# OVERVIEW OF ECONOMIC ANALYSIS FOR USACE INLAND NAVIGATION

Inland Waterways Users Board
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# Inland Navigation Economics

## Economics Framework Basics

1. Supply and Demand - Modeling
2. Cost-Benefit Analysis - Outputs

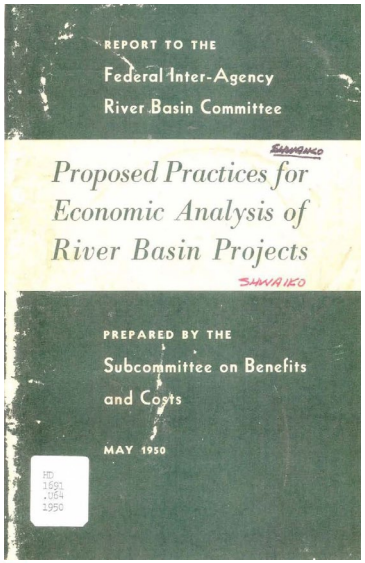
**Purpose** - provide a basic understanding of **why and how** the USACE conducts economic analysis to support water resource investment decisions

- "why" provides historical significance and context
- "how" explains what we do
- objective is a better understanding of cost-benefit analysis

# Inland Navigation Economics

## WHY? - Corps Economic Guidance

- Flood Control Act of 1936 (why)
- 1950 Green Book (how)
- 1970s Office of Chief of Engineers – System of Locks and Dams requires System Analysis
- 1973 Principles and Standards
- 1983 Principles and Guidelines
- 2000 Planning Guidance Notebook



# Inland Navigation Economics

- National Economic Development Benefits:

  The base economic benefit of a navigation project is the reduction in the value of resources required to transport commodities. Navigation benefits can be categorized as follows:

  - Cost reduction benefits for commodities for the same origin and destination and the same mode of transit thus increasing the efficiency of current users.
  - Shift of mode benefits for commodities for the same origin and destination providing efficiency in waterway or harbor traversed.
  - Shift in origin and destinations that would provide benefits by either reducing the cost of transport, if a new origin is used or by increasing net revenue of the producer, if a change in destination is realized.
  - New movement benefits are claimed when there are additional movements in a commodity or there are new commodities transported due to decreased transportation costs.
  - Induced movement benefits are the value of a delivered commodity less production and transportation costs when a commodity or additional quantities of a commodity are produced and consumed due to lower transportation costs.

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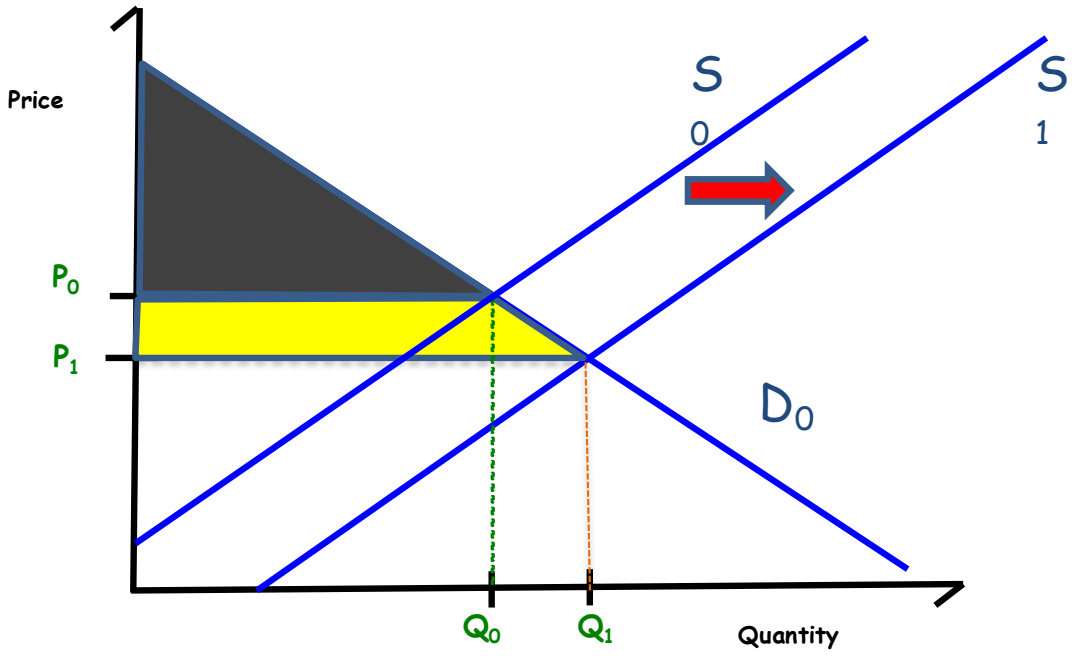
## HOW? - Supply Demand Framework



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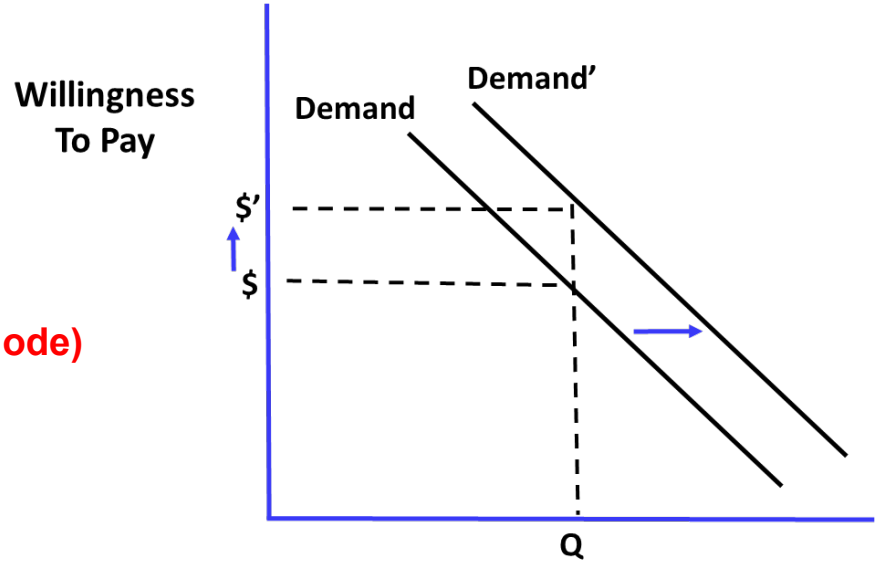
## Supply Demand Framework

- Demand – Lock Traffic, Rates and Shipper Response
  - Example – new fracking plant opens shifting demand curve to right – consequence – higher transportation costs due to higher delays




**Demand –**

**Traffic Demand Forecasts (WCSC)**
**Shipper Rates/ Operating Costs (by mode)**
**Shipper Responses**

# Inland Navigation Economics

## Traffic Demands (Forecasts)

- Past (Pre-3x3x3): Traffic demand studies typically conducted by commodity industry experts focused specifically on study area through interviews/surveys, scenario analysis, research, and modeling.
  - Expensive and Slow
  - Uncertainty more readily tied to specific scenarios & policies

- Modern: Traffic growth developed from projections for commodity groups from public sources, typically other government agencies
  - Examples:
    - U.S. Energy Information Administration (EIA) – Coal, Petroleum, Steel, Ethanol
    - U.S. Department of Agriculture (USDA) – Agricultural products and some fertilizers
  - Fast and Cheap
  - Public information that anyone can view
  - Issues with regional trends and waterway share

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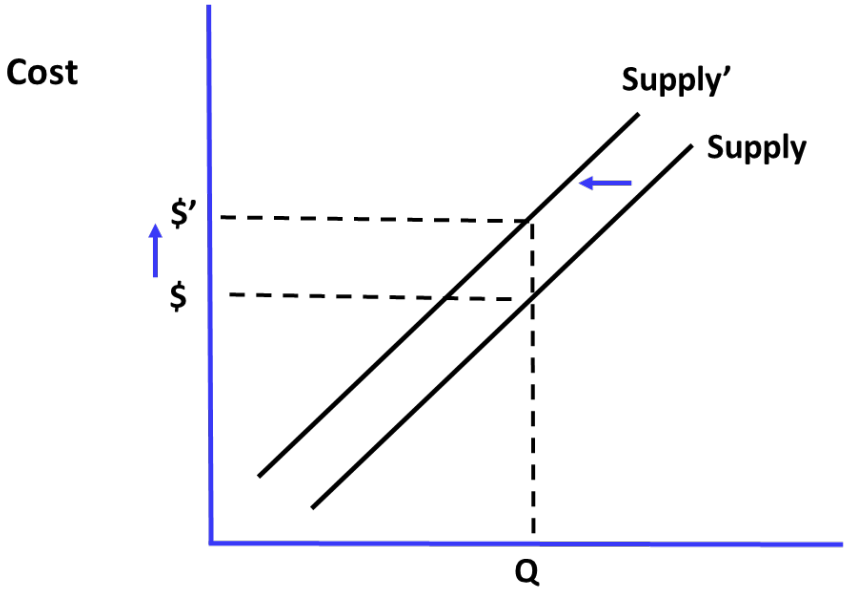
## Supply Demand Framework

- Supply – Lock Capacity and Reliability
  - Example – closure of lock shifts supply curve to left - consequence – higher transportation costs due to delays

**Supply –**

**Lock Capacity (LPMS)**

**Reliability (Engineering)**



# Economic Costs and Benefits

## Costs

- Costs are the money to operate, maintain, and improve the navigation system over the planning horizon (life-cycle).
  - Non-structural (helper-boats, etc.) costs, Operations and maintenance, unexpected repair/replacement, construction and major rehabilitation costs

## Benefits

- A benefit is the difference between revenue received and cost; A benefit is not always initially expressed as a monetary value.
  - Transportation Rate Savings, Jobs, Income, Cultural Considerations, Environmental Impacts

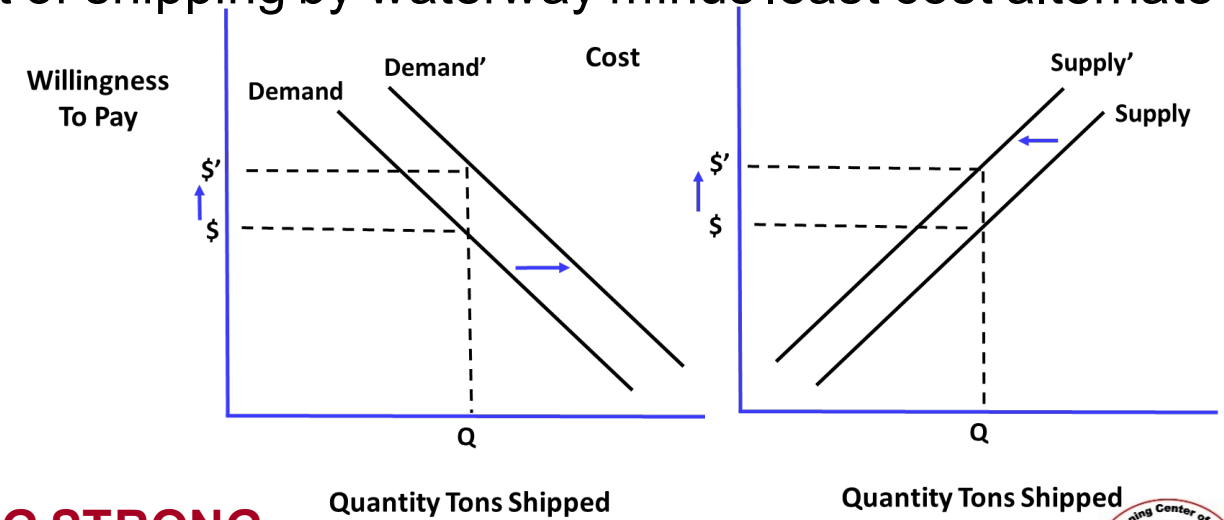
# Inland Navigation Economics

## Cost-Benefit Framework - What are Benefits?

- Tonnage times Savings per Ton
- When demand curve shifts right or supply curve shifts left, then the cost per ton of barge transportation increases which reduces the savings per ton

## What are Savings per Ton?

- Cost of shipping by waterway minus least cost alternate (overland)



# Inland Navigation Economics

## Cost Benefit Framework - What are Costs?

- Defined in CWPM 25 Aug 2011
- Costs are the money to operate, maintain, and improve the navigation system over the planning horizon (life-cycle)
  - Financial – fully funded - escalated to include inflation
  - **Economic – constant dollar – used in cost-benefit analysis**
- Project First Cost includes PED costs; construction costs, LERRD values; and contingencies
- Total Investment Cost is the Project First Cost + Interest During Construction (idc)
- Average Annual Cost is the Total Investment Cost times Amortization Factor + Annual O&M + annualized and discounted Repair/Replacement costs

# Inland Navigation Economics

## What is Cost-Benefit Analysis?

- Cost-Benefit analysis is a conceptual framework used to compare with- and without-project conditions
- Contains all pertinent costs and effects (beneficial and detrimental); incremental justification, optimization

| | | WPC | |
|---|---|---|---|
| **Average Annual ('000$)** | **WOPC** | **Alt A** | **Alt B** |
| Costs (AAEC) | $ 12,750 | $ 24,500 | $ 38,500 |
| Benefits (AAEB) | $ 157,500 | $ 179,500 | $ 199,750 |
| Incremental Costs | | $ 11,750 | $ 25,750 |
| Incremental Benefits | | $ 22,000 | $ 42,250 |
| **Incremental Net Benefits** | | $ 10,250 | **$ 16,500** |
| **BCR** | | **1.87** | 1.64 |

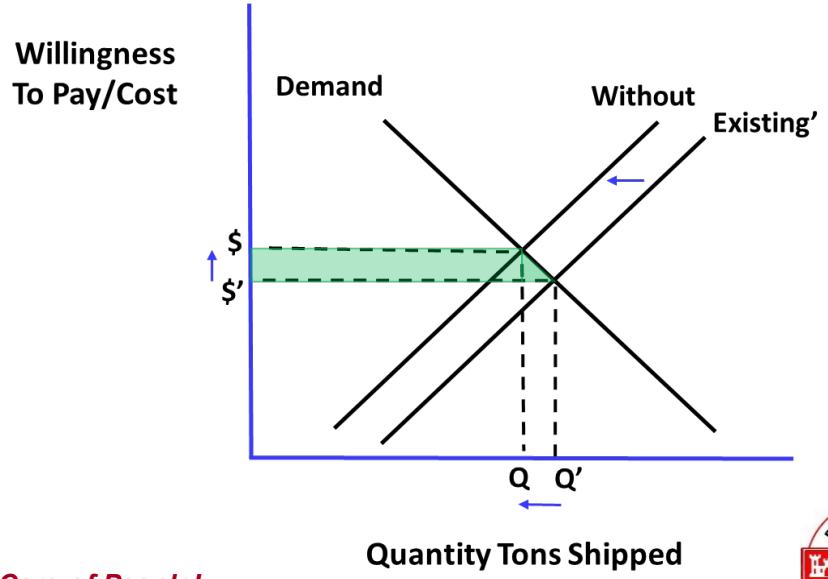
- Used to identify the NED plan - maximize net benefits

Alternative B is NED plan

# Inland Navigation Economics

## What is the Without-Project condition?

- Several possibilities and sometimes changes:
  - The current and future situation if the system is maintained with normal O&M and failures are fixed as they occur – during failure the supply curve shifts left
  - Replace unreliable component before failure (Adv Maint)



# Without-Project Condition Assumptions

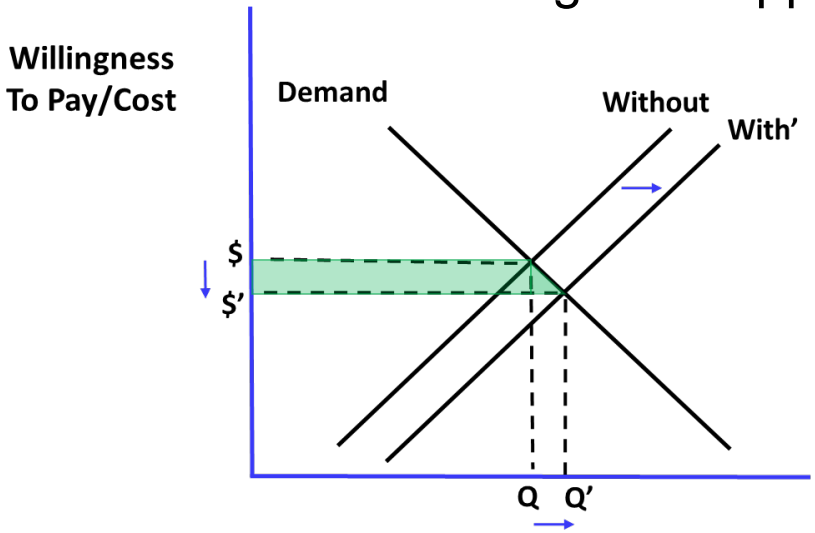
ER 1105-2-100: Planning Guidance Notebook

- (a) All reasonably expected nonstructural practices within the discretion of the operating
- agency, port agencies, other public agencies and the transportation industry are implemented at the appropriate time.
- (b) For inland navigation, only waterway investments currently in place or under construction are assumed to be in place over the period of analysis.
- (c) Normal operation and maintenance practices are assumed to be performed over the period of analysis.
- (d) In projecting commodity movements involving intermodal movements and in projecting traffic movements on other modes, sufficient capacity of the hinterland transportation and related facilities and the alternative modes is normally assumed.
- (e) For inland navigation, user charges and/or taxes required by law are part of the without-project condition.
- (f) Advances in technology affecting the transportation industry over the period of analysis should be considered, within reason.

# Inland Navigation Economics

## What is the With-Project condition?

- Several possibilities
  - Major Rehab - Make investment before failure to improve reliability with no enlargement of locks – no shift right in supply curve
  - New Lock - Make investment before failure to improve reliability with enlargement of locks – a shift to the right in supply curve



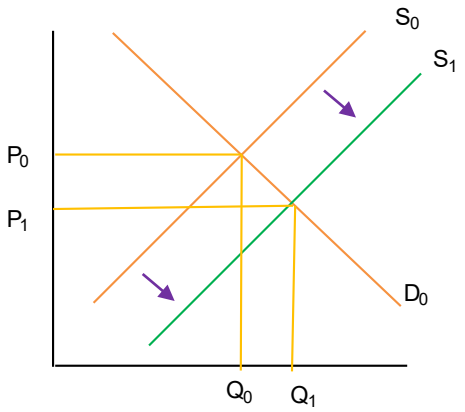
# Cost-Benefit Analysis (CBA)

## What is BCR?

- Procedure to evaluate what is accomplished (benefits) in comparison to what would be invested (costs) in dollars.
- Benefits divided by Costs = BCR (Benefit Cost Ratio)
  - BCR = 1; the costs are equal to the benefits
  - BCR < 1; the costs exceed the benefits
  - BCR > 1; the benefits exceed the costs
- This procedure is used to compare costs and benefits over potential expected futures wherein an investment is made (With Project Condition) and where no investment is made (Without Project Condition).

## What is RBRCR?

- Procedure to evaluate what is accomplished (benefits) in comparison to what has been invested (costs) in dollars thus far.
- Total Remaining Annual Benefits divided by Remaining Annual Costs.
- This procedure is used to compare what has been spent (costs) thus far and what will be achieved upon completion (benefits) to evaluate the current worth of the project and whether is it still worth investing in.



# BENEFIT COST RATIO

| Metric | Forecasted Traffic Scenario | | |
|---|---|---|---|
| | Low | Base | High |
| Total Cost-Benefit Analysis | | | |
| Recommended Plan Benefits | $ 57,380,595 | $ 148,308,607 | $ 296,923,738 |
| Recommended Plan Total Costs 1/ | $ 45,444,677 | $ 45,444,677 | $ 45,444,677 |
| Net Benefits | $ 11,935,917 | $ 102,863,929 | $ 251,479,061 |
| BCR | 1.3 | 3.3 | 6.5 |
| Remaining Cost-Benefit Analysis | | | |
| Remaining Costs | $ 21,367,922 | $ 21,367,922 | $ 21,367,922 |
| Net Benefits | $ 36,012,673 | $ 126,940,685 | $ 275,555,816 |
| RBRCR | 2.7 | 6.9 | 13.9 |