INLAND WATERWAYS AND INFRASTRUCTURE PLANNING

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Inland Waterways and Infrastructure Planning*

1) Corps Planning Process
2) Challenges
3) Conclusions

* This presentation is in support of the TRB’s consensus study titled “Reinvesting in Inland Waterways: What Policy Makers Need to Know”.
Six Step Planning Process

1) Identify Problems & Opportunities - Scoping
2) Inventory & Forecast Critical Resources*
3) Formulate Alternative Plans – Nonstructural, Structural
4) Evaluate Alternative Plans – NED, EQ, RED, OSE
5) Compare Alternative Plans
6) Select Recommended Plan – NED, NER, Combined

* Involves readying the economic model(s) too!
Problems & Opportunities

- Reliability and aging infrastructure (decay)
- Construction and declining revenues
- Maintenance backlog with flat budget
- Infrastructure Investment means jobs and economic growth
Inventory and Forecast

- Study Area
  - Resources
  - Industries
  - Commodity Traffic
  - Transportation Systems
- Shippers (Demand)
  - Traffic Demand (uncertainty)
  - Transportation Rates
  - Willingness to Pay
- Project Performance (Supply)
  - Reliability (risk)
  - Capacity
Inventory and Forecast

Ohio River Basin Forecast Waterway Demand

Forecasts Based on Alternative Futures

UNCERTAINTY
Inventory and Forecast

Transportation Rates
Waterway & Overland

Base Rate Savings

<table>
<thead>
<tr>
<th></th>
<th>Current</th>
<th>Future</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waterway Cost</td>
<td>$ 10</td>
<td>$ 16</td>
</tr>
<tr>
<td>Overland Cost</td>
<td>$ 20</td>
<td>$ 20</td>
</tr>
<tr>
<td>Savings/Ton</td>
<td>$ 10</td>
<td>$  4</td>
</tr>
</tbody>
</table>
Inventory and Forecast

Willingness-to-Pay for Barge Transportation

Price Elasticity of Demand – Shipper Stated Preference Curve

$$ \varepsilon_{pq} = \frac{\%\Delta p}{\%\Delta q} $$
Inventory and Forecast

Modeling Lock Performance - Capacity

- Tonnage-Transit (Supply) Curve
- WAM uses LPMS data to simulate Supply

Family of Curves – set of curves for different closure durations
Inventory and Forecast

Component Engineering Reliability - RISK

- Hazard Function
- Event Tree

- Performance over time
- Non-Price Determinant of Supply
Inventory and Forecast

- **Demand**
  - Forecast (Uncertainty)
  - Rates (Cost)
  - Elasticity (Shape, Slope)

- **Supply**
  - Capacity (Ton-Transit)
  - Reliability (Risk)
Formulate Alternatives

- Management Measures
- Structural/Non-Structural
- Without-Project Condition
- With-Project Condition
- Formulate to maximize benefits to national economy and environment

Diagram:
- Structural
  + all below options
- Rehabs
  + Comp Replacements and Reactive Maintenance
- Component Replacements
  + Reactive Maintenance
- Reactive Maintenance
  Fix-as-Fails
Evaluate Alternatives

Four Accounts

- **NED*** – changes in economic value of the national output of goods and services
- **EQ*** – non-monetary effects on ecological, cultural, and aesthetic resources and effects of ecosystem restoration
- **RED** – changes in regional economic activity (income and employment)
- **OSE** – community impacts, health and safety, energy conservation, etc.

* required
Compare Alternative Plans

Formulation Criteria Matrix ranked by average annual net benefits

<table>
<thead>
<tr>
<th>Plan</th>
<th>Criterion</th>
<th>Efficiency</th>
<th>Effectiveness</th>
<th>Completeness</th>
<th>Acceptability</th>
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<tbody>
<tr>
<td>1.</td>
<td>New 600’, Close Land After New Chamber Becomes Operational</td>
<td>Blue</td>
<td>Yellow</td>
<td>Green</td>
<td>Red</td>
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<tr>
<td>2</td>
<td>New 600’, Close Land After Wall Failure</td>
<td>Blue</td>
<td>Yellow</td>
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<td>3</td>
<td>New 600’ Keep Land Open as FAF</td>
<td>Blue</td>
<td>Yellow</td>
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<tr>
<td>5</td>
<td>New 800’, Close Land After New Chamber Becomes Operational</td>
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<td>Yellow</td>
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<td>7</td>
<td>New 800’ Keep Land Open as FAF</td>
<td>Blue</td>
<td>Yellow</td>
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<td>9</td>
<td>New 1200’, Close Land After New Chamber Becomes Operational</td>
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<td>11</td>
<td>New 1200’ Keep Land Open as FAF</td>
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<td>13</td>
<td>New Twin 600’</td>
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<td>13a</td>
<td>New 600’ Deferred New 600’ Land Chamber</td>
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<td>Yellow</td>
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<td>15</td>
<td>New 1200’ and New 600’</td>
<td>Blue</td>
<td>Yellow</td>
<td>Green</td>
<td>Red</td>
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<td>16</td>
<td>Advanced Maintenance</td>
<td>Blue</td>
<td>Yellow</td>
<td>Green</td>
<td>Red</td>
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<tr>
<td>17</td>
<td>Without Project, Reactive Maintenance</td>
<td>Blue</td>
<td>Yellow</td>
<td>Green</td>
<td>Red</td>
</tr>
</tbody>
</table>

Blue – superior, green-acceptable, yellow-questionable, red-unacceptable performance to meet study objectives
Select Recommended Plan

- Preferable to no action
- NED Plan – maximizes net benefits
- NER Plan – (for ecosystem restoration projects)
- Combined NED/NER Plan – optimum
- LPP - complicated
National Freight System
Challenge - Aging Lock Inventory

Age in 2012 (Years)

- 0-9: 3
- 10-19: 9
- 20-29: 16
- 30-39: 17
- 40-49: 53
- 50-59: 31
- 60-69: 19
- 70-79: 55
- 80+: 39

Dewatering and repairs of Inner Harbor Lock, GIWW, which opened in 1923 for steamboats.

60% > 50
Challenge - Condition

- Half of locks more than 50 years old
- Investments in water resources infrastructure have declined in real terms
- Result: more frequent closures for repairs, decreased performance and costly delays
Challenge – IWTF

IWTF History / Projection
FY 1987 - 2014

$ Million


Annual Surplus / Deficit
Trust Fund Balance
Challenge - O&M Funding
1977-2011 Current $ and 1996 Constant $ *

Flat or declining O&M funding in constant dollars, even as project portfolio grows and ages…

* Fuel-Taxed Waterways Only
Conclusions

• Civil Works Transformation emphasizes planning, budgeting, delivering and sustaining infrastructure – growing recognition that cost growth and insufficient funding disadvantages new construction.

• Methods of Delivery initiatives include Production, Design, & Planning Centers.

• PCXIN with study ready models and data sets supports Civil Works Transformation.

• Waterways are part of national transportation system – both competitive and complementary with other modes.

• Maintenance may present as big a challenge as construction.

• Public sector under-investment leads to private sector under-investment … resembling the downward spiral of urban decay.

• Remediation requires effective public-private partnership that is dedicated to sustaining the inland system (revenues, finance, policy).