Concrete Case Study – JFK Runway 4L-22R Unbonded Overlay

2016 CAPTG Workshop
SWIFT 2016 Conference

September 19, 2016

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Presentation Summary

Port Authority overview

Pavements

Runway 4L-22R Program

FAA/PA Field Testing

Construction

Program Risk Mitigation

Questions

The Port Authority

- **Established in 1921.**
- **Created to promote the commerce of the Port District and to undertake port and regional improvements including development of major infrastructure improvements.**
- **Facilities include America's busiest airport system, marine terminals and ports, the PATH rail transit system, two tunnels and four bridges between New York and New Jersey, the Port Authority Bus Terminal and the World Trade Center.**

Port Authority Facility Map

Aviation
John F. Kennedy International Airport
LaGuardia Airport
Newark Liberty International Airport
Stewart International Airport
Teterboro Airport
Atlantic City International Airport

Bridges
Bayonne Bridge
George Washington Bridge
Goethals Bridge
Outerbridge Crossing

Terminals
Port Authority Bus Terminal
George Washington Bridge Bus Terminal
Journal Square Transportation Center

Tunnels
Holland Tunnel
Lincoln Tunnel

Port Commerce
Port Jersey-Port Authority Marine Terminal
Brooklyn-Port Authority Marine Terminal
Elizabeth-Port Authority Marine Terminal
Howland Hook Marine Terminal
Port Newark

Port Authority Trans-Hudson
PATH Rail Transit System

WTC

Snapshot of PA Aviation assets

PA airports encompass an area that is 80% of the size of Manhattan

• 285 miles of pavement → 189 miles of roadway, 74 miles of taxiways and 25 miles of runway length

- LGA: 20 mi. of roadways, 10 mi. of taxiway and 2.6 mi. of runways
- JFK: 100 mi. of roadways, 34 mi. of taxiway and 8.4 mi. of runways
- EWR: 50 mi. of roadways, 18 mi. of taxiway and 5.3 mi. of runways
- Teterboro: 3 mi. of roadways, 2 mi. of taxiway and 6 mi. of runways
- Stewart: 16 mi. of roadways, 7 mi. of taxiway and 3 mi. of runways

- **6,687 sign structures and towers**
- **98 roadway bridges and ramp structures**
- **425 buildings and structures containing 20,766,963 sq ft.**
- **Electrical power distribution, aeronautical lighting systems, fire protection, life safety systems, and vertical transportation**

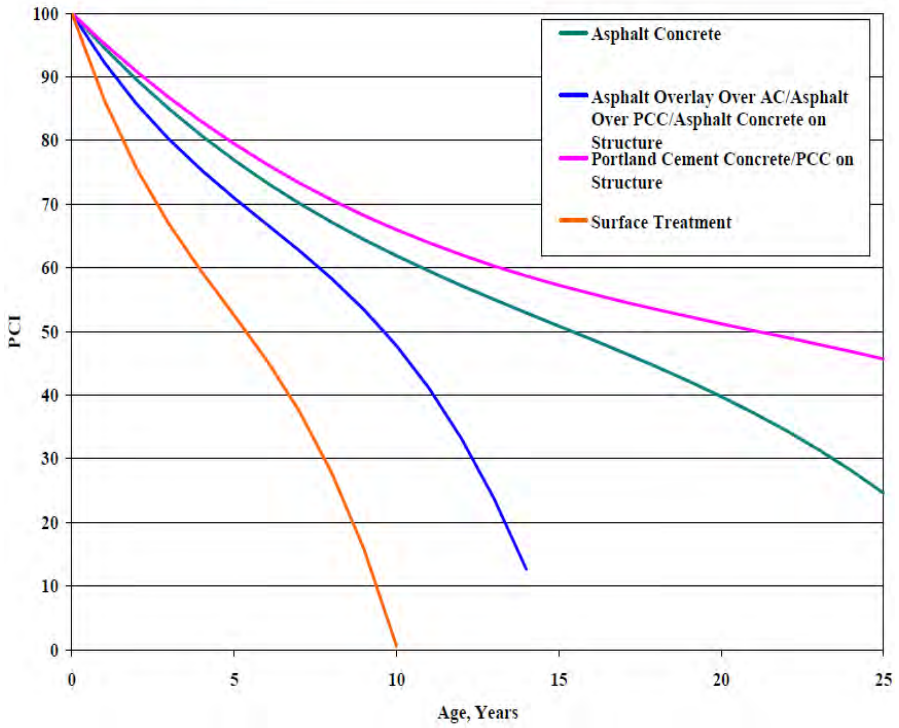
Pavements

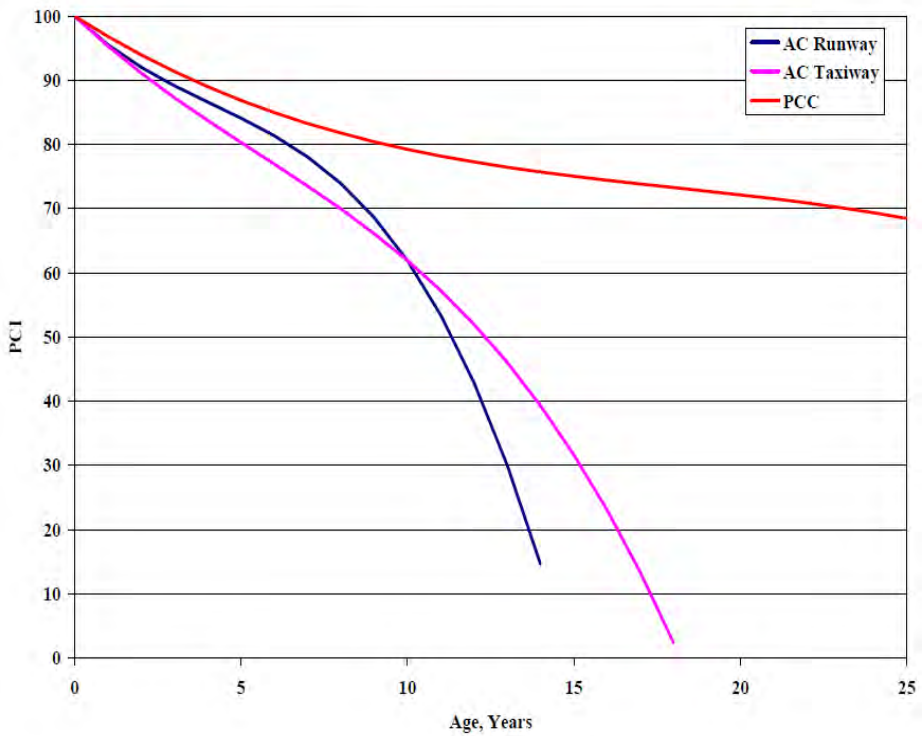
Experienced Pavement Live

- **Asphalt**
  - **Runways & Taxiways (New) 20 Years**
  - **Runways & Taxiways (Rehabilitation) 10 Years**
  - **Roadways (New) 20 Years**
  - **Roadways (Rehabilitation) 10 Years**

- **Concrete**
  - **Runways & Taxiways 30+ Years**
  - **Roadways 40 Years**

PCI Prediction Models



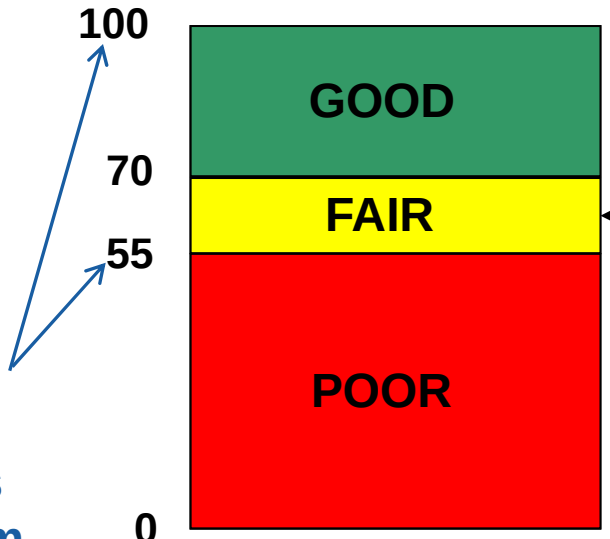


Figures developed from the Port Authority Pavement Management System

Keeping Airfield Pavements in a State of Good Repair

Pavements are inspected a minimum of once every 3 years

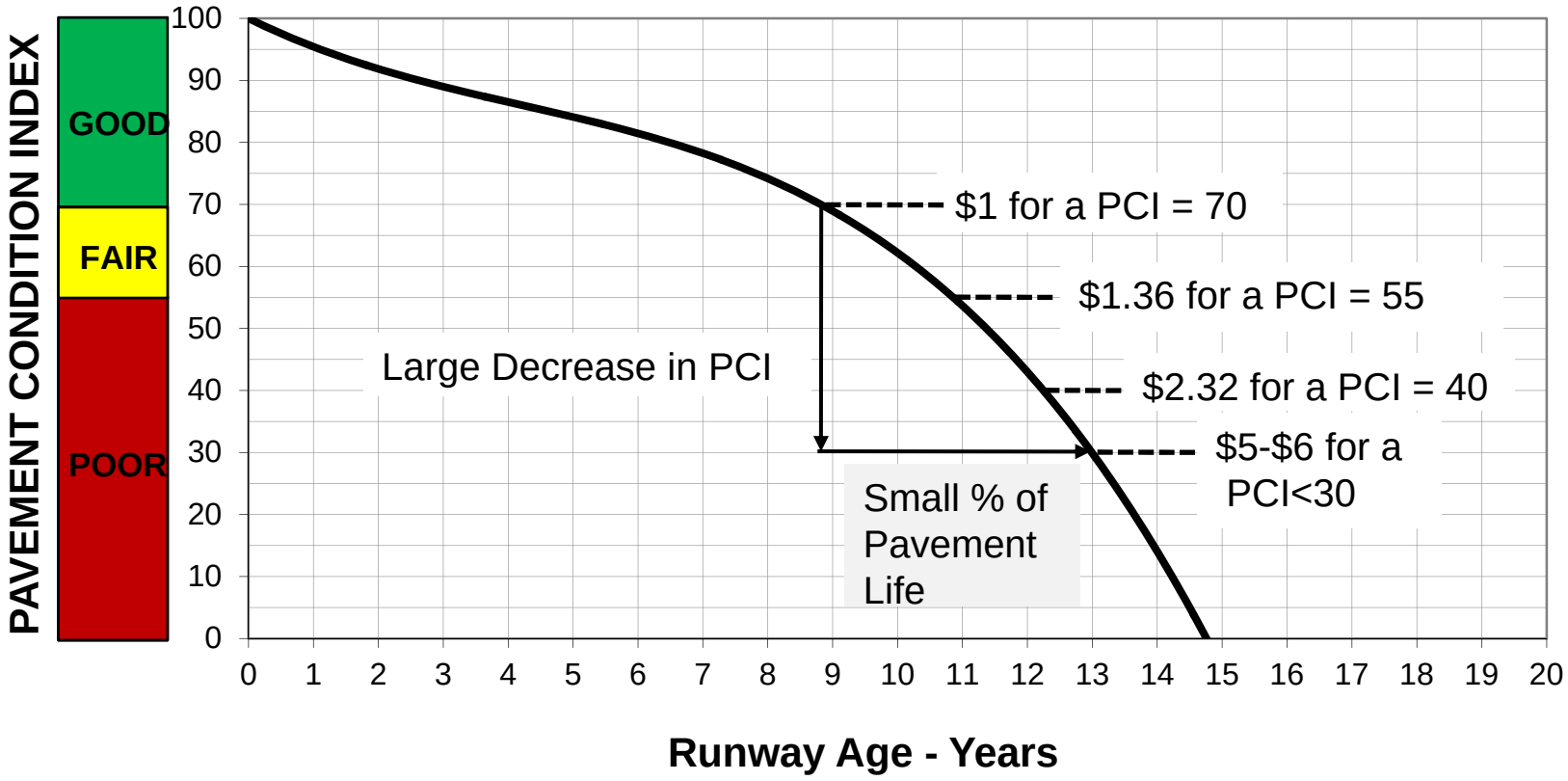
PCIs are developed using the Army Corps of Engineers Micropaver program



PCI of 60 generally triggers rehabilitation recommendation.

- **Distress type**
- **Operational constraints**

State of Good Repair Typical Runway

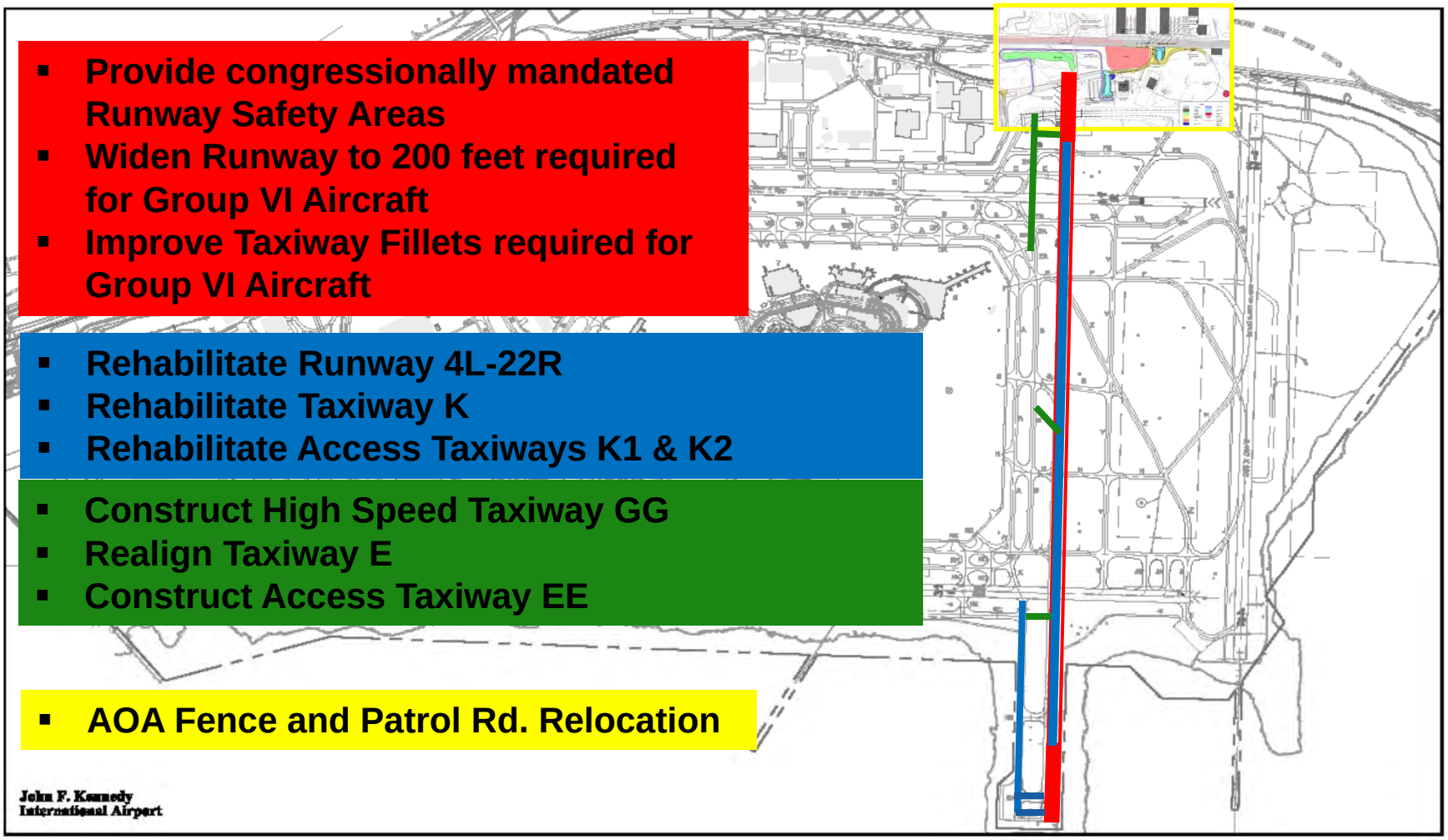


Optimal time to rehabilitate pavement is when it reaches fair condition. Otherwise, delaying the pavement rehabilitation by two years increases the cost by 36%. An additional two year delay increases the cost by five or six times.

Runway 4L-22R Program

JFK - Runway 4L-22R

RUNWAY 4L-22R PROGRAM - SCOPE OF WORK



- Provide congressionally mandated Runway Safety Areas
- Widen Runway to 200 feet required for Group VI Aircraft
- Improve Taxiway Fillets required for Group VI Aircraft

- Rehabilitate Runway 4L-22R
- Rehabilitate Taxiway K
- Rehabilitate Access Taxiways K1 & K2

- Construct High Speed Taxiway GG
- Realign Taxiway E
- Construct Access Taxiway EE

- AOA Fence and Patrol Rd. Relocation

Overall Program Development

- **Meet with all stakeholders early and often**
  - **Every stakeholder has different expectations**
  - **Operations Group - What are the airfield requirements?**
  - **Construction Group – Can we build**
  - **it this way?**
  - **Security Group – How do we keep the airport safe during construction?**
  - **Contract and Estimating Groups – How much does the program cost?**
- **Develop working staging/scoping drawings for review**
  - **Stakeholder workshop**
  - **FAA coordination**
  - **Environmental Process**
  - **Evaluate lessons learned from prior contracts**

Overall Program Development Continued

Finalize Scope

- 200-foot wide PCC FAA Group VI Runway
- New PCC and AC taxiways
- New drainage system
- New lighting system

Develop contract documents

- Drawings, Specifications and Estimates
- Finalize contractor requirements including contractor laydown areas, haul routes, utility requirements and commissioning type drawing
- Hold contractor's workshop

Construction

- Scheduling
- QA/QC
- Security
- Staging areas

Overall Program Schedule

Planning	**July 2010**	**June 2011**
Preliminary Design	**June 2011**	**April 2012**
Final Design	**April 2012**	**July 2014**
Construction	**July 2014**	**December 2015**

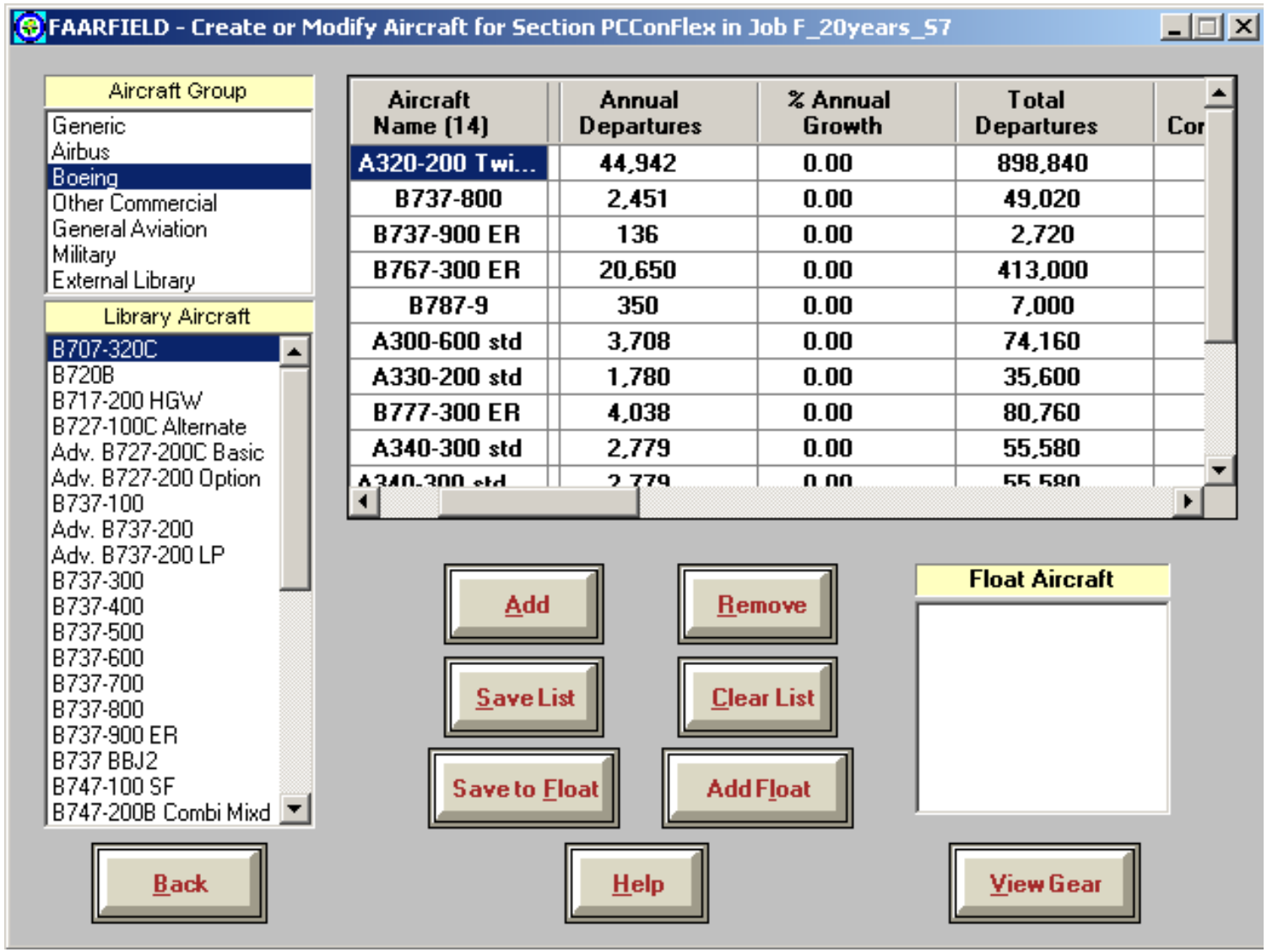
Pavement Design

Aircraft Mix – Departure Volume & Growth Factor

Year	Yearly Passenger
2006	42,629,407
2025	50,240,131
2045	51,606,901
Growth Rate (From 2006-2025)	**1.1785**

FAA Code	Model	Maximum Take-Off Weight, lb	Gear Type	Departures @ Year 2006	FAARFIELD INPUT AIRCRAFT	TOTAL Departures @ Year 2006	Projected Total Departures @ Year 2025
B721	Model 727-100 (C-22)	169,000	Dual	**22**	B737-800	2,080	**2,451**
B727	Model 727-100	169,000	Dual	**8**			
B732	Model 737-200 (VC96)	128,000	Dual	**9**			
B733	Model 737-300	138,500	Dual	**39**			
B734	Model 737-400	138,500	Dual	**1**			
B735	Model 737-500	133,500	Dual	**339**			
B736	Model 737-600	145,500	Dual	**2**			
B737	Model 737-700	154,500	Dual	**292**			
C130	Lockheed C-130 Hercules	155,000	Dual	**3**			
B738	Model 737-800	174,200	Dual	**1365**			

Pavement Design Parameters – FAARFIELD Input



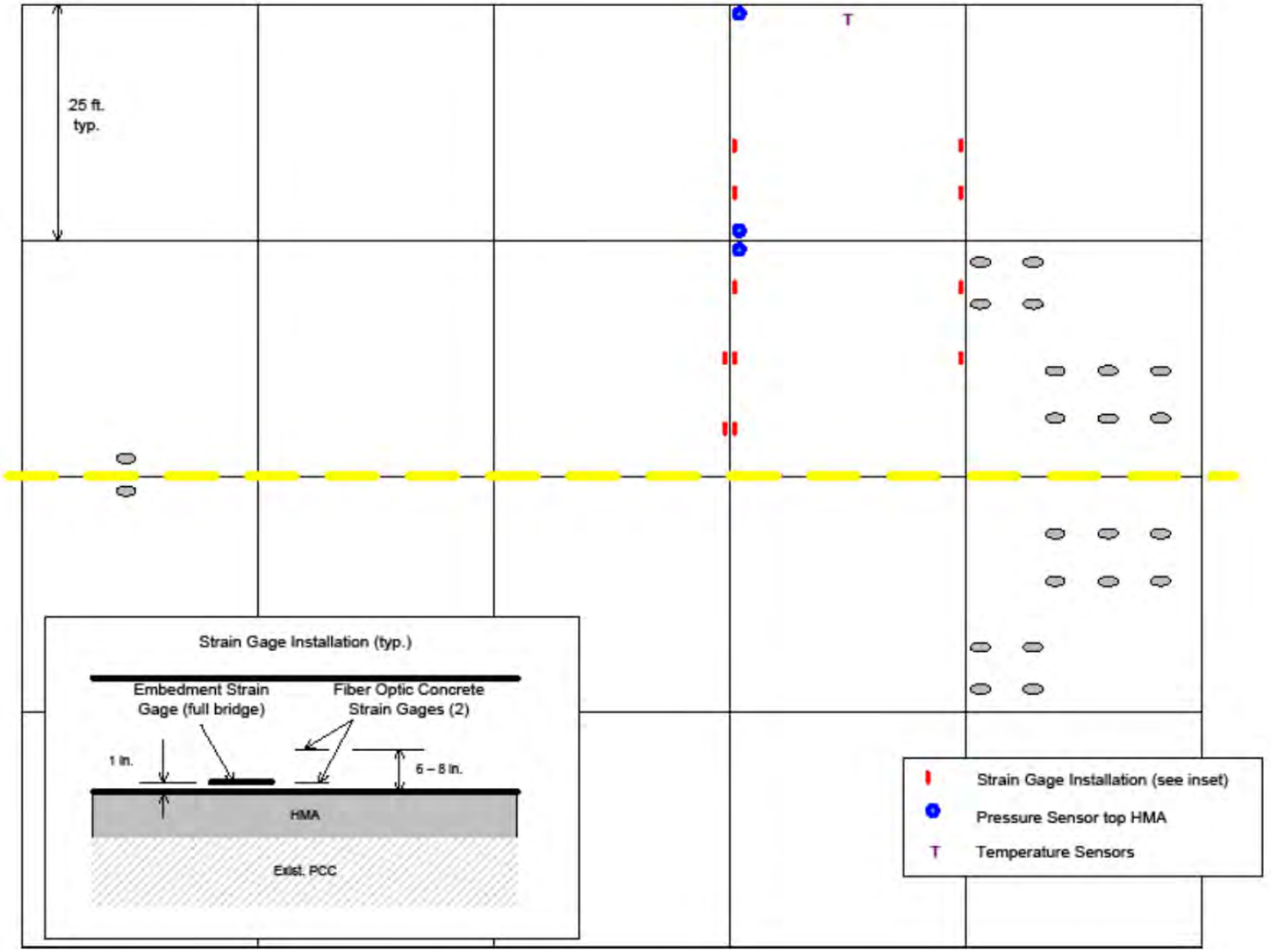
FAA/PA Field Testing

FAA Pavement Monitoring Equipment

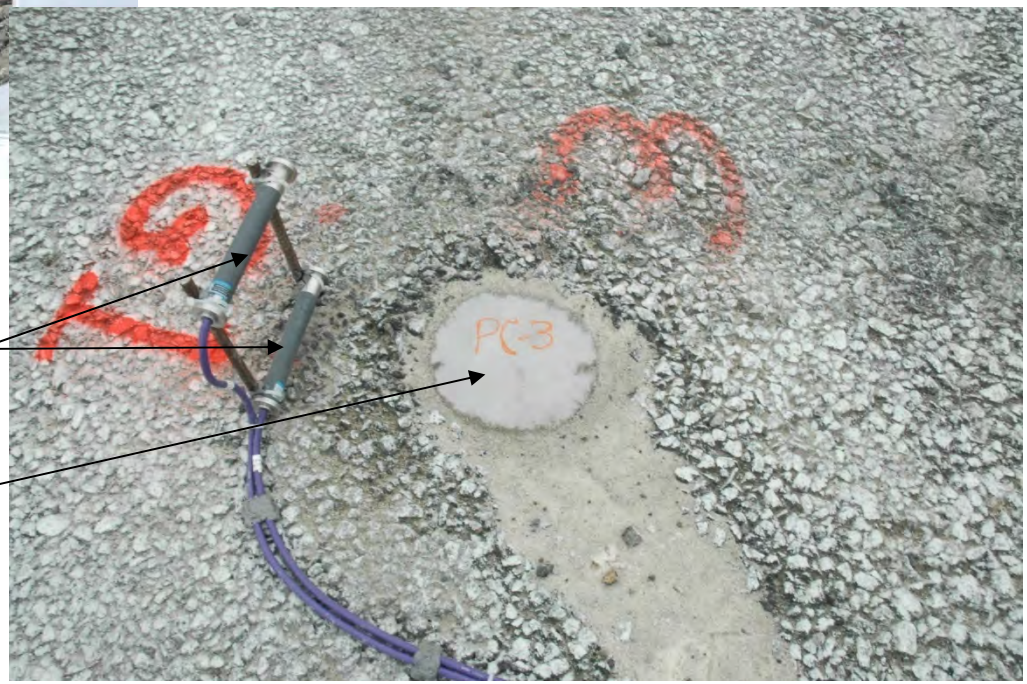
FAA and PA worked in conjunction with the Contractor to install pavement sensors to measure pavement temperature and real time strain in actual field conditions.

Data Acquisition System (DAS) Cabinet, Camera, and solar panels for powering the system.

FAA Gage Layout Concept



Embedded Concrete Strain Gage



Embedded Concrete Strain Gage & Pressure Cell

Final Pavement Designs

Runway - PCC

- Existing AC surface milled approximately 8” and a 2” AC leveling course placed.
- 18-inches PCC
- 1.5-inch diameter, 18-inch long dowels
- 25-foot typical slab size

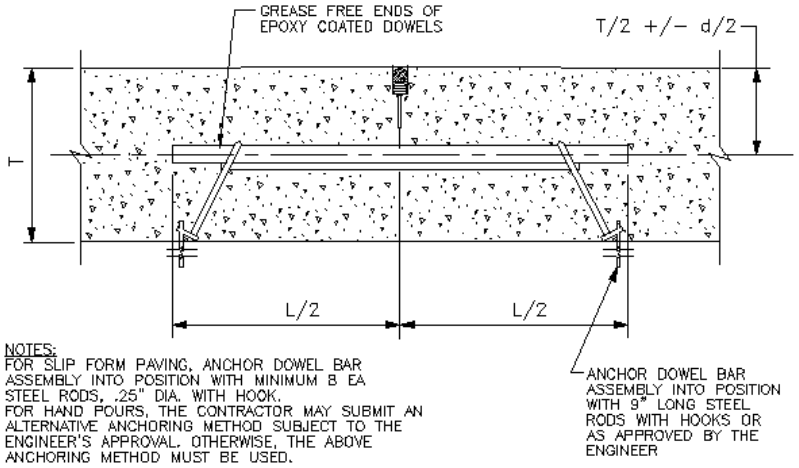
Taxiway - AC

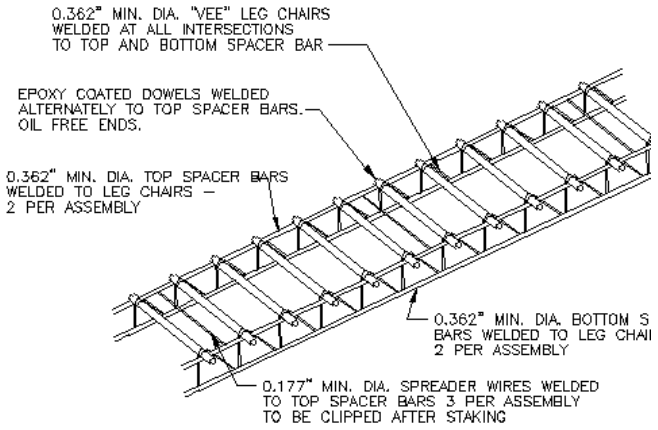
- Existing AC surface milled and overlaid with 3 to 12-inches of AC

Taxiway - PCC

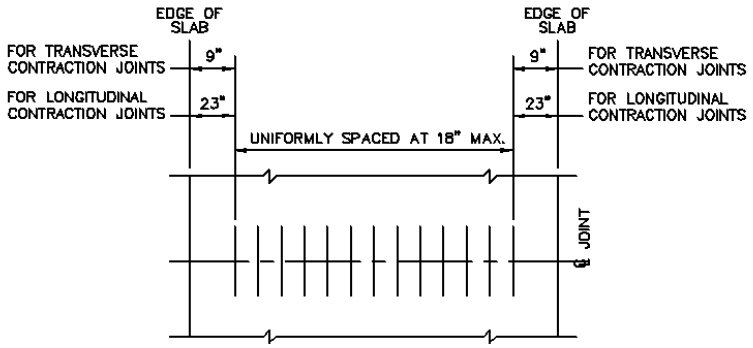
- Existing AC surface milled and a 2” AC leveling course placed
- 20-inches PCC
- 1.5-inch Dia., 18-inch long dowels
- 20.5-foot typical slab size

Dowel Bar Assembly



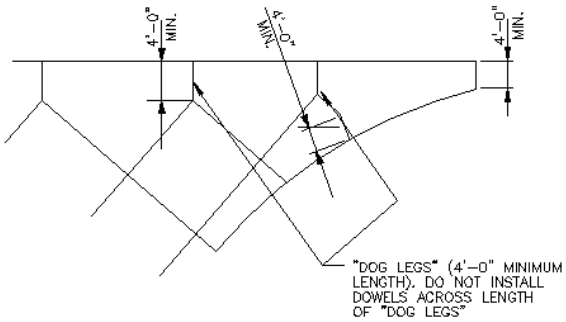


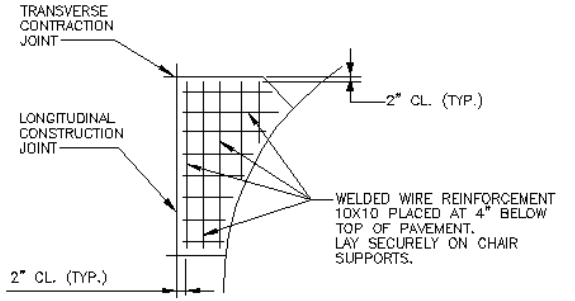
TYPICAL DOWEL BAR ASSEMBLY



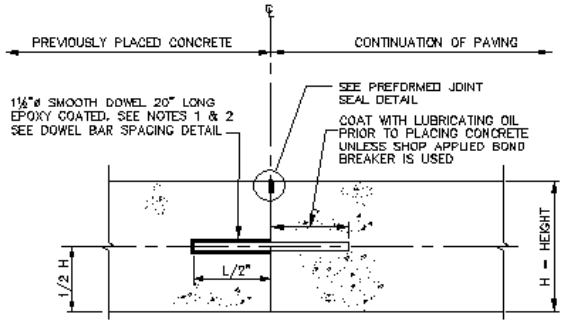
DOWEL BAR SPACING

Fillets and Jointing



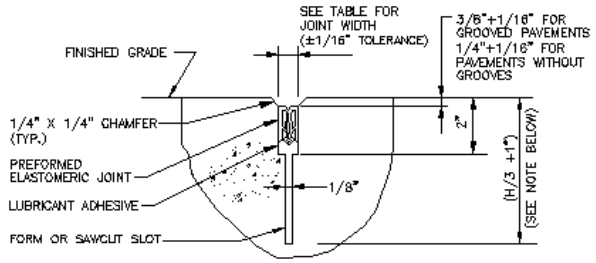


TYPICAL FILLET AND REINFORCEMENT DETAILS



NOTES: 1. FOR SIDE-FORM CONSTRUCTION DOWELS MAY BE INSTALLED THROUGH GASKETED OPENINGS IN THE FORMS OR BY DRILLING AND GROUTING.
2. FOR SLIPFORM CONCRETE CONSTRUCTION DOWELS SHALL BE INSTALLED BY DRILLING AND GROUTING.

CONTRACTION JOINT-FORMED
N.T.S.

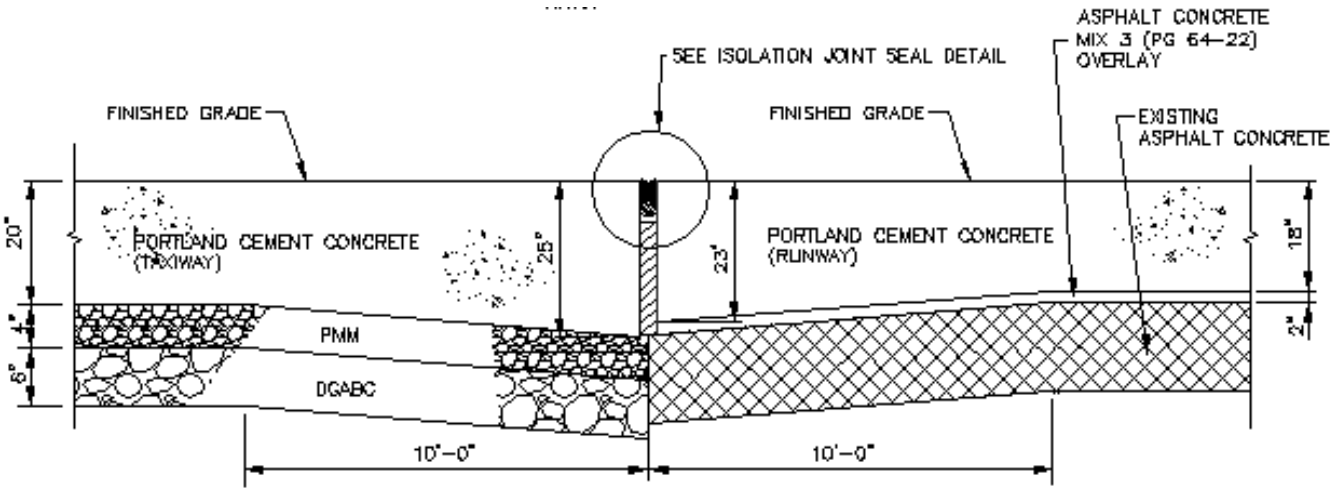


TEMPERATURE* °F	JOINT WIDTH
< 60	5/8"
60 TO 80	9/16"
> 80	1/2"
* PAVEMENT SURFACE TEMPERATURE	

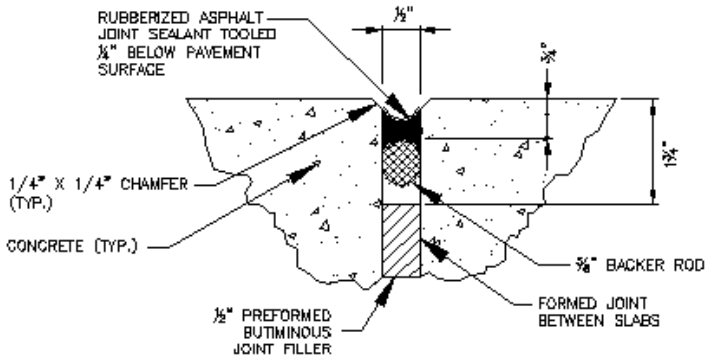
NOTE : THE CONTRACTOR HAS THE OPTION OF USING A MODEL 4200 AND 5000 D CONCRETE SAW MANUFACTURED BY HUSQVARNA SOFF-CUT OR APPROVED EQUAL TO CUT THE REQUIRED SLOT AS SOON AS THE CONCRETE WILL SUPPORT THE SAW AND THE CUT DOES NOT TEAR. IF THE GX-4000D CONCRETE SAW IS USED, SLOT DEPTH SHALL BE REDUCED TO 2 1/2". FOR ALL OTHER CONCRETE SAWS, CUT THE SLOT TO THE DIMENSIONS SHOWN.

PREFORMED JOINT SEAL

Jointing



ISOLATION JOINT DETAIL



ISOLATION JOINT SEAL DETAIL

Construction

THREE MAJOR CONSTRUCTION STAGES

Major Construction Quantities

- **AC = 450,000 Tons**
- **PCC = 220,000 CY**
- **Astroturf = 7 acres**
- **Grass = 118 acres**
- **Electrical Ductbank = 25 miles**
- **Storm Drainage Piping = 12 miles**
- **Infiltration Trench = 3 miles**
- **Airfield Lighting Cable = 13 miles**
- **All Cable = 170 miles**
- **Airfield Lighting Fixtures = 2700 each**

A million dollars a day in construction!

Construction Staging - A Construction Perspective

Meet with all stakeholders early and often

- **Operations**
- **Site Safety**
- **Site Security**
- **Haul Routes/Areas available for Contractor's Use**
- **Temporary Utility Connections**
- **Keep all stakeholders notified of staging changes**

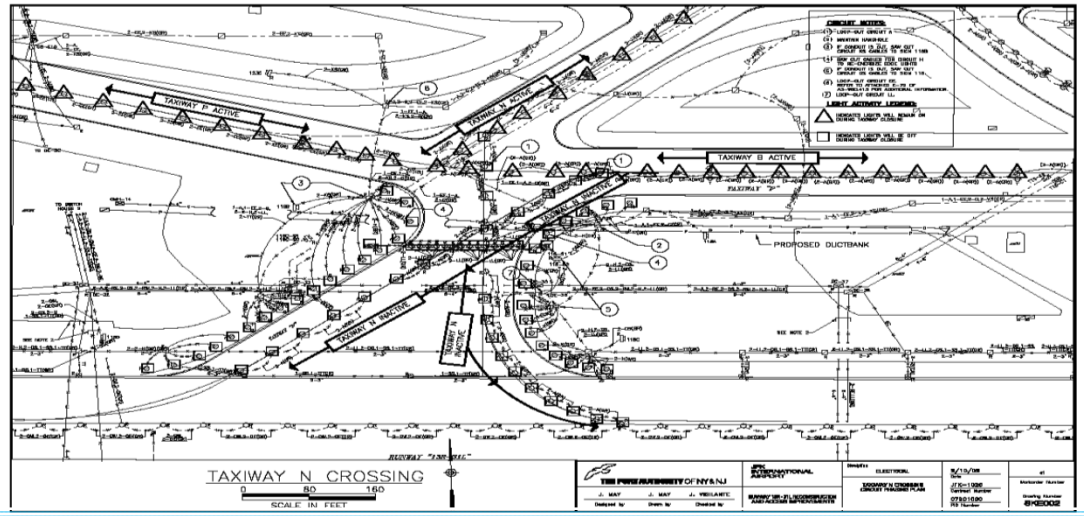
Proximity to active runways

Traffic Mitigation

- Construction brings Construction Traffic
- Traffic Study for Different Construction Stages
- Analysis by PA Traffic Engineering
- Implementation of Recommendations
  - Timing of Traffic Signals
  - Flagging
  - Queuing Areas
  - Haul Route Signage
    - Keeps Traffic off more heavily loaded routes
    - Separates Truck Traffic from Airport Passenge
    - Minimize “Lost” Truckers

Aeronautical Lighting Management

Planned Partial Circuit Shutdowns to meet Operational and FAA Requirements, coordinate between stakeholders including JFK Operations, Electrical Maintenance, Electrical Engineering, and REO



Leveraging Lessons Learned Forward Facility Design and Construction Guidelines for Future Aeronautical Lighting Construction Projects

Concrete – Test Section

- Production Test Section
- Means & Methods
- Contractor / Owner Partnering
- Paving Meetings

Electrical Base Can Installation

Asphalt Base and Prep for PCC

Slipform Paving

On-site Materials Testing

Hand Pour Section

Dowel Bar Placement

Contraction Joint

PCC to AC Transition Slab

Artificial Turf Installation

- **Reduced landscape maintenance costs**

- **Mitigation of bird hazards**

Two On-Airport Concrete Plants

- **Truck Traffic**
- **Double Handling of Materials**
- **Backup Plant Requirements In-place**

Water Main Installation and Pavement Crushing Operation

Smoothness testing

PROGRAM RISK MITIGATION

Managing Risks by Making Others Successful

- **The Traveling Public – Managing Awareness**
- **The Airlines – Managing Expectations**
- **The Facility – Managing Impact on Operations**
- **The Contractor – Managing Contractual Commitments**
- **Enterprise Partners - Managing Awareness and Resources**

The Travelling Public – Managing Awareness

- **Website**
- **AirTrain/Welcome Center Video**
- **Articles**
- **Posters**
- **Newsletters**

Runway Newsletter

JFK International Airport

Runway 4L-22R

Runway Safety Area Compliance & Reconstruction

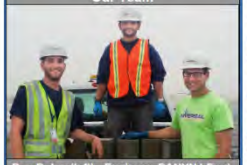
May 15, 2015

Project Location

New Taxiway E In Use

Removal Work South of Bay Runway

Our Team



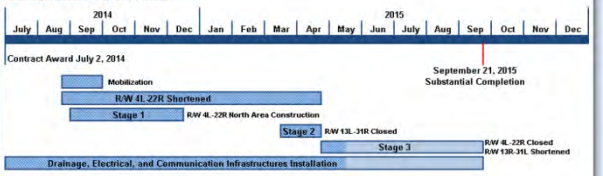
Dan Dolan (left) - Engineer, PANYNJ Engineering Materials Division
Rifat Emre (middle) - Universal Testing
Richard Mauch (right) - Universal Testing
"During a job of this scale, nothing could be accomplish without teamwork. The construction of the second concrete runway at JFK International Airport has the Port Authority and Tutor Perini working hand in hand to get the job done."

Owner: PANYNJ
Aviation Director: T. L. Bosco
JFK General Manager: M. Moran
Engineer: PANYNJ
Contractor: Tutor Perini Inc.

RUNWAY 4L-22R CLOSED & RUNWAY 13R-31L SHORTENED

Scope:
Construction of standard Runway Safety Areas (RSA); reconstruction of the existing asphalt runway in concrete; construction of new runway pavement; widening the runway from 150 to 200 feet; construction of asphalt-paved shoulders and erosion pavement; construction of new taxiways EE and K4, realignment of Taxiway E, rehabilitation of taxiways FB, K, K1, K2, K3; construction of new high-speed taxiway GG; fillet improvements; relocation of FAA NAVAIDS equipment; new drainage and electrical infrastructures; relocation of AOA fence and patrol road.

Construction Schedule:



Achievements/Actions:

- Taxiway B returned to service
- Taxiway E complete and commissioned
- Taxiway ZA realigned and returned to service
- Runway concrete placement within Taxiway YA area completed
- Installation of runway lighting systems within Taxiway YA area on-going
- Asphalt paving of shoulder and erosion pavement within Taxiway YA area on-going
- Removal work on Runway 4L-22R and Taxiway K south of Runway 13R-31L started
- Electrical/communication and drainage infrastructure work underway
- Topographic and utility survey on-going
- Coordination/scheduling for FAA NAVAID work underway
- Progress meetings with the general contractor, Tutor Perini Inc., on-going
- Coordination meetings with the FAA and Airport Community on-going

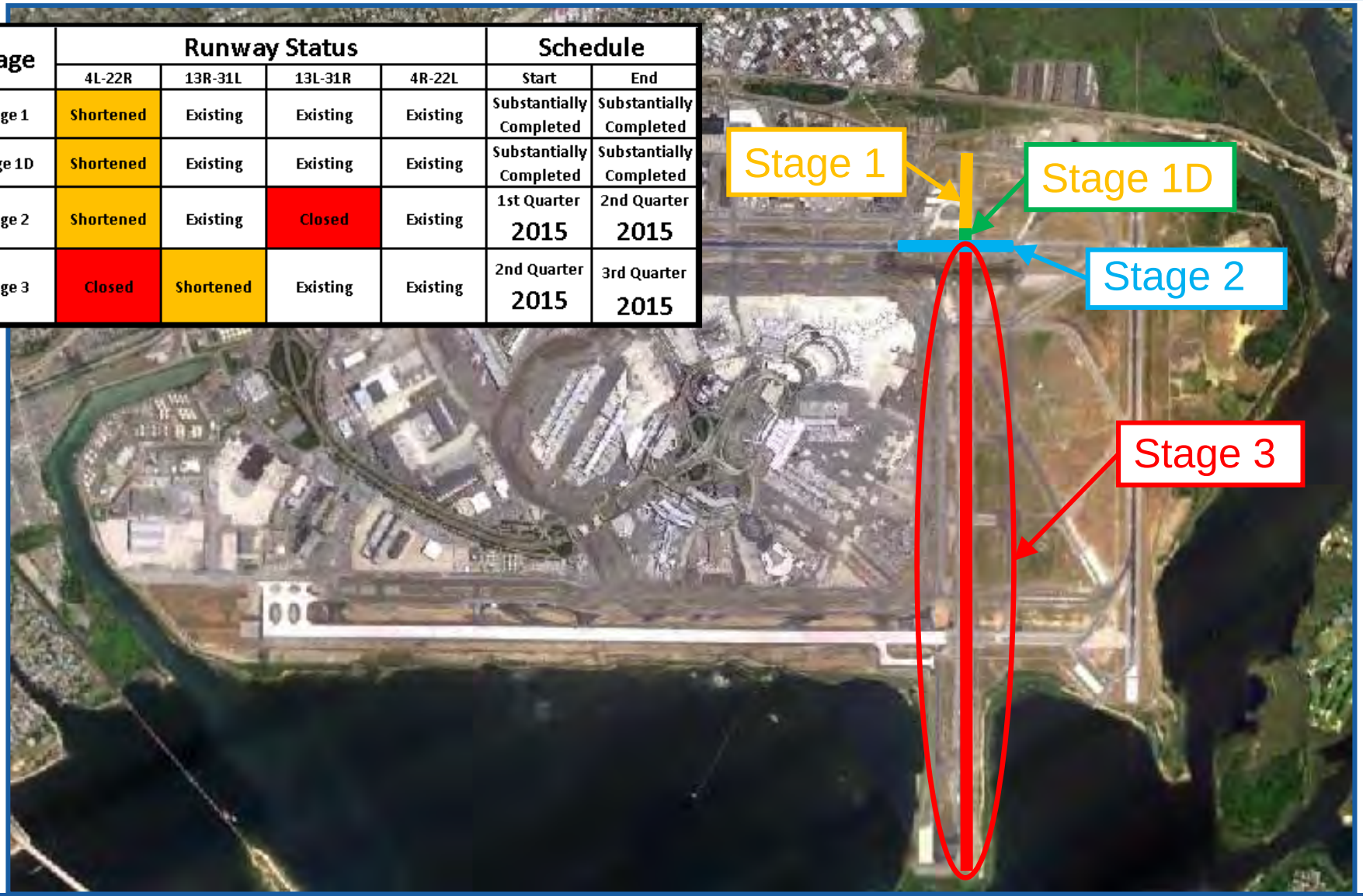
Look Ahead:

- Complete all work within Taxiway YA area and return Taxiway YA to service
- Continuation of electrical/communication and drainage infrastructure work
- Continuation of removal work on Runway 4L-22R and Taxiway K south of Runway 13R-31L
- Continuation of survey work
- Concrete placement and asphalt paving south of Bay Runway

The Port Authority of NY & NJ

STAKEHOLDER PRESENTATIONS OVERALL SCHEDULE

Stage	Runway Status				Schedule	
	4L-22R	13R-31L	13L-31R	4R-22L	Start	End
Stage 1	Shortened	Existing	Existing	Existing	Substantially Completed	Substantially Completed
Stage 1D	Shortened	Existing	Existing	Existing	Substantially Completed	Substantially Completed
Stage 2	Shortened	Existing	Closed	Existing	1st Quarter 2015	2nd Quarter 2015
Stage 3	Closed	Shortened	Existing	Existing	2nd Quarter 2015	3rd Quarter 2015



Runway Availability Matrix

Stage	Start Date / End Date	Runway Available Length													Instrument Approach Category Available
		4L		22R		13R		31L		13L		31R		4R/22L	
		TAKE-OFF	LANDING	TAKE-OFF	LANDING	TAKE-OFF	LANDING	TAKE-OFF	LANDING	TAKE-OFF	LANDING	TAKE-OFF	LANDING		
Pre-Construction/ Existing	January 1, 2014 August 8, 2014	11,351	11,351	11,351	8,655	14,511	12,468	14,511	11,248	Existing	Existing	10,000	8,970	Existing	All Runways F.O.C. (Full Operational Capacity)
Stage 3	April 27, 2015 September 21, 2015	CLOSED				10,974	8,931	10,924	11,248	Existing	Existing	9,513	8,483	Existing	R/W 4R/22L, R/W 13L/31R, R/W 13R/31L F.O.C. R/W 4L/22R CLOSED
Stage 3 Completed	September 22, 2015 December 9, 2015	11,351	11,010	11,219	7,795	14,511	12,468	14,511	11,248	Existing	Existing	9,513	8,483	Existing	R/W 4R/22L, R/W 13L/31R, R/W 13R/31L F.O.C. R/W 4L ILS OTS R/W 22R F.O.C.
Final	December 10, 2015	11,351	11,010	11,219	7,795	14,511	12,468	14,511	11,248	Existing	Existing	9,513	8,483	Existing	All Runways F.O.C. (Full Operational Capacity) R/W 4L ILS Return to Service (via flight procedure publication)

18-May-15

Notes:
1. For actual runway and/or taxiway closures refer to NOTAMS.
2. Available take-off from Runway 31L at Taxiway KE.

Changes to Runway Take-off Distances During Construction

April 27 to September 21, 2015

Runway 13R	
Taxiway	Distance
R/W 13R	10,974
PF	10,924
PE	10,599
PD	10,274
PC	9,714
PA	7,224
MD	5,907
MC	5,332
MB	4,042
M	3,779
L	2,000
KE	50

Changes to Runway Take-off Distances After Construction

Runway 13L	
Taxiway	Distance
R/W 13L	10,000
U	9,962
UA	9,548
CB	8,949
CD	7,813
V	7,751
W	6,329
D	4,748
DB	3,479
ZA	3,413
E	2,780
4L/22R	2,230
Y	1,430
YA	102

Runway 31R	
Taxiway	Distance
R/W 31R	9,513
YA	9,411
Y	8,083
22R/4L	7,283
E	6,733
ZA	6,100
DB	6,034
D	4,765
W	3,184
V	1,762
CD	1,700
CB	564

Thank You

QUESTIONS?

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