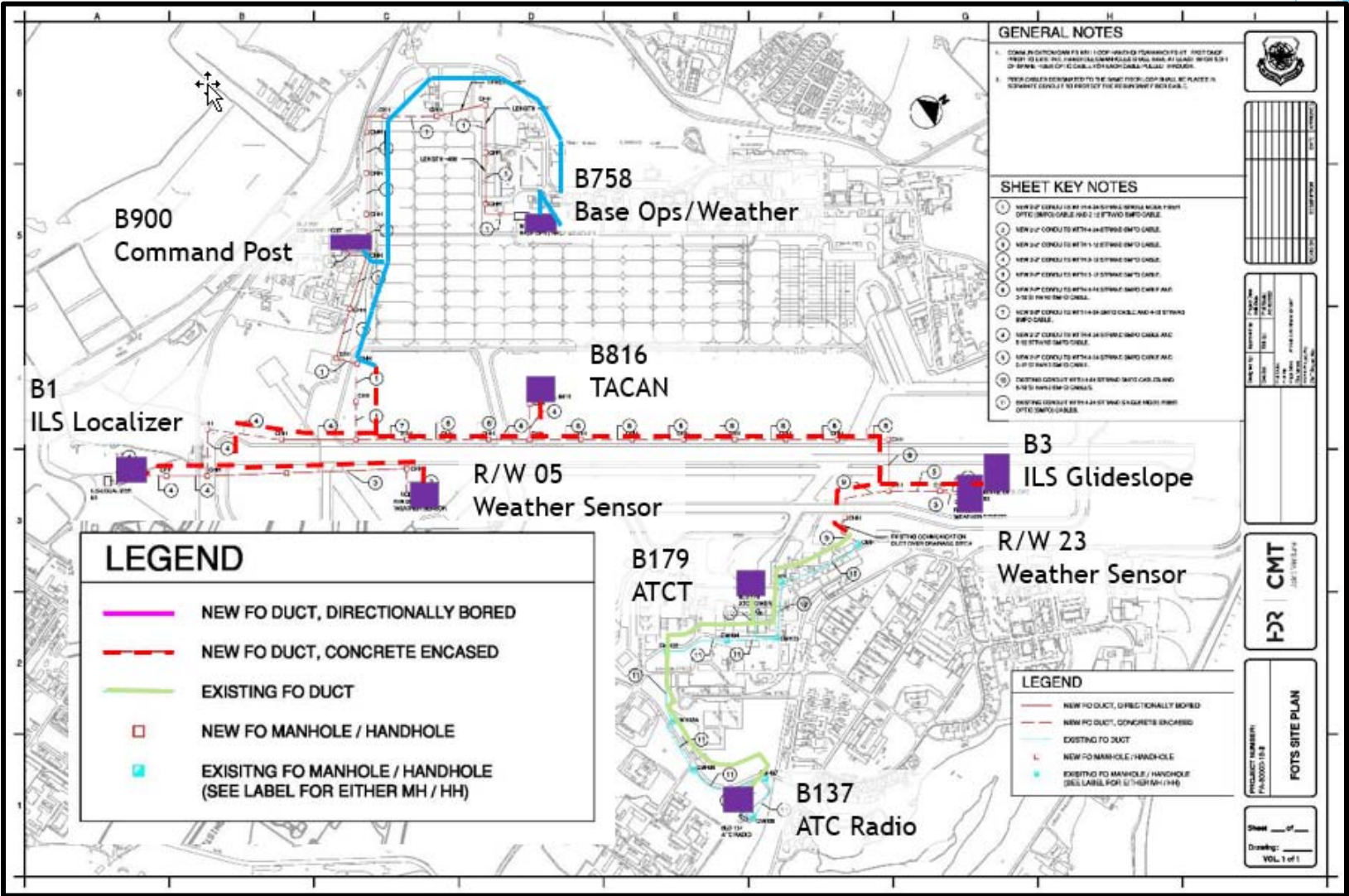


Stand-By Generator

- Remove existing generator and ATS
- Remove existing diesel tank
- Re-configure generator room to electrical room
- Install new outdoor generator



Fiber Optic Transmission System (FOTS)



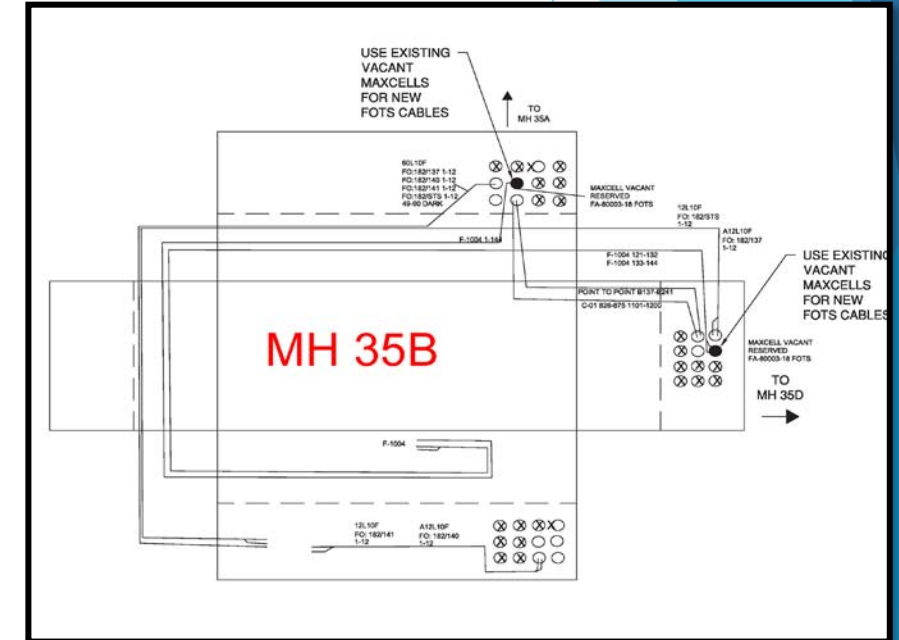
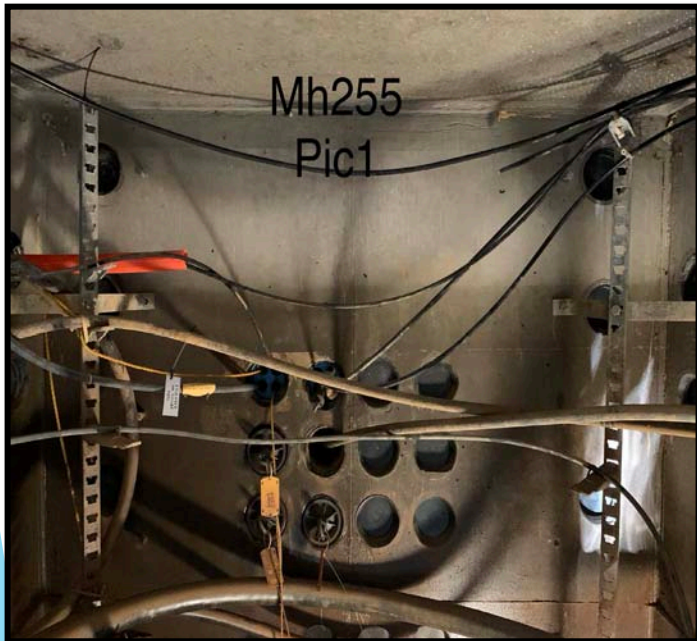
Fiber Optic Transmission System (FOTS)

- Replace existing copper with Fiber
- 3 Loops: Radio Loop, Weather Loop and ILS Loop
- Field survey of existing facilities
- New FOTS ductbank and handholes



Fiber Optic Transmission System (FOTS)

- Field investigation of manholes
- Reserved and tagged spare conduits
- Design included detailed routing information



Electrical Design Elements – Apron Lighting

- Green Ramp
- Blue Ramp
- Claw Ramp
- Shank Ramp
- Silver Ramp
- Red Ramp
- Golden Knights Ramp
- Yellow Ramp

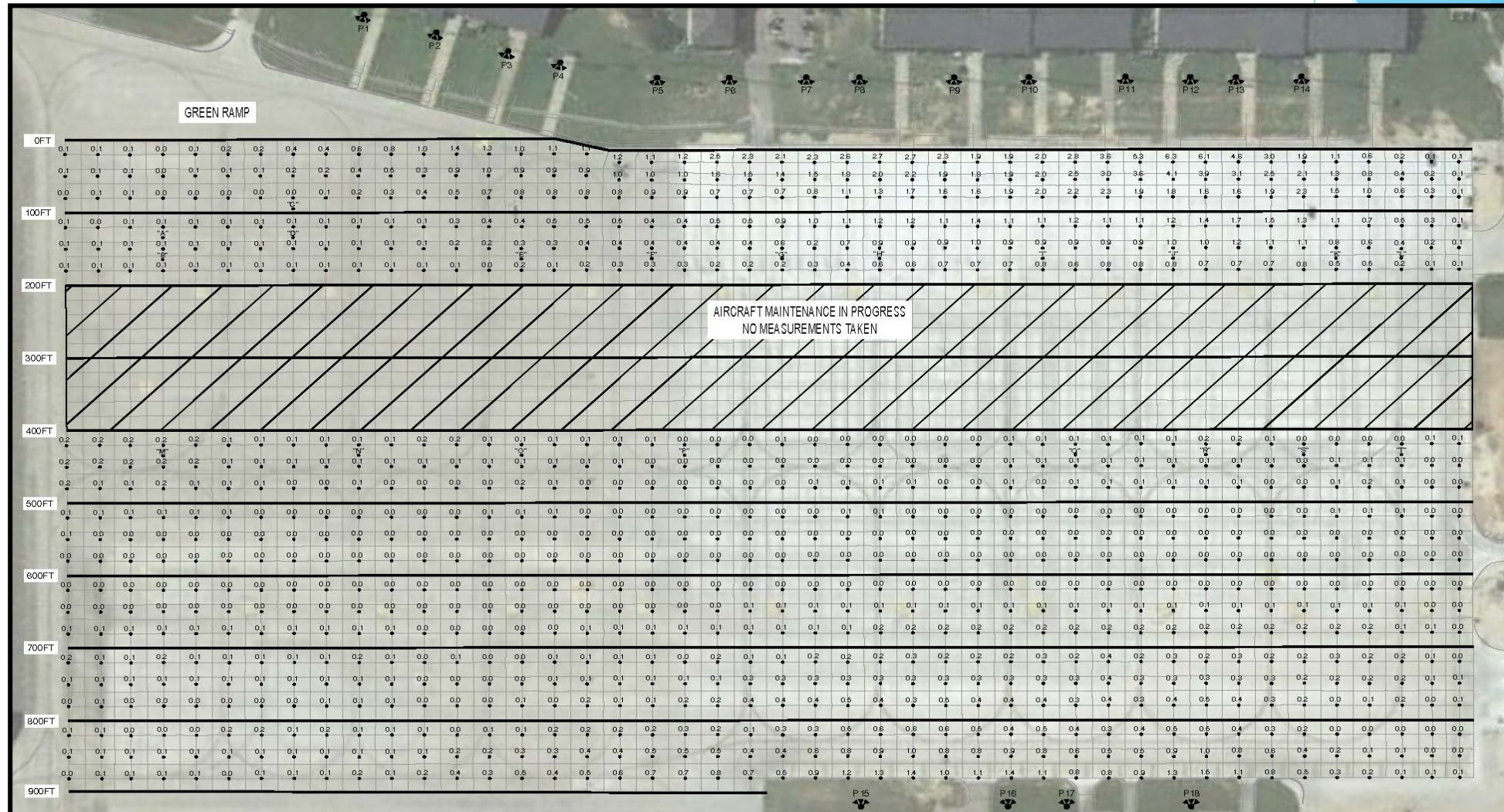


Ramp Lighting

- Field measure existing light levels
- Analyzed light levels vs UFC compliance
- Design new Ramp Lighting using LED luminaires
- Re-use existing poles and add new poles



Ramp Lighting - Field Measurements



Ramp Lighting - Field Measurements

VERTICAL PHOTOMETRIC CALCULATIONS

BLUE RAMP	VERTICAL @ 6'-0" AFF
AT POINT "A"	0.2
AT POINT "B"	0.2
AT POINT "C"	0.8
AT POINT "D"	0.5
AT POINT "E"	0.7
AT POINT "F"	1.5
AT POINT "G"	1.0
AT POINT "H"	2.3
AT POINT "I"	2.9
AT POINT "J"	3.0
AT POINT "K"	2.5
AT POINT "L"	1.0

BLUE RAMP	VERTICAL @ 6'-0" AFF
POINT "M"	0.0
POINT "N"	0.4
POINT "O"	0.3
POINT "P"	0.4
POINT "Q"	0.5
POINT "R"	0.8
POINT "S"	0.6
POINT "T"	0.4

HORIZONTAL PHOTOMETRIC CALCULATIONS

AREA	AVG	MAX	MIN	AVG/MIN
GREEN RAMP 0' - 100'	1.3	6.3	0.0	-
GREEN RAMP 100' - 200'	0.5	1.7	0.0	-
GREEN RAMP 200' - 300'	N/A	N/A	N/A	N/A
GREEN RAMP 300' - 400'	N/A	N/A	N/A	N/A
GREEN RAMP 400' - 500'	0.1	0.2	0.0	-
GREEN RAMP 500' - 600'	0.0	0.1	0.0	-
GREEN RAMP 600' - 700'	0.1	0.2	0.0	-
GREEN RAMP 700' - 800'	0.2	0.5	0.0	-
GREEN RAMP 800' - 900'	0.4	1.5	0.0	-

NOTE: - ALL CALCULATIONS SHOWN ARE IN FOOT-CANDLES (FC)
- GREEN RAMP SECTIONS ARE 20' X 20'

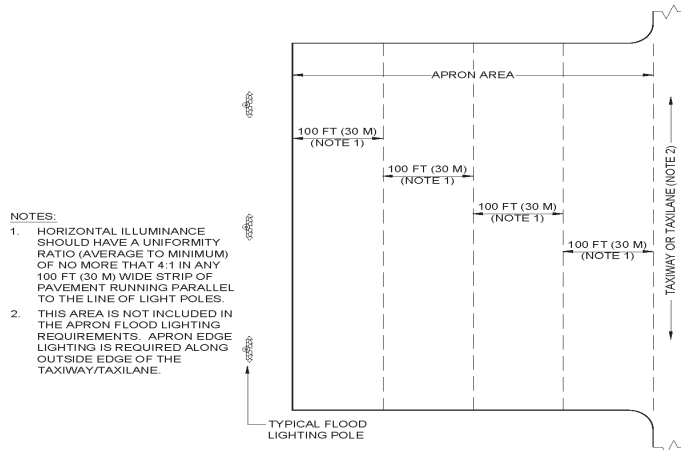
LIGHT POLE SCHEDULE

ID	HEIGHT	TYPE	WATTS	NO. OF LUMINAIRES PER POLE
P-1	110'-0"	HPS	1,000	12
P-2	110'-0"	HPS	1,000	12
P-3	110'-0"	HPS	1,000	12
P-4	110'-0"	HPS	1,000	12
P-5	110'-0"	HPS	1,000	12
P-6	110'-0"	HPS	1,000	12
P-7	110'-0"	HPS	1,000	12
P-8	110'-0"	HPS	1,000	12
P-9	110'-0"	HPS	1,000	12
P-10	110'-0"	HPS	1,000	12
P-11	110'-0"	HPS	1,000	12
P-12	110'-0"	HPS	1,000	12
P-13	110'-0"	HPS	1,000	12
P-14	110'-0"	HPS	1,000	12

Ramp Lighting - Photometrics

- Perform photometrics using AGI32 and Basis of Design LED Luminaires
- Use existing poles and power sources
- Total EPA and weight of luminaires should be less than existing luminaires
- Illuminance and Uniformity based on UFC 3-535-01, 10-4

Figure 10-1 Apron Area Flood Lighting Uniformity Criteria



GOLDEN KNIGHTS RAMP
HORIZONTAL PHOTOMETRIC CALCULATIONS

AREA	UFC DESIGNATION	UFC AVG	UFC AVG/MIN	CALC AVE	CALC MAX	CALC MIN	CALC AVG/MIN
1A	OTHER	1.00	4:1	1.27	3.7	0.0	-
1B	OTHER	1.00	4:1	2.64	8.2	0.7	3.77
1C	OTHER	1.00	4:1	2.48	4.3	0.3	8.27
1D	OTHER	1.00	4:1	1.89	4.1	0.1	18.90
2A	OTHER	1.00	4:1	2.92	4.0	1.83	2.50
2B	OTHER	1.00	4:1	3.21	4.1	2.2	1.46
2C	OTHER	1.00	4:1	2.98	4.1	1.7	1.75
2D	OTHER	1.00	4:1	2.19	3.4	1.2	1.83
3A	OTHER	1.00	4:1	1.35	2.2	0.8	1.69
3B	OTHER	1.00	4:1	1.43	2.2	0.9	1.59
3C	OTHER	1.00	4:1	1.24	1.9	0.8	1.55
3D	OTHER	1.00	4:1	0.94	1.4	0.6	1.57
4A	OTHER	1.00	4:1	0.57	0.8	0.4	1.43
4B	OTHER	1.00	4:1	0.58	0.8	0.4	1.45
4C	OTHER	1.00	4:1	0.53	0.8	0.4	1.33
4D	OTHER	1.00	4:1	0.42	0.6	0.3	1.40

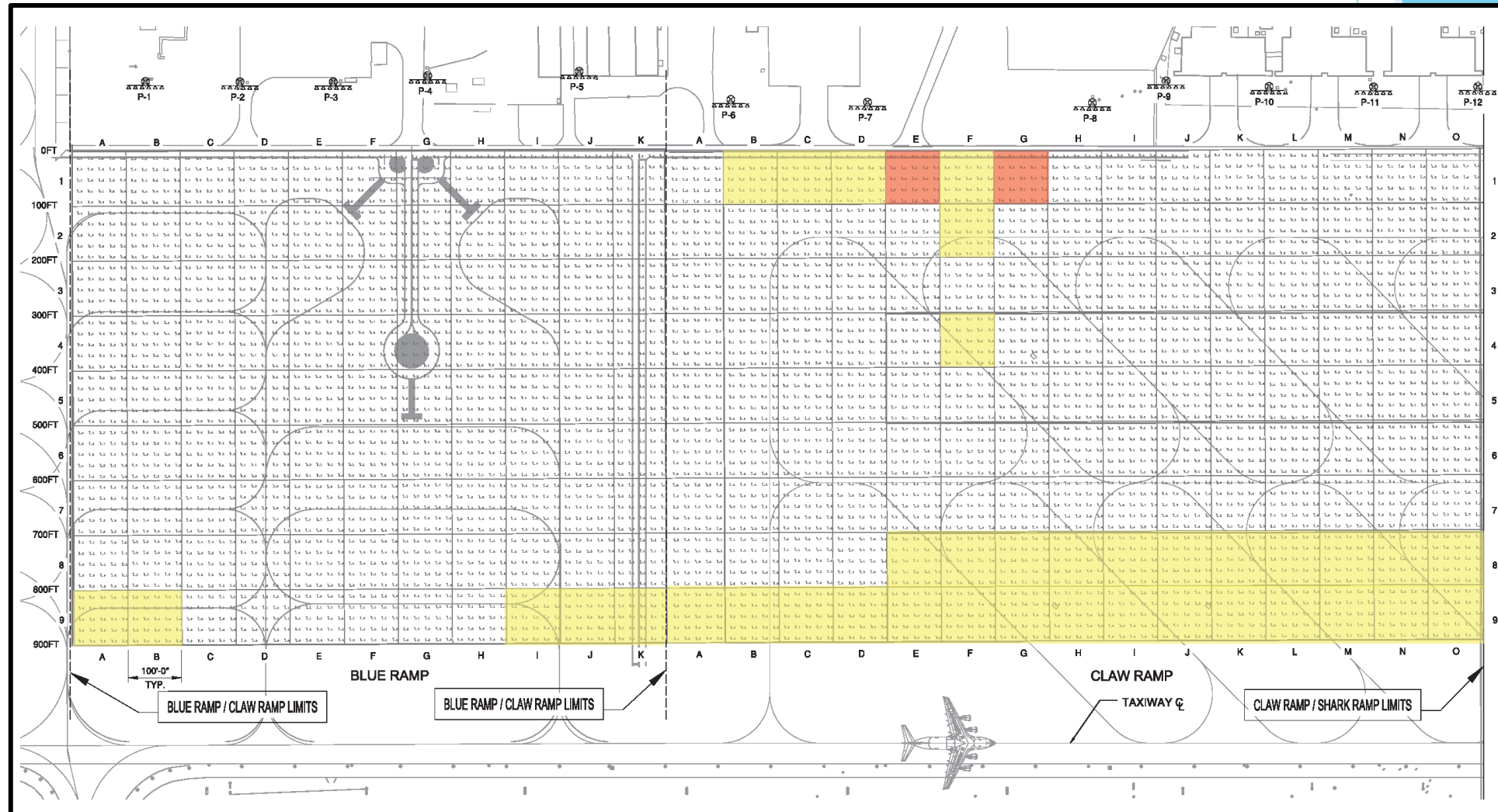
NOTE: - ALL CALCULATIONS SHOWN ARE IN FOOT-CANDLES (FC)

LIGHT POLE SCHEDULE

ID	HEIGHT	ORIENTATION						TILT	TYPE	WATTS	NO. OF EXISTING	NO. OF NEW
		A	B	C	D	E	F					
P-1	110'-0"	-15°	-10°	-5°	5°	10°	15°	10°	LED	800W	30	12
P-2	110'-0"	-15°	-10°	-5°	5°	10°	15°	10°	LED	800W	30	12
P-3	110'-0"	-15°	-10°	-5°	5°	10°	15°	10°	LED	800W	30	12
P-4	110'-0"	-15°	-10°	-5°	5°	10°	15°	10°	LED	800W	30	12
P-5	110'-0"	-15°	-10°	-5°	5°	10°	15°	10°	LED	800W	30	12
P-6	110'-0"	-15°	-10°	-5°	5°	10°	15°	10°	LED	800W	30	12
P-7	110'-0"	-15°	-10°	-5°	5°	10°	15°	10°	LED	800W	30	12
P-8	110'-0"	-15°	-10°	-5°	5°	10°	15°	10°	LED	800W	30	12
P-9	110'-0"	-15°	-10°	-5°	5°	10°	15°	10°	LED	800W	30	12
P-10	110'-0"	-15°	-10°	-5°	5°	10°	15°	10°	LED	800W	30	12
P-11	110'-0"	-15°	-10°	-5°	5°	10°	15°	10°	LED	800W	30	12
P-12	110'-0"	-15°	-10°	-5°	5°	10°	15°	10°	LED	800W	30	12

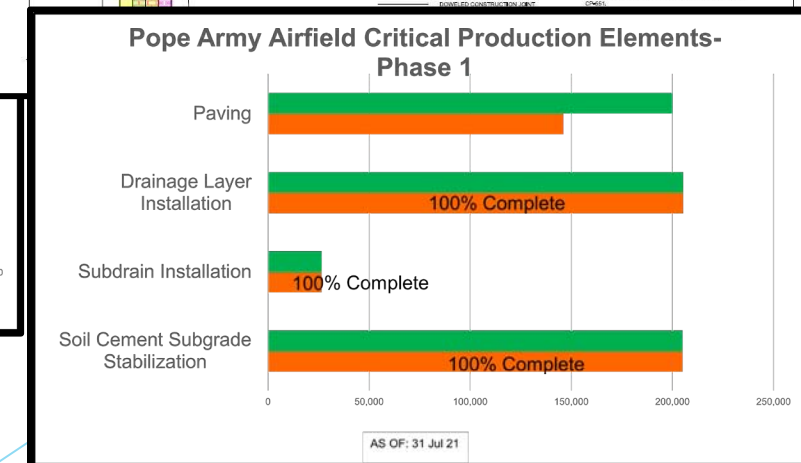
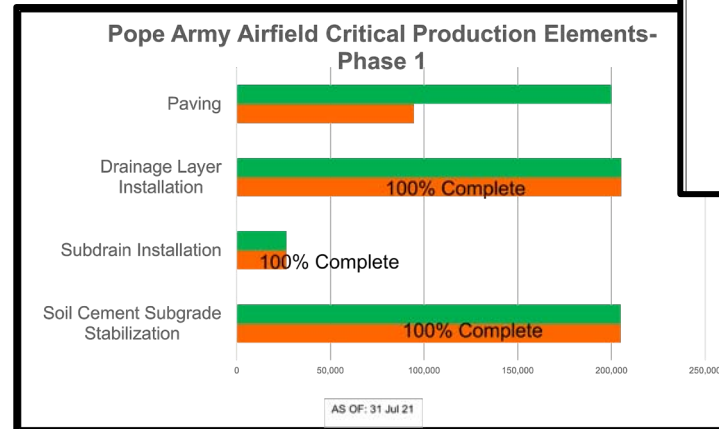
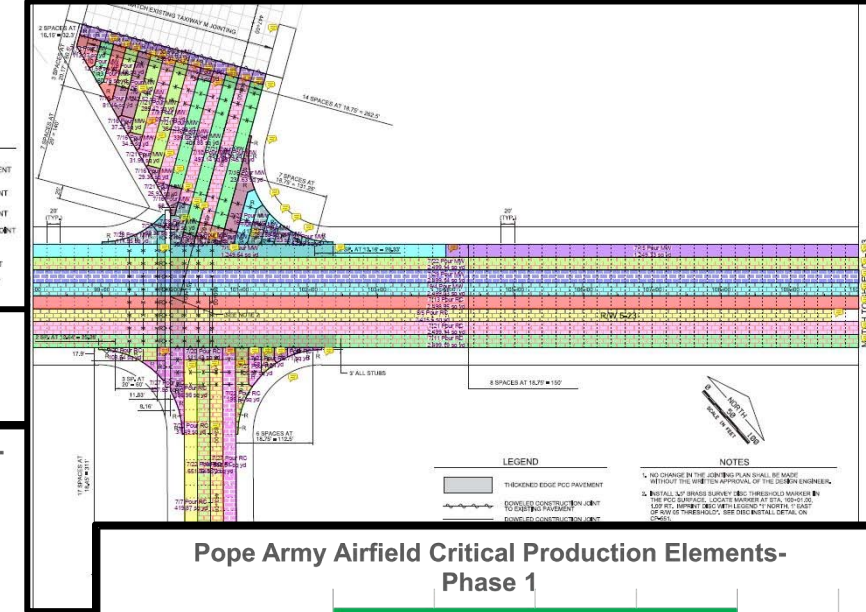
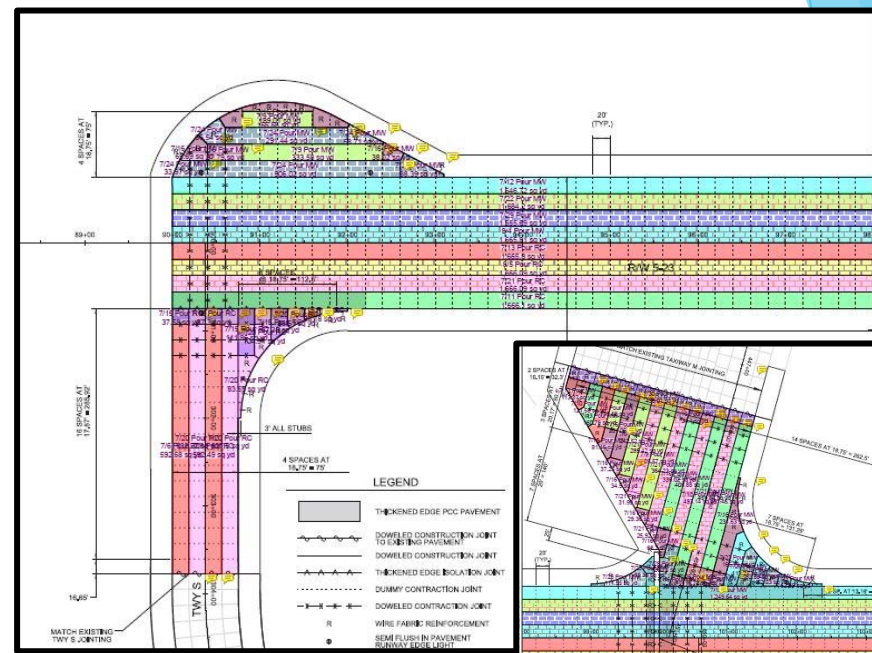
NOTE: REFER TO SHEET ES-596 FOR DIAGRAM OF AIMING ANGLE AND TITLE REFERENCED IN THIS TABLE.

Ramp Lighting - Photometrics



Productivity Tools Used

- Microsoft Teams
 - Weekly Meetings
- Procore
 - Contractor Submittals and RFI's
 - USACE Team
 - HDR CMT Team
- Newforma
 - HDR CMT Team
 - Submittal and RFI Reviews
- E-mail
 - Team e-mails
 - Continual schedule updates



Mobilization Phase

- Ductbanks
- Pre-cast Hanholes
- Pre-cast Can Plazas



Runway & Taxiway Edge Lighting - Package 1

- 98 Runway Edge Lights
- 133 Taxiway Edge Lights



Signs- Package 1

- 40 Signs



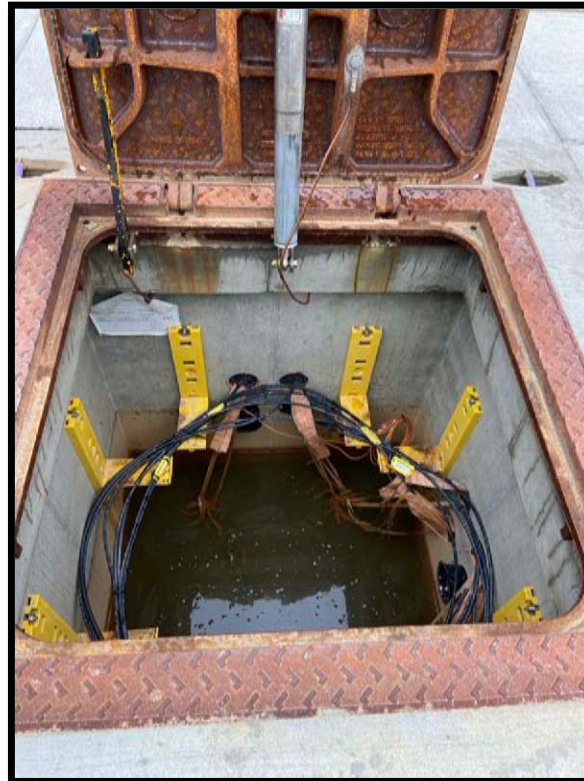
Ductbank and Can Plazas- Package 1

- 300,000 LF of Conduits
- 46 Can Plazas
- 109 Handholes

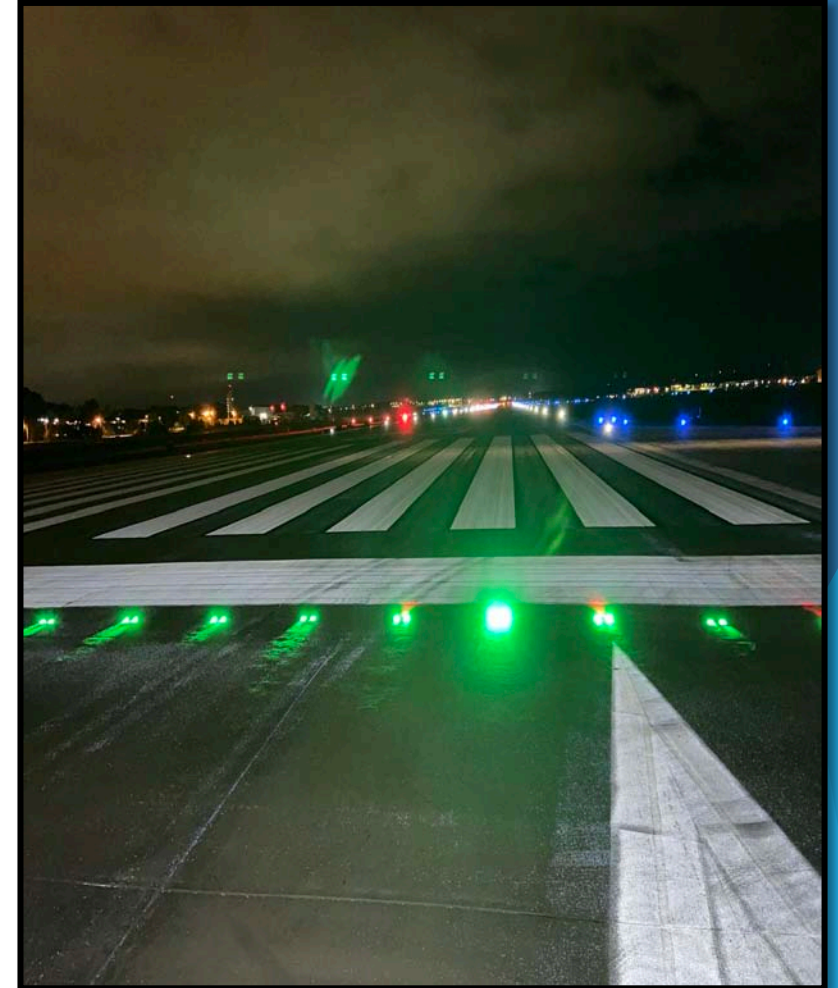


Runway 23 ALSF-1- Package 1

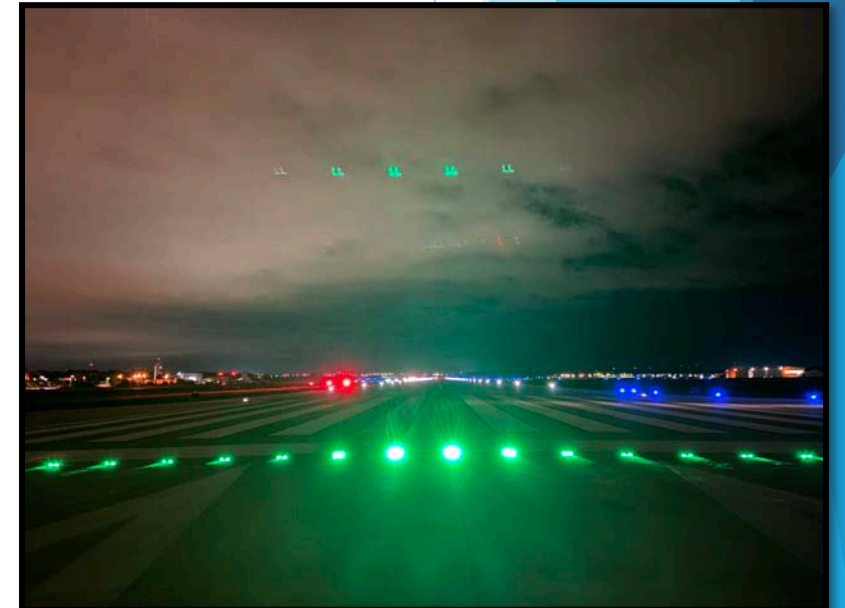
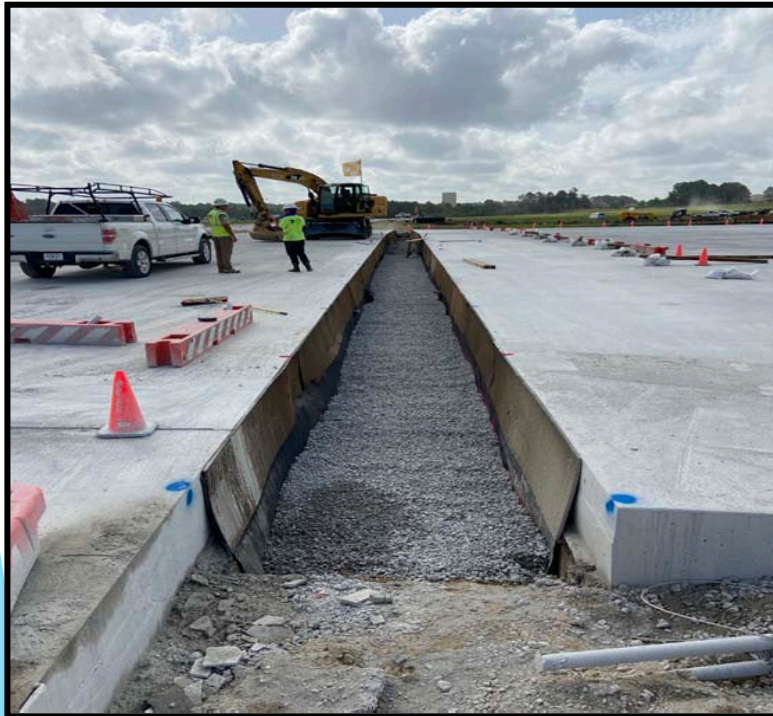
- 3,000 ALSF-1
- LED Sequenced Flashers



Runway 23 ALSF-1- Package 1



Runway 05 Threshold - Package 1



NAVAIDS - Package 1

- Runway 23 & Runway 05 PAPI's
- Runway 05 REIL's
- Windcones



Airfield Lighting Vault- Package 1

- New Electric Service
- New Power Distribution System
- New Stand-By Deisel Generator



Airfield Lighting Vault- Package 1

- 24 Switchgear Style Regulators
- Runway and Taxiway Lineups
- Manhole for Airfield Lighting Circuits



Airfield Lighting Vault- Package 1

- New ALCMS
- LZ Lighting Controls



Airfield Lighting Vault- Package 1

- Interior and Exterior Lighting
- HVAC System



FOTS- Package 1

- New FOTS ducts and Handholes
- Fiber Termination at ILS Facilities



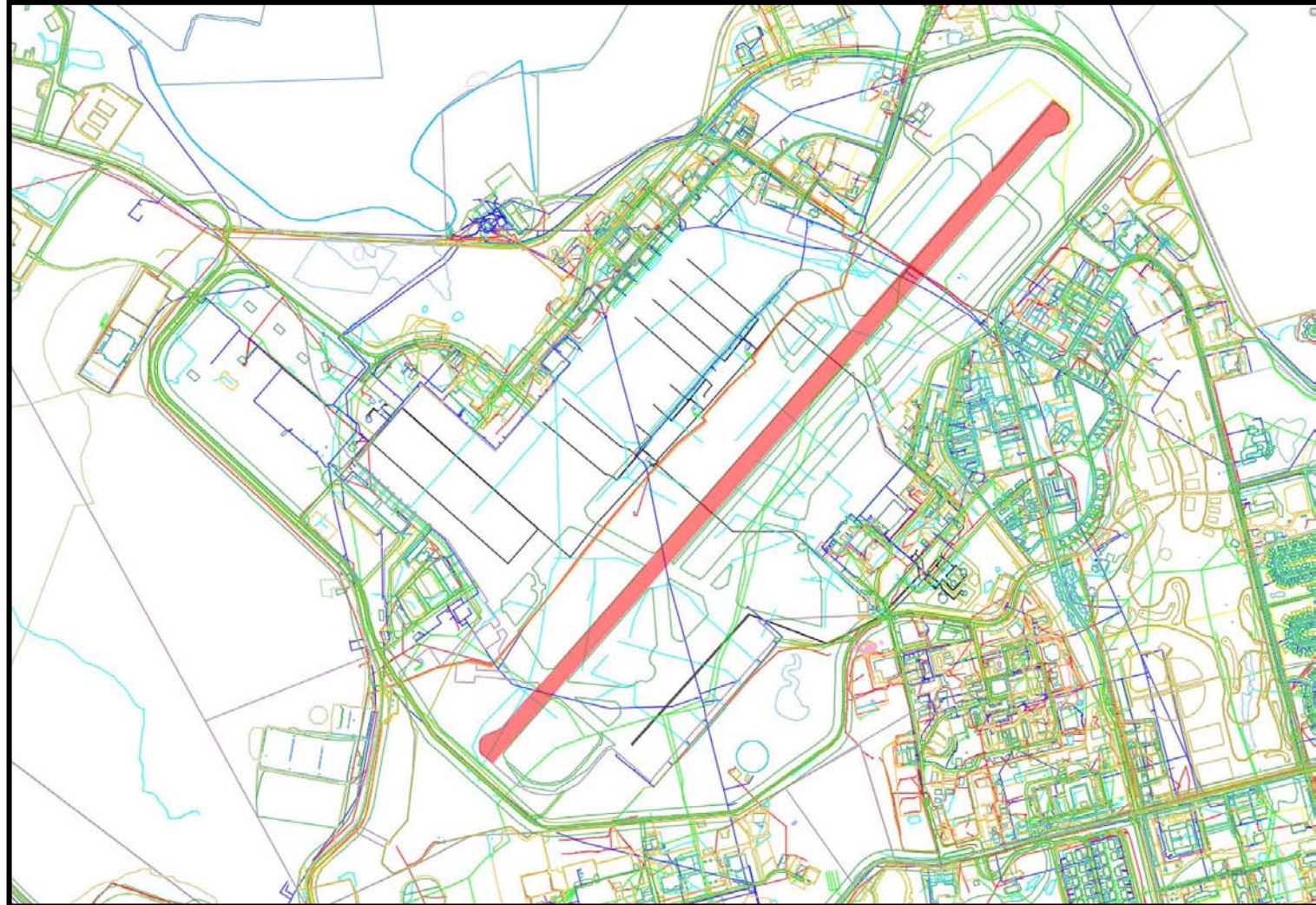
Photometric testing

- All Runway Fixtures
- All but 3 passed first shot



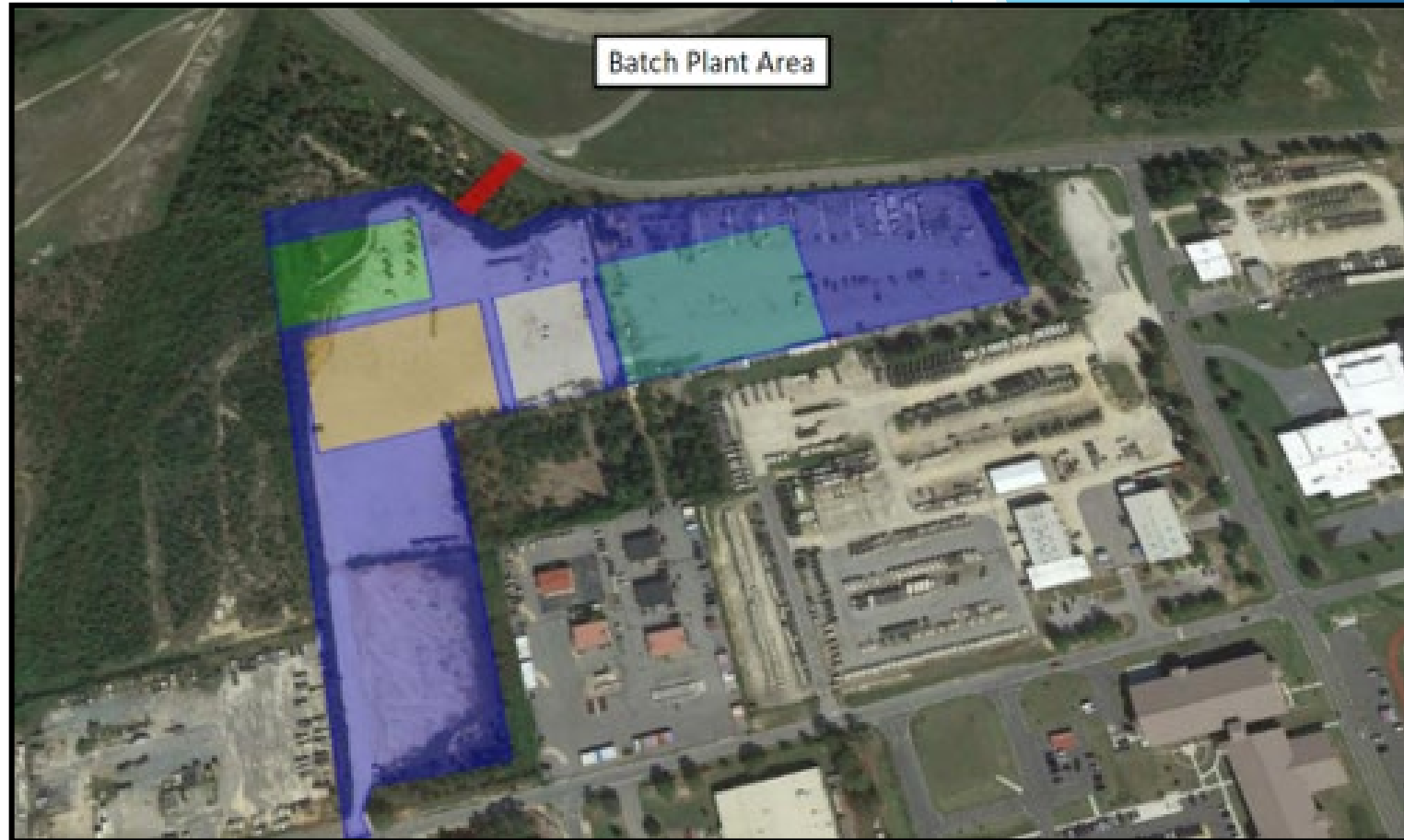
Design Lessons

- Unknown underground utilities
 - Existing plans not enough
 - Unknown utilities cause delays
 - Include subsurface investigation
- Circuit Identification
 - Taxiway Renaming
- Cybersecurity
 - Get involved early



Planning Lessons

- Laydown area
 - Substantial Electrical Space
 - On-site stocking before closure
- Scheduling
 - Electrical vs. Civil Time Required
 - Electrical work required after paving
 - Landing Zone Active/Closed



Project Success

- Runway Re-opened on Time – October 14, 2021
- ACPA National Excellence in Concrete Pavement Award Winner
- Project Progressing to Completion



Questions

