

ALTON LOCKS AND DAM:  
A REVIEW OF THE EVIDENCE

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## PREFACE

The Corps' of Engineers proposal to replace Locks and Dam 26 at Alton, Illinois, has sparked controversy because of the way in which the Corps planned to proceed with the project, and because the project itself involves a number of issues that go beyond the immediate engineering needs of this single facility. Because of concern in the Congress about the potential budget consequences of proceeding with the Alton project, CBO has been asked by the Senate Budget Committee to examine and report on the available evidence.

This report, was prepared by Craig Roach in the Natural Resources and Commerce Division. Typing of the manuscript was done by Cheryl Miller, Connie Leonard, Barbara Bishop and Lance Kornicker. Katharine Bateman provided editorial assistance. The project was carried out under the general direction of Douglas M. Costle and Kenneth L. Deavers. In keeping with the CBO mandate to be non-partisan, this report contains no recommendations.

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(HI)



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## SUMMARY

### Reasons for the Controversy

In 1969, the Corps of Engineers chose to undertake a waterway construction project near Alton, Illinois, under the general authority provided to the Secretary of the Army by Section 6 of the 1909 Rivers and Harbors Act. The project would have more than doubled the traffic handling capacity of the locks and dam at that point on the Mississippi River. Since the Corps had used this same act to replace and expand a series of waterway facilities on the Ohio River, without specific Congressional **authorization**, critics argued that the Alton project would simply be the first step in a similar **multibillion** dollar expansion of the entire Upper Mississippi Navigation System. They also argued that the inherent increase in waterway traffic would have a significant, adverse effect on the **region's** railroads, as well as on the **region's** physical environment.

In 1974, twenty-one **midwestern** railroads and two environmental groups secured a court injunction to block construction on the ground that the authority cited by the Corps was insufficient and **that**, since this project would inevitably lead to **others**, the environmental impact statement which covered only the specific impact on the site of the Alton facility, was inadequate.

The Secretary of the Army has since revoked the 1909 act authority for the Alton project. Instead, the Corps will now seek specific Congressional authorization, but for a smaller project calling for a new dam and a single lock at a cost of \$390 million (1976 dollars) as opposed to the original two lock proposal. Since the new project is much smaller, the Corps argues that the question of impact on the entire system is moot, and that **the impact** of such a project on other modes of transportation would be **insignificant**.

### Long-Term Budget Issues

At least two issues are important in assessing Alton's impact.

(1) Alton and Future Corps Projects. Since the Corps had used the general authority of the 1909 act to replace and expand a series of facilities on the Ohio River, and since there was ample evidence in the form of various project evaluations that the Corps was considering several other related **projects**, the railroads and environmentalists were able to convince the court that an Alton project would simply be the first step in a **multibillion** dollar expansion of the Upper Mississippi Navigation **System**. They argued that increased traffic handling capacity at Alton would simply alleviate congestion at that point, thereby allowing traffic to bottleneck at other facilities. Eventually, the bottleneck would move from facility to facility providing the impetus for the expansion of each of them.

Two observations are important about this argument. First, one result of the current court proceedings might well be that future Corps projects under the general authority of the 1909 act will not be allowed. Therefore while delay times at other facilities will increase as a result of the new traffic through Alton, because these locks will be closer to full utilization, this development will not automatically lead to other projects, since each project would require specific Congressional authorization in advance. (They would also continue to require specific Congressional appropriation **action**.) Thus, fears of a long-term budget impact resulting from the **Corps'** use of the 1909 act authority may be unfounded.

Second, the broader significance of this argument is a concern about current procedures for making waterway investment decisions. With these procedures the Congress usually has to make separate project-by-project decisions, even when future plans for facilities are logically related to current projects. Such a **project-by-project** approach does not provide Congress the opportunity, or the information necessary, to set a multiyear, system-wide waterway policy. And yet, it is such broad policy guidance, as opposed to detailed specific project reviews, that the Congress is in the best position to provide.

It is clear that the Corps is considering other projects which are logically related to its proposal for the **one-lock** Alton project; for example a second lock at Alton and the already authorized Illinois Duplicate Locks project. These projects are related because they involve lock and dam facilities that serve a large amount of common traffic. According to Corps **projections**, that traffic demand will grow to a level that could only be satisfied if these and other projects are undertaken. If the Congress wants to provide system-wide guidance for future waterway **investments**, and if engineering conditions permit, the Alton decision could be delayed until a policy involving all these related projects is developed.

If, however, the Congress wants to continue to review waterway investments on a **project-by-project** basis, the technical question at Alton is the relationship between the expanded capacity that would be provided by the **Corps'** new one-lock facility, and the existing capacity elsewhere on the system. This question is important because the Corps uses the increased traffic and the associated "rate savings benefits" to justify its Alton proposal. If facilities elsewhere cannot handle the traffic increase that is being credited to the new Alton facility, that expanded traffic will not develop and therefore the Corps is either overstating the amount of waterway transportation that can be purchased for the price of the Alton facility, or conversely, understating the price of providing those services because other expansion projects will be required. A review of the evidence suggests that no additional facilities will be required to handle the traffic increase credited to the one lock Alton project, since capacity elsewhere appears adequate. Thus, there is no inevitable long-term impact on the **Corps'** budget directly attributable to Alton (other than the costs of that facility **itself**).

(2) Alton and the Region's Railroads. Because of the **nation's** recent experience with rail **bankruptcies**, and the resulting federal expenditures on the rail system, another long-term budget concern has been the potential impact of an expanded waterway on the **region's railroads**. The Corps and the Department of Transportation (DOT) have not provided adequate information to make a definitive statement on this topic.

Analysis alone cannot resolve the important issue involved in the railroad-Alton debate--the apparent inconsistency between federal policies toward the water and the rail modes of transportation. The federal government directly subsidizes the barge lines by providing free waterway facilities, justifying that subsidy on the ground that water transportation is cheaper than, and therefore should pre-empt rail transportation for a certain type and amount of traffic. At the same time, given the ConRail precedent, the government stands ready temporarily to aid bankrupt railroads while expecting the railroads eventually to regain their financial health and to repay that aid. The continued waterway subsidy can both be a cause of bankruptcy and can undermine the plans for the repayment of the rail assistance. The potential for realizing the budget consequences of this policy inconsistency could not be greater than in the midwestern area since the Mississippi River is the nation's primary inland waterway and, according to DOT, seven of the midwestern railroads are already experiencing financial problems.

In the particular case in point, however, it would clearly take more than the revenue impact of a one-lock project to make a significant difference in the future financial condition (in terms of their ability to cover fixed charges) of the 21 potentially affected railroads as a group. Even for the five largest of the "financially weak" railroads identified by DOT, the impact of a one lock project, by itself, could probably not cause that group's bankruptcy given their 1974 financial condition. Furthermore, it should be noted that any adverse impact will not be realized until the project is completed in 1985.

Serious problems, however, exist with all current estimates of intermodal impact. There is simply insufficient information on the many other factors that, combined with the expansion of waterway traffic, will determine the financial future of that region's railroads; still more problems exist in assessing the budgetary consequences of any railroad bankruptcies.

## The Corps' of Engineers' Rationale for the Alton Project

Although a voluminous benefit-cost analysis was presented in support of its proposal, the Corps continues to cite physical deterioration and current traffic delays as the primary reason for immediate action on Alton.

(1) Engineering Rationale for Alton; Because of the facility's physically deteriorated condition, some engineering action is required at Alton. The Corps argues for the proposed project since, according to their cost estimates, it is the cheapest engineering response. The Corps' cost estimate for an on-site rehabilitation is \$401 million (in 1974 dollars). An alternative estimate, submitted to the Senate Public Works Committee by environmental groups and railroad representatives, is about \$46 million for rehabilitation.

If the Corps' cost estimate for rehabilitation is, in fact, seriously overstated, a rehabilitation project maintaining the current capacity would be a cheaper engineering option. Any other project, such as the Corps-proposed new lock and dam which involve greater cost and capacity, would require justification on the basis of benefit-cost analysis.\* Clearly, if the Congress is to make its decision on only engineering considerations, the current widely differing cost estimates must be reconciled.

Furthermore, the Corps' engineering analysis considered only those options providing 50 years of service. The apparently minimal costs (less than \$10 million above routine maintenance) of maintaining service at the existing facility during the seven- or eight-year construction period for the proposed project is an indication that shorter-lived rehabilitation options, which could then be followed by a construction project, may be cost-effective. Therefore, they are worthy of consideration in this narrower framework of

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\* That is, the decision on the project would have to be justified on economic grounds, rather than simply engineering grounds.

engineering options at Alton. In addition, shorter-lived options could provide the Congress considerable time to develop a **system-wide**, intermodal policy for satisfying the bulk transportation needs of the midwest. If an intermodal policy is to be developed, it might be desirable to **make major new railroad**, as well as waterway, assistance contingent upon the formulation of this policy.

(2) Traffic Delays at Alton; According to the Corps, **traffic delays** rose to 21 hours per tow in one recent peak traffic period. However, the existence of delays alone is not a sufficient justification for the Corps' Alton proposal. First, average delays at Alton could be **significantly** lowered by introducing changes in lock operating procedures. Second, traffic delays should be expected eventually at the Alton facility regardless of its size since the waterway will continue to be a cheaper transportation mode for some shippers even when "delay costs" are incurred. Only if it can be demonstrated that the "delay cost" savings and other benefits attributable to the project warrant the cost, is a new expanded facility economically justified.

(3) The Corps' Benefit-Cost Analyses: Critics of the Alton project have **argued** that the burden of proving the value of this public investment lies with the Corps and therefore, if it can be shown that the Corps' benefit-cost analysis is inadequate, there would be no demonstrated economic **justification** for undertaking the project. While this is an appropriate critical perspective, it is important not to impose standards of "proof" that exceed limits imposed by the "state of the art" of engineering and economic analysis. After reviewing the Corps' benefit-cost analyses and the critiques of those analyses, it is clear that important issues have been raised by critics of the Alton project. **This analysis** provides a framework for reviewing **their criticisms**. The criticisms focus on: the railroad and waterway rate data and computations which the critics feel lead to unrealistically high **differentials**; allegedly excessive projections of future traffic leading to "rate savings **benefits**" that are too high; and on the Corps' general benefit-cost methodology.

## I. INTRODUCTION

### The Role of Locks and Dam 26 in Mississippi Water Transportation

Today, the Mississippi River and its tributaries form the primary waterway in the United States. However, major federal expenditures were required to make these rivers commercially navigable because parts of them were too shallow and too narrow for cargo carrying vessels. Much of that federal expenditure was for locks and dams **such** as the Alton facility. Small navigation dams are used to create adequate water depth and locks enable vessels to traverse the **dams**.<sup>1</sup> The federal government, through the Corps of **Engineers**, constructs, operates, and maintains a series of locks and dams on the Mississippi system which can be used free of charge. Additionally, the Corps maintains the depth and width of the river channels between these facilities by dredging.

The number, length, **depth**, and width of locks, as well as the depth and width of channels determine how much traffic can be handled by the waterway. These dimensions determine the "capacity" of the waterway simply because they limit the number and size of vessels that can travel the river in a given time period. Obviously, a greater number of locks at any dam will allow a greater number of vessels to pass. Longer, deeper, and wider locks would allow larger vessels with a greater amount of cargo to pass through each time the lock is operated, **i.e.**, at each "**lockage**". And, of course, the depth and width of the river channel to which the vessel passes must be consistent with that of the relevant locks.

Cargo is carried on these inland rivers in "barges" which are propelled by separate vessels called towboats. Any configuration of barges is called a "tow", and may vary from 4 to 40 barges. However, 15 barges per tow is the maximum in the area that is relevant to the Alton facility.

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1. A lock is an elevator type mechanism which carries **vessels** from the high water level behind the dam to the lower water level on the other side (or vice **versa**). The elevator movement is achieved by raising and lowering the water level in the lock chamber.

## The Geographic Setting of the Alton Facility<sup>2</sup>

The Alton facility is directly below the junction of the Upper Mississippi River and the Illinois Waterway, and, therefore, channels traffic to and receives traffic from both river segments (see map). There are 25 other sets of locks and dams above Alton on the upper Mississippi and 8 others on the Illinois Waterway. All but 6 of these other facilities have a single lock which is 600 feet long and 110 feet wide and, therefore, have a smaller capacity than the existing Alton facility which has 2 locks (one 600 x 110 feet and one 360 x 110 feet). Locks and Dam 27 with 2 locks, one 1200 x 110 feet and one 600 x 110 feet, is the only facility directly below Alton on the Mississippi River. A channel depth of 9 feet is maintained throughout the Mississippi River and the Illinois Waterway.

## How the Alton Controversy Began

In 1969, rather than seeking Congressional authorization, the Corps chose to undertake a project at Alton under the authority of Section 6 of the 1909 Rivers and Harbors Act which allows the Secretary of the Army to approve reconstruction and modification of existing facilities to provide adequately for existing navigation. The Corps' proposal involved a new dam (2 miles downstream) and 2 locks, both 1200 feet long and 110 feet wide, to replace the existing 2 locks. By the Corps' estimates, the new facility would have expanded locking capacity from 73 to 175 million tons annually.

After \$28 million had been appropriated for planning purposes, under the authority of the 1909 act, all project activity was halted by a court injunction in September of 1974.<sup>3</sup> The plaintiffs, 2 environmental groups and 21 mid-western railroads, successfully argued that the authority cited by the Corps was insufficient for the expansion of a facility and that, since this project was merely the first

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2. Report of the Board of Engineers for Rivers and Harbors: Locks and Dam 26 February, 1976. (Hereafter referred to as BERH.)

3. It is unclear whether the injunction effectively revoked the appropriation or if these funds remain available for expenditure.



step in an expansion of the entire waterway system, the environmental impact statement (EIS), which covered only the Alton facility, was inadequate.

The Secretary of the Army has since agreed that the 1909 act authorization was not sufficient for the proposed Alton project. Instead, he will now seek specific Congressional **authorization**, but for a smaller project calling for a new dam and a single 1200 foot lock at a cost of \$390 million. Despite this, the Secretary of the Army has not indicated whether he would attempt to use the 1909 act in the future for other projects as it has been used in the past; for example, to authorize 15 new and expanded locks and dams on the Ohio River.<sup>4</sup> The Corps' also asks that the Congress authorize economic and environmental studies to determine the need for a second lock at Alton.

The Corps' response to the issue of Alton's system-wide impact has been to scale the project down **significantly**. The Corps now argues that the issue is moot since the one lock proposal would only provide a level of capacity which is consistent with the capacity of existing facilities elsewhere. That **is**, the Corps' new proposal would provide for a traffic level at Alton that would not require expansion of other locks and dams on the Mississippi-Illinois waterway system. (The Corps estimates that the new one lock facility would have a capacity of 86 million tons annually.) The court will make a judgement on this point and on the adequacy of the new EIS.<sup>5</sup>

#### The Project Approval Process

The Corps' St. Louis District recommended a two-lock project for Alton (both locks 1200 feet long). The Board

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4. Plaintiff's Memorandum in Response to Federal Defendants' Motion to Dismiss and to Dissolve the Preliminary Injunctions (April 26, 1976) U.S. District Court, D.C.; Civil No. 74-1190 and 74-1191.

5. Since the primary focus of CBO's analysis of the Alton project has been on budget effects, no detailed **review** has been made of the environmental issues. The court is currently considering the Corps' motion to dismiss the case. Several memoranda have been filed by both sides, but no date has been set for a decision.

of Engineers For Rivers and Harbors, however, recommended a one-lock project and asked that economic and environmental analysis be performed to determine the optimum size of a second lock. The Chief of Engineers concurred with the board in his draft report. The chief is now reviewing the comments of relevant federal agencies and states and will make his final report in August. The final steps in the approval process are a review by the Secretary of the Army, clearance by the Office of Management and Budget and most importantly, Congressional action.<sup>6</sup>

### CBO Analysis

The existing evidence on four issues, critical to the pending decision on the Alton project have been examined by CBO. In Chapters II and III the long-term budget concerns expressed about Alton are reviewed.

One budget concern stems from the current project-by-project approach to waterway investments, which does not provide an opportunity or the needed information for Congress to develop system-wide policy. However, the technical question underlying the debate about Alton and other Corps projects is the relationship between the expanded capacity that would be provided by the new Corps facility at Alton, and the existing capacity elsewhere on the system. A review of the evidence suggests that no additional facilities will be required to realize the increased traffic credited to the new lock and dam, since the capacity elsewhere on the system appears adequate to handle this increase. Thus, there is no long-term impact on the Corps' budget directly attributable to Alton (other than the costs of that facility itself).

The second long-term budget concern relates to Alton's potential to generate railroad bankruptcy, which would result in federal expenditures in support of the railroads. Here the evidence is not clear. Certainly, a one-lock proposal is unlikely to make a significant difference in the future financial condition (in terms of their ability to cover fixed charges) of the 21 potentially affected rail-

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6. The Senate Public Works Committee scheduled 4 days of hearings in late June and will make a decision by the end of August.

roads as a group. Even for the 5 largest of the region's "financially weak" railroads identified by DOT, such a project could probably not cause their bankruptcy given their 1974 financial condition. However, serious technical problems exist with all current estimates of inter-modal impact and these are detailed in Chapter III.

The significance of the Alton debate, as shown in Chapter's II and III, is that it highlights a number of concerns about current federal transportation policy, and procedures for making it. There is a serious potential conflict in attempting to undertake federal support of transportation system development on a mode-by-mode basis. It may create a situation where federal assistance to one mode contributes to the financial decline of another mode, eventually leading to federal expenditures to support that mode as well. It is this mode-by-mode approach that makes future railroad assistance a potential cost of waterway investments.

Recently, the Corps has based its argument for proceeding with Alton on 2 rather narrow grounds: physical deterioration and current traffic delays. Chapters IV and V examine these 2 possible justifications for Alton. In each case, there are sufficient unanswered questions so that one cannot conclude that the current one-lock proposal is an appropriate response to either problem. This leaves the Corps' voluminous benefit-cost analysis as the primary justification for Alton. Chapter VI describes the Corps analysis, and the criticisms that have been made of it.

CHAPTER II  
LONG-TERM BUDGET IMPACT:  
ALTON AND OTHER CORPS' PROJECTS

Since the Corps had used the general authority of the 1909 act to replace and expand a series of facilities on the Ohio River, without specific Congressional authorization of the projects, critics argued that the Alton project would simply be the first step in a similar multibillion dollar expansion of the Upper Mississippi Navigation System. It appeared obvious from benefit cost studies, etc., that the Corps wanted to undertake several other projects. Therefore opponents of the Alton project argued that increased capacity, such as that represented by the Corps' proposal, would simply alleviate congestion at Alton and, thereby, allow traffic to bottleneck at other facilities. Eventually, the bottleneck would move from facility to facility, providing the impetus for the expansion of each of them.<sup>1</sup>

Two observations are important about this argument. First, one result of the current court proceedings might well be that future Corps projects under the general authority of the 1909 act would not be allowed. A "moving bottleneck" could not automatically lead to other projects in this case, since each project would require specific Congressional authorization in advance. (These projects would also continue to require specific Congressional appropriation action.) While delay times at other facilities will increase as a result of the new traffic through Alton because these locks will be closer

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1. A major fear of Alton critics was that the Corps intended eventually to undertake a "12 foot channel" project. While there are no 12 foot channels currently maintained, the authorization for the Illinois Duplicate Locks project calls for a lock depth to accommodate such a channel and a 12 foot channel is authorized on the lower Mississippi below Cairo, Illinois. (BERH. p. 9.) The 12 foot channel controversy arose because the proposed lock at Alton was designed with an 18 foot depth. The Corps argues the this depth is premised on operational need and not the needs of a deeper channel.

to full-utilization, the Congress needn't respond by authorizing new unjustified projects. Thus, fears of a long-term budget impact resulting from the Corps' use of the 1909 act authority may be unfounded.

Second, the broader significance of this argument is a concern about current procedures for making waterway investment decisions. With these procedures the Congress usually has to make separate project-by-project decisions, even when future plans for facilities are logically related to current projects. Such a project-by-project approach does not provide Congress the opportunity, or the information necessary, to set a multi-year, system-wide waterway policy. And yet, it is such broad policy guidance that the Congress is probably in the best position to provide.

It is clear that the Corps is considering other projects which are logically related to its proposal for the one-lock Alton project; for example a second lock at Alton and the already authorized Illinois Duplicate Locks project.<sup>2</sup> These projects are related because they involve lock and dam facilities that serve a large amount of common traffic. According to Corps projections, that traffic demand will grow to a level that could only be satisfied if these and other projects were undertaken. If the Congress wants to adopt a system-wide perspective for waterway investments, and if engineering conditions permit, the Alton decision could be delayed until a system-wide policy involving all these related projects is developed.

If, however, the Congress wants to view the one-lock proposal in isolation, the technical question is the relationship between the expanded capacity that would be provided by the new Corps facility at Alton, and the existing capacity elsewhere on the system. This question is important because the Corps uses increased traffic and the associated "rate savings benefits" to justify its Alton proposal.

Clearly, the barges going through Alton will use many other facilities on the Mississippi system **before** they complete their long, intercity hauls. If those other facilities cannot handle the traffic which is credited to Alton, that expanded

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2. P.L. 87-874; the 1962 Rivers and Harbors Act. \$708 million is the estimated cost of this project as currently envisioned by the Corps.

traffic level and therefore the project "benefits", will not develop. If this is the case, the Corps is either overstating the amount of waterway transportation that can be purchased for the price of the Alton facility, or, conversely, understating the price of providing those **services** because other expansion projects will be required.

Based on a review of the existing evidence, including supplementary material supplied to CBO by the St. Louis District Office of the Corps, it does not appear that other projects will be required on the Upper Mississippi and Illinois Waterways to handle the increased traffic credited to the one-lock Alton proposal. In this sense, then, there does not appear to be a long-term budget impact implicit in going forward with Alton. A detailed review of the evidence is presented in the remainder of this **section**.

### Adequate Capacity

The Corps recognized the need to demonstrate adequate capacity in all facilities. This is indicated by its claim that the combined capacity of the Upper Mississippi and the Illinois Waterway is believed to be 105 million tons annually and that of the one-lock project is only 86 million tons annually. In other **words**, the Corps is saying that it has not credited traffic to its new facility if that increased traffic could not complete its haul because of existing locking constraints elsewhere.

**Unfortunately**, this claim can be misleading since the estimated capacities of the single facilities immediately adjacent to the Alton facility on the Upper Mississippi and on the Illinois Waterway were used to represent the capacity of their entire, respective river segments. At first glance this might appear to be an appropriate procedure, since most of the locks are the same size and, therefore, would appear to have the same capacity. However, this is not the case on the Illinois Waterway. The CBO found that the **Corps'** Chicago District estimated that the capacities of the uppermost locks on the Illinois Waterway were only half that of the first lock. CBO requested further information from the Corps. The St. Louis District Office, after reviewing the **calculations**, claims that growth in the shipments through the uppermost locks are not important to the

benefit calculations for the one-lock proposal<sup>3</sup> and these lower capacities are not exceeded by Alton traffic. However, the Corps failure to explore thoroughly the relationship among facilities brings all of its statements on "capacity balance" into question, and highlights the need for an additional, system-wide analysis of any **two-lock proposal**.

### Capacity Estimating Procedures

Capacity estimates involve 3 sets of **assumptions**: lock operating procedures, i.e. how long it takes to perform a lockage for a given type of tow; fleet characteristics, i.e. what types of tows will be arriving at the lock (what size, empty or full, etc.) and when; and, level of service, i.e. what the average delay time is. There is no single correct set of assumptions. Therefore, a broad range of capacity estimates can be presented for any facility. The Corps states that it started its capacity estimation by using locking times and fleet characteristics that were actually

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3. The Corps' argument is as follows. First with the "revised most likely" traffic projections (see Section VI for a discussion of these projections) that were used by the Board in making their recommendations on Alton, the traffic going through Alton that traditionally uses the uppermost locks -- primarily petroleum shipments to Chicago -- actually declines from 21 to 16 million tons between 1985 and 2000 and then reaches 22 million tons by 2035. Thus the estimated 30 million ton capacity of these uppermost locks is not exceeded by the expanded traffic of a one-lock Alton facility. Second, the Corps claims that the shipments that are dropped in the revised most likely projections are replaced by grain shipments that use only the 2 bottom locks on the Illinois Waterway, both of which have approximately 60 million tons of annual capacity. Third, the Corps argues that the capacities of all the relevant locks on the Upper Mississippi, when calculated on comparable assumptions about acceptable delay times and the use of switchboats, are roughly equal to their estimate for the bottom lock so that the capacity estimate for that segment is appropriate (45 million tons). Fourth, if necessary, Alton traffic would pre-empt internal traffic (i.e. tows only traveling within a river segment) because the latter faces a smaller rate differential.

observed on the waterway at Alton and elsewhere.<sup>4</sup> Adjustments were then made to determine the potential impact of changes in those observed values. Since existing conditions are clearly an acceptable starting point, only the changes will be reviewed in the following sections. The major criticism is that the capacity of the proposed new, one-lock facility is underestimated.

Capacities were estimated for a one-month period by computer simulation. Since lock and tow operation is hampered by winter river conditions and because the Upper Mississippi is effectively closed during that period, the monthly estimate is multiplied by less than 12 to determine annual capacity. All of the following discussions refer to the assumptions for the simulation period.<sup>5</sup>

(1) Operating Procedures: The Corps' estimate for the ultimate capacity of the existing Alton facility assumes that "multiple switchboats"<sup>6</sup> will be introduced.

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4. U.S. Army Corps of Engineers, St. Louis District, Locks and Dam No. 26 (Replacement) Formulation Evaluation Report (hereafter referred to as FER).

5. The lower tonnage estimates for the three winter months reflect both the decrease in effective capacity because of greater locking times and the observed seasonal demand (that is, the observed failure of Illinois Waterway traffic to replace Upper Mississippi traffic during the winter). FER, Vol. 2, p. app-g-27.

6. If a tow is too large to fit into a lock chamber, it must be locked through in two pieces. To expedite this "double lockage" auxiliary vessels: called switchboats could be made available at the locks to quickly propel the first piece of the tow through the lock. Without the switchboats an alternative, more time consuming method is used. Double lockages also create delays because operators block the lock entrance when they recouple the two pieces of their tow. To eliminate blockage, switchboats can be used to push their half of the tow further downstream to facilities called "moorings" that can be used for recoupling. These changes represent the Corps' version of a "ready to serve" policy. A broader definition of this policy would include the elimination of "set-overs". Set-over lockages are required when a tow is too long and must be reconfigured to fit into the lock chamber. The reconfiguration could be performed outside the chamber

The Corps estimates that this will increase the capacity of the existing Alton facility by 15 million (from 58 to 73). Introducing nonstructural operating changes elsewhere will increase capacity to 105 million annually.<sup>7</sup> However, switchboats could not be used to increase capacity at the new facility.<sup>8</sup>

Two other operational changes are implicit in the Corps' capacity estimates: scheduling of tow arrivals and "through putting". In actual operation a lock is sometimes idle because tows have not arrived, and at other times it is congested with a queue of tows waiting for service. If arrival times could be scheduled, all idle time would be eliminated and capacity increased. The Corps' estimates are based on the assumption that the lock is fully utilized in the simulation period, so scheduling of arrivals is implicitly assumed.

Locking capacity is also lowered in practice if non-cargo carrying vessels require individual lockages. The Corps assumes that in the future all pleasure craft will be "put through" the lock with cargo laden tows and that the number of unladen commercial vessels individually put through will remain constant at the 1972 level.<sup>9</sup>

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so that locking time would be lower for these tows and the result would be a small increase in the capacity estimate. The Corps simply did not view this change as likely because its small impact on capacity would have to be weighed against the resulting decrease in safety for tow personnel at Alton. However, since it had a larger impact on the Illinois Waterway, this change was assumed for these capacity estimates. Corps of Engineers, St. Louis, Formulation Evaluation Report Lock and Dam 26; Design Memorandum No. 11, June 1975 (hereafter referred to as FER). Vol. 2, p. app-g-26.

7. The Upper Mississippi capacity increases from 39 to 45 million tons (FER Vol. 2, app-g-34) when switchboats are introduced. However, the use of switchboats was not assumed for the Illinois Waterway estimates even though they could probably be used to increase capacity at least on the lower locks.

8. The longer lock would eliminate double locking.

9. FER, Vol. 2, p. app-g-14. The Illinois Waterway estimates embody a high level of recreational use.

Because the Corps has incorporated these changes in operating procedures in its estimates, this set of assumptions does not appear to be a source of underestimation.

(2) Fleet Characteristics: There has been a steady increase in the average size of tows at Alton, but the Corps did not choose to reflect this trend in their capacity estimates. If the trend did continue, however, the ultimate capacity of the existing facility would be increased to about 79 million tons annually. More significantly, the ultimate capacity of the new one-lock proposal would be increased from 86 to 111 million tons<sup>10</sup> and the capacity elsewhere would increase to 115 million tons or more.<sup>11</sup> While this change in fleet characteristics would not disturb the balance between facilities, it would clearly increase the potential intermodal impact. The Corps argues that if the trend in fleet characteristics continues at its current pace, this capacity would not be reached until after the year 2000.<sup>12</sup> Although it is impossible accurately to predict the size of future tows, at least some increase will be realized so it is probably more appropriate to use 111 million tons as the capacity estimate for the one-lock proposal than the Corps' current estimate of 86 million tons.

(3) Level of Services: In addition to assumptions about operating procedures and fleet characteristics which will determine the "physical" capacity of a facility, there is an economic constraint that could limit the availability of tows, and, thereby, reduce traffic to a point below physical limitations. The economic constraint is delay costs.

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10. FER, Vol. 2, p. agg-g-34.

11. The capacity on the Upper Mississippi would increase to 55 million tons. No estimate is provided for the Illinois Waterway, but some increase would probably be realized.

12. FER, Vol. 2, p. agg-g-att-16. The same capacity could be realized if a practice called "chamber packing" was adopted. Chamber packing means rearranging the distribution of tow sizes for each lockage so that a greater portion of lockages is composed for a near chamber filling number of barges. (FER, Vo. 2, p. att-g-30.) The required rearrangements would be time consuming and probably dangerous so it is not clear that this change would be adopted.

If shippers are not willing to wait for the **waterway**, there may actually be idle lock time. Since the Corps assumed there is no idle lock time, it has implicitly assumed that the delay costs involved with a given **facility** are acceptable to **shippers**.<sup>13</sup>

In summary, it appears that the Corps' procedure for estimating the capacity of its **new one-lock** proposal is reasonable, and that capacity is consistent with current estimates for the remainder of the Mississippi Waterway System. It seems likely, however, that by failing to forecast continuation of trends in fleet **characteristics**, the Corps has underestimated the capacity of all of the facilities, including Alton. The main consequence of this will be an underestimate of the potential **intermodal** impact of Alton. This is discussed in more detail in Chapter III. Such a change would also result in a greater amount of incremental benefits for the one-lock project.

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13. Most of the Illinois Waterway capacity estimates assume a 4-5 hour acceptable delay and therefore would probably be higher if based on this alternative assumption.

CHAPTER III  
LONG TERM BUDGET IMPACT  
THROUGH RAILROAD BANKRUPTCY

Because of the Nation's recent experience with rail bankruptcies and the resulting federal expenditures to assist the railroads, a key concern in the Alton debate has been the potential impact of an expanded waterway on the region's railroads. The fate of those railroads will depend on numerous factors, including waterway competition; and recently passed rail legislation authorizes studies<sup>1</sup> to put all of the factors into perspective and to determine the potential for another series of financial failures. But no one has assessed the intermodal impact of an Alton project in this context.

In its 1975 report on Alton, DOT stated that the primary impact of an Alton project would be felt by the 21 midwestern railroads who were parties to the original court suit to halt construction at Alton.<sup>4</sup> Furthermore, DOT noted that one of these rail carriers was already in bankruptcy and "at least six other carriers are in 'weak' condition" (see Table 1).<sup>3</sup> However, DOT has not provided a more detailed analysis as of this date.

Without forecasts of the probable financial condition of the affected railroads in 1985, when the new Alton project would begin operation, and information on the likely distribution of the "impact", in terms of lost or foregone railroad revenue, the long-term budget consequences of any Alton project cannot be determined.

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1. Section 902 of the Railroad Revitalization and Regulatory Reform Act.

2. U.S. Department of Transportation, An Advisory Report to the Senate Commerce Committee: The Replacement of Alton Locks and Dam 26, September, 1975. (Hereafter referred to as DOT.)

3. DOT, p. 44.

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Table I

Affected Area Railroads and Financial Indicators: <sup>a</sup>  
 (Five-year Average, 1969-1974)

<u>Railroad</u>	<u>Earnings/ Fixed Charges</u>	<u>Margin of Safety</u> <sup>b</sup>	<u>Current Ratio</u>	<u>Debt/ Capitalization</u>
Atchison, Topeka & Santa Fe	5.94	9.98	1.74	18.3%
Burlington Northern	1.76	3.78	1.40	35.3%
Chicago & Eastern Illinois	d	d	1.28	30.3%
Chicago & North Western	d	d		
Chicago, Milwaukee, St. Paul & Pacific	d	d	.90	40.8%
Chicago, Rock Island & Pacific	d	d	.65	31.8%
Denver & Rio Grande Western	8.66	21.48%	1.84	25.8%
Elgin, Joliet & Eastern	no debt	16.21%	1.84	0
Green Bay & Western	d	d	.83	N/A
Illinois Central Gulf	3.37	6.35%	1.50	30.9%
Kansas City Southern	2.92	9.62%	1.11	37.3%
Missouri Pacific	2.73	6.56%	1.27	57.8%
Missouri -Kansas -Texas	d	d	.7	negative share- holders equity
Norfolk & Western	2.86	11.68%	1.44	37.1%
St. Louis-San Francisco	2.59	7.58%	1.20	43.9%
St. Louis-Southwestern	45.5	28.18%	1.61	11.8%

Table I

Southern	5.29	N/A	1.85	35.7%
Southern Pacific	3.29	8.52%	1.04	33.0%
Texas & Pacific	2.53	7.93%	.87	38.2%
Toledo, Peoria & Western			1.01	10.2%
Union Pacific	7.03	18.17	.98	20.0%

Source: Moody's Transportation Manual for 1974 ; presented as Table III - 10 p. 46 of DOT Report in 1975.

N/A = not available

d = calculation not meaningful due to deficit operation in one or more years.

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<sup>a</sup> According to the First National City Bank of New York, desirable financial indicators for a viable railroad are:

Earnings/Fixed Charges	2.5 - 3.0
Margins of Safety	10 - 15%
Current Ratio	1.8
Debt/Capitalization	35 - 45%

as shown in "A Capital Markets Approach to the Financial Needs of the Railroad Industry" presented to the National Research Council, Transportation Research Board, Woods Hole, Massachusetts, July 7, 1975.

<sup>b</sup> Margin of Safety is the percentage of gross revenue remaining after fixed charges but before Federal income tax accruals. It indicates how far operating revenues can decline before fixed charge coverage would be endangered.

If the financial condition of some railroads deteriorated by 1985, and the revenue impact concentrated on that group, their chances of bankruptcy would be increased. The issue cannot be dismissed simply by citing the fact that the amount of lost railroad revenue involved is small relative to the existing revenues of the affected railroads as a group. It is not known how much it would take to push some individual railroads into bankruptcy in 1985. Nor is it clear how many failures would constitute a potential disruption to the regionwide rail system, justifying federal intervention as in ConRail. The following sections outline what is and what is not known about the impact of the Alton project on the railroads.

Analysis alone, however, cannot resolve the important issue involved in this aspect of the Alton debate--the apparent inconsistency between the federal policies toward the water and the rail modes of transportation. On the one hand, the federal government directly subsidizes the barge lines by providing free waterway facilities and justifies that subsidy on the often challenged ground that water transportation is cheaper than and, therefore should preempt, rail transportation for a certain type and amount of traffic. On the other hand, the federal government, given the ConRail precedent, stands ready temporarily to aid bankrupt rail lines; expecting those railroads to regain their financial health and to repay that aid. Continued waterway subsidies can be a cause of railroad bankruptcy and, thereby, necessitate the initial rail assistance. Furthermore, the waterway subsidy can undermine the plans for repayment of that rail assistance and, thereby, force a decision on a permanent form of direct railroad subsidy. The potential for realizing the serious budget consequences of this policy conflict could not be greater than in the Midwest, since the Mississippi River is the nation's primary inland waterway and, as noted above, seven midwestern railroads are already experiencing financial difficulties.

The Alton decision highlights the need to articulate a national transportation policy encompassing all modes. If Alton is viewed as providing the impetus to or an opportunity to develop such an approach, a decision to expand Alton could be deferred.

### The Effect on the Railroads

There are five steps in evaluating the expansion of waterway capacity as a potential cause or cure of rail bankruptcy:

(1) Determine how much revenue the affected railroads could earn if **they**, rather than the barge lines, carried the projected increase in traffic.

(2) Determine how these revenues would be divided among the affected rail lines.

(3) Since bankruptcy is generally caused by a failure to cover fixed charges, determine how much of each dollar of revenue would be available to cover fixed charges.

(4) Determine the financial position of the affected railroads (in terms of their ability to cover fixed charges) in the year the project would have been completed

(5) Determine if the increase in waterway traffic allowed by various project sizes would have been new traffic or if it would have actually been traffic "diverted" or taken from the railroads.

Based on available information, an attempt to answer the above questions is made below.

(1) Rail Revenues: The Corps actually provided estimates of the "rail revenue" value of the increased traffic that it envisioned for various sizes of projects at Alton. According to the Corps, \$135 million of potential rail sales would, on average, go by barge each year (1985-2035) if waterway capacity were increased by 13 million tons with a one-lock project<sup>4</sup> (from 73 to 86 million tons). This assumes that

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4. FER, Vol. 1, p. 6-98.

TABLE 2  
REVENUE IMPACT (IN MILLIONS)

Increase Capacity from 73 Million Tons to	Using Corps' "Most Likely" Traffic Projection <sup>a</sup>			Assuming Maximum Traffic Diversion		
	Average Annual Revenue Impact	Revenue Impact in Year			Average Annual Revenue Impact	Range of Average Annual
		1985	2000	2035		
86	135	108	178	90.8	135 <sup>b</sup>	---
111	261 <sup>c</sup>	-			348 <sup>d</sup>	261-348
127	341	108	490	427	450 <sup>e</sup>	341-450
142	367	108	490	537	557 <sup>e</sup>	367-557
175	383	108	490	724	724 <sup>f</sup>	383-724

<sup>a</sup> The Corps first projected the amount of traffic that would pass through Alton if there were no constraints on the entire waterway. If a proposed project did not have sufficient capacity to meet this "unconstrained" traffic demand in any particular year, the projection was scaled down to an appropriate level. The commodities facing the lowest rate differentials between barge and rail were diverted first. The one (1,200 ft.) lock project had an 86 million ton estimated capacity; 127 is for a new 1,200 ft. lock at the existing site as opposed to two miles downstream. 142 is for one 1,200 ft. and one 600 ft. lock; 175 is for two 1,200 ft. locks.

<sup>b</sup> Since 86 million tons were projected for 1985 there is no period of excess capacity. The revenue impact varies each year because of a change in the commodity mix.

<sup>c</sup> Estimated as discussed in the text. This and the remaining estimates in this column would be lower if "revised most likely" demand projections were used.

<sup>d</sup> The implied revenue impact per ton at full capacity falls from \$10.40 to \$8.34 as one goes from a 13 to a 54 million ton increase. It falls because of a change in commodity mix. Therefore, \$9.15 was multiplied by 38 to yield this estimate of revenue loss with full diversion.

<sup>e</sup> This is an average of the revenue estimates for the full capacity years presented in the text of the Corps' report.

<sup>f</sup> Actually represents impact at about 160 million tons because traffic at Alton is constrained by capacity elsewhere.

(a) the rail rates originally used by the Corps in its benefit calculations, (which have been criticized as being too high) are correct, and (b) the commodity mix will be that envisioned by the Corps.<sup>5</sup>

It is important to note that, as discussed in Chapter II, the one-lock project has the potential to increase waterway capacity by 38 million tons (from 73 to 111).<sup>6</sup> The revenue impact of this capacity increase was not specifically estimated, but it can be derived from the estimates for other projects.<sup>7</sup> The estimated revenue impact is \$261 million.

It should also be noted, that the Corps' revenue impact estimates for capacity increases beyond 13 million tons assume that there will be long periods of unused excess waterway capacity. For example, the Corps' waterway traffic demand projections do not reach 127 million tons until the year 2000.<sup>8</sup> Therefore, there are 15 years of excess capacity assumed in their revenue impact estimate for a 54 million ton increase (from 73 to 127).

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5. The Corps accounts for the fact that the commodity mix will actually vary over time. When capacity is reached, shippers will begin to compete for the limited locking services and those facing the lowest rate differences will be the first to divert to competing modes.

6. This overestimates the impact slightly since it would actually increase from 79 to 111 with the larger fleet size.

7. FER, Vol. 1, p. 6-98. The revenue impact for a 13 million ton increase is \$135 million and for a 54 million tons increase it is \$342 million. The average "per ton revenue impact" for the incremental 41 million tons is \$135 million (for the first 13) and \$5 for each of the remaining 25 million tons for a \$261 million total.

8. FER, Vol. 1. p. 3-181; the "most likely" traffic level is 86 million tons in 1985 so there is not excess capacity assumed for the 13 million ton increase.

Critics contend that excess capacity would lower waterway rates by cutting delay time and, **thereby**, divert traffic from other modes. To reflect this criticism, revenue impacts can be estimated under the assumption that the waterway is always filled to capacity. The result is an increase in the average annual revenue impact for 38 million tons of \$87 million (from \$261 to \$348 million) and a much bigger increase for larger facilities (see Table **Two**).

(2) Distribution of Revenue Impact: There are several reasonable methods of allocating the revenue impact among the 21 affected area railroads identified by DOT,<sup>9</sup> but the only complete and precise method would be to identify the origin-destination pairs of the increased traffic and to then allocate that traffic revenue to the rail line with the lowest rate for that route. This allocation would require extensive analysis by the DOT.

Because some perspective on railroad impact will be useful in a later section, the following rough allocation method was explored: the total revenue impact was allocated among the 21 railroads in proportion to their share of that group's revenue collected on barge competitive commodities.<sup>10</sup> With this method, the five largest railroads of the seven DOT believed were in a "weak" financial condition would bear 30 percent of the total revenue impact. <sup>1</sup>

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9. DOT, p. 46-50.

10. 1974 operating revenues were multiplied by DOT's estimates of the portion of revenues derived from barge competitive commodities in 1973 (see DOT p. 49-50; the average portion for the other 17 was assigned to the four rail lines for which data was **unavailable**.)

11. The railroads **are**: Burlington Northern; Chicago and Eastern Illinois; Chicago and Northwestern; the already bankrupt Chicago, Rock Island, Pacific; and the Missouri, Kansas, Texas.

(3) Fixed charges; While there are many financial indicators, the "ultimate financial integrity of any firm rests on its ability to meet **contractual** fixed charges such as interest and rents, with the income derived from operations."<sup>12</sup> For this reason, two items in published railroad income accounts are clearly labeled "income available for fixed charges"<sup>13</sup> and "fixed charges." In 1974, these items for the 21 railroads as a group were \$1,038 and \$327 million respectively; for the five financially weak railroads as a group these items were \$152 and \$82 million respectively.<sup>14</sup>

It is very difficult to determine what portion of each dollar of revenue would be available to cover fixed charges. Since some of the railroads did not adequately cover fixed charges with operating income one cannot use their 1974 experience as a base. Therefore, it is assumed, for convenience, that for the relevant traffic all railroads would attain the ratio experienced by western district railroads as an industry in 1974; 12.4 percent of each dollar of revenue would be available to cover fixed charges.<sup>15</sup>

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12. U.S. Railway Association, Preliminary System Plan Vol. 1, p. 246.

13. This item includes operating income plus income from other sources.

14. Interstate Commerce Commission, Transport Statistics in the U.S., 1974.

15. Two very important adjustments were made. Depreciation and Federal income taxes are usually deducted from net operating revenues before the "income available" item is calculated. Both of these were added to net railroad operating income before the 12.4 percent was computed. If this adjustment had not been made 6 percent would have been the appropriate figure. Depreciation was put back in because it is a "non-cash" item. Federal income taxes were put back in because such items would normally be paid after fixed charges were deducted. This portion of each dollar that will be available will vary by product and

(4) Future Financial Condition; Complete information on the future financial condition of the affected area railroads has not been made available by DOT. While it is difficult to envision a decline in revenue for these railroads as a group, the revenues of individual rail operators, especially those characterized as "financially weak" by DOT, could actually decline from the 1974 level. Furthermore, rail revenues can increase even though a firm's financial condition, in terms of ability to cover all of its expenses, deteriorates. For example, it is reported that between 1960 and 1970, revenues less operating expenses (but before deducting taxes, rents, fixed charges) for all Class 1 Railroads<sup>16</sup> increased by 19.7 percent. During the same period, however, rents for hired equipment rose by 129 percent and fixed charges such as interest on debt rose by 58 percent. As a result, "ordinary income" for that group declined by 49 percent.<sup>17</sup>

(5) New vs Diverted Traffic; There is no easy way to know whether the increase in waterway traffic allowed by the one-lock project would be new regional traffic or if it would actually be existing traffic that was diverted from the railroads. One could argue that in the former situation the affected railroads would not be worse off than they are now because their existing revenue base would be maintained. However, as noted, their underlying financial condition could deteriorate. Furthermore, at least seven of the 21 potentially

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by railroad because some products can be shipped at a lower cost than others and because some railroads are more efficient than others. While the industry average does not provide a precise estimate for each railroad it does not appear to be seriously inappropriate when viewing groups of commodities and groups of railroads.

16. Railroads earning more than \$10 million in operating revenue.

17. The Penn Central and Other Railroads; A Report to the Senate Committee on Commerce, December, 1972. p. 238.

affected railroads are already experiencing financial difficulties. Therefore, one could argue for "constraining" waterway growth as an attempt to channel traffic to these ailing businesses to avoid the chaos of bankruptcy. In the latter context, the Alton project could actually aggravate the current financial plight of some railroads.

Existing traffic could be diverted from the railroads if the new project lowered the effective price of using the waterway. Since delays are estimated to be very high when the existing Alton facility reaches its 73 million-ton capacity, it is likely that a larger facility would lower the effective waterway price by reducing delay costs. However, it is very difficult to determine the actual reduction in price and the amount of traffic that would be diverted as a result. The maximum amount of diversion--which is very unlikely--would occur if the waterway diverted an amount of traffic equal to the increase in capacity i.e. 13 to 38 million tons or \$135 to \$348 million in revenues. As waterway traffic demand grows, less of the revenue impact can be in the form of diverted traffic so the chance of significant diversion exists only in the early years of the project.

If diversion does not occur, then the revenue should be viewed as forgone as opposed to diverted or lost. If capacity is increased by 13 to 38 million tons, the average annual forgone revenue is \$135 to \$261 million,<sup>18</sup> if waterway traffic grows at the rate projected by the Corps. If waterway traffic actually grew at a faster pace, the range of average annual forgone revenue would be \$135 to \$348.

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18. These are based on the "original most likely" projections. Since the "revised most likely projections" are lower these estimates are high.

### Assessing Intermodal Impacts

It would clearly take more than the revenue impact of a one-lock project to make a significant difference in the financial condition of the 21 railroads as a group. Even with the maximum "diverted traffic," the decline in that group's income available for fixed charges would be between 1.6 percent and 4.2 percent. But income available would still be 3.0 times fixed charges.<sup>19</sup>

With the impact distribution scheme discussed above and with the maximum diversion, a one-lock project could make a 3.3 percent to an 8.6 percent difference in the level of income available for fixed charges of the five largest, "financially weak" railroads.<sup>20</sup> Still, income available would only fall to 1.7 times fixed charges.

The problem with both these examples is that they assume the financial condition of the affected railroads does not change from the 1974 level. It is not clear what would push some individual railroads into bankruptcy in the 1980s. Nor is it clear at what point the federal government would provide financial assistance. Even if there is no diversion and therefore the new project is not a direct, contributing "cause" of bankruptcy, the Congress may not want to forgo the opportunity to channel even a very small amount of income to financially distressed railroads by constraining the growth of the waterway.

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19. Assuming 12.4 percent of each revenue dollar is available for fixed charges. The two revenue figures are \$135 and \$348 million. Income available for fixed charges was \$1,038 million in 1974. Fixed charges were \$327 million.

20. Using the 12.4 percent estimate, \$5 to \$13 million would be the difference in their income available if they bore 30 percent of the revenue impact.

In summary, further analysis on at least two major technical points is required before a definitive answer to the question of intermodal consequences could be given:

(a) What is the probable, future financial condition of the individual Midwestern railroads and

(b) What is the likely distribution of the revenue impact among the 21 potentially affected rail operators.

Long-term budget consequences would depend even then, on whether federal policy would be to assist every railroad threatened with **bankruptcy**, or only some "group" which would jeopardize the region's "essential" rail system.



CHAPTER IV  
PHYSICAL DETERIORATION AS A JUSTIFICATION  
FOR THE **CORPS'** ALTON PROPOSAL

Because of its deteriorating physical condition, there is general agreement (even among critics of the **Corps'** proposal) that some engineering action is required at Alton. Recently, the Corps has argued that the proposed project is the appropriate engineering action, since all rehabilitation **alternatives**, as well as a downstream, in-kind replacement project would cost as much or more than the new dam and lock with its greater **capacity**.<sup>1</sup> Therefore, the Corps believes the proposed facility is the cheapest way to solve the problems of physical deterioration.

Critics argue that, in fact, rehabilitation costs have been seriously overstated by the Corps. They further argue that, if properly assessed, rehabilitation of the existing facility (with no increase in capacity) would be the appropriate, **cost-effective** engineering action at **Alton**.

The following Sections discuss two questions that must be addressed, before accepting the **Corps'** claim that the one-lock proposal is appropriate.

(1) Why is the **Corps'** rehabilitation cost estimate ten times that of an alternative plan submitted to the Senate Public Works Committee by engineering consultants who oppose the Alton project?

(2) What is the cost-effectiveness of "shorter-lived" engineering responses to the problem of physical deterioration; ones that provide, for example, 20 or 30 years of service rather than the 50 years the Corps requires.

Two Cost Estimates

The Corps' cost estimate for a complete, on-site rehabilitation of the existing Alton facility is \$401 million<sup>1</sup> (in 1974 dollars). An alternative estimate, that was

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1. BERH, p. 32

submitted to the Senate Public Works Committee by environmental and railroad concerns, is about \$46 million.<sup>2</sup> While the CBO cannot make a detailed comparison of the engineering options, it is possible to identify the two major reasons for the differences between the cost estimates. Both have to do with variations in the engineering procedures for repair.

(1) The Corps argues that to keep water away from the dam so that repairs can be made, expensive, temporary dams (coffer-dams) would have to be constructed at a cost of about \$100 million.<sup>3</sup> The engineering consultant who prepared the alternative cost estimate indicates that structures called "stop logs," "bulkheads," and "floating pneumatic caissons," can be used to block the water flow at little or no cost.

(2) The Corps argues that a temporary lock would have to be built for \$155 million" so that traffic would not be disrupted. The alternative proposal envisions repairing the existing locks one at a time (the jargon is "individually dewatered"), with the maximum shutdown time for either lock of 60 days. In other words, the temporary lock would not be needed.

One other engineering consideration important to the Corps is the safety of the dam during construction. The Corps is concerned that vibrations caused by construction activity (primarily pile-driving) could damage the existing structure.<sup>5</sup> The alternative procedure involves what the consultant calls "vibrationless," "widely-used" methods.

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2. Jerome Cushing, Maintenance of Locks and Dam 26: Executive Summary, June 12, 1976. Mr. Cushing is a consulting Civil Engineer and has worked with the Corps' consultant, Harza Engineering Co., and the Illinois Dept. of Transportation on the Alton project. Mr. Cushing's design and construction methods have been corroborated by other consulting firms: Dames and Moore, Chicago, Illinois; W.A. Whaler & Associates, Palo Alto, California; and F.T. Wheby, Evanston, Illinois.

3. Jerome Cushing's estimate.

4. Ibid

5. BERH, p. 26 and 33.

The methods are purported to be vibrationless because they involve drilling rather than pounding. "Drilled caissons" would be used to improve the dam's vertical stability, and "drilled rock anchors" would be used to improve its horizontal stability.

Even if the structure was fully rehabilitated, according to the Corps, "there would still be a poor structural base,"<sup>6</sup> since the facility would not be founded in bedrock. However, it is alleged that most of the other locks and dams in the area are not founded in bedrock either.

GAO has been requested by the Congress to explore the reasons for the large difference in the two cost estimates for rehabilitation.

#### Shorter-Lived Rehabilitation Options

Even if the difference in cost estimates was resolved in favor of the Corps, there is another reason why the Corps has not demonstrated the appropriateness of the one-lock proposal. In its review of alternative engineering responses to the problems of Alton, the Corps apparently considered only options for providing 50 years of service.<sup>7</sup> Thus, the Corps has not examined engineering responses which, for example, could extend the service time of the existing facility for 10, 20, or 30 years. One indication that such options exist is the estimated cost of the Corps' plans for maintaining services at the existing facility during the seven- or eight-year construction period of their proposed new lock and dam. General Graves, the Corps' representative before the Senate Public Works Committee, testified that although the issue requires further study, current indications are that only one \$7 million project beyond normal operation and maintenance costs of the existing facility will be required to keep Alton functioning.<sup>8</sup>

Shorter-lived options, like the one described by General Graves, which maintain the existing capacity at

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6. BERH, p. 33

7. BERH, p. 26

8. June 17, 1976

Alton may be the cheapest engineering solution. More **important**, if Alton is viewed as providing an opportunity to develop a consistent approach to federal support of the various transportation modes in the region, rather than as a single waterway project, shorter-lived options could buy the Congress considerable time to develop such an approach.

CHAPTER V  
CURRENT TRAFFIC DELAYS AS A JUSTIFICATION  
FOR THE CORPS' ALTON PROPOSAL

Traffic delays at the existing Alton facility along with physical deterioration are cited as a primary justification for a **new**, expanded lock and dam. The Corps reported a **five-hour** average delay per tow in **1974**, although peak traffic delays can be much longer. For example, the Corps reported that in October 1975, the Alton facility experienced a record level of traffic which resulted in a 21-hour average **delay**.<sup>2</sup> Since traffic delays mean that barge equipment and personnel must be hired by shippers for a longer time on a given distance haul, there is a very real "delay cost" which is often reflected in barge **rates**.

There are two factors to be considered in assessing current traffic delays as a factor in justifying the **Corps'** Alton project:

(1) Traffic delays should be expected eventually at just about any sized Alton facility since the waterway will continue to be a cheaper transportation mode for some shippers even when "delay costs" are incurred, and

(2) Average delays could be significantly reduced for the current traffic at Alton by introducing changes in lock operating procedures. The following section concludes that the Corps has overemphasized the importance of current traffic delays to the Alton decision and has **not** adequately demonstrated that these delays alone provide the justification for their one-lock proposal. Thus, the Congress must rely on the engineering or cost-benefit analyses for evidence of the value of a public investment at Alton.

Traffic Delays Should Be Expected

One should expect to have traffic delays eventually at just about any size Alton facility, because it often makes good business sense for a shipper to accept at least some delay. For a variety of reasons, including the absence of

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1. BERH, p. 16
  2. BERH, p. 16

user charges, barge operators can often charge lower rates than competing modes of transportation for hauling certain kinds of freight. Although there are several factors that influence choice of mode, rate differences are very important. The rate difference between barge lines and the other modes of transportation will attract shippers to the waterway until a level of congestion occurs at which the rate difference is offset by delay costs for any additional shippers.<sup>3</sup> when delay costs erase the rate difference, shippers will go by rail, pipeline, etc. In addition, one can always expect traffic delays at peak traffic times such as during grain harvesting periods.

Traffic delays alone are not a clear indication of the need for expansion, because delays are an expected result of rational economic behavior. A further step is required to demonstrate the need for a larger facility. If congestion is used as a justification for a new facility, it must be shown that the total "delay cost" savings of an expansion exceed the costs of that expansion.

#### Changes in Lock Operating Procedures

Obviously, if one can reduce the time it takes to get tows through the lock there will be shorter delay periods, and reduced "costs." The Corps' own figures show that at least one change in current lock operating procedures (called "multiple switchboating") could significantly reduce locking time. Based on the graphs presented in the Corps' report, it appears that multiple switchboating could lead to about a two-hour reduction in average annual delay time at the existing facility. Although multiple switch-

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3. Of course, there are other factors working to erase the rate difference. The cost of shipping cargo to the waterway will obviously limit its geographic reach. Therefore, with a very large facility, rate differences may be erased prior to the traffic level at which congestion would occur.

4. In their Appendix G Attachment, the Corps presents graphs relating annual delays to traffic levels. On page APP-G/ATT-90 the relation is shown for the existing facility with a "FIFO" priority rule and a "ready to serve" policy. For 55 million tons the total annual delay is about 24,000 hours. Assuming, as the Corps does, an average tow of 6,250 tons, 8,800 tows are involved. The average delay time per tow is, therefore, 2.73 hours.

boating is the major change, other options have also been suggested. They include greater use of the auxiliary lock and the scheduling of tows. Together, these changes in operating procedures represent a low-capital option for substantially reducing delay costs at the current Alton facility.<sup>5</sup>

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5. It should be noted that the Corps' capacity estimates assume multiple switchboats, full use of the auxiliary chamber, and, implicitly, scheduling of arrivals.



CHAPTER VI  
THE CORPS' BENEFIT-COST ANALYSIS

Critics of the Alton project have adopted the view that the burden of "proving" the value of Alton as a public investment **lies with** the Corps. Given this perspective, if it can be demonstrated that the Corps' analysis is inadequate, there would be no demonstrated economic **justification** for undertaking the project. While this is an appropriate critical perspective, it is important not to impose standards of "proof" that exceed limits imposed by the "state of the art" of engineering and economic analysis. After reviewing the Corps' benefit-cost analyses and the critiques of those **analyses**, it is clear that important issues have been raised by the opponents of the Alton project. The purpose of this chapter is to provide a framework in which all the evidence (including the August report of the Chief of Engineers) on the benefit-cost analysis can be viewed.

However, even when the Corps' benefit-cost analysis for waterway investments are free of major criticism, they provide a relatively narrow framework for transportation policy decisions. First, public investment options involving other modes of transportation are not usually considered. Therefore, these analyses do not provide a basis for choosing the least cost response to a **regions'** transportation needs. Second, since projects are "justified" **individually**, the Congress is faced with the tedious task of making hundreds of detailed project decisions. These project decisions do not provide the Congress an opportunity, Or the information to set multiyear, system-wide waterway policy. Yet, it is such broad policy guidance that the Congress is probably in the best position to provide.

The Corps' Benefit-Cost Methodology

The Corps has a simple, five-step formula for calculating benefits that, for the most part, is defined by Section 7(a) of the DOT Act.

(1) The Corps assumes the rehabilitated or reconstructed lock and dam will last for 50 years (1985 to **2035**). For each of these years, the Corps estimates the type and amount of traffic that would pass through the proposed facility if there were no capacity constraints on the entire waterway. If a

proposed project will not have sufficient capacity to meet this "unconstrained" traffic demand, the projection is scaled down to an appropriate level.<sup>1</sup>

(2) The Corps compares the rates that are currently charged on the waterway to those of the competing transportation modes such as railroads and pipelines for each type of commodity by origin-destination. If waterway rates are lower than others for a particular commodity, the Corps simply multiplies the rate difference times the projected tonnage for that commodity to yield the so-called transportation rate savings or benefits.

(3) The Corps has also been attributing "delay cost" benefits to all its proposed navigation projects. The Corps correctly stated that there was a real cost involved in having towboats and barges lie idle in queues waiting to be served at congested locks. If an expanded facility lowered average delay times and, thereby, delay costs, the Corps considered the reduction to be a benefit of the new facility.<sup>2</sup>

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1. The commodity mix used for benefit calculations will vary by facility. Commodities facing the lowest rate differences between barges and competing modes are the first to be diverted to other modes as the capacity of a facility is reached. The Corps argues that traffic is diverted when delay costs exceed its rate differential. Given this model, rate differentials provide a convenient measure of delay costs. When capacity is reached one knows that all "tons" are incurring delay costs at least equal to the rate differential of the last ton that was diverted.

2. There is an alternative, nonstructural method of achieving these delay benefits; the imposition of a "congestion toll". There is general agreement that a toll is a lower-cost method (in terms of real resource use) of realizing these benefits. If the Congress is not opposed to imposing tolls, the Corps should not claim delay benefits for the Alton project. However, if tolls are not used, delay benefits can be claimed and the Corps' rough measure of delay costs is reasonable in concept. One must also accept the Corps' rate differentials before accepting their actual numerical estimates.

(4) All the benefits in any year are then "discounted to present value" and the total present value is averaged over 50 years to yield average annual benefits. A discount rate of 5.9 percent was used in the Alton analyses as prescribed by P.L. 92-251.

(5) Benefits are presented in 2 forms: total and incremental. For example, the one-lock Alton proposal has an estimated capacity of 86 million tons annually; which represents an increase of 13 million tons over the 73 million ton estimate for the existing facility. Average annual benefits were presented for the total 86 million tons and for the "increment" of 13 million tons. All the benefit cost comparisons involve average annual incremental benefits. Project costs include those for construction as well as for future operation and maintenance.

The project with the greatest difference between average annual incremental benefits and costs is chosen by the Corps. This "maximum net benefit" principle is based on the belief that facility size should continue to be increased as long as the increases generate more benefits than costs. Additional costs begin to exceed additional benefits when a maximum net benefit is reached.

### Rate Differentials

Clearly, the most important information in the Corps' analysis is the rate differentials. They are crucial to both "rate savings" benefit and "delay cost" benefit calculations. The method of collecting the rate data as well as the nature of that data have been the focus of criticism.

Since railroads are regulated, their rates and the procedures for determining those rates are public information. But only a small fraction (about 10 percent) of waterway traffic is regulated and there is no consistent, published record of actual rates for the unregulated operation. To overcome this data problem, the Corps contracted with Donley Associates, a transportation consulting firm, to determine water rates as well as those of alternative modes of transportation for a sample of the commodity movements of the type that traverse the Alton facility. The Donley report notes that rates for the exempt barges were the most difficult data to gather.<sup>3</sup>

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3. FER, Vol. 3, p. appi-6.

According to the Donley report;

(a) "Most of the rate information on the grain movements was, therefore, obtained from the several barge lines that concentrated on grain transportation."<sup>4</sup>

(b) Coal and lignite rates were "obtained primarily from barge lines, who, in some instances allowed us to view actual contracts for transportation." But, says Donley, "This is highly confidential trade information and should under no circumstances be disclosed to outsiders."<sup>5</sup>

(c) Gasoline rates were obtained from "several sources" on a "first hand basis and, again, are highly confidential."<sup>6</sup>

Since these references are the only discussion of the data collection methods, one can only assume that most the waterway rates were determined by asking barge operators what they would charge for a certain haul. This methodology is likely to lead to biased estimates of rate differentials because barge operators have a clear interest in the outcome of the Corps' Alton analysis. The Corps notes that the Tennessee Valley Authority (TVA) was asked to verify the Donley rates and essentially concurred with their estimates, but TVA's methodology (which is not reported by the Corps) was the same as Donley's.<sup>7</sup>

There is an obvious alternative procedure for obtaining rate data for barge lines. It includes collecting a large number of past freight bills from shippers, from which smaller samples could be chosen for the analysis. In addi-

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4. FER, Vol. 3, p. appi-11.

5. FER, Vol. 3, p. appi-12.

6. FER, Vol. 3, p. appi-13.

7. George Tully of the TVA provided this information.

tion to reprovng the conflict of interest problem, this procedure would have the advantage of allowing an analysis based on a sample of rates which takes account of the wide variation in barge rates during the year.

The Donley report was also criticized for another important assumption: if a larger Alton facility were not built, shippers would use railroads which would follow the same origin/destination pattern as the waterway. Critics claim that some shippers could be served by alternative origins and destinations. For example, if the larger facility were not built, utilities could switch to another coal-producing origin or grain shippers could switch to export points other than the waterway destination of Mew Orleans (such as those ports on the Great Lakes, the Texas ports, or Atlantic coast ports). If the rail costs for alternative origin destination pairs are lower than those used by the Corps, rate savings benefits are now overstated. It should be noted that a change in either assumption would require extensive, complex reanalysis.

Although Donley reports that it took account of handling and access costs for most commodities, the cost of getting grain to rail terminals was assumed to equal that for water terminals. Although it is not clear in the Donley report, the Corps argues that this assumption is generally acceptable since Donley used "multiple car" rail rates. The rationale is that the lower, "multiple car" rates require high volume shipments from a single terminal that could only be achieved with extensive and costly grain collection in trucks. This prior collection effort by truck, it is argued, would cost as much as truck movements to riverside. This assumption is probably not valid. It is generally agreed that "line haul" costs for the waterway are lower than those for rail. If the increased cost of trucking the grain to riverside did not eventually offset the line haul cost advantage railroads would not have any business for commodity classes moved by barge. The effect of this assumption is to overstate rate savings benefit.

### Traffic Projections

In 1975, the Corps actually generated three sets of traffic demand projections for Alton: those done by the Corps' St. Louis District personnel; those prepared under contract with A.T. Kearney, a consulting firm, which are based on a review of several earlier projections including the Corps 1968 and 1972 projections; and a final set pre-

pared under contract with Lawrence Berkeley Laboratory which were not considered usable. Only the St. Louis District's projections were used for detailed benefit cost analysis although the Board of Engineers eventually used Kearney estimates in the "sensitivity analysis" presented in its March 1976 report. There are large differences between the two sets of projections. Furthermore, the projections -- low, most likely, and high -- in the St. Louis District's analysis also vary greatly, but only the "most likely" projections were used for the benefit-cost analysis. Low and high traffic benefit calculations were presented, but the low and high projections were arbitrarily set, at 25 percent below and 25 percent above the most likely projections. In this section only the basis for the St. Louis District's "most likely" projections are discussed, unless otherwise noted.

Since three-fourths of the traffic at Alton involves grains, coal, and petroleum, the Corps' benefit computations are very sensitive to changes in traffic projections for these commodities. Critics have focused their attack on projections for these important commodities and, in each case, have cited reasons why the Corps' projections could be too high. Generally, the projections are the result of simply applying a growth rate from some relevant source to 1972 Alton traffic. Since the choice of a base year and a growth rate is very important, detailed statements in support of those choices are to be expected.

(1) Grains: Over 40 percent of the current traffic at Alton involves corn, soybeans, and other grains from the Upper Mississippi region.<sup>8</sup> Since 80 percent to 90 percent of the grain passing through Alton is transported to New Orleans and other Mississippi ports for export, the Corps based its grain traffic projections on estimates of future growth in U.S. agricultural exports. For each of 3 major agricultural commodities -- corn, soybeans, and wheat -- the Corps assumed that traffic passing through Alton would grow at the same rate as total U.S. exports of those commodities.

It is clear that the Corps' projection involves 2 major, interrelated assumptions:

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8. DOT, p. 9.

(a) that waterway-served areas in the Upper Mississippi region will continue to produce the same share of each commodities' exports as in 1972 and;

(b) the Mississippi ports would continue as the major export point for that grain.

Critics argue that since the relevant agricultural area is already heavily cultivated, grain production could shift to other areas which might not be served by the Alton facility. With or without the production shift, alternative export points such as those on the Great Lakes, on the Texas coast of the Gulf of Mexico, or at Ports in the West like Seattle could attract some of the increase in export traffic that the Corps assumes will exit at the Mississippi ports. The Corps chose to test the sensitivity of its benefit-cost calculations to changes in grain traffic. An arbitrary, lower grain projection was used in the Board's sensitivity analysis which is discussed later in this section.

(2) Coal: . Currently, coal represents 15 percent of the total traffic at Alton. The coal projections used in the Alton analysis are based on projections of the demand for electric power in 2 large midwestern regions: the Mid-Continent Area Reliability Coordination Agreement region (MARCA) and the Mid-American Interpool Network region (MAIN). MARCA and MAIN electricity demand estimates for the 1975 to 2000 period were taken from a report of the Technical Advisory Committee on Fuel to the Federal Power Commission. Projections for the remaining period, 2000 to 2040, were based on the assumption that per capita energy use would rise by 4 percent annually. The Corps offers two justifications for the 4 percent growth rate:

(a) it is below the average annual per capita growth rates in the 1975-2000 period (from 4.8 percent to 6.4 percent)<sup>9</sup> which would imply a doubling of energy demand every 15 years and;

(b) since, according to the Corps, "It is doubtful that the increase in energy demand could fall below the rate of growth in real GNP," it is above 3 percent which the Corps assumes is the growth rate in real GNP.<sup>10</sup>

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9. FER Vol. 1, p. 3-124.

10. FER Vol. 1, p. 3-132.

It is not immediately clear why the growth in per capita energy use must keep pace with the growth in GNP. Since it is a key assumption, this relationship should be supported in more detail. The supporting evidence should at least discuss the probable impact of a quadrupling of energy prices on per capita demand. In addition, the relationship between MAIN/MARCA coal demand and Alton coal traffic is apparently not very stable. If the Corps had used 1973 as a base year, Alton coal traffic would have been about 8.9 percent<sup>11</sup> of MAIN/MARCA coal use instead of 12.4 percent as in 1972. Since a change in base years would significantly change coal traffic projections, the Corps should support its choice.

As the Corps notes in its report which contains the coal projections, the entire question of energy demand, supply, and alternative sources is up in the air.<sup>12</sup> Indeed, the report on which the Corps based its coal projections is now considered to be out of date by its sponsor agency, the Federal Power Commission,<sup>13</sup> because the analysis was done before the oil embargo. But the Corps should not be faulted for using a study which, at that time, was current.

Also, the Corps should be credited with recognizing and briefly discussing the major assumption for their coal projections; the introduction by 1990, of some pollution control device that would allow utilities to burn high sulfur coal and still meet air pollution standards. The assumption is key because a shift by the region's electric utilities to low sulphur coal from Western states could mean that coal shipments would not involve the Alton facility since alternative transportation modes would be used. It should also be noted that the Corps says it did not reflect the possibility of new, southward movements of coal through Alton in its traffic projections, but the possibility exists that western coal could be shipped on the waterway from a point above Alton to southeastern utilities and

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11. Testimony of Joseph Carrol before the Senate Committee on Commerce on S.3425, 94th Cong., 2nd Session. p.15 of the Appendix.

12. FER Vol. 1, p.3-139

13. Report of the Technical Advisory Committee on Fuels. Mr. Alex Gakner, a member of the advisory group and an FPC employee states that the report was considered out of date and therefore, was never published.

thereby increase coal traffic **through Alton**. The upshot is that there is genuine doubt about the impact of western coal on future coal traffic at **Alton**.

Coal traffic is projected to **grow** rapidly before and after the 1990<sup>14</sup> introduction of **scrubbers**. An explanation of this should be provided. **Furthermore**, since utilities make long-term **contracts** for **fuel**, and would probably make long-term plans **for scrubbers**, the impact of western coal could be assessed **for the near future** by systematically collecting **information** from the relevant utilities.

(4) Petroleum; **Initially**, the Corps argued that petroleum movements through **Alton** "**réveal a growth pattern quite similar to the U.S. economy**" and this pattern "**allows projections to be based on economic growth.**"<sup>15</sup> But, after segregating petroleum products into five classes, a **variety of "scenario"** growth rates are applied to current traffic to yield petroleum projections. The relationship between these projections and national economic growth is never demonstrated.

Residual fuel oil is the primary petroleum product in the **Corps'** projection. **The growth scenario** for this product, based on the FPC study that was used for the coal projections, involves a **growth** in residual fuel oil traffic at Alton between 1973 and **2000**, with traffic then held constant at the year 2000 **level**. However, **the FPC study** only projected fuel needs for the generation of electricity. **The Corps** applies the chosen growth rate to **all uses** of residual fuel oil, with no explanation of why this is appropriate. Furthermore, there is no explanation of why the chosen growth rate differs from an alternative FPC growth rate that the Corps used for its so called "**low movement**" **scenario**. The alternative is much lower, but the only assumption cited for each of these rates is that coal and nuclear will **eventually** replace oil and gas as utility **fuels**.

The **Board's** report notes that, after discussions with the Federal Energy **Administration**, it believes the petroleum projections were too high. The change in petroleum projections

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14. FER Vol. 1, p. 3-181; From 8 million tons in 1972 (or 6 million in 1973) to 14 million in 1990 and then to 32 million in 2035.

15. FER Vol. 1, p.3-145.

accounts for the major reduction of the Corps' "most likely" traffic projection used for the Board's sensitivity analysis.

### The Board's Sensitivity Analysis

In response to criticisms of the St. Louis District's analysis, the Board conducted "sensitivity analyses", i.e. analyses to determine the changes in benefits that would result from changes in important assumptions. The Donley assumption of equal "prior trucking costs" for rail and water grain hauls was dropped and grain rate differentials were cut by 50 percent to reflect this change.<sup>16</sup> The resulting drop in average annual benefits for the one lock proposal amounted to \$80 million.<sup>17</sup> In addition, the District revised its "most likely" projections for coal, petroleum, and agricultural chemicals. In phone conversations, the Corps explained those changes as follows: coal projections were lowered prior to the year 2000 to reflect the delayed introduction of "scrubbers". Petroleum projections were lowered in the latter part of the planning period to reflect the decline in residual fuel oil as a fuel for electricity generation. Finally, agricultural chemical projections were raised slightly. The impact of

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16. The 50 percent cut is based on a theoretical argument. The cost of prior truck movements would cut rate differences from zero at river side to 100 percent at some outlying point. The average cut would be 50 percent.

If there is an equal number of grain shipments at each point as one moves from either side of the river, benefits, tonnage times rate differences, would also be cut by 50 percent when the costs of prior truck movements were included in the cost of water transportation. Although, at first glance, 50 percent appears to be high, this estimate is based on the assumption that water terminals exist at every point on the river and, therefore, in the real world, the difference between prior truck hauls could be much higher. At the same time, the estimate assumes rail terminals are ubiquitous so the change could be too high.

17. BERH; compare benefits in Table 4 p. 48 (\$555.5 million) to those in the table for sensitivity analysis No. 1 (\$475.4 million).

the "revised most likely" projection was an \$82 million<sup>18</sup> reduction in average annual benefits for the one-lock proposal. The Board also dropped all delay benefits.

Although the Board used the St. Louis District's "revised most likely" projections, no official explanation of the changes has been published. Furthermore, an alternative unexplained sensitivity analysis, presented in the Board's report, involved a large reduction in grain, coal, and petroleum traffic projections, and the impact on average annual benefits was a \$130 million reduction. No implications are drawn from either of the sensitivity analyses by the Board except that even "under the most restrictive set of assumptions, all of the alternatives tested are economically feasible."

However, the Corps has been criticized for not simultaneously testing the sensitivity of its finding to changes in several assumptions. The suggested combination is the "revised most likely" demand projections and the elimination of the Donley assumption on prior truck movements. The combined test may result in a larger decrease in benefits. However, it should be noted that, if the Corps' cost estimates are correct, there are no incremental costs to weigh against incremental benefits.

#### Conceptual Problems with the Corps' Benefit Cost Analysis

As noted earlier, barges passing through Alton will use many other facilities on the Mississippi during their long intercity hauls. Therefore, the costs of realizing 50 years

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18. Compare Table 4 p. with the table for sensitivity analysis No. 3. However, one must account for the fact that No. 3 also includes the benefit impact of using TVA's rate estimates. One can determine the impact of using TVA rates by comparing Table 4 and sensitivity analysis No. 2. This estimate of the TVA impact is then deducted from the total difference between benefits in Table 4 and in the table for analysis No. 3.

of transportation rate savings on total Alton traffic are understated if only the costs of a new Alton facility are cited. Other costs such as those for inevitable replacements in-kind of locks on the Upper Mississippi and Illinois Waterway should be included. However, these additional costs would be incurred whether Alton is maintained at its current capacity or expanded. That is, the Alton replacement is the only cost of realizing the 13 million ton increase in traffic at Alton and, therefore, the only costs of realizing the incremental benefits that the Corps identifies. Benefits and costs are defined on a comparable basis only in the incremental comparisons.<sup>19</sup> By focusing on incremental benefits and costs the Corps never reestablishes the economic value of the existing system, and is therefore implicitly assuming that it is justified in perpetuity.

There is one other conceptual problem. The Corps will recommend any project with benefits in excess of costs. However, excess benefits only indicate that there is some "rate or return" to that investment in excess of the discount rate. Benefit cost analysis cannot aid in the selection of the best investment, i.e., the one with the highest rate of return unless all alternatives are considered and their rates of return compared. A favorable benefit-cost comparison for a 50 year project at Alton does not preclude the possibility that a shorter-lived project, or a project involving an alternative transportation mode would have a higher return.

For these reasons, even when there are no major criticisms of the actual numerical estimates, the Corps' method of benefit-cost analysis does not provide a basis for choosing the least cost response to a region's transportation needs. First, since only incremental costs are provided, the full costs of 50 years of waterway service are not known. Full costs would include replacements in-kind, operation and maintenance costs, etc. These would then be added to the costs of barge equipment and personnel to determine the cost of the water mode.

Second, since rates are used for modal comparisons, real costs in terms of resource use are not examined for the alternative modes. Even if rates must be used as a proxy for resource costs, the Corps does not explore the possibility

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19. It should be noted that the Corps took account of the necessary expansions of the Illinois Waterway when two lock proposals were considered.

that current rates **could** change. For example, railroads have large "fixed" **costs**, and their **rates could be** lower if more customers shared that **burden**. **This** would require a comparison of **rates** that would be charged with expanded traffic, rather than current **rates**. More important, the Corps does not explore the possible **rate** impact of investing public funds in alternative modes. If railroads are "locked into" using old equipment and **facilities** by their low rate of return that they **are able** to earn, public **investment** funds (loans or **grants**) could enable them to buy newer, more efficient equipment, leading to productivity increases and to **lower** effective rates.



CHAPTER VII  
CONCLUSIONS

The significance of the Alton debate is that it has highlighted concerns about current federal transportation policy, and procedures for making it. First, there is an apparent inconsistency between existing federal policies toward the water and the rail modes of transportation. Second, even within the water mode, current decision-making procedures can needlessly complicate and can bias the outcome of waterway investment decisions by precluding multi-year, system-wide project reviews. No additional analysis on specific technical points can resolve these broad issues that underly a decision on Alton.

DOT, and others, argue that an appropriate transportation policy goal is first to consider all costs, both public and private, and then to encourage the least costly method of meeting transportation needs, whatever the implications for established alternative modes. Such a policy would mitigate many of the concerns about Alton, since it is separate mode-by-mode policies that make the budget costs of railroad bankruptcy a potential cost of waterway investments.

The traffic level envisioned for the one-lock Alton project technically does not require other Corps projects. However, it is clear that the Corps is considering other projects which are logically related to the one-lock Alton project; for example a second lock at Alton and the already authorized Illinois Duplicate Locks project. These projects are related because they involve lock and dam facilities that serve a large amount of common traffic. According to Corps demand projections, that traffic will grow to a level that could only be satisfied if these and other projects are undertaken. With current procedures, the Congress will have the task of making a series of detailed, individual project decisions, rather than providing multiyear, system-wide policy direction.

A reasonable first step in the decision on Alton would be to determine the least costly response to the problem of physical deterioration. The Corps will have to explain the differences between the alternative cost estimates, and provide additional information on shorter-lived options, before the appropriate engineering solution will be known. If rehabilitation is actually the cheapest response, the new one-lock project will have to be justified on other grounds. In this case, the Congress must rely on the Corps' benefit-cost analysis,

