



# *Life Cycle Costing and Port Structures*

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# *Objectives*

- ◆ What is Life Cycle Management
- ◆ How to incorporate into current plans
- ◆ Research challenges and sources for more information

# *What is Life Cycle Costing*

- ◆ Avoiding unexpected system failure from negligent maintenance, budgeting or planning
- ◆ Generally starts at preconstruction of a project, but can be incorporated anytime
  - Do you build what you want or what you can?
  - How is this maintained?



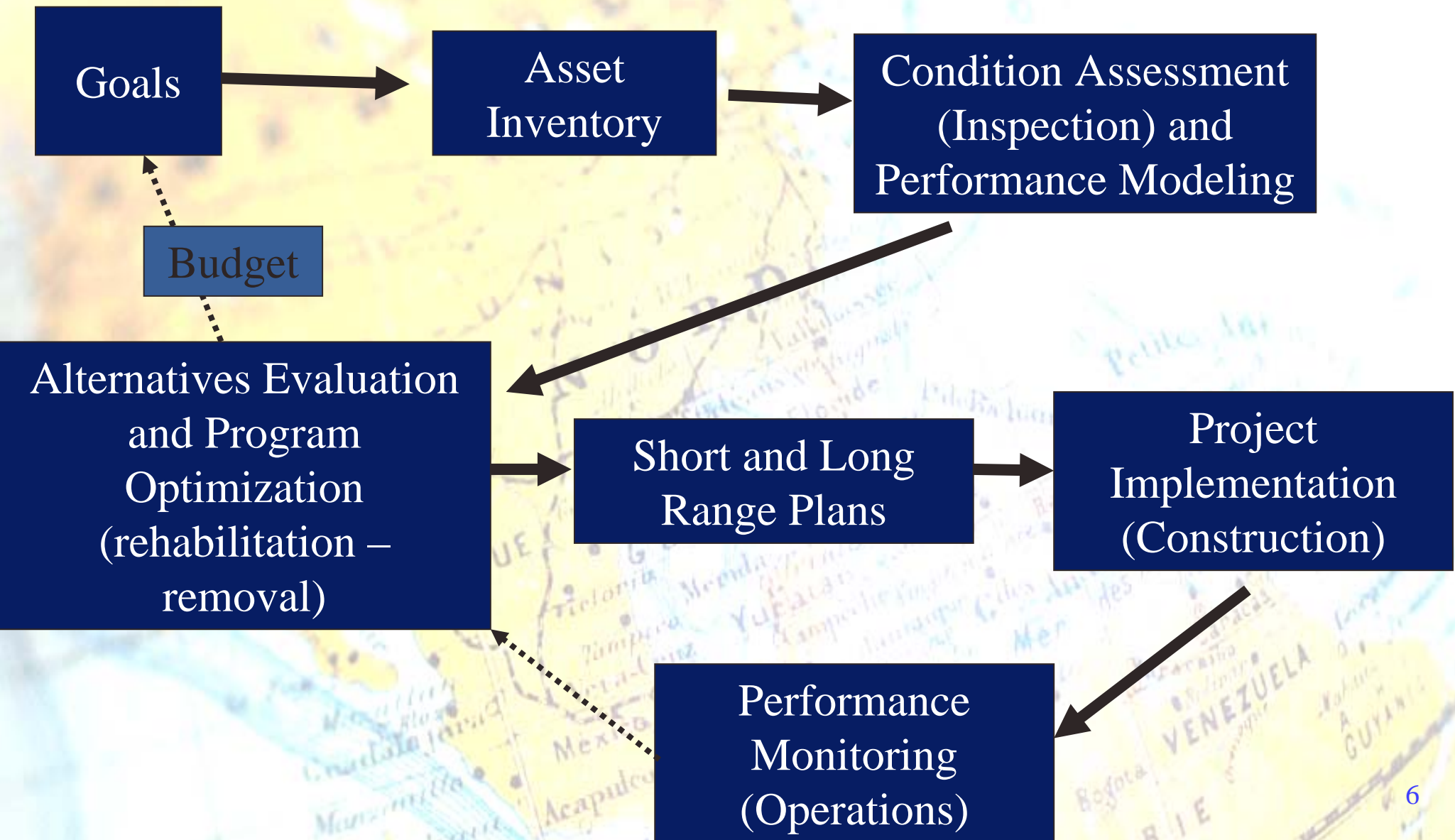
# *Challenge in Life Cycle Management for Infrastructure*

- ◆ Engineering Design Standards are basis-structures gauged on risk of structural “failure” or condition
- ◆ Lack of consistent inspection approaches
- ◆ Engineering standards for different components – mechanical versus structural
- ◆ Difficult to test large structures
- ◆ Long Design life – 50 -100 years
- ◆ Harshness of Marine Environment
- ◆ Structure become technical obsolete before becoming physically obsolete

# *Risks from Poor LCM*

- ◆ Port closures
- ◆ Risk to structural integrity (loss of load bearing wharves, corrosion, collapse)
- ◆ Safety – injury or loss of life
- ◆ Environmental exposures
- ◆ Potential liability issues

# *A Generic System for Managing Port Structures*





# *Implementing Life Cycle Costing During Planning/Construction*

- ◆ Determine required project needs and total costs over project cycle
- ◆ Parameters to consider when costing alternatives:
  - Net Present Value
  - Determine useful life
  - Loss of Revenue from failure
  - Maintenance costs
  - Demolition or removal costs
  - Tax structures

# *Inspection During Operation*

## ◆ Three approaches –

- Fix as fail
- Inspect and rehabilitate
- Preventive Maintenance

## ◆ Inspection types and frequency

- Initial design suggests inspection schedule
- Visual inspection not always accurate
- Balance of other inspection types – costly and may not be preformed as frequently



# *Implementation Challenges?*

- ◆ Projects have multiple uses
- ◆ Competing and changing interests - commitment
- ◆ Determining or guaranteeing a minimum standards for safe use or performance
- ◆ Planning and defining current and future needs
- ◆ Data integration – GIS and data warehousing
- ◆ Process transparency must be developed
- ◆ Education to port staff, commissioners and port users necessary

# *Research gaps related to adopting life cycle management*

- ◆ Movement to more portable models and tools for end users
- ◆ Recognition this is a data intense process
- ◆ Examine ways to reliability model condition assessments
- ◆ How does system respond to extreme events
- ◆ Non-destructive inspection techniques
- ◆ Examine recommendations for given repairs
- ◆ Can uncertainties be properly quantified?



# *More Sources of Information*


- ◆ “Life cycle Management of Port Structures-  
General Principles” – Report of WG 31,  
Supplement to Bulletin 99 (1998)
- ◆ ASCE/AASHTO/FHWA/TRB
- ◆ Journal - “Structure and Infrastructure  
Engineering”
- ◆ PIANC – MarCom Technical Seminar, Feb 05



# *Design of Movable Weirs and Storm Surge Barriers*

## *InCom WG 26 – Jan 2006*

- ◆ One of 6 goals – LCM
- ◆ Topics included design standards, costing structures, performance goals, and environmental considerations
- ◆ Enclosed CD-Rom with appendix materials



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