NAVIGATION ECONOMICS/ CORPS PRACTICE

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Key Points—

Basic topics covered in this presentation:

- Describe what we are supposed to do in inland navigation planning.
- Talk briefly about the planning process.
- Present the navigation evaluation framework.
    - Procedures analysts are supposed to follow.
    - Practical issues- will be addressed in detail by following speakers.
- What we are really doing.

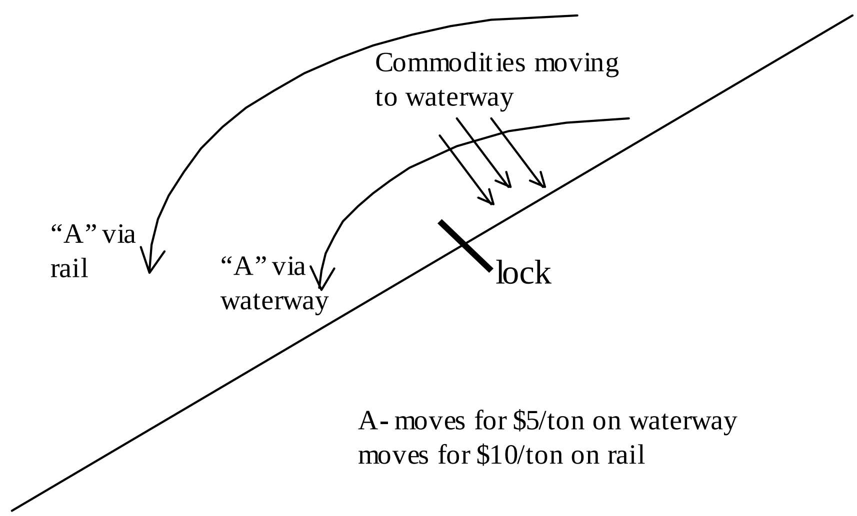
Planning Background:

- Planning Guidance Notebook (PGN a.k.a. ER 1105-2-100) - Incorporates the planning guidance signed in 1983. It outlines a 6-step logic for doing planning studies.
    - Interesting highlights:
        - The process describes logical processes for a range of alternatives to be identified, screened and eliminated.
        - PGN identifies an iterative process.
        - Non-structural measures (such as demand management) are instructed to receive equal consideration as structural engineering alternatives.
        - Without project condition is base line against which we measure benefits and costs of improvements.
        - With exception of ecosystem studies, the plan that best optimizes benefits should be selected.
        - Importance of economic principles is identified in planning process.

- Evaluation Framework:
    - Navigation planning studies lay out the future for the waterway. The without project condition answers the question: In absence of any significant improvement, what is the performance of the waterway?
    - At the end of the study when a BCR is calculated, all of the assumptions that went into the without project condition are wrapped up in the final number. Analysts work hard to get this condition right because it can drive the evaluation.
    - Navigation benefits are the reduction in the cost to transport commodities. For all alternatives the benefit is the delta between conditions without and with the project over the life of the project.
- Navigation Analyses:
    - Step 1 - Identifying the commodity types. If it is an existing waterway we have knowledge of what is moving and can more easily identify movements that may potentially benefit from the project.
    - Step 2 - ID study area. This is the area where we expect the impacts of the project to occur. Potentially there could be improvements that cause movements of commodity (s)(coal) from some other location.

- Step 3 - Examine commodity flow- examine the data- what is moving on the waterway and through the study area- what might benefit if the system was improved. This is an extensive data effort.
- Step 4 - Determine current cost of waterway use. (Figure below)

Figure 1




Transportation Costs (simplified from drawing): In the present system a shipper is saving $5/ton by using the waterway instead of rail. If traffic movements grow by 100% but the alternate mode stays the same, what happens to the waterway? We can assume it will become congested because it is the cheaper mode. Congestion will drive up the cost of waterway transportation (congestion causing delays). Our assumption is that the alternate mode has same expected cost.

Step 5 – Estimate transportation cost. This is the total cost from original origin to final destination, not just waterway cost.

- Data may not always be available. The analyst has to research data for each study. TVA has been digging out data for the landside leg for several COE studies. They start with dock-to-dock movements in the Waterborne Commerce data and then talk to operators and find out what is moving and where it came from and where it is going. TVA has a file with about 12,000 movements. Sometimes locating O-D is complicated- with petroleum products (for example) the commodity may come from off shore rig but when one goes to investigate O-D it no longer exists

Step 6 – Forecast commodity movements. The COE had a requirement to assume no growth after year 20, show flat line benefits. COE is moving away from the single point forecasts, especially with regard to coal because it is 60% of tonnage on the Ohio and subject to wide variation under different political assumptions.. The Corps is moving toward using more scenario analysis. The scenarios are more likely to bracket actual outcomes than is a single point forecast. In end we are trying to estimate what the traffic will be for the without and some with-project alternatives.

- Future cost of the alternative mode. The PNG states that we are to assume that the alternative modes can handle unlimited quantities at the current rate, unless there is evidence to the contrary. It is normally assumed that the future cost of alternative modes is same as in the present. This is an imbedded assumption about elasticity (perfectly elastic supply curve) of rail or other alternate modes.
- Point forecasts are wrong before the ink is dry. In the Ohio System coal is 60% of tonnage and major driver of the traffic. The coal-fire power industry wanted to be on river because it had extensive transport requirements and water transportation is cheap. Now they are locked into this relationship that is driven by the geography of the region. Coal is getting heavy-duty regulation that may be more onerous in the future. The Ohio River Main-stem study team developed scenarios based on 4 different regulatory levels because no one really knows what the regulatory environment will be.

Figure 2

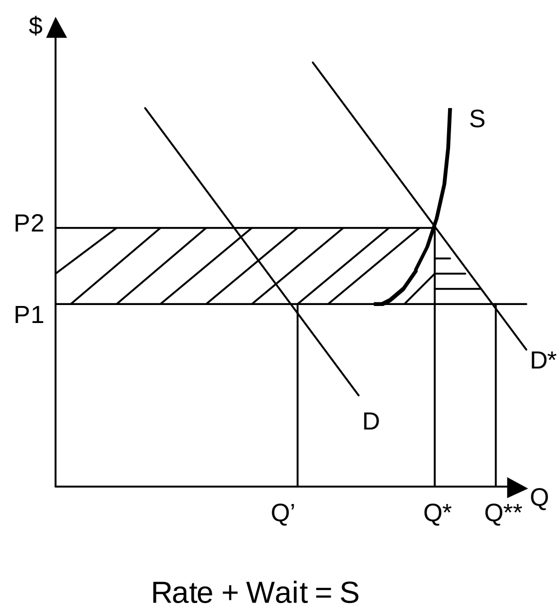


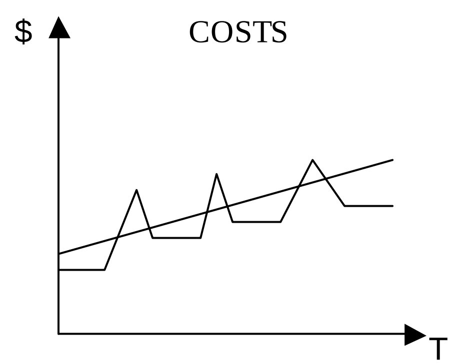

Figure 2: Assume the current cost of waterway is lower than the alternate mode but that as demand shifts over time (D to D*) the cost become higher due to delays. The fact that shippers stay on the waterway shows a willingness to endure congestion. With-project alternatives will have investments that add capacity. These projects shift the supply

curve (Rate + Wait = waterway supply curve) to the right and may eliminate all the congestion. The benefit results from the decrease *in congestion* to the existing traffic as well as the *induced traffic* (Q**-Q*). This is represented by the shaded region in the graph.

The improvement may also result in inducing some future traffic because the demand function also depends on transit times, so D* could shift as a result of the waterway improvement (not shown). Shipper expectations about the waterway service level will factor into the demand. More people will shift if they know the waterway is improved.

Figure 3 (below) looks at cost of operating waterway into the future. The analyst may find the cost to operate the waterway (keep existing system going) requires large expenditures over time. The cost of O&M could be very large. In figure 3, the peaked line may represent O&M of without project condition. The with-project condition may be the straight line. It isn't immediately intuitive which has lower cost. The two cost streams must annualize to see which has the lower cost over the entire period.

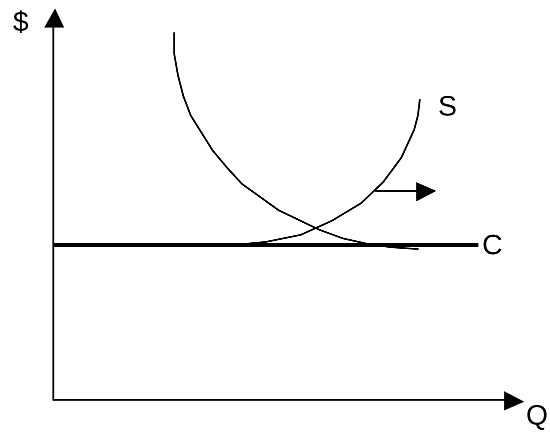
Figure 3




Selected problems:

- Congestion results when a lock's *physical capacity* is approached. As the quantity demanded approaches the physical capacity congestion gets increasingly larger. Computer models generate estimates of physical capacity.
- Figure 4 (below) shows that if we take marginal cost of moving a barge and then add on the congestion the result looks like a supply curve. Have normal barge operating costs (C- straight line in graph) then add congestion costs and the curve looks like supply. "S" represents to delay.

Figure 4




- Small scale improvements: Measures that can be undertaken that help barges through faster. These efforts speed up the process and don't cost much.
    - Helper boats- help maneuver barge through lock to reduce total locking time.
    - Manage barges (3-up, 3-down) to order.
        - These efforts are trying to bend the lock delay function to get as much capacity out of lock (the S curve in Figure 4- want to make as flat as possible)
    - Have many barges arriving at once and then none- try to make them come at more regulated rate. Could follow the airline model by giving barges some sort of schedule of when to go through the lock.
    - Regulate the demand. Possibly set a fee that would eliminate the marginal user and reduce overall delay. This is complex analysis, but an option.
- Externalities: There has been a fair amount of attention to other transportation impacts such as air quality or highway safety. The Corps doesn't have formally accepted procedures for evaluating these externalities. The Chickamauga Locks study showed movement that would've used the lock had it been available (not available due to safety in without project condition) moved to truck transportation. The trucks would go through Chattanooga, which is a non-compliance area. Did estimate of costs, the avoided externalities if waterway is fixed. The analysis supported the without project condition assumption of replacement in kind
- *Disjointed Incrementalism:* Different people making investment decisions for transportation. Will better data help the system to be better understood? Will poor decisions still be made?

- *Themes*:
    - Uncertainty in the present & future- how much traffic? Will people wait in line or do something else?
    - Comprehensiveness- have we done enough (granularity)?

- External pressures; budget, schedule and people who don't like answer (within and out of the organization). The ITR could help take the pressure off the team by giving them support for the technical analysis.

Discussion:

- The assumption that alternative mode's costs are the same into the future regardless of how much shifting traffic should be examined
  - Rail prices have decreased by 20-30% since deregulation in real terms.
  - Guidance provides flexibility if one can prove (indication of otherwise) that there is some reason to believe the price is not stable.
  - In absence of indication then must treat the price of the alternative mode as fixed. Guidance as such because not easy to predict (i.e. rail decline).
- Where do you cut off your analysis for the purpose of lock system forecasting?
  - This is a question about the comprehensiveness, you can't be studying everything so where do you cut off the forecast or do you simply take the forecasts of others?
    - We don't try to develop a general equilibrium model due to budget for analysis. To get the demand forecasts we might look at population growth and trends for electricity demands. The electricity will come from certain plants that use coal. Where will the coal come form? Everything is dependent on the regulatory environment- make projections based on the different anticipated environments.
  - Forecasts vary depending on study and District. In general if available try to use forecasts that are not our own.