CILTHK Seminar

Topic: Asset Life Assurance

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ASSET LIFE

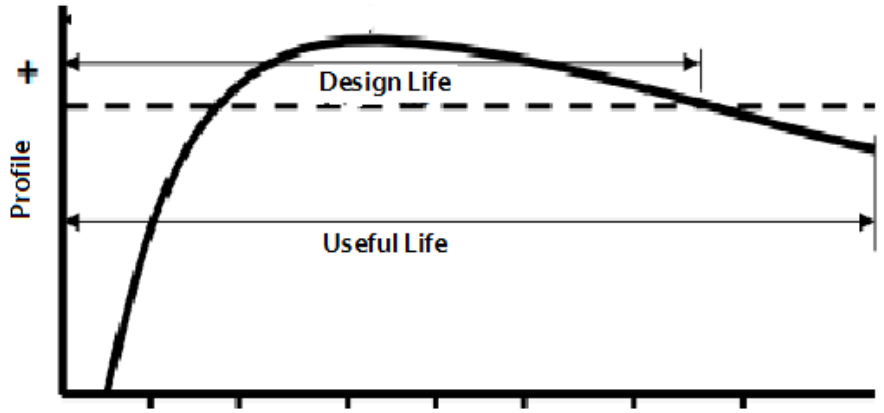
Asset Life

Any asset has a lifespan and eventually gets old and needs replacing.

Asset life can be defined in 2 senses:

1) Design Life

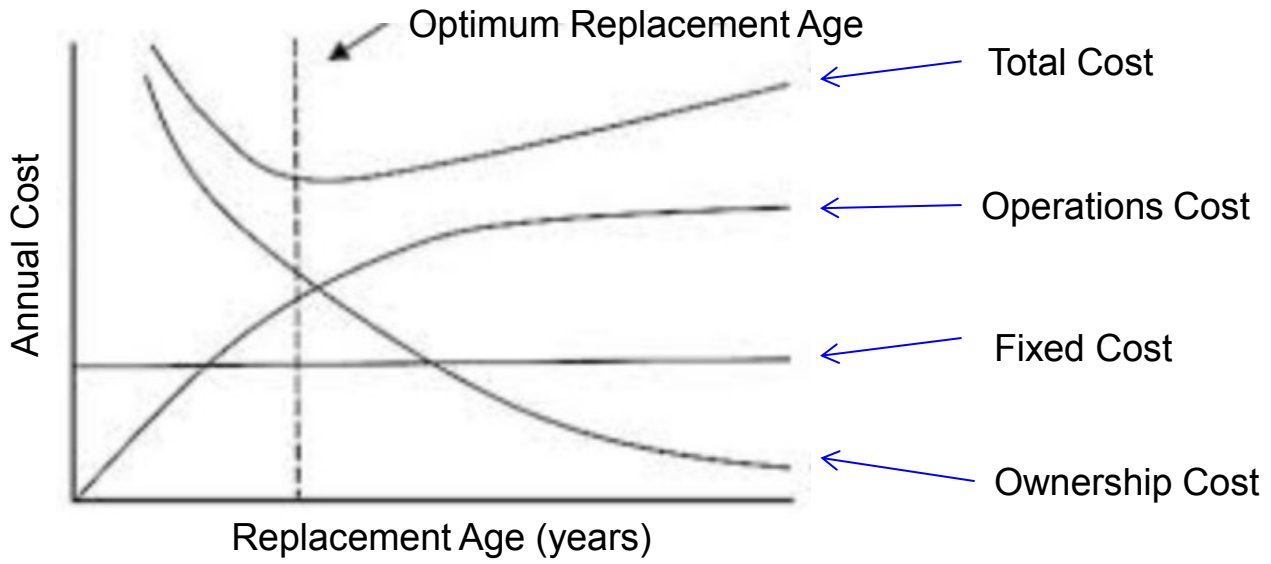
The design life of an asset is the period of time over which the asset is expected to provide service at the specified level as attributed to the asset by the asset designer or manufacturer.



2) Useful Life

It will be identified as the service life. This time period ends when equipment can no longer be operated. This stage is greatly impacted by the repair and maintenance attention that the machine has been provided over its lifespan. A piece of equipment that has not been given adequate maintenance throughout its lifespan will deteriorate at a faster rate than a machine that has been given substantial preventive maintenance. Thus, the useful life will vary depending on the piece of equipment and the amount of upkeep it has been provided.

In principle, the decision of equipment renewal can be made by locating the optimum total cost by when the ownership cost and the operating cost hit the minimum as illustrated in the below chart.



Factors that steer the decision:

Operating cost: asset condition, reliability of major components, availability of critical spare parts, productivity limit, technology, asset useful life remain

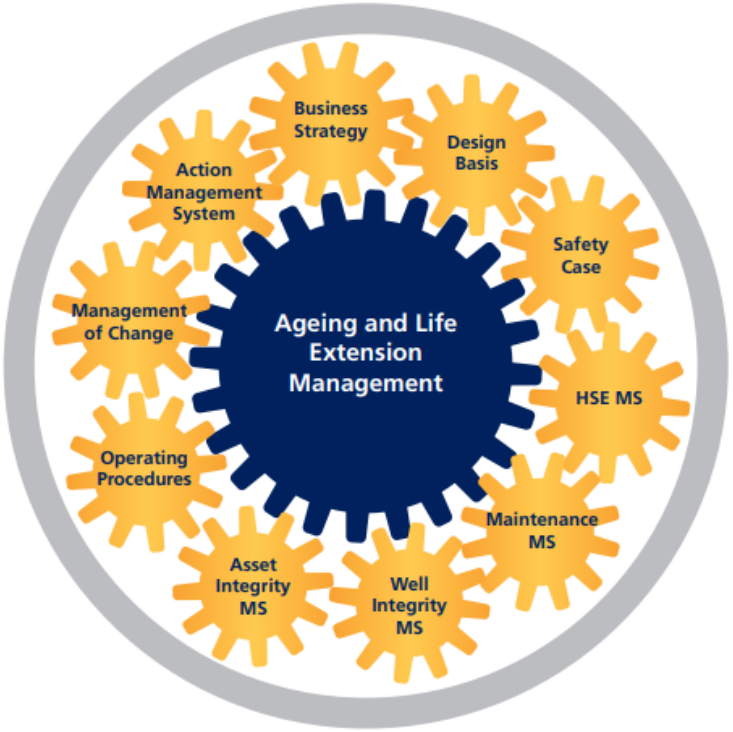
Ownership cost: investment plan, asset price

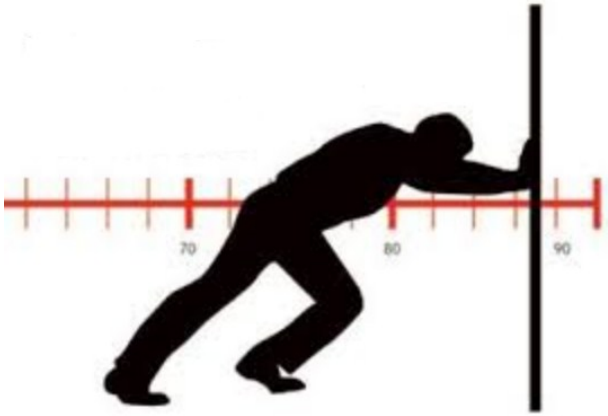
Asset Life Assurance

It becomes an issue when the equipment is approaching end of its design life. Along its operations and maintenance process, the asset condition would be kept diagnosed at intervals to ensure the capability being fit for service.

Asset life assurance may imply to:

- The capability of serving for coming years until expiry of design life
- Condition deteriorated that needs mitigation
- Useful life is beyond the design life that leads to a review of life extension





Asset Management – State of Art

A balance between Performance, Cost and Risk over all stages of asset's lifecycle

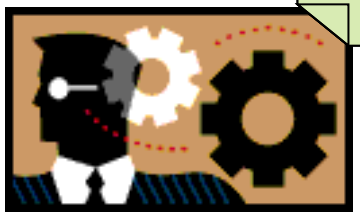
Asset Introduction/ Modification

- Corporate Goals & Policy
- Rail Business Demand
- Asset Investment Planning
- **Asset Introduction / Modification**
- Asset Maintenance
- Asset Condition and Performance Management
- Asset Life Assurance

Customer
Requirements
Brief

1. Defining Requirements

EDOC



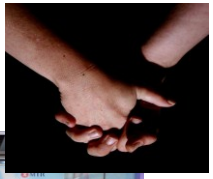
2. Design

Safety
Critical
Systems ??

3. Installation & Commission

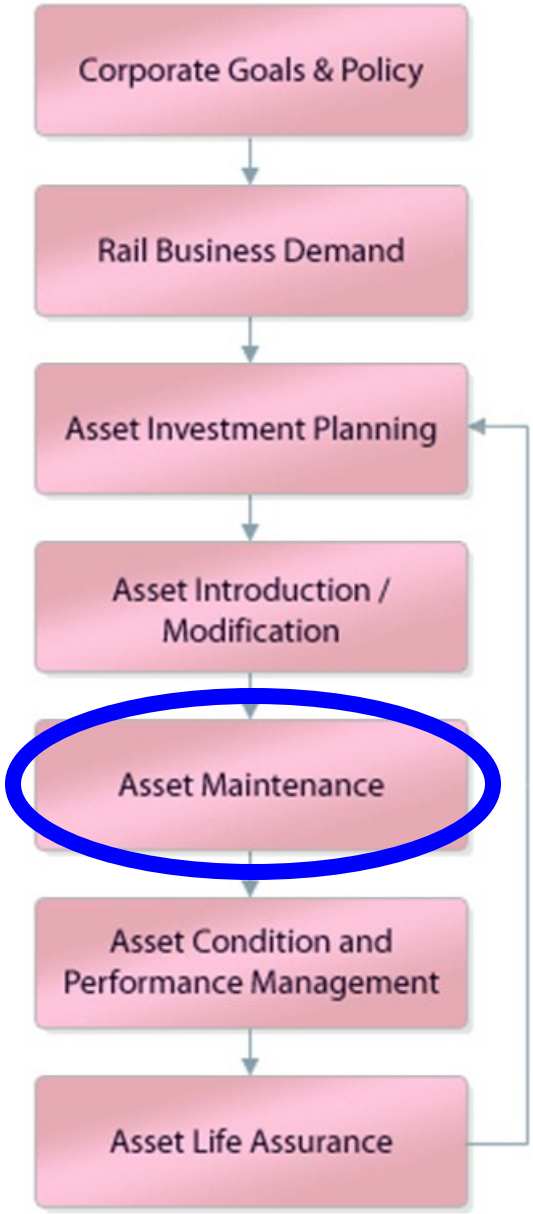
6. Post Completion Review

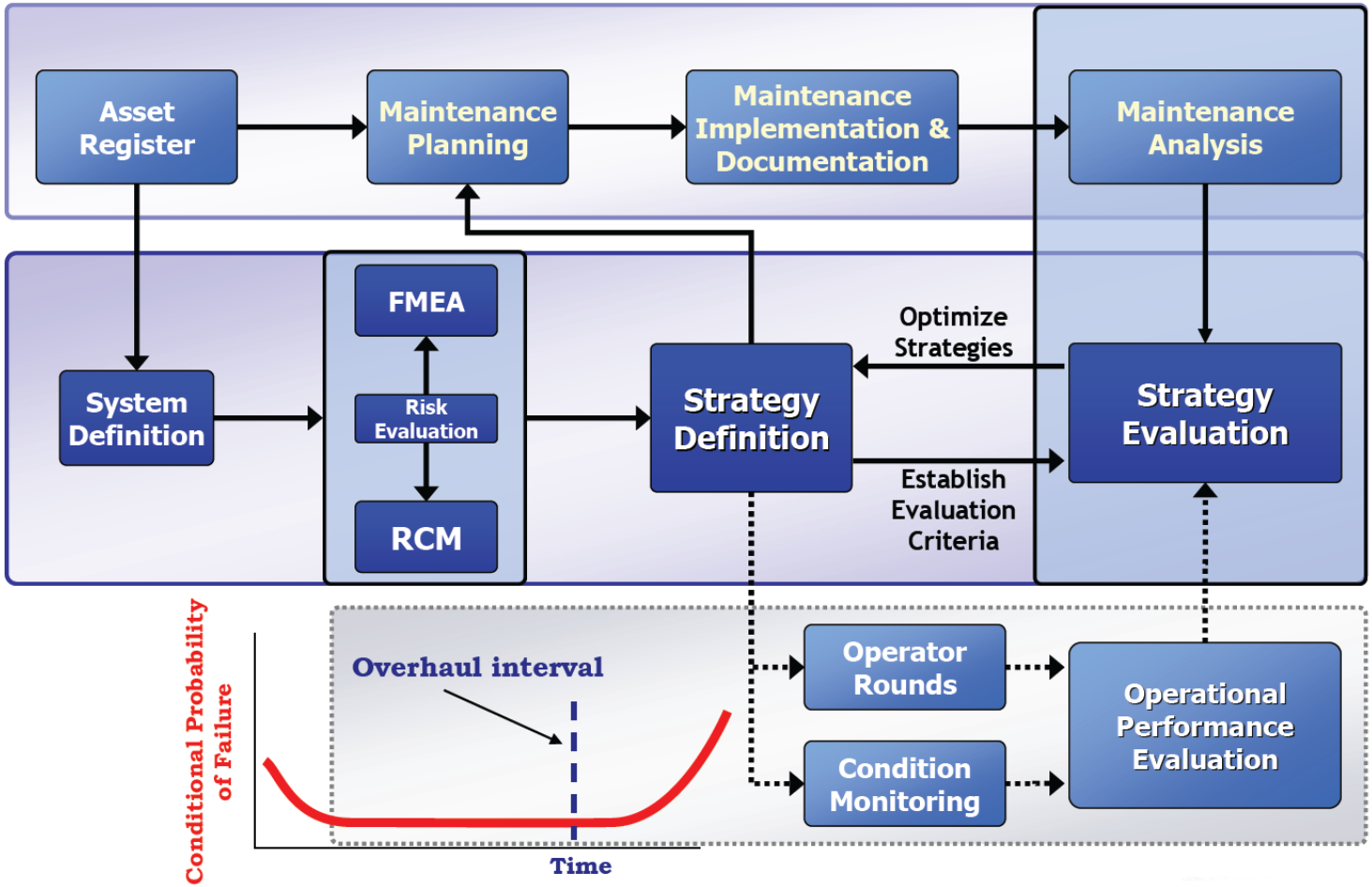
5. Registration & Capitalization



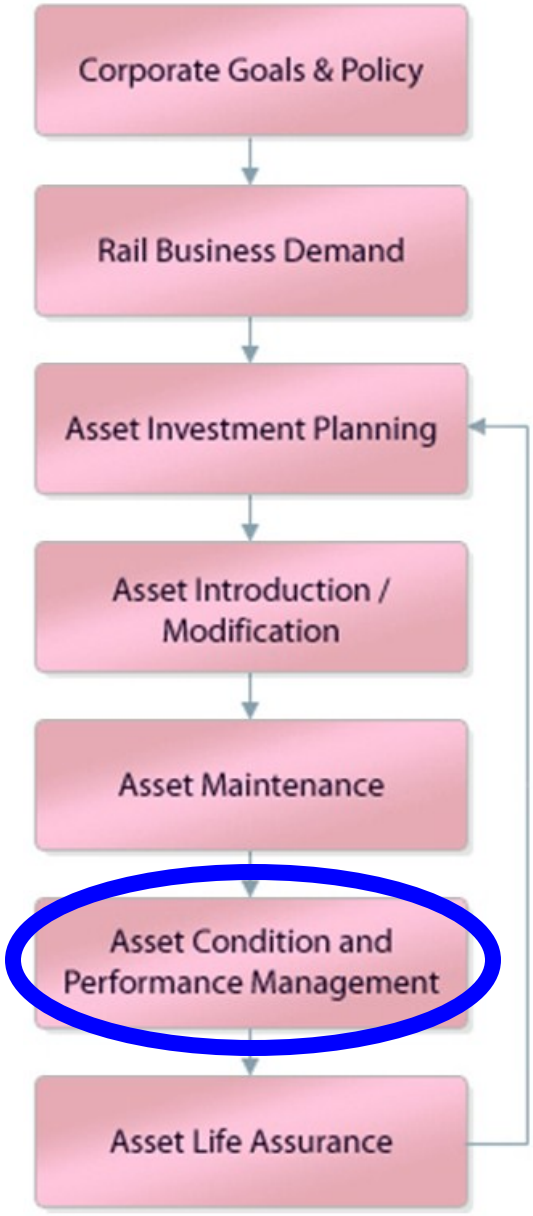
4. Handover

Asset Maintenance

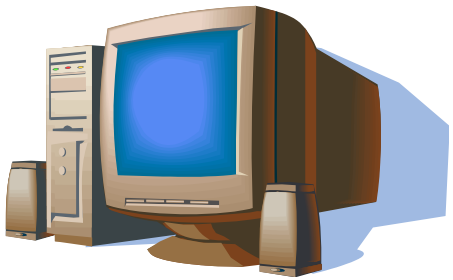




Asset Condition and Capability Assessment



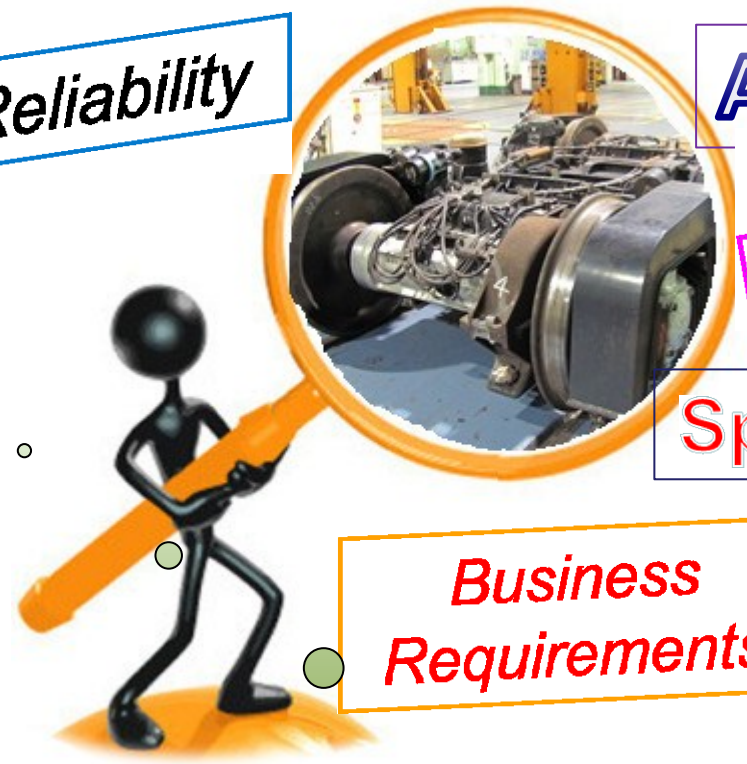
To evaluate the reliability and condition of an asset in order to infer if the asset is capable to meet the business needs in the coming 3 years. Results of the assessment also serve as inputs to asset replacement planning and the regular review of asset depreciation life.



Asset Condition and Capability Assessment

- Corporate Goals & Policy
- Rail Business Demand
- Asset Investment Planning
- Asset Introduction / Modification
- Asset Maintenance
- Asset Condition and Performance Management
- Asset Life Assurance

What do we assess ??



Reliability

Asset Life

Asset Co...

Interfacing Capacity

Spare Obsolescence

System Limitation

Business Requirements

Legislative Compliance

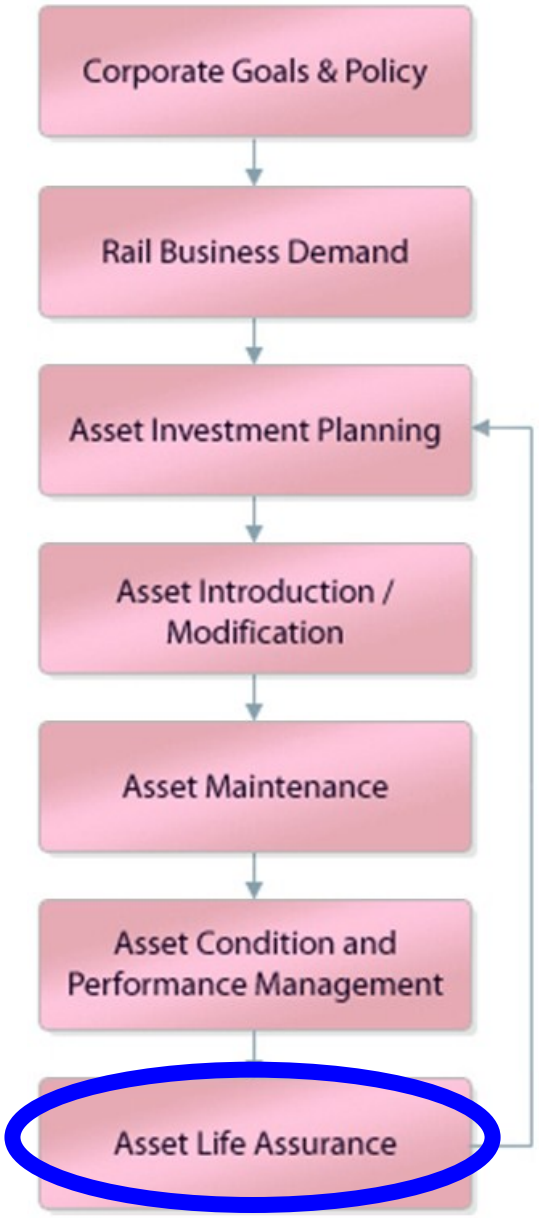
Capable to meet next 3 yrs. business needs ??

Asset Condition and Capability Assessment (ACCA)

8 elements to be assessed:-

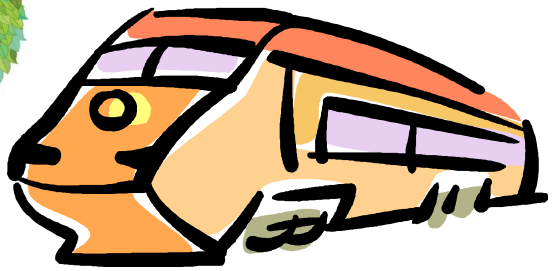
- Reliability Performance Trend
- Asset Condition Analysis
- Asset Life
- Spare Obsolescence
- System Limitation
- Interfacing Capacity
- Legislative Compliance
- Business Requirement

Asset Life Assurance (ALA)



Main Objective

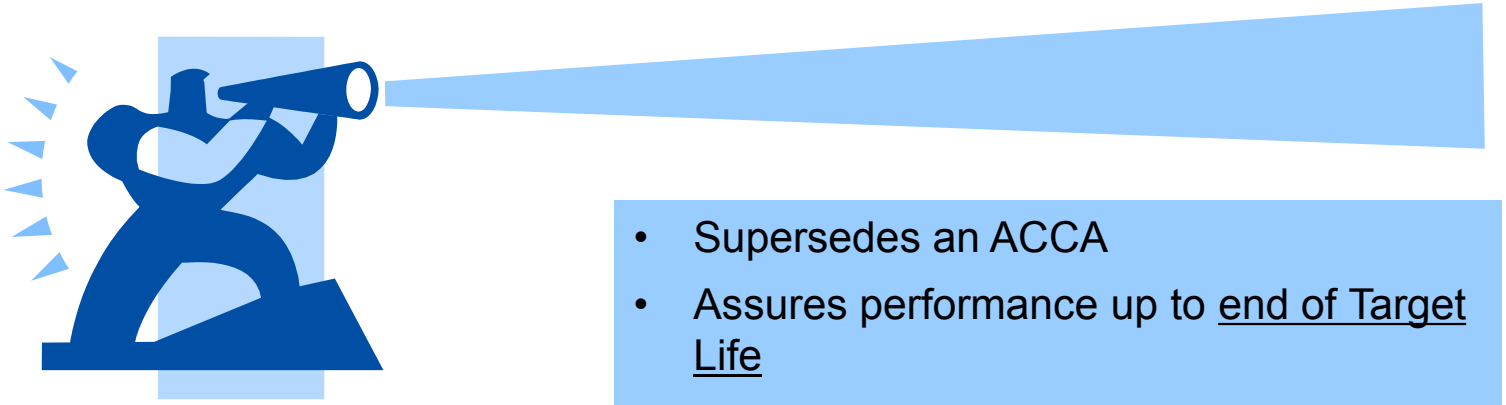
1. Ensure stable performance meeting all safety requirements and system performance standards.
2. Obtain best value of Railway Assets throughout Useful Life.
3. Optimise life cycle costs.



Difference between ACCA and ALA Review

ACCA

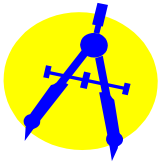
- Confirms performance in coming 3 years
- Relatively simple review
- Short-term measures



ALA Review

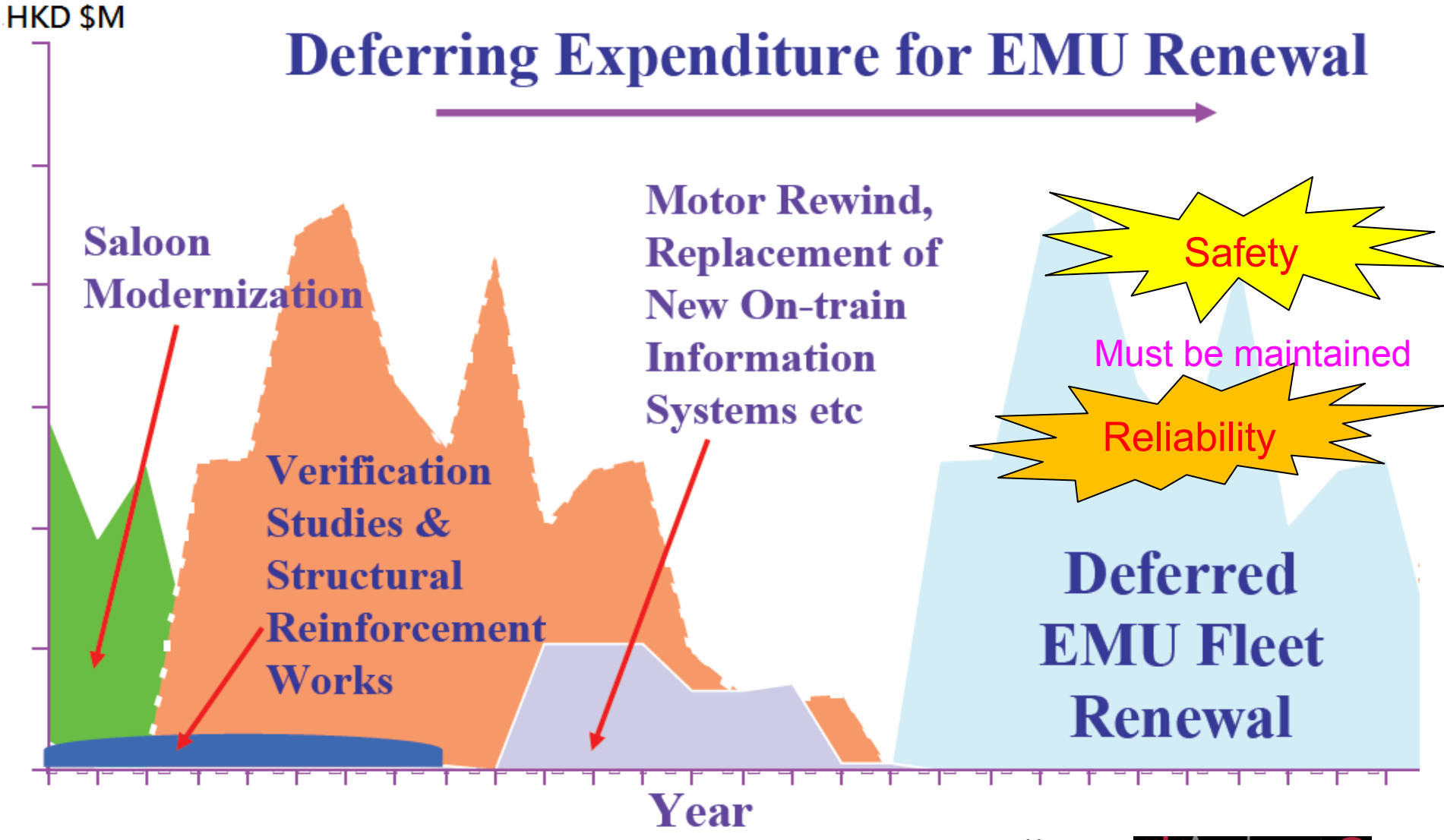
- Supersedes an ACCA
- Assures performance up to end of Target Life
- Comprehensive review
- Life-long ALA Plan

Asset Useful Life

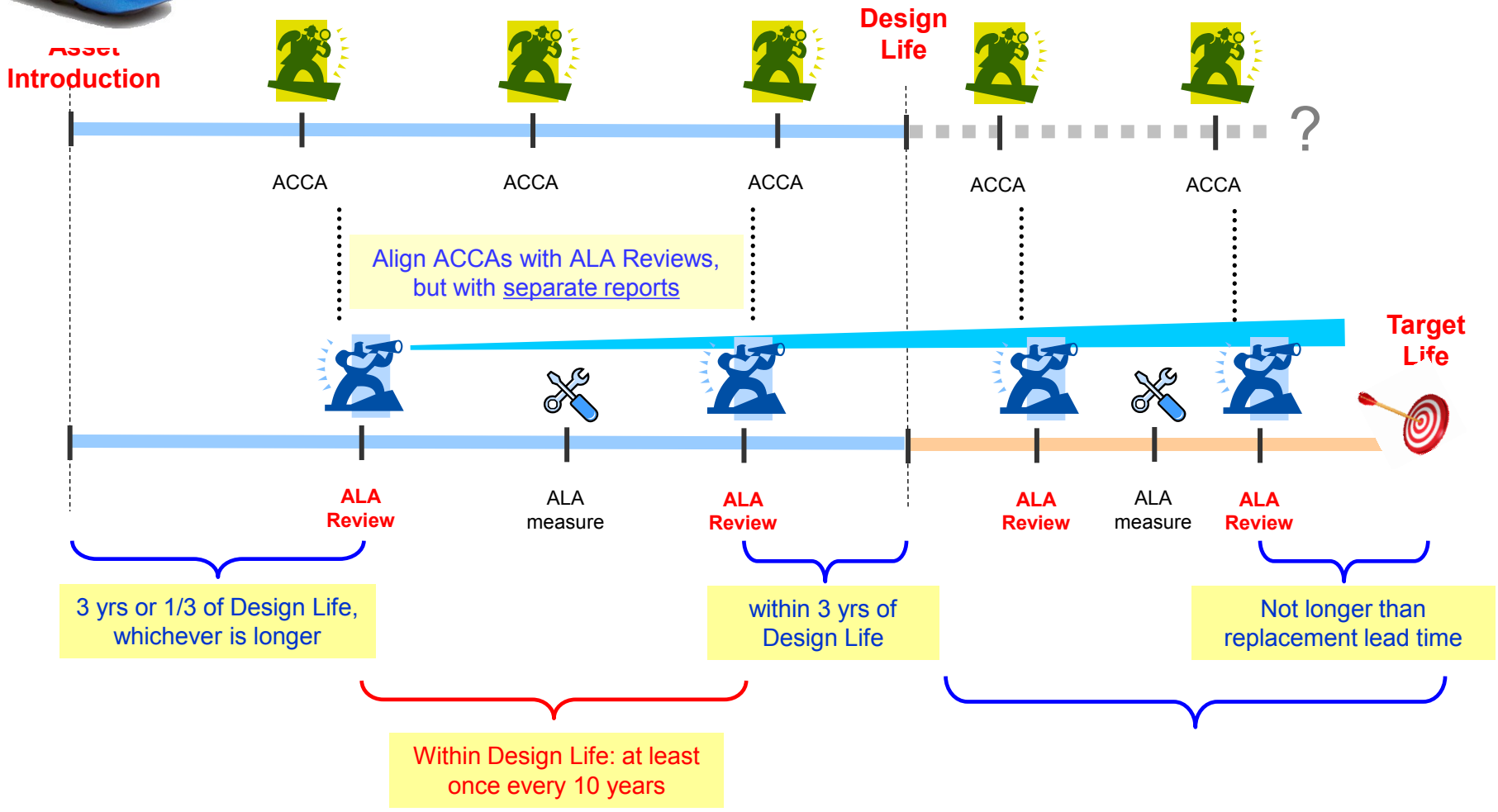
Useful Life	• General term – time where an asset can serve its intended functions • Quoted in Fixed Asset Register (FAR) – for depreciation calculation
Design Life 	• Life defined in Technical Specification
Target Life 	• Life that the Lead Maintainer aims to achieve • Generally 150% of Design Life where feasible

Always capitalise "**D**esign **L**ife" and "**T**arget **L**ife" in ALA documents

Financial Benefits of ALA (Example: EMU)



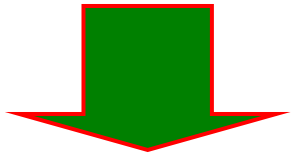
Asset Life Assurance



Study and Implementation

Study Phase

- To study both technical feasibility and financial implication of asset life assurance measures of major assets



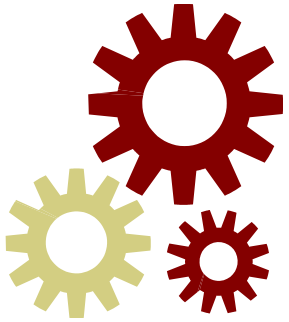
Implementation Phase

- To ensure all ALA measures / recommendations are implemented in an effective and efficient manners.

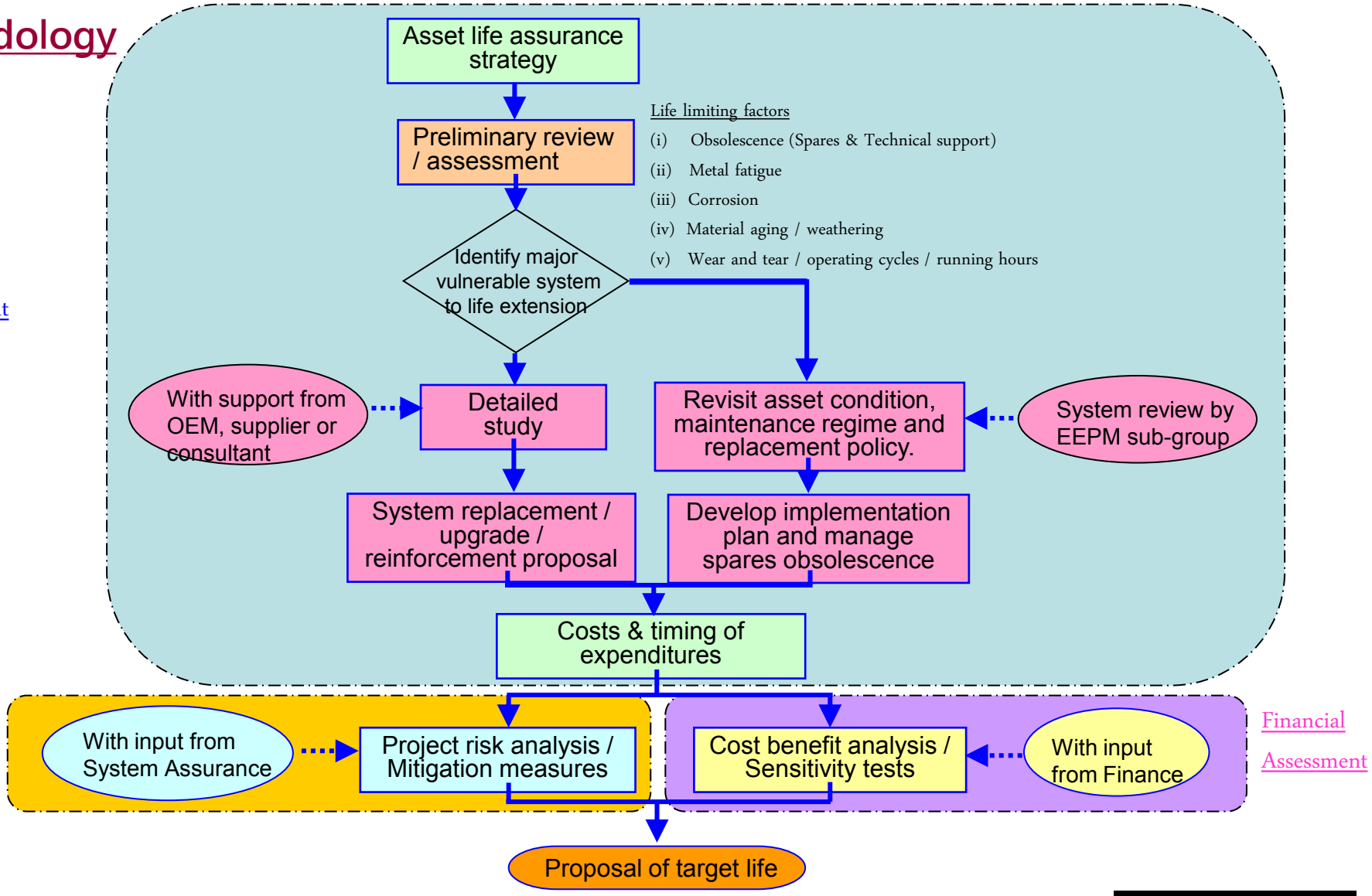
Asset Life Assurance Study

Scope of Study

- Assess asset conditions.
- Identify the areas requiring upgrade/ replacement.
- Estimate costs and timing.
- Conduct cost and benefit, & sensitivity analysis.
- Conduct project risk analysis.
- Conclude the study

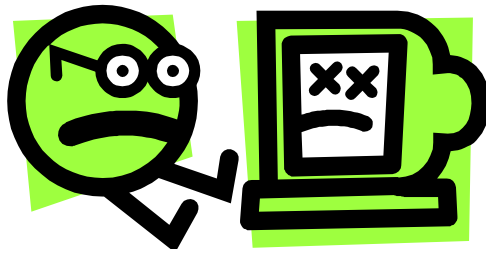


Study Methodology



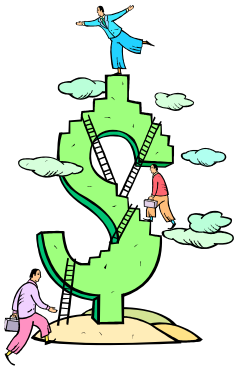
Technical Assessment

- **Life Limiting Factors**
  - (1) Obsolescence (both spares or technical support)
  - (2) Metal Fatigue
  - (3) Corrosion
  - (4) Material ageing/ weathering
  - (5) Wear and tear/ operating cycles/ running hours



- **Identify vulnerable systems for further study**
- **Propose strategy, LARP, costing and timing of expenditures to support asset life assurance**
- **Manage spares obsolescence**
- **Confirm technical feasible for asset life assurance**

Financial Assessment



- **Assumptions**

  (e.g. Operations requirements, statutory requirements and etc.)

- **Cost elements to be considered**

  (1) Running Maintenance (Light & Heavy Maintenance)

  (2) Up-keeping (C&R works for improving reliability and safety)

  (3) Long Term Asset Replacement Plan (LARP)

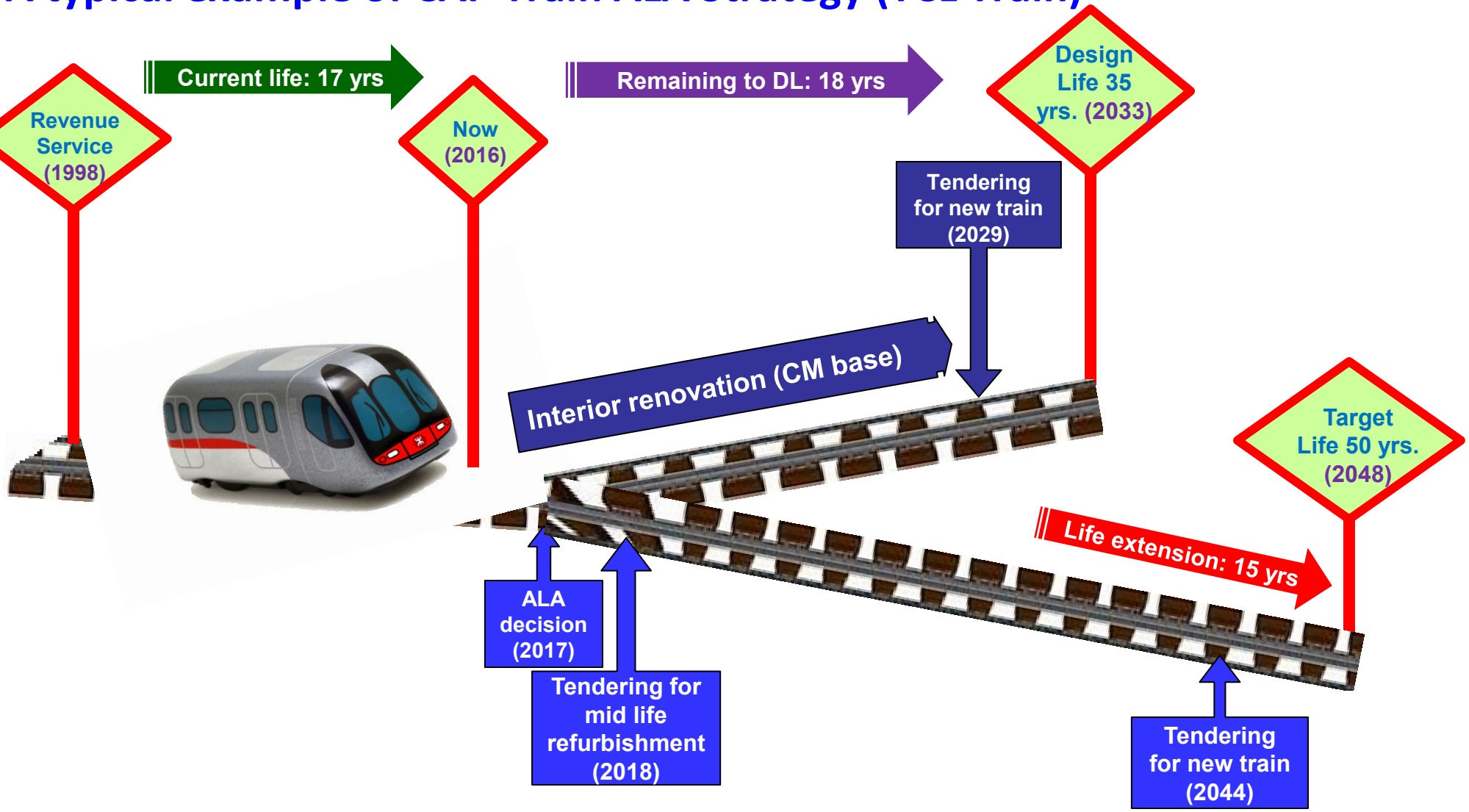
  (4) Life Assurance Related Costs

  (5) Additional Stock Holding & Managing Spare Obsolescence

- **Method and acceptance criteria for evaluation** *(CGI 249)*

  Required Rate of Return (RRR) is defined by minimum acceptable Internal Rate of Return (IRR) in a Discounted Cash Flow Method (DCF).

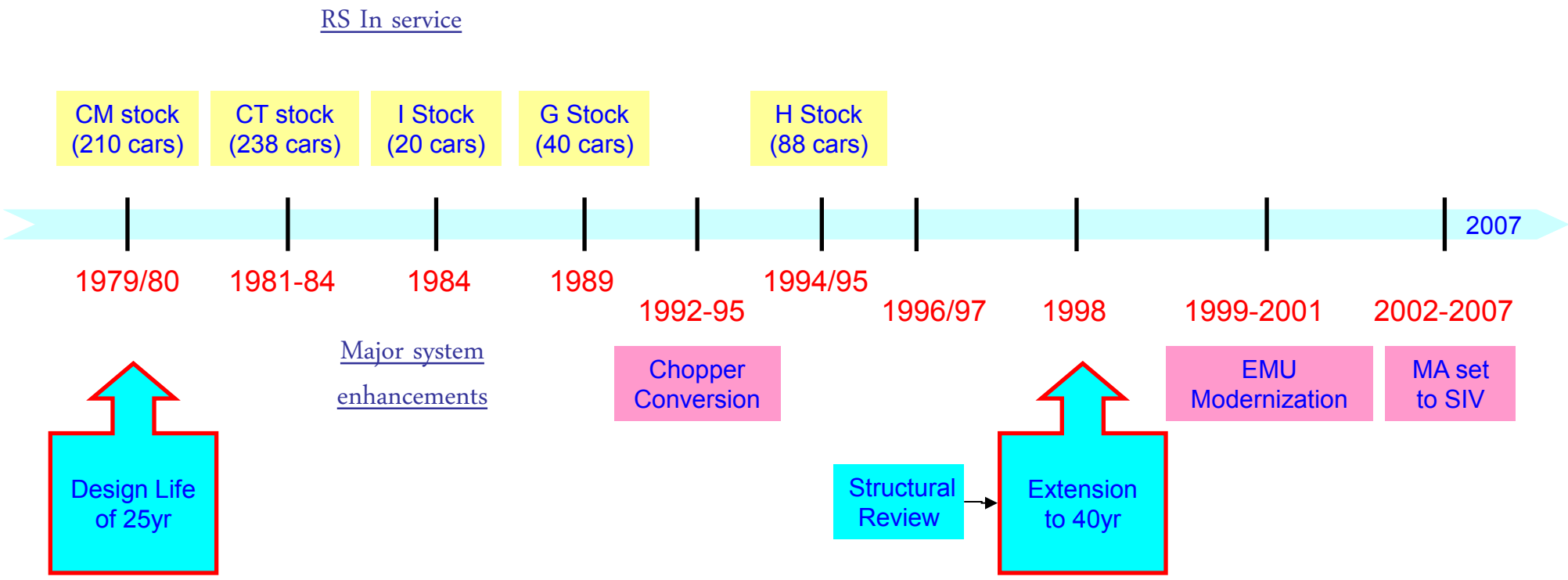
A typical example of CAF-Train ALA Strategy (TCL Train)



Asset Life Assurance (ALA) Example in MTR

Background

M Train Introduction and System Enhancements



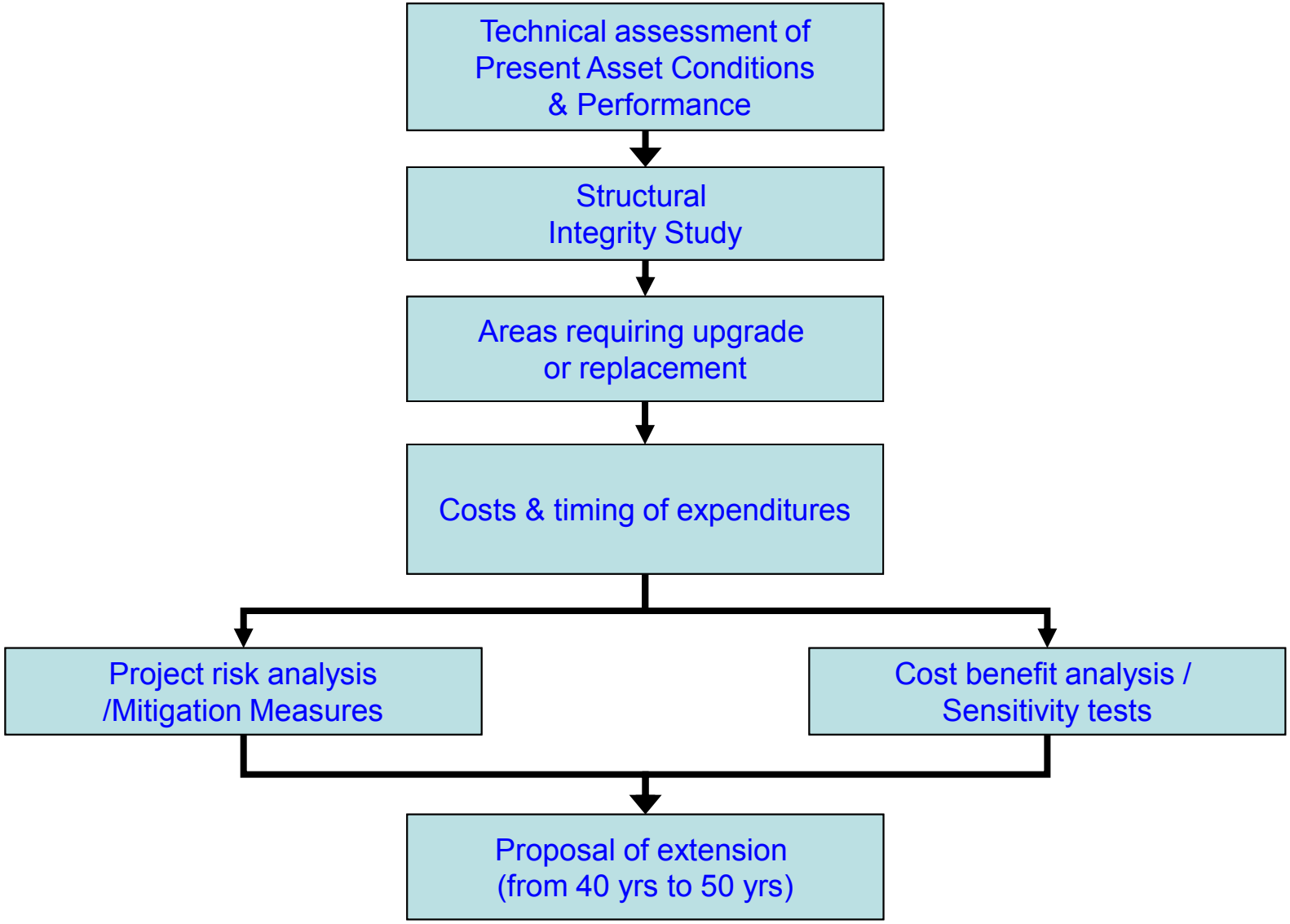
Background

- M-trains have design life of 25 years
- Structural reinforcement in 1998 extended life to 40 years
- Asset condition of M-train is good with major enhancements implemented.
- M-trains performance is improving.
- Time to proactively assess if life extension feasible.
- 2006, study group formed with members from RSMD, TSEG, Asset Replacement Mgr, P&CD and Finance

Objectives of the Study

- Assess asset conditions
- Identify areas requiring upgrade/replacement
- Estimate costs and timings of Capex
- Conduct cost and benefit analysis
- Conduct project risk analysis
- Recommend way forward

Study Methodology



Review of Major EMU Systems

13 functional systems covered (P/L1/SYM/008 – Asset Condition and Capability Assessment):-

1. Carbody & Structure

2. Bogie & Suspension

3.Traction Motor

Critical and Expensive

4. Traction Ctrl & Braking

5. Auxiliary Inverter

6. Pneumatics

7. Pantograph

8. Door

9. Coupler

10. Gangway

11. Aux power Supply & Battery

12. Air-conditioning

13. ATC SACEM

Car body and Bogie Structure

- Structural integrity reviewed by a UK consultant, Delta Rail in 2007
- Independent reviewed by The Hong Kong Polytechnic University
- Concluded that life extension to 60 years is feasible (subject to reinforcement on highly stressed areas)

Traction Motors

- Service life study by RSMD/T&ES
- Support by HK University of Science & Technologies and University of Wollongong
- Confirm the Traction motors can have life extension beyond 60 years subject to a refurbishment programme during their services life of 35-40 year

Cables

- Service life studies/tests by:
  - City University of Hong Kong
  - The cable manufacturer
- The study concluded that the cable can last for 60 years

Other Considerations

- For other sub-systems, provision of funding for their replacement or refurbishment included in cost-benefit analysis

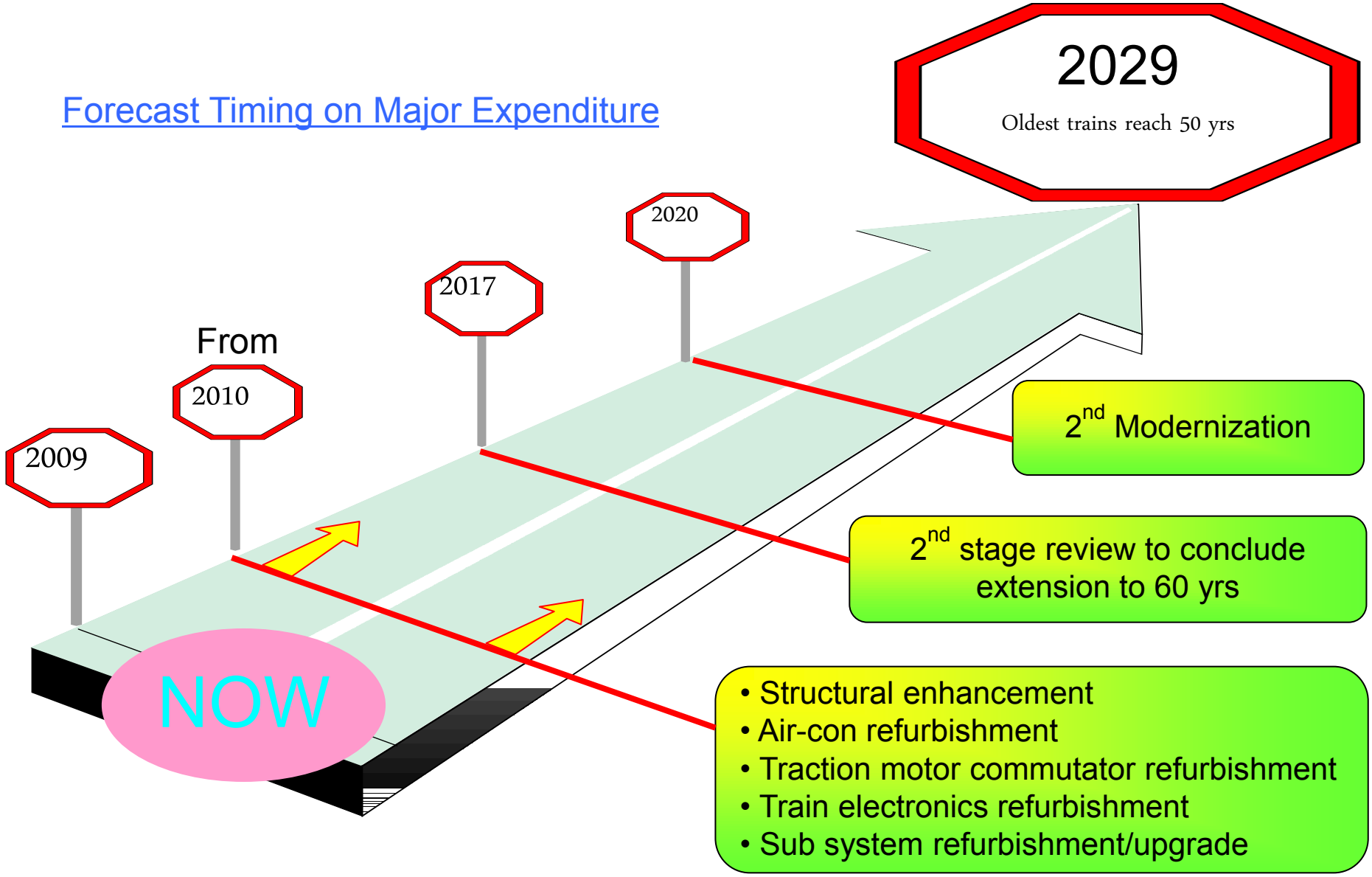
The study concluded
M-Train has a “technical life” of 60 years

Financial Evaluation

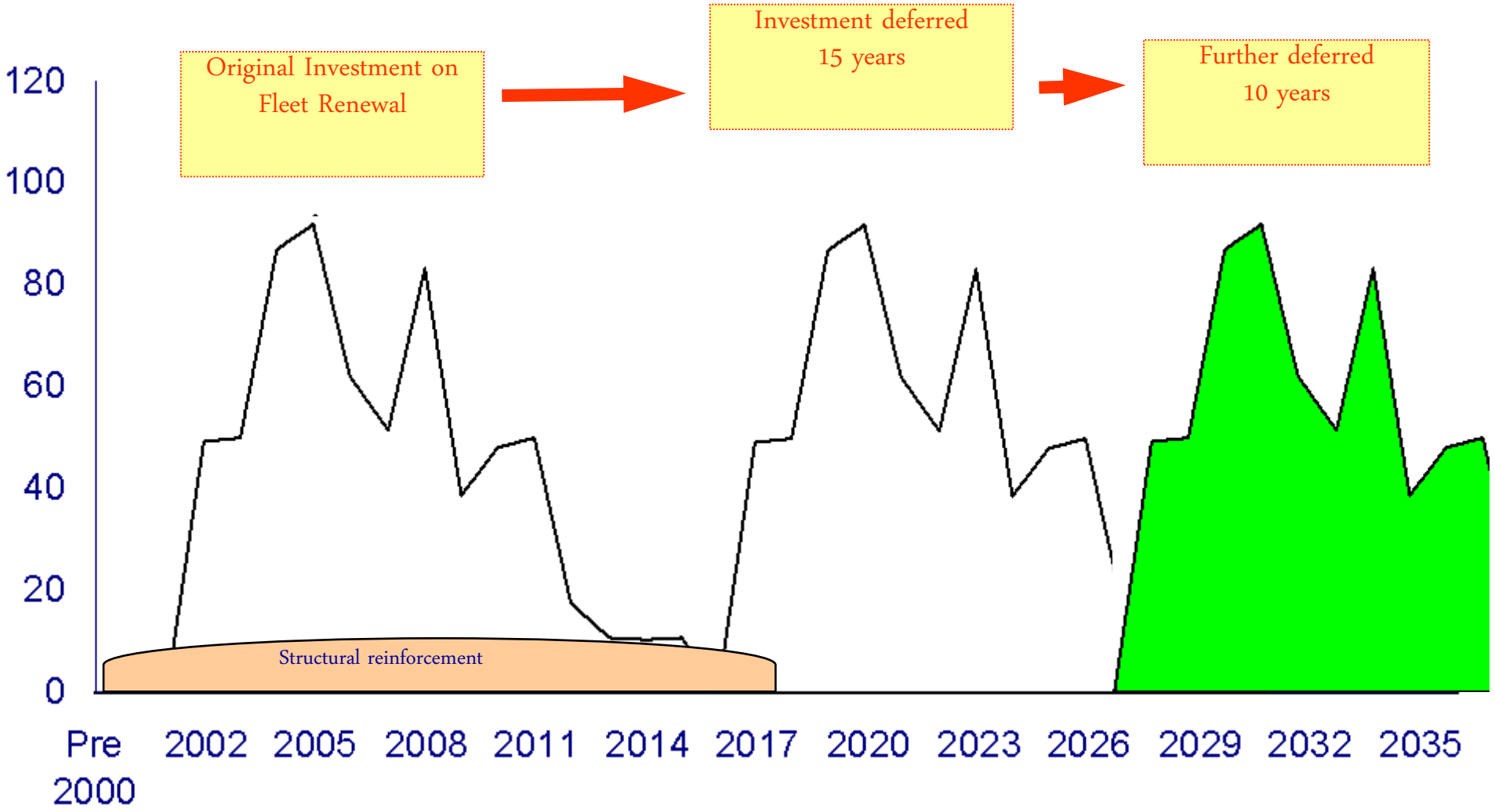
- Financial Evaluation – Using Guidelines on Methodology and Parameters issued by Financial Planning Committee
- Discounted Cash Flow Method (DCF) is used to derive the
  - Net Present Value (NPV)
  - Internal Rate of Return (IRR)

Life Extension to 50 Years

Forecast Timing on Major Expenditure



Financial Benefits



Project Risk Analysis

- GPR/3828/A2a “Project Risk Management” and reference to enterprise risk categories
- 3 major concerns and mitigation measures were identified.

Concern	Mitigation
➢ Structural integrity	➢ Consultancy study
➢ Spare Obsolescence	➢ By obsolescence management
➢ The capital investments required is much higher than expected	➢ Sensitivity test included in financial model

Conclusions - Technical

- Recent Asset Condition Report - Assets are in good condition
- Identified areas of reinforcement, refurbishment, or replacement
- Effective On-going Asset management process in place to sustain and even further improve performance
- Technical life can be 60 years

Conclusions - Project Risk

- Risks identified are mitigated by:
  - ✓ Asset condition monitoring
  - ✓ Life assessment studies
  - ✓ Refurbishment & upgrade
  - ✓ Obsolescence management

Q & A

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