USACE Inland Navigation Economics 101

Inland Waterways Users Board No. 80

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US Army Corps of Engineers

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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

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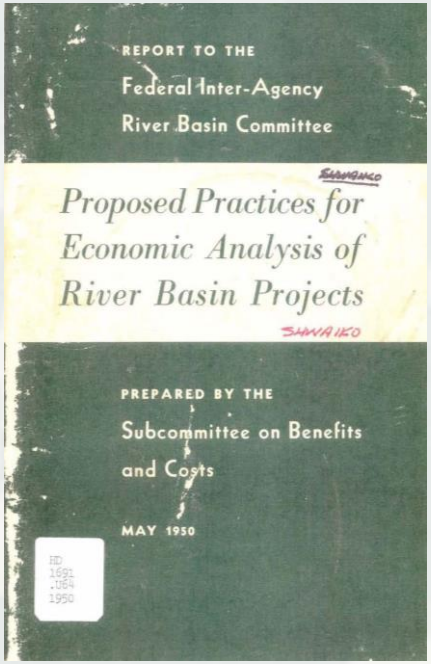
WHY? - Corps Economic Guidance

- 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



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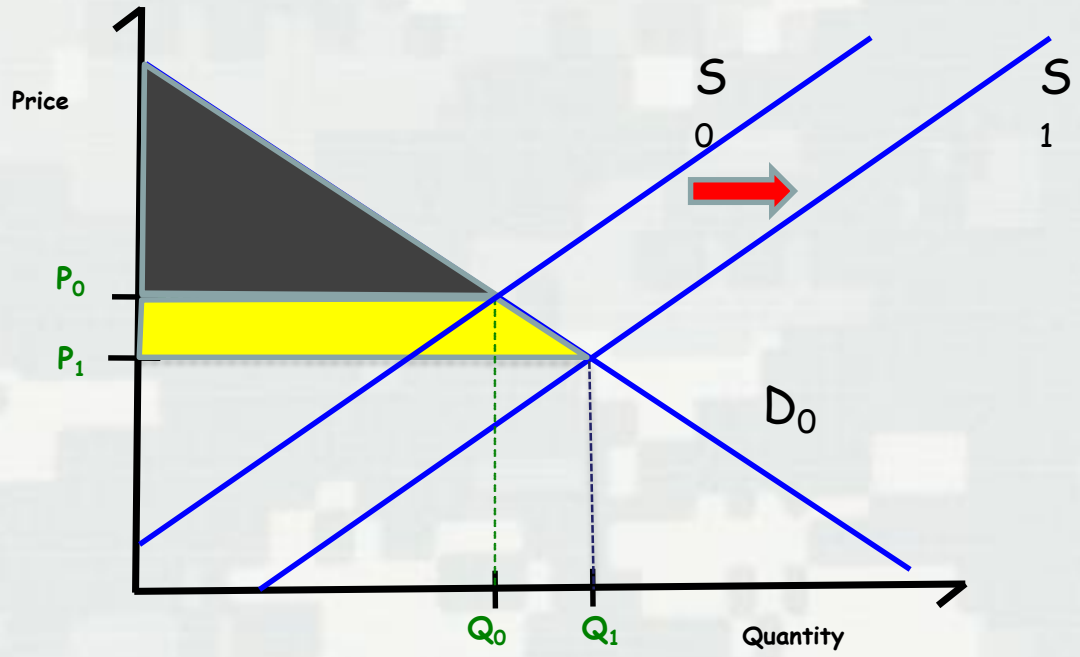
HOW? - Supply Demand Framework



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Supply Demand Framework

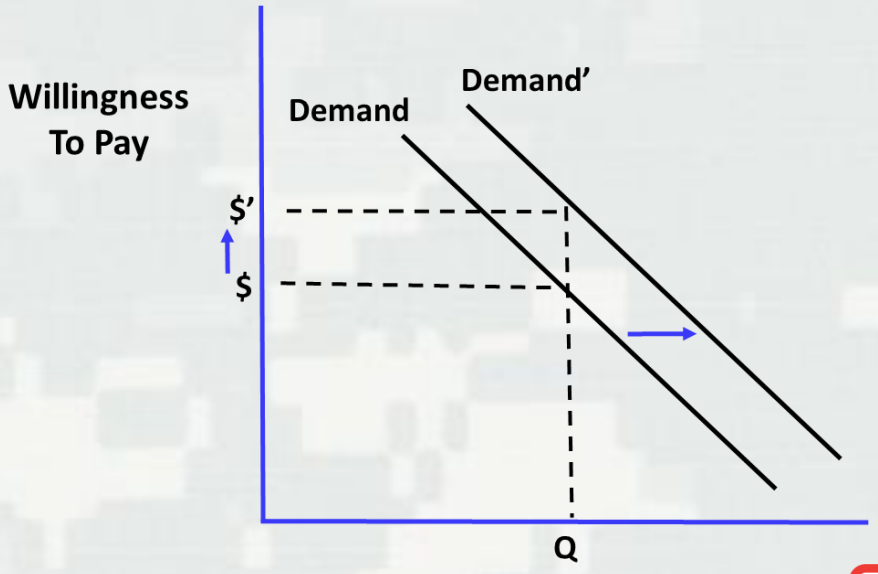
- Demand – Lock Traffic, Rates and Shipper Response
  - Example – new fracking plant opens shifting demand curve to right – consequence – higher transportation costs due to higher delays

Demand –

Forecasts (WCSC)

Rates/Costs

Shipper Responses



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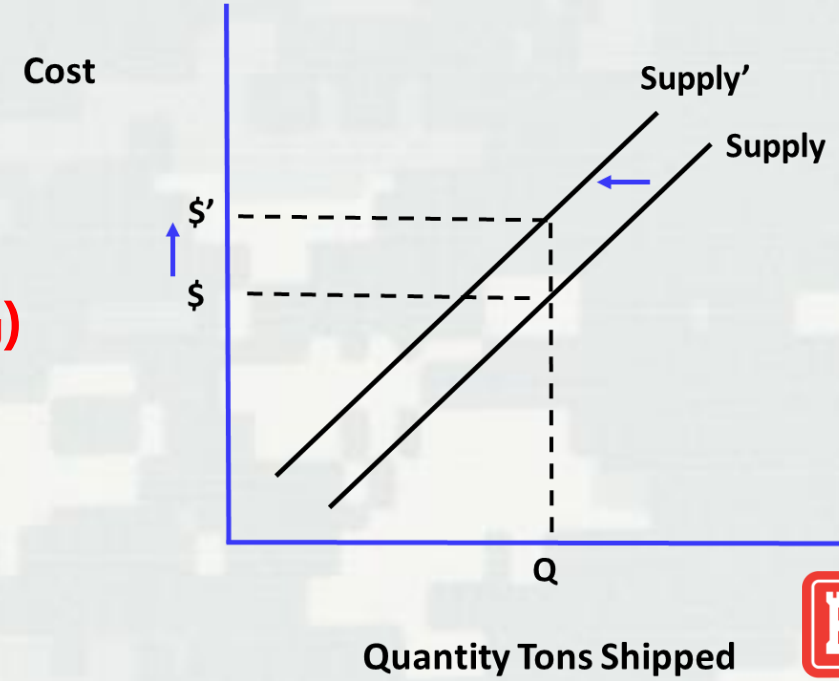
Supply Demand Framework

- 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)



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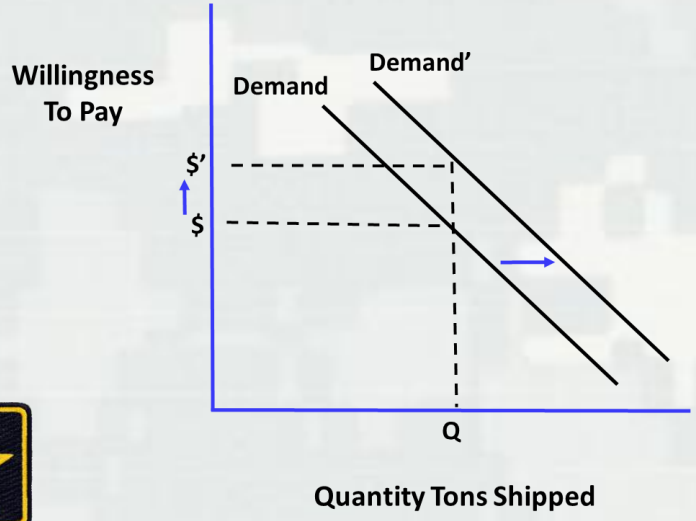
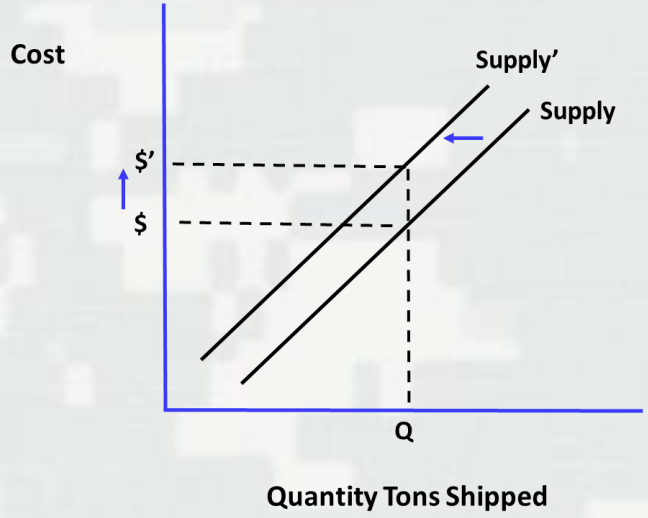
Cost-Benefit Framework - What are Benefits?

- 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)





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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

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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

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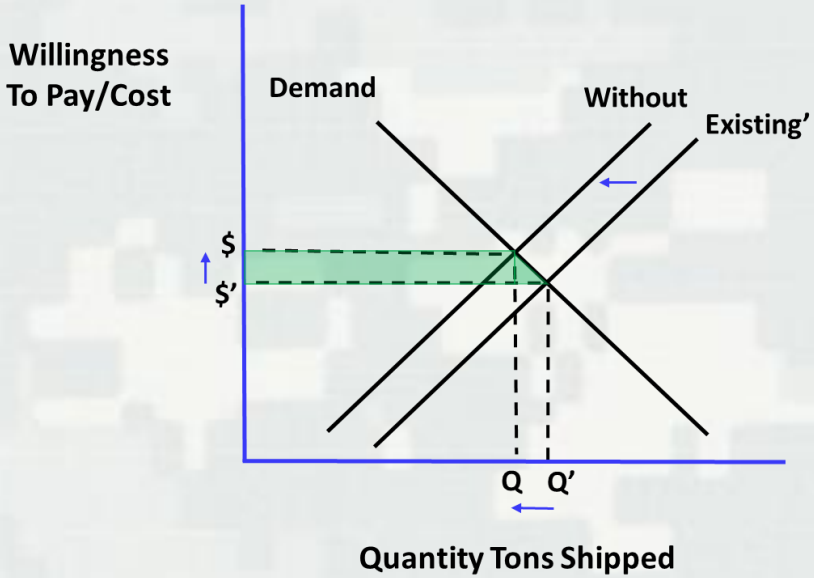
What is the Without-Project condition?

- 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)



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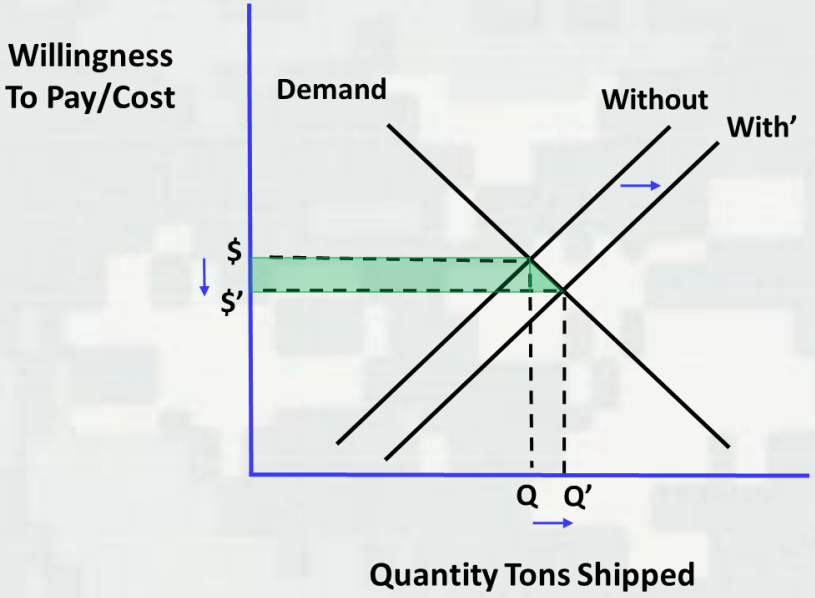
What is the With-Project condition?

- 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



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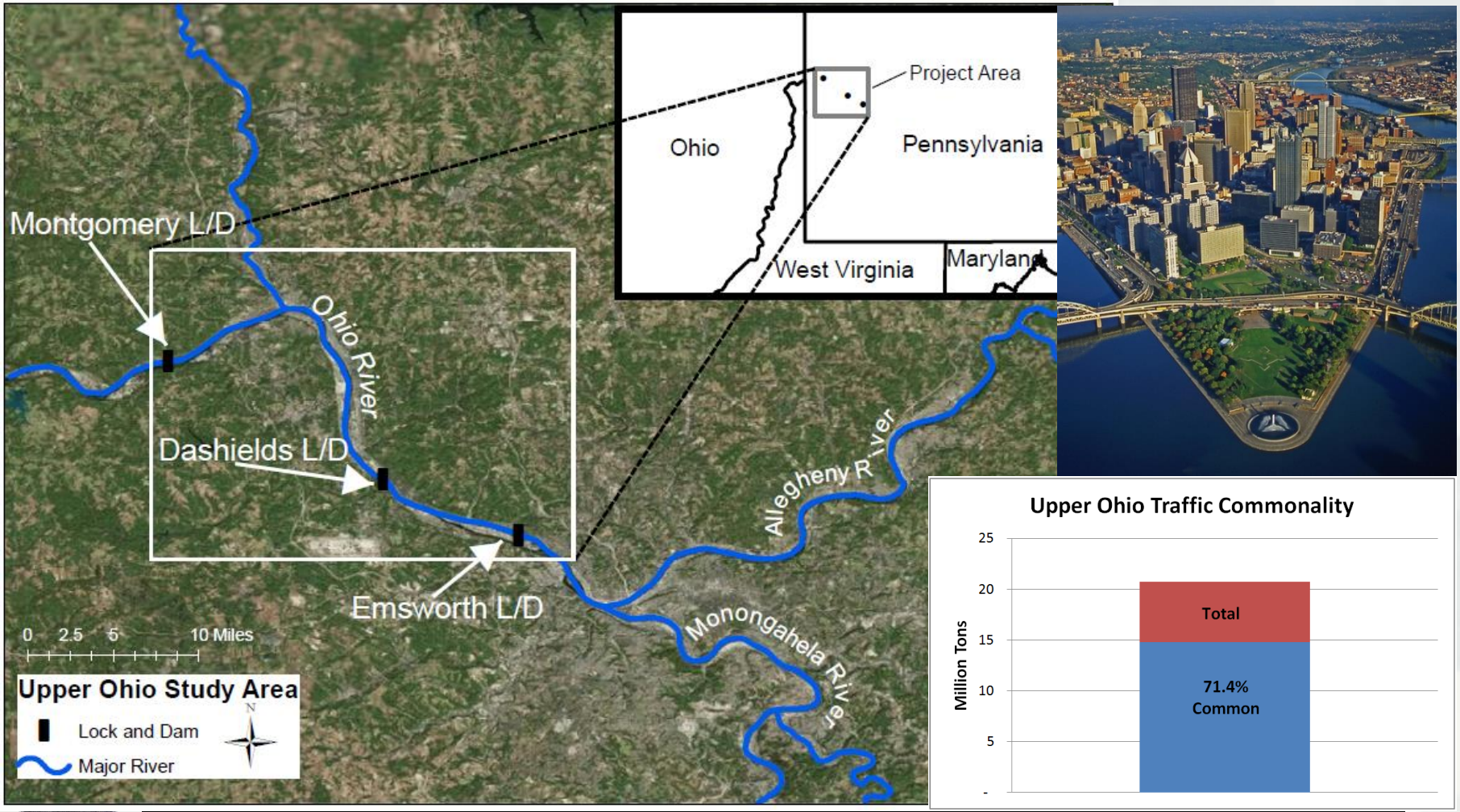
Upper Ohio Navigation Study (UONS)

1. Identify Study Area



Upper Ohio Navigation Study (UONS)

2. Problems and Opportunities

Navigation Opportunities

- Improve structural integrity
- Enhance reliability
- Increase auxiliary capacity

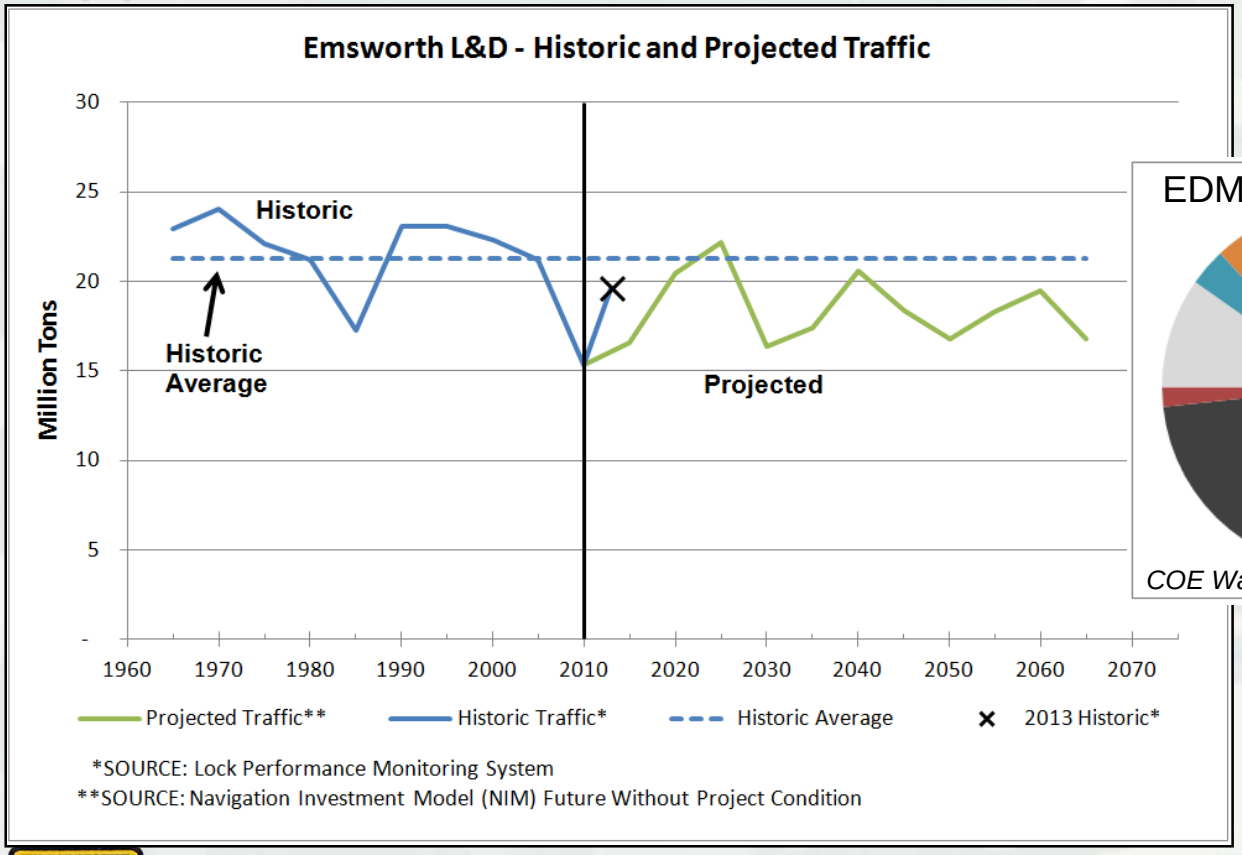
Measures

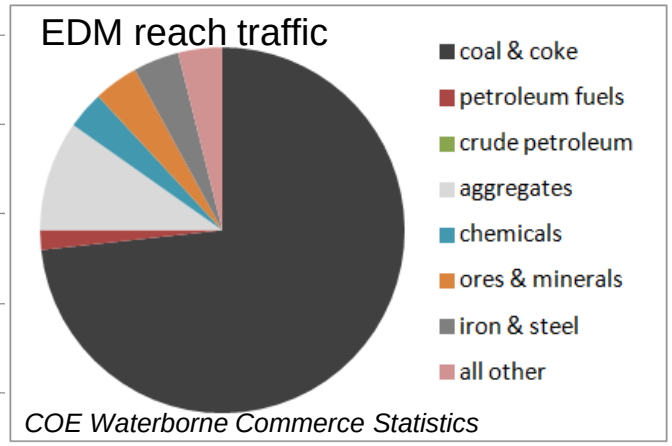
- New replacement facilities (3 for 3)
- Fewer facilities (2 for 3)
- One new lock chamber per facility
- Two new lock chambers per facility
- Advanced maintenance
- Major Rehabilitation
- Low-cost features to improve efficiency

Upper Ohio Navigation Study (UONS)

3. Forecast Future Conditions

Upper Ohio Traffic





Upper Ohio Navigation Study (UONS)

4. Plan Formulation

Without-Project Condition

(Baseline; NEPA – No Action Alternative)

Status quo: Three structurally deficient lock facilities

- Maintenance (routine, cyclic, and reactive)
  - ✓No major component replacement
  - ✓No major rehabilitation
- High & increasing probability of structure failure
  - ✓Progressive deterioration
  - ✓Significant consequences
    - Multi-year closures
    - Potential pool loss

Upper Ohio Navigation Study (UONS)

4. Plan Formulation

With-Project Condition - Navigation Measures

Measures eliminated

- × Replace locks & dams (all new 3 for 3)
- × Remove one lock & dam (2 for 3)
- × Add new third locks (retain existing)
- × Major Rehabilitation

Measures carried forward for analysis

- ✓ Advanced maintenance (some component replacement)
- ✓ New lock construction (at existing locations)

Upper Ohio Navigation Study (UONS)

5. Evaluation of Alternatives

Cost-Benefit Analysis

(FY'09 Price Level; 4.125% Discount Rate)

Avg Annual ('000,000$)	WOPC (FAF)	WPC				
		Adv. Maint.	*Dual 600'	Single 600'	Single 800'	*Single 1200'
Costs (AAEC)	$ 39	$ 78	$ 110	**$ 104**	$ 116	$ 132
Benefits (AAEB)	$ 250	$ 364	$ 434	**$ 433**	$ 428	$ 417
Incremental Costs		$ 38	$ 70	**$ 65**	$ 77	$ 92
Incremental Benefits		$ 115	$ 184	**$ 184**	$ 179	$ 168
Incremental Net Benefits		$ 77	$ 114	**$ 119**	$ 102	$ 75
BCR		3.01	2.62	**2.83**	2.34	1.81

**Navigation stakeholder preferences: Dual 600'; Single 1200'*

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Upper Ohio Navigation Study (UONS)

6. Recommend a Plan - NED

Construct 3 new lock chambers (110'x600')
- *Remove existing auxiliary river chambers*

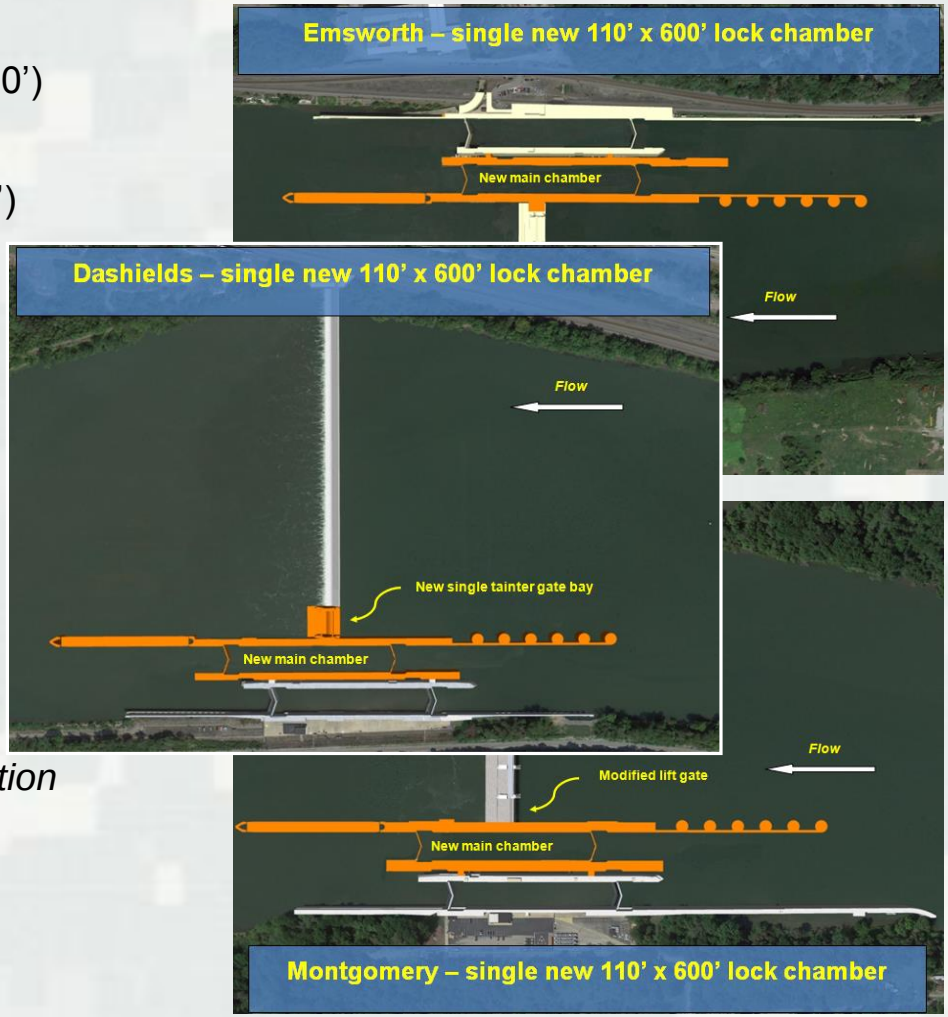
Retain existing land chambers (110'x600')
- *Reactive maintenance*

Cost: $2.32 Billion

National Economic Development Plan
- *Maximizes national economic net benefits*

Sustains navigation capability and capacity
- *Minimizes risk of river closure*

Meets the Planning Objectives
- *Safe, reliable, efficient & sustainable navigation*
- *Protection of the environment*



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Questions

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