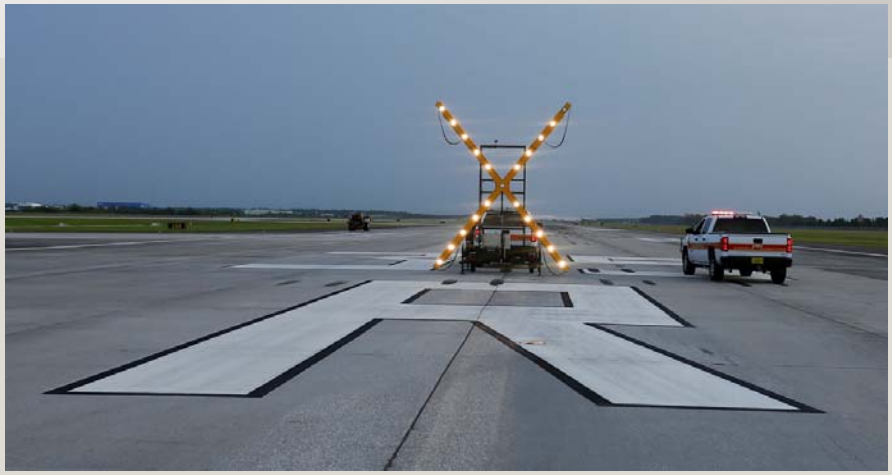
2017 IESALC FALL TECHNOLOGY MEETING

IESALC | ILLUMINATING ENGINEERING SOCIETY of NORTH AMERICA
AVIATION LIGHTING COMMITTEE

CONDUCTING AIRFIELD LIGHTING ASSESSMENTS TO IDENTIFY FUTURE CAPITAL IMPROVEMENT PROJECTS



HYATT REGENCY DALLAS | OCTOBER 22 – 26 2017

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AIRFIELD LIGHTING ASSESSMENTS FOR CAPITAL PROJECT PLANNING

- WHAT IS WRONG WITH AIRFIELD LIGHTING CAPITAL PLANNING?
- BRIEF OVERVIEW OF ASSET MANAGEMENT AND THE RISK MANAGEMENT APPROACH
- DISCUSS HOW TO IMPROVE EQUIPMENT ASSESSMENT AND PROJECT SELECTION

AIRFIELD LIGHTING ASSESSMENT | OBJECTIVES

- INVENTORY ALL AIRFIELD LIGHTING SYSTEM COMPONENTS
- EVALUATE THE CONDITION OF THESE LIGHTING SYSTEM COMPONENTS INCLUDING PHOTOMETRIC AND ELECTRICAL TESTING OF THE SYSTEMS
- IDENTIFY AREAS THAT NEED TO BE ADDRESSED BOTH IN THE NEAR TERM AS WELL AS THE FUTURE

AIRFIELD LIGHTING ASSESSMENT | OBJECTIVES

- PROVIDE INVENTORY DIAGRAMS OF ALL LIGHTING SYSTEM COMPONENTS
- DEVELOP / UPDATE A CAPITAL IMPROVEMENT PLAN (CIP)
- LOOK FOR POTENTIAL IMPROVEMENTS IN THE MAINTENANCE PLAN TO ADDRESS ROUTINE AIRFIELD LIGHTING MAINTENANCE
- PROVIDE ALL DATA IN ELECTRONIC FORMAT SO THAT IT CAN BE INTERACTIVELY MAINTAINED & UPDATED BY THE AIRPORT

ASSET MANAGEMENT| DEFINED

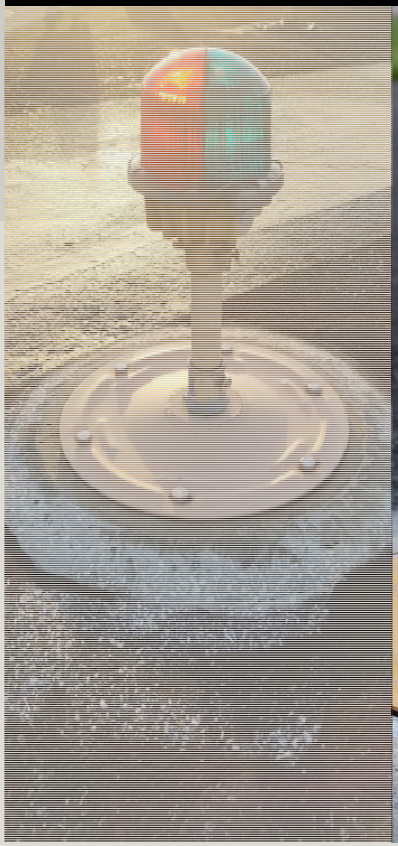
"SYSTEMATIC AND COORDINATED ACTIVITIES AND PRACTICES THROUGH WHICH AN ORGANIZATION OPTIMALLY AND SUSTAINABLY MANAGES ITS ASSETS AND ASSET SYSTEMS, THEIR ASSOCIATED PERFORMANCE, RISKS AND EXPENDITURES OVER THEIR LIFECYCLES FOR THE PURPOSES OF ACHIEVING ITS ORGANIZATIONAL STRATEGIC PLAN"

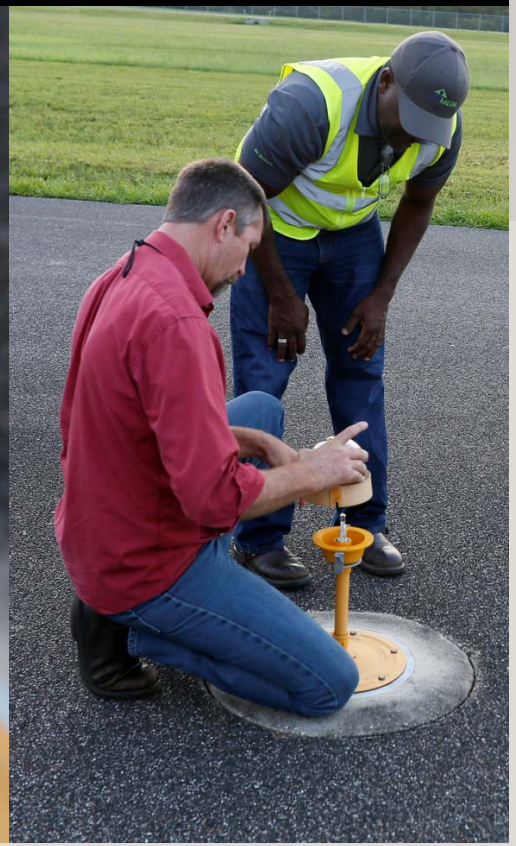
ACRP REPORT 69 ASSET AND INFRASTRUCTURE MANAGEMENT FOR AIRPORTS – PRIMER AND GUIDEBOOK

AIRFIELD LIGHTING ASSESSMENT | SYSTEMS

- ELEVATED EDGE LIGHTING
- IN-PAVEMENT LIGHTING
- AIRFIELD GUIDANCE SIGNS
- BEACONS, WIND CONES
- EQUIPMENT HOUSED IN AIRFIELD ELECTRICAL VAULTS USED TO CONTROL/FEED LOCAL SYSTEMS
- POWER DISTRIBUTION EQUIPMENT
- GENERATOR(S)

SITE SURVEYS | ELEVATED EDGE LIGHTS





SITE SURVEYS | IN-PAVEMENT LIGHTS

SITE SURVEYS | GUIDANCE SIGNS

SITE SURVEYS | OTHER MISC. "LIGHTS"

SITE SURVEYS | AIRFIELD ELECTRICAL VAULT

SITE SURVEYS | AIRFIELD ELECTRICAL VAULT

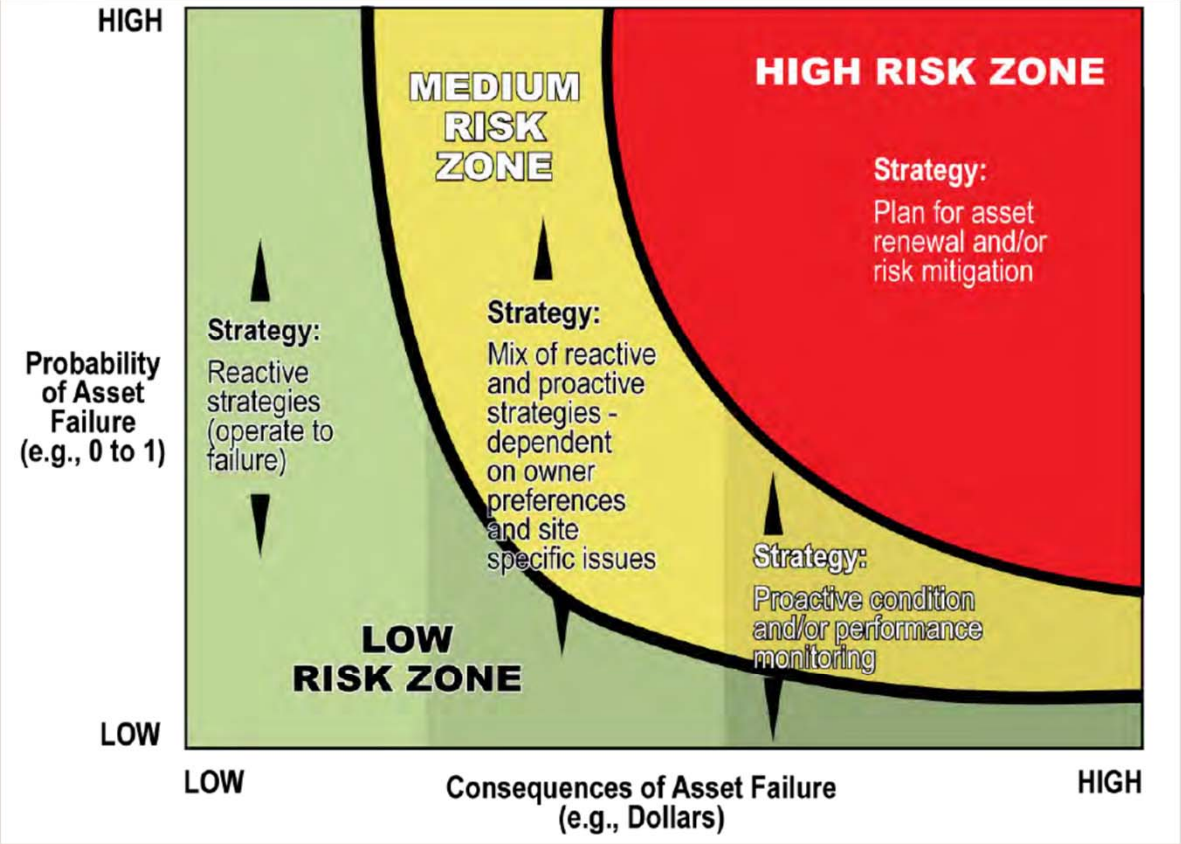
AIRFIELD LIGHTING ASSESSMENT | SYSTEMS

Elev. Fixtures	Semi-Flush Fixtures	Bulbs	Isolation Transformers
Lighted Signs	Wind Cones	Obstruction Lights	PAPI/VASI
REIL/ODAL/MALSR	Power & Ctrl Stands	Power Converters	Grounding & C/P
5kV & 600V Cables	MV Cables	Duct bank	Handholes
Pull Cans	Manholes	Weather Sensors	Pavement Sensors
Regulators	Circuit Selectors	Panelboards	Disconnects
Transformers	Cutouts	Lightning Arrestors	Vault Facility

AIRFIELD LIGHTING ASSESSMENTS | THE PROCESS

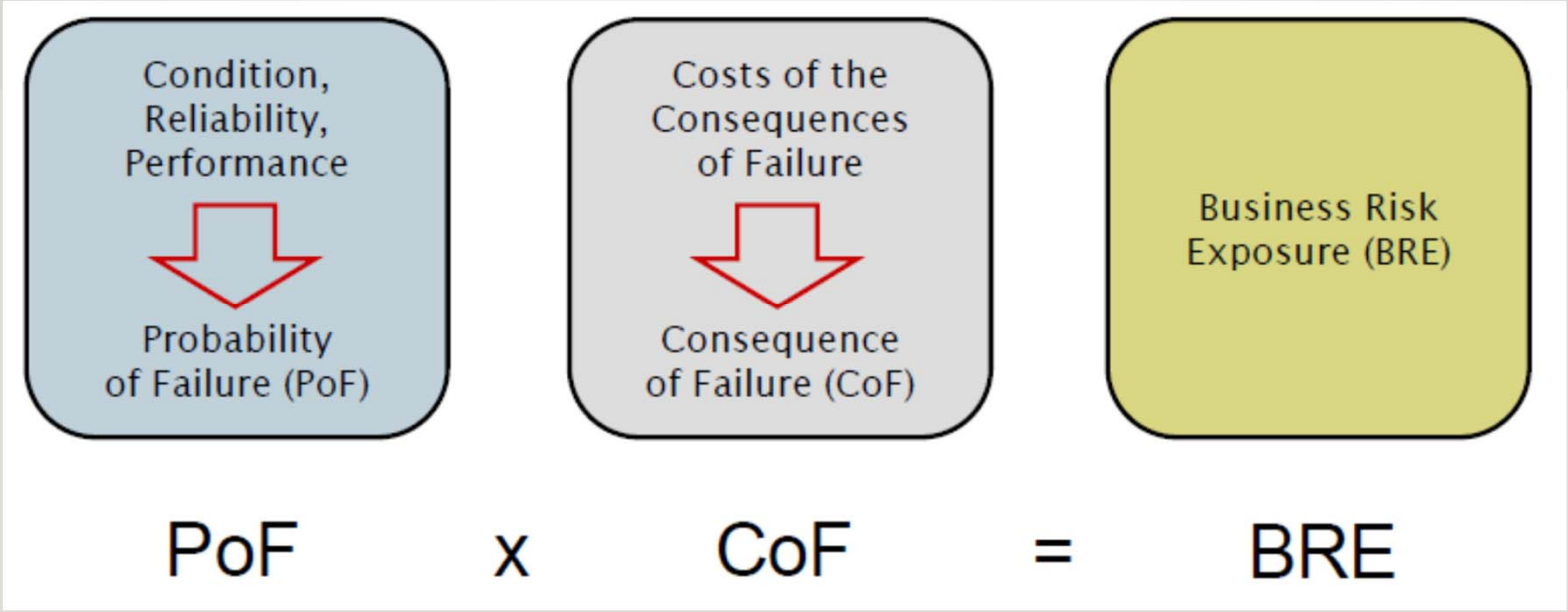
- IMPLEMENTATION
  - SINGLE ASSESSMENT
  - INTEGRATE INTO A LARGER ASSET MANAGEMENT PROGRAM
- USE A CONSISTENT METHOD SO ASSESSMENTS CAN BE COMPARED FROM YEAR TO YEAR

AIRFIELD LIGHTING ASSESSMENTS | RISK MANAGEMENT



Source: EPA Presentation 2016, Fundamentals of Asset Management

AIRFIELD LIGHTING ASSESSMENTS | CALCULATING RISK



Source: EPA Presentation 2016, Fundamentals of Asset Management

AIRFIELD LIGHTING ASSESSMENTS | STRATEGY

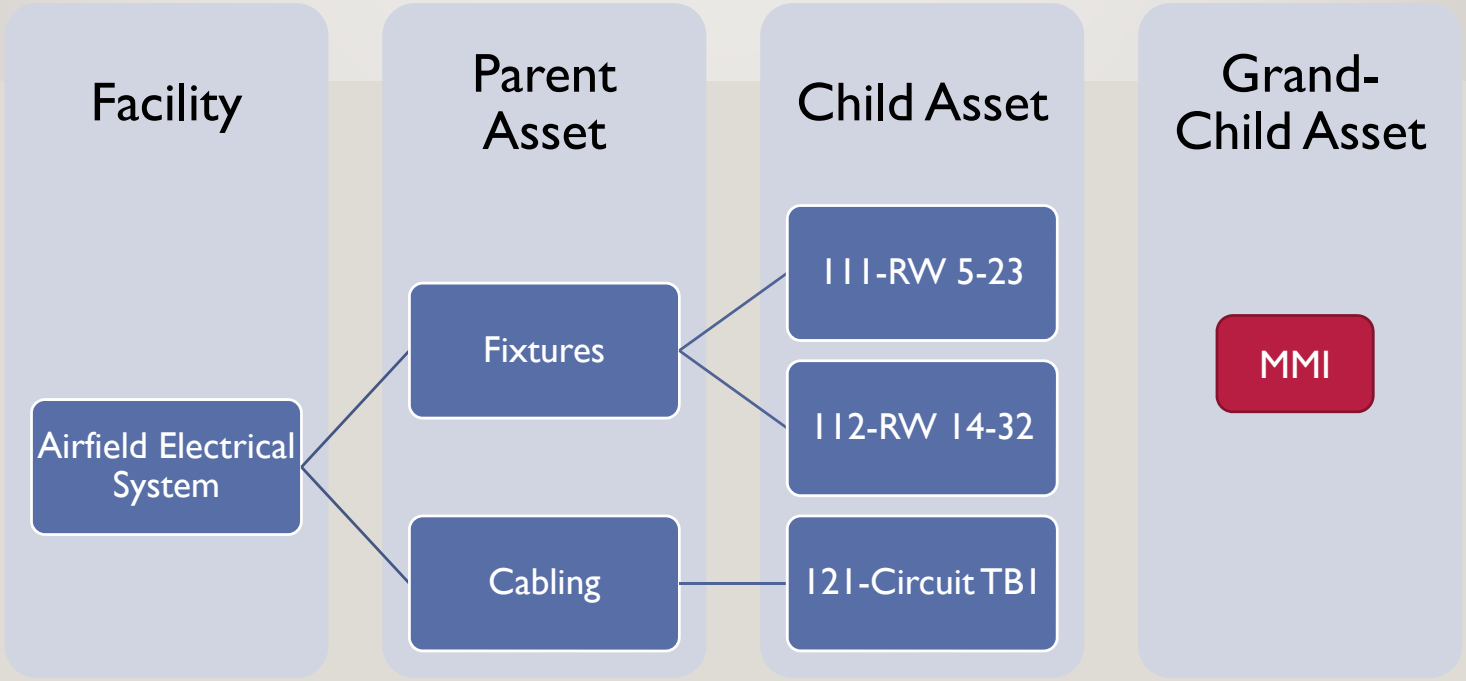
1. DEVELOP ASSET REGISTRY
2. ASSESS PERFORMANCE AND FAILURE MODES
3. DETERMINE RESIDUAL LIFE
4. DETERMINE LIFECYCLE AND REPLACEMENT COSTS
5. SET TARGET LEVELS OF SERVICE
6. DETERMINE BUSINESS RISK/CRITICALITY
7. MAXIMIZE OPERATIONS AND MAINTENANCE INVESTMENT
8. DEVELOP / UPDATE CAPITAL IMPROVEMENT PLAN

AIRFIELD LIGHTING ASSESSMENTS | ASSET REGISTRY

- WHAT IS AN **ASSET**?
- A LIST OF WHAT IS TO BE INSPECTED

  THE REGISTRY IS A **SYSTEMATIC RECORDING** OF ALL ASSETS AN ORGANIZATION OWNS OR FOR WHICH IT HAS RESPONSIBILITY
- USES **ASSET IDENTIFICATION NUMBERS** TO WHICH ATTRIBUTE INFORMATION CAN BE LINKED

AIRFIELD LIGHTING ASSESSMENTS | ASSET REGISTRY

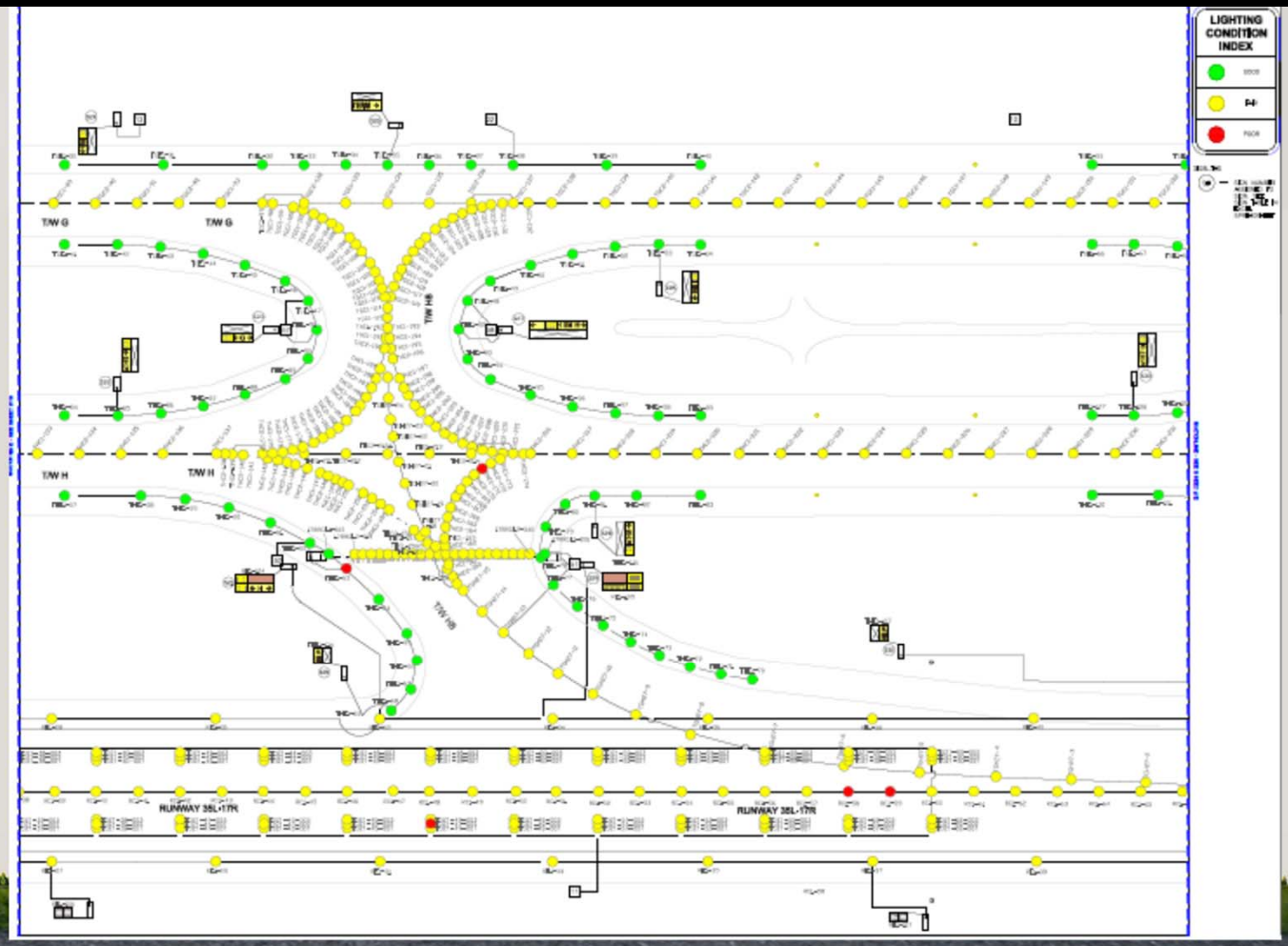


AIRFIELD LIGHTING ASSESSMENTS | ASSET REGISTRY

TABLE 1

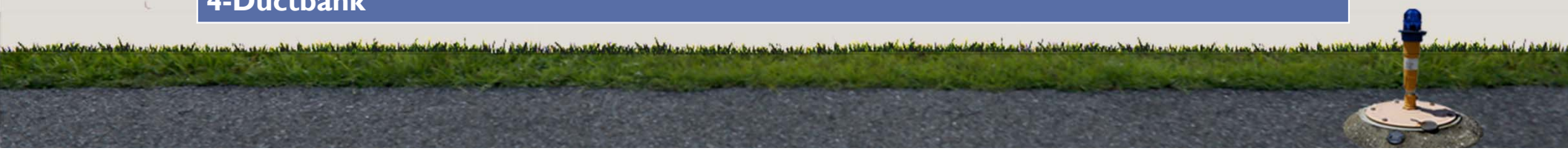
RWY / TWY ID	FIXT ID	LOCATION	TYPE	MANUFACTURER	LENSE COLOR	CIRCUIT	LAMP TYPE	LAMP WATTAGE	TYPE	YEAR INSTALLED	CONDITION	PHOTO LINK	NOTES
17L-35R	17LE2-001	EDGE	L-862		C/C	17LE2	QUARTZ	200	ELEVATED	2003	FAIR	RW Edge Light Link	Based on BP-316 Record Drawings dated 8-29-05
17L-35R	17LE2-002	EDGE	L-862		C/C	17LE2	QUARTZ	200	ELEVATED	2003	FAIR	RW Edge Light Link	Based on BP-316 Record Drawings dated 8-29-05
17L-35R	17LE2-003	EDGE	L-862		C/C	17LE2	QUARTZ	200	ELEVATED	2003	FAIR	RW Edge Light Link	Based on BP-316 Record Drawings dated 8-29-05
17L-35R	17LE2-004	EDGE	L-862		C/C	17LE2	QUARTZ	200	ELEVATED	2003	FAIR	RW Edge Light Link	Based on BP-316 Record Drawings dated 8-29-05
17L-35R	17LE2-005	EDGE	L-862		C/C	17LE2	QUARTZ	200	ELEVATED	2003	POOR	RW Edge Light Link	Based on BP-316 Record Drawings dated 8-29-05
17L-35R	17LE2-006	EDGE	L-862		C/C	17LE2	QUARTZ	200	ELEVATED	2003	FAIR	RW Edge Light Link	Based on BP-316 Record Drawings dated 8-29-05
17L-35R	17LE2-007	EDGE	L-862		C/C	17LE2	QUARTZ	200	ELEVATED	2003	FAIR	RW Edge Light Link	Based on BP-316 Record Drawings dated 8-29-05
17L-35R	17LE2-008	EDGE	L-862		C/C	17LE2	QUARTZ	200	ELEVATED	2003	FAIR	RW Edge Light Link	Based on BP-316 Record Drawings dated 8-29-05
17L-35R	17LE2-009	EDGE	L-862		C/C	17LE2	QUARTZ	200	ELEVATED	2003	POOR	RW Edge Light Link	Based on BP-316 Record Drawings dated 8-29-05
17L-35R	17LE2-010	EDGE	L-862		C/C	17LE2	QUARTZ	200	ELEVATED	2003	FAIR	RW Edge Light Link	Based on BP-316 Record Drawings dated 8-29-05
17L-35R	17LE2-011	EDGE	L-850C		C/C	17LE2	QUARTZ	105	IN-PAVEMENT	2003	FAIR	RW Edge Light Link	Based on BP-316 Record Drawings dated 8-29-05
17L-35R	17LE2-012	EDGE	L-862		C/C	17LE2	QUARTZ	200	ELEVATED	2003	FAIR	RW Edge Light Link	Based on BP-316 Record Drawings dated 8-29-05
17L-35R	17LE2-013	EDGE	L-850C		C/C	17LE2	QUARTZ	105	IN-PAVEMENT	2003	FAIR	RW Edge Light Link	Based on BP-316 Record Drawings dated 8-29-05
17L-35R	17LE2-014	EDGE	L-862		C/C	17LE2	QUARTZ	200	ELEVATED	2003	FAIR	RW Edge Light Link	Based on BP-316 Record Drawings dated 8-29-05
17L-35R	17LE2-015	EDGE	L-862		C/C	17LE2	QUARTZ	200	ELEVATED	2003	FAIR	RW Edge Light Link	Based on BP-316 Record Drawings dated 8-29-05
17L-35R	17LE2-016	EDGE	L-862		C/C	17LE2	QUARTZ	200	ELEVATED	2003	FAIR	RW Edge Light Link	Based on BP-316 Record Drawings dated 8-29-05
17L-35R	17LE2-017	EDGE	L-862		C/C	17LE2	QUARTZ	200	ELEVATED	2003	FAIR	RW Edge Light Link	Based on BP-316 Record Drawings dated 8-29-05
17L-35R	17LE2-018	EDGE	L-862		C/C	17LE2	QUARTZ	200	ELEVATED	2003	FAIR	RW Edge Light Link	Based on BP-316 Record Drawings dated 8-29-05
17L-35R	17LE2-019	EDGE	L-862		C/C	17LE2	QUARTZ	200	ELEVATED	2003	POOR	RW Edge Light Link	Based on BP-316 Record Drawings dated 8-29-05
17L-35R	17LE2-020	EDGE	L-862		C/C	17LE2	QUARTZ	200	ELEVATED	2003	FAIR	RW Edge Light Link	Based on BP-316 Record Drawings dated 8-29-05

AIRFIELD LIGHTING ASSESSMENTS | ASSET REGISTRY



AIRFIELD LIGHTING ASSESSMENTS | ASSET REGISTRY

Level 1	Level 2	Level 3	Level 4 (MMI)
1-Fixtures			
	11-RW 14-32		
		111-Edge Light #RA4	
			1111-Fixture
			1112-Lamp
			1113-Transformer
			1114-Base
		112-Threshold/End	
		113-RWCL	
	12-RW 5-23		
	13-TW A		
2-Signs			
3-Cable			
4-Ductbank			



AIRFIELD LIGHTING ASSESSMENTS | PERFORMANCE & FAILURE MODES

Failure Mode	Definition	Tactical Aspects	Management Strategy
Capacity	Volume of demand exceeds design capacity	Growth, system expansion	Redesign
Performance	Functional requirements exceed design capacity	Regulatory requirements, customer commitments	O&M optimization, renewal
Condition	Consumption of asset reduces performance below an acceptable level	Physical deterioration due to age, usage, acts of nature	O&M optimization, renewal
Economic Efficiency	Operations costs exceed that of feasible alternatives	Pay-back period	Replace

AIRFIELD LIGHTING ASSESSMENTS | PERFORMANCE & FAILURE MODES

Score	Description
1	NEW OR EXCELLENT CONDITION
2	MINOR DEFECTS ONLY
3	MODERATE DEFICIENCIES
4	SIGNIFICANT DETERIORATION
5	VIRTUALLY UNSERVICEABLE

AIRFIELD LIGHTING ASSESSMENTS | PERFORMANCE & FAILURE MODES

3.2 Lighting Condition Index (LCI) Survey Methodology

The LCI procedure was created to provide an objective condition assessment rating of each surveyed electrical equipment. The rating is based on orders of severity of the exiting condition observed during the survey. The following table shown in ***Figure 3.2*** was developed to provide a visual representation of equipment condition.

LCI Classification	LCI Color Identifier	Recommended Repair
GOOD (G)		Preventative Maintenance per AC 150/5340-26
FAIR (F)		Preventative Maintenance per AC 150/5340-26
POOR (P)		Replace or Repair

Figure 3.2 LCI Table

AIRFIELD LIGHTING ASSESSMENTS | TARGET LEVELS OF SERVICE

- FIXTURES
  - Photometric test results, availability, condition
- 5KV CABLES
  - Megger results, operating voltage
- SIGNS
  - Availability, fading, condition
- PAPI/REIL/ODAL/MALSR
  - Availability, aiming, condition
- REGULATORS
  - Loading, condition
- POWER DISTRIBUTION / GENERATORS
  - Capacity, loading, condition

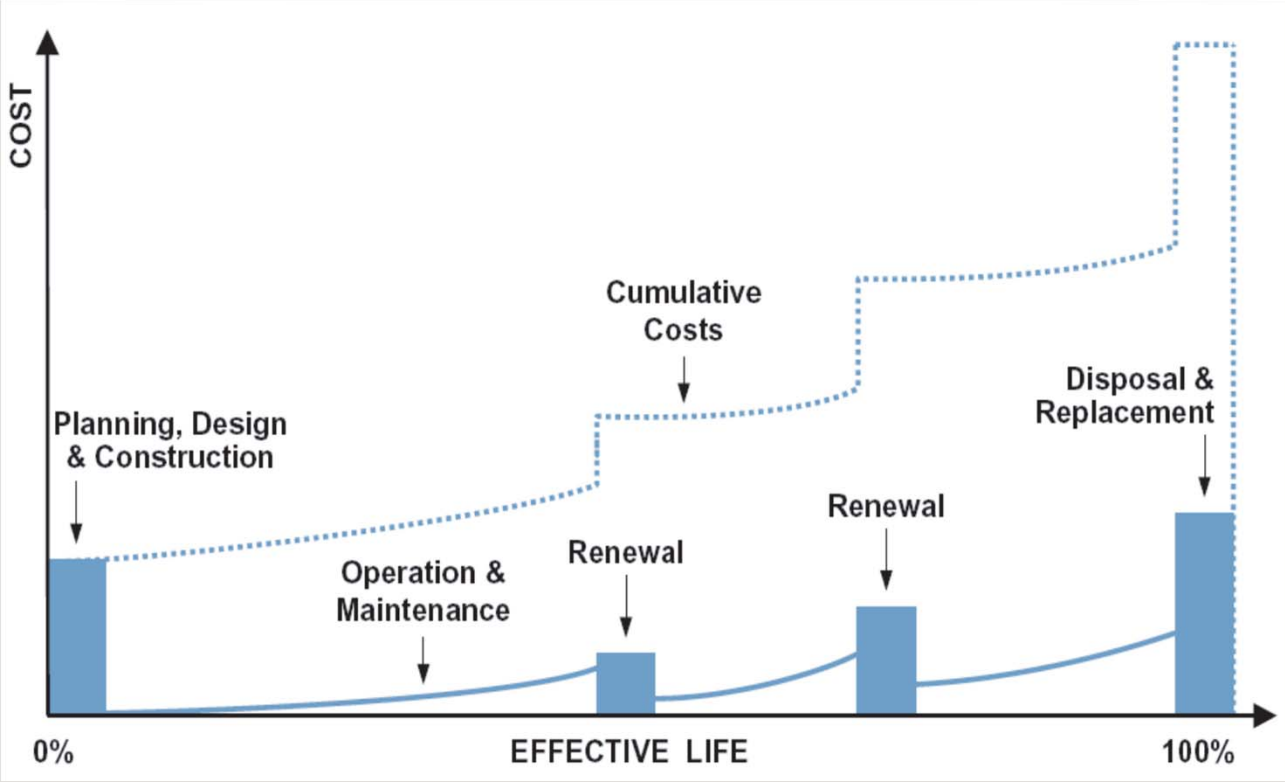
AIRFIELD LIGHTING ASSESSMENTS | TARGET LEVELS OF SERVICE

Lvl 1	Lvl 2	Lvl 3	Lvl 4	Operating Cost / Year			% Availability			Condition		
				Goal	Actual	Trigger	Goal	Actual	Trigger	Goal	Actual	Trigger
1-Fixtures												
	11-RW 14-32											
		111-Edge Lt #RA4		$191	$200	>$225	100%	98%	<95%	1	2	>2
			1111-Fixture	$100	$150	>$200	100%	98%	<95%	1	2	>2
			1112-Bulb	$20	$50	>$75	100%	98%	<95%	1	2	>2
			1113-Transformer		0	>$50	100%	100%	<100%	1	2	>2
			1114-Base Can		0	>$50	100%	100%	<100%	1	2	>3

AIRFIELD LIGHTING ASSESSMENTS | RESIDUAL LIFE

Level 1	Level 2	Level 3	Level 4	Install Date	Original Cost	Typical Life	Condition Rating	Calc Residual Life	Judg Residual Life	% Asset Consumed
				Act or Est	Act or Est	Years	1 to 5	Calc.	Est.	Calc.
1-Fixtures										
	11- RW 14-32									
		111- Edge Light #RA4		10/12	$300	5	3	0	1	50%
			1111-Fixture	10/15	$100	5	3	3	4	20%
			1112-Lamp	10/16	$75	2	3	1	1	50%
			1113-Transformer	10/12	$50	5	2	0	1	80%
			1114-Base	10/12	$75	10	1	5	5	50%
	12-RW 5-23									
	13-TW A									
2-Signs										
3-Cable										
4-Ductbank										

AIRFIELD LIGHTING ASSESSMENTS | LIFECYCLE COSTS



Source: ACRP 69 Asset and Infrastructure Management for Airports – Primer and Guidebook

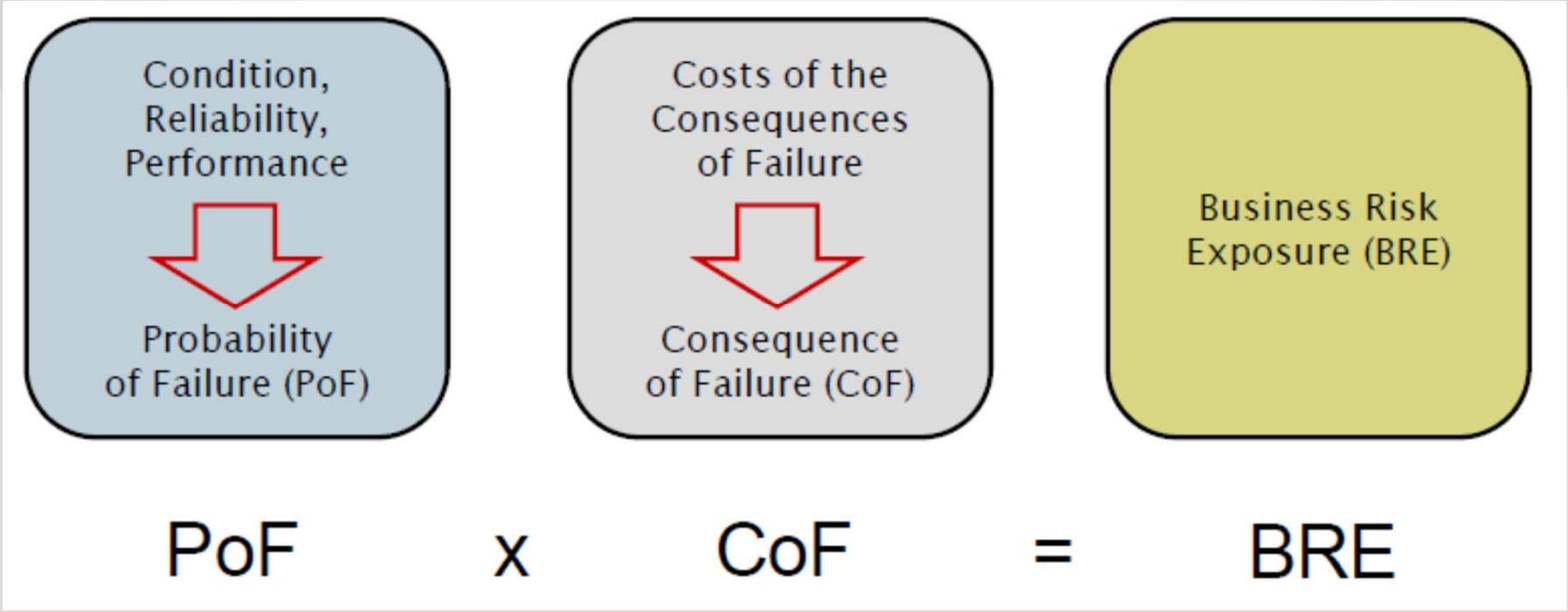
AIRFIELD LIGHTING ASSESSMENTS | PROBABILITY OF FAILURE (PoF)

Assessment	Probability Weighting	Description
Almost Certain	10	Expected to occur with a year
Very High	8	Likely to occur within a year
High	5	Estimated 50% chance of occurring in any year
Quite Likely	2	Expected to occur within 5 years Estimated 20% chance of occurring in any year
Moderate	1	Expected to occur within 10 years Estimated 10% change of occurring in any year
Low	0.2	Expected to occur within 25 years
Very Low	0.1	Expected to occur within 50 years

AIRFIELD LIGHTING ASSESSMENTS | BUSINESS RISK / CRITICALITY

Organizational Impact						
Loss of Service - Pri RW (max outage)	Indef.	1 mo.	1 wk.	1 day	8 hr.	1 hr.
Loss of Service -Cw RW (max outage)	Indef.	1 mo.	1 wk.	1 day	8 hr.	1 hr.
Loss of Service -Pri TW (max outage)	Indef.	1 mo.	1 wk.	1 day	8 hr.	1 hr.
Safety (impact)	None	Bother	Mnr Inj	Mod Inj	Major Inj	Death
Airport Image	None	Neutral Coverage	Adverse Media	Wide Adverse Media	Continual, Political	National Adverse
Consequence of Failure (CoF)	**1**	**3**	**5**	**7**	**9**	**10**

AIRFIELD LIGHTING ASSESSMENTS | CALCULATING RISK



Source: EPA Presentation 2016, Fundamentals of Asset Management

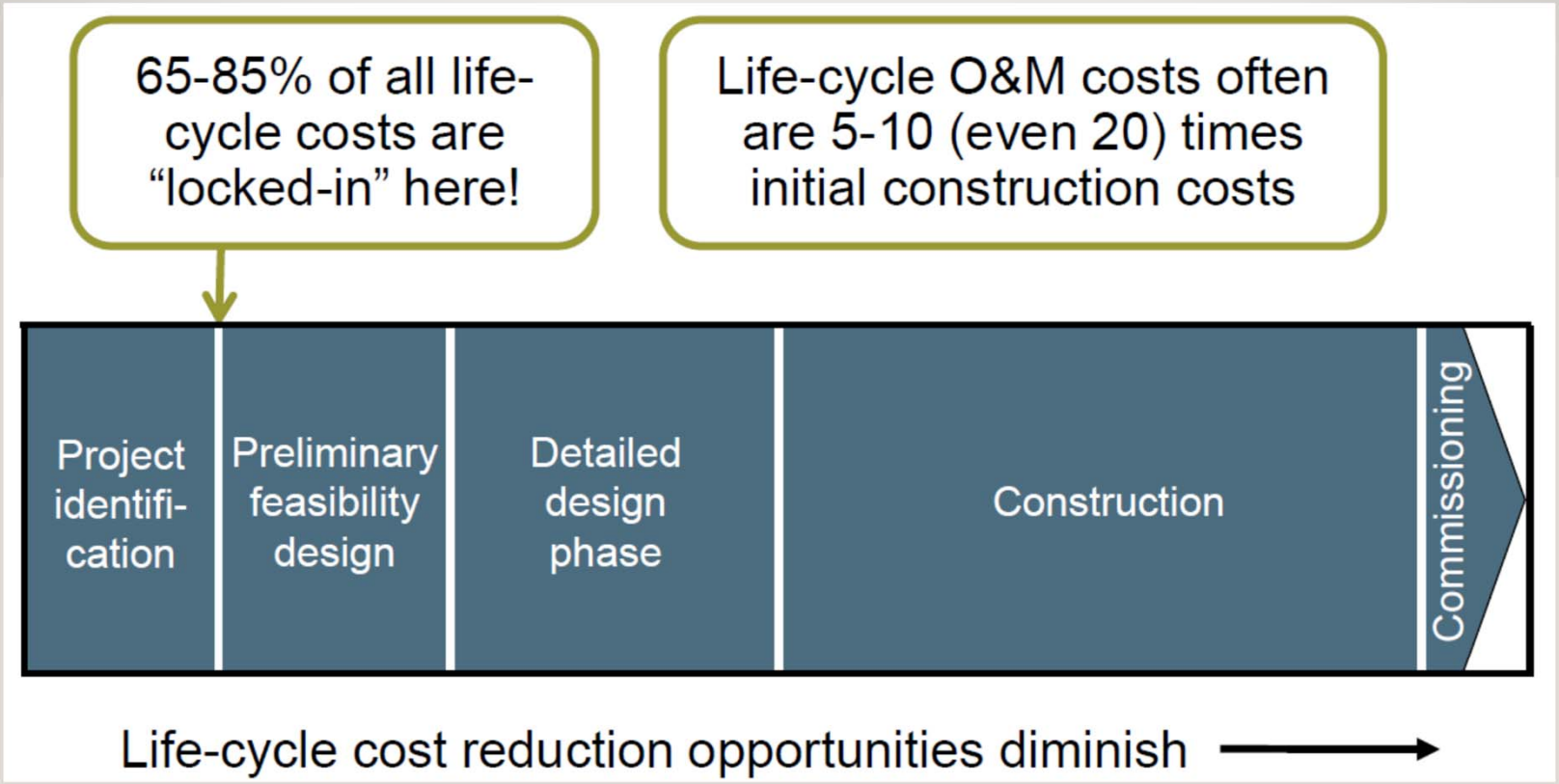
AIRFIELD LIGHTING ASSESSMENTS | MAXIMIZE O&M INVESTMENT

- WHAT ALTERNATIVE MANAGEMENT OPTIONS EXIST?
  - WHAT CAN BE DONE RIGHT NOW TO REDUCE THE BUSINESS RISK?
  - INCREASE MAINTENANCE TO EXTEND ASSET LIFE?
  - EXAMINE CAUSES OF FAILURE MORE CLOSELY?

AIRFIELD LIGHTING ASSESSMENTS | DEVELOP / UPDATE CIP

- WHAT ARE WE GOING TO DO AND WHY?
- WHAT WILL IT COST?
- HOW WILL IT BE FUNDED?
- LIFECYCLE IMPACT ON LOS, RATES, AND FINANCIAL CONDITION
- CONFIDENCE IN THE SOLUTION (QUALITY OF DATA, QUALITY OF ANALYSIS)

AIRFIELD LIGHTING ASSESSMENTS | DEVELOP / UPDATE CIP



Source: EPA Presentation 2016, Fundamentals of Asset Management

AIRFIELD LIGHTING ASSESSMENTS | DEVELOP / UPDATE CIP

- PROJECT INDENTIFICATION
  - What assets are at risk?
  - What are the strategic drivers the asset supports?
- VALIDATION
  - High confidence in solution? Solving high risk problem?
  - Right project? Right time? Right Cost? Right Reason? – Good business case
- PRIORITIZATION
  - Prioritization Factors, Factor Weights

AIRFIELD LIGHTING ASSESSMENTS | SOURCES

- ACRP REPORT 69 ASSET AND INFRASTRUCTURE MANAGEMENT FOR AIRPORTS – PRIMER AND GUIDE
- EPA WORKSHOP, THE FUNDAMENTALS OF ASSET MANAGEMENT
- FAA A/C 150/5345-26C MAINTENANCE OF AIRPORT VISUAL AID FACILITIES
- ACRP REPORT 148 LED AIRFIELD LIGHTING SYSTEM OPERATION AND MAINTENANCE
- AIRFIELD LIGHTING ASSESSMENT AT ORLANDO INTERNATIONAL AIRPORT

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AVIATION LIGHTING COMMITTEE

THANK YOU!
QUESTIONS?

Oh Be Brilliant. | B