

**Use of Asset Management
Risk Assessment
Methodology
for Public Safety Analysis**

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Experts Teaching from Practical Experience

Presentation Objective



Facilitate Discussion on the following topics:

- ❑ Using Asset Management Risk Assessment techniques for assessing risk to **public safety**
- ❑ Quantify risk and risk consequences to public from various LDC's facilities:
 - Substations
 - Overhead plant
 - Confined spaces
- ❑ Compare cost-effective ways to minimize **public risk**

Asset Management Methodologies



Equipment Focused methodologies focus on assessing condition of equipment, evaluating associated risk of failure and developing replacement/refurbishment plans

Strategy Focused methodologies focus on assessing effectiveness of company's processes in making optimum investment and prioritization decisions

T&D Asset Management Challenges

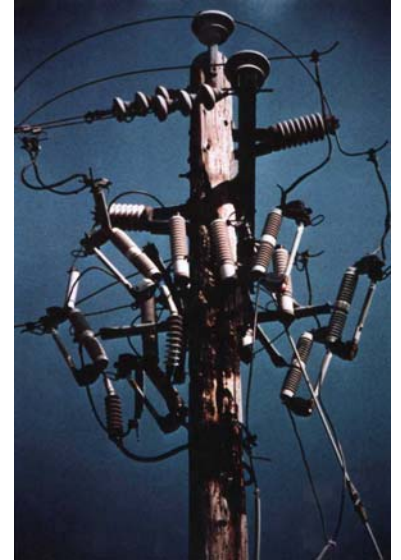
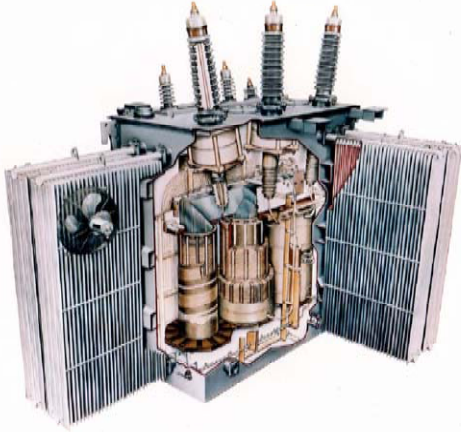


- ❖ Not a controlled environment: external vs equipment caused failures
- ❖ No need to perform PM for some assets
- ❖ Hard to estimate Risk Cost of failures for T&D utilities
- ❖ Difficult to establish direct impact of Asset Failures on System Performance and Reliability indices
- ❖ History of asset failures is a combination of asset condition and stresses this asset is exposed to (hard to get)

T&D Assets

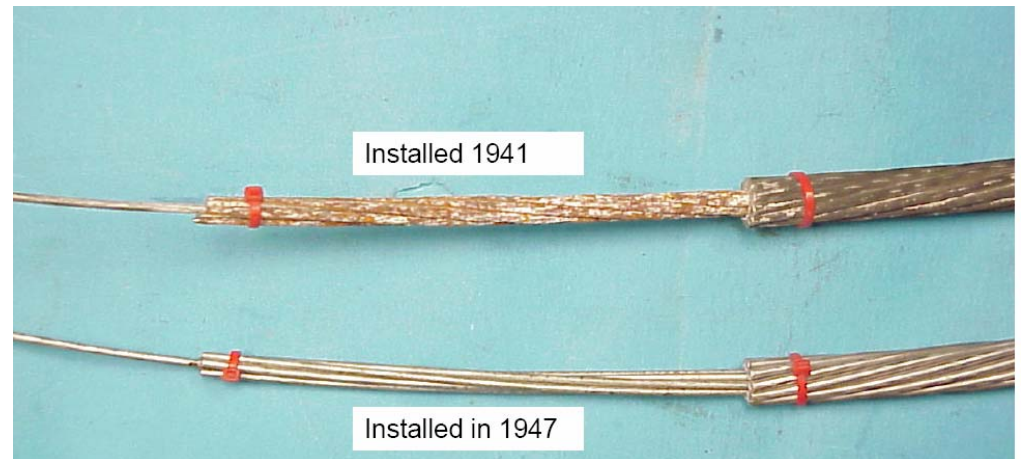
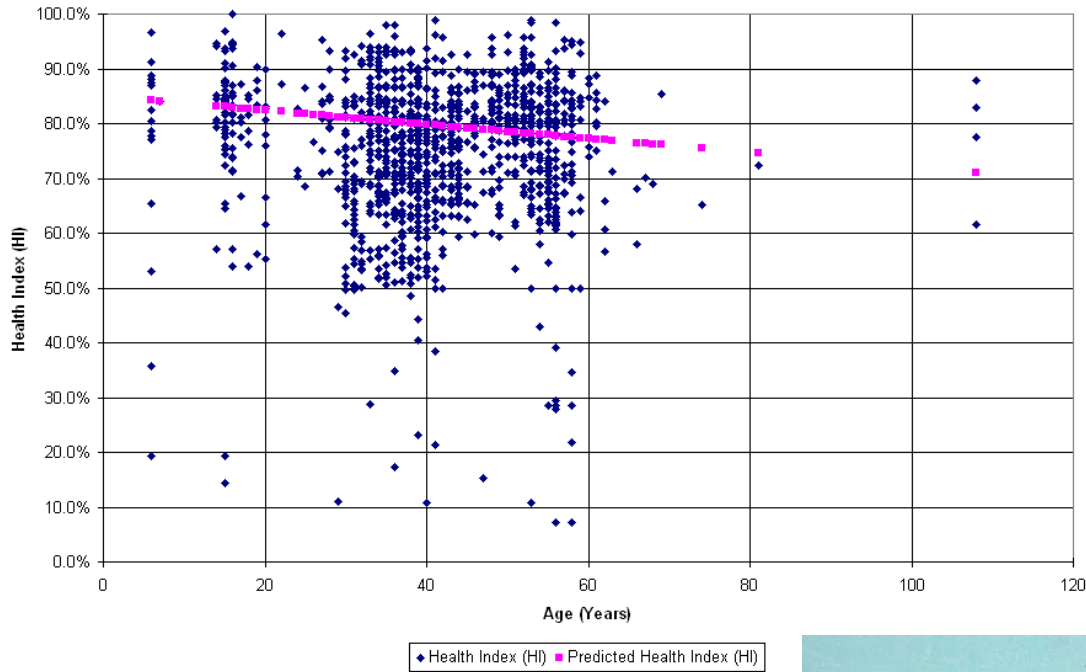


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Health Index vs Age

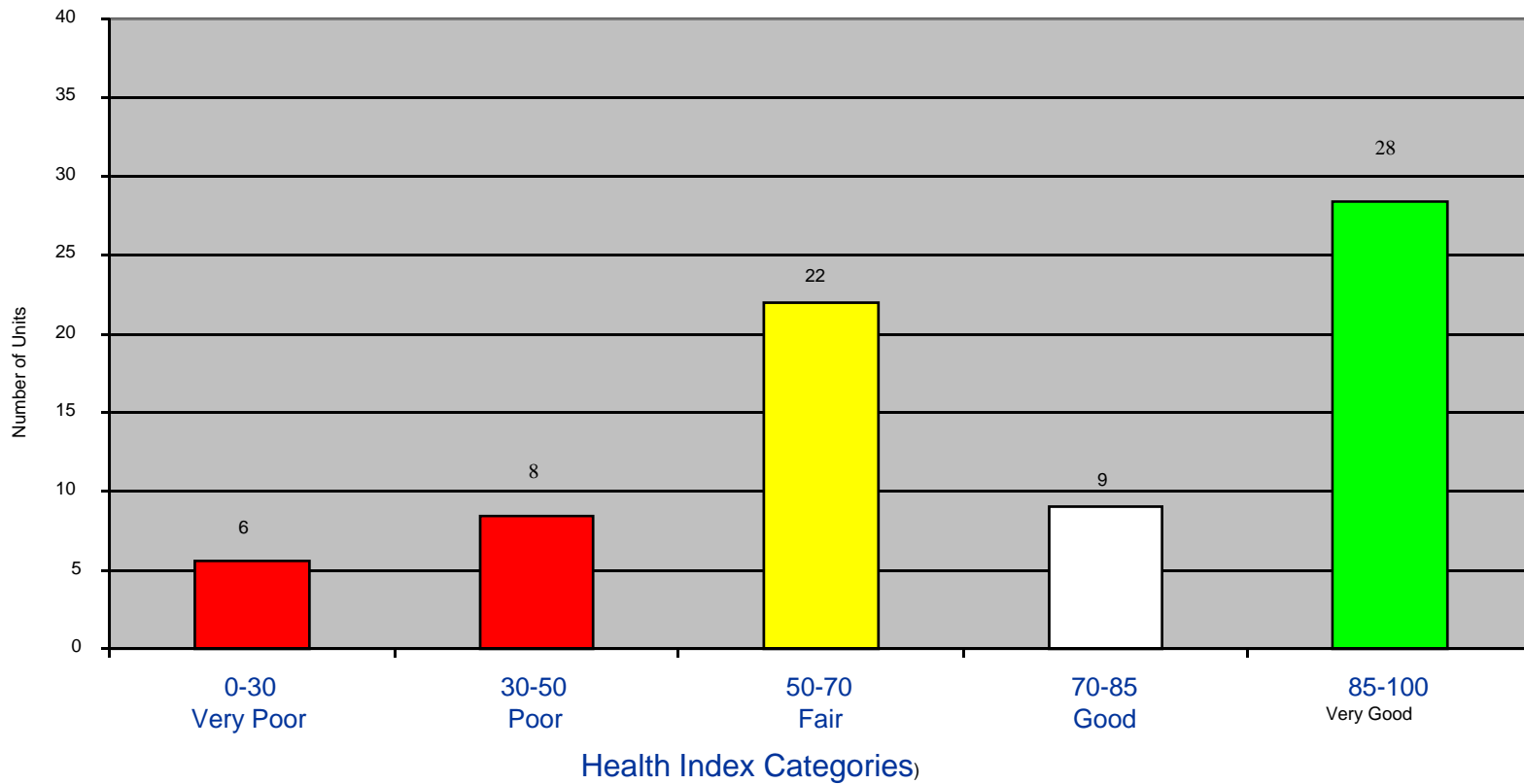
Age Line Fit (R square = 0.016567)



Health Index Distribution



Health Index Distribution

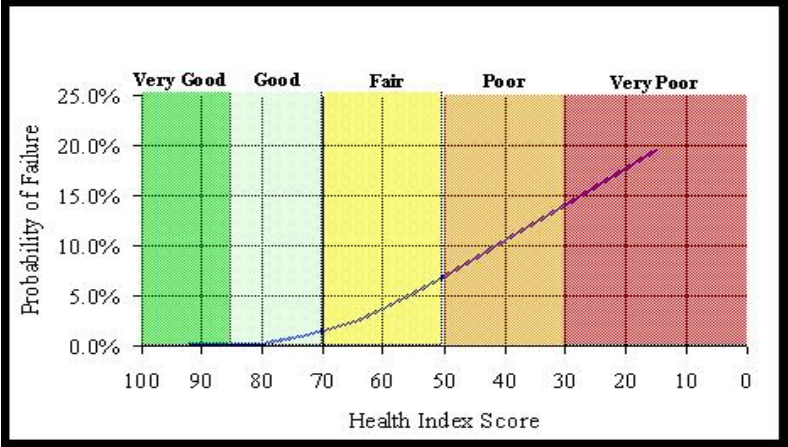
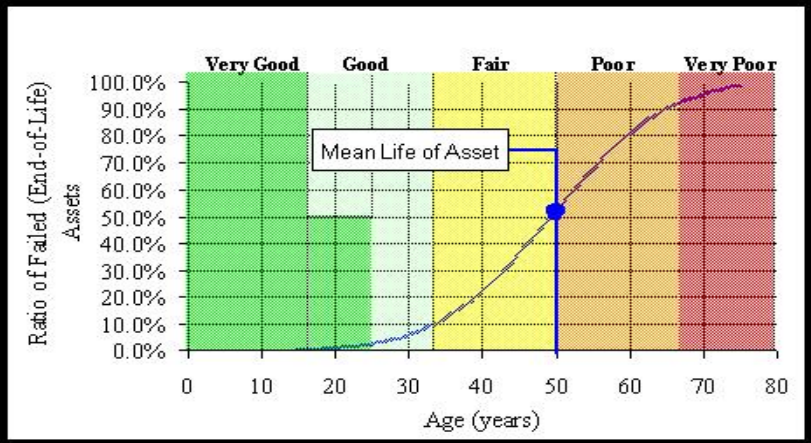


Asset Condition and Age vs. Probability of Failure



Correlating Health Index results to Probability of Failure:

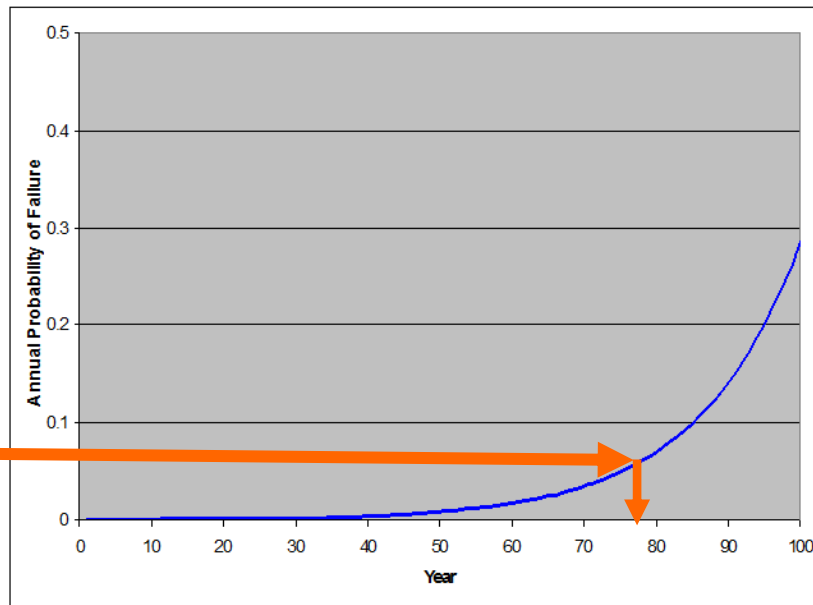
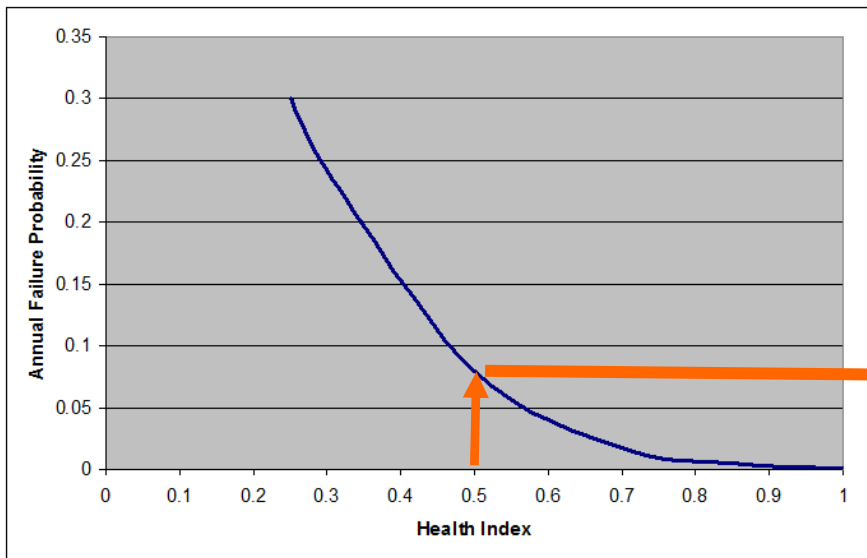
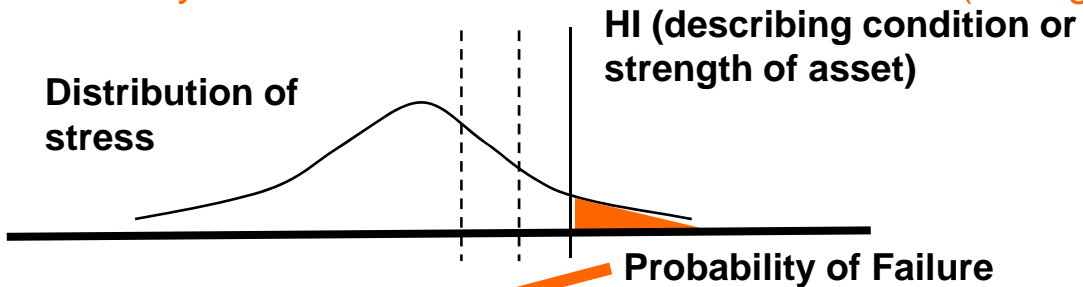
- Formulate HI for Each Asset Category
- Determine HI Using Utility Data
- Estimate Effective Age
- Estimate Probability of Failure
- Develop Replacement Plan
- Update with New Data



Relating Condition & Failure Probability to Effective Age & Replacement Timing



Probability of Failure includes stress and condition (strength)

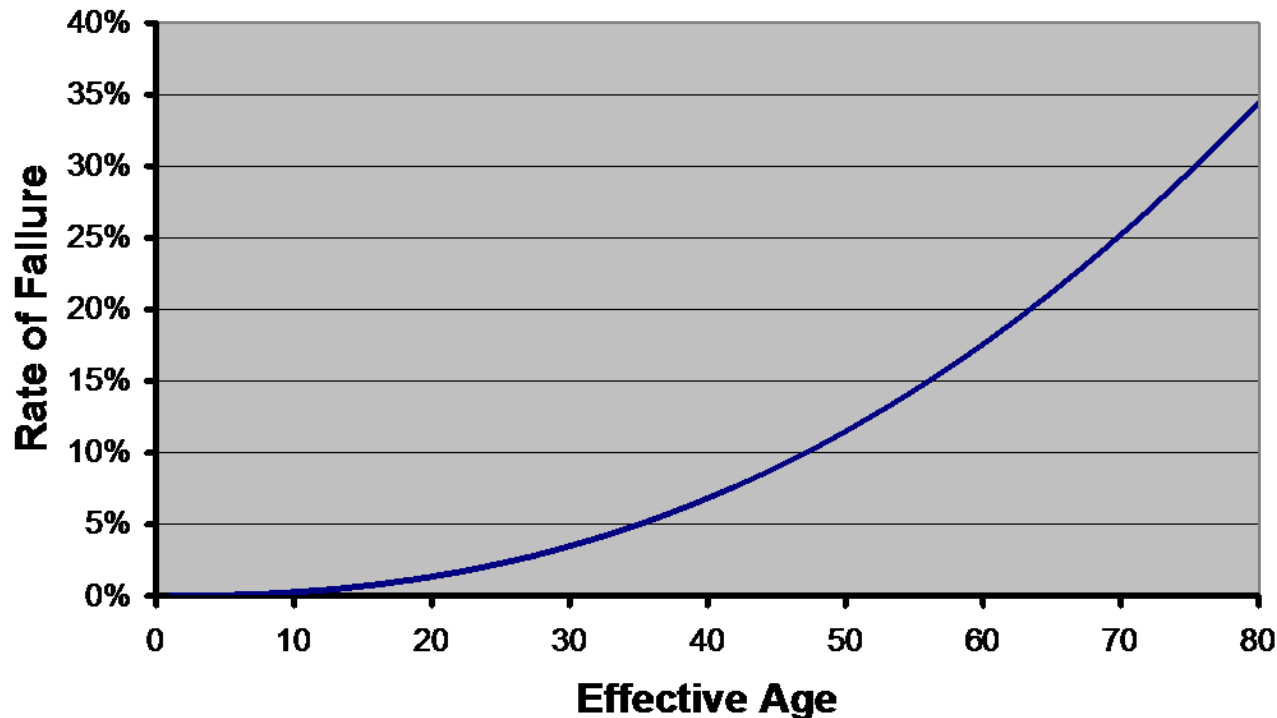


HI (Condition), relates to Probability of Failure, which relates to Effective Age

Example - Failure Rate vs Effective Age

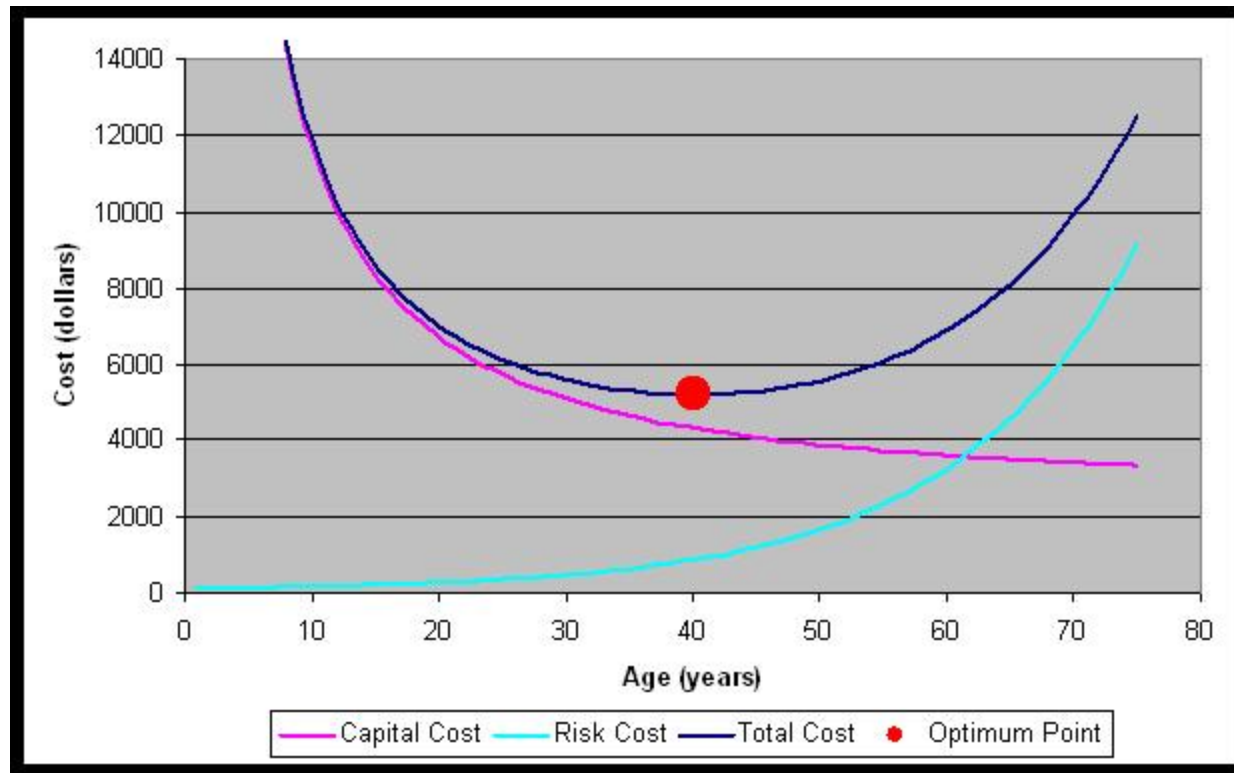


Transformer Failure Rate Curve

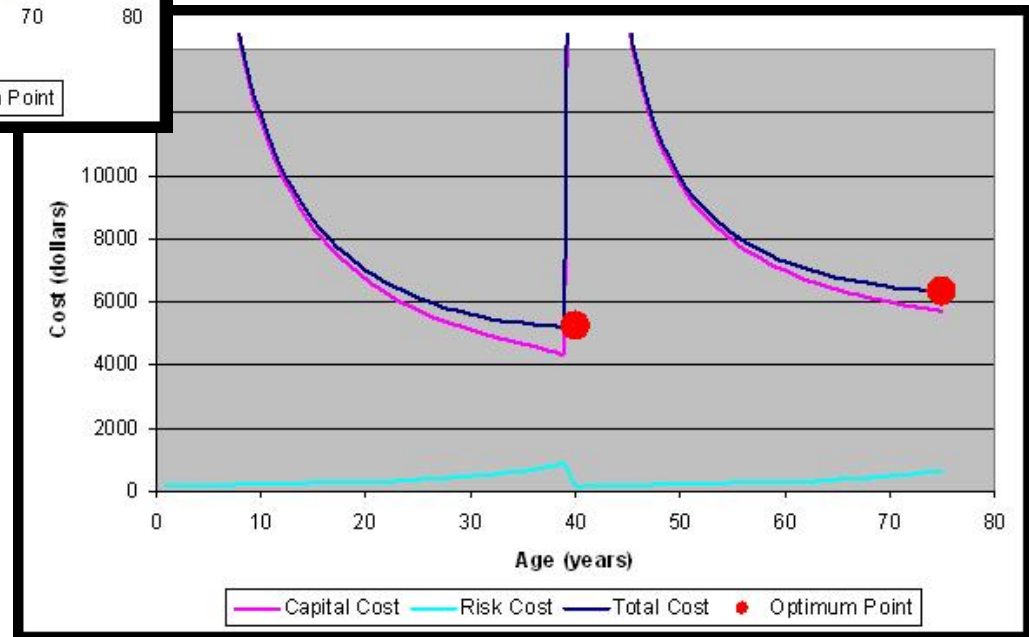
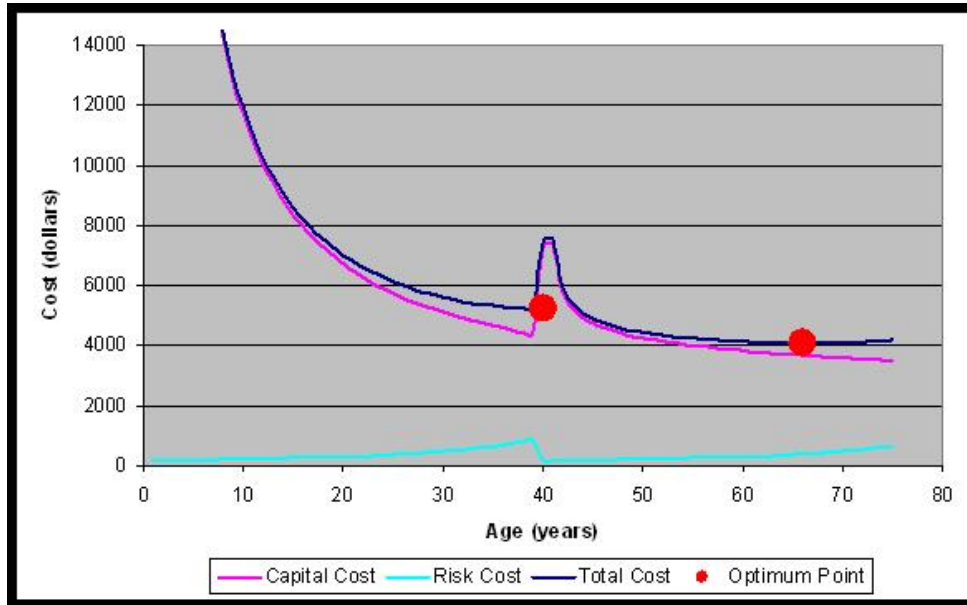


Additional data is required to improve probability of failure curves for many assets

Economic End-of-Life - Replacement



Cost Effective and Non-Cost-Effective Refurbishment



Typical Business Values



- ❖ Safety (employees and public)
- ❖ Reliability
- ❖ Customer Service
- ❖ Financial
- ❖ Reputation
- ❖ Environment
- ❖ Regulatory Relationship
- ❖ Efficiency and Effectiveness

Risk Evaluation Matrix for a Business Value



	Minor	Moderate	Major	Severe	Worst Case
Very Likely (>95%)				Unacceptable Risk Zone	
Likely (65 to 95%)					
Medium (25to 65%)					
Unlikely (5 to 25%)					
Remote (<5%)					

Risk to Public Safety Categories



- Falling parts
- Electrical shock
- Explosions
- Fires

What Could be Done



- ❖ Replace or refurbish existing assets BEFORE they fail
- ❖ Implement failure investigation recommendations for existing assets, e.g. global inspections, repairs, design modifications, barriers
- ❖ Review existing maintenance practices, e.g. PM scope, inspections interval, etc.
- ❖ Review existing utilization practices
- ❖ Install protective barriers
- ❖ Issue public communications/announcements
- ❖ Modify design specification for new equipment

Selecting Cost-Efficient Mitigation



1. Estimate Risk Value (RV) from the Risk Matrix for each public safety risk category.

Note 1: If RV for any of the risk categories is in the **Red Zone** immediate action is required!

2. Calculate overall existing risk using a formula below:

$$\text{Total Risk (TR)} = \text{Sum}(w_i \times RV_i)$$

where w_i = weighting of Risk_i and $\text{Sum}(w_i) = 100\%$

3. Calculate a new resultant TR for each mitigating action.

Note 2: Each mitigating action should result in ALL RVs being out of the **Red Zone**.

4. Select the most efficient mitigating action by comparing cost of each mitigating action with the corresponding TR reduction.

Recommendation



Develop an asset-specific action plan for each asset category to estimate associated Public Risk and to determine cost-efficient Corrective Action(s) when required

QUESTIONS/DISCUSSION



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