
Generating an Initial Project List
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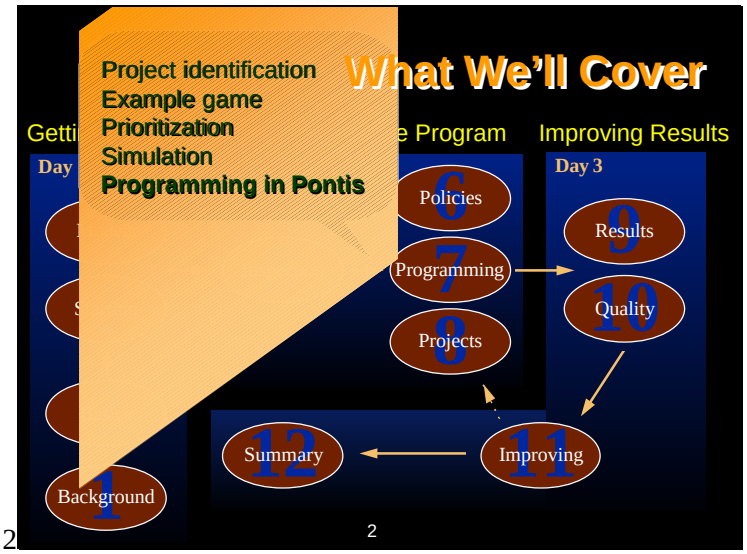
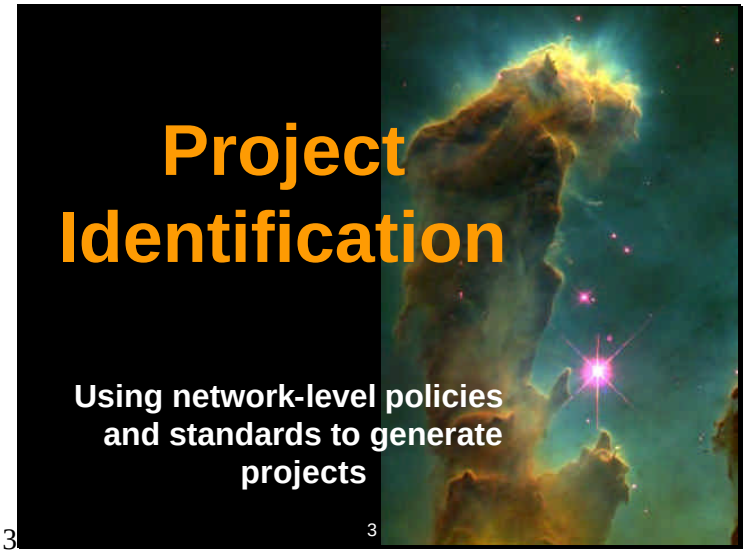

What We'll Cover
Project identification
Example game
Prioritization
Simulation
Programming in Pontis
Improving Results
Day 3
Policies
Programming
Projects
Results
Quality
Summary
Improving
Background
2


Project Identification
Using network-level policies and standards to generate projects
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## Basic Decision Criteria

- Accomplish as much as possible with current budget
- Minimize the long-term cost of keeping each bridge in service
- Minimize inconvenience to road users
- Act in a consistent manner across all projects

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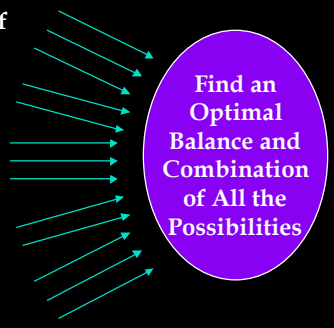
## Generalized Problem

Nearly infinite number of possible actions

Wide range of possible:
- Policies
- Budgets
- Deterioration Rates
- Costs




All the combinations

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## How Policies Simplify Things

- Ensure consistent actions
- Reduce the number of optimizations and decisions
- Quickly eliminate the least attractive alternatives
- Clear day-to-day guidance
- Easy to understand agency decisions

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## How To Make Good Policies

- Find Commonality
- Clear Objectives
- Clear Constraints
- Predict Impacts

Detail points

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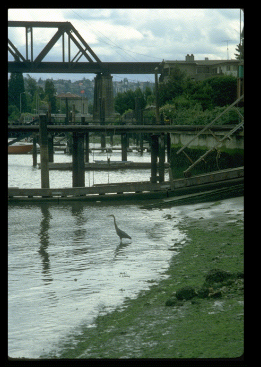
## Choosing Relevant Policies

- Categorize the bridge by:
  - Elements
  - Environments
  - Condition States
  - Functional Class and Traffic
  - Highway System



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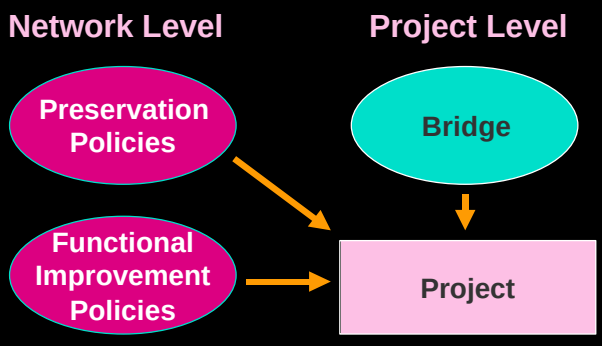
## Formulating a Project

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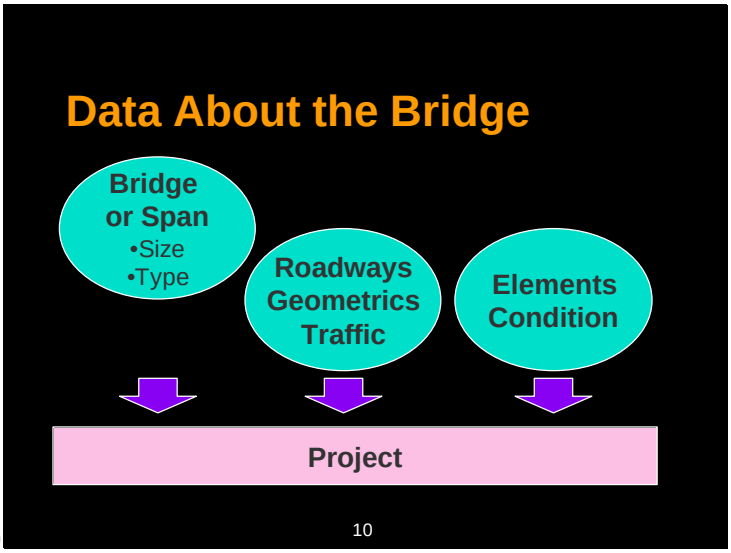
Data About the Bridge
Bridge or Span
•Size
•Type
Roadways Geometrics Traffic
Elements Condition
Project
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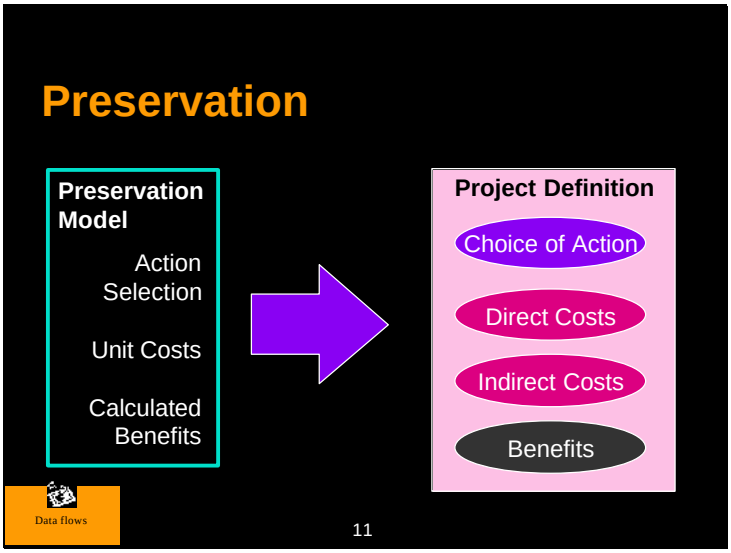
Preservation
Preservation Model
Action Selection
Unit Costs
Calculated Benefits
Project Definition
Choice of Action
Direct Costs
Indirect Costs
Benefits
Data flows
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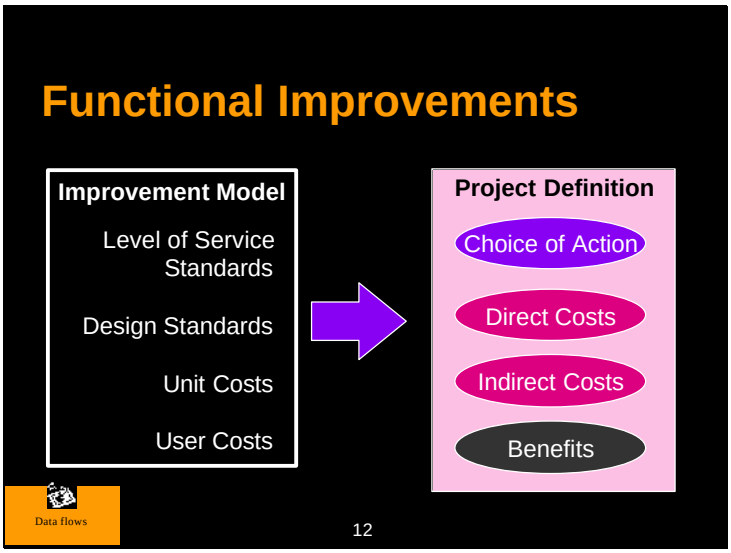
Functional Improvements
Improvement Model
Level of Service Standards
Design Standards
Unit Costs
User Costs
Project Definition
Choice of Action
Direct Costs
Indirect Costs
Benefits
Data flows
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## Summary

- How the Network-Level Input Makes the Project Level Easier

- Forecast of future project impacts
- First-cut balance of competing priorities
- First-cut cost estimate
- Reflects consistent affordable policy

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# The Pig-Out Game!

Or how to maximize your waistline on a limited budget by making strategic choices of cuisine.

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## Game 1 Rules

- You have a menu of 6 items
- Each item has a cost (in dollars and cents) and a benefit (in calories)
- You have $10 to spend on dinner
- Try to get as fat as you can

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## Game 1 Menu

**Pig-Out Game 1** [Reset] [Finish]

| Item | Yes | Cost | Calories | Cal/Cost |
|---|---|---|---|---|
| Pizza | | 4.00 | 500 | 125 |
| Beer | | 2.50 | 400 | 160 |
| Wine | | 4.50 | 675 | 150 |
| Cookies | | 2.00 | 200 | 100 |
| Ice Cream | | 4.00 | 550 | 138 |
| Nuts | | 3.00 | 500 | 167 |
| **Bill** | | **20.00** | **2825** | |

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## Game 2 Rules

- Choose up to one item from each of the 6 essential food groups
- Each item has a cost (in dollars and cents) and a benefit (in calories)
- You have $10 to spend on dinner
- Try to get as fat as you can

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## What does this have to do with bridges?

- Imagine each food group is a bridge
- Imagine each menu item is a possible project on the bridge
- You have a limited budget and want to make the best of it
- It's easier with food
- It's healthier with bridges

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## The 6 Essential Food Groups

- **Pizza: Cheese, Onions, Pepperoni, Anchovies**
- **Beer: Bud, Henry's, Heineken, Guiness**
- **Wine: Gallo, St.Michelle, Beaujolais, Gevrey-Chambertin**
- **Cookies: Oreos, Chips Ahoy, Fig Newtons, Toll House**
- **Ice Cream: Sherbet, Safeway, Breyer's, Haägen-Dazs**
- **Nuts: Filberts, Peanuts, Brazils, Macadamias**

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## Game 2 Results

**Pig-Out Game 2** Reset Finish

| Group | | 0 | 1 | 2 | 3 | 4 | | Choice | Cost | Cal | IBC |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pizza | < | | | | 1 | | > | Pepperoni | 4.00 | 500 | 65 |
| Beer | < | | | | 1 | | > | Heinekin | 2.50 | 400 | 155 |
| Wine | < | | | | 1 | | > | Beaujolais | 4.50 | 675 | 54 |
| Cookies | < | | | | 1 | | > | Fig Newtons | 2.00 | 200 | 28 |
| Ice Cream | < | | | | 1 | | > | Breyer's | 4.00 | 550 | 47 |
| Nuts | < | | | | 1 | | > | Brazils | 3.00 | 500 | 89 |
| **Bill** | | | | | | | | | **20.00** | **2825** | |

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## Game Strategy

- **Initially: Pick each group's most fattening item**

**This blows the budget, so consider less expensive but lower-calorie choices.**

- How:
  - **In each group, find the next-cheapest item, then compute the ratio of change in calories divided by change in cost**
  - **Choose the item with the lowest ratio**
  - **Repeat until within budget**

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## Prioritization

Getting the most bang for the buck

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## Simple Prioritization

- Sort by ratio of total benefits divided by total costs
- Works if each bridge has only the choice of do-something or do-nothing

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## Incremental Benefit/Cost Ratio

$$IBC = \frac{\text{Change in benefit}}{\text{Change in cost}}$$

- **Compares mutually-exclusive do-something alternatives on the same bridge**

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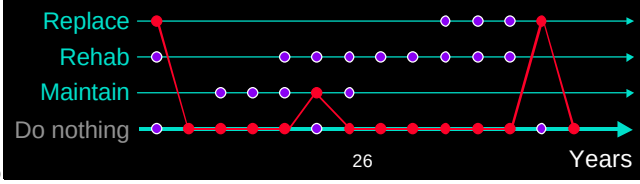
## IBC Considerations

- Requires multiple discrete project alternatives
- Requires diminishing marginal returns
- Near-optimal for an inventory of any significant size

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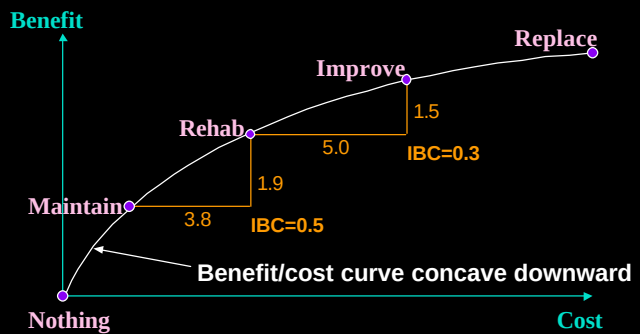
## Diminishing Marginal Returns

- **As cost increases, IBC decreases**

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## Corollaries

- In a large enough optimized program,
  - Divide the inventory into any two sets
  - The sets will have roughly equal IBCs
- The more alternatives available on each bridge, the more benefit that can be achieved from the same budget

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## Prioritization vs. Optimization

**No**

- Prioritization is not:
  - Network optimization, because it doesn't evaluate policies
  - Project optimization, because it doesn't necessarily find the best action for each bridge

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## Prioritization is...

- A way to optimize programs, if
  - Consistent policies have been optimized and followed
  - All feasible project alternatives have been developed on each bridge

**Yes**

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## Prioritization Is Like Optimization

- The Pontis network optimization is like the IBC method, except it uses continuous linear policies instead of discrete projects.
- The North Carolina program optimization is like the IBC method, except it allows a broader range of constraints, not just budget.

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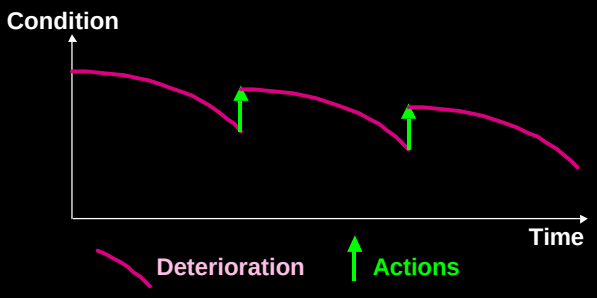
## Simulation

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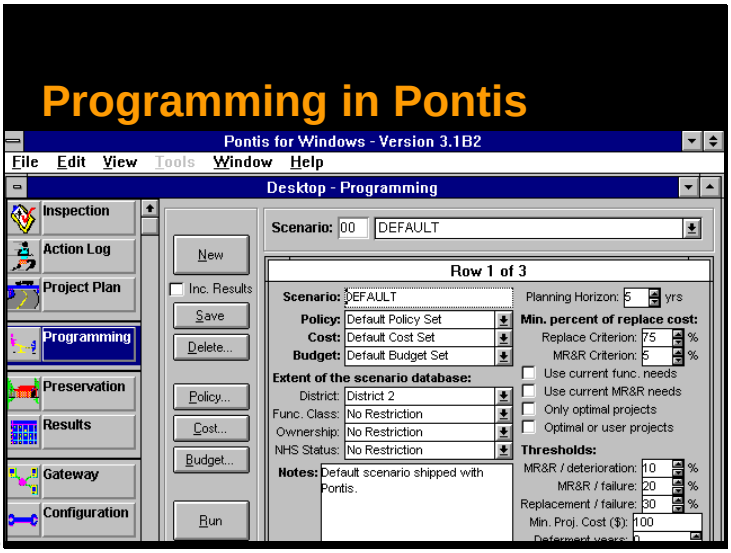
Programming in Pontis
Pontis for Windows - Version 3.1B2
File Edit View Tools Window Help
Desktop - Programming
Inspection
Action Log
Project Plan
Programming
Preservation
Results
Gateway
Configuration
New
Inc. Results
Save
Delete...
Policy...
Cost...
Budget...
Run
Scenario: 00 DEFAULT
Row 1 of 3
Scenario: DEFAULT
Policy: Default Policy Set
Cost: Default Cost Set
Budget: Default Budget Set
Extent of the scenario database:
District: District 2
Func. Class: No Restriction
Ownership: No Restriction
NHS Status: No Restriction
Notes: Default scenario shipped with Pontis.
Planning Horizon: 5 yrs
Min. percent of replace cost:
Replace Criterion: 75 %
MR&R Criterion: 5 %
Use current func. needs
Use current MR&R needs
Only optimal projects
Optimal or user projects
Thresholds:
MR&R / deterioration: 10 %
MR&R / failure: 20 %
Replacement / failure: 30 %
Min. Proj. Cost ($): 100

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...Next:
Project
Planning